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HAROLD CONKLING:
HYDRAULIC ENGINEER

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INTRODUCTION

Harold Conkling, hydraulic engineer, irrigation expert and water consultant was born in Tekamah, Nebraska, on October 30, 1882. Although he received university training as an engineer, he gained most of his knowledge about water development through practical experience in the field. While employed by the U.S. Bureau of Reclamation from 1911 to 1920, he was involved in such important projects as the [REDACTED] Arrowrock Dam in Idaho and the Elephant Butte Reservoir in New Mexico, and conducted investigations in the North Platte River Basin in Nebraska, and the Mono Basin and the Imperial Valley in California. The results of his Colorado River studies were of particular significance and became an integral part of the planning and design of Hoover Dam.

In 1920, he left the Reclamation Bureau to work for the State of California Division of Water Rights and become Chief of the Division in 1927. Before his resignation from the division in 1945, he made important water studies in the San Fernando, Santa Ana, and San Gabriel Valleys, and during these years established a reputation as an authority on alluvial geology, ground water, and other areas. Because of his knowledge and

experience, he often served as an expert witness and consultant during the time he worked for the state, and after 1945, he was retained as a consultant by the Los Angeles Department of Water and Power and by various other organizations. In 1962, he retired and for the past two years has been a resident of Hawaii.

This interview was conducted under the auspices of the Water Resources Center at UCLA as one of a series dealing with the history of water development in California and the Southwest. The original recordings for the following tapescript were made in October, 1965, by Daniel Simms. The tapescript was edited and indexed by Donald J. Schippers.

Conkling: I was born on October 30, 1882 in Tekamah, Nebraska. This town had been settled sometime before 1870 and a big log blockhouse had been built to protect the citizens in case Indians attacked them. My parents came there about 1872. They were strangers to each other then, but there seems to have been a lot of people there about that time because my parents' friends during my boyhood days were people they had known before they were married.

In 1900 I graduated from high school, and in that year my parents sent me to Grand Island College. I didn't like it at all! The next fall I went to the University of Nebraska, and during the latter part of the two years I was there I went into the engineering course but I took several courses outside the prescribed engineering course.

In 1903-04 I went to Cornell University in New York. My father had a severe financial loss about that time, or about the end of that year, so in 1904 I came back to Nebraska and re-entered the University; also, I thought I could probably get a better job there than at Cornell where all the jobs were just waiting on table. That didn't work out very satisfactorily, so at the end of the first semester I got a job with the Burlington Railroad

which had its western headquarters in Lincoln, Nebraska where the University was.

The next year I had to spend out in Wyoming locating a railroad from Denver north to try to reach the line the Burlington had purchased. I accumulated some money from that job because there wasn't any place to spend it, I guess. You weren't near a town--ever. I think we did get into Cheyenne, Wyoming, but I don't know why. Finally we were transferred from the southern end of the line we had been working on to the northern end, so I went back to Lincoln and the University of Nebraska for a half-year.

I thought I had better look up! By that time I had gone to universities for five years, and I thought I'd better find out how much longer I had to go to school to get a degree in engineering. I had taken so many courses outside of engineering--the arts courses and other subjects I liked very much--that I found nineteen hours in engineering would have to be taken to get a degree. That would have taken a whole year as the necessary classes came during the fall and spring semesters. I decided to quit school, which I did, at the end of the semester.

I got another job. That was in 1907. It was with the city engineer of Omaha, and I worked there

for about three months--or four--I know I had enough money to pay my fare to Seattle, and a little left over. I went there with a school friend; I don't remember what he did, but I knew I had to get something right away. That was the time of the severe depression of 1907. There were just no engineering jobs to be had. Skilled and unskilled people were working for the city for twenty-five cents a day and their lunch just to keep alive. I finally landed a job. It wasn't in engineering, and we had a split up over something I did--I can't remember what it was--and I decided I would get the agency for taking subscriptions for the Saturday Evening Post. They would give such a job to anybody, and I worked at that four months or longer covering the cities of Seattle, Tacoma, Portland and San Francisco which, right after the earthquake, was a pretty blown up town, but I sold subscriptions and was doing very well. By the end of that time I was making more money than I made in engineering for several years later.

I went back to Seattle from San Francisco and ran across a couple of friends. They had heard about a tremendous project being built in Idaho, in Southern Idaho, called the Twin Falls Project. It was an irrigation project which would take water

out of the Snake River and water about 200,000 acres, I believe, on the south side of the river. A very nice project. It was a Carey Act project putting water on the land for \$25 an acre--and making money out of it too, I guess.

My friends and I decided to go into the contracting business. They had a little money. I didn't have anything by that time, but we went into the contracting business there in the town of Twin Falls. It turned out that they, my friends, didn't do any of the work! I had to do it all, and the business wasn't profitable. At the end of four or five months we just quit. I got jobs as an instrument man on other irrigation projects which were being built in the general area. One was on the north side of the river and the other on the south side of the Twin Falls Project.

Well, I didn't like that kind of life very well and I'd met a girl. I wanted some place where I could settle down. I quit and went to Boise and took odd jobs there, made enough to keep alive, and finally landed what I thought was a permanent job. That was all I asked for. I wrote down to Twin Falls and asked the girl if she would come to Boise. I was to go to work on the Monday after Thanksgiving. She came with her father and we were

married on Thanksgiving Day in 1910. I went around Monday to take the job; the job wasn't there! I never got a good explanation of why it wasn't, but it just wasn't there. That was a nice permanent job, wasn't it? Maybe they had heard something about me they didn't like. I don't know, but I do know I was in a rather delicate position.

I'd seen a store a little off the main street that had vacuum cleaners for sale and thought, "Well, I'll go in there and see if they want me to go out and sell vacuum cleaners for them." The vacuum cleaner was hand-operated. This was the first vacuum cleaner made that I had heard of, and I thought it a wonderful idea. I suggested to them that I go from house to house canvassing and see if I could sell their vacuum cleaners--at least that would be an advertisement for them. They offered to pay me \$75 a month and give me something extra for each cleaner sold. I don't remember exactly how long I worked at that but it soon became evident that we couldn't live on \$75 a month plus. They didn't let me go, but I told them that I didn't think I would work there anymore.

In the meantime I had met a man with, what seemed to me, considerable money. He had decided he wanted to buy a lot of land and set out apple trees (it was

good apple country) and sell it off in ten acre tracts. At that time it was thought that if you had ten acres of apples, or oranges, or ten acres of anything, you had a fortune for the rest of your life. I think that they know now that you have to have more than ten acres to support yourself.

Anyhow, I got acquainted with him and he said he had found an area down on the river that was owned by a man who was in Germany and would be coming back in about a month. He said he would pay me to go out with another man to run an instrument around the area to see if it was good property for irrigation. We did that. The owner didn't come back from Germany, he was delayed another two months, and the plan seemed to be petering out. It wasn't actually petering out, but there was a big delay on it, and I had done all the work that was necessary.

I heard about a job with the Reclamation Bureau. The principal office of the Idaho District of the U. S. Reclamation Bureau was in Boise. That district embraced the whole Snake River Valley; that is the west part of Wyoming, the east part of Oregon, and Southern Idaho up to the Washington line. The Boise River is a tributary to the Snake River from the north, and the Payette River west of the Boise is also a tributary. When I understood this man was

not going to be back from Germany for about two months I went to the Bureau and was hired right away. They said it would be two months' work. That was all right with me because I had something else in mind after those two months. Then the man I was working for died in Germany and the estate wouldn't sell the land, so whatever I had had in mind didn't come to pass. Well, the Bureau didn't say anything about letting me go at the end of the two months, and so I stayed and worked for it for eleven years.

I'll describe the Snake River Valley which is really the area of that particular Reclamation District because there is something I want to tell you about it later. The Snake River rises, the principal tributaries of the Snake River, in Western Wyoming just south of Yellowstone Park. That area also has since been made into a park, and it is very, very beautiful up there. The river flows out westward into Idaho and then southward to Southern Idaho and westward clear into the big canyon that occurs below Boise beginning just about at the Washington line. The Snake River flows south and then westward through Idaho; the Boise River flows from the north into it near the western side of Idaho; and the Payette River is a short distance west of the Boise River paralleling it into the Snake. The Snake River is

a tremendous stream. Its principal headwaters are a tributary to natural Jackson Lake in Wyoming.

Well, the Reclamation Bureau had built a project called the Minidoka Project in Idaho just below the point where the Snake River turned westward and immediately east of the Twin Falls Project I mentioned a few moments ago.

My job with the U. S. Reclamation Bureau was working under Frank Banks who as Office Assistant to F. E. Weymouth who was the head of the Idaho division. Frank Banks died some years ago in Glendale, California.

Simms: Any relation to Harvey Banks?

Conkling: No. Harvey Banks used to work for me here in Los Angeles after I became a consultant.

Frank Banks was a Bureau engineer. I had been hired to do the preliminary work on Arrowrock Dam which was to be built on the Boise River to create a reservoir just before the river comes out of the mountains. We located a railroad up there and some sheds, and at least did enough work so the chief could talk more intelligently about it. As I said, nobody said anything about my quitting so I just stayed on without going on to that tremendously attractive job I don't remember about.

The Arrowrock Dam on the Boise River, when built,

was to be the highest dam in the world. They had all of the water rights from the river running down in the Boise Valley adjudicated so that they would know just exactly how much each holder was entitled to.

The Boise Valley is a flat, rich valley about four or five miles wide and is perhaps twenty-five miles long before it merges with the Snake River Valley. It cuts into the plain a couple of hundred feet. Well, the Bureau was going to supplement the water through some newer larger canals (the farmers were using water but were short of it in the late summer) and a lot more land was to be irrigated. Part of the project was an offstream reservoir which was to be on the top of the low divide between the Snake River and the Boise River--the Boise River having turned westward for a ways before reaching the Snake. They started the dam and work on it went on without our office having anything to do with it.

There were all sorts of things that Weymouth referred into our office. The Reclamation Bureau had built a small dam across the mouth of Jackson Lake in Wyoming that was letting that water down to the Minidoka Project about a couple of hundred miles down stream and through a large area irrigated from the Snake. It took a lot of work to get that water

down there past those diversion dams. The Bureau decided to build the dam across the mouth of Jackson Lake higher and make a bigger reservoir there. Frank Crowe was to be in charge; Frank Banks became the Resident Engineer on that dam, and I succeeded to his job.

Well, going back, the only time I had anything to do was when Weymouth wanted me to do it, and he always wanted me to hurry! I might go a stretch of several days when I wouldn't have anything to do but a few chores so I used my time learning more about irrigation. I became very interested in the work of Professor Widtsoe of the University of Utah and of a county agent in Twin Falls. These two were trying to find out how much water was consumed per acre by the irrigated crops because the farmers were using so much water. They thought if they found out how much was actually consumed by crops they could cut down on their diversions. I studied their different reports with great interest because the amount of water that was consumed was far less than the amount that was being diverted.

Finally the Arrowrock Dam was completed in three or four years. The Bureau's Consulting Engineer, Mr. Henny of Portland, I forget his first name, was called in to make a report on it and see

how it fitted into the task of controlling the whole flow of the river and so forth. He found that it was just exactly the size of the reservoir. Weymouth turned the report over to me to analyze and I found that the consulting engineer had added up all the rights that had been decreed to all of the canals downstream from the dam. With this demand, he found the reservoir was just the right size. The original dam designers must have done the same thing in their figuring.

I understand the Reclamation Bureau at that time didn't have much experience with water supplies, and I had had no experience, but I got to thinking about it. It certainly couldn't be that they needed all of that water because if they diverted so much per acre perhaps some of it came back to the stream. I took a trip down the stream and found that approximately 10,000 second feet, as I remember, were flowing out into the Snake River from the Boise River and that they were letting the natural flow down from the reservoir up to the sum of the decrees. There wasn't any need of that whatever because the return flow from the irrigated area came back very soon into the stream and was used by the canals below.

Simms: The same drainage area so to speak.

Conkling: Or very close to it. It came back almost immediately,

supplying a considerable flow during the low period. To this day I can't understand why no one saw it because whenever we had hydrographers on the river they would measure at several points but they never found out that the release was too great. I still can't understand it. Well, I told the boss about it and he said, "You go ahead and analyze the report and make your own." I did. My report showed the reservoir should have been just about twice as big if they were going to control the Boise River by it and that was the idea! I had had enough measurements made on the river to be sure I was right. There was plenty of water down there without letting so much down from the reservoir. When I think about that going on for several years, letting that water down--well, not several years but long enough that the hydrographers had measured it without saying anything about it--I was astounded. Well anyway, Weymouth called in the consulting engineer, and the consulting engineer agreed with me so that was that. I was very pleased. Here was something I'd studied and learned, you know.

Next, operation showed that the offstream reservoir on top of the divide wouldn't hold any water. They flowed water through a big canal to the reservoir and the water disappeared just about

as fast as it came in. They had a meeting of the Board of Consultants and the Board decided that the reservoir should be abandoned. Weymouth told me to go down and look at the thing and see what I thought about it. When I got down there I saw some water was actually flowing out of the reservoir into one of the natural channels leading from it. I made an analysis of the whole operation from the beginning. I found out what was happening. And, of course, you know what was happening--the ground underneath was being filled with water, and when full, during the years of heavy leakage, the water had to flow away at a much flatter grade underground. Weymouth wrote to each member of the Board of Consultants and sent my analysis to them. They agreed that the reservoir should be continued. It actually was holding the water pretty well.

Then there was another item. While Banks was there I never had anything to do with control of the water going down river from the Jackson Lake Reservoir in Wyoming. After Banks had gone I went into it. I found they weren't giving any credit to the natural flow as influenced by the natural storage in the lake. As the season advanced and the lake was going down, it would be storage for those projects along the river in the Idaho Falls

area. I didn't say anything about that right away but later talked to Mr. Weymouth and the consultants. That ended that. We turned it over to the Geological Survey and they made an analysis of it, and everybody was satisfied after that. I am telling you this because of what happened later.

There was an office started in Denver, the head engineering office of the Reclamation Bureau (leaving the Commissioner of Irrigation in Washington to politics) and Weymouth was appointed to the head office. Frank Crowe went up to the San Ignatius Project in Montana which was on an Indian reservation in a very beautiful valley, the south end of which is about forty miles north of Missoula and off the main east-west railroad. Weymouth had sent Crowe up there because the project manager had died suddenly and there wasn't anyone else to send. Frank was very pleased because he was going to build two or three reservoirs up there, and that's what he liked to do. And what happened? There were no records whatever on anything to do with the project. The project manager had left an absolute blank. Crowe requested that I be sent up there to spend enough time to analyze the project to see what ought to be done. There was nothing to tell him. The planning of the project amounted to absolutely

nothing. The former manager had carried it all in his head! I went up there and analyzed the project. I just loved that country and could have stayed there for the rest of my life, but Weymouth wanted me to come to Denver.

I must tell you some of the troubles the Reclamation Bureau was having. The Reclamation Law was passed in 1902. Then they gathered together engineers from all over the country to go out and investigate irrigation projects along the western rivers. Many who investigated the projects knew little, if anything, about the fundamentals of irrigation, so when a project was built on a river the Bureau would ask the Federal Land Office to withdraw from entry all public land upstream from the diversion point. They didn't want anybody interfering with the project water. They would build a project if they had an area, such as that on the Rio Grande, which would take all of the water that was available.

Since almost all of the streams in the west, except the Columbia, at least partly originate in Colorado and flow out in every direction from that state, the people in Colorado were giving a lot of trouble to the government about the withdrawal of almost all public land in the mountains of their

state. They couldn't enter and irrigate new public land; in fact, they couldn't do anything additional on any stream that originated in Colorado. For irrigation purposes further down, the Reclamation Bureau built the Elephant-Butte Reservoir on the Rio Grande River and caused the Land Office to withdraw all public land along the course upstream from the reservoir. The Rio Grande rises in Southern Colorado.

The Bureau also built a project on the North Platte in Nebraska with similar withdrawal of all public land on that watershed upstream from that project. The North Platte originates in Northern Colorado. The Bureau had examined many reservoir sites on the Colorado River Basin and had withdrawn, I believe, much of the land on that watershed which lies largely in western Colorado. The Bureau intended to build some of these reservoirs. Trouble with the Colorado interests resulted from these withdrawals. I had discussed these matters with Weymouth and we agreed that the situation should be examined carefully. We were going to have a real investigation on each of these rivers. Weymouth saw the opportunity. I suppose he was getting pretty close to this trouble because he was now in Denver where the local boys knew something about water.

Well, he transferred me back to Denver and I spent my time investigating these rivers and making plans for the complete development of each. Fortunately people of Colorado had been irrigating land in the South Platte River Valley for many years and the State Engineer knew the total amount of water that discharged into the stream from the mountains into the irrigated area. The streams were all measured and they knew the total amount of water that was getting past their lowest irrigation diversion from the South Platte. It came out that one acre foot was being consumed per year for each acre in that whole area irrigated from the South Platte. That was a pretty good guide. If you knew the precipitation and the approximate temperature there it was a pretty good guide then for determining how much water would be consumed by any land that was irrigated in other similar areas if you'd make the proper adjustments for differences in temperature and in rainfall.

So I was sent down on the North Platte River, which joins the South Platte to form the Platte, which flows through Nebraska from west to east. That was one of the great routes for the folks coming out to California in the Gold Rush days. They came up the Platte River. Nebraska rises at

the rate of seven feet to the mile from east to west and the Platte flows on and on and on for perhaps four or five hundred miles. They irrigated from the Platte River in the western part of the state in the earlier days; then their water was taken away from them by developments in Colorado and Wyoming so their irrigated area disappeared. This was causing a lot of political trouble. The Nebraska people were demanding that the water be let down the streams from the reservoir in Wyoming. The first stream I investigated was the North Platte River. With me was a representative from the State of Nebraska. It was a joint investigation. I confined my time to the upper end of the river; he made a very detailed investigation of the diversions from the North Platte in the western part of Nebraska. There were about a million acre feet of water per year going down the river, mostly in the winter time, through the Nebraska area which might be irrigated. The Nebraskans never saw that million acre feet. They wanted to get some of the water from the reservoir which had been built by the Bureau four or five hundred miles above where the land had formerly been irrigated.

The report on that investigation ended with the recommendation that all of the withdrawn land

in Colorado be restored to entry because there wasn't any possibility that they could irrigate anything there except wild hay, and that only makes one small crop a year, but that would be the salvation of that valley. It is called North Park. It is in Colorado. It is about 7,500 feet above sea level on the valley floor, and you can't do anything but raise wild hay for cattle.

It was recommended that the Bureau build another reservoir in Wyoming and a reservoir on the river in Nebraska in the reach below the project the Bureau had built. Well, after the Board of Consultants reviewed it, the recommendation was thrown out because they said that the sand brought down the North Platte River would fill the reservoir. Instead of that, the Board recommended an offstream reservoir near to and on the land side of the city of North Platte. The site is at a higher elevation than the city. This reservoir was constructed, together with a long feeder canal from the river. I didn't know anything about that until afterwards. What happened was the City of North Platte was partially swamped by the percolation from the reservoir.

Simms: What did it do?

Conkling: The water just percolated into the alluvium at a

higher elevation. It traveled along the aquifers to lower elevations. Even with the example of an inland reservoir in Idaho, the Board didn't expect what happened.

Incidentally, I might say that later on when I was with the State of California I did consulting work with other governmental agencies and I was called in, finally, on an interstate suit over the North Platte River water. This is going way forward but I will tell you what happened now. Nebraska had brought suit against Wyoming and Colorado over apportionment of the water, and the Federal Government was implicated through the Reclamation Bureau. As stated, I was then working for the State of California but the Federal Government asked that I be released to testify in the suit. What I actually found was that this was the case. There was enough return flow then coming from the irrigation of the North Platte project so that the Bureau now didn't have to let any flow through its reservoir in Wyoming more than sufficient to reach the diversion next below the upstream diversion. The big reservoir which I had recommended further down the river was being built in spite of the fact that it had been previously turned down because the sand was going to fill it.

Next I was sent out to analyze the Elephant-

Butte Reservoir and the Rio Grande River. The reservoir was built to water the land just below the state line of New Mexico and Texas where the Rio Grande crosses the line. The dam was just about at that point and it formed a long narrow reservoir.

Up in the San Luis Valley, where most of the water of the Rio Grande originates, the Bureau had refused to build a reservoir and its engineers had proposed that a large area of seeped land on the valley floor be drained to let the water down the river to add to the supply of the Elephant-Butte Reservoir.

Well, I ended up disagreeing with everybody who had recommended anything in that watershed. The facts were so convincing that there was no question about accepting my report; furthermore, if any reservoirs were constructed on the Rio Grande tributaries which were also tributaries to San Luis Valley, the water would be used only in that valley. That's another very high area.

Simms: That's up in Colorado.

Conkling: Yes, that's up in Colorado. It's about 7,000 feet above sea level at the lowest point. What occurred in San Luis Valley was they used to irrigate the west side of the valley out of the Rio Grande River where it comes out of the mountains. They did a lot

of irrigating from the Rio Grande without any reservoir and the water gradually seeped into the lower lands--it increased the area of seeped land. The Reclamation Bureau was going to drain that water and use it down stream. Of course, the drain would mess up the whole thing inasmuch as the farmers of the valley would have started to irrigate that formerly seeped land. Anyway, the water would stay up there. The government finally built a reservoir on the Rio Grande just above its discharge into the San Luis Valley I believe.

I recommended that instead of draining San Luis Valley to get water for the Elephant-Butte that they drain the Middle Rio Grande Valley through which the river flows in New Mexico and get water for the Elephant-Butte that way. It is a broad, very flat low valley averaging maybe five miles wide from just north of Albuquerque clear on down to the upper end of the Elephant-Butte Reservoir.

Then I also investigated a possible reservoir site down below the Colorado-New Mexico state line on a tributary of the Rio Grande from the west. It turned out to be a very good site and the reservoir was full. The changes in plan were accepted. These plans were not for doing something with the San Luis Valley for the sake of the lower river but for the San Luis Valley itself.

During the depression of the 1930's there must have been some powerful senator from New Mexico because the Reclamation Bureau was directed to go in there and drain the Middle Rio Grande Valley thus giving New Mexico a large area of irrigable land and giving the Elephant-Butte part of the water saved. The engineers didn't pay any attention to the fact that the river was flowing at a few feet higher elevation than the land on each side of it. The drains were dug parallel to the river and sometimes quite close to it, and those drains carried a lot of water. Actually it was water that was largely coming out of the river.

Well, Texas filed suit against New Mexico. New Mexico claimed that the water in the drains was all new water salvaged from the death of the swamp vegetation. They didn't get very far with that. The Federal Government requested that I come over and represent New Mexico in the suit. Well, the first thing I told the New Mexico people was, "I'm not going to say that that water in the drains is the water that is seeping the land and evaporating from it. The water comes from the river." They wanted to throw me clear out but the government wouldn't let them. Actually, it should have been drained a different way. If they had gone quite a

way from the river on one side and drained they would have drained only part of the land but they wanted to drain the whole thing. I certainly was in disfavor, and still am, with the State of New Mexico. The law suit, incidentally, ended in a compromise.

Next I went on to the river that drains almost all of Nevada. I forget the name just now, but I'll think of it. Oh, yes, the Humboldt. Well, they were having a lot of trouble on the Humboldt. I don't know why they were having trouble, but I investigated and made a plan for the development of the Humboldt, and I understand that a key reservoir has been built. It probably doesn't have any water in it at present because, and I might say right now that like every other engineer, I estimated the safe yields of water too large for a desert region, and that is a desert region. They have long droughts. It may be that our averages are good, but if you have a drought forty years long it doesn't make any difference whether the averages are good or not. You can't build a reservoir that large; the water will evaporate.

After that I was sent to California to investigate the plan to bring the Mono Basin water into Owens Valley, then to determine if a power plant could be built and whether some of the land in Owens

Valley, from which the water had been diverted by the City of Los Angeles, could again be irrigated. As a Reclamation Bureau project, Los Angeles was trying to get out of a terrible fight with the Owens Valley people. They had brought most of the valley land. I laid out the plan that was later built, that is to bring the Mono water through the mountains and I also looked into the irrigation of the Owens Valley and decided that some of it could use the water. That was all there was to it. But the Los Angeles people didn't care whether the land was reirrigated or not. Los Angeles was interested in getting, through the Reclamation Bureau, water out of Mono Basin into Owens Valley. Later, as you know, they found that they needed the water here in Los Angeles, and it was about this time that the development of the Colorado River came up.

The Reclamation Bureau had made a tremendous investigation of the upper Colorado River and found a number of reservoir sites on the tributaries, but no place else. Los Angeles was looking toward the future and felt they needed some of that water. What brought the matter to a head was that the Imperial Valley wasn't getting enough water from the Colorado in the late summer. There was more area being irrigated from all of the tributaries in the upper Colorado Basin so the water was not sufficient

in the late summer for Imperial Valley. An investigation was started by congressional authority to determine some way of assuring water to Imperial Valley. A committee was formed consisting of water engineers from each of the seven states of the Colorado River Basin, together with Mr. Weymouth, Chief Engineer of the Reclamation Bureau. As Mr. Weymouth was busy on other things, the job of representing him on the committee was turned over to me. It became immediately apparent, of course, that the way to control the Colorado River was to build a reservoir down in the great Colorado River Canyon and not a way up in the tributaries. You see, it had been my job to investigate the whole Colorado River Basin. I worked very closely with the committee members and insisted that each one of them approve or disapprove what I said in each tentative conclusion that affected a particular member's state. This consisted of estimates of the land in each state which could be developed and the water required for it, and the reservoir available, as well as some comparatively minor exportations from the basin in Colorado. They finally all approved of my plan, and I recommended that the reservoir be built down at Boulder Canyon, which is about 25 miles upstream from where it was built. A detailed

investigation showed the lower site was better, but the name was not changed, and it is still referred to as Boulder Dam. The name had become a byword by that time.

My report was included in the Fall-Davis Report which was made to Congress and was one of the principal appendages. It deals with the entire water supply, how much land could be irrigated in each state, and the water consumed by each project, reservoir, and swampy area. As I told you, it was approved by each of the engineers of the committee and everything was all right. I remember when Mr. Davis, Mr. Weymouth, and I floated down the Colorado River for several days above the Boulder Dam site to Yuma. We looked over everything. We slept out on the sand bars, and I can recall our fear that the water would rise suddenly. It took about four days to make the trip, and on one of those days Mr. Davis asked me to design a dam for the site on which everyone had agreed. He had a cross section of the site and I was to design the dam while floating down the river in a boat without a technical book! Of course, I didn't have anything to figure on, but that didn't make any difference, I went ahead and designed an arch dam over 700 feet high. It's interesting that the dam that was built later is

the same height. That's one thing that was right about my report, but that's the only thing I was right about because politics now came into the picture.

Well, about a year after I had left the Reclamation Bureau and came out here and was working for the State of California, I got a telegram from Denver asking, "What did you use for Poissons ratio in the Boulder Dam you designed?" Poissons ratio is the elastic coefficient of each material, and as I told you I didn't have a technical book or tables when I designed that arch dam while floating down the river.

I can recall that in my report I had left out the Gila River because it had no effect on the Imperial Valley but in order to satisfy the representative of Arizona, a Mr. Norvell, I don't believe he was an engineer, but he was in charge of the water for that state, I did put some material in the report about the Gila River just to satisfy him. It had nothing to do with the essence of the report because the Gila River can be diverted only in Arizona or in Mexico. It can't be diverted by California and we were working on something--an analysis that would give a better water supply to the Imperial Valley in California. Well, anyway,

the first reaction to the report was that nobody could build a dam that high, and I swear that was the reaction for about five years, or so it seems to me.

Frank Crowe was in charge of it. He was a very close friend of mine. I went over there once in awhile to see it. I was interested in it because I had imagined it. However, the politicians got into the situation, and in some way they influenced Hoover, who had been appointed to hear testimony as to the formation of a Colorado River Board or Commission to control the allocation of water to each state, and Hoover is the man who finally made the decision. That was before he was elected President. He held hearings, it seems to me for a couple of years, and it finally ended with the Colorado River Compact which was all right as far as it went, but it took in the Gila River which could be diverted only by Arizona and not by anyone else in the United States. Arizona wouldn't sign the Compact just for that reason. The Supreme Court in the last case, Arizona v. California, decided that the Gila water belonged to Arizona and wasn't a part of the compact.

I had investigated only the Colorado River area, I mean the watershed area potentially available to Imperial Valley. The diversions, or what looked

like potential diversions from that watershed were practically all in Colorado.

At the time of the investigation the Reclamation Bureau wasn't building as expensive projects as it has been building since.

Inasmuch as the upper states included in the Colorado River Basin didn't have potential irrigation projects in the watersheds which would use much water, they each asked that projects outside the Basin which could be reached by tunneling through the mountain ranges be considered as a claim on the water.

Los Angeles wanted to bring this water over here for use because even at that time they figured they needed more water than they could get from Owens Valley and Mono Basin. In other words, about seven and a half million acre feet were allocated to meet the potential demand of the lower states on the Colorado River Basin, and then Mexico was given about twice as much water from the river as it had ever used.

The records since 1920 indicate that the safe yield estimated by me was about two million acre feet too high. I don't know that it doesn't represent the long-time average, but I do know that my estimate was wrong for practical purposes. We had absolutely no record of the runoff of the main river.

The Colorado River in Colorado was then called the Gared, a tributary. There was a short record of the runoff on that, but it had been sort of manufactured at Yuma based largely on depth of water measurements and that sort of thing. Actually, I looked up every rainfall record in any part of Colorado, New Mexico, Wyoming--in fact, any place where water of the Colorado originated to find out if that period in which we had this so-called record at Yuma was on an average period, and it turned out that it was just about an average period. I think, however, that the estimated flows were probably too high.

Simms: It's not surprising that they were knowing what we know now about drainage patterns, rainfall, drought years, cycles, and things like that.

Conkling: Well, they had a few records up in Colorado on the Colorado River watershed at that time but they did not cover a long enough period. In the desert regions you have to have a much longer record to find out whether it is safe to use what you might call an "average." You might get an average for a thousand years and then look over the detail of it, and if it is a desert region you would find that some of the droughts have been far longer than our actual records show according to tree rings. Tree rings investigations have been made in the San

Bernardino mountains by the University of Arizona whose scientists are expert in this matter and they found that there was one drought which was forty-three years long. With that knowledge the long-time average becomes less important unless capacity in underground reservoirs is available to store the water.

Up in Owens Valley there is nice reservoir site near the north-south center of the valley on the river--that's where the canal diverts to Los Angeles. When you figure it out, you find the evaporation from a reservoir of sufficient size to hold the surplus water would completely dissipate all the water that the reservoir held back.

Well, to go on. When I made that Colorado River report, and by golly that was a hard one to make, I worked on that nights and day after day after day, every day for a year, and I had quite a crew working for me. There was so much to do. I don't know whether I should say this or not, but when A. P. Davis, who wrote the Fall-Davis Report, saw the report he looked at it and said, "I wouldn't sign this blankety blank thing. I know that that's not true (pointing to certain tables)." He was taking the values for consumptive use of water used for irrigation for the values of diversion. This

was the first time during these three or four investigations I have talked about previously where the values of consumptive use of water were taken as the amounts of diversion from the stream. When you are talking about a river development you must use consumptive use.

Well, I decided to quit the Reclamation Bureau and go to California. The Bureau gave me a job in Reno so they could pay my fare out that far. I did the job at Reno and then resigned and came over to San Francisco to see where there was a job. I needed one right away. I was as poor as could be because traveling around as I had done during the past two years when my headquarters were in Denver I couldn't possibly live on the expenses allowed.

Simms: Was you wife still moving around with you all this time?

Conkling: Oh, no. We did live in Denver, but she went back to my parents until I was sure that I was going to be located in California. I came across the mountains from Reno to San Francisco. I went up to the State Division of Water Rights, then located in San Francisco; Charles Lee was in charge. I didn't know him, but had heard about him. After I asked for a job he wanted to know to whom I could refer him and I told him W. B. Matthews, a lawyer

connected with the Los Angeles County Department of Water and Power. Lee called Matthews on the 'phone, then turned to me and said, "You're hired." I really wasn't looking for a job with a governmental agency, but there it was. It paid a salary, and I worked for the State for twenty-four years. I began in 1920 and left in '45, yes, it was about twenty-four years. In one way it was a blessing because if one didn't have a job like that in the depression of the 1930's one just about starved, and, furthermore, during the Second World War there was nothing in the way of engineering work either.

I had come to California and the engineers here had never had the same experience that I had had. The streams here, except the Sacramento River and streams in the extreme northern part of the state, are all very short. They discharge out of the mountains on the east to the valley floor, and their flows are diverted and used right there and they don't intermix until they get far away. The water troubles had been very localized.

Simms: It's almost a troughless drainage pattern along the Sierras. All the rivers like the Stanislaus and the Mokelumne Rivers, and others like that, more or less parallel each other.

Conkling: Yes, they're parallel. They come down into the

valley. If they are not used right there near the mountains they go into the Sacramento River which follows the trough of the valley at almost right angles to the tributaries and go to the delta and then into the bay. It produced an entirely different kind of complication than I had become accustomed to in my work with the Reclamation Bureau, and I didn't find anything about the problems in print. With all the knowledge of the general principles that I had gained in my investigations, and with the fact that nobody seemed to know the values which must be used, I thought I had better write a book. Every water engineer in California would have to begin to use such values and methods soon. I wrote to Wiley and Son, publishers of technical books in New York. I had said the book would be about 150 pages. I got an answer back. They said, yes, they published a technical book like the one I proposed once in awhile but at a loss, but they still published them because they wanted to preserve their record as technical publishers. What they really wanted was a book about six hundred pages long to sell for about six dollars.

Our office was moved to Sacramento. As I told you Charles Lee was in charge of it, and he didn't want to move to Sacramento so he was replaced. The

Division became a Bureau of the State Department of Public Works. It had been under a Commission prior to the move.

I talked about my idea for a book to Don Baker, now dead, who was one of the engineers of the office. I told him what I had planned and of the fact that I couldn't get a small book published and I thought that something like it ought to be published to give to all engineers so that they would have a much better background than they had in water supply studies for irrigation purposes in particular. The fact was that the engineers of California didn't have much data or much of an idea as to how to go about such studies because, up to that time, 1920, there had been little reason to know the facts required to plan irrigation developments. In this state it was customary as the need for water increased to install a reservoir on a particular stream up in the mountains to store the snow-melt or flood waters. Any legal difficulties, except along the Sacramento River, were minor.

Simms: That's what they're still doing it seems. . .

Conkling: Well, I started to work for the State in 1920 and that was the year Lee quit. I forget the name of the man who took his place, but it was sometime after Lee left that he was appointed. I applied

for the job and I probably was lucky that I didn't get it as I was practically unknown in California.

In 1923 the City of Pasadena made an application to appropriate the water of the San Gabriel River to provide for a potential shortage of water. They realized they would have to have a big investigation before the Division of Water Rights would give such a permit for diversion. It happened that Franklin Thomas, who was then the head of the Department of Civil Engineering at Cal. Tech., was also interested in city administration. He was on the city council. It also happened that on his sabbatical leave in 1919, I believe, he asked if he could get a job in the Reclamation Bureau at Denver. That was when I was in Denver. He did get the job and worked under me for some time on an analysis of the Rio Grande River. That was a revelation to him as he had never done anything like working out the development of a stream system. He was delighted with it, and he thought I was a pretty smart guy. I had worked out the forms on which these long analyses were made and all anyone had to do was put the data in the proper slot and the answer appeared miraculously and finally. When Pasadena wanted to have an investigation of San Gabriel by the State, representatives of Pasadena, including Franklin, asked that

I be appointed to take charge of it, and the request, of course, was granted.

I moved to Los Angeles and spent the next four or five years investigating the San Gabriel to determine how much of its flow percolated into the underground basis, into the ocean, and how much could be appropriated.

Simms: You had your job cut out for you there.

Conkling: Oh boy! Well, sir, we had two floods during that four-year period. I laid out a system of measurements of the flows which were probably the most intensive that had ever been done on a stream of such a large flow. The results fell right on the curve and gave a basis for estimates of percolation. When there was a small flood not much percolated, but when the big floods came along we had a real job.

While I was on that investigation, I became interested in underground water. I realized there had to be a tremendous amount of information available, which then didn't exist, before we could really know how to control the streams of California south of San Francisco particularly such streams as the San Gabriel, or the San Fernando, in fact any of the streams up and down the coast. To an extent, that would also be true of the streams of the San Joaquin Valley. It finally came to me what kind of

information must be gathered. I finally made the report on the San Gabriel, and I was quite satisfied with the report because the measurements turned out so well and showed at what flow the water would percolate and how much would percolate with every flow. I don't know of any place or any time when measurements had ever been made like those. A man with a meter, in a car suspended on a cable across the stream stations up and down the river, with other men measuring the elevations of the water surface five hundred feet upstream, five hundred feet downstream, and the men at the station checking the elevation of the water at intervals of every two hours, or four, or whatever seemed necessary. They would work all night long. They all got so interested in it they couldn't quit and go home.

The floods are of very short duration and very violent on the San Gabriel River.

Well, just about the time I finished that, Paul Bailey, who had been State Engineer, was retained by the Orange County Flood Control District as their Chief Engineer and Manager. They were going to build a lot of dams on the Santa Ana River and its tributaries. Ed Hyatt who had been in charge of the Division of Water Rights for some time was moved over to the State Engineer's Office.

That left his job vacant, and very shortly after they put me in that job. I had moved down south from Sacramento, and I told the State people at the time that when I finished the San Gabriel job I was going to start a consulting office. When they offered me the job as Chief of the Division of Water Rights it seemed to me to be a good thing to occupy it for a couple of years and get a wider acquaintance with the State. So I accepted it and told them I would take it for only two years. In 1927 my family and I moved back to Sacramento.

In 1929, and probably you know about it, the depression started. That was the start of the awfulest depression there has ever been. If I had been trying to get established as a consulting engineer I would have been on the bread line for the next ten years. It was just terrible. Engineers I had known from the time of my railroad experience when I was at the University of Nebraska would come to me for work and I would always send them over to the Forest Service who had told me they would hire anybody that I would send to them.

Just before I went back to Sacramento I saw the chance I had been waiting for. I had written a report which was printed locally and read by everybody interested in water in Southern California.

It was on what should be investigated as to the ground water basins so we would have a logical basis for using the basins as reservoirs and putting water into them. In other words, I mean, think of them as reservoirs into which you were going to pour water and take water out just as you would when you have a surface reservoir. With that conception you would have to find out how much water should be put in and the capacity between levels and so on and so forth. So, late in 1927, I made arrangements with one of the federal agencies versed in such matters to start making investigations of the consumptive use of the different types of vegetation--not only of the native vegetation but of all commercial vegetation. There's a consumptive use not only of the water used in irrigation but of the precipitation on the valley floors. I realized that a lot of the precipitation went into the ground past the root zone and it was an item in the recharge of the ground water. Well, I had some power then to make such arrangements for an investigation such as I desired and we had money to pay on it. The fact that the people of the area were interested in water was influential with the Legislature in making appropriations for the work.

During the time I was on the San Gabriel project,

I had hired a couple of excellent geologists to make a report on the San Gabriel Valley. Their report dealt with the mountains. They did mention the alluvium but it didn't really interest them. As I mentioned, that was in the very serious depression of the 1930's and many talented technical men were out of jobs. One, Rollin Eckis, I knew slightly from some work he had done on ground water. He went on our staff and recruited a group of other young geologists who had some background of alluvial geology. Eckis is now President of Richfield Oil Company and all of the others hold high positions.

After several years, in 1934, a very good report for its time on the alluvial geology of the San Fernando, Santa Ana, and San Gabriel Valleys, and the coastal plain (although that portion on the coastal plain was not so good, the alluvial geology is much more complex there) was issued. We were seeking the capacity to store water in the alluvium and, with the detailed studies of consumptive use by vegetation on the valley floor, we finally had a basis that was useable. With all of these techniques one could make an equation which could supply the information to determine the capacity of the ground water reservoirs. These are now being used more and more systematically and it has been

very useful.

Don Baker, and I think I mentioned him previously, was now a consulting engineer in Los Angeles. He asked me if we both couldn't write the book I had planned to do. I wasn't much interested in being a co-author, and I didn't see where I could find time to write a book even if I could get a publisher. Anyway, Don got in touch with Wiley and Son who told him they would be interested in a 600 page book on water supply. I finally agreed to write the book with Don. That was just about the time I got through here in Los Angeles and when I was appointed Chief of the Division of Water Rights in Sacramento. I still had to write the report on the San Gabriel investigation and, at the same time, supervise the water rights business of the State. I had so many things to do it seems as if I couldn't do much on the book, but Don and I laid out a synopsis and it ended that he finally wrote most of the book. It was published in 1930. It was never a success because it came out during the depression for one thing and at a time when few people were interested in that particular subject. Water supply was not of such great interest as it is now, and when the Second World War came publishers were required to melt the type of any publication which had not sold

well. The type of our book was melted. So I guess it didn't amount to very much of a book.

Simms: Just before its time, that's all.

Conkling: Yes, it did come before its proper time.

While I was still with the State, beginning about 1935 or 1936, my services as a consultant or expert witness began to be called for by other governmental bodies and, as a courtesy to them, I was released from California for what averaged about three months a year. One call was from Peru. After my report to that government, which was printed in Spanish and widely circulated, other South American countries tried to get me as a consultant but I felt I couldn't accept their offers. If I was going to stick to my job I thought I should spend at least nine months of the year on it.

Other matters for which I was released by the State of California were on law suits between some of the states before the Supreme Court of the United States. One of these suits was on the Rio Grande, and another was on the North Platte. I was spending quite a lot of time on this outside work and I finally had to quit doing it. The war came on about that time and that effectively stopped the demand for my services and for the services of consultants in general. Luckily I had a job but I decided to

leave State service just as soon as things got back to normal. I resigned in 1945. The war was still going on but the end was in sight.

Immediately after my resignation I was retained by several organizations as a consultant. Their retainers were paid on a monthly basis and were largely to insure that I would be available when the need arose. I moved back to Los Angeles and other jobs soon became available on a consulting basis. In a short time I began to be offered consulting jobs in foreign countries, but I had decided against building up an organization. I had to decide whether I was going to do foreign work, and I thought by golly I'd like to, but if I have to choose I'd rather work in California than I would to be taking trips to some foreign country. I had agreed to go over to Formosa for the government of that island but I begged off and confined my work to California. There was all kinds of work--and very pleasant work in very pleasant areas--and there was a very pleasant relation with my clients. I became sort of a semi-geologist, a semi-ecologist, a semi-meterologist due to my studies of this ground water business.

Simms: It's easy to do that. You get tied up in a number of different disciplines when you start thinking

about some of these things.

Conkling: Well, you have to become a geologist, not in the sense that you make a formal report on the earth masses and rock masses but because so few geologists had, at the time I became specialized in this work, done anything with the alluvium and you had to do the studies on that yourself. Now you can do a better job because there is a much broader background. In those days you couldn't always get the information.

Simms: Well, ground water is coming into its first geological concern. It's only been on its own for the last, oh, twenty years.

Conkling: I seem to be the first one that ever seemed to approach the job with the idea of solving a specific problem. The U. S. Geological Survey was making reports on ground water basins but they were generalized, and they weren't the same kind of an investigation and reports that I would be making. I was making it for an entity that I wanted to use it to get more water or to keep what it had. But, I wouldn't have been able to do nearly as much as I did do if I hadn't been sort of absorbed with the geology of the ground water basins. At the time I was in Los Angeles in the 1920's I couldn't find anybody that would write a meaningful report on the

alluvium. As I told you before, those two well informed men had worked with the U. S. Geological Survey and made the report on the San Gabriel Valley, but it was all about the rocks and it was very generalized as to the alluvium.

I continued as a consultant until March 1962 when I retired. I had been retained by the Los Angeles Department of Water and Power since I left State service. One principal job was preparing to adjudicate the right to the water of San Fernando Valley. The suit was filed in 1953. It was referred by the court to the State Water Rights Board to make a complete report on the physical facts. This report was completed early in 1962. During the previous five years I had gradually been resigning from the services of the various agencies which were my clients so that the Los Angeles Department of Water and Power was the only one left in early 1962. When the report was made by the State on the San Fernando Valley I thought it an appropriate time to retire from the Los Angeles department's services and thus from active practice. The suit still goes on and probably will for several years.

My wife died in 1964 after a long illness. Since my retirement I have not been in touch with

the advancement of engineering in general, but I am sensible to the wide interest which is being exhibited in water in all areas. The limitations of the supply are becoming apparent. It will call for a great change in water laws of the states and the United States--possibly a virtual elimination of state lines. The necessity for safety is now apparent even in our limited regions.

Well, I guess I have told you almost everything. It has been work I've enjoyed, and I hope you haven't been bored.

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