Interview with Andy Dolyniuk

Intro: Let's start out for future generations listening to this tape though that today is Tuesday, August the 3rd of 2004 and I'm Pam Stevenson (Q). I'll be doing the interview and Manny Garcia is shooting it and we're here at the SRP studio at 27th Street and Washington in Phoenix. And I'd like to let you identify yourself and give us your name.

Andy Dolyniuk (A): My name is Andrew Dolyniuk, most people still call me Andy which I enjoy being called Andy in those terms. I'm a native of North Dakota and graduated from North Dakota State University a long time ago, 1950 to be exact, and I ended up in Arizona which I'm glad to be here at this time particularly today.

Q. Even though it's August.

A. Even though it's August.

Q. When were you born?

A. I was born August 17, 1927, which means pretty soon I'll be having my 77th birthday.

Q. Well congratulations. What sort of a family . . . you say you're from North Dakota?

A. That is correct.

Q. Where you a farm family? What did your family do?

A. Actually my parents migrated from the Ukraine long time ago and they homesteaded in North Dakota and I was the youngest of eleven children. Actually we were in a little, on a farm outside of a little town by the name of Belfield, North Dakota, which is the western part of North Dakota. Also, of course that's where I attended my high schools and my schools. I was privileged to help or join the service prior to the end of World War II and from then I went on to the University of North Dakota or North Dakota State University.

Q. Growing up as the youngest of eleven children out on a farm, did you do a lot of farm chores or were you kind of the baby that got spoiled?

A. A little bit of both. We certainly had our share of work to do. And with this, its all a good memory. I'll leave it go at that.

Q. What about school? What kind of school did you go to?

A. Actually went to a public school in the town of Belfield, North Dakota. It was a relatively a small school. To give you an idea, my graduating class in high school had 30 people in it. So that gives you an idea. The town itself at that time was about a thousand people which is about the same as it is today.

Q. Where you a good student?

A. Fairly good I think.

Q. What sort of thoughts did you have, what did you want to be when you grew up?

A. Actually I really didn't know what I wanted to be going through high school. Then spending some time in the Navy right after high school is when I really got that first exposure to the outside world sort to speak. We discussed the various professions and various things that some of the people would be thinking about going to or entering what field. So probably at that time I thought that engineering sounded pretty good so after I was discharged from the Navy, we took some placement exams and it turned out that engineering was probably one of the fields that I was suited for.

Q. Let's talk a little bit about how you came to be in the service. When did you enlist or were you drafted?

A. No actually not. During the war of course as soon as I turned 17, I wanted to join the Navy and my father and his wisdom wouldn't sign right away. I had to get his permission. He did let me join and he signed for me just prior to my graduating from high school.

Q. What year was that?

A. That was in actually 1945 so I entered the service in May of 1945.

Q. Where did you go for training?

A. San Diego which was a good time of the year to go to San Diego.

Q. So that was one of your first times you left?

A. Basically that was my first exposure to the outside world, that's true.

Q. What did you think of it?

A. Well, I guess I shouldn't say it was frightening but it was eye opening. I was exposed to the different races of people. I was exposed to different industries that I had an opportunity to see where as of course my home town was basically all agricultural or cattle or farming/ranching.

Q. What did you do in the Navy?

A. Well after boot camp, the war ended while I was in the Navy for a little while. And after boot camp, they sent me to Yeomen school. Yeoman school being people that took care of personnel records and the reason I got to go to Yeoman school was because in high school I had taken typing and they noticed that in my records. But that didn't last very long and I ended up on a destroyer after that for awhile. Basically the effort was decommissioning, decommissioning the destroyers after the war.

Q. How long were you in the Navy?

A. Just a little bit over a year, it was a good one year education. When I enlisted it was for duration of six months that's the way it was - during for some of us you enlisted for, repeating myself, the duration of the war plus six months.

Q. So you were kind of lucky then.

A. Very lucky, very lucky because that was what really brought me to go on to the university and provided for my schooling, most of it anyway, not quite all of it but most of it.

Q. So where did you say you went back to school then?

A. In North Dakota State University which is in Fargo, North Dakota.

Q. And how did you decide what you wanted to study?

A. Well again based on some of the discussions with the other ones I had pretty much decided that I wanted to take up engineering, and civil engineering sounded like the right choice.

Q. How long where you in college then?

A. Four years, four years to get my standard or my bachelor's degree.

Q. Did you have an idea of what you wanted to do after you got out of college?

A. Right after college, actually as it turned out, opportunities in employment were rather scarce so there was quite an influx of people and it seems as if we were sort of in a status quo situation industry wise. Fortunately, I did have an opportunity to go with the either the State Highway Department or the Bureau of Reclamation and I decided to go with the Bureau of Reclamation which started my career with the Bureau.

Q. And why did you choose that?

A. Basically, the reason I choose that was within a few miles of my home town they were constructing a dam on Heart River and I did work on that dam prior to graduating I actually worked on a dam in between my junior and senior years. So it was sort of natural to go with them.

Q. Where did you go to work for the Bureau, your first job with them?

A. Actually here again I started in North Dakota at Bismarck, North Dakota. My first part of my career was in the electrical world constructing transmission lines, sub-stations, and facilities related to electrical transmission.

Q. What did you actually do? What was your job?

A. Well to start with, we started out like most of us do a lot of us surveyors on survey crews. We had quite a network of transmission lines and I was assigned a survey crew and they spent the first three or four months surveying. And after that when we started going into construction, I became a field representative on construction and this is what kicked off my construction activities.

Q. And that was construction of transmission . . . .

A. Transmission lines and transmission facilities.

Q. Some how I don't think of that as being the Bureau of Reclamation doing transmission lines.

A. Well, actually up until the time that there was a change in the Department of Energy took over some of the activities. The Bureau of Reclamation was very, very much involved in transmission lines. A good portion of their overall budget was involved in electrical work.

Q. Did you know that when you joined them?

A. That I did, yes.

Q. So tell us a little bit about your career with the Bureau of Reclamation. What did you do from there? How did you end up in Arizona?

A. Very interesting. The work in North Dakota sort of came to a conclusion other words the facilities were pretty well constructed. And I thought it was about time to switch activities so really from there, just for a real brief short time, I was transferred to a dam and irrigation facilities in Montana which is called Fort Clark Project I believe. But that was just very brief because they were in the process of constructing transmission network in Arizona as related to power coming out of Glen Canyon Dam. And I was sort of directed, I wasn't given much of a choice, you're going to Phoenix, Arizona. So I did. So I came to Phoenix, Arizona and all these transmission lines that came from Glen Canyon and in this particular area of were constructed out of the Parker Davis Project which I was the construction engineer for these facilities.

Q. So were you actually based in Phoenix or Parker?

A. Actually we were based in Phoenix, so the Parker Davis Headquarters was on 43rd Avenue just north of Buckeye.

Q. What was your first impression when they said you were coming to Arizona?

A. I was excited naturally. I thought that this was going to be another phase of my life and the interesting part was I was told it was probably a short term job, probably for a couple three years and then I probably would move on. Well that was not at all true because I'm still here. So anyway, we constructed I don't

know how many miles probably several thousand miles of transmission lines in Phoenix, Arizona and surrounding states, partly in Nevada and so forth.

Q. What year was it that you came here?

A. I came in ’62, came to Arizona in ’62.

Q. Did you have a family at that point?

A. Sure did. Actually we had three of our four children here with us.

Q. What did they think about moving to the desert?

A. They were probably too young to really know what was going on at that particular time. The oldest was a first grader.

Q. What did you think of Phoenix? What was Phoenix like at that time?

A. Prior to being transferred down here, I was assigned some work out of Salt Lake City so I had an opportunity to come to Phoenix which was during the summer. And I knew it was warm or going to be warm or hot, if you want to use the right word. So I was pretty well aware of the fact that we were in for a different climate, a different type of life.

Q. No snow.

A. No snow for sure. I’ve seen plenty of that in my day.

Q. How big was Phoenix?

A. Phoenix itself I believe was right around six hundred thousand people and in the surrounding cities were about a hundred thousand at the maximum. There were about a million people in the valley at that time.

Q. Did look different than it does today?

A. Very much so and actually I don’t live to far off and of course Glendale Avenue at that time was nothing but a gravel road and Bell Road didn’t even exist to give you an idea what it was like at that time. The cotton fields were surrounding our

particular place. Its changed tremendously; I can't even begin to explain how much of a change it was.

Q. So it was more of a farming community then?

A. No, the industries were starting to show up. I mean we had Alcoa has a big aluminum plant here which was an accumulation of after the war. The industry was starting to show up at that time. Farming yes, as always in the perimeter of the city, farming was the main stay of Arizona really.

Q. When you went from Phoenix to Glendale, you went through farm lands right?

A. Pretty much, going down 43rd Avenue there were a lot of vacant areas. Vacant areas along 43rd Avenue and my gosh now you have to go give west before you even think about finding any vacant areas.

Q. You thought you'd only be here for a couple of years, what changed that?

A. Oh actually, transmission activities are the power grids sort to speaking, kept growing and it seemed as if there wasn't any end to it. Just about the time that we were pretty much through with the power system then the Regional Director in Boulder City instructed me to move over to the Central Arizona Project.

Q. When was that?

A. 1970.

Q. What was the stage that the Central Arizona Project at, at that time?

A. That was shortly after the Supreme Court passed their decree that Arizona was entitled to so much water sort to speak. And it kind of looked as if maybe some funding, construction funding, would start so the Regional Director said it's time to start proceeding with the design data and finish all your final locations and we got to get it moving. So he pretty much asked me to help in that particular area.

Q. Who was that?

A. Ed Lumberg, Ed Lumberg was the Regional Director for a few years during that period.

Q. What did you know about the Central Arizona Project at that time?

A. Well we sort of rubbed elbows with the office, our office was on 43rd Avenue, and of course the Central Arizona Project office was downtown Phoenix. We had activities that sort of coincided so I was very much familiar with the project. Everybody was anticipating that sooner or later this was going to break.

Q. What did you think of it? It's pretty ambitious to build a canal that far.

A. I probably wasn't smart enough to know what I was getting into really at that particular time. But it turned out very well. As soon as, we had some very capable people on the Central Arizona Project office so we preceded concluding all the particular locations or starting on it. We had a tremendous amount of exploratory work to do, a lot of drilling, a lot of surveying, locating some of the major facilities, and determining the sizes of the facilities. It was all part of particular requirement at that time.

Q. You were kind of on the ground floor of the planning stages of it?

A. Not the basic initial planning, but on a final planning and to conclude facilities and everything yes very much so.

Q. What was your title actually?

A. Actually at the particular time it was Chief, it came down to we didn't have any construction going yet so it was I don't know if they called it Chief of the Civil Engineering Department or what. But then it was later changed to Construction Engineer, Project Construction Engineer.

Q. Describe to me what were some of the things that you were actually doing? Were you actually out in the field? Were you sitting in a office, what were you actually doing?

A. Oh actually I'd say probably to start with it was about half and half, half in the field and half in the office. We had of course our survey crews going and our geologists out in the field, our drill crews. And in the office end, we had our particular designer so once we had determined the economics of the different facilities; what size we should make the canal, what size we should make the pumping plants, where we should put the pumping plants. It's all part of the big picture because it's very interesting and the adrenaline really kept going. So glad we had a lot of good people.

Q. So at that point, they haven't actually decided even where the pumping plants should be?

A. They had a general idea where they'd be. In other words, they had the concept, the overall concept was there but you had to fine tune it sort to speak. I mean there were a lot of things that were changed from the overall concept.

Q. You say you were drilling, what were they drilling for?

A. That's the exploration work where you determine what type of soils that you encounter at your particular work sites whether it's from the canal or whether it's at the pumping plants. Whatever the features are, we have an exploration program which tells us how to design the foundations or what we need to look at. And of course also, it involves and ultimately and the contractors know what they're going to encounter in their construction activities. So that's what the exploration was, it's based for your designs and also for your construction activities.

Q. We're talking about several hundred miles of canal; you must of have all sorts of different soils and rocks?

A. For sure, I mean for sure. You look at Arizona and you'll find anything you want from the potato dirt sort to speak to your hard rock which you'll find in many of the areas, especially like in the western part of the state.

Q. So when did actual construction start?

A. We had a ground breaking at Parker in May of '73; in fact I think it was May 6. I looked that up this morning. So anyway, that's when we had our ground breaking ceremony. We had limited funds to work with, to start with so we started a little bit slow. The first contract was to provide excavation for Havasu Pumping Plant as well as to build a dike up in to Lake Havasu. So that was our first contract. And the interesting part about that was there were twenty six bidders on that job. Everybody wanted to be the first bidder. And Kiewit was the low bidder of twenty six. Anyway, it was kind of interesting everybody said that if you're the low bidder of twenty six, you're not going to make any money on a job but I guess they did. I think they did. Incidentally, it was run by an individual by the name of Jim Knight.

Q. What was the name of that company?

A. Kiewit, Kiewit Construction.

Q. How do you spell that?

A. K-I-E-W-I-T. They're still one of the main contractors in the valley here.

Q. So you were one of the people that oversaw, supervised all the construction starting with the pumping plants?

A. Well, that's pretty much correct not me personally but the team that I was working with. I had the role of being a supervisor or leader yes, we had a good staff to do this particular work.

Q. Must be a pretty big staff, how big of staff did you have to do that?

A. Including, I'm not sure, but including the surveys, the geologists, the designers, the inspectors, the field engineers, I think we probably peaked out at maybe close to three hundred people scattered from one end to the other doing various portions of the work.

Q. You started with building the pumping stations?

A. Actually we started; we started just providing excavation for the first pumping station, to move on to the pumping stations that happened until three years later. Some of our major contracts to start out with were the big ones, of course the Buckskin Mountain Tunnel and we started out in the Phoenix area which everybody thought was going to be a disaster but in turned out great in constructing the particular dikes up in north Scottsdale area.

Q. Why did they think that was going to be a disaster?

A. Some people thought the environmentalists would hang on to that quick like and give us more trouble than what they did. I should say environmentalists as such, but some people that were against the project, at which we had several at that particular time. But there was such a constructing these detention dikes in the north Phoenix area because that's one of the things that make me feel good about the project, besides delivering water to central Arizona, were some other side effects that were just great. One of them in fact that this dike, detention dike, which I'm sure you've seen in the north Phoenix area being it's about fifteen miles long. It was a good flood prevention measure as such, if it wasn't for that

dike, Indian Bend Wash would've never been constructed. We wouldn't have Tournament of Champions Golf Course in Scottsdale, we would've have Horse World up there. We wouldn't have any of these recreation facilities as such. There was real effort going where we had a planning committee of, I don't know, probably twenty something entities that were involved in making up the master plan for all of this. That was one of the real good side benefits of the Central Arizona Project. It was very interesting how it developed. How all these different entities were just really into it sort to speak? It was great.

Q. Were you involved with of those kinds of planning committees that was working on those things?

A. To a point yes. Actually our office engineer was very much involved. He was one of the members on the committee. And that was really a good combined working effort, beautiful thing. I mean if you'd been up to that golf course up there, you'd know what it's like.

Q. How did the Central Arizona Project make the golf course possible, explain that?

A. Actually to construct this detention dikes, we had to acquire a right-away to capture or to hold any flood waters water where we do not permit any permanent structures to be constructed. However, you could use this particular area for other than permanent structures such as golf courses, like Horse World, polo grounds – they've got polo grounds out there. So that is the way it actually all tied together.

Q. So those could never be used for something else?

A. Not for a residence, you can not construct any permits for impeding or any permanent structures in what would be the flood area should the event you get that major flood situation.

Q. You mentioned the environmentalists that caused some problems. Do you want to talk about some of the issues that they had with CAP?

A. Actually, I really don't want to use the word environmentalists because we need environmentalists, and they do a lot of good. Actually it was people that were against CAP like Caroline Butler and a few others were some of the people. Actually we had a civil engineer, and I can't recall his name, but they were very vocal and in some areas probably effective into letting people think, hey were doing the right thing.

And I'm not to sure about President Carter, just about killed the project whether that had anything to do with it, it might have, I really don't know. Except I know that President Carter had a young individual on his staff that was definitely against the project. For awhile there, we thought we were going to have to bury everything we had done up to date. In fact, we had studies on what it would cost to undo what we did and everything. It was close. That wasn't a fun year sort to speak.

Q. What year was that?

A. I would guess that was probably about '75. Well, tell me when President Carter was in office?

Q. 1977 when he was elected.

A. Then it was right after that.

Q. Do you remember who it was on his staff?

A. No I don't. All I know is this person was supposedly 29 years old, not that that makes any difference.

Q. Well, I knew there was a lot of controversy about whether or not to build the Orme Dam was that part of that or was that already decided by then?

A. Orme Dam I think was . . . well let's see . . . here again I don't remember the dates but the failure of the Teton Dam was one of the big needles that helped kill Orme Dam and of course a particular tribe was not in favor of it. I'm not sure what changed their minds because I remember personally taking 33 of their people on a tour one time to the Orme Dam and the facilities. And I thought boy their all in favor of it but things changed. But in the long run through, it turned out probably just as well that we didn't build Orme Dam, although I think it would've been great.

Q. Were you involved in choosing, that was Plan 6 that was finally chosen, were you involved in all deciding those alternatives and all those different options?

A. I probably wasn't instrumental making decisions, but our people were instrumental in providing data so they could make a decision. So, no.

Q. Were they coming up with some of the alternatives?

A. That is correct alternative costs and what we would have to do to make it work like raising Lake Pleasant instead of Orme Dam. We were also of course at the same time, we of course negated a couple of other dams; Charleston Dam on the San Pedro River and the other dam, excuse me, on the Gila River that I'm not sure what we called it at that time.

Q. Earlier they talked about dams on the Colorado River but that was in the 60's, I guess that those were all gone.

A. Yeah, they come and go.

Q. Talk a little bit more about, you know the planning and getting the construction under way. That had to be just a massive project that you had to figure out where they were going to start. My father was in construction, he was a construction superintendent, and he always had a chart on the trailer wall of, you know, how things, dates things were supposed to happen, did you have those kinds of big planning charts and how do you do it for something that big?

A. Well we had PF2B's, what we called PF2B's, which was a Bureau standard form where you laid out the budget and you go across the various construction features into different schedules or whatever you wanted to call them. And it was quite a task asked to lay out how to build the whole the project in a given amount of time and it with a given amount of money. And you schedule all your activities to match this particular thing and you made a plan or goal and schedule the activity and of course next year you didn't get as much money or somebody changed something so you had to keep this up to date continuously. We started out with a limited amount of funds and then for awhile there the funds dropped off so we sort of backed off. And then later on, the funds came rolling in again so we'd pick up again. With what we had during the peak years, we of course had to bring in more people as the work progressed.

To start with it was '75, I believe, that we let the major, first real major contract which was the Buckskin Mountain Tunnel which was seven miles of tunnel coming out of the Havasu Pumping Plant. It was a hard rock tunnel. This was rather an interesting project to the point where we selected a design which was really not used in America before, United States before. It required boring a hole twenty five foot in diameter through the mountain. With that, we had a machine with arms that laid precast segments right behind us. So we built a tunnel with a mole moving ahead crushing the rock, loading it on a train, put these segments in place and then grouting behind it. I won't go in complete details, but we started at one end and the whole object was to come out at a given point on the other end and they did. It came out right where it was supposed to come out including

a curve in this particular tunnel. So these are the things that most people aren't aware of what you really do out in the field. It's exciting. It's exciting work when you're involved and you know what you have to do and you know when you get it done. And that really gives you boost in your life sort to speak.

Q. I've heard about that tunnel. How long was it?

A. Seven miles long and actually we started on a down hill side or downstream side of the tunnel and progressed towards the outlet for the pumping plant in other words we had some "pen-stocks" going up through the tunnel and we already excavated where the inlet for the tunnel was. And of course, we did hit right on target.

Q. Did you ever have any doubt about that it wouldn't come out where you're supposed to?

A. Not really, not really, that's one thing that goes back to the fact that our skills and people that can match those skills and get the job done. So if you look at the surveying, it's kind of amazing that you start at one point and through the network of tunnels, canals, pumping plants, siphons, and everything three hundred miles downstream everything worked out fine.

Q. How long did it take to get that tunnel built?

A. Actually it took three years to construct that tunnel itself which was basically about right on schedule. We had our problems. We had some cave in grounds, we got the mole stuck several times, and I had to go in there and take care of those particular problems but kept on working.

Q. So you were actually out on site for some of that?

A. I'd watch them. Actually, we had the field engineers that stayed on site.

Q. Did your job entail quite a bit of travel, you have several miles of canal you're constructing?

A. Well myself I would probably go out once a week travel wise, really not. Personally like again I would just try to stay abreast of what's going on and probably provide any particular leadership where we needed it. I mean I'm not . . . I mean what I did wasn't all that spectacular a lot of people would've done the same thing.

Q. But there was a lot of different projects that are kind of going on simultaneously?

A. Correct. Actually we'd just spend, construction wise, we would probably spend for awhile two hundred million dollars a year, which today's money it would be, what three hundred and fifty million probably. So we were really moving, really producing. And all during this time, we had all these other activities going on pre-construction work as well as the construction work just moving on ahead.

Q. Describe to me some of the challenges in building the canal that long? What were the things you had to plan for? How did you do that?

A. Actually that's an interesting question because somebody would always say what do you have to build first and why did you do it this way. And we were instrumental in laying out the particular plan but when you have three hundred miles of canal to build, you know one thing that you have to do. You have to have this operation going continuously. Now we didn't start the pumping plants right away because we wanted to, we didn't want them sitting around until you energized them. We wanted to take advantage of the latest technology sort to speak. So we didn't start them right a way. We started the siphons right away. Some of these major siphons which include the constructing, building tremendous pipes that go underneath the rivers. We started them right away because we knew that we could construct them and fill them up with water and they would last. There was a method to our madness really, it was a plan. And it worked out very well I think. So basically our whole schedule was based on that philosophy.

Q. So sometimes it didn't look logical to the casual observer?

A. There were a lot of questions asked. I mean particularly you had to match these with the budgets and that became tricky. I mean working for the government you never were assured that what you think you had two years from now is going really to happen. But we lived through it all. It worked out.

Q. Talk about the siphons. What are siphons; I think a lot of people aren't getting what we're talking about the siphons, what is a siphon?

A. A siphon actually is a lid conveying the water underneath the river or any other particular feature that you might want to go underground with. So they call them inverted siphons, normally when you think of a siphon as something that you put a hose in a gas tank and you siphon it out. Well that's a regular siphon. An inverted siphon is were you actually start at one end and then you plunge

underneath the ground, in other words you go underneath the river – if it's a river like the Salt River for example – you might go several hundred feet below the starting point not below the river bed but the starting point. Then you come back up on the other side. And this can be a tricky activity because normally you hit water conditions that you have to take care of and you have enormous excavations. These particular siphons included pipes up to twenty-one feet in diameter, inside diameter. And most of them were constructed right at the site in the field. A huge operation that in itself was recognized throughout the whole industry sort to speak. We had a tremendous number of foreign engineers come and observe some of this activity.

Q. So rather then taking a canal over a river, you took it under the river?

A. That is correct otherwise you would have to construct a flume, where of course flood conditions normally will raise havoc with anything up above the river so you go underneath them. And it's the most economical and safe way to do it.

Q. How many places did you have to build these kinds of siphons?

A. Oh golly, I think major siphons on the major sites. Well just looking at it, we had the Salt River, the Agua Fria River, New River, and Hassayampa River; there were seven, seven major of the major siphons. And of course then once we headed south we had the Gila River and a few others but they were not quite the same size once we turned south from Phoenix going towards Tucson.

Q. That does sound pretty massive though to have to go under; most of the rivers are pretty wide.

A. Some of them like the Agua Fria River was over two miles long the siphon was. So you would be under, you're right, it was very wide.

Q. Even though they look like they dry but they're not.

A. Right. When they're dry, they're dry but boy they can get mean.

Q. Those were some of the things you did first was that kind of construction?

A. Actually one of our early major contracts was constructing three of these siphons. And here again, the reason we combined three of them was for economic purposes. We get the advantage of volume sort to speak. That was one of the

early larger contracts as well as Buckskin Mountain Tunnel. We had some of that activity going on simultaneously.

Q. How do you know how deep to go under the river, like the Hassayampa River it's underground itself quite a ways.

A. Well, we're getting into a technical area there. What you have to do is calculate the estimated "scouring effect" that determines how deep you're going to have to go with a particular pipe. So like the Agua Fria River some of the pipe, the top of the pipe was probably twenty some feet below the river bottom. And that way you're assured of the fact that in a flood condition, it will not move the pipe or in any way affect its operation. One of the other things that you have to worry about is flotation. As big as these pipes are, should an event that the pipe be empty and there's water in the river, the pipe is just going to pop up on you. So there is a lot of things to consider, yes. Like with anything else, you have to get down to ground zero sort to speak and figure out anything that might affect your particular product.

Q. You kind of pictured how you built those siphons pipes down, were the rivers mostly dry at the time you were doing the construction?

A. Arizona has a lot of rivers and they're usually dry, yes. But in the event they weren't dry then you would have to provide a bypass or something and dry out the portion that you're working on. So yes, we have constructed the siphons in wet areas as well. But unfortunately, Arizona's rivers are pretty quiet. The Salt River of course was a wet one because you have Granite Reef Dam right up above where we built the siphon. So we had groundwater to encounter there but it was not a surface type of run off.

Q. So when you were going to put these siphons, like at the Agua Fria that went several miles, did you dig out a huge trench or how did you do that?

A. It was a tremendous trench, usually it done by a combination of different means. Either you use scrapers or you'd probably drag lines. There were some places in Agua Fria River where the trench was probably thirty feet deep and probably a hundred and fifty feet wide at the top. So the excavation quantity was tremendous, very large volume of earth moved.

Q. And was most of that dirt, or sand, or rock?

A. A little bit of everything. We had rock. We had sand. We had clays. It could be a conglomerate or a mixture of anything. And this was one of the reasons why I

mentioned, we did the drilling before hand to determine what we would encounter. Which in the long term, also of course covered some of our design criteria as well as we told the contractor what he would encounter and what he would have to consider when he made his bid.

Q. Tell me a little bit about the siphon, the pipe that you had to actually used? Is that going to last forever or have to be replaced?

A. Can we avoid that subject?

Q. I think that is an interesting subject.

A. Yes, actually the first contract what they consisted of was precast, pre-stressed concrete pipe. And what this pipe consisted of was the fact that you would have concrete and you would wrap the concrete with really high tension pressures. You'd wrap the pipe, so in essence, you'd be wrapping, you'd be squeezing the concrete. This would be to provide stability for the pipe not to burst sort to speak under terrific pressures. And you probably wrap, one wrap depending on where you were at, you'd probably wrap one wrap and in some cases you'd put more mortar culp, more wire, another mortar culp, more wire. And then in some cases, even a third layer of particular wire. This was the heart and soul of his particular type of pipe and unfortunately, some of these wires probably for various reasons started corroding. And as they corroded, being that they were under tension, they would pop. They would break. And as a result, a lot of these siphons had to be replaced.

Q. How did you discover that they would break?

A. How did we discover that they were breaking?

Q. They're buried underground aren't they?

A. I'm trying to recall. This was after I left the Bureau and I'm trying to recall how they were discovered. For some reason or the other, they were performing some excavation work or something someplace and they noticed some of the mortar was off. I'm going to have to pass on that question as to really how they discovered it to start with. It's a good thing they did probably because the last thing we want to happen is to have it burst when it was in operation.

Q. So these pipes are you said twenty some feet?

A. Twenty one feet in diameter on the inside.

Q. And they go under the rivers, is there just one pipe or more than one?

A. Oh actually it would be a series of pipe, most of them were twenty feet in length. And then you would place them in a section and then you would have a gasket. And you'd have a gasket that would seal the particular joints.

Q. It's just one big pipe; it's not like a secondary one next to it?

A. It's just one pipe that they meet end to end as you progress, yes.

Q. If that pipe some how collapsed or something, it could shut down the whole canal system?

A. That would be disastrous; it would shut down the whole system and it would take a little while to get it back it in service.

Q. That's an understatement.

A. Probably a little bit more noteworthy than what transmissions are if blistering?

Q. When you specified those pipes and got that and decided to use those precast pipes, did they tell you how long they would last?

A. Supposedly they would last indefinitely. Actually the final, within the parameters of the Bureau, the final design with the Bureau's approval was done by the manufacturer of the pipe and in hindsight, I think most of us know what we should have done and that's in hindsight. I don't think we need to elaborate on that or should we?

Q. Yes I think we should.

A. Well it's just my own opinion. Actually we used a class of wire and we tensioned it too high. And when you have something that's under tension sort to speak, it's more suspect to different conditions such as corrosion or other failures. So anyway, that's my opinion that if we would've used a different class wire and not stretched it to the high tension we did, I think we, that would've been okay.

Q. Why did you have the wire, why couldn't it be just a concrete pipe?

A. It would not withstand the pressure, when you have pipe that's under several hundred feet of "hid" sort to speak. In other words, you have a level up there and then you come down with the bottom of the pipe, in a matter of calculations, so it just would not withstand the pressure. You got . . . I find it difficult to explain. You have a certain area of a pipe, I don't care what the given area is, and once the area becomes larger then the pressure it can withhold will just blow your pipe up.

Q And the pressure is coming from the water inside the pipe?

A. That is correct, it's from the weight of the water.

Q. And there is also a lot of weight from the dirt and the river on top of the pipe.

A. Well, that's another consideration, yes. And that's some case it tends to balance out the other pressures but you have to design for both conditions.

Q. So concrete was the material of choice rather then . . .

A. There were options. Initially in the first contract, we had options where they could go either steel, welded steel, or they could roll casts in place which would be normal reinforcing in casted place concrete only the pre-stressed kind of pipe. So with these three options, they actually had bidders on all three of them. And, I hate to say unfortunately at this time, we ended up with the pre-stressed pipe.

Q. Was that partly because you took the low bid?

A. Well, basically yes but this pipe was successfully placed in other areas, not quite as big. But it was used in other areas and here again if I remember right, the pipe of steel was stressed under different conditions on those other pipes.

Q. So what happened when you discovered that there was problem with the pipes, you said you weren't with the Bureau at that time, do you know what they did to correct it?

A. They provided a temporary fix to most of these locations. They could by various electronic means they could tell where you had broken strands and they went ahead and provided a temporary fix for a lot of these locations by wrapping cables around them and using the same principle of putting the cable around the

pipes so it could hold internal pressure. But that's not a permanent fix or wasn't a permanent fix.

Q. So you had to dig them all up to do that?

A. No actually you put one along side of it. To make up a temporary fix? Yes, you had to excavate around them. That is exactly right.

Q. Temporary means how long?

A. I don't know. I use the word temporary because that's what it was. In some of these particular cases, they decided to go ahead and replace them. It was intended to be a permanent fix but as of right now, as far as I know, none of them are considered permanent.

Q. Well sometime they are all going to have to be replaced?

A. Probably not, I mean this condition hasn't been checked I don't think as thoroughly as some of the other areas. See it was basically a problem where you had the deeper, higher tension siphons. I think they're still looking; I haven't talked to any of the people. They're still looking at Hassayampa River and a few other ones to see what they do have. One instrument set internally to try and determine what problems might exist or to what degree you have a problem.

Q. So where are the ones that had the worst problems?

A. The worst one started out at Agua Fria. The one that we started talking about was the longest one and the Salt River. We started out by replacing, or they started out by replacing the Salt River Siphon and then to Agua Fria and the New River. They've all been replaced.

Q. Are there any new technologies since then that would make it easier or better now in any way?

A. I really don't know. You still have to look at the same thing. In my opinion of course, the cast in place ones are the ones that seem to be the most durable and work out the best. And traditionally, they're still using that particular method. In fact in California right now, they're constructing some siphons that will be cast in place.

Q. Is that more expensive? Is that why you didn't do that here?

A. Actually as it turned out to start with on a thirty five million dollar job at that time, the pre-stress bid was only sixty thousand dollars cheaper then the cast in place.

Q. Sixty thousand out of thirty five million?

A. Right.

Q. That's not much of a savings.

A. No and of course, had anybody dreamed that there was going to be this type of a problem, naturally they would've went with the cast in place.

Q. Any idea what the cost is going to be to try and correct the problem?

A. Yeah, I probably could relate. We did recover some of the costs from the manufacturer of the pipe, did recover some of it. But again it began to cover the replacement; I think the replacement cost is probably in the neighborhood of fifty million.

Q. More than it cost to build it in the first place.

A. Yep but of course we're looking at twenty years later. That is exactly right, you got that right.

Q. And you say, it's still not really a permanent fix?

A. Those are, those are. It's just the other ones that have been replaced that they're still keeping an eye on which is three of them. They're shorter, smaller in shorter areas. And they do have emergency measures of how to take care of it if something does happen.

Q. What would that be?

A. We bought some spare parts, steel parts ready to go in case something happens so you don't have to go through a manufacturing process.

Q. But still its pretty major construction, would that shut down the whole CAP?

A. It would, it would to a point. Well, it all depends where. Now if, with Lake Pleasant in the system and you know, if you had water in Lake Pleasant it can still provide water for the southern portion.

Q. What if it was to the west of Lake Pleasant?

A. But we don't have that situation west of the lake. I mean east of Lake Pleasant. The problems are west of Lake Pleasant so if Lake Pleasant has a good supply of water then the City of Phoenix and the downstream users could still be able to get water.

Q. (tape change) Let's talk about some of the other construction assets, we're talking about three hundred miles of canal, what were some of the other challenges that you faced in constructing this whole project?

A. Well basically as far as the major features, sort of repeating we have pumping plants, and I forget whether it's twelve or thirteen of them on the system - the major ones being between Parker and Phoenix. And we have the tunnels. There are three major tunnels between Parker and Phoenix; the Burnt Mountain, the Agua Fria and the Buckskin Mountain Tunnels. The siphons, there were seven major siphons (again I'm just talking about between Parker and Phoenix for beginners here). There were seven major siphons and plus a hundred and eighty some miles of canal between Parker and Phoenix. So initially there were more pumping plants but by shifting some of the canals, we eliminated some of the pumping plants and also shortened some of the particular siphons. And that was the main thrust of what we called the Granite Reef Aqueduct at that time. We called it Granite Reef Aqueduct, now it's called Hayden-Rhodes Aqueduct.

So from Parker to Phoenix is where the canal is the largest. It supplied three thousand cubic feet per second of water. Once we left the Salt-Gila Pumping Plant which is by the Salt River, turning down towards Tucson, the deliveries were getting smaller as we went down there. But never the less, the situation was the same. Heading south we encountered first of all, major change from canal work would be the Gila River Siphon which was smaller then some of siphons that we talked about earlier on the Granite Reef System. Once we got down towards the Tucson area, our initial plan called for deliveries to the north west part of Tucson but through some negotiations of arrangements we ended up with the deliveries actually in the south west part of Tucson, which took us through some terrain that required additional pumping plants in the Tucson area. So what I'm basically leading to here is to determine exactly where the pumping plants were as to what size, what pumps to use. It was probably one of the efforts that required a good economic evaluation to provide the best system.

Q. For people that might not be familiar with this at all, what is the purpose of a pumping plant? What does it do?

A. A pumping plant provides, it lifts the water from a given elevation to a higher elevation so the water can flow by gravity to the next pumping plant. Consequently, for example Parker, the lake in Parker is approximately nine hundred feet lower than what we are in Phoenix. So we have to lift the water nine hundred feet plus whatever we lose by having a canal slope towards a particular area. I don't remember exactly what the exact figure is. But I think we need to lift the water twelve hundred feet up from Parker to Phoenix to get the water to the Phoenix area. And this takes quite a bit of energy and quite a bit of effort to raise this water to keep it flowing. One of the economics of this is based on power usage, when you start talking about power usage, then you'll continue on and this determines; the size of the pumps, what kind of motors to use with pumps, and believe it or not it also determines what shape and size the canal should be. Because the different sizes and shapes of canals takes a different amount of drop in order to keep three thousand feet per second feet flowing.

It's kind of difficult to explain all of this. There is more to it then meets the eye. You see a canal and you go well the canal is flowing but there was definitely quite a bit of work that went in to it as to determine where it came from, what size it is, and where it's going.

Q. When you were looking for the route for the canal, you had to look at . . . what were the factors to decide where the canal is going to go?

A. Oh, actually along with that you need to pinpoint the elevations and where the pumping plants would be. Basically it's a study of topography; it's what you do to start with and to determine just exactly where the locations would be. Now a days of course, with the new aerial mapping it's a lot easier and it was thirty five years a go when we first started doing this or forty years ago when we really first started doing it.

Q. How did you do it back then?

A. You had quad sheets, what they called quad sheets. You did have maps but you didn't have the accessibility or the availability to double check and firm up these particular locations which is actually required when pinpointing the exact location. We did actually by aerial photography, map the locations once we had a general idea where they were at. So then of course before we got into construction, we did real definitive mapping of the local areas so that we could calculate volumes and whatever you needed to do to put out a good specification for the contractors to look at.

Q. How did you do aerial mapping back then?

A. That was about the beginning of the time where they had flights and where they put cameras on airplanes. They'd come up with individual photos that would cover so much of an area. Then you provided by surveys, you provided particular targets for them to follow and you give the elevation to it and with the specific proper cameras and then followed up with the right plotting equipment, you can determine the topography and our elevations. Now days, it's much, much easier with all your great computers and everything. It's a snap compared to what it used to be.

Q. I would see it would be challenging to be sure you had a picture of the right thing and the picture wasn't upside down or backwards.

A. But anyway, it all worked. The water starts over in Parker and you can get it all the way down to Tucson without any trouble, I mean flow wise. I mean there's always trouble.

Q. You mentioned the other tunnels; I hadn't heard much about the other. . . I always here about Buckskin Mountain Tunnel, what were the other tunnels?

A. Burnt Mountain Tunnel and Agua Fria Tunnel are . . . they're shorter, much shorter. In fact one of them, both of them are less than a mile long. They're of different construction. They were of a horseshoe type of construction. And actually they were excavated by simply drilling, hit, and blasting and hauling the rock off with particular loaders as such rather than the mole and having a train assembly. The more traditional way of constructing tunnels.

Q. In the canal, why don't you talk a little bit about the construction of the canal? The design of the canal, we just talked about it makes a difference, is the canal the same all the way from Parker to Phoenix or is it different in different places?

A. From Parker to Phoenix it's basically the same because its based on the same calculation, economic calculations. But once we got to Phoenix and went south and with less deliveries and different pumping requirements so the size changed some what. In terms of designing a particular canal, boy can we get in to it here. In terms of designing a particular canal, you have to consider just exactly how wide you want to make it, do you want to consider what the friction factors are, and you want to determine what the slope is and if it's just strictly gravity and you have no pumping plants, its not any particular big problem. From that part on, it's based on economics of material you used. When you have pumping plants, you

have to consider the additional lift that is required to lift the water as you proceed down the line and this impacts the size of the canal because it'll vary as to how much lift you have to make. In other words, with a hundred and eighty miles with the slope of approximately six inches per foot that means you have to raise it an additional ninety feet if your slope varies on a particular thing. So it's a matter of definite calculations to what you want to do.

Q. How big is the canal? What is it made of?

A. The canal from Parker to Phoenix is twenty four foot on the bottom and it slopes, the side slopes one and a half to one. In other words, its trapezoidal slope without and the top of it is about eighty feet wide on the top. The water theoretically, the water when it's flowing at three thousand second feet it'll be a little bit short of seventeen feet deep in the bottom of the canal. Normally, you have check structures about every six miles. So this is to help control the flow and to prevent any blowouts sort to speak by changing flow rates. So the water normally is kept within two feet of the top of the concrete lining. The sides are concrete lined and on the CAP they're three and a half inches thick, the concrete is. And you have to provide for contraction joints and expansion joints to make sure that it doesn't deteriorate on you or in fact that it doesn't basically explode on you or buckle up on you or items of that particular nature.

Q. How is it constructed? Is it like a swimming pool or how do you build concrete walls?

A. They're three phases of operation basically for a canal. First of all, you have your amount of earth work. Earth work will contain, actually involves excavation of the major prism and sometimes the ideal canal will be such that you excavate some and then you build some up above ground to a point above ground. And you excavate this by basically catapillars or scrapers sometimes you use dozers. Anyway, you excavate it and then where you built up backwards you have to make sure that you compact it which requires the right amount of moisture to get the exact compaction requirements. Then after the excavation and compaction is completed, you start thinking about trimming. In other words, you have to provide exact finish grade on the size and bottom of this. Normally they bring in what they call a trimming machine. The CAP canal was of a specific size where you could only do half at a time. And with this half at a time, your particular trimmer would be, there's two different kinds, either it would be the type that augers it or the kind that buckets it. And it will trim the canal to an exact elevation. In other words, it would be smooth. It's got to be smooth and precise. After it's trimmed, then you have another machine that lays the concrete on it. After the concrete is hauled to a particular canal site, it's dumped into a machine and this particular machine lays the concrete along the trim's surface and makes sure that it's on the right thickness and it also finishes it. In other words, it makes

it smooth. It's important to have the canal concrete very smooth because that prevents "drag" when the water flows down the canal. So these are the three major elements about canal construction as such.

There are a lot of other things to consider of course which is probably worthy to mention, is normally a canal will follow a certain contour. In other words, it's usually if there's a hillside it follows along the hillside so it leaves all the normal run off of water from the terrain. It's going to come perpendicular to the canal. Now you have to make sure that somewhere this water run off, water gets across the canal. So in various situations, if it's in a particular wash area, you might have a culvert underneath the canal that will carry the run off water below the canal. Or in some areas you might have what you call overchutes, where you have a structure that will carry run off water or rain water up over the canal. The one thing that you don't want to do is dump it in the canal and secondly, you have to make sure that this does not happen because if it does, it will quickly tear out your lining in the canal. Because water, once it gets underneath the concrete lining, it will blow it out. There's so many of these little things that you have consider during particular canal operations, canal construction.

Q. And all that had to be planned ahead of time?

A. Every bit of it. There's a lot of hydrology involved and run off, you have to determine what your run off areas are. It's . . . one . . . probably, it requires a lot of forethought like anything else once you know what you're doing it's easy, really.

Q. I wouldn't of thought of run off because you see the canal going across the desert, the last thing you'd worry about is water in the desert, but even though it doesn't happen that often it's . . .

A. It's very important in some area because it could tear out a canal in a hurry if you don't provide the right cross drainage. We call it cross drainage.

Q. So when you're constructing the canals you're talking about digging them out and you're building them up, did you use the dirt that you dug to build them up?

A. Well normally that's the ideal economic way to do it. You try to balance the earth work if you can. It doesn't always happen but if you can do it, that's what you do. It's cut and fill. In other words, you try to balance the earth work.

Q. One of the other things I've heard that there was a concern about animals out in the desert and how they were going to get across the canal or worried about them falling into the canal? How did you deal with those issues?

A. Very interesting, there's a side issue right now that involves that very same thing in California. Deer and other particular animals, two popular things that we talk about is a desert tortoise and deer.

Q. Two very different animals?

A. Very different animals so consequently, they had a normal canal, a concrete lined canal, once a deer gets into the canal that's lined with concrete chances are he will not get out of there unless you some way or other provide some means to get him out. Talking about from Parker to Phoenix sort to speak, actually after considerable studies and dealing with the Fish and Game people and what have you. There's actually what you'd call wildlife fences that's been constructed to keep the deer out of the canal. Every once and awhile, of course we want the deer to go across. Now if you have a siphon, they automatically can cross were the siphon are but you'll find some deer bridges throughout the CAP system in some particular areas. And some of them double as tortoise crossings. A deer fence is one thing; it's normally eight feet high, and its woven wire type, two sets of woven wire with some barbed wire on it. The tortoise fence is two feet high. It's a little different. It's a matter of mesh and then of course to keep them from crawling under, you have to put rock or something on the mesh to keep them from going under it. And there's considerable amount of both on CAP. In fact in some places where you have the deer fences and it's combined with a tortoise fence.

Now in your residential areas or your more public areas, for safety purposes, we have chain link fence which also serves as a deterrent for the deer. The chain link fences, you'll find it all the way through in the Phoenix area. You'll find a chain link fence from, oh golly; in fact, to this day they're still replacing some old fences, with new chain link fences. So eventually, the entire CAP will be fenced with either wildlife fence, what they call wildlife or deer fence, or a chain link fence which supposedly keeps everybody and everything out in some places coupled with the tortoise fences. That took a quite a bit of study and its quite expensive to provide all this fencing.

Q. And of course now they're worried about terrorism and security that way. Is the CAP vulnerable for somebody who would want to do some damage?

A. I know that they have taken measures to look at this and especially at the pumping plants which are really the vulnerable areas. I know they've taken measures for special security concerns. They've got alarms systems and

cameras and all that. So they are very well aware of what could happen and they're trying their darnest to take care of it, same with all the other water agencies all over the United States sort to speak as well as with the power systems contrary to what some people might think.

Q. Did you every have to think of those things when you were doing the planning back in the 70's?

A. Not really, not as far as terrorism was concerned no, we weren't concerned about terrorism. We were sure familiar with the local person running off your some of your equipment or with some of your materials that's for sure, vandalism.

Q. What about safety as for humans, I mean falling in or driving their car into . . . what were some of the safety issues then?

A. In terms of safety issues, of course I mentioned that we got the chain link fences down there and everything. But in front of every check structure or every siphon they're also there are safety nets in the canal, so if a person does happened to be in a canal for any given reason that will provide him an opportunity not to be sucked in by the siphon. And also every seven hundred and fifty feet on each side of the canal there is a ladder that is actually bolted onto the concrete. This provides the measure also if he is in there hopefully he can grab on to one of the ladders and climb up. For the safety stand point, the design had that really well covered. But you can't prevent everything from happening. I mean I understand that they've found bodies in front of the pumping plant. And here a couple years ago, a person fell into the canal working on the bridge crossing and I guess we loss him. These things do happen.

Q. You were talking about be involved in aerial surveys to do the planning, and I assume during the construction too that you had to be inspecting all the work that was going on. I've heard from some of the other people that CAP had developed quite a little Air Force with planes and helicopters and things, can you talk a little bit about that?

A. I don't know if you could call it exactly an Air Force and such. I'm not sure how many helicopters we had aboard for awhile there. But we used to use them like for example to haul the equipment up into, the drilling equipment for where you couldn't drive to and stuff like that. We used to use helicopters to import the equipment as well as haul the people to some of those sites. And the political types enjoyed the helicopters so that entered into the picture. So we did have a couple of them available.

Q. Did you use them for yourself to get out to the sites?

A. At times, yes, yes. Again, it's was a quick way to get to some trouble areas which was one of the main benefits. But basically they were used to provide capability for the people before construction and a lot of show and tell for political reasons, a lot of that.

Q. A lot of those construction sites you're talking about, the canal and the pumping stations especially some of the canals, aren't they in pretty remote areas.

A. It takes a while to get to them from Phoenix, yes. But we had a construction office in Parker which handled all the work in the Parker area. Likewise, they later on set up a construction office in Tucson to take care of the lower area and we had our construction offices here in Phoenix.

Q. Just getting, getting in and materials and concrete and everything in to all the canal sites, did you like have to build your own roads to get to these places?

A. Yeah, you automatically built a road with the canal. There's a road adjacent to the canal. Really not to often did we build a special road to get to the canal, mostly you'd find existing roads. I can recall only one real area where we built some roads to get to it and that was about half way between here and Parker before you got to the Salome area.

Q. So you were also in the building business?

A. Oh very much so, I guess maybe I kind of forgotten some of this. To build the Buckskin Mountain Tunnel, we had no road at all to get out to the tunnel which was our starting point. We pretty much built a highway, or a paved road, from Parker to the Buckskin Mountain Tunnel, that we did. See I keep forgetting some of this. We did that and that ended up being quite an effort in itself.

Q. That's even before you could start construction.

A. We built it right there, yep, exactly.

Q. What is it about the whole involvement with CAP that you're the proudest that you were involved with?

A. Personally, I'm just glad that I was part of it. I don't think I did anything exceptional on my own and such. It's just that we had a good bunch of people

and in spite of some of the political and money problems and what have you, we got the job done. I wasn't around to finish it but I was around for a good thirteen years of it. Actually, there were a few innovations that some of us sort of promoted that turned out to be right. Basically it was just one heck of a good ball game.

Q. Talk about what are some of those innovations?

A. This detention dike in north Phoenix, that was basically something that a few of us dreamt up that took hold. That was one of the things. The Buckskin Mountain Tunnel, the method of construction, which was something that we participated in. We did the preliminary design work and provided the data and the Denver office actually did the final design work. They're the ones that put the nuts and bolts and everything together sort to speak. So with a combined effort, I just feel real good about some of the things that were done. And the fact that it's working as good as has.

Q. You said you weren't there for the completion of it, what years were you working on it?

A. From '70 to the first part of '83. And actually construction continued for about another six years after that to get the Tucson part completed. However, I stayed pretty close, I stayed pretty close to the activity because I had directly provided some consultant work for the project for CAP. I worked for Tom Clark. After that, it's just part time so I've stayed with the project until it was pretty much done.

Q. In '83 what did you go on to do? Did you retire?

A. No I didn't intend on retiring. I've done some consultant work since then. I thought I retired three, four different times but as it turned out, I'm still providing some consultant work basically on similar work.

Q. So in '83 did you go on to another project or did you leave the Bureau?

A. I left the Bureau. I left the Bureau, I retired from the Bureau. I retired as soon as they'd let you, sort to speak. Not that I didn't enjoy the work, but there were other things that entered into the picture. So I did some consultant work various types and bounced around with different, as a consultant, with different firms. And I also got involved with some private work so still hanging in there.

Q. So you weren't there for the big ceremonies when they brought the water into valley here in I think '85?

A. Well we had that at Harquahala, when they had that sort of get together. Yes, I was there. And then we got into a groundwater program where CAP did. '98 I believe they had the ceremony for the first recharge project down in Tucson which happened to be twenty-five years after the ground breaking ceremony in Parker twenty-five years later.

Q. Did you ever think about that when you where planning the building and bringing the water to the valley, was groundwater recharge something that was ever brought up?

A. It really wasn't brought up. I mean everybody was aware of the fact that groundwater withdrawals were going to catch with everything but who actually dreamt the idea of recharge, I'm not sure. I think it was the people at CAP which you will see eventually which I'm sure is a good thing and eventually we'll find out, especially if we don't get some snow up in the mountains.

Q. If you were planning to build the CAP today, knowing everything from your experience and the way technology has changed what would you do differently today?

A. Well basically some of the, utilizing some of the latest technology and equipment. We'd probably refine it a little better. I know where we should've done things a little different. I know where some bad rocks lay. In other words, yeah I could sit down and write a pretty good story or list quite a few items that should've been done a little different but nothing real major. Nothing real, real major I don't think. The project would've been very similar. Sure just like everything else, I mean I wish I would've done it that way. Hindsight is great.

Q. Any of those things you'd want to mention that you would've done differently, the smaller things.

A. Well, naturally we probably would've been a little more concerned about the siphons, that's hindsight pure hindsight. And there's a few places where I think we should've been, just a little bit, little different location than more economical. Basically most of the Phoenix things are economical rather than physical sort to speak. Down on the lower end which I really didn't have to much to do with, I think we could have done away with one or two pumping plants. But that would have created some other difficulties, so it's a toss up. It's just an opinion I guess.

Q. One of the things that people may not know about the pumping plants, they're all automated that they're not run by a person. Was that in the plans?

A. Pretty much either way you can run it manually from the particular plants. The main control board is right here in Phoenix. So they can run everything from the Phoenix area. That of course is the same thing with all water companies, major water companies whether it's Imperial Irrigation District in California or Chochella. They're all automated. A button can control the whole system, all the pumping plants, all the check structures, what ever you need it to do. And there, my gosh, the electronic industry is so much advanced since 1970 that they're doing things that we didn't even dream that would do. Fantastic.

Q. What was the biggest surprise for you when building the CAP? Is there anything that turned out differently then you thought?

A. I don't know if there was anything that was a big surprise. I look at surprise as something that would be embarrassing. I don't feel embarrassed about anything. I really don't. It was a great, great job. Great life.

Q. You see all the ceremonies when they brought the first water to Phoenix from the project, you always see the politicians up there making the speeches. Who do you think should really get credit for building and planning . . .

A. Well you can't deny the fact that people like Carl Hayden and John Rhodes should get a lot of credit because if wasn't for them it wouldn't have happened. Who actually dreamed up the project to start with, I'm not really sure who dreamed up the project. Somebody had to dream it up and it's probably somebody that was sitting on the table there with us at the ground breaking ceremony. And whoever envisioned it is the person who should really get the credit I think. Sure the people that did the planning, the final planning, very deserving. The people that did some of the field work, they're deserving. But I'd give the credit to whoever envisioned it to start with.

Q. Seems like a pretty futuristic plan in the 40's when they first started.

A. For sure, for sure, you probably now who envisioned it to start with, I don't know.

Q. Not really, never heard a name to that.

A. Essentially they sold some of the congressman of the fact that this is what we got to do and there's no question or doubt that everybody recognized there was a need for something like that. You know, southern California systems were built

before CAP, not too much earlier, but I think the overall planning or the overall dreaming about it, they all came about the same. It's interesting. That's a good question. Who really is deserving?

Q. I guess it's a big enough project that there's enough room for credit to be spread out.

A. It's how you feel individually and how you feel about yourself is what counts.

Q. How do you see the future of Arizona and the water resources Arizona has?

A. I think everything is going to work out real rosy. We got to get over this drought to start with, which will happen. So with the Colorado River flowing full blast and everything and getting some of the local run offs in Arizona, I'm not worried. I'm not worried at all.

Q. Did you ever think when you came here in 1962 that you would see Arizona grow like it has?

A. Golly, no. Of course, I thought I was just here for awhile anyway. I never gave that a thought. It's great.

Q. What advice would you give for the people who are running CAP today in planning for the future? Would you give them any advice?

A. They keep studying this and everything and I think they are way ahead of me as far as knowing what they need to look at and what they need to do. They're on top of it. They really are. I know personally some of the people that are working there and they're not going to sit down and just start taking everything for granted.

Q. One thing that I always like to ask everybody is just as a person thinking about your life and your career, what advice would you give to young people today that are thinking what is it that they want to do when they grow up, what advice would you give them or your grandchildren?

A. I know that they think differently then what I used to think. Of course for I guess right now or the thing that they think about is what kind of a carrying case should I get for my laptop. I work a lot with young engineers and I find that they're very brilliant. Some of them are goal orientated but, I think, some are more concerned about what they're working with, what's their equipment, and more types of electronic field. I'm kind of stuttering here, we're going to do okay. That I know,

we're going to be okay because most people that are coming out of the universities are very brilliant and capable.

Q. Do you think there will be projects like this for them to tackle in the future?

A. Not quite, I mean not in the United States. We're out of places to develop new projects. One of the things that we got to start looking at is rebuilding. And rebuilding is going to be the thing of the future. Right now, I was involved in a couple projects in California that are upgrading systems. In fact, one of the things that we will be looking at is widening the All American Canal. Are you familiar with the All American Canal? I mean, that's something that we're going to start doing this year is the design work and redoing it. Bookman-Edmonston got the contract for it for the design work out of Sacramento and they have asked me to kind of look in on them and help them on this particular thing. So there's some young people that under the guidance of some of the more mature people that will be working on these particular projects. Life will just keep on going.

Q. I know when you talked about the Colorado River one of the things they talk about is the drought and the problem with the flow being down but with the salinity problem and getting the water to Mexico, did you ever get involved with any of that?

A. Not really involved in that but there's a lot a talk about getting the desalinization plant running again regarding some water costs. You know, what is that - you build the field and they will come or whatever it is, it all follows the same philosophy regardless of what kind of problems we get sooner or later, we're going to resolve them. And we're going to resolve them and everything will get bigger and better as we go along. Unfortunate that we all won't be around to see everything the way it might end up being.

Q. I think I covered most of the questions that I had, was there anything that you wanted to bring up that I didn't ask you about.

A. Oh golly, I probably could think of something right off the top of my head. No I really don't. I just want to repeat that it was a great project, it was great working with the politicians and all the other good people that we had in the field.

Q. You were at the right place at the right time.

A. I guess so, I enjoyed it.

Q. Is the All American Canal a dirt bottom right now?

A. Yep.

Q. Really? I wouldn't have guessed that. I thought it was lined.

- - - End of Interview - - -