COLORADO RIVER BASIN PROJECT

HEARINGS

BEFORE THE

SUBCOMMITTEE ON IRRIGATION AND RECLAMATION

OF THE

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS HOUSE OF REPRESENTATIVES

NINETIETH CONGRESS

FIRST SESSION

ON

H.R. 3300 and Similar Bills

TO AUTHORIZE THE CONSTRUCTION, OPERATION, AND MAINTENANCE OF THE COLORADO RIVER BASIN PROJECT, AND FOR OTHER PURPOSES

S. 20 and Similar Bills

TO PROVIDE FOR A COMPREHENSIVE REVIEW OF NATIONAL WATER RESOURCE PROBLEMS AND PROGRAMS, AND FOR OTHER PURPOSES

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Mr. SAYLOR. Now, if my colleague will yield, I would like to get the record straight. The project that the Senator went up on had nothing to do with a placid pool. This is one that the Corps of Engineers built and some of us fought it, and after we got run over because a deal was made between certain people in the West with the Corps of Engineers, who, run as rampant over the rights of people as anybody else, we decided we would have to use something to allow the people in megalopolis that live from Boston to Norfolk to have some place to have a little recreation around that area. That is why we have taken it.

Mr. Chairman, I would hate to end on this note, but for the benefit of members of the committee, I have just received word that Dr. Miller, former chairman of this committee, died this morning and he has been ill for quite some time. He was the chairman of this committee during the 83d Congress.

Mr. JOHNSON. Well, as chairman I am sorry to hear of that. Dr. Miller was a very fine chairman of this committee from the State of Nebraska. He was well aware of the problems of the West. I am sure that under his leadership there was much legislation put through dealing with the water matters in the West in this committee.

The clerk informs me that there is a rollcall on the military appropriations supplemental and I would suggest that we recess for a half hour and come back.

Senator Moss. May I be excused, Mr. Chairman? We are expecting a rollcall, too, over there.

Mr. JOHNSON. Yes. If there are any pertinent questions——

Mr. FOLEY. I don't have a question. But if the gentleman from California would yield, I just wanted to add my greetings to the distinguished Senator from Utah. I had the pleasure not only of knowing him as a member of the committee, know of his great work in the field of water resources development, but I was a staff member of the committee of the other body where the gentleman from Utah was chairman of the Subcommittee on Irrigation and Reclamation before the reorganization over there and I want to say it is a distinct pleasure to see you here, Senator.

Senator Moss, Thank you so much, Tom.

Mr. TUNNEY. Mr. Chairman, I would just like to say to the Senator how terribly sorry I am that I wasn't here for your testimony. You know how much I admire you and the work that you have done and I appreciate so much the help that you have given me. Thank you.

Senator Moss. Thank you, Mr. Tunney.

Mr. SKUBITZ. If we should provide for this sort of a study do you feel that this would bind this Congress or any future Congress to provide or import water into this area?

Senator Moss. No, sir, I do not believe it would. I think obviously any study, any information developed by a study must come back, then, to be examined by the Congress and authorization would have to follow for construction of any project, any importation. So it does not bind us, but it does get the machinery going to learn the facts.

Mr. SKUBITZ. Thank you.

Mr. JOHNSON. The gentleman from Utah, Mr. Burton.

Mr. BURTON of Utah. I just want to welcome my colleague from Utah to this side of the Congress and say it is nice to have you over here, Senator.

Senator Moss. Thank you, Laurence.

Mr. JOHNSON. Thank you for coming, Senator, and I am sorry we are under this situation but I am sure that you understand our position right now.

Senator Moss. Yes, I do, and I did appreciate your courtesy, Mr. Chairman, and I have enjoyed it.

Mr. JOHNSON. I want to say to our next witness and his group, Mr. David Brower, that we will return after this rollcall because it is a rollcall and a very important matter before the body and no one wants to miss it. We will return here at about 3:15. I presume you want to go on this afternoon. Your group is here.

(At this point a recess was taken.)

Mr. JOHNSON. The Subcommittee on Irrigation and Reclamation will come to order. Our next witness will be Mr. David Brower, executive director of the Sierra Club. He is accompanied by a group.

Mr. Brower, I wish you would introduce your group for the purposes of the record and for the committee.

STATEMENT OF DAVID BROWER, EXECUTIVE DIRECTOR OF THE SIERRA CLUB

Mr. BROWER. Thank you, sir. I would like to introduce the editor of the Sierra Club Bulletin, Mr. Hugh Nash, Mr. Soucie, New York, and Mr. Jeffrey Ingram, Albuquerque, our Southwest representative.

I would like to request, Mr. Chairman, if possible, that each of their statements be inserted into the record as if read. They will summarize and I understand the chairman would like us to make all our presentations before the questioning.

Mr. JOHNSON. That is true. The reporter has your official statement and has the official statement of the other members that are with you?

Mr. BROWER. Yes, she does, I believe, in that one packet.

Mr. JOHNSON. They will appear in the record at this point in their entirety, and you may summarize your statement or make whatever statement you wish, Mr. Brower, and then they will have an opportunity to summarize their statements.

Mr. BROWER. Thank you very much, Mr. Chairman.

Mr. JOHNSON. Then we will ask questions of the group. You field the questions and if you want to answer them, fine. If you want to pass them on to the other members or if any member of the committee would want to ask an individual question, I presume they will be willing to answer and participate.

Mr. BROWER. Thank you very much, Mr. Chairman. I would like if I may to try to highlight my statement by reading from here and there and interpolating a little bit as I go.

My name is David Brower. I am executive director of the Sierra Club. I live in Berkeley, Calif., in one of the upper basin counties of the State of California.

Once again, Mr. Chairman, it is my privilege to appear before this committee on legislation dealing with Colorado River problems, and

especially, with the aid of people conversant with many fields and drawn from our staff or our own committees, to help as we can in providing information to the committee and the Congress about the conservation of water and of scenic resources in the Lower Colorado River Basin, with particular reference to the Grand Canyon.

When I first appeared in this room in 1953 to testify about similar problems in the Upper Colorado River Basin, the Sierra Club had 7,800 members. This year, our 75th, finds us with a membership 40,000 greater than that, distributed in 20 chapters that reach from the Pacific to the Atlantic, with offices on the west coast, in the Northwest and Southwest, and in New York and Washington. Our most rapid growth, consisting of some 10,000 new members, occurred since last June, when the Internal Revenue Service singled out the Sierra Club for special attention owing to its attempt to save the Grand Canyon.

I believe I have a special understanding of the dilemma of several members of the committee in the controversy before you because I was one of the 15 directors of the Sierra Club who in 1949, as Mr. Dominy reminded you on Tuesday, voted unanimously to approve the building of Bridge Canyon Dam—an even higher one than the one now advocated by some members of this committee. We rescinded the vote in 1950. The Bureau of Reclamation has enjoyed taking note of our initial error as if the Bureau had dug it out of secret records. We have published it far and wide, however, and have cited and explained it in our book, "Time and the River Flowing: Grand Canyon," of which there are 48,000 copies in print, one of which went to each Member of Congress last year through the good offices of trustees for conservation—of which I am presently a vice president.

Each time this embarrassing vote has been brought to my attention, as on the occasions of my debating with Mr. Dominy, or his chief information officer, Mr. Ottis Peterson, or with the present very able advocate of Hualapai-Bridge Canyon dam, Congressman Morris Udall, I have explained that we do not believe on our side that because we were wrong once we have to stay wrong. We dug further for the facts, found them, reserved ourselves, and have been reassured of our wisdom, at least on that subject, ever since that reversal.

I know that my own wrong vote—the vote for the dam—was a reluctant one, but was influenced by a quotation from Frederick Law Olmsted, Jr., then one of America's foremost landscape architects. His comment sounded very much like statements you have been hearing—the reservoir would be far down in a deep canyon, would enhance the view, would flood nothing of significance, and would make the canyon more accessible to tourists. We in the Sierra Club should have been alert to this misappraisal, because of the Hetch Hetchy disaster, in which a second Yosemite Valley was ruined by the same kind of rationalization.

Mr. Olmsted had not seen the detail of the part of the Grand Canyon that he thought the reservoir would not harm. Neither had I, nor most of our directors. We had the kind of interpretation the members of this committee have had in Mr. Dominy's photographs. For all his talents, Mr. Dominy failed badly as a photographer in the Grand Canyon. It is almost as if he had flown past the Lincoln Memorial so

fast as to blur the columns, photographing in light so flat as to lose their modeling, too preoccupied with other things even to notice that within the memorial there was a seated figure, exquisitely illuminated—yes, a great sculpture there, and a spirit in the space the columns mark off.

No photographer can succeed in the Grand Canyon. But he can begin to interpret what is there if he concentrates on the effort and has enough time and is artist enough to find out what this place has to say.

Mr. Dominy must know this himself now. After having advocated for so many years that Marble Canyon should be dammed, Mr. Dominy reversed himself after last year's hearings, and has persuaded many others to reverse themselves, and to argue that the Marble Gorge of Grand Canyon should be added to Grand Canyon National Park. With more time to consider the matter, preferably with enough time to go down the canyon themselves, I believe other key people will be changing their opinions, too, and will realize at last, but soon enough to save the day, that 110 miles of Grand Canyon climax would be destroyed by the Hualapai-Bridge Canyon dam. It would destroy not only the full length of what is best in the national monument, but also some 30 miles of river sculpture in the national park, and still more miles below the park. All the canyon has a higher use, which is to be preserved for all time within an extended Grand Canyon National Park. We can all rejoice in Mr. Dominy's change of heart upstream, and be glad there is still an unspoiled Marble Gorge to preserve there. And I myself can be grateful that I found out the truth, and, a year after voting wrong, that I switched in time and could enjoy, last September, the downstream canyon I had so wrongly voted against.

We don't really have the tools yet for measuring some fairly important things, such as love—either for people or for environment. Anthropologists are discovering that man's perspective has developed far more slowly than his ability to use tools. This is what the illustration was about in our Sistine Chapel ad, the gist of which was missed completely in a remark Tuesday by a member of this committee. I submit the advertisement here as part of my testimony. It has run in many newspapers and magazines so far, in several of them free of charge. It has been commented upon in feature articles and in some editorials, and has received a copywriter's award as well. I had a lot of help in writing it.

Our point is that we are changing our environment with unprecedented technological speed and with frightening ecological illiteracy. A form of tool-using primate presumably slightly lower than man existed on this planet for 2 millions years before Homo sapiens evolved. For 300,000 years subsequent to that, man himself managed to exist with no tool more advanced than a shaped stone, which he eventually learned to attach to a stick and to decorate.

The Industrial Revolution has been with us only about two centuries, and I don't have to point out to this committee that man has achieved some remarkable engineering victories over the natural environment during that time. We are beginning to sense this as we find less and less natural world around us, and more and more of what the machine has done to that world and to its pure waters and breathable air, as well as what our own ever-increasing numbers are doing to other forms of life.

This is the committee of the House of Representatives of the U.S. Government that, more than any other, is concerned with the blending of machines and of natural world in America's future, and anything we can do to stress the importance of the natural world, in controversies such as this one, we shall try to do. It is out of public concern that man's ability to control tools should catch up with his ability to fashion them that the conservation movement has grown.

Certainly in this country, man should start with the assumption that we are in the dawn of American culture, and not the duck, and that the resources we have, including the resources of unspoiled and beautiful environment, must last us for centuries to come. The first imperative is that we leave a freedom of choice to those who follow us on down the ages, and that one of those freedoms be the freedom to see unspoiled wilderness, to know that it exists—and of particular relevance to us here today, to know that it exists in the Grand Canyon.

In the course of our doing what we can to serve this imperative, we in the conservation organizations have tried to understand the intangible values in America. It is that effort that brought us to the Grand Canyon controversy. Once in such a controversy, we find that we must cast about for experts in various fields, particularly in the appraising of various kinds of alternatives. We have been successful in the past, occasionally supplying information more accurate than Government agencies themselves had put together. I think we have been equally successful this year in putting together information that is new, and in bringing up to date some of the material we tried to bring to the committee's attention last year to fill in some gaping holes in the record.

I can assure the committee that this effort gains us nothing but a continuing operating deficit in the Sierra Club, the displeasure of the Internal Revenue Service, and the less than total approval of some members of the legislative branch, the only real reward being the hope that if we are successful we shall somehow have served the future.

The material I myself should like to present consists of several parts. The main part I entitle "Sedimental Journal: Grim Prospect for the Colorado." This has been compiled from fragmentary data, because there seem to be no other kind, on a subject vital to long-range planning for the Colorado. It will soon be published, with illustrations, in our bulletin.

I should like also to offer to provide illustrative material to the committee for inclusion in the record, noting the precedent set by use of Mr. Dominy's photographs, and I offer the following:

1. Eight black and white photographs of sediment encroachment on the Lake Mead impoundment area made from the air by Mr. Martin Litton, a director of the Sierra Club. They are especially helpful to an understanding of the part of my testimony relating to sedimentation.

Mr. JOHNSON. Mr. Brower, these will be made a part of the file.

Mr. BROWER. As you wish, sir. What I was offering—I don't know whether you read ahead—was that we could supply them if the committee in looking over the possibilities thought this was desirable, printed according to specifications laid down by the staff so that they may be supplied, printed and folded ready to be gathered into the record of the hearings. This would include 16 black and white photographs and a signature of color photographs that are to be used in a forthcoming Sierra Club book.

Mr. JOHNSON. As of right now I would have to say that we will take them under consideration and if they meet the approval of the chairman of the full committee and the ranking minority member they will appear.

Mr. BROWER. Thank you very much.

Mr. JOHNSON. Because the record will be held open for 10 days after the hearings close.

Mr. BROWER. Fine. That offer is in greater detail in my statement here, and I would be glad to check further with the committee.

At this time I would like to submit for the committee file the 80-page amendment to our petition to intervene before the FPC in the matter of proposed Marble Canyon Dam, this material constituting further evidence to support our belief that preservation of the canyon represents its highest use. I have this here.

I list three other things in my prepared statement that I foolishly left in the hotel room, but would like to give over to the staff so that the committee may decide whether or not it would like them for the file.

Mr. JOHNSON. They will be received for the file. You will have 10 days to get in any other material that you wish.

Mr. BROWER. Thank you, Mr. Chairman.

To go on rather quickly, I had better summarize this sedimental journey because that is the main thrust, you might say, of what I have to offer that is new.

When the Bureau of Reclamation boasts of turning into sparkling blue lakes and crystal clear streams good for fishing something that had previously been too thick to drink and too thin to plow, there is a tendency to share the Bureau's delight. But there is a good question to ask before we get too ecstatic: What happened to all the sediment and debris, all the silt and sand that gave the Colorado its color?

There is quite a bit of Mark Twain's philosophy in my prepared statement. One of his remarks was that it is an exciting thing about science that "one gets such wholesale returns of conjecture out of a trifling investment of fact," and I hope the members of the committee will have a chance to go through the detailed story on sedimentation. It is rather frightening when you look at it, and has been almost totally ignored in these hearings.

Two statistics I will give and pass briefly over them. At the time of its advocacy of the Upper Colorado storage project, the Bureau of Reclamation pointed out that there are a hundred thousand acre-feet of sediment coming down the Colorado each year. That was enough, combined with what was added downstream, to give only a 37-year silt life for Bridge Canyon Dam were Glen Canyon Dam not built. We have tried to gather and present here some facts on where the other sediment comes from and what the real threat seems to be.

I will skip quickly over what I have here to mention one other figure. In the FPC hearings on Marble Canyon Dam, we had a statistic of 104 years as the silt life of Marble. That assumed, even though it was the same dam, a capacity nearly 120,000 acre-feet greater than the Bureau now thinks it can put behind that dam.

We would say, then, that the silt life of Marble with Glen Canyon Dam built but with no silt retention [illegible]

70 years. The Paria silt-retention dam might extend that life quite a bit, but it might not. Just a few years ago the Bureau of Reclamation and the Corps of Engineers jointly built a sedimentation trap on the Paria which was expected to last for 10- to 20-years, in order to test the silt flow in that river. One single event filled it.

I go to a series of attempts to estimate the lifespan before silting in of the four proposed Grand Canyon dams. If we combine the capacity of the Grand Canyon dams—that is Marble, Paria, Bridge and Coconino—it is a little bit more than six million acre-feet in total. In the worst case, the life of the dam complex might be as little as 62 years.

I have a better case where the dam complex lasts about twice that long, and still other figures have come in showing that it might last even longer. But there isn't too much solace to be taken from various estimates because our knowledge of sedimentation is so poor. For example, the Colorado River records are brief. We have a nice 59-year average, but we don't know about sedimentation for all that period. We have not in those 59 years, so far as I know, yet recorded a once-in-a-century flood. The California redwood country has had a once-in-a-century flood and a once-in-a-millennium flood within a single decade. A U.S. Geological Survey man who was primarily concerned with sedimentation yield told me that up in the redwood country where logging has helped the water flow more freely, a single event in 1964 did more to the watershed in the 36 hours than had been done by all the rains and snows and runoff of several hundred years—perhaps 800 years—previously.

The whole sediment story is something really to worry about. I sum it up this way. Between 60 and 160 years after their construction, the four Grand Canyon dams would be out of action. Long before that they would be uneconomic despite the Bureau of Reclamation's most optimistic dreams about power users' love of the Bureau's high power rates.

If we were to assume a Rip Van Winkle capability and wake up a hundred years or so from now, we would find the reservoirs almost gone, loaded with sediment and nearly out of action. There are no equivalent damsites left in the Colorado because we have used the best. There are far more people needing far more than we do the residue we left them of the earth's treasures, but they will have to do without anything but the dregs of the Colorado damsites.

The best of the scenery is gone, too. It has been replaced in the Grand Canyon area by some 200,000 acres of phreatophyte jungle. You don't like asphalt jungle too well; you will like these less. This is the fate of the whole complex of Grand Canyon dams. Developments the Bureau has built or planned in the Lower Colorado Basin might be evaporating as much as 3 to 4 million acre-feet of water per year from silted-in reservoirs. If you take out Mexico's share of the half that is left for the lower basin, California doesn't even get half its 4.4.

Now, this is explained in my prepared testimony in a way that bears a very close scrutiny. I grant you it must be scrutinized by people who know a great deal more about this than I do. But I do have to say to the chairman and the committee that when we went to the U.S. Geological Survey to ask them about the prediction of sedi-

ment rates last year, they told us, that they were not permitted to predict sedimintation rates. If there is any danger of loss of water of the order suggested here, then this bears the most serious consideration.

I hope that Mr. Udall, the gentleman from Arizona, will have some information on this. I sent him a copy of an earlier draft of my piece long months ago and I believe it was sent to some other people, too. There should be a pretty deep inquiry into this. Perhaps the 5-year period during which the National Water Commission would be studying might be a very good time to make a very careful inquiry.

I add a postscript to all of this because I have not talked about bank storage. We hear that if water is stored in the banks of the reservoirs it fills it will come back when the reservoirs are pulled down.

We are not sure how much will come back out. But we know that as the reservoirs are filled with silt, there will be no recovery of what has been lost there because there will be no further pulling down. The reservoirs it fills, it will come back when the reservoirs are pulled down. permanently lost and it may be an enormous amount.

So I think that with this kind of scrutiny we might find some shocking results. I recommend strongly to the committee that it seek expert testimony from the Government agencies—require them to submit testimony on this—submitting also to very careful questioning. I think that the people as a whole would like to give the whole proposition a harder look, insisting that man's inertia shall be used less and his genius more.

Perhaps there is a moral. Grand Canyon is a place to stop, look and always have a river to listen to—240 miles of river, all of it alive.

That concludes my summary, Mr. Chairman. I would like to pass the baton on to Mr. Nash, our editor.

(The prepared statement of Mr. Brower follows:)

STATEMENT BY DAVID BROWER, EXECUTIVE DIRECTOR, SIERRA CLUB

Mr. Chairman, once again it is my privilege to appear before this committee on legislation dealing with Colorado River problems, and especially, with the aid of people conversant with many fields and drawn from our staff or our own committees, to help as we can in providing information to the Committee and the Congress about the conservation of water and of scenic resources in the Lower Colorado River Basin, with particular reference to the Grand Canyon.

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Each time this embarrassing vote has been brought again to attention, as on the occasions of my debating with Mr. Dominy, or his Chief Information officer, Mr. Ottis Peterson, or with the present very able advocate of Hualapai-Bridge Canyon dam, Congressman Morris Udall, I have explained that we do not believe on our side that because we were once wrong we have to stay wrong. We dug further for the facts, found them, reversed ourselves, and have been reassured of our wisdom, at least on that subject, ever since that reversal.

I know that my own wrong vote—the vote for the dam—was a reluctant one, but was influenced by a quotation from Frederick Law Olmstead, Jr., then one of America's foremost landscape architects. His comment sounded very much like statements you have been hearing—the reservoir would be far down in a deep canyon, would enhance the view, flood nothing of significance, and would make the canyon more accessible to tourists. We in the Sierra Club should have been alert to this misappraisal, because the Hetch Hetchy disaster, in which a second Yosemite Valley was ruined by the same kind of rationalization, was still fresh in our minds. Happily, we came to the right conclusion in Grand Canyon soon enough to help save Dinosaur National Monument and the National Park System from the likewise unnecessary dams proposed at Echo Park and Split Mountain. We did not know enough about the extraordinary scenic resource in Glen Canyon soon enough to try effectively to save that marvel of the world, and the best of it is now destroyed beyond recall, lost beneath a reservoir that has had its beautiful moments, celebrated by the Bureau of Reclamation's book. That book depicts scenes that will not be visible when the reservoir is full, and that people will wish were not visible when the reservoir is drawn down, as the Bureau will draw it down to produce high-cost power, revealing the truth about the destruction.

Mr. Olmsted had not seen the detail of the part of the Grand Canyon that he thought the reservoir would not harm. Neither had I, nor most of our Directors. We had the kind of interpretation the members of this committee have had in Mr. Dominy's photographs. For all his talents, Mr. Dominy failed badly as a photographer in the Grand Canyon. It is almost as if he had flown past the Lincoln Memorial so fast as to blur the columns, photographing in light so flat as to lose their molding, preoccupying himself with other things too much to know that within the memorial there was a seated figure, exquisitely illumined—yes, a great sculpture there, and a spirit in the space the columns mark off.

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In the course of the several hearings on the Lower Colorado Basin Project, the Committee has, as the majority report said last year, heard an extraordinary amount of testimony. It is my own conviction that there were major gaps in past testimony, and that had it not been for those gaps the majority of the Committee would have come to a different conclusion about the Grand Canyon. Several agencies which could have supplied expert testimony, and could have been carefully questioned to bring out still more evidence, were not here at all. The overwhelming preponderance of testimony related to the engineering and cost accounting of water development—the tangibles that, though not easy to handle, were at least measurable in the marketplace. The intangibles, such as

Canyon, and that are still creating it, that are keeping it alive, are hard to talk about but are no less important to America and the world. If anything, they are more important. But the marketplace cannot measure them, unless you seek out and audit carefully the estimates on what it would cost, at current prices, to build a separate but equally unique Grand Canyon of the Colorado.

We don't really have the tools yet for measuring some fairly important things, such as love—either for people or for environment. Anthropologists are discovering that man's perspective has developed far more slowly than his ability to use tools. This is what the illustration was about in our Sistine Chapel ad, the gist of which was missed completely in a remark Tuesday by a member of this committee. I submit the advertisement here as part of my testimony. It has run in several newspapers and magazines so far, in many of them free of charge. It has been commented upon in many feature articles and in some editorials and has received a copywriter's award as well. I had a lot of help in writing it.

Our point is that we are changing our environment with unprecedented technological speed and with frightening ecological illiteracy. A form of tool-using primate presumably slightly lower than man existed on this planet for two million years before *Homo sapiens* evolved. For 300,000 years subsequent to that, man himself managed to exist with no tool more advanced than a shaped stone, which he eventually learned to attach a stick and to decorate. In all this time our attitude toward our environment was evolving too, but it did not have to evolve far because we were unable to do much harm to it, or enough harm that the environment would strike back, so to speak, and eliminate the intrusion that was harming it.

The Industrial Revolution has been with us only about two centuries, and I don't have to point out to this committee that man has achieved some remarkable engineering victories in that time over much of the earth's surface. What the cost of those victories has been is something else, and we're beginning to sense this as we find less and less natural world around us, and more and more of what the machine has done to that world and to its pure waters and breatheable air, as well as what our own ever-increasing numbers are doing to other forms of life.

This is the Committee of the House of Representatives of the United States Government that, more than any other, is concerned with the blending of machines and of natural world in America's future, and anything we can do to stress the importance of the natural world, in controversies such as this one, we shall try to do. It is out of public concern that man's ability to control tools should catch up with his ability to fashion them that the conservation movement has grown. If he is to control them, he will find that one of his highest priorities is to keep them out of some places altogether, and to make the best judgment he possibly can about the long-range effects of his tools wherever he does use them. Certainly in this country, he should start with the assumption that we are in the dawn of American culture, not the dusk, and that the resources we have, including the resources of unspoiled and beautiful environment, must last us for centuries to come. The first imperative is that we leave a freedom of choice to those who follow us on down the ages, and that one of those freedoms be the freedom to see unspoiled wilderness, to know that it exists—and for particular relevance to us here today, to know that it exists in the Grand Canyon.

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I can assure the Committee that this effort gains us nothing but a continuing operating deficit in the Sierra Club, the displeasure of the Internal Revenue Service, the less than total approval of some members of the Legislative Branch, the only real reward being the hope that if we are successful we shall somehow have served the future.

Accordingly, from our membership and staff in various parts of the country, we have put together the presentation that follows. The members of the staff

who participate are either on salary or under separate contract, supported by members' dues, contributions, and an increment of the income that comes from our books and wilderness outings. Those from the membership at large are contributing their time and knowledge—this is the real strength of our organization —at no expense to the club, which has merely picked up their out-of-pocket travel expenses.

The material I myself should like to present consists of several parts:

1. "Sedimental Journey: Grim Prospect for the Colorado." This has been compiled from fragmentary data, because there seems to be no other kind, on a subject vital to long-range planning for the Colorado. It will soon be published, with illustrations, in our bulletin.

2. My letter to the President with reference to the Grand Canyon controversy and the enclosure relating to the National Water Commission.

3. Significant letters addressed to Mr. Felix Sparks, of the Colorado River Water Commission, from Mr. Jeffrey Ingram and from me relating to the possible effects of downstream dams upon Colorado itself.

4. I should like also to offer to provide illustrative material to the committee for inclusion in the record, noting the precedent set by use of Mr. Dominy's photographs, the following:

(a) 8 black and white photographs of sediment encroachment on the Lake Mead impoundment area made from the air by Mr. Martin Litton, a director of the Sierra Club. They are especially helpful to an understanding of the part of my testimony relating to sedimentation.

(b) A further 8 black and white photographs of the scenic and recreational resource at Lake Powell, now that it is 34 feet lower than the maximum surface elevation reached so far.

These 16 photographs listed above can be submitted two weeks from now, printed and folded according to specifications worked out with your staff, at no cost to the government.

(c) A signature of color photographs by Mr. Ernest Braun of the scenic, ecological, and recreational resources that would be obliterated within the Grand Canyon were the proposed Grand Canyon dams built. These can also be provided, printed in color in the format used in the hearings, reduced from color plates made for our forthcoming book, "Grand Canyon of the Living Colorado," itself drawn from an exhibit of the same name about to be shown concurrently in four major cities. We can supply these at no cost to the government in the quantity desired for the hearings, with factual accompanying legends. They should be of particular help to the Congress in determining the highest use of the Grand Canyon.

I should like to submit for the Committee file:

The 80-page amendment to our petition to intervene before the Federal Power Commission in the matter of the proposed Marble Canyon dam, this matter constituting further evidence why, in our belief, the preservation of the canyon represents its highest use.

"Confrontation," the transcript of a program presented over the radio in Albuquerque, New Mexico, November 15, 1966, directly related to the present controversy and giving an important insight into our principal point here—that there are major gaps in the evidence about sedimentation and about the scenic importance of the Grand Canyon. The speakers include Mr. Dominy and myself.

"Water and Esthetics in the Lower Colorado River Basin," my statement in a debate with Commissioner Dominy before the Second Annual American Water Resources Conference, University of Chicago, November 21, 1966.

A series of brief observations and essential questions related particularly to evaporation and resource planning aimed directly at the present controversy and concerning which the Committee may wish to seek further testimony or evidence.

PART 1

Sedimental Journey: Grim Prospect for the Colorado

INTRODUCTION

Somewhere, on the Colorado before it pauses momentarily in the reservoir backed up by Glen Canyon Dam, scoop up a cupful of river, let it settle, and consider the sediment in the bottom of the cup. It has more story to tell than tea leaves ever would. Contemplate what the sand there does if it is free—such creations as the Grand Canyon, for example. And what it will do if man tries to entrap it. Be frightened a little.

PART A

When the Bureau of Reclamation boasts of turning into sparkling blue lakes and crystal clear streams good for fishing something that had previously been too thick to drink and too thin to plow, there is a tendency to share the Bureau's delight. But there is a good question to ask before we get too ecstatic: What happened to all the sediment and debris, all the silt and sand that gave the Colorado its color?

In the first place, for a whole series of reasons, many of them consisting of abusive treatment of the land, the Colorado tributaries are still stripping just as much off the land as ever and starting it all down to the Gulf of California. Sooner or later, it will arrive there. In geological time, all the reservoirs man builds on the river will become filled with sediment, filled to the brim and more. The river will cascade over the dams, finally erode them, and in the end transport the sediment to the sea, cleaning out its channel, revealing once again what was buried there, and resuming the work rivers must always carry on—the constant attempt to level the land.

Long before this, man may have disappeared from the earth. A more discernible perspective is needed. What will be the immediate effect on this civilization, on the generations of people those of us now alive will know and must feel some responsibility for, of the sedimentation of the Colorado River reservoirs now existing? Of immediate importance, how about sediment and the proposed Grand Canyon dams? For the foreseeable future, what kind of storage loss and water loss can be expected? What validity is there to projections of long-range revenues, for example, if there are poor forecasts of sedimentation rates and if it is assumed certain reservoirs will be storing water, conserving water, and producing hydroelectric power for longer periods than they actually will?

There is a lot of Mark Twain's philosophy in what follows. By a simple extrapolation of one known statistic, he showed how the Mississippi must at one time have extended more than a thousand miles into the Gulf, as narrow as a fishing rod. And he commented on "something exciting about science." "One gets such wholesale returns of conjecture out of a trifling investment of fact," he said.

If you will, with pencil and scratch pad handy, let's invest the trifling facts at hand, multiply and divide a little, and conjecture a lot. Try to take all the figures in stride, reading them as if they were poor prose. There will be no final examination—except by posterity if we fail. The figures won't be too dull, silty though they are, and may even stir someone in government into producing better figures in time to save us. Meanwhile, here are some data to work with, and lots of luck! Or you may skip the next several paragraphs, miss some of the fun, and resume reading at Part B, below.

For sedimentation rates on the Colorado, House Document 364 (1954) showed that 100,000 acre-feet of sediment passed the Glen Canyon damsite each year. This, then, is the amount that is now beginning to finish off Lake Powell, with its water capacity of 27,000,000 acre-feet.

Walter Huber, the late former president of the American Society of Civil Engineers, and an expert on dam construction and operation who has well aware of Colorado River hydrological statistics, told me that one-third of the silt that went into Lake Mead came from the Little Colorado River. If you assume, then, that 180,000 acre-feet went into Mead (before Glen Canyon dam), then 60,000 would come from the Little Colorado, 100,000 from the Main Stem above Glen, and 20,000 from all others. One of the siltiest others is the Paria, which flows 22,600 acre-feet per year. Other tributaries would be the Virgin and the host of water tributaries within Grand Canyon's limits—Kanab, Havasu, Tapeats, Spencer, Quartermaster, Separation, and so on.

In the early predictions for Bridge Canyon dam, with no upstream sediment control, a 37-year silt life was predicted. The capacity of Bridge at elevation 1866 is 3.7 million acre-feet (maf henceforth), its surface area 16,700 acres. The capacity of sediment would be perhaps 25 per cent greater than the capacity in water, assuming headward aggradation (the upstream grade a river builds back from the reservoir that stops it) from the dam itself that could produce a grade of 1.5 feet to the mile. This figure must be predictable and the calculation should be checked. If it is correct, 125,000 acre-feet of sediment passes Bridge Canyon site, or enough to render the upper 40 miles of the reservoir recreationally unusable in 3½ years—assuming no upstream control. (There is now major

upstream control, remember, in Glen Canyon, but there is a lot that Glen doesn't control.)

As a cross check, the Southwest Water Plan, 1963 edition, shows 2.1 maf capacity for the Coconino silt-retention reservoir, and the Pacific Southwest Water Plan Supplement on Bridge says this will last 100 years. Add 25 per cent for aggradation, or .5 maf, divided by 100 years and you get 26,000 acre-feet/year Little Colorado sediment. This is less than half what our previous estimate shows. This may be explained if it is really a gross underestimate of the Coconino sediment capacity. Considering the shape of the Coconino impoundment area, the gross underestimate is possible. The area is 76,000 acres when full of water. Bridge Canyon reservoir, for comparison, is 16,700 acres for 3.7 maf capacity, versus Coconino's 76,000 for 2.1 maf capacity and compared with Glen's 176,000 acres for 27. maf capacity. Thus, in acres per maf capacity: Bridge, 4,500; Glen, 6,500; Coconino's 38,000. So gently sloped a basin might aggrade unconscionably. If aggradation doubled Coconino's capacity for sediment, as compared with its water capacity, we'd get our 60,000 acre-feet per year of sediment—and an incredibly big silt trap, of perhaps a 150,000-acre surface.

A 1949 publication of the Bureau of Reclamation (N. H. Daines, Study of Suspended Sediment in the Colorado River) may be too old to be of much help. It shows an average of 175,000,000 tons per water year of sediment discharge at Grand Canyon station (probably near Kanab Creek), 1926–1948. At an assumed density of 1.1, this is some 150,000 acre-feet of sediment at almost the Bridge site (albeit, some 120 miles above it, but with little silt entering between). The bedload was not measured, but that could hardly explain the difference.

So we probably shouldn't place much store in the Daines opus. An interesting figure may be worth remembering: 90 per cent of the water and 60 per cent of the sediment of the Colorado comes from above Glen. Reading this backwards, 40 per cent of the sediment comes from below Glen, and it would be easy to estimate that one-third of the sediment in Mead would come from the Little Colorado. Just what Walter Huber said.

In the Pacific Southwest Water Plan Appendix, the Geological Survey lists all kinds of plans for studies, but none for studies of sedimentation. In pursuing sedimentation data at the USGS last August, we were told that the USGS was "*not permitted to make sedimentation projections.*"

Now for a couple of flow figures. What's the Little Colorado got? Using the 90–10 ratio above, and taking some flow figures accompanying a letter, August 3, 1966, from the Bureau of Reclamation to Walter Edwards, we find the virgin flow at Lee Ferry, 59-year average, is 15,025,000 af; 90 per cent of that leaves 1,503,000 for the Little Colorado and associated streams below Lee Ferry. The Paria average, 1914–65, was 22,000 acre feet, so we can say the Little Colorado does about 1.6 maf per year. (Note: it's really nearer 300,000; but don't worry because errors of this magnitude are trivial in the league we're playing in.)

One further detail about the Paria and we can close up the data gathering and try predicting.

The Paria silt-detention reservoir holds 98,000 acre-feet of water. It is 13 miles long and has an 8,000-acre surface according to the BuRec map (2,500 on the area-capacity curve in the same supplement!). Note: Although the Southwest Water Plan says 98,000 acre-feet capacity, the Marble Supplement says 235,000 in text, 200,000 being all that shows on the area-capacity curve accompanying the text. The text says there is 5,100 acre-feet of sediment per year between Glen and Marble, with the Paria contributing about 4,475 annually (a nice precise figure, that one). The dam is 18 miles up the Paria, with some 250 square miles of Paria watershed below the dam, so perhaps 4,000 acre-feet per year will end up in Paria until it is full, in its century: the rest ends up in Marble, which has only a 363,000 acre-feet capacity.

Part B

The preceding paragraphs prove that the figures hardly ever check out. If my arithmetic is bad, I've been working too long with Bureau of Reclamation figures. Remember that, depending upon which page you read of their figures that are in the evidence before Congress, the Paria silt trap has an area of either 2,500 or 8,000 acres and a capacity of 98,000 or 200,000 or 235,000 acre-feet. Vote for one—and then move on to something stranger still. The Federal Power Commission has been told that the Marble Canyon reservoir would hold 480,000 acre feet of water

and that without the Paria silt trap, Marble would be silted up in 104 years. The Bureau of Reclamation, with the same dam, would have a reservoir with one-fourth less capacity—so it would silt up in 71 years (assuming Glen Canyon dam still works; otherwise four years' silt would finish Marble). So Marble would be gone in plus or minus 7 decades (i.e., before it is as old as the Sierra Club) unless Paria were built to extend Marble's life 25 or 60 or 70 years, depending upon how you voted on the Bureau's credibility gap.

Or Marble could go sooner. The Sheep Creek test barrier that the Bureau and Corps of Engineers constructed jointly on the Paria was supposed, I am told by an expert sedimentologist, to last from 10–20 years. It was filled by one "event." The Bureau assumed 4475 af of silt per year in the Paria, so this one event would extrapolate to 45,000–90,000 af for the whole Paria-Marble basin below Glen Canyon dam—and half a dozen such events would wipe out Marble and Paria silt-detention capacity and be at work on Hualapai's, aided by other helpful events in the Lower Basin.

If there seem to be too many figures, don't let it bother you. They don't bother the Bureau too much, so why should you worry? Reclamation Commissioner Floyd Dominy told me and a New Mexico radio audience last November that Glen Canyon would never silt up; apparently he doesn't take his own Bureau's figures seriously, even though he does want you and me and 200,000,000 Americans to put up the money for the dams his figures advocate. So in its first century, to go into more figures, Marble would be ⅔ (or 1¼) full of sediment and be having troubles in power generation and with clogging up Glen Canyon's tailwater. Marble would be quickly finished off thereafter if the Paria detention dam were built—and done in by silt. The closer Marble gets to its death, the more the reservoir must fluctuate daily to put its peaking-power water through the turbines. The initial ten-foot fluctuations would get grimmer and grimmer, and would probably exceed 100 feet daily in the vestigial puddle at the lower end of the Marble Canyon sediment flats.

Note in passing that with the Paria averaging 22,600 acre-feet per year flow and 4,475 acre-feet per year of it sediment, a cupful of Paria will not stir easily—it is flowing 20 percent nonwater.

Before we leave the Little Colorado, with the sun setting fierily in the West, we should look at the Southwest Water Plan supplement map of the Little Colorado's Coconino silt-retention reservoir basin. As scaled on the Bureau's map, it has about one-eighth the area of Bridge Canyon reservoir. Yet we know from the text that Coconino's area is 4.5 times that of Bridge. Error factor: 3600 percent! That's what I meant about figures that don't quite check out.

Now let's start a preliminary summing up and assessing of error of a dimension that should produce shock.

1. Nowhere do we have a reliable estimate, or more than detached pieces of estimate so far removed as not to fit together, of what the all-important sedimentation rates really are.

2. The U.S. Geological Survey, one of the few remaining objective agencies that John Wesley Powell hoped to have so many of, is not permitted to make sedimentation predictions. If it is permitted, really, and someone merely misspoke, where are their predictions? If they exist, please send a set to Mr. Dominy.

3. The Bureau admits 20 percent sedimentation in the Paria, 0.6 percent in the Colorado above Glen, and an approximate 1.4 per cent in the Little Colorado. The wide range is cause for suspicion.

About that headward aggradation of 1.5 feet: The mechanics of this aggradation will always puzzle me, but if carrying capacity really and truly does vary as the sixth power of velocity, then when a river slows to half its speed, it must dump 98 percent of its load. The slowing happens gradually, not all at once; but in any event the river has to figure out what to do with all the water and silt it has when it must dump the silt but still get the water on toward the sea. In some situations it will cross itself up, dumping the load so fast it has to ride on ridges instead of in gulches. Slow China's Yellow River with dikes and it will ride higher than the land the dikes seek to protect. On a steep alluvial fan, with a flash flood and boulders rolling at an alarming clip, a stream can apparently lose its mind. In a restricted canyon like the Colorado's, where the river builds bars and the side streams tear them apart and build dams, and the river tears those apart when it is up to strength, the things a Colorado River

will do when a 736-foot concrete clot is poured into it are not yet really quite known. Happily, no one has yet tried to dam the Grand Canyon and the Colorado River that runs through it was able, because of the sediment, to carve the canyon. All we can do, until too late, is to postulate.

A point in passing: If the 1.5 feet/mile is too much aggradation, then there will be less immediate damage to Grand Canyon National Park and Monument, et el., but there will be much more immediate damage to the economics of the Lower Colorado Basin Plan because the reservoirs won't last long enough to pretend to pay for it, and pretend they must.

In the worst case, for the economics, we have 6¼ maf capacity in the (Grand Canyon; i.e., Marble, Paria, Bridge, Cononino) 4-dam complex, a river than has about 100,000 acre-feet per year to fill it, and a 4-dam silt life of 62.5 years. Looking backward, this takes us just about exactly to the year Theodore Roosevelt said of Grand Canyon, "leave it as it is." If they had paid as much attention to him then as the Bureau of Reclamation fails to pay now, all four dams would be through today. And their revenues would have been diminished to one-half when FDR declared a bank holiday and beer came back.

In the best case, we can add some 25 per cent to the silt capacity, since silt slopes better than water does. We can drop the Colorado's silt habit index to half. That would be about 8 maf silt capacity, 50,000 acre-feet per year of silt doing it in, and 160 years to go. Power revenues would be on a half-life basis.

But don't cheer too fast. The Colorado River flow records are brief. We have a nice 59-year average. But those 59 years have not yet included a once-in-a-century flood. The California redwood country had a once-in-a-century and a once-in-a-millenium flood within a single decade. So don't place your bets yet. Remember that constant: the carrying capacity of the Colorado varies as the sixth power of its velocity. If at 6 miles per hour it can carry 150,000 tons of suspended sediment per year, not to mention bed load, then at twelve miles per hours, for the day the extraordinary flash flood excites the river that much, the Colorado can carry in that single day 21 times as much as the 60-year-average-river carried in its average year.

One U.S.G.S. man who is primarily concerned with prediction of sediment yield told me that up in the redwood country, where logging has helped the water flow more freely, a "single event" in 1964 did more to the watershed in 36 hours than had been done by all the rains and snows and runoff for several hundred years—perhaps 800—previously.

Things like this shake your faith in what engineers are thinking of when they say the Paria carries 4475 af of sediment a year and Marble will last 104 years. This is a little hard to grasp. But grasping it helps you understand how that little stream down there a mile below you, which looks as if it had dried up in the bottom of that incredible canyon, could carve the whole works in just a few minutes, if you use eons for years, or in about 10 million years if you insist upon being conventional.

In any event, with nice columns of figures that don't check out as often as we wish they did, the Bureau of Reclamation has postulated a revenue-producing operation of dams in Grand Canyon that in the course of a century will, they pray, pay for the fraction of their projects that the nation as a whole doesn't have to pay for first. The Bureau counts on that century of operation, and puts all the money from the operation in its cash registers and sounds very cheery about it, without having the slightest assurance that the century will ever leave their dams alone and unsilted up.

In the worst case, their revenues start drying up, giving a half life, about 60 years before their payout tables face the facts of silt life. In the worst case—if you want to bet on it, remembering the odds that a 6th-power calculation force upon you—they fade 10 years ahead of their schedule. And all the while they assume the public will like the Bureau's hydroelectric peaking kilowatts so much better than anyone else's that they will pay the Bureau, for the very same product (to us, one kilowatt hour looks very much like the next one), about $2 billion more over the 100-year payout period than they would pay investor-owned, tax-paying utilities. Don't believe it.

But let's sum things up.

Between 60 and 160 years the four Grand Canyon dams (let's group them) will be out of action. Long before that, they will be uneconomic—even by the Bureau of Reclamation's most optimistic dreams about how well power users love the Bureau's high power rates.

But let's all assume a Rip van Winkle capability and wake up 100 years or so from today. The Bay Area Rapid Transit System is almost ready to go and New York's has rusted away. We find we have been forgiven for our faults in handling transportation, but not for letting them dam the Grand Canyon.

The reservoirs are almost gone now; they are loaded with sediment and nearly out of action. There are no equivalent damsites left on the Colorado because we have used the best. There are far more people, needing far more than we do the residue we left them of the earth's treasures after we had first grabs. But they will have to do without anything but the dreges of Colorado damsites.

The best of the scenery is gone, too. It has been replaced, in the Grand Canyon area, by some 200,000 acres of phreatophyte jungle. You don't like asphalt jungles too well; these you will like less, and ask the man who bemoans one. Or even ask the Bureau of Reclamation, an agency that hates phreatophytes so much that it had a major program afoot to eradicate 42,000 acres of the jungle so as to save 100,000 acre-feet of water per year. While tooling up to eradicate the 42,000, the Bureau created another 200,000. And still another 200,000 or so up where Lake Powell was, in another century or two.

Remember those figures. 2 plus 2 equals 400,000 acres of wall-to-wall sediment, topped with that jungle. The evaporation index in this country is about 6–8 feet per year, to which the extra efficiency in evapo-transpiration phreatophytes (saltcedar, or tamarisk, for one, add willows, and other pleasant bits of green you find along desert water courses) are capable of. Round it to 10 feet of evaporation per acre per year to help the arithmetic, and you find that the Bureau of Reclamation has planned a river-development scheme, and now wants to round it out, that will evaporate, beyond anyone's use, 3,000,000 acre-feet of water per year (4,000,000 if you include Lake Mead and more if you include its aggraded expanse and throw in Parker and Davis dams, too) on a river that was going to give them only 7.5 million acre feet in the Lower Basin. That doesn't even leave California half of its 4.4. So Arizona gets left out.

Charge it all to river planning, and especially to the idea that if you are to have any water at all, you must dam it and evaporate it so as to produce hydroelectric power. You must, you see, because here, in the year 1967, with the atom and its energy known for a quarter of a century, we have a Bureau that has let itself be tied to hydropower, and has the political power to go on insisting on being tied.

And all this, to add Ossa on Pelion, stemming from the idea that man can do without unspoiled nature, especially such unspoiled nature as remains in the Grand Canyon. He can do without nature so well that he must continue loading more of his kind on this planet. So many more that within the century even his self-impoverished earth won't sustain him.

P.S. There is one minor item not quite to be ignored: bank "storage." This is a bank that issues many deposit slips, but very few for withdrawals.

As Lake Powell began to fill, the Bureau was chagrined to learn that the prediction of 15 per cent loss to bank storage had risen to 33 per cent, with the reservoir only one-third full (and now dropping). Three years, now, Lake Powell has been trying to get full. The maximum capacity reached was about 9,000,000 acre-feet, one-third of the potential. To get that 9,000,000 with a one-third bank-storage loss, 14,000,000 had to flow in, counting the 1,000,000 lost in the interim to evaporation. That makes 5,000,000 arce-feet beyond recall in three years. Don't yet anyone fool you into thinking you can get it back. It's gone, into the wild dark yonder of the desert's understory, which hasn't given forth much water for a long time.

That's just the beginning at Lake Powell. One wild rumor (we hope it's wild, that is) would have 80,000,000 acre-feet of much-needed water disappearing into the great beyond of bank storage when the lake is full. Some will trickle back as the Reclamation Bureau pulls the reservoir back down, 221 feet from time to time. This the Bureau must do, exposing about 100,000 acres or so of badly damaged lake edge, if the Bureau operates Lake Powell as it said it must. When the reservoir is pulled down that 221 feet, some bank storage will flow back into the Colorado Basin. Much of it, oozing out in seeps on desert-hot rock where once-green shade has long since died, will vaporize; but some will get to Los Angeles. Not much to Tucson.

For a while, that is.

But then the lake will fulfill its destiny. The Colorado will fill it full, that is, with sediment. At that point in time, whatever got away into bank storage

cannot return when the reservoir gets pulled down because there will be no more pulling down. Quite the opposite. Headward aggradation will build the ramps that can spill still more precious waters into that wild, bank-storage beyond.

So much for Lake Powell, a bad enough beginning. When you take what the aggraded Coconino silt-retention reservoir can do, in addition to impairing, unauthorized, a substantial area on the Navajo Reservation, you will find that it is quite possible that the Bureau's Coconino silt trap will be capable of evaporating all the flow of the Little Colorado. Add the gross losses in bank storage as Coconino silts up. Do the same for the Paria silt trap, for the Marble Canyon silt trap, for the Bridge Canyon (Hualapai) silt trap, and then remember that Lake Mead's day will come, with Lakes Havasu and Mojave not far behind.

Add up the acres again: Glen, 200,000; Grand Canyon foursome, another 200,000; Mead, duly aggraded, with Havasu and Mojave similarly favored, and the Bureau's few upstream devices, Flaming Gorge, Curecanti, Granby, Juniper, Navajo, and ancillary attractions. Round those all off at a conservative 100,000. Call it all, for easy rounding, 500,000 acres, all of it quite impressive in its phreatophyte expanse, evaporating that average 10 feet per year, and losing in bank storage, and permanently, something like 40 percent of the total storage capacity.

Multiply this all by the 100 year years of the cost-benefit period the Bureau now likes to use. And see what we have taken away from the generations that will have a harder time making out with the earth than we do—all at a cost to ourselves and them of five to ten billion dollars.

Or perhaps the people would like to give the whole proposition a harder look, insisting that man's inertia be used less and his genius more. Perhaps there's a moral: Grand Canyon is a place to stop, look, and always have a river to listen to—240 miles of river, all of it alive.

PART 2

Lower Colorado Basin Project: Hualapai Dam or a National Water Commission

On January 30 of this year, Mr. Chairman, I wrote the following letter from our Washington office and it was hand-carried to the White House:

Dear Mr. President:

The purpose of this letter is to transmit a documented demonstration that the authorization of the proposed Hualapai Dam in the Grand Canyon is antithetical to the purpose of the National Water Commission that your administration has so wisely proposed. We urge for that reason that your support for the Lower Basin Project be contingent upon establishing a National Water Commission as previously recommended by you and the omission of both proposed Grand Canyon dams—Hualapai and Marble Canyon.

The enclosed statement is by Jeffrey Ingram, whose testimony before the 89th Congress showed that revenue from the Grand Canyon dams is not necessary for Southwest water development, including the Central Arizona Project. His contention was conceded to be right by the Bureau of Reclamation. His present statement has been reviewed by Laurence I. Moss, nuclear engineer with Atomics International, who has extended the reasoning of Dr. Alan Carlin and Dr. William Hoehn of the RAND Corporation, also presented to the 89th Congress, to show that the benefit-cost ratio of the proposed Hualapai Dam is less than unity. Our petition of today before the Federal Power Commission for leave to intervene explains in detail our separate concern about the proposed Marble Canyon Dam.

The Sierra Club, in supporting the National Water Commission, understandably does not commit itself to supporting all the conclusions the commission may reach. We have our own commitment to try to protect the superb living things and places that humanity and other forms of life may enjoy but cannot replace. We know that either of the proposed Grand Canyon dams would irreversibly change the Grand Canyon. The change would be so much to the lasting detriment of the Grand Canyon that an extra-ordinarily greater cost would be justified for an alternate solution to Southwest water development. Actually the alternatives are likely to cost substantially less in dollars, and infinitely less in the cost of mankind were there any further impairment of the Grand Canyon.

We urge you to join Theodore Roosevelt in the admonition, "Leave it as it is," and to continue to support your earlier proposal to establish a National Water Commission and thus bring fresh thinking to the solving of water problems.

The enclosure I sent the President was entitled "The National Water Commission v. Hualapai Dam" and its text follows:

Either the creation of the National Water Commission, or the authorization of Hualapai Dam may be justifiably sought; not both. For they represent contradictory ways of solving the water problems of the future.

The National Water Commission is to take a broad fresh look at the nation's water resources and come up with recommendations which are not biased by prior commitment or predetermined plan (1). Hualapai Dam would be built to provide a development fund for future water projects. This memorandum argues that the existence of such a dam-based development fund is itself a "prior commitment and predetermined plan," and would make unbiased conclusions by the National Water Commission impossible or irrelevant.

Authorization of Hualapai Dam would be a commitment to one particular method of solving the future water problems of the West. This statement might need to be qualified if Hualapai Dam were an integral part of the operation and financing of the Central Arizona Project in the sense that the CAP could not succeed without that dam. The project can succeed, however, without the dam; no proponent of the Colorado River legislation now seriously contends that the Hualapai Dam is necessary in this sense. (2). The dam would provide a convenient way to finance water development because it is the traditional way; but there are other ways. (3). Moreover, it is the very fact that it is the traditional way that makes authorization of Hualapai Dam so dangerous.

What the proponents of Hualapai Dam lay their stress on is the need to accumulate funds to help solve the long-range water problems of the Southwest. They would extend the traditional method of funding reclamation projects far into the future to pay for supplying water for various uses and from various sources. Of the various sources being considered for augmented water supply in the Southweast only large interbasin transfers, to move water from one basin to another for agricultural purposes, need the money from Hualapai Dam (4).

Paradoxically, the dam's contribution will be nowhere near large enough to cover the costs of such interbasin transfers (5) and other subsidies will be needed. In spite of the inadequacy of the Hualapai Dam's revenues, in the final analysis they serve only one purpose: supplying imported water for irrigation.

A further point, subtle but important, is that authorization of Hualapai Dam would be a victory for those who believe with Commissioner Dominy that "The high Hualapai Dam project is much more economically feasible and fits into the operating procedure and revenue requirements much better than any thermo-generation proposal" (6). Without arguing the merits of the statement, we can conclude that what Mr. Dominy is voicing is a self-fulfilling prophecy; i.e., the dam, if built, will be better because the alternative was never tried, except on paper, and concrete is better than paper, and old thinking better than new.

The President and the Senate last year approved a National Water Commission to "study alternative solutions to water problems without prior commitment to any interest group, region, or agency of government" (7), Rept. 1212, 1966, a committee free to survey the field, to search out the best way to supply water needs.

But last year, and now this year, the Bureau of Reclamation urges that a dam be authorized that will give what Senator Anderson has called the "ditch and dam method" of water supply a lead over any other method. If the Bureau now succeeds, then by the early 1970's, when the recommendations of the National Water Commission are being considered, the Bureau can say: "See the dam work. It is the best way."

If accepted as the best way, the ditch and dam method will dominate all others. Commissioner Dominy goes a step further when he says: "Weather modification in the high reaches of the Rockies gives extra-ordinary promise of additional precipitation which will even further justify the proposed hydropower development on the Colorado" (8). Thus, one of the alternatives a National Water Commission might consider is already being used to "justify" the traditional dam and ditch method.

Authorization of the CAP could appropriately close out a period, the Reclamation-for-Agriculture period, the ditch-and-dam period.

Authorization of Hualapai Dam, however, will project that period too far into the future, a future in which the water needs are most likely to be the needs of cities and industries. Authorization of Hualapai will make it excedingly difficult to consider city-oriented solutions to water problems. Some dams and ditches may still be needed, but for a city they will probably be a small part of an over-all water-supply complex. We cannot predict this, nor can the Bureau of Reclamation. The National Water Commission should be able to make the best predictions. Unbiased analysis of what this water-supply complex should consist of will be precluded in the face of the actual presence of a Hualapai Dam.

The National Water Commission is aimed at the future; it is the President's response, with which we concur, to the need of being responsible to the future. We can do that only with a clean slate. If Hualapai Dam is written in large letters at the top, then the type of solution it represents will most likely fill the rest of the slate in the decades ahead.

In short, the Hualapai Dam, with a purpose of trying to make money the old way to pay for future water projects, and the National Water Commission, with the purpose for searching out the best new way to solve future water problems without commitment to present methods, are contradictory.

If Hualapai Dam is authorized, the Commission's recommendations will either be determined for it or ineffectual against the argument, "We have a dam; it works; our old method works; it is the best way; try no other."

Consequently, if the Hualapai Dam is authorized, the National Water Commission will be a waste of time.

On the other hand, if Hualapai Dam is not authorized, then the National Water Commission can consider all methods, without prejudice, without being faced by a fait accompli. The Commission will be able to weigh all data, to choose freely between alternate methods, and to fit those methods into rational plans which, by bringing out the best in present thinking, can most effectively provide for the future's needs.

NOTES

(The references are abbreviated; correspondence referred to, or appropriate excerpts from documents cited, are available on request to the Sierra Club, Mills Tower, San Francisco, attention: David Brower, Executive Director)

(1) Letter, Senator Henry M. Jackson to Jeffrey Ingram, Nov. 9, 1966.

(2) Commissioner Floyd Dominy in House hearings, August 1966. Director Felix L. Sparks, Colorado Water Conservation Board Meeting, December 14, 1966.

(3) Alan Carlin and William Hoehn, RAND Paper presented in House hearings, 89th Congress.

William E. Martin and Leonard G. Bower, "Patterns of Water Use in the Arizona Economy," *Arizona Review*, Univ. Arizona, Dec. 1966.

Jeffrey Ingram, testimony in House hearings, 89th Congress.

(4) Letter, Jeffrey Ingram to Felix L. Sparks, January 17, 1967. Letter, David Brower to Felix L. Sparks, January 16, 1967.

(5) Morris K. Udall cited in House hearings, 89th Congress, a capital investment rule-of-thumb of $1 billion/1 million acre-feet of import capacity. Bureau of Reclamation testimony, *loc. cit.*, shows only $2 billion earned by *both* Grand Canyon dams by 2047.

(6) Grand Junction (Colorado) *Daily Sentinel*, January 22, 1967.

(7) Senate Report 1212 on National Water Commission, p. 2, 1966.

(8) Grand Junction (Colorado) *Daily Sentinel*, January 22, 1967.

PART 3

Of particular interest to the Chairman of the full Committee, I would think was some Sierra Club correspondence with Mr. Felix L. Sparks, Director of the Colorado Water Conservation Board in Denver. I wrote him January 16 of this year:

Dear Mr. Sparks:

I have been following your correspondence with Jeff Ingram with a consuming interest owing to our concern over what is happening to the scenic resources of the west—but with a few economic interests too.

Would you care to respond to this hypothesis?

1. If further generating capacity is added on the lower Colorado in order to produce revenue, then the political and financial pressure will be greatly increased to keep a maximum amount of water running down the Colorado and to keep upstream diversions to a minimum.

2. That is, if the Grand Canyon dams are built, then every potential diversion for consumptive use will have to overcome a substantial economic handicap: the deduction from its grown benefits of revenue lost because that water did not flow instead through the generators at Glen, Marble, possibly Kanab, Bridge, Hoover, Parker, and Davis.

3. Therefore the likely prospect is that Upper Basin development would be inhibited or blocked so as to favor the build-up of a still larger development fund, as well as to realize the higher value of the water for agricultural, municipal, and industrial uses downstream, where a concentration of political power already exists and more seems inevitably to be on the way. The "bananas on Pikes Peak" refrain will be heard again, but more loudly than in 1955.

We wonder if the people in the Upper Basin who are so strong for the Grand Canyon dams have thought this point through. They must already be fully mindful of the steadily increasing trouble experienced by areas of origin in recapturing, or even getting, their water, whatever the paper guarantee. The trees go on growing upstream, all right, but the votes grow faster downstream.

The 6.4 billion question is this: Who would want the development fund to grow as big as possible for whom to spend?

The answer: California, southern style.

I have tried this out on several Colorado friends who are unprofessionally concerned with water, and would like to know how it strikes you.

The letter to Mr. Sparks which Mr. Ingram wrote, and which I had thought was especially good in bringing an important issue into focus, was mailed the following day from Albuquerque and stated:

DEAR MR. SPARKS: Your letter of the 3rd raises serious questions about the future of the bills introduced into the 90th Congress by various Colorado Basin Representatives, including Mr. Aspinall.

Your essential point is that the dams are needed to help pay for augmenting the Colorado Basin water supply. You talk of tremendous costs, and the Bureau of Reclamation claims that, with both dams, a development fund will total one billion dollars in 2025, two billion in 2047.

What methods of augmentation are foreseeable that would require such sums of money?

1) *Reallocation of water* from low value, extensive irrigation uses would end the water crisis in large measure, as studies at the University of Arizona show. Such reallocation will not require large sums of money, only the courage to overcome the oft-repeated myth of water shortage.

2) *Weather modification* may increase water yield in certain sections of the West, but again there is no indication this will require large sums of money.

3) *Large dual-purpose nuclear plants* may help localities. Large capital expenditures will be required, but the fact that such plants will themselves generate large amounts of power for commercial sale indicates that the revenue produced by the Grand Canyon dams may not be required. Moreover, the combination of off-peak power for pumping with on-peak power for commercial sale from these dual-purpose plants will compete with the dams, and, according to the work of Carlin, Hoehn, Moss & the Parsons Company, actually undersell the dams' power. More study of this crucial matter is needed, but the dams seem neither economic nor necessary given this third possible method of augmenting the water supply.

4) *Importation of water* from another river basin is most frequently mentioned, in part, of course, because it is the most traditional method. There are three uses for such imported water, and each has a different financial structure.

a) *Importation to relieve the Mexican treaty burden* will not require a development fund, since the legislation proposed would charge this job to the taxpayer in New York, Massachusetts, Florida, Oregon, etc.

b) *Importation for municipal & industrial needs*, over & above what will be satisfied by taking over water supplies used by agriculture, will not need the dams' revenues because municipal & industrial users are charged enough to pay for their share of the capital costs.

c) *Importation to irrigate crops* is traditionally subsidized, and in this brief summary, appears to be the only purpose which needs a development fund which

might require the Grand Canyon dams. The question that faces you, then, is what is the future of any Colorado Basin bill which includes authorization of dams whose only purpose can be to finance bringing irrigation water from the Columbia River, or some other convenient basin?

I find it hard to avoid certain conclusions, and would like your comment:

1. The Grand Canyon dams will be a divisive element among water-users in any attempt at the West-wide water planning that Mr. Aspinall spoke of at the N.R.A. convention in Albuquerque.

2. The conservation organizations will be further stimulated to oppose dams in the Grand Canyon, since they seem unnecessary even in remote prospect.

3. Augmentation can succeed in various ways, if many alternatives are studied imaginatively & pursued diligently. Such study & pursuit will most likely occur if the moratorium on Grand Canyon dams is extended by Congress, thus avoiding temptation to take the old dam-&-ditch way, and if an independent National Water Commission is created, thus allowing conclusions which will be in the national interest, rather than a sectional interest.

And of course, by 1972, everybody might see the value of a Grand Canyon, left as it is.

CONCLUSION

I hope, Mr. Chairman, that the club's testimony will not only point out the obvious, that time exists and moves, but also that it changes man's thoughts, often for the better. The controversy thus far has been uncomfortable, but because of the controversy, such genius as man has been brought to bear from many quarters, and a way out of the controversy has been revealed. The solution does not deny the Southwest its water needs, does not commit the uncounted generations to irreversible schemes growing out of inertia, and saves as much as we can save it the world-renowned greatness of the Grand Canyon, the best of it, the heart of it, its pulsing bloodstream.

This committee can sense and grasp a new opportunity, present a plan that the House and Senate will pass, the President sign, and that the nation's people will celebrate. Then the Interior Committee can move swiftly on to other programs that there is all too little time to consider soon enough. On all of these, I hope, the conservation movement and the committee will be in occasional, stimulating disagreement, but on none of them at cross purposes. If there are to be two sides, good luck to both, but especially to ours, because we need it more!

Mr. JOHNSON. Mr. Nash, you may go ahead and give a summary of your prepared statement.

STATEMENT OF HUGH NASH, EDITOR

Mr. NASH. Thank you, Mr. Chairman. The principal purpose of my testmony is to get some expressions of opinion from the National Park Service into the record. There are two things that I know of that should be a part of the record of these hearings. One is a letter from Theodor Swem, who is Assistant Director of the National Park Service, to Congressman John Dingell. I would like to read several sentences from it. If it sounds a bit jerky, it is because I am skipping.

The park resources of the area between the eastern boundary of Grand Canyon National Park and Glen Canyon Dam include a magnificent portion of the Grand Canyon of the Colorado River.

The value of the Grand Canyon in the vicinity of the proposed Marble Canyon Dam and Reservior is greatest from the viewpoint of park resources in its present and relatively unaltered condition.

Basic park resources and values are impaired rather than enhanced by the introduction of man-made developments which cannot be considered to be anything other than damaging intrusions on the natural scene.

There is more here, but I will go on to the other expression of Park Service opinion, this one relative to Hualapai Dam and Reservoir site. This is from an appendix to the Pacific Southwest water plan. As I understand it, this received very little distribution. I don't believe it is well known even to students of the Grand Canyon dam projects, and I am quite sure it is not in the record. I will again quote only a few sentences:

The proposed Bridge Canyon Reservoir would change the character of a particularly scenic length of wild river to something far less desirable from the National Park standpoint * * * *. The construction of a reservoir in this reach of the Canyon would inevitably result in the loss of park values of national significance * * * *.

The Grand Canyon of the Colorado affords the finest study area available for students of geology.

The most obvious change in recreational use of the canyon brought about by the Bridge Canyon Project would be the limitation of the traditional and exhilarating experience of wild river boating, for which the Grand Canyon is famous.

Undoubtedly, the running of the Grand Canyon would grow in popularity in the years ahead as the quality of such an experience and its safety with proper preparation, equipment, and guidance became more widely known * * *.

That concludes the quotations that I wanted the privilege of reading aloud to the committee. If you will bear with me just 1 minute longer, I would like to read aloud the last paragraph of my prepared testimony:

A Grand Canyon used for commodity purposes and transitory gain would soon be exhausted as a source of power and profit, and would be permanently diminished as a scenic and recreational resource. An undammed and unimpaired Grand Canyon, on the other hand, is an imperishable and unique treasure. We submit that the highest and best use of Grand Canyon is the use that has no temporal limit. We submit that the Grand Canyon should be preserved in its natural state for the enjoyment of all future generations, and that the national park should be enlarged to include the whole of the Grand Canyon within its boundaries.

Thank you, Mr. Chairman.

(The prepared statement of Mr. Nash follows:)

STATEMENT BY HUGH NASH, EDITOR, SIERRA CLUB BULLETIN

My name is Hugh Nash. I am editor of the Sierra Club Bulletin.

Since there are bills before this committee to include the Marble Gorge area within the boundaries of Grand Canyon National Park, I shall address myself first to the scenic and recreational values of that portion of Grand Canyon extending from Lee's Ferry to the northeastern boundary of the present park. I boated through Marble Gorge within the last six months, and cannot find words to describe adequately the scenery or the experience. Perhaps it's just as well. Rather than ask you to accept the appraisal of an enthusiast, I take this opportunity instead to quote an official of a federal agency—the National Park Service—which thus far has had little to say to this committee about a threatened area now widely acknowledged to be of park caliber. The letter from which I quote was written to Congressman John Dingell by Theodor Swem, Assistant Director, National Park Service.

"The park resources of the area between the eastern boundary of Grand Canyon National Park and Glen Canyon Dam include a magnificent portion of the Grand Canyon of the Colorado River. The lower portion of the canyon in much of this sector is cut into and through the cliff-making redwall limestone. The steep canyon walls rising from the river are very colorful and spectacular.

"This segment of the river offers fine opportunities for float trips amidst spectacular surroundings, possesses unusual value and should be altered as little as possible. The canyon's maximum park value here is achieved when its wild and spectacular scenic grandeur is retained in as nearly a natural condition as possible.

"For the river runner, the only feasible access to the river above Phantom Ranch is Lee's Ferry. The construction of Marble Canyon Dam would block the river and preclude continuation of that activity in the reservoir area. Participation in river running increased from some 60 persons in 1964 to more than 1,000 in 1966. River guides are planning considerable expansion in the number of commercial river trips in 1967.

"The value of the Grand Canyon in the vicinity of the proposed Marble Canyon Dam and Reservoir is greatest from the viewpoint of park resources in its present and relatively unaltered condition. The reservoir would substitute an unnatural appearing lake with higher water elevation as contrasted with the present tortuous river in its natural environment. Marble Canyon Dam would result in still further modifications in the behavior of the river already changed by the Glen Canyon Dam. Basic park resources and values are impaired rather than enhanced by the introduction of man-made developments which cannot be considered to be anything other than damaging intrusions on the natural scene."

For several years, the Sierra Club has urged that the entire Grand Canyon—from Lee's Ferry to Grand Wash Cliffs—be given national park status or equivalent protection. It is gratifying to us that members of this committee have introduced bills that would include Marble Gorge within the national park. We hope that such legislation will be favorably reported and passed, but we hope Congress will not stop there. The lower reaches of Grand Canyon, from the national monument to Grand Wash Cliffs, is equally deserving of protection.

Turning now to the Lower Granite Gorge of Grand Canyon, where Hualapai damsite is located, I recently traversed this too by rowboat and am tempted to describe the indescribable. But I seem to detect a disposition to dscount Sierra Club superlatives, and no section of the Canyon can be described without superlatives. Again, I quote from Park Service sources. The following excerpts are taken from the National Park Service Appendix to the Pacific Southwest Water Plan, September 1963.

"The proposed Bridge Canyon Reservoir would change the character of a particularly scenic length of wild river to something far less desirable from the National Park standpoint * * *. The construction of a reservoir in this reach of the Canyon would inevitably result in the loss of park values of national significance * * *.

"The river, with its ever changing currents, pools, and rapids, would be blotted out by the slack water of the reservoir * * *. The existing, natural streambank ecology would be drastically changed throughout the extent of the reservoir. The existing plant and animal habitats would be drowned out, and colonization by exotic species would be expected. In the uppermost regions of the reservoir, silt deposition and debris accumulation would be inevitable * * *."

Let me interject here that the living river, running through the canyon it created, is an education. Substituting a reservoir for the river would divorce cause from effect, and reduce an education to an enigma. Plant and animal habitats that would be drowned would not, for the most part, be recreated at a higher elevation. For much of its length, the reservoir would be confined within sheer walls. And a slack reservoir cannot build new habitat—sandbars, beaches, and dunes—as a living river does. The borders of Hualapai reservoir would be extraordinarily sterile. I would add that silt deposition and debris accumulation would not be confined to the uppermost regions of the reservoir. An alluvial fan would build upstream from the head of the reservoir, penetrating perhaps 15 miles or more further into Grand Canyon National Park. Moreover, the entire reservoir area will become a single gigantic silt deposit within a few generations, if a dam is built. To continue with the Park Service report:

"The change from river to reservoir would change the aquatic fauna. The limited natural range of native fish * * * would be further changed and reduced. Non-native species would become established in the new environment * * *.

"The Grand Canyon of the Colorado affords the finest study area available for students of geology. The effects of the dam on geologic features in this vicinity are discussed in detail by Dr. Edwin D. McKee, now of the United States Geological Survey, in a report he submitted to the Director of the National Park Service by memorandum dated October 21, 1942. The following is quoted from Dr. McKee's report:

" 'The greatest losses, in so far as geologic features are concerned, from the backing up of water behind the Bridge Canyon Dam will be in the area of volcanic activity at and westward from Toroweap Valley. In this section several features illustrating the early stages of canyon cutting and of local vulcanism will be concealed. Also covered will be remnants of lavas that flowed down the river channel and sediments, in two places, formed in ancient lakes or reservoirs behind natural lava dams * * *.' "

Mr. Chairman, another geological feature whose loss would be deplored just as greatly by many of us is the rock sculpture along the river. Multi-colored, intricately carved and polished to a high sheen by the river, the finest sculpture is in the Hualapai reservoir area. Similar sculpture that once existed as higher elevations has been weathered away; all that remains is near river level, and the finest examples would be submerged—first under water, then under silt. To return to the Park Service report:

"The most obvious change in recreational use of the canyon brought about by the Bridge Canyon Project would be the limitation of the traditional and exhilarating experience of wild river boating, for which the Grand Canyon is famous. This unique form of recreation was beginning to show a marked increase prior to the closure of the Glen Canyon Dam. Since 1955, more than 1,300 persons enjoyed boat trips through Grand Canyon; nearly 400 of these made the trip last year."

I would remind the committee that figures on the number of people boating through Grand Canyon are notoriously unreliable. One figure often cited by those who depreciate the recreational importance of river running places at 900 the number of people who have ever, in all recorded time, passed through the Canyon. This was true once, momentarily, but the figure continued to be used after that many people had boated through the Canyon in a single year. In his testimony earlier in these Hearings, Commissioner Dominy told the Committee that about 2,000 people traversed the Canyon by boat in 1966. This would indicate that river running has quadrupled in the last four years. The Park Service was justified in saying in 1963 that:

"Undoubtedly, the running of the Grand Canyon would grow in popularity in the years ahead as the quality of such an experience and its safety with proper preparation, equipment, and guidance became more widely known * * *."

Reservoirs have a limited lifespan, and their usefulness for recreation or power generation is relatively brief. If we look far enough into the future, the total number of people served by the living river exceeds the number that could use the reservoir during its brief lifespan. If we must think in terms of man-days of recreation, regardless of the quality of recreational experience, surely we should consider the fact that a brief period of reservoir recreation would foreclose the possibility of river running for all the foreseeable future.

"If a high Bridge Canyon Dam is constructed at an elevation of 1876 feet above sea level, the resulting reservoir would extend into Grand Canyon National Park a distance of 13 miles to within one-tenth of a mile of the mouth of Kanab Creek * * *. This section of the inner canyon is characterized by extreme narrowness and high, sheer walls of sedimentary rock. Near the mouth of Havasu Creek, the inner gorge is at its narrowest along the entire length. The views into the canyon are spectacular and awe-inspiring * * *."

Mr. Chairman, I believe it is essential to consider not only temporary effects, but ultimate and permanent effects. The ultimate effect of Hualapai reservoir—a century or more hence and thereafter—would be to drive a wedge of sediment approximately 15 miles into the national park and 13 miles along the boundary between park and monument. The extraordinarily beautiful mouth of Havasu Creek would be buried, and the impressive junction of Kanab Creek with the Colorado would be almost as seriously injured.

"The late Norman Neville, well-known organizer of the boat trips through the Grand Canyon, stated of this section of the inner gorge:

" 'In all of my notes, on four separate trips, I have noted again and again that the section of river canyon from Kanab Creek to Havasu Canyon is outstanding and among the most beautiful of all the Grand Canyon.' "

Even if we were to concede that the reservoir would in general enhance the Canyon, and we certainly do not, the injury inflicted upon this particularly choice section of the Canyon would be severe. Here the rushing river would be slowed and stopped, dumping its silt. Floating debris would accumulate at the head of the reservoir, with no current to carry it onward. Daily fluctuations in reservoir level would produce a lifeless zone of ugliness around the perimeter. All this within the park and monument, which the Park Service is charged to preserve in its natural state.

great reason for optimism, but is perhaps true on this single issue of the Grand Canyon.

But the Grand Canyon is embedded in a larger issue, an issue which I think overrides all others that face us today, and that issue, of course, is population. It is almost a cliche that the population is too big, it is growing too fast. And yet cliche as it is, there is a very strange ambiguity in our attitude toward population and I would like to quote from remarks that Senator Kuchel made a few days ago in a speech. He was talking about this water project, such bills as the one he introduced and H.R. 3300, and he said, "We will have 50 million Californians by the end of the century." He described life in California in the year 2000 as wall-to-wall people, jammed into a vast coastal metropolis and then he goes on to say that "Water must be provided far in excess of its presently projected availability." He concludes that if we don't prepare for this eventuality, this wall-to-wall people—I take it back; for him it is not an eventuality, it is a certainty—then this well lead to an economic and social cataclysm. I submit that a person who can stand up and say what is going to happen and describe it as wall-to-wall people ought to stop and think and ask himself the question, Is this really going to happen?

I don't think anybody wants wall-to-wall people. I don't think it was even comfortable in this committee room last Tuesday, when we had the Secretary here. That is only for a day. Think what it would be like if we had to stand it for years and years and years.

The point here, then, is to question Senator Kuchel's statement that we will have 50 million people in California in the year 2000. I would submit first of all that grammatically the Senator is wrong. The verb is not "will," the verb is "may be." There may be 50 million people in California in 2000. There may not be. As a matter of fact, there might be a 100 million, might be 8,200 million, and if wall-to-wall people gives you the fits, think what it would be like to take the whole population of the United States today and stuff it into California. This might cause some people to worry.

But there is more than a grammatical error in what the Senator has said. There is an error in attitude and this error in attitude can lead to disastrous errors in policy.

Population, as the Senator has treated it here, and as it is too often treated, the numbers that he uses, are treated as facts—as fixed, as things you can't change, that you have to accept.

Well, that is not true. The figures that I used are projections. They are usually based on various kinds of assumptions, usually present trends extrapolated, and then they give some margin of error.

But there are two points to make about this, I think. The first is that the projection is just accepted. You just say we are going to move along the way things have been going and never ask the question, "Is it desirable, do we want this many people?"

And the second thing we don't realize is that population is not fiixed. It is not one of those things which determine everything else.

The number of people we have is perhaps one of the most dependent factors we have today. For verification look at World War II and what happened to the rate of population growth there, and look at the depression and what happened there.

These events have occurred all along. People are very sensitive, when they decide whether they are going to have children, to all kinds of other factors. Consequently I would like to suggest here that we stop thinking that we will necessarily have this many people, and ask the question—it is a difficult question to ask, it seems perhaps heretical—but let's ask how many people are desired in a given area? I am not saying that there are 180 million people now and we ought to cut it down. But let's remember that when Senator Kuchel says there will be 50 million people in California, most of those people haven't even been contemplated, much less born.

We are not depriving anybody who is born now of anything. So we can start thinking in terms of the years ahead as to whether or not a particular projection is one that we want. And then we can choose between the ideal of endless increase, where we always project a steady increase (because this is what we have had and we never bothered to think of anything else), or a realistic point of view that you can't increase forever. The world can't stand it. Not only that, but normal human beings won't stand it. I think everybody will eventually come to the point where they don't want it. So let's plan. Let's think of a realistic point of view. Let's talk about a stable population. Let's talk about a realism which includes planning, which includes preparedness that the Senator is talking about, but which also includes a little bit of self-discipline, a little bit of acceptance of the limits that exist in the natural world—and the limits our own tolerance, of our own abilities to get along in the social situation.

Let's decide not just to accept the figures that the population statisticians come up with and their little bit of margin of error; let's ask the question, "What is desirable?" I would suggest some language for section 3(a) of S. 20, for instance, which could embody this—which would direct the National Water Commission to provide projections which would allow a real choice to be made.

Now, I am not saying that the National Water Commission should go ahead and try and decide what is desirable for the country. This is a job for Congress, and ultimately, of course, it is the duty of people. But I think the National Water Commission can take a look at two things, two different kinds of projections, and provide information for this committee and for all of us, and perhaps then we can make a little more rational decision.

The wording I would suggest is in section 3(a):

> The Commission shall, (1) as its first duty, prepare projections of water needs based on, first, an expanding population, using present trends for the projections, and second, a stable population, where stability would be achieved by 1990; and shall review present and anticipated water resource problems for each of these two projections identifying alternative ways in which the methods of applying water and the amount of water supplied would lead to the realization of these projections.

And then continue as given.

Then a little further on in section 3(a)(2) I would like to suggest the following wording:

> The Commission shall consider economic and social consequences of developing water resources at various rates, including, for example, the impact of water resource developments on national and regional population growth, considering such factors as birth rate and migration.

Now, I would submit that this is the realistic course, that this is nothing radical here. We do this in our economic policy, [illegible]

I don't think anybody today accepts that we have to endure as natural the depressions and inflationary cycles that we had over the hundred years of our industrial expansion. I don't say that these are all ironed out, either, that we all like the methods by which we hope to achieve stability, but the point is we have adopted a policy. We say that it is desirable to try and have an economy that is at one and the same time stable and yet prosperous, which provides the things that we want without going way up and then falling way down. I think we can do the same thing for population and I think that the National Water Commission is one body that can start providing us with some of the information so that we can make a decision. It is not the only one. Water is not the only factor which would enter into any kind of a decision about population. But for the West it is probably one of the most important and I suspect one of the most sensitive. Water planning is too prevalent in everybody's mind in the West for a decision, whether or not you build an aqueduct or whether or not you import water, not to have an effect upon how many people boom or boost their region and whether or not they remain a little quiet about it. So water, I would suggest for the West—as well as other areas, but for the West partcularly—is a constraint and it is a limit. Just to speak my own personal opinion here now, I am saying that the National Water Commission may not show this, but I think that we can show that water will turn out to be a limit which can help us, by planning, to avoid this business of wall-to-wall people (who will exist, I am sure, at that time, in earth-to-heaven pollution).

The West may need help in this kind of planning. Water is too emotional an issue for westerners to think that perhaps they can just change the way they think about it all at once. I think perhaps one of the indications of this is a quote from a speech that Congressman Aspinall made last November. He said:

> How can an independent evaluation free of state, regional or local interests resolve complicated water issues involving water rights, interstate compacts, long-standing agreements, et cetera?

That is not the issue, however, for the National Water Commission. The National Water Commission is set up actually to deal with the complete reverse of that question, which would be, How can State, regional, and local interests make an independent evaluation of the multifaceted water problem, bringing to bear on problems in many places the elements which are common to those places and to those problems?

The National Water Commission's mission is to provide a forum to discuss and to generate new ways of looking at the water problem.

When the National Water Commission makes a recommendation, this recommendation does not then become law. Nobody here thinks this. Instead it will be mediated and filtered through all these regional and local interests, through this committee. And they will be in turn affected by what the National Water Commission has said.

I think that is the way things work. Nobody gets everything they want. But I think the effect of the Commission in allowing a new framework to be tested against the old, the water rights, and the other things which are long established, will have a beneficial influence on them, particularly if we have before us the choice that if we go along with the present framework we get an expanding population,

while if we go along with the Commission's framework we may possibly be able to achieve a stable population.

And just to dwell on that point a minute, if I may, the kind of water planning we have now is a subtle encouragement of population growth. Thinking of what Senator Kuchel said in his statement—"we will have 50 million people"—we must provide water for them, so water is provided. So, of course, you get 50 million people.

It is sort of subtle, but people don't have to worry about having any provision made for them, so they don't worry about them. They just have the children, and then they have got the 50 million people living wall to wall and choking in the exhaust of each other's cars.

Well, probably one of the best ways to specifically illustrate what the Commission might be able to do is to consider the Marble Canyon project. Because there was a delay last year in authorization of the legislation, Marble Canyon Dam was rethought. In rethinking it, new imaginative ideas were tried and they came up with a solution which would not have been tried, which would not have been thought of, if Marble had been authorized. I would suggest that the same is true for Hualapai Dam. The National Water Commission will be sorely handicapped if Hualapai is authorized because National Water Commission is set up to find new solutions to the water problem and the Hualapai Dam is a solution to a water problem.

I would suggest, then, that if Hualapai is constructed, there is a contradiction—the National Water Commission recommendations are going to be irrelevant. If the National Water Commission is authorized to study Hualapai Dam, there is chance here that we can put it, if it turns out to be necessary—and certainly we hope it does not—in the proper perspective in the water plan.

Well, I have gone on far too long. I made the point about population I wanted to make. I think the National Water Commission can make a contribution here, and I suggest the wording contained in my statement on page 3 to the Committee.

(The prepared statement of Mr. Ingram follows:)

STATEMENT BY JEFFREY INGRAM, SOUTHWESTERN REPRESENTATIVE, SIERRA CLUB, ALBUQUERQUE, N. MEX.

"Time is on your side" is a remark often made to conservationists working to have the Grand Canyon National Park extended to include all of the Canyon. Perhaps on this single issue, where the main change over time is that more and more people learn about the threat dams pose to the Canyon, this remark is true. Time may be on our side in trying to save the Grand Canyon; it seems so at the moment, though optimism is hardly called for.

However, the Grand Canyon issue—and I include both preventing the authorization of the unnecessary, uneconomic, and destructive hydroelectric dams and preserving the whole Canyon—is embedded in a larger issue, one in which time is on no one's side, and in fact, is working against everything we all believe in. This larger issue overhangs, like an almost-unbalanced avalanche, all conservation issues, and indeed, all social issues. I refer, of course, to the problem of population. Our population is too big now; it is growing too fast; it may soon reach the point where it will become, to use a phrase that Senator Kuchel used in a different sense, an "economic and social cataclysm". (Speech before U.S. Senate, March 1, 1967.)

Senator Kuchel was referring to the possible result of not planning for an exploding population. He said, "We *will* have . . . 50 million (Californians) by the end of the century." (Emphasis added.) The Senator describes life in California in the year 2000 as "wall-to-wall people jammed into a vast coastal megalopolis". The Senator then says that "water must be provided far in excess of the presently projected availabilities".

pose new solutions for consideration. Certainly there will be varying degrees of acceptance of these solutions, but most important is that a place be made available for encouraging imaginative departures such as the Administration's prepayment proposal.

There is another lesson here. If Marble Dam had been authorized last year, there would have been no new thinking, no atempts to experiment, no searches for new directions. Similarly, if Hualapai is authorized, the National Water Commission's value will be severely curtailed for the West, for Hualapai Dam and the Commission represent contradictory ways of solving the water problems of the future.

The National Water Commission is to take a broad fresh look at the nation's water resources and come up with recommendations which are not biased by prior commitment or predetermined plan. Hualapai Dam would be built to provide a development fund for future water projects. The existence of such a dam-based development fund is itself a "prior commitment and predetermined plan," and would make unbiased conclusions by the National Water Commission impossible or irrelevant.

Authorization of Hualapai Dam would be a commitment to one particular method of solving the future water problems of the West. This statement might need to be qualified if Hualapai Dam were an integral part of the operation and financing of the Central Arizona Project in the sense that the CAP could not succeed without that dam. The project can succeed, however, without the dam; no proponent of the Colorado River legislation now seriously contends that the Hualapai Dam is necessary in this sense. The dam would provide a convenient way to finance water development because it is the traditional way; but there are other ways.[1] Moreover, it is the very fact that it is the traditional way that makes authorization of Hualapai Dam so dangerous.

What the proponents of Hualapai Dam lay their stress on is the need to accumulate funds to help solve the long-range water problems of the Southwest. They would extend the traditional method of funding reclamation projects far into the future to pay for supplying water for various uses and from various sources. Moreover, the dam would be authorized before anyone has even studied the possible water projects. For the first time, a "cash register" would be provided before there is anything to buy.

Of the various sources being considered for augmented water supply in the Southwest only large interbasin transfers, to more water from one basin to another for agricultural purposes, need the money assumed to come from Hualapai Dam.[2]

Paradoxically, the dam's contribution will be nowhere near large enough to

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[1] Alan Carlin and William Hoehn, RAND paper presented in House hearings, 89th Congress.
William E. Martin and Leonard G. Bower, "Patterns of Water Use in the Arizona Economy," *Arizona Review*, Univ. Arizona, December 1966.
Jeffrey Ingram, testimony in House hearings, 89th Congress. S. 1013, administration bill.

[2] What methods of augmentation are foreseeable that would require such sums of money?
(1) Reallocation of water from low value, extensive irrigation uses would end the water crisis in large measure, as studies at the University of Arizona show. Such reallocation will not require large sums of money, only the courage to overcome the oft-repeated myth of water shortage.
(2) Weather modification may increase water yield in certain sections of the West, but again there is no indication this will require large sums of money.
(3) Large dual-purpose nuclear plants may help localities. Large capital expenditures will be required, but the fact that such plants will themseves generate large amounts of power for commercial sale indicates that the revenue produced by the Grand Canyon dams may not be required. Moreover, the combination of off-peak power for pumping with on-peak power for commercial sale from these dual-purpose plants will compete with the dams, and according to the work of Carlin, Hoehn, Moss, and the Parsons Co., actually undersell the dams' power. More study of this crucial matter is needed, but the dams seem neither economic nor necessary for this third possible method of augmenting the water supply.
(4) Importation of water from another river basin is most frequently mentioned, in part, of course, because it is the most traditional method. There are three uses for such imported water, and each has a different financial structure.
(a) Importation to relieve the Mexican treaty burden will not require a development fund, since the legislation proposed would charge this job to the taxpayer in New York, Massachusetts, Florida, Oregon, etc.
(b) Importation for municipal and industrial needs, over and above what will be satisfied by taking over water supplies used by agriculture, will not need the dams' revenues because municipal and industrial users are charged enough to pay for their share of the capital costs.

cover the cost of such interbasin transfers and other subsidies will be needed.[3] In spite of the inadequacy of the Hualapai Dam's revenues, in the final analysis they can serve only one purpose: financing the import of water for irrigation.

A further point, subtle but important, is that the authorization of Hualapai Dam would be a victory for those who believe with Commissioner Dominy that "The high Hualapai Dam project is much more economically feasible and fits into the operating procedure and revenue requirements much better than any thermogeneration proposal."[4] Without arguing the merits of the statement, we can conclude that what Mr. Dominy is voicing is a self-fulfilling prophecy; i.e., the dam, if built, will be better because the alternative was never tried, except on paper, and concrete is better than paper, and old thinking better than new.

The President and the Senate have approved the National Water Commission to "study alternative solutions to water problems without prior commitment to any interest group, region, or agency of government",[5] a Commission free to survey the field, to search out the best way to supply water needs. But if the ditch-and-dam method, as Senator Anderson calls it, is accepted as the best way, it will dominate all others. Commissioner Dominy goes a step further when he says: "Weather modification in the high reaches of the Rockies gives extraordinary promise of additional precipitation which will even further justify the proposed hydropower development on the Colorado". Thus, one of the alternatives a National Water Commission might consider is already being used to "justify" the traditional ditch-and-dam method. This "justification" will be turned into a necessity by the dam's proponents if the dam is built; they will say they must have all possible water flowing downstream to generate revenue.

Authorization of the CAP could appropriately close out a period, the reclamation-for-agriculture period, the ditch-and-dam period.

Authorization of Hualapai Dam, however, will project that period too far into the future, a future in which the water needs are most likely to be the needs of cities and industries. Authorization of Hualapai will make it exceedingly difficult to consider city-oriented solutions to water problems. Some dams and ditches may still be needed, but for a city they will probably be a small part of an overall water-supply complex. We cannot predict this, nor can the Bureau of Reclamation. The National Water Commission should be allowed to make its best predictions. Unbiased analysis of what this water-supply complex should consist of will be precluded in the face of the actual presence of a Hualapai Dam.

The National Water Commission is aimed at the future; it is the President's and now the Senate's response, with which we concur, to the need of being responsible to the future. We can do that only with a clean slate. If Hualapai Dam is written in large letters at the top, then the type of solution it represents will most likely fill the rest of the slate in the decades ahead.

In short, the Hualapai Dam, with a purpose of trying to make money the old way to pay for future water projects, and the National Water Commission, with the purpose of searching out the best new way to solve future water problems without commitment to present methods, are contradictory.

If Hualapai Dam is authorized, the Commission's recommendations will either be determined for it or ineffectual against the argument, "We have a dam; it works; our old method works; it is the best way; try no other."

Consequently, if the Hualapai Dam is authorized, the National Water Commission will be a waste of time.

On the other hand, if Hualapai Dam is not authorized, then the National Water Commission can consider all methods, without prejudice, without being faced by a *fait accompli*. The Commission will be able to weigh all data, to choose freely between alternative methods, and to fit those methods into rational plans which, by bringing out the best in present thinking, can most effectively provide for the future's needs.

It may be asked by the proponents of Hualapai Dam: What will be the result if the Commission and Congress do finally conclude that Hualapai is a good idea? Won't five years of revenue have been lost? A rough calculation shows that there will be at most a 2½-year deferral of Hualapai revenues, if Congress

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[3] Morris K. Udall cited in House hearings, 89th Congress, a capital investment rule of about $1 billion/1 million acre-feet of import capacity. Bureau of Reclamation testimony, *loc. cit.*, shows only $2 billion earned by both Grand Canyon dams by 2047.

[4] Grand Junction (Colorado) Daily Sentinel, Jan. 22, 1967.

[5] S. Rept. 1212 on National Water Commission, p. 2, 1966.

should authorize the dam. (The time is so short because the Hoover Dam revenues after payout are available earlier in Hualapai's pay-out period.) So even under the worst assumption—that Hualapai is authorized after the National Water Commission study—the effect is small.

The question is often asked: How would the National Water Commission study Hualapai? Hopefully, the study would be in the broadest context. Of course, all water developments need to be considered broadly; that would be the Commission's job. To further this broad study, I would suggest inserting the words "natural and" after the word "on", line 11, p. 3, of S. 20, and the phrase "and the effect of alternative water resource developments on the land and the environment;" after the word "people", line 12, p. 3.

Sec. 3 (a) (2) would then read, including the changes I suggested above:

> (2) consider economic and social consequences of developing water resources at various rates, including, for example, the impact of water resource developments on national and regional population growth—considering such factors as birth rate and migration—on regional economic growth, on institutional arrangements, and on natural and esthetic values affecting the quality of life of the American people, and the effect of alternative water resource developments on the land and the environment; and . . . (continue as given)

The aim of such language is to encourage the appointment to the Commission of an outstanding figure, full of experience and wisdom, who would be chiefly concerned with the natural sciences, with the land and its life, with the effect man has on that land.

We must have such people, along with engineers and lawyers and others, to help balance one method against another. This balance is incredibly difficult to achieve, as the Interior Committee is well aware, since that is what it is doing all the time. The difficulty is illustrated by an aspect of the issue at hand:

Suppose the dams are dropped from this legislation in favor of coal plants. Then we get air pollution. But if we give up coal plants for dams to save the air, we lose water through evaporation, (which is one of the dam's hidden fuel costs—sedimentation is another). Yet if we save water by building coal plants instead of a dam, we use up the coal. But if we then argue that we must save coal, a non-replenishable resource, and therefore build dams, we lose the river and canyon bottom, which puts us back where we were.

Going round and round in this way is inevitable. The earth, as far as our resource uses are concerned, is a closed physical system. A gain here is a loss there. These gains and losses need to be broadly considered by the Commission.

The National Water Commission can be a tremendous force for realism in this country, and not just on the water problem, where the Commission can consider all ideas and try to identify their relative value for each region of the nation. The Commission can do more, for it can think of water as a natural limit, and can ask: What will be necessary if the people of an area are to prosper in a land that is still livable? What are the benefits and costs to the nation of providing water for an endlessly expanding population? Of providing water for a population that has stabilized itself?

So I close by urging again that the National Water Commission be instructed to consider the question of population and to provide the information necessary for us to decide which is more desirable: a stable population or an ever-increasing one. With this information, we may then choose: Do we want wall-to-wall people with the attendant destruction of the land that we cherish, the unusability of the air and water, and the disappearance of a way of living that any of us would consider worthwhile? Or do we want the alternative: a stable population, a prospering economy, a civilization of quality, a land of natural beauty and continued inspiration?

DECEMBER 12, 1966.

CAN WE END THE GRAND CANYON CONTROVERSY HAPPILY?

The Grand Canyon controversy is at a crucial point. It can be ended now; and what is decided this month will determine whether the conflict will be amicably resolved or whether a bitter struggle will be renewed. The responsibility is shared by all of us on every side of this complex subject. Wishing to go on to other, more constructive work, we offer this memorandum, which we believe provides a basis for negotiation on, and solution of, the problem.

In brief, the repayment analysis of the Lower Colorado River Basin Project, which appears on the next page, shows that more water could flow to Phoenix and Tucson sooner, with less cost to the water user, the power user, and the

Lower Colorado River Basin Project repayment analysis without construction of Grand Canyon Dams—2500 C.F.S. Aqueduct

	Hoover Dam fund		Municipal and industrial			Irrigation	
	Aid to Lower Colorado River Basin project	Lower Colorado River Basin project	Net operating revenue	Interest on unpaid balance at 3.225 percent	Unpaid balance	Net operating revenue	Unpaid balance
1973					$36,477		$23,151
1974			$32	$1,176	146,306	$1,560	271,448
1975			3,333	4,718	154,063	593	302,635
1976			3,541	4,969	212,820	2,363	322,091
1977			3,723	6,863	215,960	2,380	319,711
1978			5,645	6,965	217,280	2,089	317,622
1979			6,001	7,007	218,286	2,052	315,570
1980			6,342	7,040	218,984	2,051	313,519
1981			6,675	7,062	219,371	2,018	311,501
1982			7,031	7,075	219,415	1,991	309,510
1983			7,362	7,076	219,129	1,920	307,540
1984			7,694	7,067	218,502	1,967	305,573
1985			8,025	7,047	217,524	1,949	303,624
1986			8,356	7,015	216,183	1,936	301,688
1987			8,688	6,972	214,467	1,921	299,767
1988			9,029	6,917	212,355	1,912	297,855
1989			9,359	6,848	209,844	1,891	295,964
1990			9,692	6,768	206,920	1,888	294,076
1991	$6,368	$6,368	10,022	6,673	203,571	1,857	292,219
1992	6,347	12,715	10,359	6,565	193,409	1,840	290,379
1993	6,326	19,041	10,694	6,237	182,605	1,821	288,558
1994	6,305	25,346	11,019	5,889	171,149	1,805	286,753
1995	6,284	31,630	11,354	5,520	159,010	1,727	285,026
1996	6,263	37,893	11,691	5,128	146,163	1,677	283,349
1997	6,242	44,135	12,002	4,714	132,612	1,599	281,750
1998	6,221	50,356	12,337	4,277	118,310	1,485	280,265
1999	6,200	56,556	12,661	3,816	103,274	1,379	278,886
2000	6,179	62,735	12,972	3,330	87,402	1,285	277,601
2001	6,158	68,893	13,308	2,819	70,734	1,172	276,429
2002	6,137	75,030	13,308	2,281	53,549	1,128	275,301
2003	6,116	81,146	13,281	1,727	35,858	1,112	274,189
2004	4,951	86,097	13,271	1,156	17,627	1,063	273,126
2005		86,097	13,245	569	0	1,033	272,093
2006		86,097	13,245		0	990	257,858
2007		86,097	13,243		0	940	243,675
2008		86,097	13,207		0	923	229,545
2009		86,097	13,207		0	870	215,468
2010		86,097	13,181		0	845	201,442
2011		86,097	13,181		0	805	187,456
2012		86,097	13,171		0	752	173,533
2013		86,097	13,143		0	735	159,655
2014		86,097	13,143		0	692	145,820
2015		86,097	13,118		0	664	132,038
2016		86,097	13,106		0	617	118,315
2017		86,097	13,080		0	600	104,635
2018		86,097	13,080		0	547	91,008
2019		86,097	13,055		0	519	77,434
2020		86,097	13,053		0	485	63,896
2021		86,097	13,017		0	458	50,421
2022		86,097	13,017		0	405	36,999
2023		86,097	12,991		0	393	23,615
2024		86,097	12,965		0	367	10,283
2025		83,101	12,955		0	324	0
2026		69,866	12,930		0	305	
2027		56,684	12,902		0	280	
2028		43,554	12,902		0	228	
2029		30,488	12,867		0	199	
2030		17,464	12,839		0	185	
2031		4,484	12,839		0	141	
		0	12,839		0	141	

1. The bulk of this memorandum describes a repayment analysis for the Lower Colorado River Basin Project. The analysis demonstrates that the costs of the Project can be paid back:

(1) Without construction of any dams in the Grand Canyon, which extends from Lee's Ferry to the Grand Wash Cliffs;

(2) Without using revenues from Parker or Davis dams;

(3) Without federal construction of or investment in any type of power generating facilities;

(4) Without raising the rates for Hoover Dam power beyond their present level.

Further, any Hoover revenues used in repayment of the Project will be repaid by the beneficiaries of the Project.

Legislatively, repayment by this method could be accomplished by Section 403, H.R. 4671, 89th Congress, plus an amendment to the Boulder Canyon Project Adjustment Act which would provide that:

(1) Revenues from Hoover dam shall be used to aid in repayment of the Lower Colorado River Basin Project;

(2) Any revenues so used shall be repaid by the Lower Colorado River Basin Project as soon as that Project is paid for.

II. A key to this analysis is the recently-signed contract between the California Department of Water Resources and four California power suppliers. Under the contract, the utilities would supply off-peak power to pump water in the California Water Project at the rate of three mills/kwh. (See enclosed clipping.) This repayment analysis is based on the assumption that a similar contract can be negotiated for the Lower Colorado River Basin Project. Since not all pumping power can be supplied during off-peak hours, the analysis uses a 65% load factor as the switch-over point from off-peak to peak rates. The peak rate used here was six mills/kwh. (The switch-over point could have been as low as 40% without changing the analysis and its conclusions.)

The peak power requirements for pumping has been allocated to irrigation, since municipal and industrial water, being of necessity a firm supply, has first claim. It should be noted that the conclusions would not be changed under any other assumption about allocation of peak-rate pumping power.

If the two Grand Canyon dams are not built, then some 100,000 acre-feet of water per year, which would have been evaporated off the reservoirs, becomes available for diversion. This is a firm supply of water. The most advantageous use of this water is for municipal and industrial needs and, if this extra water had been used in the analysis, there would have been additional net operating revenue of some $3.25 million available after the year 2010. Before that year, some lower figure would be appropriate, depending on how much was allocated to irrigation. However, in order to keep the present analysis as simple as possible, this extra water was not included in the calculations.

III. The repayment analysis presented stops with the repayment of the Hoover dam revenues, and there is thus no build-up of any Development Fund. It has often been pointed out that the main purpose for the Grand Canyon dams, raising the rates for Hoover dam power, building a federally-financed thermal power plant, etc., is to build up a large Development Fund for augmenting the Colorado River's water supply. Since all of these revenue-production methods are controversial, and since the possible means of augmentation are both speculative and controversial, we thought it best to leave the building-up of a development fund to another time. The point of this memorandum is that the Grand Canyon dams—one, two, or more, high, low, or middle-sized—are unnecessary; the Lower Colorado River Basin Project can proceed and succeed without them.

IV. Details of method: The figures for capital costs, water supply, power needs, interest rate, etc., are those supplied to me by the Bureau of Reclamation for the 2500 c.f.s. Central Arizona aqueduct, and used by the Bureau in its own analyses. The Hoover Dam aid is extrapolated from the Bureau figures. The methods used in this analysis are those of the Bureau, as provided for in present practices and H.R. 4671.

The net operating revenue for municipal and industrial water, as provided by the Bureau, was adjusted to take account of the fact that the Bureau's cost for pumping such water is 4¼ mills/kwh, while this analysis uses the three-mill figure. Likewise, the net operating revenue figure for irrigation water was adjusted to account for the difference between 2½ mills/kwh, the Bureau's figure, and the three-mill and six-mill figures used here.

Using these adjusted revenue figures, the municipal and industrial costs were repaid, with Hoover Dam aid used as it became available in 1991. Municipal and industrial costs were paid off in 2004. No more aid from Hoover was used, and all water revenues were used to pay off irrigation costs by the year 2024. The Hoover dam aid was then repaid, using all water revenues, by the year 2031.

[From the San Francisco Chronicle, Mar. 19, 1960]

UTILITIES, STATE SIGN WATER-PUMPING AGREEMENT

The State Department of Water Resources and the director of California's four largest utilities signed a contract yesterday pledging enough electricity to pump Northern California water to the Southland.

Roughly, enough power to serve a city of two million will be provided to 42 separate pumping units along the 444-mile pipeline to Los Angeles. The cooperation of the utility companies eliminates the need for the State to duplicate costly, utility-owned facilities along the route.

Under the terms of the agreement, Pacific Gas and Electric Company will supply 43 percent of the power, Southern California Edison Company, 36 percent, the Los Angeles Department of Water and Power, 15 percent and the San Diego Gas and Electric Company, 6 percent.

The agreement calls for the utilities to supply off-peak, steam-generated power through their interconnected systems at a rate of three mills per kilowatt-hour. Ultimately, sales under the contract are expected to reach $30 million annually paid by the southern water users.

Most of the power will be used to boost the water nearly 3000 feet over the Tehachapi mountains. The task requires pumps with a combined capacity of 1.7 million horsepower.

Department of Water Resources director, William E. Warne, said the project is expected to save water users $20 million annually. The contract, he added, makes the State the utilities' biggest customer.

"The contract we are signing today required two full years of exceedingly complex negotiations," Warne said at the signing. "After general agreement was reached on the principles and the rates involved, there still remained many details to scrutinize.

"The new director of the Department (of Water Resources) now can move with full confidence into the construction of the remaining facilities needed to put the project into operation."

Warne's administration will end with Governor Edmund G. Brown's.

Mr. UDALL (presiding). Mr. Brower, does this conclude the presentation of you and your group?

Mr. BROWER. Yes. I have an announcement to make when we are all through.

Mr. UDALL. Go ahead.

Mr. BROWER. So that you may see some of the photographs we have in mind that we would like to supply to the committee, over in room 602 of the Congressional Hotel as soon as this meeting breaks up, we have some of these Ernest Braun color photographs on display. I invite anyone here to come over and look. Some of these pictures we hope to put in a new book, "Grand Canyon of the Living Colorado," which is due out very soon.

Mr. STEIGER. Mr. Chairman——

Mr. UDALL. I was advised by the staff that there was a statement by Mr. Evans. Was that the statement you put in previously?

Mr. FOLEY. Yes.

Mr. UDALL. Do you have other material in addition to those mentioned before?

Mr. BROWER. That is all I believe we have now, Mr. Chairman, except that we would be glad to answer any questions if we can.

Mr. STEIGER. Mr. Chairman, before the questioning, I wonder if without objection we could note for the record the presence of the junior Senator from Arizona, Senator Fannin.

Mr. UDALL. We are delighted to have him again. He is one of the great fighters for conservation and wise use of natural resources.

Senator FANNIN. Thank you, Mr. Chairman.

Mr. UDALL. I will announce to the members of the committee we intend to continue, to attempt to finish the witnesses listed this afternoon, and I propose to preside until Mr. Johnson returns in about 10 minutes. So any of you who want to play this game of committee leapfrog with us will probably have an opportunity to get your questions in when you return, if you have any.

The gentleman from California, Mr. Tunney.

Mr. TUNNEY. Mr. Chairman, I would like to reserve my time because I am going to have to leave in 2 minutes and get down and answer on the roll call.

Mr. UDALL. The gentleman's time is reserved. The gentleman from Oregon.

Mr. WYATT. Mr. Chairman, I would like to ask to do the same thing, if I may.

Mr. UDALL. The gentleman's time is also reserved.

The gentleman from Washington.

Mr. FOLEY. No questions, Mr. Chairman.

Mr. UDALL. The gentleman from Idaho.

Mr. HANSEN. It looks like we are all in the same boat, Mr. Chairman.

Mr. UDALL. The gentleman from Arizona, Mr. Steiger.

Mr. STEIGER. Mr. Chairman, I think it might be just as well that I have to leave. I would like to express a few of my own doubts with regard to the statements of these gentlemen, and perhaps, ask some specific questions.

I like the language of Mr. Soucie in which he indicates disbelief, outrage, and anger at a concept. I recognize the emotions very vividly, Mr. Soucie, because I share them, only I feel I share them because of the conclusions that you gentlemen have reached with regard to the Grand Canyon.

I think again I will indicate that the merits of my expertise on this certainly don't go beyond yours with regard to study, but I think the fact that I have spent most of my adult life within 100 miles of this area is of some value at this moment.

I think that the concept that anybody, be he a representative of the people or simply a resident of the area, who would willingly violate anything of beauty, whether it be a national monument or a single tree, would wantonly violate this, would have to offend those who are so accused, and therefore I feel offended.

The concept of—the arbitrary concept that Hualapai Dam is going to do great damage to the Grand Canyon is not only not factual, but by any yardstick of esthetic judgment is irresponsible, and I found myself wondering what was the motivation here.

Obviously you are intelligent people. You obviously have given this thing a great deal of thought and some study. I don't know how objective your approach was, but a great deal of time has been spent on it.

I find myself believing that there must be a sound motivation since you have spent time on it, since you have been in the area, at least Mr. Brower has. He knows that the Grand Canyon itself will not be violated.

Is it conceivable that there is a reward of self-gratification other than that of fighting a cause? And I would like to determine that

now and I assure you that is the spirit in which I am going to ask a few questions.

For example, you mentioned in your statement, Mr. Brower, you mentioned that you had 10,000 new members since June. How many advertisements did you run, and how many paid advertisements, approximately, did you run in the 90 days prior to June?

Mr. BROWER. We ran our first advertisement in the preceding December. We ran a full-page ad on the Redwoods in five newspapers.

Mr. STEIGER. Do you recall the cost of that?

Mr. BROWER. The cost of all those ads, the preceding December, was something like $19,000.

Mr. STEIGER. $19,000?

Mr. BROWER. Yes.

Mr. STEIGER. And that was the only national effort you made as far as expenditures for advertising?

Mr. BROWER. That is the first time we have tried the use of newspaper advertising to acquaint the public with problems related to our scenic resources and the public obligation to be responsible for them. However, we have been publishing for a long time in other ways, and we began publishing our books in 1959——

Mr. STEIGER. I was referring——

Mr. BROWER (continuing). Which have provided fully as much notice as the advertisements and brought our membership from 15,000 in 1960 up to the level we had at the beginning of this year, which was 34,000.

Mr. STEIGER. Well, actually December of last year is not the first time that you have resorted to newspapers because on October 31, 1955, you turned to the newspaper—this is from the Denver Post, and it follows the——

Mr. BROWER. You will note that wasn't a Sierra Club advertisement.

Mr. STEIGER (continuing). Informing the——

Mr. BROWER. That was the council of conservationists. I was a member of the executive committee, but that was not the Sierra Club nor was it related to it.

Mr. STEIGER. In this ad——

Mr. BROWER. That is where we got the idea, however.

Mr. STEIGER. So this device, this method, however, of informing the public and soliciting membership is not a new—it didn't start in December of last year.

Mr. BROWER. You will note in that ad that membership was not solicited. I can correct the date. The first ad was December 1965. That was on redwoods. About December 17, 1965. Then we didn't run ads until June of 1966.

Mr. STEIGER. Well, at any rate you generated such an interest in December of last year to gain 10,000 members or more actually in that interval.

Mr. BROWER. No. The thing that really made the gain was the attack of the Internal Revenue Service on the Sierra Club. There was a general feeling that it was unfair and there was a response all over the country editorially and in the feature articles, and I think the Internal Revenue Service gave the Sierra Club a rather enviable

underdog position. It cost us a great deal in major contributions, but it brought us much broader support than we had before. So I think we owe Mr. Sheldon Cohen a vote of thanks.

Mr. STEIGER. Now, were these 10,000 members—were they added at the $14 membership fee, or were they just a variety of contributions?

Mr. BROWER. The coupon on those ads called for $14—$5 for admission fee that lasts the rest of your lifetime, and $9 a year. Not all membership applications came in on the coupon. Starting with the June advertisement, we had something like 2,500 memberships come in on coupons right up until now, the recent ad.

Mr. STEIGER. Well, the 10,000 new members would represent somewhere in the neighborhood of $140,000 of income, wouldn't it?

Mr. BROWER. Receipts, not income. There is a difference. It costs something to serve them.

Mr. STEIGER. Right. The cost was $19,000 plus whatever administrative costs you have.

Mr. BROWER. No. You have got to go into some further figures than that because that was one set of ads in December of 1965. I can just report here roughly that when we placed the advertisement for the new memberships, the requests for information, the outright contributions, and the full cost of the membership, receipts just about recover the cost of the ad. This is a way that the message can be given to the public at least in part at the public's expense. It costs us a little bit but not much, and the information does get out.

Mr. STEIGER. So actually you spent somewhere in the neighborhood of $140,000 for the ads in this period?

Mr. BROWER. No.

Mr. STEIGER. You spent $140,000 for the ads in your administrative——

Mr. BROWER. I think you are confusing things a little bit, Mr. Steiger. If you are attributing all the new members to the ads, you can't do that. That is not a proper allocation of cost or income source.

Mr. STEIGER. Well, I think regardless of what the motivation was, my only point in this questioning, which I am sure you are aware of, is to find out if you arrived at a net profit.

Mr. BROWER. My executive committee would assure you this is a futile line of inquiry because we have a fairly handsome deficit. Our last year's deficit was $97,000 and a great deal of this is part of the effort of trying to bring to the public the news, the factual information about the real damage that is threatened to the Grand Canyon, and of this we have no doubt. You yourself living 100 miles from the canyon might have doubts of it, but if you go down the canyon—Mr. Nash and Mr. Ingram and I have gone down the canyon—we don't have any doubts; we know what would happen.

Mr. STEIFER. I have been down the canyon seven times in 9 years.

Mr. BROWER. Down through the river?

Mr. STEIGER. Seven times in 9 years.

Mr. BROWER. If you would contemplate what a dam 180 feet higher than the Washington Monument would do to some of the finest sculpture on the river, you would know first that that would never be seen again. It would be underwater. And finally as my testimony

shows—and rather sooner than later, possibly—it is perpetually gone under sedimentation. That is major damage to the scenic resource.

Mr. STEIGER. The only result would be to reduce the trip from somewhere up around 13 or 14 days to somewhere around 6 or 7 days.

Mr. BROWER. I think we will have to disagree on that very strongly.

Mr. STEIGER. I wouldn't be surprised if we disagreed.

Mr. Chairman, I am going to have to return it to you, because I need the votes more than you do.

Mr. UDALL. We will miss you, but you are excused.

Mr. STEIGER. Thank you, gentlemen.

Mr. UDALL. Mr. Brower, maybe we can start out by compromising. I have had no indication that the Sierra Club is ever willing to compromise but in the light of Mr. Nash's rather dramatic testimony about population, and as one who introduced the first population bill ever presented in the House of Representatives, maybe we can compromise by your letting us build Hualapai with the understanding that the Bureau of Reclamation would inject there some kind of a birth control substance which would go into the water at that point and stop any population growth in Los Angeles.

Mr. BROWER. Mr. Ingram is the population man.

Mr. INGRAM. Mr. Brower may answer. As you well know, Congressman, and as too many people do not know, the water will not come from the Grand Canyon Dam but only high-cost subsidized power, hopefully.

Mr. UDALL. I know your position, that to take out one dam is not a compromise because one arrow into the heart is just as bad as two—it seems to me in all of the country's resource decisions we have to compromise. Mr. Souci's club, I am sure did not fight the Tocks Island Dam. If I am wrong I hope they will correct me. But this flooded out 37 miles of living river and sedimented up tributaries and areas around them and required 4,000 God-fearing, taxpaying families to be removed from the land. Against that you balance off the regulation of the river, more steady water supply for the cities in that area, and recreation for 50 million or 60 million people in the most populated area of the country. So I had though that maybe if we took Marble Canyon out as I am willing to do, and put it in the park as I am willing to do, and give you 158 miles of living river instead of 104 which wasn't sufficient last year, that maybe we had the grounds of compromise.

If we lower the dam so that we take out 13 miles more and we give you 171 miles of living river forever, does the Sierra Club find this proposition at all interesting now that you have rejected my birth control proposal?

Mr. BROWER. Maybe Mr. Soucie would like to respond to that because I believe he knows a little more about the Tocks Island problem.

Mr. SOUCIE. I leave to Mr. Brower the answer on the Grand Canyon, but on the Tocks Island project, Mr. Chairman, what I want to point out is that the Sierra Club is not against dams per se. Certainly some dams are necessary and in the case of the Tocks Island project, though this developed before I was a resident of New York, so I can't speak very intelligently about the history of it, but it was felt that this proj-

ect was necessary and that the values sacrificed were in no way on the order of the values of the Grand Canyon.

Mr. UDALL. Well, in short, all I am getting at is the Sierra Club did not oppose that.

Mr. SOUCIE. That is right.

Mr. UDALL. And you agree with me in certain cases you must balance in these resources decisions the things you gain against the things you lose. In this case you would agree that with construction of the dam probably you had more to gain than you had to lose looking at it overall.

Mr. SOUCIE. I am not sure we went that far. What I would say is we didn't get alarmed enough at the beginning to pursue it. I don't think that anyone in the Atlantic chapter, say on the executive committee, the people who make the decision, actually went through all the steps of comparative analysis, but certainly the values to be sacrificed were not so great that immediately we rose up in arms. That is why I say we are not against dams.

Mr. UDALL. I understand.

One of the things that has troubled many of my colleagues here is what they deem the impossibly adamant noncompromising position of the Sierra Club. We have 104 miles of living river, the longest stretch of national park in the country. We enlarge that to 158 miles. We are willing to enlarge the Grand Canyon to take in Marble Gorge and Vermillion Cliffs and all of that. We are willing to talk about going downstream another 13 miles. What would the Sierra Club accept? If we have a low, low, low Bridge Canyon dam, maybe 100 feet high, is that too much? Is there any point at which you compromise here?

Mr. BROWER. Mr. Udall, you are not giving us anything that God didn't put there in the first place, and I think that is the thing we are not entitled to compromise. That is the primary scenic resource of this country. If there are no other ways to go about getting your water, I would still say that the compromise should not be made—that Arizona should be subsidized with something other than the world's Grand Canyon, or any part of it.

We would not expect you to sacrifice a major part of the central Arizona aqueduct for the possibility of getting water. You are here for the principle of getting water for Arizona. And although we could question some of the economics of this, we are perfectly willing to compromise there.

The aqueduct is going to damage a great deal of scenery. The new storage reservoirs along the aqueduct will too. These things we are taking a walk on. On the Grand Canyon, we are not entitled to take a walk.

Mr. UDALL. You won't agree or compromise on any dam at any point regardless of what you conceive to be the total geological Grand Canyon regardless of how high, how low, how little damage or anything else.

Mr. INGRAM. I think we are biased by the use of compromise as a verb. This is not a compromise. You can't compromise when one side says "we will define what is to be compromised." Both sides have to come together, and I have been emphasizing this point, of course, as you know, for several months, that you have to come together first and talk about what you can discuss as to compromise. We have never been able to do that. Every time we have come in there we have been accused of being inflexible and not bargaining in good faith. But you won't bargain in good faith on issues that are important to us.

Mr. UDALL. We know your position and you know ours. What I am getting at, I want the record to show that the Sierra Club would not slacken its efforts in any degree if we lowered the dam by any amount or changed the dam in any way. This is the point I wanted to make. Nor does the Sierra Club slacken its efforts or compromise when the Secretary of the Interior and the administration are willing to simply defer the dam and take 5 more years to decide whether we build it.

You say that you will continue to fight and try to defeat the bill unless it contains a provision setting aside that damsite once and for all time in the Grand Canyon National Park.

Mr. BROWER. We have no choice. There have to be groups who will hold for these things that are not replaceable. If we stop doing that, we might as well stop being an organization and conservation organizations might as well throw in the towel.

Mr. UDALL. I know the strength and sincerity of your feelings and I respect them. I simply want to make sure I have the position of the Sierra Club firmly laid down here today.

Now, because much of what you brought in today is reargument of things we have had before in the hearings and things that I have discussed with both of you privately, I don't want to take the time to go over them again. But because there probably won't be any answer in the record to your dreary predictions on sedimentation in your "Sedimental Journey" which I read both today and in a previous draft, I want to have just a short colloquy and make a couple of observations on that.

The Coast and Geodetic Survey I am told by a gentleman from the Bureau of Reclamation here, with the Bureau of Reclamation and the Navy a few years ago made a special study trying to determine the useful life of Lake Mead and Hoover Dam. It was calculated by these experts to be more than 500 years without Glen Canyon. With Glen Canyon, Lake Mead's useful life was believed to be considerably longer than that. I know you contest these facts but I am going to ask you a question.

I think we would all like to know ahead of time what really would have to happen with sediment. You don't know and I don't know. We can make projections or guesses. But I think the way I would really want to do it if I were to be sure would be to find some planet off in outer space somewhere where I could build a dam exactly like this and check it out for 50 or 60 or 200 years and see what the sedimentation actually was to guide me in making a decision here on earth.

Well, it seems to me that we actually have almost that good a test, and it is called Lake Mead. You are talking about the silting at Hualapai, the silting which you predicted in Marble Dam, and they closed the gates at Hoover, and for 33 years you got all the sediment in the whole Colorado River. You didn't have Glen Canyon. You didn't have Coconino that we propose to put in or Paria that we pro-

pose to put in, and yet according to your calculations this period of time, 33 years, should have seen wall-to-wall mud about halfway down through Lake Mead. Yet, the truth of the matter is—I flew over it just a few months ago—and less than a fraction of 1 percent of Lake Mead has anything like wall-to-wall mud.

I know you have pictures. I have seen the area. In terms of the huge lake, in terms of the total lake surface, in terms of the flood control that has enabled that whole lower stretch of the river to develop, the disasters that have been avoided all through the river basin down to the Imperial Valley and along the Colorado down below, that very small percentage of wall-to-wall mud in upper Lake Mead, which is certainly inaccessible would seem to be a reasonable price to pay when you balance off the damage and the destruction you would have down below. Now, this is a record of 33 years which doesn't bear out anything like the kind of predictions you have been making.

Mr. BROWER. May I answer?

Mr. UDALL. You may answer in just a moment. I emphasize that, except for the past 2 years, this 33-year test in this very reservoir took place when you didn't have Lake Powell and when you didn't have Paria or Coconino.

My question is, Why didn't we have this complete silting up of that reservoir that you predict will surely happen if we have the other reservoir? And I can't wait for the answer. I have got to go vote. It will be in the record and I will read it.

Mr. BROWER. The answer to Mr. Udall's question is that we are thoroughly aware of the study he cites. I have it back in the hotel room and can bring it in anytime. The study is over a short period, and we have not predicted in this statement that there would be any appreciable silting of Lake Mead in that time. We do have a fairly good measurement of how much sediment has come in in this period, and we also know that there have been no major disruptive floods in that period to add an extraordinary amount.

That was the point of my showing what happened on the Paria to one little silt detention trap and what happened in the redwoods country. The record is terribly short. We have Lake Mead. No conservation organization I know of protested it. It will be there a long time. I think we can have quite a bit of time to see that we silt up just Lake Mead and Lake Powell, and not the Grand Canyon, while this test is running. We have a reservoir there. I have been through it. I know the trouble of getting ashore at the head of Lake Mead for the first 50 miles. I know what a mess it is when the water is drawn down, as it is now. If you are coming down the river from where you hit Separation Canyon, where the top of Lake Mead is when full, you have 50 miles to go to get down to where the river is dumping sediment. Pierce Ferry was going to be a great recreational area, but it is out of action because of sediment. If you want to have fun boating in the canyon, there is 40 miles of Lake Mead in the Grand Canyon. Let the mass recreation go there if it can. It can't because of the mud. Not very many people can navigate through that mud or get over the ultimate barrier.

If it is so good, let's play with that because we do have Hoover Dam and the dam is about half full. We have got plenty of chance to test sedimentation further.

Our records are extremely fragmentary and my testimony bears out that the U.S. Geological Survey has not been allowed any funds to speak of to study this matter. I hope that they will be. I would like to see those studies precede any further authorizations of dams.

The Bureau of Reclamation figures worry me a great deal. If you will read my testimony in detail you will find there are various errors where you have to just decide which page of the Bureau's figures you want to read. I cite one error of 3,600 percent. They don't know much about sedimentation. Mr. Dominy was telling me he didn't think Lake Powell would ever silt up. They don't know. I think they ought to know, and the Congress ought to know before it allows anything more to happen to the Grand Canyon.

Mr. TUNNEY (presiding). What about Mr. Udall's statement with respect to the fact that he has just recently flown over the lake, Lake Mead, and found that only a very small percentage, I think he said one and a half percent of its was—of the shoreline was in any way damaged by silting?

Mr. BROWER. Well, I don't quite understand what he means. I boated through it. The photographs that I am offering to the committee—and I hope a selection of these can be printed in the hearing so that we will understand—show what amounts to a mud glacier from Pierce Ferry on up. There is enormous damage done up there. And you have to bear in mind that the sedimentation and so forth at Lake Powell at maximum drawdown, once it has been filled, is something like 100,000 acres of badly damaged terrain. This is exposed from time to time in Lake Mead as things now stand. Was that responsive to your question?

Mr. TUNNEY. Yes, it was responsive.

Mr. JOHNSON. (presiding). Do you have any further questions?

Mr. TUNNEY. Thank you, Mr. Chairman.

From what I was able to gather from your statement, Mr. Brower, the main objection you have to the building of the dam here, as last year is, one, the damage it would do to the Grand Canyon itself by flooding it, and, two, that the dams would create a great deal of silting behind the artificial wall which in the long run would render the dams themselves no longer efficacious for the purpose that they were being built: to generate power.

Mr. BROWER. Yes, they would go out of action completely by the time sedimentation has run its course. You will notice that I used the figure of 110 miles for the length of damage from the proposed Hualapai Dam. The reservoir is only 93, but as that reservoir silts up, the river begins to build its own grade upstream somewhere between a foot and a quarter to a foot and a half a mile, so that the mud would extend on up another 15 miles beyond what we have always thought in the park—up to Havasu, 30 miles. At Havasu Junction Mr. Dominy said he thought the water would go 85 feet deep. The mud might be 15 feet more—more than 15 feet deeper. It is major damage that nobody has really thought much about.

Mr. TUNNEY. If you could be convinced—now taking this in the abstract—that it was of absolute importance to build a dam at, we will say, the Hualapai area, build the dam to provide power, to construct the central Arizona project, to provide water to the Phoenix-Tucson

area, and that the only method of economically providing for such importation works was the construction of the dam, would you still say that the dam should not be built?

Mr. BROWER. I most emphatically would. I would say then the thing that should happen would be a reallocation of water within Arizona. Our latest advertisement in the Times just alludes very briefly to this. If Arizona stopped growing cotton it would not be a water-short State. It gets a price support on cotton. One-third of its water is used for cotton. Another third for the grains and cattlefeeds. Two-thirds of the water is going to these purposes.

Mr. Goldwater himself pointed out, I think, that if Arizona were to use its water for people instead of for these crops that can be grown elsewhere, it could sustain a population of 20 million people. It could be wall-to-wall, too. I don't think it wants to. But if we are going to postulate something, I would say this: that if there were no Grand Canyon to dam, California somehow would continue to exist. Arizona would continue to exist. They would find their water somewhere else.

I think it is our obligation to pretend that there is no Grand Canyon to dam. That isn't its purpose. It has a higher purpose on this planet as long as people are here, and it doesn't need to be demeaned in any way. We can find routes around the Grand Canyon for our commodity purposes and that is what I hope this committee will do. That is what I hope the National Water Commission will see a way to support.

Mr. TUNNEY. What about the economic impact on the people that do grow cotton in Arizona or the people that grow cotton in California? What about the people who are involved in the farming business and who have a very vital stake in agriculture? Do you feel that they are in any way entitled to consideration when you weigh keeping Grand Canyon inviolate, at least inviolate as it now stands? Do you think that these people shouldn't be figured in the equation?

Mr. BROWER. I think they very much should be—and really, if you will examine some of the new studies that have been done in the central Arizona region—the way to build up the economy is not to waste that water on low-value products such as crops. Industry will produce up to 100 or 200 times as much per acre-foot of water in income for the State. To say we must keep growing cattlefeed and cotton because 5 percent or 1 percent of the people have that habit, where the rest of them don't, is not really making economic sense in our view for Arizona. I hasten to add, as Clair Engle, the late chairman of this committee used to say, it doesn't matter if Arizonians put water on their farms or in their bourbon; it is their water. I am not really arguing that. But I do not want to bleed for Arizona if it doesn't have this water right away. They should have their water and do what they want with their full share of the Colorado, but they should not say they are drying up. They can reallocate their water themselves. That is within their power.

Mr. TUNNEY. Has any member of your organization done any, conducted any studies in the area of weather modification or have you been in touch with the authorities in the Government who have done studies of weather modification?

Mr. BROWER. I think probably they have, but I haven't been pursuing that. I know that by the time you go through the 47,000 members you can find some people quite conversant in many subjects.

Mr. TUNNEY. I would assume from your remarks that you are supporting the administration's bill as introduced by Congressman Saylor and Congressman Edmondson?

Mr. BROWER. Yes. We are in support of that. We put in our letter to the President, which is also included in the file, the stipulation that we hoped the Water Commission would find a way to support us in saving Grand Canyon. We will still be fighting that battle, and I suppose our children will. I hope our grandchildren, too, will always have a chance to try and save the Grand Canyon. I hope it will still be there.

Mr. TUNNEY. I don't know what your answer was to Congressman Udall when he mentioned that because of the silt going into some of the tributaries, like Paria, that it was very unlikely that you would have anywhere near the same degree of silt content flowing from these tributaries into the Colorado River as we now do. And as a result the statistics you used with regard to Lake Mead, assuming that they were correct in and of themselves, would not apply in the eventuality that you did build Hualapai Dam. Did you make any comment?

Mr. BROWER. All those dams are included in such projections as we tried to make with the extremely meager data. That is, you can take any of the projections I have made and multiply by 4 or divide by 4, the figures are so poor. We have been provided with so few, and the Congress has been provided with so few, that you cannot make a good projection. As for the Paria Reservoir, I cited there the sediment trap they built for testing purposes. They thought it would last 10 to 20 years while they tested it. One storm, just one storm, took it out. That was it. One storm filled it up. Now, the same kind of thing must be contemplated at Coconino. I did in the projection I put together.

Mr. TUNNEY. But you must admit that the Colorado River is an awful lot greener as the result of Lake Powell being there than it would have been if there was no Lake Powell.

Mr. BROWER. I don't really admit that, and if you come over to room 602 I will show you why. We were in the Colorado River in September last year. I went down September 18. I arrived at the bridge near Phantom Ranch. The river was running sort of a sickly green at that point, near noon. At 5 o'clock it was really roiling, and for the remaining 12 days of our trip it never cleared up. All you have to do is get one of these storms——

Mr. UDALL. You don't seriously contend if you have a river running 14, 15, 16 million acre-feet a year carrying silt and you dam that stream at a point halfway you are still going to have as much silt coming down the river below that mainstream dam with only the lower tributaries contributing silt, as you did before with both tributaries and mainstream?

Mr. BROWER. There will be a momentary pause, in geological terms, but you have not changed the cause of the trouble. The entire Colorado watershed is still a watershed that gets stripped by rains and snows and running water. It doesn't matter where you put the plugs. That stripping is still going on and it will fill whatever you put——

Mr. UDALL. Granted all that, but I still don't understand—you put in the plug so that all the silt of Colorado, Utah, New Mexico—all that silt can't get by the plugs.

Mr. BROWER. Not until that plug fills up.

Mr. UDALL. Now, do you people tell me there is just as much silt down at Phantom Ranch as before you put the plug in?

Mr. BROWER. No. I said it was running clean and I saw it running clean at 12 o'clock. At 5 it wasn't. The storms continue. The main point is in the projections I tried to put together in the statement about Glen Canyon. We know what the Bureau said the silt sedimentation rate is. It is somewhere around 100,000 acre-feet a year above Lee's Ferry. When Glen Canyon Reservoir is about as old as Harvard University, it will become the Glen Canyon "Memorial Phreatophyte Farm." Harvard is a fairly old university. Meanwhile the other tributaries are still pouring the silt in and most of the sediment comes from below Lee Ferry. If you put a plug in the Paria, you have got the Bureau's figures for how long that would last. Another one in Coconino. We have their figures for how long that will last. We have Kanab, and so far they haven't publicly announced they want to put anything in there. You have all the rest of the country that gets stripped off in streams that don't matter until it storms, when they really count. That is when the country——

Mr. UDALL. Will the gentleman yield further? I don't want to extend the record, but will you give me in about two or three sentences the answer to my question why in the world if all this silt sedimentation is going to occur, fill up all these lakes in 33 or 50 years, with all of New Mexico, Colorado, and the Coconino, and Paria coming into Lake Mead, that we have filled up only a tiny strip, less than 1 percent of Lake Mead. Why, in 60 years the whole lake ought to be filled, whereas in 33 years virtually none is filled?

Mr. BROWER. You left before I finished my eloquent statement. The sediment is laid down wherever the river meets the lake and its current slows down. That fluctuates according to Lake Mead's level. Now, the big silt dumps run for 50 miles in the short time since Lake Mead existed. That silt dump extends 50 miles from Separation Canyon into Iceberg Canyon. That is a long bit of mud and a lot of ruined canyon surface.

Now, below that there is a low velocity current that carries finely divided mud all the way down to the dam. It was that, that frightened them in the first place because they thought if there was silt down there already, they had had it. They found out that wasn't really what counted. The big dump is at the head, and right now, with the lake as low as it is, it is 50 miles below the head of Lake Mead at its maximum elevation——

Mr. UDALL. One more question——

Mr. BROWER (continuing). And it is a mess.

Mr. UDALL. No, I flew over it and it didn't look like much of a mess but in light of what you said and in light of the fact that 33 years have passed since they closed the gates down there, do you believe—you have to believe that either (a) the Bureau of Reclamation and the Navy and Coast and Geodetic Survey don't know what they are talking about, and that you have the only true information.

Mr. BROWER. I am not using any information that I haven't picked up from those three agencies—the Navy, the Coast and Geodetic Survey, and the Bureau of Reclamation, or other cooperating agencies.

Mr. UDALL. These experts say 500 years and you say 100 years.

Mr. BROWER. They don't quite say that, I believe. And Mr. Dominy, as I said, Lake Powell will never fill up with silt. Now, he is the Commissioner. I think that the man who gave you these sedimentation figures should talk to Mr. Dominy, because the figures are very poor. I am using them because I can't go out and measure them myself. I am using their figures, and it is a kind of indoor sport to check the figures from page to page because that is where you get the real fun. They don't check.

The main reason they have been measuring it that carefully and they have to, is so that they will know what the capacity of the reservoir is at its various levels, because there is a requirement that Lake Mead must always have so much flood control space. At the beginning, and later in the year, they have to know how much of the site is being encroached upon by sediment. I trust those figures. Those are as accurate as you will get. As I said after you left the room, but I will repeat, I would like to see the tests continue in Lake Mead. We have that. Let's not spoil anything else right now.

Mr. UDALL. I thank the gentleman for yielding.

Mr. TUNNEY. I don't have any questions. Thank you.

Mr. UDALL. Let me ask one more question, and I am just pursuing this philosophic argument, but I think in the light of what has been said and put here in the record today, some reply ought to be made on this one point.

As conservationists, you gentlemen are all concerned with the wise use of natural resources, preserving those things that ought to be preserved. And I take it that you support the Secretary's program to have a thermal plant to provide a pumping plant. That has been a position you have taken for a long time, rather than a dam.

Mr. BROWER. We support the elimination of the dams. We have a good many data on alternatives might be best for power.

Mr. UDALL. Do you propose a coal-fired thermal plant, then, as an alternative?

Mr. BROWER. I know what you are up to. I don't like smog either, and neither does the Secretary, and I think the Four Corners plant is going to be improved upon——

Mr. UDALL. Let me finish because I have more than smog. You don't always have—my point is you don't always have perfect alternatives in this, one having all the damage and one having no damage. If you are for a thermal plant or atomic plants, you have got to be for some damage to the environment, so the question really is, is this more damage to the environment than the dam?

I have a little photograph which shows on the Navajo Reservation where you are going to get the coal for this thermal plant you advocate, a little old strip, only 5 miles long, taking out 7,000 tons of coal a day for the Arizona public service generating plant. The mine extends for 5 miles and will be pushed to 23 miles as coal is stripped out. It has a big dragline, moving dirt and rock to expose the coal which is then loaded. The dragline is bigger than a two-story house. You are going to have smoke going into the air out of this thermal plant which will cover several States, no doubt. And on this, just let me give you the

figures. While water is a replaceable resource that we get that all the time, coal is an irreplaceable resource. Every year of delay on the production of power at Hualapai results in annual waste of 13 million barrels of oil, 3.3 million tons of coal, or 7.8 billion cubic feet of natural gas, an unrecoverable natural resource. This waste would represent more natural gas than was used in 1965 for electric generation in the Intermountain States.

Now, if you don't have perfect choices, how can you say that the choice of knocking out the dams and having the thermal plants is a conservationist's choice and that the reverse is not? What is your answer to that?

Mr. BROWER. I think that the Secretary probably should answer that more than I. We don't really think the steam plants are necessary and our argument has been, when we talk about steam plants—either fossil-fuel fired or nuclear—we are talking about what should be used as a reasonable alternative if you are going to do any benefit-cost studies. Mr. Ingram last year threw things out of joint a little bit in the Bureau's calculations, I think you will remember, by taking their own figures and showing that you didn't need anything more than Hoover, Parker and Davis revenues. By the time you take the figures that were produced here when the Secretary was on the stand, and see what fund is built just out of Hoover, Parker and Davis revenues, you find you have a great deal of leeway there.

We are not advocating the alternative steam plants. It is an attempt—and I don't say it is a bad one—to find some way to get the Bureau of Reclamation off the hydroelectric horse which is becoming rather spavined these days. I think this is probably a good thing. We don't like strip mining any better than you do. But I——

Mr. UDALL. You don't pretend that is beautiful, 5 miles——

Mr. BROWER. No.

Mr. UDALL. Across the Navajo Reservation is a thing of beauty?

Mr. BROWER. No. But I also don't think the area was world famous for its scenery, and Grand Canyon is. I also point out that Grand Canyon damsites have far shorter life than coal reserves. These damsites would wear out far sooner than the fossil fuels. We don't even argue that you go into fossil fuels for this, and I will supply a few questions I hope the committee can get answered by the agencies.

The real source of energy, if we look ahead, is going to be the atom. Now, I am not competent to testify on that but Mr. Moss will be here tomorrow and he will be ready.

Mr. UDALL. Thank you, Mr. Chairman.

Mr. JOHNSON. The gentleman from Utah, Mr. Burton.

Mr. BURTON of Utah. It is not clear in my mind, Mr. Brower, whether the Sierra Club has proposed a solution, or a way to get water to these people in central Arizona. It seems to me that everybody who has appeared has pretty well agreed they need it. Give us your recommendations.

Mr. BROWER. No, we have not. Our position is still in that respect the way it was last time. You don't need the dams for the central Arizona project. The primary financing is that of Hoover, Parker and Davis revenues and sales of water in Arizona. The only reason these dams are being talked about is to finance the development fund and they aren't even necessary for that.

The way to get the water to Arizona is to go ahead, authorize the central Arizona project, and get on with it. This is what we have been saying in all our statements, that we think that there are some funny things in the economics. But that is Arizona's problem. Arizona should have its chance at its share of the Colorado and should not hazard the entire operation by continuing to argue for the damming of the Grand Canyon, because I don't think the world wants that done.

The rest of the world gets by without having a Grand Canyon to dam, and I think Arizona and California are just as ingenious as anyone else.

Mr. BURTON of Utah. I understand your position against the dam or dams. I am just asking you if you have a proposal of a way to get water to these people who need it in central Arizona. You endorse a big steam——

Mr. BROWER. Yes, we did, and it is in our same testimony.

Mr. BURTON of Utah. Steam generation plant.

Mr. BROWER. No. You don't need that.

Mr. BURTON of Utah. I didn't read that into Mr. Ingram's testimony. I read into it the possibility that maybe we shouldn't even readjust or develop our water supply.

Mr. BROWER. I am talking too much, and this is Mr. Ingram's point that he brought out last year and has refined since then.

Mr. INGRAM. Well, the point of my testimony was not that any particular scheme that I would advance, or the Secretary advanced this year, is the only answer. Just that there are other ways to do it. This was all.

Now, I don't think we have to advocate a particular way of financing the central Arizona project. If we had been engaged in the negotiations over how to do this, perhaps it would be our duty to do it. But our point was that there were other ways, and we tried to bring that out. Apparently we did, because there have been other ways suggested by the Secretary. I don't think we have to back a particular way.

Mr. BURTON of Utah. Sometime uncertain in the future, the idea of a dam at Hualapai, if it should be given up, and then a proposal comes before the committee and we start holding hearings on this coal dragline business for steam generating plants, will you come back and testify against that?

Mr. INGRAM. Testify against——

Mr. BURTON of Utah. Against the steam generating and coal-fired plants?

Mr. INGRAM. I think just to take up the point we made before, you can't win here. You are going to lose something, whatever you do. And all I can think of is, on the case of the coal plants, there are many things that you can do to make them less objectionable. I don't think this is an argument for or against coal plants, but you don't have to take the kind of scars that Mr. Udall has shown pictures of and extend them forever into the future. You can put the dirt back. And in fact, Mr. Udall himself has given an example in Happy Valley, in

Tucson, of what is being done by one of the mining companies with the overburden from a copper mine so that people who live in this area don't object to it.

Mr. BURTON of Utah. I will reserve the balance of my time.

Mr. JOHNSON. The gentleman from Oregon, Mr. Wyatt.

Mr. WYATT. Thank you, Mr. Chairman. I don't think in view of the hour and what has gone on that I will ask any questions or make any statements. I don't believe Mr. Brower would like any statement I might make. I will yield back the balance of my time.

Mr. JOHNSON. The gentleman from Idaho, Mr. Hansen.

Mr. HANSEN. Mr. Chairman, I believe the gentleman from Oregon has voiced my sentiments to a degree. I do have a couple of questions, however.

Mr. Brower, do you subscribe to the statements made by Mr. Ingram earlier in the afternoon?

Mr. BROWER. Yes.

Mr. HANSEN. I think the gentleman from Arizona, Mr. Steiger, mentioned something about other interests than just conservation involved. Is there any possibility that you or some of you gentlemen are using your organization to also promote such things as population control?

Mr. BROWER. I don't think the general conservation effort and population control are separable.

Mr. HANSEN. Well——

Mr. BURTON of Utah. That doesn't answer your question.

Mr. HANSEN. Yes, I believe it does answer my question. Mr. Brower, are we to assume that you are promoting population control as part of the answer to what you believe is the problem?

Mr. BROWER. I believe population stability is an important aspect. Every conservation program, every resource-planning program you can think of, is not worth the paper to draft it on if we keep doubling the number of people every 30 or 40 years as we are doing. This is a statement that I have made many times around the country. There is nothing new about it. We have a policy in the Sierra Club urging the study of population control. Right now, for example, we are planning on doubling population every 30 to 40 years. That is the way the projection goes.

Mr. Ingram, before the Public Land Law Review Commission in his testimony in Albuquerque and here, is pointing out that there is a different goal than forever dividing what we leave our children—and you can't do anything but divide it if you keep multiplying the people. I don't see any recourse than try to get into balance with the environment. That is the primary message of our Sistine Chapel ad, that man could somehow live on this earth for a million and a half years without damaging the environment.

In the last hundred years, or less than that, we have done more damage to the environment than in all previous history. Somehow we figure we can continue, but we can't.

That is our general philosophy.

Mr. HANSEN. I hesitate to say this but it seems that some of these issues make strange bedfellows. There are certain things that you don't want that some of us don't want also, but for different reasons

However, I am wondering if your motives in a sense were entirely honest. I believe that Mr. Ingram engaged in some categorical nonsense in his statement in that he took a statement by the senior Senator from California to be more or less the position that he had to work from so far as this committee's attitude on reclamation is concerned. I don't think you are squarely meeting the problem we are facing right now. I think yours is an evasion of the problem.

We are currently working here in the United States on some sort of a sane and prudent method of holding down on population. But it is categorical nonsense when you state that a big family all across the board, as Mr. Ingram cited in his statement, is undesirable. Now let's get down to the case of what we are really talking about.

We are not concerned about population problems right now. We are talking about the fact that there is a significant natural growth going to occur in the West, the Northwest, Southwest. There is much room for expansion there yet in my area, in other areas of the West.

It will be a long time in the future before we will have a problem of overpopulation. But right now we have problems of development to take care so that we can grow and you are evading the issue with your statement.

Mr. BROWER. I would disagree with you, and agree with Mr. Ingram. He has a response.

Mr. INGRAM. I don't like to be accused of indulging in categorical nonsense, and I am sure you wouldn't. However, I think your statement that you are going to indulge in a certain amount of development is one that is ambiguous enough for you to read anything into it. All right. You are going to have a certain amount of development. But how much? That is the question. What is desirable? Nobody has asked that question.

The Public Land Law Review Commission, if you read their studies, never ask themselves that. And so far as I know, in their public discussions and things that I have been able to find out, they are saying, it has not said what is desirable and what we can do if we decide something is desirable to work toward it. I am not suggesting we should indulge in population control. I am not really suggesting one thing or the other as far as that is concerned. I am just suggesting that the National water commission can perhaps offer some information about alternatives, can help us choose. There are other alternatives. I just picked the two that seemed most likely.

Mr. HANSEN. Were you for the Glen Canyon Dam?

Mr. BROWER. Initially, as when I made my wrong vote in 1949, we said build Bridge but build Glen first. And that was one of the most disastrous things I ever did. We were against Glen Canyon late in the game, too late to stop it. We did not believe it was a good necessary dam, and I do not believe that now. I don't think that it can be proved that it is. I think that there has been quite a bit of evidence right here in this committee meeting, and in this committee hearing that it was a very bad move.

We are talking about scarce water. We have Glen Canyon only one quarter full. We have Mead half full. The prediction was made when we were fighting the Colorado River storage project that if Glen Canyon Dam were built, Lake Mead would never fill again, and the Colorado River seems to be busy trying to prove that.

Meanwhile, because you have it, you have now two master evaporation ponds and the ultimate loss will be enough water practically to supply the city of New York—in a time and in a country that doesn't have that much water to waste.

Mr. HANSEN. Are you against reclamation projects just categorically?

Mr. BROWER. No, we are not, and as I said earlier—perhaps you weren't here—we have no objection to the central Arizona project, which is a reclamation project.

Mr. HANSEN. Which one?

Mr. BROWER. Central Arizona project.

Mr. HANSEN. You supported this one?

Mr. BROWER. Yes. We have no objection to it. That is, we have had no objection to the central Arizona project aqueducts and diversions. The dam that was necessary for control of the Colorado is Hoover. That is there. We did not oppose that.

Mr. HANSEN. You have Hoover and central California. Now, which others have you felt would be proper reclamation projects?

Mr. BROWER. I think if you would go through the records, you would find that we have opposed those that would invade the National Park System, including national monuments, and more recently, those that would do major scenic resource damage when there are alternatives. That is all that we have opposed. There is a lot of reclamation that doesn't make too much economic sense, but we stay out of that. We are concerned about scenic resources. That is our field.

Mr. HANSEN. Well, in reading through Mr. Ingram's statement, you had me wondering for a few moments if you people wanted to substitute all possible reclamation moneys for buying pills.

Mr. BROWER. No. I think you missed the point pretty badly there.

Mr. STEIGER. Will the gentleman yield?

Mr. HANSEN. Yes.

Mr. STEIGER. Mr. Brower, there is one reconciliation among many that I find very difficult to make and perhaps you can qualify it. You have credited Arizona with being willing to violate the Grand Canyon for profit, to establish this cash register. You must surely be aware that Grand Canyon itself represents a very profitable enterprise as far as Arizona is concerned. Over 2 million visitors a year that come to Arizona or at least visit the Grand Canyon.

If you would look at us as only an economic entity, the State of Arizona, one anxious to prosper at whatever the cost, how do you rationalize the rape—in your own language, my paraphrasing of your language—how do you rationalize the fact that we would be willing to destroy that which brings 2 million people into our State?

Mr. BROWER. I go back to the testimony by Mr. Rodack the other evening, that too many Arizonans don't know what is in the Grand Canyon. Many don't know that the water that they want is not going to come from the Grand Canyon, that it is going to come from Lake Havasu. Too many don't know that they don't even need those cash registers. They don't know that the Bureau of Reclamation in this room admitted it does not need those cash registers for the central Arizona project. They do not know that the main purpose is an alleged accumulation of a development fund that the gentlemen from the Northwest are quite apprehensive about—and so are a lot of other people—to bring an unknown amount of water to an unknown place by an unknown route at an unknown cost, but we must build Grand Canyon dams to put something in the piggy bank. That is what the people in Arizona don't know. They are not told that, and I wish you would help tell them that—where their water comes from, and that there is revenue in the water sales and in Hoover, Parker, and Davis that will pay for central Arizona project.

Mr. STEIGER. Mr. Brower, I think you do the people of Arizona a great disservice. If you will recall in the same testimony, Mr. Udall indicated that out of responses to some 22,000 questionnaires, responses that he got in returns, I think as a fair sample—Mr. Rodack by his own admission represented at the most some 800 people, not all of whom he himself contended were particularly well informed.

But even that aside, even assuming the people of Arizona have been kept in the dark, now, for 27 years and don't understand this central Arizona project and don't understand the Grand Canyon, you will concede that those who have worked for such things as Hualapai Dam, they do understand and they do, yet how can you credit those of us who have worked for the dams with and for profit, as you say, whose sole motivation is profit, would destroy the profitable enterprise if indeed we are going to destroy the Grand Canyon. That is a rationale I think is impossible to make.

Mr. BROWER. I don't want to put aside that first point. I think if you in your district, or Mr. Udall in his district, would put Mr. Rodack's questions, you would get about the same response. Mr. Udall didn't ask people where the water was coming from. His question assumed, I think, the common illusion, and Mr. Rodack's did not. I think that is——

Mr. STEIGER. I have stipulated that the people are ignorant. All right.

Mr. BROWER. No.

Mr. STEIGER. In order to—those of us who are informed, how can you credit us with duplicity on the one hand and that we are going to end up destroying that which is now making money?

Mr. BROWER. I didn't use the word "duplicity."

Mr. STEIGER. I used the word "duplicity." You say that the only motivation, our only motivation in wanting to dam the canyon is to generate revenues.

Mr. BROWER. No.

Mr. STEIGER. You say by the generation of these revenues we are going to violate the Grand Canyon. When you say we violate the Grand Canyon, we are then placing in jeopardy that which is generating revenues now. How do you reconcile that, the fact that we are willing for profit to destroy that which is making profit?

Mr. BROWER. I can't figure your motivations, as a matter of fact, I have heard this testimony, that you don't think the present revenue from visitors in Grand Canyon will be impaired. It has been said again and again in the Arizona papers by the Arizona advocates that when you go to El Tovar and look at Grand Canyon with all the dams built, you won't see a single thing from El Tovar. You have to go by an old jeep trail, it is alleged, to see one of the reservoirs. This is

inaccurate, but I think there are a good deal of people who figure you can have your cake and eat it too, simply because so far too many people don't know what is at stake in the rest of the canyon and what the damage will be.

Mr. STEIGER. I am afraid you are not being consistent. Now you are telling us that the Arizona papers have informed the people, but you are saying they are misinformed. Are they either ignorant or misinformed? Which is it?

Mr. BROWER. I think you are trying to narrow this down and we are getting at cross-purposes unnecessarily.

Mr. STEIGER. I think we start out at cross-purposes.

Mr. BROWER. I would say at this point that we have not argued that the only reason Arizona wants to do this is for money. We have said that is one of the reasons. I have observed here that Arizonans have been informed that there will be nothing visible from El Tovar, the primary visitor point in the Grand Canyon National Park, if both dams should be built.

Now, this is not misinforming them. I said I would use Mr. Rodack's term, his term of people informed or people not informed on this subject, that you recall. First he would ask, "Where would the water come from?" I forget just how the question went. If they said the water would come from Grand Canyon, then they weren't informed on the physical facts of the central Arizona project. There are similar questions——

Mr. STEIGER. You weren't seriously using Mr. Rodack's figures. By his own admissions he talked to less than 100 people on his sample. You certainly aren't supposing that is a statistically accurate evaluation of the knowledge of the people of Arizona.

Mr. BROWER. The number of people questioned is far less important, as Mr. Gallup will tell you, than the accurate and careful phrasing of the question. I would contend that Mr. Rodack's questions will produce a more accurate reply, more accurate that Mr. Udall's.

Mr. STEIGLER. You think he was—you think he approached this thing in an objective manner? Obviously we are going to get bogged down here.

Mr. BROWER. I think so.

Mr. STEIGER. I do think you have not answered my question how you can credit Arizonans who support this project, who support the dam, who understand the problem, with a willingness to do this thing for profit that will render by your own definition a profitable venture unusable.

Mr. BROWER. Mr. Steiger, I don't think you understood me when I pointed out that they don't think the dams would render it unusable.

Mr. STEIGER. They are wrong. Is it your position that they simply don't understand?

Mr. BROWER. You misunderstand me. I said they do not think that the building of the Grand Canyon dams will lose them their tourist revenue.

Mr. STEIGER. I see.

Mr. BROWER. That is my point.

Mr. STEIGER. I see. In other words, these badly informed people, these misinformed people feel that this will not violate the Grand Canyon.

Mr. BROWER. They feel that they will not lose their tourist revenue. That is my statement.

Mr. STEIGER. Because the canyon will not be violated.

Mr. BROWER. No, you are putting other words in my mouth, you asked if I understood the question: "Why do the people of Arizona wish to do any damage to the Grand Canyon if it is going to hurt them because this is a good source of revenue." The people of Arizona might not worry about what happens to the Grand Canyon if they are reasonably assured that what they do would not be visible to the people who produce the tourist revenue. That is a valid position. I don't think that it solves your problem of trying to say that we have, well, maligned Arizonans. I think we would like to see more Arizonans, as a good many do, know more about the physical requirements of the central Arizona project.

We would like to see them feel that the central Arizona project is not inextricably tied into the Grand Canyon dams, which it is not.

Mr. STEIGER. Mr. Hansen, I will yield back my time.

Mr. HANSEN. Mr. Brower, I would have to agree with one thing you said some time ago about the possible importation of water from one basin to another under circumstances that weren't very well planned. But I would like to ask you this. You mentioned a lot in your statement about sedimentation problems, gap, whatever you wish to call it. And apparently you don't wish to take the Bureau of Reclamation's figures, or at least their word for it on how much sediment there is and what the problems are involving sedimentation. Is that correct?

Mr. BROWER. I share their problem, because they don't take their own figures from page to page.

Mr. HANSEN. Would you then be willing to take the figures or the conclusions of the proposed Water Commission?

Mr. BROWER. I would like to see them study this and get this kind of information. I don't think we or the Congress or the Bureau has reliable information at this point on a very critical matter—sedimentation rates and the longevity of the proposed reservoirs.

Mr. HANSEN. Do you think they would be prone to be objective enough for your purpose, the type of commission that has been set out in some of the proposed legislation?

Mr. BROWER. Yes, I do.

Mr. HANSEN. I yield to the gentleman from Utah.

Mr. BURTON of Utah. Mr. Brower, you were asked a direct question by the gentleman from Idaho, is the Sierra Club endorsing birth control or something to that effect? Your response, as I recall, was that you thought that conservation and population control were inseparable?

Mr. BROWER. Yes, we do.

Mr. BURTON of Utah. Well, now, has the Sierra Club ever taken any kind of a position on birth control or population control?

Mr. BROWER. Yes.

Mr. BURTON of Utah. Has your board of directors ever voted on it?

Mr. BROWER. Yes. There is a policy statement. I will provide it for the record at this point if you wish.

Mr. BURTON of Utah. I am glad to hear that because a year or so ago before another committee I sat through a hearing in which they

were concerned with the world population explosion. I am aware that something needs to be done to arrest this growth. I would hope that in the future, instead of taking out full-page ads in the New York Times, maybe you would take out just a half-page ad and devote some of your money and extensive resources in other areas.

Mr. INGRAM. Could I respond to that? If you will allow us to spend our time on things like constructive future planning, instead of trying to defend the Grand Canyon from unnecessary dams, we can do that.

Mr. BURTON of Utah. Well, it is a question which comes first, I suppose. Because of overpopulation, 12,000 people die every day of starvation in this world.

Mr. INGRAM. Of where the crisis is.

Mr. BURTON of Utah. I have had the feeling today that you have opposed rather than proposed and I don't have the feeling that the Sierra Club has given us an answer to this problem. How do we get water into central Arizona where there are people who need it now, not 50 years from now?

Mr. BROWER. Mr. Burton, the Secretary has come up with a proposal and we support it. We have no objection.

Mr. BURTON of Utah. You support the steam generating plant, then. This is what I tried to get you to say a little while ago.

Mr. BROWER. The questions I think were about financing of a development fund, not the central Arizona project.

Mr. BURTON of Utah. That is not right.

Mr. BROWER. The purpose of the steamplant is not for the central Arizona project. That is, the water——

Mr. BURTON of Utah. Financing.

Mr. BROWER. I beg your pardon. I believe, if you will review the project, the purpose is not to finance the water project but to build the development fund. We had quite a bit of testimony as to how big the fund would be with this plant and how big it would be with the dam. Now, there will be——

Mr. BURTON of Utah. No.

Mr. BROWER (continuing). Some power; that is, you are looking for energy for the pumping. One of the sources has been and still is Hoover, Parker, and Davis. I think that you will also find that part of the revenue, a good part of it, is going to come from the sale of water to irrigators who can pay $10, from M. & I. users who pay $50, and presumably from the proposed ad valorem tax.

Mr. BURTON of Utah. I have reviewed the project very carefully, Mr. Brower, and it is all wrapped up in one ball of wax. The whole thing is involved in power to pump the water up and power sales from the dams and so forth. It is all in the same package. Now you just said it. Let's leave it there. The Sierra Club supports the Secretary's proposal.

That is all the questions I have.

Mr. JOHNSON. Do you have further questions?

Mr. STEIGER. I have taken up too much time now.

Mr. HANSEN. Mr. Chairman, we've all heard the statement about having a pill for every ill, and it appears these gentlemen would even apply this to reclamation.

Mr. JOHNSON. Mr. Brower, you made quite a bit of the siltation problem in the river. Siltation has been a problem for a long, long time where there have been dams on the rivers, where we have navigation, and what have you. And those problems have been resolved for the most part by man and his ability and technology and engineering feats.

Silt has been handled to allow the project or the facility to be used as a resource. We have had to dredge our rivers for navigation, flood control, a little of everything. And in the smaller reservoirs silt is always a problem. The people have been able to handle it, remove the silt. They can handle this today with pipelines. With new equipment, pipelines can transport materials across the Nation. And I see no reason why the silt is a problem because by the time the silt comes down, it is very readily in a form that can be taken out, and I think that is a part of any consideration that goes to one of these projects where silt is going to be a problem.

Now, we transport coal slurry and we are transporting a little bit of everything today in modern facilities. Silt is very readily available in the reservoir for that purpose of removal with new equipment, and we create islands out in the bay, reclaim lands by pumping out of the various places where silt has accumulated.

I am sure that this has been looked at by the engineers, I would say, in behalf of these projects. Silt is going to be a problem.

Mr. BROWER. Mr. Chairman, if I could respond, I don't think you will find any cost estimate whatsoever for any silt removal in any of these projects.

Mr. JOHNSON. If it becomes a problem——

Mr. BROWER. But the——

Mr. JOHNSON (continuing). Where the facility is going to be taken over by silt, I fail to see the silt problem handled because——

Mr. BROWER. The problem here is the enormous volume of it. If you are going to slurry it away, then you are going to be right back in the problem they had before the building of Hoover Dam, where they had to get out with their old shovels to clear up what was being silted in their canals.

Mr. JOHNSON. Well, I think siltation is a problem, no matter where you find it. Man has been able to cope with that problem for the most part.

Mr. BROWER. But not on the Colorado.

Mr. JOHNSON. Today with modern technology I think we can remove the silt. I don't think that would be a real problem because I don't think they could ever work up their cost-benefit ratios and feasibility on these projects and have them approved by such people as the Congress of the United States and put them in operation.

Now, in my time I saw the first facility on the Colorado made useless from the standpoint of silt, a major problem. Another thing you stated a little while ago, and I understood the Secretary yesterday to say that the reason he left Hualapai alone at the present time is because it created a great controversy and why have a bill with controversy when everybody is in harmony with one another. I don't think that is a just reason myself, and I think these figures alone as to Hualapai and the power potential there over the prepaid system in

the coal plants, I think Hualapai is much better all the way around from the standpoint of a financial gain and funds that will be accumulated and at the same time it will eliminate the mining of coal in that area and the other things that go with coal-fired plants.

Now, in southern California our coal-fired plant is just about ruled out. For what reason? We don't mine any coal there but we will bring it in or we will bring gas in but from the standpoint of effluent from the facilities going into the air, causing more of a problem all the time with air pollution, they are just about abandoning that. They are either going to nuclear or they are going back someplace in the hinterlands and tear it up and produce the energy there and then move the energy out with large transmission lines.

Now, I think Hualapai Dam and powerhouse in relationship to pumping stations on the river to take care of the central Arizona project will do less to that country down there than any other thing you can do.

Mr. BROWER. I think, Mr. Chairman, as I was commenting to Mr. Udall, strip mining would do damage. But the country it damages, if we have to do it, and we are not advocating that necessarily, is far less precious to the world that the Grand Canyon. And if you do put in Hualapai at the present rate of projections by the Bureau of the incremental increase in installed hydropower capacity in the Southwest, the entire installation at Hualapai will take care of the Southwest power growth needs for only 3 years. Then you are going to have to go on to something else—strip mining, or go nuclear or stop making such heavy demands on power. I think that going back to the initial observation——

Mr. JOHNSON. I am trying to confine it to the problem before us which is the central Arizona project.

Now, the Secretary said that he needed energy to pump the water for the central Arizona project, the water had to be pumped. Pumping lifts were there. There had to be a supply of energy, and that comes prior to the repayment, the payout period of Hoover, Parker, and/or Davis, and the big accumulation into the fund doesn't come until after these are paid out, but in the meantime central Arizona needs a pumping requirement of a large amount of energy.

Mr. BROWER. Mr. Ingram has been watching——

Mr. JOHNSON. And it will come from here. Now, that energy I say could much better come from the power facilities in the Hualapai Dam itself. I am sure that with today's engineering ability, you could design a dam there and powerplant and get the necessary power potential out of the site and have it look pretty good, and it would be much closer, would disturb a lot less the whole area in that area there and accomplish the purpose. Now, if you didn't have to have energy that would be one thing, but you have to have energy.

Mr. INGRAM. Mr. Johnson, the Commissioner——

Mr. JOHNSON. The energy can't come from Hoover, Parker, or Davis.

Mr. INGRAM. But the energy will come from the coal plants. That is what the Commissioner——

Mr. JOHNSON. I realize that, but I am trying to pin it down that you have to have a source of power.

Mr. INGRAM. No. You have to have a source——

Mr. JOHNSON. Yes, you do. You are going to support the central Arizona project. It is in a prepaid power source that they are advocating to put into this and it is not coming from Parker, Hoover, or Davis.

Now, after Parker, Hoover, and Davis pay out——

Mr. BROWER. Could we supply an analysis of——

Mr. JOHNSON (continuing). Then the money would go into the fund but the power potential from those facilities is already being consumed and they have already been contracted for at the present time.

Mr. INGRAM. But assume Hualapai is built——

Mr. JOHNSON. And the feasibility of those projects was underwritten by people who are taking the power at the present time.

Mr. INGRAM. Suppose Hualapai is built. The Commissioner testified on Tuesday that even if Hualapai is built, pumping power will not come from Hualapai.

Mr. JOHNSON. Oh, yes, it will.

Mr. INGRAM. No, it will not. You look it up in his testimony. You will find there that only in a certain period of time——

Mr. JOHNSON. You look back. I asked the Secretary wouldn't it be more feasible to get the power from the power facilities at Hualapai and run your transmission lines down to where you are going to take the water from the river and pump and divert it.

Mr. INGRAM. Mr. Johnson, I think we ought to get something in the record on this point because the Commissioner has said this year—he said last year, and he said the year before—that the power for pumping the water in the central Arizona project doesn't come from the dams; they trade energy, but it does not come from the dams.

Mr. JOHNSON. That is the same thing.

Mr. INGRAM. No; no, it is not.

Mr. JOHNSON. Oh, yes, it certainly is.

Mr. INGRAM. The only thing you have to have, then, if you don't have the dam, is the money, and the money comes from the water revenue.

Mr. BROWER. Mr. Chairman, could I request here that at this point—it is getting late, and I think that a request from the chairman to the Bureau of Reclamation could verify that, and also the Bureau and the Geological Survey could clarify what the sediment life was like for these reservoirs—what their best estimates were—and what it would cost to clean it out. I think you will not find those figures anywhere in all the hearings we have had.

Mr. JOHNSON. Well, now, last year the Secretary testified before this committee and he advocated Hualapai Dam. This year he comes in——

Mr. BROWER. No, I beg your pardon. No. I am afraid that is not correct. He advocated Marble but advocated the deferral of Hualapai pending a 5-year study by the national water commission.

Mr. INGRAM. The position of the administration hasn't changed on Hualapai since May 1965.

Mr. JOHNSON. I think Hualapai was in.

Mr. INGRAM. That was in Congressman Udall's bill, but the administration never introduced a bill last year, or had a bill introduced.

Mr. JOHNSON. But there was not the opposition, I don't think, at that time to this particular dam.

Mr. INGRAM. Their policy has not changed. The administration's policy is 2 years old.

Mr. JOHNSON. The Commissioner and the whole Department of the Interior did not take the stand they have taken this year in the elimination of Hualapai.

Mr. BROWER. Mr. Chairman, if you will look at the letter of February 15 to the chairman of the full committee from the Secretary, or the Bureau of the Budget, you will find that they reiterate, the position of May 1965 which called for the deferral of Hualapai Dam pending a review of the relative needs for wilderness and scenic resource protection and the needs for power and that was to be studied among other things by the National Water Commission which would be, according to the Bureau of the Budget letter of 1965, would be to report in about 5 years.

Mr. JOHNSON. Well, it might have developed in private conversations. We have had so many on dams here over the years that I am sure at one time both the Secretary and the Commissioner——

Mr. STEIGER. Mr. Chairman, I wonder if you would yield for just a moment. I think possibly it has been brought out again in this last exchange, but I think there is one basic conclusion that kind of points up the arbitrariness of your position and conceivably an honest misconception.

It deals with, Mr. Ingram, your population philosophy. You assume that we are going to consume our resources at the rate that the population increases. You have said that you have assumed that. You credit man with only the capacity of production. His productivity is limited to increasing the population rather than to increasing his resources ingeniously.

You must know that this will not stand observation. I would submit that this position is perhaps symptomatic of the impropriety of your other positions. I like to think so. And I don't expect rebuttal on this but I would like to point out to you that there is no geometric theorem that dictates or correlates the consumption of resources in direct proportion to the growth of the population.

Mr. INGRAM. Since you have misinterpreted me, could I just answer briefly?

Mr. STEIGER. Certainly.

Mr. INGRAM. I just want to say I didn't assume the thing you said I am assuming. What I am assuming is that man indeed can plan and that is why I suggested that the National Water Commission should furnish Congress and the people with two alternatives, with information on two alternatives, so that he can choose.

Mr. STEIGER. I have no further questions.

Mr. JOHNSON. I have no further questions, either. It is late. You people have been on the stand here a long time. I am sure that we will have this under consideration for some time and all of the material certainly will be made available to the committee that is here someplace in these reports as to just what will be needed to service the legislation that we hope is reported out by this committee, whether we have the dam in or the dam out.

I want to thank you, Mr. Brower, and your group here for giving us the benefit of your testimony. Certainly you have been in this for

many years now, much longer than I have been in it, and we appreciate your patience and the answers to the questions.

Mr. BROWER. Thank you very much, Mr. Chairman, for the privilege of appearing before you. I hope that in the years to come there will be some friendly, stimulating disagreements between us and the members of the committee, but that we will not be at cross purposes. I hope that for the gentlemen of Arizona, too.

Mr. JOHNSON. We thank you.

(Subsequent to completion of the hearing the following letter was furnished the committee:)

U.S. DEPARTMENT OF THE INTERIOR,
BUREAU OF RECLAMATION,
Washington, D.C., April 3, 1967.

Hon. WAYNE N. ASPINALL,
Chairman, Committee on Interior and Insular Affairs,
House of Representatives, Washington, D.C.

DEAR MR. CHAIRMAN: Your letter of March 20 requested that we review Mr. David Brower's statement on the sediment problem of the Colorado River which he presented during the recent hearings on Colorado River legislation.

Mr. Brower's semi-facetious "Sedimental Journey" is similar to most of his other statements, advertisements, books, etc., in that it is designed to appeal to public emotion with too little attention to fact. Where facts do enter into the statement they are, for the most part, distorted, misapplied, and buttressed with unfounded assumptions, rumors, and oblique references to unnamed experts. The net result is a mish-mash of fact and fancy leading to completely erroneous conclusions which no responsible hydrologist could support.

For example, he states that "nowhere do we have a reliable estimate, or more than detached pieces of estimate so far removed as not to fit together, of what the all-important sedimentation rates really are." The facts are that records of sediment flow on the Colorado River are among the best, if not the best, of any major river in the country. In some instances they go back as far as 1926. The most valuable and complete record, as far as reservoir sediment deposition is concerned, is that for Lake Mead, where three separate sediment surveys have been made which provide an accurate historical record of actual sediment accumulation over a 30-year period.

Another absurdity in Mr. Brower's statement is his allegation that there is a 3,600-percent error factor between information on the surface area of the proposed Coconino Reservoir, as shown on maps and tables in the same Reclamation report. To reach this startling conclusion, Mr. Brower scaled reservoir areas, as shown on a location map, and compared them with corresponding areas as indicated in the report tables.

Any person possessing ordinary common sense and a desire for true facts would realize that project features on location maps are not drawn to scale; rather, they are presented generally to show relative importance. If they did not understand this, they certainly would have inquired as to what caused a 3,600-percent error, rather then blandly stating it as an accepted fact as Mr. Brower did in his testimony before your committee. We are not perfect, but this is the first time we have been charged with being 3,600 percent wrong.

As another example, he postulates future water losses in the magnitude of 3,000,000 to 4,000,000 acre-feet per year resulting from what he terms as phreatophyte jungles that he envisions will spring up in the reservoir areas of proposed dams. Typical of his reasoning to reach such alarming figures, he conjures up a 150,000-acre silt trap and phreatophyte jungle behind Coconino Dam on the Little Colorado River that will cost the Colorado Basin an annual loss of 1,500,000 acre-feet through evaporation and transpiration. He doesn't explain how it is possible to lose 1,500,000 acre-feet of water annually from a stream with an annual runoff of less than 200,000 acre-feet.

Further, Mr. Brower recognizes that Lake Powell will act as a huge sediment trap but then apparently ignores this in his calculations of the projected life of Hualapai Reservoir.

Rather than attempt to make reason out of Mr. Brower's labored distortions, we believe it would be simpler and more understandable to provide an up-to-date statement on our sediment studies and their relation to existing and proposed

projects on the Colorado River. The statement is attached. We hope it will be useful to your committee.

Sincerely yours,

FLOYD E. DOMINY, *Commissioner.*

[Enclosure]

SEDIMENT RECORDS, ANALYSES, AND PROJECTIONS, COLORADO RIVER BASIN PROJECT

A great deal of information on sediment flows of the Colorado River and its tributaries between Lees Ferry and Lake Mead has been accumulated over the past 40 years. Included are three sediment surveys of Lake Mead completed in 1935, 1948, and 1964, which measure accurately the actual sediment deposition in Lake Mead over the period covered.

Available records of sediment flow

Records of the suspended sediment load of the Colorado River and its tributaries are maintained by the U.S. Geological Survey and available at several points between Lees Ferry and Lake Mead, for varying periods as follows:

Station and period of record	*Years*
Colorado River at Lees Ferry, 1929–33; 1943–44; and 1948–65	25
Paria River at Lees Ferry, 1948–65	18
Little Colorado River at Cameron, 1957–65	9
Colorado River at Grand Canyon, 1926–66	41
Virgin River at Littlefield, 1948–66	19
Sediment Survey of Lake Mead, 1935, 1948, and 1964	30

Discharge and sediment records of Colorado River at Lees Ferry

The 25-year period of record shows an average water discharge of about 10.7 million acre-feet and an average suspended sediment load of about 83 million tons. Assuming that sediment weighs 65 pounds per cubic foot, the average annual sediment flow in this period was equivalent to 59,000 acre-feet per year.

Starting in 1959, however, the records are not representative of sediment inflow into Lake Powell. In 1959 the storage back of the cofferdam was filled, and in 1963 the diversion tunnel was closed and storage initiated. Some sediment was deposited in Lake Powell in these recent years. For the 18 years of record at Lees Ferry which were not affected by sediment deposition in Lake Powell, the average annual water discharge was about 12 million acre-feet and the average annual suspended sediment load about 107 million tons, or about 75,000 acre-feet per year.

Historic rates of sediment discharge on the tributaries

The following table summarizes the historical information (averages) on water discharges and suspended sediment loads on the three tributaries:

River	Years of record of sediment	Average annual discharges in period of sediment record		
		Water	Sediment	
		1,000 Acre-feet	Million tons	1,000 Acre-feet
Paria at Lees Ferry	18	18	3.54	2.5
Little Colorado at Cameron	9	141	9.44	6.7
Virgin at Littlefield	19	131	2.39	1.7

The long-time average water flows of these streams are somewhat greater than the flows indicated for the period of record of sediment. From a study of the relationships between annual water flow and annual sediment flow, the long time average annual sediment discharges are estimated to be about as follows:

	Acre-feet
Paria River at Lees Ferry	4,000
Little Colorado at Cameron	10,000
Virgin at Littlefield	2,500

Colorado River at Grand Canyon

For the 18 years of concurrent record at Lees Ferry and Grand Canyon, the average annual water discharge at Grand Canyon was about 12.3 million acre-feet and the average annual suspended sediment load was about 135 million tons. The average annual equivalent volume of sediment in this period is estimated to be about 95,000 acre-feet.

Sediment deposition at Lake Mead

Storage was initiated at Lake Mead in February 1935. To check the amount of sediment deposition the reservoir was surveyed in that year and resurveyed in 1948 and again in 1964. These surveys show the following average annual rates of sedimentation:

	Years	Acre-feet per year average
1935–48	13.7	104,000
1949–64	16	80,750
Total 1935–64	29.7	91,450

During the years 1935–1964, the average annual sediment flow passing the Grand Canyon station was about 73,000 acre-feet, or about 80 percent of the sediment deposition in Lake Mead in this period.

Estimate of future sediment flow at Hualapai damsite

On the basis of the historic records presented herein, and with allowances for the effects of Lake Powell in storing the sediment flow of the Colorado River at that point, the future average annual sediment inflow initially to the Hualapai reservoir site is estimated to be as follows:

	Acre-feet
(a) Without sediment barrier dams on tributaries	25,000
(b) With sediment barrier dams on Paria and Little Colorado Rivers	16,500

Useful life of Hualapai Reservoir

The reservoir, recommended in several of the bills now pending before the Congress, has a total surface storage capacity of about 3.7 million acre-feet. If we assume 100 percent trap efficiency, but with the capability of flushing 10 percent of sediment from the reservoir, the time required to fill this space with sediment is estimated to be as follows:

	Years
(a) Without sediment barrier dams on the tributaries	163
(b) With sediment barrier dams on Paria and Little Colorado Rivers	250

Delta deposit at head of Hualapai Reservoir

The Colorado River Canyon is steep and narrow and there is no space for the buildup of a sediment jungle in the backwater. A reservoir at this site will probably cause some deposition of sediment in the river channel upstream from the reservoir pool, but this will be in the bottom of the river and the riverbed will progressively increase in elevation. However, it will still appear as a river.

Now we have some ladies who have been waiting here all day, 2 or 3 days. Dr. Ruth Weiner and Miss Joy Coombs.

STATEMENT OF DR. RUTH WEINER, REPRESENTING THE GRAND CANYON WORKSHOP OF THE COLORADO OPEN SPACE COORDINATING COUNCIL, ACCOMPANIED BY MISS JOY COOMBS

Mrs. WEINER. Mr. Chairman, we will be here tomorrow if you would like to defer.

Mr. JOHNSON. If you look at the list tomorrow it is about as long as the list today. How much time would you want?

Mrs. WEINER. Well, our entire testimony will take only about 15

WHEREAS, The proposed hydroelectric projects in the Grand Canyon are not necessary to the Southwest Pacific Water Plan now before the Congress, and impair its chances of passage; now, therefore,

Be It Resolved by the House of Representatives of the Forty-sixth General Assembly of the State of Colorado, the Senate concurring herein:

That the Congress of the United States be requested to refrain from authorizing any hydroelectric projects in the Grand Canyon of the Colorado between Glen Canyon and the headwaters of Lake Mead; and

Be It Further Resolved, That a copy of this Memorial be sent to the members of Congress from the State of Colorado; to the members of the Interior Committee of the House of Representatives of the Congress; and to the Secretary of the Interior of the United States.

Committee on Natural Resources.

Mr. JOHNSON. We have Dr. Stephen Jett. Is Mr. Jett here?

Mr. JETT. Yes, sir.

Shall I proceed?

Mr. JOHNSON. Yes. Tomorrow, we have a full schedule.

STATEMENT OF DR. STEPHEN JETT, IN BEHALF OF THE NAVAJO TRIBE OF INDIANS

Dr. JETT. I have here several documents which I would like to submit.

Mr. JOHNSON. Dr. Jett, would you for the record give us your full name and who you represent?

Dr. JETT. Yes, sir. My name is Stephen C. Jett. I am an assistant professor of geography. I reside in Davis, Calif. I am testifying as an individual to the question of the position of the Navajo Tribe of Indians on this legislation before us.

As I mentioned, I have several documents I would like to submit to the committee, either for inclusion in the record or as part of the file, depending on how the committee——

Mr. BURTON of Utah. Could I ask one further question?

Dr. Jett, are you here to represent the Navajo Tribe?

Dr. JETT. I am not here at their request. I am here with the knowledge and consent of the resources division of the tribe.

Mr. BURTON of Utah. It seems to me we had representatives of the Navajo Tribe here a year or two ago when we were considering this.

Mr. STEIGER. It was Dr. Jett.

Mr. BURTON of Utah. But you are not here officially speaking for the tribe; is that correct?

Dr. JETT. Only to the extent I am presenting official documents of the tribe.

Mr. BURTON of Utah. As a former assistant professor, myself, I would like to know where you are an assistant professor.

Dr. JETT. The University of California.

I will try to make this statement brief. The gist of my statement is quotations from the documents which I am presenting at this time. These are resolutions by the Navajo Tribal Council and are also—the documents include petitions addressed to the Federal Power Commission in regard to the question of licensing the Marble Canyon Dam.

The Navajos, at the time of my previous testimony in 1966, had not taken any official position on this question. They had not, according to the chairman of the tribe, been adequately informed on the subject.

Since that date, however, the position of the tribe has been made quite clear in several resolutions as well as in these documents prepared by the legal department of that tribe.

The position is a dual one. No. 1 is opposition to any hydroelectric structures in the Grand Canyon. This position is the result of the fact that the Navajos do not wish to see scenic resources impaired by the construction of such a dam, and also because of the availability, particularly with the use of resources on the Navajo Reservation, of alternative power sources, specifically coal and uranium.

The Navajo Tribe has a tradition of respect for the natural landscape. It is a religious matter with the Navajos. Their ritual literature is full of allusions to the beauties of nature.

And I would like to just very briefly summarize, if I may, the history in the last few years of their development of a tribal park system. They have specifically created tribal parks—six, I believe, at the present time—and are also specifically advocating in these documents the extension of the National Park to include the entire Grand Canyon from Lees Ferry to the Grand Wash Cliffs, including a portion of the Navajo Reservation, with the proviso that the Navajo Tribal Park Commission be in charge of the administration of the Navajo Run of the national park.

In 1956, Glen Canyon Dam was authorized. The following year, 1957, the tribal council created the tribal park commission. This was established to identify scenic resources, to make recommendations on the tribal parks, which were to be approved by the advisory committee of the tribal council.

In 1957, the first tribal park was established, unanimously—in 1958, excuse me—as also the tribal park commission was established unanimously. In 1962, Lake Powell Tribal Park and the Little Colorado Park were established. These two are particularly important in that they protect portions of Marble Gorge.

The Lake Powell Park is related not only to Lake Powell but includes the upper portion of the Marble Gorge, as well as the lower part of Glen Canyon.

The Little Colorado Tribal Park includes the lower portion of Marble Gorge.

In 1966, a further tribal park was established to further protect Marble Gorge. This one was called the Grand Canyon Navajo Tribal Park. In 1966, as well, the tribe, having studied this question with some thought, resolved in fairly strong language, as I believe the minority opinion of the committee's report indicates—it has the full text of that resolution—that they were unequivocally opposed to any structures of this sort built in any portion of the Grand Canyon, specifically their own portion, and it is gratifying to note that, with the exception of H.R. 722, Marble Canyon Dam has been omitted from present proposed legislation.

The Arizona Power Authority, in attempting to have a license issued to build a dam at Marble Canyon and one at Hualapai as well, has also run into opposition of the Navajo Tribe, as these documents that I will present indicate.

I think rather than dwell on this subject further, I will let the documents speak for themselves, and thank the committee for permission to testify.

Mr. JOHNSON. Any questions? Congressman Burton?

Mr. BURTON of Utah. Yes, sir.

Professor, one of the arguments you say that the Navajos are advancing against construction of the Hualapai Dam is they feel it might be a deterrent to their scenic values.

Mr. STEIGER. Excuse me, Mr. Chairman. May I interrupt the gentleman? I think the professor will agree the Navajos have taken no position on Hualapai. Their position is only in connection with Marble. The resolution adopted mentioned it is only in connection with Marble.

Excuse me, Mr. Burton, but I did want——

Mr. BURTON of Utah. I understand they were definitely opposed to Marble, and Marble is mentioned in here, but in reading this, they make reference to the "proposed flooding of the Colorado River and the Grand Canyon," and there is reference in here at one point to dams. Quoting further:

> The source for generating base power could be transferred from these dams to the existing and planned coal-fired or nuclear generating plants in and around Arizona, and more of the capacity of these dams could then be utilized for producing the higher value peaking power, thereby providing a higher rate of return to the investment in these dams.
>
> The potential tourism benefits to the Navajo Tribe are greater if the Grand Canyon is left in its natural state, than if another huge body of water were impounded.
>
> The Navajo Tribal Council thereby affirms the position of the Navajo Tribe as opposing the construction of any dams, diversions, or obstructions in Marble Gorge or in any other portions of the Grand Canyon.

That is why I assumed they are against Hualapai, too.

Dr. JETT. Yes. Actually, it is specifically mentioned here on page 2, the third quotation, "The Navajo Tribal Council condemns as a needless waste of public funds the immense cost of constructing Hualapai and Marble Canyon Dams."

Mr. BURTON of Utah. As far as Hualapai, it can't be seen from any place that a tourist goes. I mean, the waters.

Dr. JETT. I would have to demur on that because the presently developed viewpoint in the Grand Canyon National Monument at Toroweap Overlook does provide an outlook, and the bottom at that point would be inundated to a depth of 300 feet.

Mr. BURTON of Utah. We had witnesses here and the gentleman from Arizona told us many times that this wasn't possible from the overlooks that now exist where tourists go. It is impossible to see any of the water that would be backed behind Hualapai.

Dr. JETT. Well, I will have to disagree with the gentleman from Arizona because of the fact that this point overlooks a portion of the Canyon which is below——

Mr. BURTON of Utah. What point is this?

Dr. JETT. Toroweap Overlook.

Mr. BURTON of Utah. Does it?

Mr. REINECKE. Is there a paved road there?

Dr. JETT. No. It is a dirt road at the present time.

Mr. BURTON of Utah. There is a considerable volume of opinion that tourism might increase with the presence of the water near the Canyon.

Dr. JETT. Yes, there is. However, the Bureau of Outdoor Recreation does not subscribe to this view. Their statement in the case of Marble Canyon Reservoir site was that the sheer cliffs would prevent any effective access at a point other than Lees Ferry, and that it would have no postive additional recreational benefits.

Mr. BURTON of Utah. Well, it is my understanding that the construction of the Hualapai would involve no traditional, historical, or presently occupied lands of the Navajo. I sometimes wonder if perhaps their position in opposing the dam isn't so much aesthetic as it is that they hope to get the coal-fired plants, using Navajo coal. I submit to counsel this picture, and ask him to let you look at it and see if the Navajo really would rather have us tearing up their actual reservation lands in that fashion, rather than have a dam that perhaps is 200 or 300 miles from where they are.

Dr. JETT. Well, I am sure that the Navajos would just as soon see no damage whatsoever done to the landscape. On the other hand, I think they do see a series of priorities, perhaps, and since they did permit this development to take place on the reservation, presumably they approved it.

I might add that this particular coal-fired power plant, the Four Corners plant, is, fortunately, in the least scenic portion of the reservation.

Mr. BURTON of Utah. Part of those people, I represent, and I know they are good horse traders. I am certain they see a tremendous economic advantage here. I hope that they are not too disappointed when and if it comes, to see their air polluted and their blue skies they have looked at for hundreds of years, gone.

That is all.

Mr. JOHNSON. The gentleman from California, Mr. Reinecke.

Mr. REINECKE. I would like to ask my colleague from Utah, Are we aware of an inversion layer in that area?

Mr. BURTON of Utah. I am not aware.

Mr. REINECKE. That would accumulate air pollution.

Mr. BURTON of Utah. I am not aware of it.

Mr. REINECKE. I think it is well to understand that air pollution occurs where there is an inversion layer in the sense that it puts a lid on.

Mr. BURTON of Utah. There are several known inversion areas in Utah. I can testify to the committee that there might be one in the Navajo lands, because there are valleys and mountains, and peaks, there, that might be subject to that.

Mr. REINECKE. I have never heard of any in that area.

Mr. BURTON of Utah. Never heard of any pollution.

Mr. JOHNSON. The gentleman from Arizona, Mr. Steiger.

Mr. STEIGER. I just have a few questions. Dr. Jett, you are well aware that the tribe is active in many endeavors which causes them to send representatives to Washington.

Dr. JETT. Yes.

Mr. STEIGER. I take it, are you—have your expenses been paid by the tribe in this effort?

Dr. JETT. No; they have not.

Mr. STEIGER. Well, I would like to interpret their lack of sending an official representative here as a demonstration of the fact that their concern is not of a magnitude that they felt a paid trip was justified. I can testify, as my colleague from Utah mentioned, that the Navajos are excellent horse traders. I have traded horses with them now for 15 years and they are very good. Their interest in a thermal plant is a very genuine one, I think a very proper one, as a matter of fact. I mean, it would mean much employment on the reservation and it would mean significant employment in excess of some 300 people. So I don't think their approach is entirely objective.

I question, personally, their real concern over any destruction per se, their definition of either the lakes that were proposed as destructive, and I would have to credit them with a genuine interest in the economic benefits from the thermal plants.

I think you might give them the same credit.

Dr. JETT. Well, if I may address myself to that point, I certainly would agree with you that they have a financial consideration here which is a valid one. I don't think you should minimize, on the other hand, the possible value they place on the esthetics as well as on the integrity of the landscape. The Navajo, being of a different culture than we are, have somewhat different values, and their values are not necessarily as entirely material as ours may tend to be.

Secondly, if I may also comment on the question of their not sending a representative here, they do have two representives in Washington at this time who are testifying this afternoon at another hearing before the Appropriations Committee. So they were unable to be present.

Mr. STEIGER. I have no further questions.

Mr. MCFARLAND. Mr. Chairman—Dr. Jett, the resolution passed last year by the Navajo Tribe indicated the eastern end of the proposed Marble Canyon Dam would be based upon Navajo lands, flooding approximately 46 miles of Navajo Reservation land. Do you think that is an accurate statement?

Dr. JETT. Would you read it again, please?

Mr. MCFARLAND. It says the eastern end of the dam would be based upon Navajo land, flooding approximately 46 miles of Navajo Reservation land.

Dr. JETT. Yes, I would say that is accurate.

Mr. MCFARLAND. Then, Mr. Chairman, all I say, the Navajos had better find out where their boundary is, because the dam would not affect any Navajo Reservation land, or the reservoir.

Dr. JETT. If I may comment on that, the eastern abutment of the dam would be on the Navajo side of the river. The border of the reservation at that point is the bank of the river.

Mr. MCFARLAND. Dr. Jett, that is not correct. Just leave it that way. I want to leave it that way. They do not own up to the river. There is a withdrawal, and the reservation only comes to the withdrawal.

Dr. JETT. May I make a further comment on this?

Mr. JOHNSON. Yes, you may.

Dr. JETT. I have looked into this. Perhaps you are thinking of a bill, I think it was perhaps in 1937 or thereabouts, which had some mention of a power reservation. This did not mean that this was not reservation land, nor that just compensation would not have to be made in the event of any confiscation. The title of that land had been guaranteed prior to that time, and this would be an *ex post facto* application to it in any event.

Mr. MCFARLAND. Mr. Chairman, the only reason I brought it up, it came up in connection with other legislation. It is not appropriate to pursue at this point, but I think it will be borne out and will be part of the other record, as to where the Navajo Reservation ends and the effect of the withdrawal upon the Navajo Reservation land.

Mr. JOHNSON. I understand the counsel; Mr. Witmer, you have a question.

Mr. WITMER. Dr. Jett, how much development, if any, has there been in the three tribal parks that you mentioned?

Dr. JETT. Six I mentioned. I did describe the three specifically, but there are six altogether.

Mr. WITMER. Well, make it six. How many are there?

Dr. JETT. Well, in Monument Valley tribal park there has been a fair amount of development, a good bit of roadbuilding; I think approximately 20 miles of roadbuilding.

The visitor center there is quite large and impressive, a museum and craft shop existing there, and observation decks, and so forth; a campsite with shelters and toilets, and so forth.

In addition to this, there is the Kinlichee tribal park, which is an archeological site. This has been excavated, a shelter has been built to protect the ruins, and so forth. Brochures have been printed to describe these areas and to make them known to the tourists.

There are several visitor centers around the reservation, and the Navajo tribal museum—these sorts of things are the types of things they are doing. Also picnic tables scattered along the major highways all around the reservation.

Mr. WITMER. How much money has been expended? Do you have any idea?

Dr. JETT. I couldn't give you exact figures. I think for Monument Valley, the major construction involved around $150,000.

Mr. WITMER. That was tribal funds?

Dr. JETT. Yes, sir.

Mr. BURTON of Utah. How much has been spent on the three river parks?

Dr. JETT. In the Little Colorado area, some access road has been built, and I think possibly picnic facilities. In the case of Lake Powell, they are working on developments at several points along that lake itself. As far as the Marble Canyon portion of that is concerned, I don't believe anything has to date been undertaken.

Mr. WITMER. How many people visit it, do you have any idea?

Dr. JETT. Visit what?

Mr. WITMER. The six parks.

Dr. JETT. Again, I don't have exact figures on this. It is in the—well, in the case of Monument Valley Park, I think it is certainly over 50,000 a year. They each pay a dollar entrance fee.

Mr. WITMER. How close to the rim of the Canyon are these?

Dr. JETT. Are the parks?

Mr. WITMER. Yes.

Dr. JETT. Well, the three parks that involve the Marble Gorge area, of course, include all of the gorge which belongs to the Navajos, as well as a portion in back of that.

Mr. WITMER. If you don't mind, Mr. McFarland has already corrected you on what belongs to the Navajos.

Dr. JETT. Well, this——

Mr. WITMER. You are not building up a record by saying that it does, but you may make your point if you want to.

Dr. JETT. I say that portions, of course, belong to the Navajos. I don't think the entire gorge is being contested here. Perhaps a portion is being contested. My opinion doesn't coincide on that. But that is something that can be determined; but in any event, the park extends to the extent that the Navajos do own the gorge, whether it is from the bank of the river or from the halfway up point, or wherever, that is included in their park area.

I have among these documents a description of that as far as just what area is included, if you would like to see that.

Mr. WITMER. And to the extent that the Navajos do not have any proprietary interest in the gorge, they may have spent their money unwisely.

Dr. JETT. Well, as I say, they haven't developed the Gorge itself, but on the other hand, as far as the rim is concerned, they can certainly build facilities on the rim and profit from it.

Mr. WITMER. I think you had better leave out the "certainly," just to be on the safe side, unless you have really checked into it.

Dr. JETT. Well, I will stand on my statement. If that needs correcting at a later date, I will be glad to reconsider it.

Mr. WITMER. Thank you, Mr. Chairman.

Mr. JOHNSON. If there are no further questions, we want to thank you, Dr. Jett.

Dr. JETT. Thank you.

(The above-referred to documents presented by Dr. Jett follow:)

STATEMENT BY STEPHEN C. JETT, PH. D., ASSISTANT PROFESSOR OF GEOGRAPHY

THE NAVAJOS AND GRAND CANYON DAMS

"We are fortunate in occupying an area of unmatched primitive and natural beauty. This is a most valuable resource and must be protected, preserved and utilized wisely."—Raymond Nakai, Chairman, Navajo Tribe [1]

"Crops can be replanted. Stock can reproduce. So can human beings. But the land is not like these. Once it is taken away, it is gone forever."—Howard Gorman, Navajo Tribal Councilman [2]

I am Stephen C. Jett, Ph. D., Assistant Professor of Geography, University of California, Davis, and author of the book "Tourism in the Navajo Country: Resources and Planning," published by the Navajo Tribal Museum.[3] I am testifying as an individual.

At the May, 1966 hearings on the Colorado River Basin Bill, I testified as to how the proposed Marble Canyon Dam would detrimentally affect the interests of the Navajo Tribe, which owns the left bank of the Colorado in the area of the reservoir site. At that time, the Tribe had taken no official stand on this issue, and I was authorized by Tribal Chairman Nakai only to state his feeling that the Navajo Tribe had not been appropriately informed regarding the proposed dam; this situation was in contrast to the pro-dam Hualapai tribe, which, according to its chairman, had been specifically invited to prepare testimony for the hearings (p. 646).[4]

Subsequent to the May hearings, however, the Navajo Tribal Council has given thoughtful consideration to this issue, and it is now possible to present to the Subcommitee two resolutions of the Tribal Council regarding this subject, as well as another Tribal document, addressed to the Federal Power Commission, regarding the Navajos' position. I will summarize their contents by abstracting appropriate quotations.

Resolution CAU–97–66 (Aug. 3, 1966, passed 29 to 2): [5]

> The proposed flooding of the Colorado River in the Grand Canyon, which now offers one of the last great canyon wilderness waterways, would impair and destroy many scenic beauty spots and tourist attractions in the canyon along said route, thereby partially destroying one of the greatest resources of the Navajo people, the Marble Gorge of the Grand Canyon.
>
> The proposed Marble Canyon Reservoir would have no practical point of access from the Navajo side of Marble Gorge due to sheer cliffs . . .
>
> The Navajo Tribal Council condemns as a needless waste of public funds to immense cost of constructing Hualapai and Marble Canyon Dams . . . . the high cost of hydroelectric power is rendered obsolete and unnecessary, especially when [coal and] nuclear plants can ultimately generate power at vastly less cost than hydropower.
>
> In lieu and instead of the construction of Hualapai and Marble Gorge Dams the Navajo Tribal Council urges and memorializes the Congress to consider favorably . . . bills to enlarge the Grand Canyon National Park, to include the entire area of the Grand Canyon, provided, however, that the Navajo Rim . . . shall be administered by the Navajo Department of Parks and Recreation in cooperation with the National Park Service respecting tourist facilities in any portions of the area embraced in the Grand Canyon National Park which lie within the Navajo Reservation.[6]

Answer of the Navajo Tribe of Indians Opposing the motion of Arizona Power Authority for Commission Decision & Order Issuing License (Jan. 10, 1967):

> . . . construction costs applicable to the Marble Canyon Project have increased 11.53 percent since 1960, while the costs for constructing a steam generating plant have increased only 1.97 percent. . . . such increases in construction costs have a much greater effect in increasing the total costs and lengthening the payout period of hydroelectric dams because they require a higher initial capital investment.
>
> Among the new developments for providing both base and peaking power is the use of gas turbine generators. This method of power generation has already been proven to provide economical peaking power.
>
> There has been an increased use of nuclear powered generating plants during the past several years. Their economic feasibility has already been proven. . . . they can be located near the load centers, eliminating or greatly reducing the transmission costs required from hydroelectric plants.
>
> . . . the inter-regional intertie of electrical systems . . . permit[s] different regions of the country to more economically use the natural resource power generating methods of other regions. . . . the Pacific Northwest-Southwest intertie . . . will serve the same marketing area as would the Marble Canyon Project.
>
> One of Arizona's basic contentions . . . is that the Grand Canyon dams would provide *peaking power* which . . . cannot be provided by other generation means. But . . . to the extent Glen Canyon Dam is operated to maintain a minimum flow, the proposed plant will have to be operated in step with it, if at all. In other words, for a substantial part of the time, the plant will be capable of generating only non-firm or dump power.
>
> The source for generating base power could be transferred from . . . [Hoover, Park, and Davis] dams to the existing and planned coal-fired or nuclear

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[1] Remarks in *Navajoland Council: Recreation and Tourism.* Window Rock, 1965.

[2] Translated from a speech in Navajo during discussion by the Tribal Council of the resolution of Aug. 3, 1966, opposing dams in the Grand Canyon. Quoted in Philip Hyde and Stephen C. Jett. "Navajo County." *Audubon,* vol. 69, No. 1, p. 24. New York, 1967.

[3] *Navajo Publications,* Series A. Window Rock, 1967. For the section discussing Marble Gorge and opposing Marble Canyon Dam, see pp. 92–3.

[4] Hearings record, pp. 1581–7.

[5] For full resolution, see the Committee's Report No. 1849, pp. 138–141. The other two documents cited are being submitted with this statement.

[6] See also: National Park Service, U.S. Dept. of the Interior. *Cooperation in Recreation Development.* Washington, 1962.

generating plants . . . and more of the capacity of these dams could then be utilized for producing the higher value peaking power, thereby providing a higher rate of return to the investment in these dams.

Petition of the Navajo Tribe of Indians to Reopen the Proceedings [before the Federal Power Commission] (Feb. 21, 1967):

. . . the costs for nuclear generation are already competitive with costs at which the Marble Canyon Project would produce power . . . in the near future the greater efficiencies which will inevitably be brought about by increased use of and experience in nuclear generation, will bring these costs even further below those for hydro generation.

Another alternative to hydro generation . . . is low cost generation by coal-fired plants. . . . coal-fired plants are already competitive with or are even more economical than hydroelectric plants.

Although these alternative systems can be designed to accommodate peak loads, they can also be supplemented by gas turbine generators which can supply the peaks in demand on very short notice.

It is to the best interests of the Navajo Tribe and to the American public to maintain the diversity of recreation type facilities by creating a string of lakes on the Colorado River.

Resolution CJA–13–67 (Jan. 27, 1967, passed 57 to 0):

The potential tourism benefits to the Navajo Tribe are greater if the Grand Canyon is left in its natural state than if another huge body of water were impounded.

The Navajo Tribal Council thereby affirms the position of the Navajo Tribe as opposing the construction of any dams, diversions or obstructions in Marble Gorge or in any other portions of the Grand Canyon.

A further indication of the Navajos' position is the fact that three Navajo Tribal Parks have been created to protect the full length of Marble Gorge. Two of these parks would be invaded by Marble Canyon Reservoir.

The position of the Navajo Tribal Council has thus been made clear. Its opposition to the Grand Canyon dams and its support of an expanded National Park are based on considerations of the general public interest as well as on considerations of Tribal interest. The reasons for this position are essentially those outlined in my testimony of May 1965: the dams' needless damage to an extraordinarily beautiful and potentially valuable scenic resource, and their subsidized competition with less costly thermoelectric power sources that exist on the Navajo Reservation.

It is of note that of presently pending bills, only Congressman Hosmer's H.R. 722 now includes Marble Canyon Dam. Secretary of the Interior Stewart Udall [7] has submitted a Colorado Basin proposal to Congress eliminating the Grand Canyon dams. Pumping power would be generated by thermoelectric plants, which could be supplied with Navajo mineral fuel. The Secretary also proposes inclusion of Marble Gorge in an expanded National Park. Barry Goldwater [8] states that Marble Gorge "is one of the world's most beautiful spots," and recommends elimination of the proposed dam there, the gorge to be added to the National Park. Congressman Aspinall, Chairman of this Committee, has introduced a bill (H.R. 6132) including similar proposals. The Navajo Tribal Council is on record as favoring complete National Park protection to lower Grand Canyon as well as to Marble Gorge, as proposed in the bill introduced by Congressman Saylor (H.R. 1305).

Addendum on Strip Mining, Coal-Fired Power, and Air Pollution

The colloquy between Mr. Burton and Mr. Reinecke regarding the possible effects on air purity of coal-burning power plants in the Navajo area suggests the utility of some additional discussion of this and related points.

First, it must be recognized that serious air pollution is associated primarily with urban areas, with their concentrations of automobiles and industries. There is no present likelihood that the Navajo Country will become heavily urbanized. Nevertheless, any foreign matter including smoke from coal plants, that is introduced into the air has its negative aesthetic effects.

In the case of coal-burning plants, however, low-cost smoke-control devicees can be installed to greatly reduce the release of undesirable substances and to produce salable byproducts.[9] In any event, the main climatic condition causing smog problems, *i.e.*, persistent temperature inversion, has a very low frequency in the Navajo region. Nor are mountain-ringed valleys, another phenomenon promoting smog accumulation, characteristic of the Navajo Country.[10]

The damage to the land caused by strip-mining is also a problem, but not an entirely insoluble one. A conservation text [11] states, "Even strip mining . . . can be offset by rather inexpensive reclamation practices. . . . By leveling and soil building [on strip-mined lands], many of them can be made suitable for most any kind of land use." In any case, the coal-producing areas of the Navajo Country are also the least scenic.

[7] U.S. Dept. of the Interior news release dated Feb. 17, 1967.

[8] "How to Save the Grand Canyon and Water the Desert, Too." *U.S. News and World Report*, Vol. 61, No. 17, pp. 124–6. Washington, 1966.

[9] A. J. Haagen-Smit. Air Conservation. In: Jack B. Bresler (Ed.), *Human Ecology*. Addison-Wesley. Reading, 1966, pp. 390–5. C. T. Wanzer. "Use of Fly Ash in Concrete." *Combustion*, February 1959. Bituminous Coal Institute. Washington, p. 4.

[10] Philip A. Leighton, "Geographical Aspects of Air Pollution." *The Geographical Review*, Vol. 56, No. 2, pp. 151–74. New York, 1966.

[11] Ruben L. Parson, *Conserving American Resources* (2nd Ed.), Prentice-Hall. Englewood Cliffs, 1964, p. 456.

Before the Federal Power Commission

(Project No. 2248)

Arizona Power Authority—City of Los Angeles and its Department of Water & Power

Correction to the Answer of the Navajo Tribe of Indians Opposing Motion of Arizona Power Authority for Commission Decision and Order Issuing License

The Navajo Tribe of Indians filed its Answer referred to above on January 10, 1967. In the last sentence of Section III, page 7, and in Section IV, pages 7 and 8 of said Answer, in the discussions of portions of Section 7(b) of the Federal Power Act, the Navajo Tribe referred to and quoted incorrect sections of said Act. To correct said errors, the Navajo Tribe hereby submits its amendment to said Answer, as follows:

Page 7, last sentence of Section III should read as follows:

"In the execution of its authority to issue licenses for projects which, as required by the Federal Power Act, are in the public interest,[12] we submit that the Commission, also, should consider the strong expression of public opinion opposing the construction of any dams in the Grand Canyon which have mounted steadily since public awareness of the possible dam construction was created by the Congressional hearings".

Page 8, the quotation at the top of page 8 and the first sentence following thereafter should be deleted and the following substituted therefor:

"(b) 'Whenever, in the judgment of the Commission, the development of any water resources for public purposes should be undertaken by the United States itself, the Commission should not approve any application for any project affecting such development, but shall cause to be made such examinations, surveys, reports, plans, and estimates of the cost of the proposed development as it may find necessary, and shall submit its findings to Congress with such recommendations as it may find appropriate concerning such development'.

"It is impossible that the requirements of Section 7(b) could have been fulfilled by any of the Congressional hearings or other Congressional consideration of the Colorado River Project proposed in H.R. 4671 because it is only the presiding examiner who has made findings and recommendations in this matter. The Commission has not as yet arrived at a judgment or made any such findings or recommendations to submit to Congress pursuant to Section 7(b). The Chairman of the Commission, Joseph C. Swidler, recognized that no such referral could be made until the Commission made its findings and recommendations, when in his letter to the Honorable Oren Harris, dated June 2, 1964, concerning the bill (H.R. 9752) to suspend the Commission's jurisdiction in this matter,

[12] Federal Power Act, §§4(a), 4(e), 10(a), and *State of California* v. *Federal Power Commission*, 345 F. 2d 917 (1965); *Northern States Power Company* v. *Federal Power Commission*, 118 F. 2d 141 (1941).