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HAROLD HEDGER:

FLOOD CONTROL ENGINEER

Completed under the auspices
of the
Oral History Program

University of California
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INTRODUCTION

Harold Everett Hedger, former chief engineer for the Los Angeles County Flood Control District, was born in Riverside, California on December 17, 1898. He attended grammar school and high school in Long Beach, California and received his B.S. from the University of California at Berkeley in 1924, after serving overseas in the United States Naval Reserves from 1918 to 1919.

During the summers, when he was not attending the University, he came to Los Angeles and worked for the Los Angeles County Road Department on topographical surveys and, in 1919, began his career with the Los Angeles County Flood Control District. In his first year with the District, he worked as an instrument man, and from 1920-1925 as a draftsman. In 1925, he became a resident engineer and in 1926 an assistant engineer, a position he filled until his promotion to office engineer in 1929. In 1935 he was again promoted, this time to the rank of senior assistant chief engineer, and in 1938 he became the chief engineer of the District. He served in this post until his retirement in January, 1959.

Other posts he has held include the presidency of the Los Angeles Section of the Society of American Engineers (1930) and the vice-presidency of the Los Angeles Engineering Council (1940). Since his retirement, he has served as chairman of the Water Resources planning committee of the American Society of Civil Engineers and as a board member of the Glendale Public Service Commission.

In the following narrative describing his affiliation with

the Flood Control District, Mr. Hedger gives the historical background for its origin, the history of the development of the District, the design and construction of its major works, the nature of its policies and the scope of its responsibilities. He also describes some water consultant activities he has engaged in since his retirement. The written addenda to his narrative provides an excellent description of the roles various people have played in bringing flood control and water conservation to Los Angeles County.

The interviews were 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. Records relating to this interview are located in the Oral History Program.

INTERVIEW HISTORY

INTERVIEWER: Daniel Simms, Interviewer-Editor, Oral History Program, UCLA. Age 33. B.S., Geology, Long Beach State College.

TIME AND SETTING OF INTERVIEW

Place: In the study of Harold Hedger's home, 448 Woodbury Road, Glendale, California

Dates: May 17, 19, 1965; July 8, 1965.

Time of day and length of sessions: Each session lasted approximately one and one half hours and was limited to one hour of recording. The interviews took place in the early evening. This manuscript represents a total of three hours of recording time with an addenda beginning on page 78 written by Mr. Hedger after reviewing the manuscript.

Persons present during Interview: Simms and Hedger

CONDUCT OF INTERVIEW: A topical approach was encouraged and the interviewee was given liberty to develop themes in the manner he felt most appropriate. No outline was prepared by the interviewee, although an historical-chronological approach appears to have been the interviewer's scheme for the development of the narrative.

EDITING: Editor: Donald J. Schippers, Interviewer-Editor, UCLA Oral History Program. Age, 34. B.S. American History, UCLA, M.A. American History, Occidental College. Material from a verbatim transcription of the tape was only slightly emended, although several lengthy digressions made by the interviewer were deleted because of their lack of relevance to the interview. With the foregoing exceptions, the manuscript faithfully reflects the order and content of the tapes. The index was prepared by Jack Vaughn under the supervision of Donald Schippers.

TAPE NUMBER: ONE, SIDE ONE

May 17, 1965

Simms: That book that you've got: May I take off this jacket?

Hedger: Yes.

Simms: Thank you sir. Yes, this must be a pretty interesting book. You say that this is the bound volume here?

Hedger: Yes, it's a bound volume and it's typed. It's simply a tabulation of interviews by some of the engineers, before the Flood Control District was organized. [The interviews were done] by some of the county employees with old timers that lived in the flooded areas.

Simms: If that's the only copy of it, I sure would like to get hold of it for awhile and have it done again.

Hedger: Well, we'll have to see if we can arrange that with the Flood Control District.

Simms: You say that these interviews were done before the Flood Control District was organized. Approximately what period was that?

Hedger: I think that most of the interviews that appear in this book were taken in the years 1915-1916, perhaps. The Flood Control District was authorized by the State Legislature in 1915 and was put into effect by the Board of Supervisors, I believe, in about August of 1915. But that was only on paper. There was no activation of the organization until a chief engineer was appointed in 1917. The [District as an]

organization was originated at that time.

My first connection with the Flood Control District was right after my return from service in the United States Navy during World War I. I had finished high school in Long Beach and had matriculated at the University of California at Berkeley. And before the end of my sophomore year, I went into the service and spent over a year in the Navy. I returned in 1919 and sought employment with the county offices and finally found a spot in the County Road Department. That was early in 1919, and then I heard about the Flood Control District looking for surveyors at that time and moved over to the Flood Control District Office in June, 1919. So my acquaintanceship with the District covers all of its history except the first two years, you might say.

Simms: That's quite a span. You were born where?

Hedger: Riverside, California.

Simms: Riverside. What year was that?

Hedger: December, 1898.

Simms: Did you grow up in Riverside County?

Hedger: No. My folks moved from Riverside to Long Beach in 1902, I think, and then returned to Riverside for a year when I was about age 11. Then we went back to Long Beach, and I spent all of my early school period in the Long Beach schools.

Simms: What was your father's occupation?

Hedger: My father was in what they called the transfer business. He had at that time, when he was in Riverside, a team and wagon with which he hauled goods for people, and he did the

same in Long Beach.

Simms: So, after you spent a year in the Navy, you then went into the Road Department.

Hedger: Yes, the County Road Department.

Simms: A lot of people go into the engineering profession through highways or through roads or something like that. I imagine all of us have done something like that.

Hedger: Well, in 1919, jobs weren't begging. You had to take what was available, and being fresh out of the service without too much money in my pocket, I was glad to take the first job I encountered.

Simms: Well, cars were just getting into their own about the first part of the '20's. Did you see a big advent in the road construction industry about that time?

Hedger: Yes, the Road Department was getting quite active along in the early '20's, but I'd say that the big explosion in road building came after 1923-24, in the late '20's.

Simms: That's interesting. You look back and think of all the cars they had, and then you look at the early maps and the USGS topo sheets and they don't have a road on them. You wonder where inthe world those cars went to.

Hedger: Well, in that time, say in the early '20's, generally, there was only one good road between two points. And if you wanted to go from one of the smaller cities to Los Angeles, you didn't have much choice. Two would be the most that you could find in the way of alternatives.

Simms: Yes, my mother told me that when she came out to this

coast in '28, there was one road across Texas and most of that wasn't paved. So it's changed quite a lot.

Well, let's see, after you tied in with the Flood Control, which was in 1919, what were the first things you decided to do?

Hedger: Well, my first assignment was on a survey crew. I was an instrument man and started to work locating flood control channels, mapping, topographic mapping. And soon after that, I shifted to the topographic work that was necessary for the San Gabriel Dam. That was in the late 1900's, and it was studied a number of years before it was proposed for financing in 1924.

Simms: They actually built that thing when?

Hedger: The San Gabriel Dam construction started (I'm relying on memory entirely now.) along about '26 or '27, I think. Then as I remember, it stopped suddenly along about '28 or '29, due to a slide at the damsite which resulted in the site being declared unsafe for dam construction by the State Engineer. That caused a move to be made to another site to replace the Forks site, as it was called originally.

Simms: Did they actually do that later on--scrap the first site and move? I'm not familiar with that.

Hedger: Yes, yes they did. And another interesting engineering activity connected with that was that the Chief Engineer here at that time, a man named E.C. Eaton, was anxious to consider every reasonably potential damsite as an alternative. Realizing that it would take a long time and be an expensive job to

survey damsites throughout the area by ordinary survey methods, he went to the Fairchild Aerial Surveys and arranged for what must have been one of the first of the topographic surveys by aerial methods.

I particularly remember that we had fifty-foot contours taken of the San Gabriel Canyon, from the floor of the canyon up to about 500 feet in elevation, for the entire length of the canyon from its mouth to the main forks in the canyon, and then probably thirty or forty miles up each fork. Then the topography resulting from the aerial surveys was checked as to reservoir capacities available at some of the critical points. Then those points were examined more closely for potential actual damsites. Several were considered, but the decision was finally reached to construct the principal dam probably six miles down stream from the original Forks site. The San Gabriel Dam has since been completed at that point.

Simms: That was the first major flood control feature in the Los Angeles area, wasn't it?

Hedger: That was the largest of the major flood control structures. There had been several dams constructed previously in smaller canyons, and they varied from 125 to as much as 400 feet in height at different locations. I think there were about 11 dams, altogether that were constructed in the period, say from 1920-1935.

Simms: Were they actually built with flood control in mind or were they built for water entrapment for recharging and as debris dams and things like that?

Hedger: Well, I think they were built with both flood control and conservation purposes in mind, but there was virtually no hydrologic data available for determination of effectiveness in either respect. So, I think that time has proved that their flood control effectiveness has been almost nil because of the limited capacity attained compared to the need for [effective regulating] capacity. That's not true of the San Gabriel Dam, however. It was built for a minimum capacity of around 55,000 acre feet and paid for itself within a few weeks after it was completed.

Simms: How was that?

Hedger: [The dam was complete and] the final concrete was poured in the spillway about three weeks before the flood of March, 1938, which is oneof the largest of the recorded storms that we've had. And, if my memory is correct, there were inflows in the two forks of about 110,000 cubic feet per second. But with the large capacity of the reservoir and the fact that the spillway had been completed long enough to withstand the over-pour, the maximum discharge was 55,000 second feet, just about half [the inflow. The outflow of 55,000 second feet] filled the natural channel of the San Gabriel River, as it issued from the canyon, in toto. In fact, it overflowed about a foot in depth [and swung] over the road that leads down into Azusa. Well, if the dam hadn't been there and the full 110,000 second feet had passed all the way down the canyon, it takes only a little imagination [to realize what would have happened].

Simms: It would have washed a lot of people out into the middle of Baldwin Hills. You say that Mr. Eaton was responsible for surveying these dam sites?

Hedger: Yes, the first Chief Engineer of the Flood Control District was a man named James W. Reagan, who was a Long Beach citizen, by the way, and who was also a member of the Board of Engineers [when they were originally] employed by the Board of Supervisors to study the various plans for flood control before the District was organized. Perhaps I'd better go back to what brought the organization into being.

Simms: I was going to ask you that.

Hedger: The flood of February, 1914, was really the basic reason for the creation of the District. The last previous flood experienced in Los Angeles County, prior to 1914, was back, I believe, in 1891. In other words, there was a period of almost a quarter of a century that had gone by without many major floods. And the population of the County, of course, was small at that time, so no attention was paid to the need for flood [control] except by the people who happened to own property along some of the main channels. They had had enough trouble so that they had organized a few river protection districts for the purpose of providing bank protection along the Rio Hondo Channel, for example, along the San Gabriel River and others. But the bank protection works usually consisted of piling, driven along in one or two rows, and then faced with fencing, heavy hog-wire fencing. Sometimes [brush or tree cuttings were] packed down in the fencing. While

it was helpful against the smaller floods, it could not stop the flood waters from eating into the banks in a major flood.

The flood of 1914 (I don't remember it causing any deaths.) caused a great deal of flooding of property in San Fernando Valley, in San Gabriel Valley, and in what we call the Coastal Plain, that is, from Los Angeles to Long Beach and San Pedro. It caused damages totaling about ten million dollars, which was a terrific loss in 1914. Many places were washed out completely, and the demand came to the Board of Supervisors from all sides for some means of protection against the reoccurrence of those floods. The board itself was concerned and immediately organized, as I remember it, a citizens' organization. It was called the Los Angeles County Flood Control Association. This was before my time. I read about it in some of the documents on the District's history. And they went about preparing legislation to introduce into the State Legislature for the creation of an official district.

It seemed that the cities were not able to meet the flood control needs. The City of Los Angeles was seriously affected, but it had no authority to expend funds on flood control works and the engineers were not trained in that respect. That was true of the smaller cities to even a greater degree. The county didn't have the necessary legislative authority to act on that, so a move was started to create a separate district which would have the sole function of controlling and conserving flood waters.

There was very little difficulty, I gather, in reaching

agreement on enabling legislation, except for one point. That point was whether it should be financed through special assessment, based on benefits received, or [whether] work [should] be financed by ad valorem taxation over the whole district. And I believe that battle swayed back and forth. As I remember reading of it, the City of Los Angeles definitely favored special assessment, and some of the smaller cities, Long Beach particularly, and Compton and some of the other cities, favored the ad valorem method of financing.

And it seems strange, but if history is correct, the State Legislature considered two bills, each one similar except for the method of financing, and passed both of them.

Simms: Oh, mercy.

Hedger: But finally, the cities that favored the ad valorem system prevailed and the Los Angeles County Flood Control Act, as it was finally passed and executed by the governor, called for ad valorem financing. That measure, which is the one that was passed in June, 1915, provided that the objectives of the Flood Control District would be flood control and conservation and flood and waste waters.

It provided that the District would include all of Los Angeles County lying south of township five north and as the south line of township five north would pass through Palmdale. In effect, it would include everything south of the east-west line drawn through Palmdale, except Catalina and San Clemente Islands. They were excluded, and that has never been changed.

The Act provided that the administration of the District would be through the Board of Supervisors of the county acting exofficio as the Board of Supervisors of the District, as a separate entity. It provided that the board could employ a chief engineer who would be the principal officer of the District and as many engineers and clerical people and workmen as were needed for the conduct of the work. It also provided that the board could order the chief engineer or any other engineer [it named] to bring in the proposals for needed work, and estimates of cost, which could be submitted as bond issue proposals. It gave the District, through the Board of Supervisors, authority to own property and construct flood control, conservation works, and, in effect, to do all the things necessary to implement the flood control and conservation system.

The first chief engineer was appointed in about January 1917 and was called upon at once to prepare a program for submission to the people. If my memory is correct, the first bond issue proposal was put before the Board of Supervisors and then placed on the ballot in 1917. It totalled a little over four million dollars and provided for the construction of dams in three or four canyons. [These canyons] included San Dimas Canyon, Tujunga Canyon, Arroyo Seco (where the Devils Gate Dam was [one of the first built]), and Pacoima Canyon. It also provided for construction of a great many small check dams. In many of the canyons, these were small dams of rock or wire-bound rock, that were built from eight to ten feet

in height and anchored to the rock so they would impound silt as well as water.

Simms: I see a lot of those down there in the Whittier Narrows still.

Hedger: Yes. Then the 1917 bond issue also provided for some conservation works, or spreading grounds as we call them. It was passed by a very narrow majority.

Simms: It seems like water bonds are always passed by a narrow majority in this area.

Hedger: Well, that was so in the early days, but the situation has changed in the recent years. In 1924 there was a bond issue proposed which totalled, I think, over thirty-nine million dollars, and that passed by a pretty substantial majority. That's the bond issue that included the San Gabriel Dam, the Forks site. Twenty-five million dollars was allocated, I believe, for that project. Then there was a bond issue proposed in 1926 and one again in 1934. Both failed.

No further bond issues were proposed to the electorate until 1952, at which time the comprehensive flood control system [proposed by the District] had come to three-quarters fruition, you might say, and the need was being felt for supplementary storm drain systems to bring local storm waters to the flood control channels. In 1952, I recommended a storm drain bond issue for the amount of 179 million dollars to the Board of Supervisors, and it [was voted upon and] passed with a four to one majority. Again, in 1958, the people could see the benefits of the 1952 program, and I submitted another [storm

drain] program to the Board of Supervisors [estimated to cost] 225 million dollars. And that again was approved by a large majority. So for a period of time, particularly just before and during the Depression time, the people would not vote for bond issues, but in recent years they have. Another one was just passed [by the electorate] this year. So people still believe in that method of financing.

I should have said that one of the powers given the District was that of financing its works through [the media of] bond issues, which required but a simple majority of the electorate for passage. That's quite important because that, too, was a strong factor in the setting up of a separate district rather than utilizing a county department [to undertake flood control jurisdiction], because the county and the cities all required a two-thirds majority for the passage of a bond issue. And that has been a very strong influence in the financing of flood control works here.

Another power granted the District was the levying of taxes for the repair and maintenance of the structures that were built [with bond-funds]. In the original act], as the limit of ten cents on each one hundred dollars of assessed evaluation was imposed and that was later increased to fifteen cents, that levy is in addition to the tax rate that is necessary to service the bonds when they've been passed. And I believe that the limitation of fifteen cents is still in effect. At the present time, I believe that the tax rate which is due to the bonds that have been voted, increases

the maintenance tax to the point that the total District tax rate is somewhere nearer thirty-five cents on the hundred dollar assessed evaluation.

Simms: That's getting up there.

Hedger: That should be about as high as it will go, because some of the previous bond issues are now being phased out. That is, being paid off, and that, of course, will knock down the resultant tax needed to service the bond issues.

Well, in the things that should be mentioned as of great importance to the early efforts of the District is that, after the 1914 flood, the Board of Supervisors appointed a board of five engineers to study the need for flood control works and recommend what should be done. That report was rendered on July 27, 1915. The engineers that were appointed included J.W. Reagan, Frank Olmstead, J.B. Lippincott, [illegible] Major Charles T. Leeds and Harry Hawgood. All were fine engineers.

There was quite a difference of opinion among the various members of the board as to the best methods of providing flood protection here. It's a little difficult to understand the differences that existed among them today, but if I could take a few minutes to give you a little broader picture of what they had to face, it might help.

Today, we see the concrete-lined channels of the Los Angeles River, Rio Hondo, and San Gabriel River and all of these other rivers, and they're fixed right there. But it wasn't always so. For instance, if you read this volume that

deals with the eyewitness statements of people that lived in Los Angeles County way back in 1870 and 1860, you'll find that some of them will say that in 1815, for instance, [they were told that] the Los Angeles River flowed down [what is now] Alameda Street in Los Angeles, toward Fourth and then turned off toward Exposition Park and out to the sea at Playa Del Rey, and that it stayed in that course until about 1825.

You'll also find that many of them refer to the floods that were experienced in the area between Dominguez and Long Beach as the flow from the San Gabriel River. And that is true. The San Gabriel River at that time came out of the San Gabriel Canyon at Azusa, flowed down to Whittier Narrows along the course that is now taken by the Rio Hondo andon down what is now the Los Angeles River Channel. The San Gabriel River in 1861 or 1862, I believe, overflowed and started a new course toward Alamitos Bay.

Simms: Down there now.

Hedger: But these streams didn't have any positive course. One year they might be here and, another, [in a different location]. I remember well that the same [situation was true] in 1914. In the 1914 flood, there were railroad bridges east of Huntington Park that were left high and dry. The river took a new course and left the bridges sitting there several miles from what [had been the] river channel. Furthermore, the ancient history depicted by this book indicates that, say from Huntington Park and Whittier to the ocean, the area

was a big cienega, as it was called, a swampy area, partly forested by cottonwoods and willows, with lakes and swamps in between. There were no river channels running through that area. The rivers came down through Whittier Narrows or down past central Los Angeles and just dumped their waters into this area and created this marshy land.

Simms: And they brought so much silt with them that they just fanned it out and began to spread.

Hedger: Yes. In 1825, the waters started to break through to the Los Angeles Harbor and from then on, according to the record, the channels became more and more clearly pronounced. And as they did, the water would drain away and the lakes and the forests disappeared. This background shows you that the Board of Engineers was faced not only with shifting river channels, but with a tremendous silt problem. And really, that is the primary problem of the flood control engineer in this area today and always will be. Because if you don't have dams and reservoirs to control the waters, then the silt, as it comes out of the mountains, will deposit in the channels and fill them and [the water will] go a different course. Then if you put those reservoirs in, the silt...

Simms: Piles up behind them.

Hedger: ...piles up in the reservoirs and fills them. For instance, the San Gabriel Reservoir, which I think I mentioned had a capacity of about 55,000 acre feet at the time it was built, was filled to about a third of that capacity with silt

in the first storm that it encountered in '38. And the last time that I checked on it, it had lost about almost 40 percent of its capacity to siltation.

Simms: Did they ever try to do anything about dredging those out?

Hedger: Oh yes, yes. There were several methods that were used to overcome that, [one method that] we call sluicing is a very effective method. The material that is deposited in the reservoirs varies from fine silt to quite large material. The large material is dropped at the upper end of the reservoir with the fine going on down to the lower end. Well, by emptying the reservoir while there is still a continuing flow in the stream from above, you can run that stream on through the silt and sluice the fine material out. We have placed what we call sluiceways through each of the major dams so we can sluice that material right on. And it's amazing how effective sluicing is. You have to put crews in to break back the banks and keep feeding this deposit of silt into the water which carries it out. But unfortunately it just carries it out into the next reservoir downstream. [laughter]

Simms: Right. When you get below the spillway level, though, you have to either breach the dam or bypass the spillway, don't you?

Hedger: Well, we build these sluiceways [through the dam itself]. It's really a tunnel built right through the dam [and discharging] directly into the stream bed. And they're

built so they can be opened when the reservoir is virtually empty. They open full width, so the flow of the stream will run right through as if the dam weren't there, and [the stream flow] will carry the silt on down.

And another method of overcoming that condition is that we hope to in time utilize that material for building purposes. It really is the same type of material that the rock and gravel companies dig out of the stream channels down below [and soil as aggregate for concrete construction]. But it has much more fines in it, because it's all concentrated in one reservoir area and, therefore, it's more expensive to develop for aggregate. But, as the present points of supply are used up, and it becomes more expensive for the aggregate companies to move out farther and farther away from Los Angeles to bring the material in, then they will have to look to sources closer at hand for supply, even if there is a greater cost of removing the silt from them.

Simms: Will they have to dredge that?

Hedger: No, the reservoirs are dry a good deal of the time. Actually, the reservoirs are normally operated so as to have them drawn down to a minimum by about the first of October of each year. I'm speaking of the flood control [operations insofar as] the District [is concerned. We] keep them at a low ebb until along about the first of March and then start to step up the amount of the water stored until, by the middle of April [if the water is available], they're holding as much water as possible. That water is there until about July,

when it's released and put into the spreading grounds down lower where it will recharge the ground water.

Simms: So these gentlemen were faced with these deluges and these shifting channels.

Hedger: That's right; and to get back to that point, I think the majority of the board favored what they called upstream measures. That was the use of the small check dams [previously mentioned] and the development of spreading grounds and channel protection measures.

Reagan was at odds with the rest of the members of the board and wanted to concentrate on improvement of the lower channels in the Long Beach area and San Fernando Valley area, rather than do the upstream work and watershed protection that the other engineers favored. And when he was appointed chief engineer, his ideas won out over the others.

There was an interesting argument, too, at that time, between the engineers as to where the Los Angeles, San Gabriel River, and Rio Hondo should be discharged into the sea. In 1914, both the Rio Hondo and the Los Angeles River came together and passed through the Cerritos area between Dominguez and Long Beach [filled the inner harbor at Long Beach with silt] and then filled Los Angeles Harbor with silt. The San Gabriel River continued its path into the Alamitos Bay [east of Long Beach] as it does today. Some engineers wanted to divert all three of the rivers into Alamitos Bay and so provide full protection to the Los Angeles Harbor area.

Reagan argued against that and proposed containment of

the San Gabriel River into Alamitos Bay, as it is now, and combining of the Rio Hondo and the Los Angeles River [into one channel] and moving it over against the Long Beach side of that Dominguez-Long Beach gap and thence along the west side of Long Beach [to the ocean]. That was done with the help of the federal government back in 1922. Reagan's plan prevailed. The federal government accepted it and constructed the Los Angeles River channel there. That's where it is today, the Los Angeles River outlet combined with the Rio Hondo. The San Gabriel River outlet is still over in Alamitos Bay as it was then.

Simms: Does the Rio Hondo still merge with the Los Angeles River at Cerritos?

Hedger: Yes. The Rio Hondo has a rather interesting history of its own. The lower Rio Hondo was originally the San Gabriel River, as I mentioned. The upper Rio Hondo didn't come about until, I think it was, the flood of 1911. [It started as a minor one] that deposited rock and boulders in the San Gabriel River cone below Azusa in such a manner as to divide the stream. Part of it took a new course down the west side of El Monte while the rest went down the east side. So a new channel was started which became the upper Rio Hondo, one that didn't exist prior to 1911.

Simms: You can look at these things and see some of this old activity on soils maps. You can see these delta deposits as they fluctuated out of the canyons in these fan-type areas, and they wouldperiodically breach the old channel, go

off on another tangent, spreading and giving these different silt depositions.

Hedger: Quite so. That's particularly been the case in the foothill areas on some of these mountain streams. Take the Montrose area. There are seven or eight smaller canyons lying to the north that have watershed areas of but from one to two square miles back, but they are steep and run up to elevations of four or five thousand feet.

In the fall of 1933, we had a [brush] fire [in this area]. I believe it was in November, 1933, and that fire burned off almost the entire watershed of all seven of these streams. Then in December, 1933, there was a very substantial amount of rainfall which culminatedin a terrific downpour on the 31st of December. As I remember it, at one rainfall station located in Briggs Terrace above Montrose, the record showed eleven inches of rainfall in eleven hours.

Simms: Oh my God!

Hedger: It washed all the ash and detritus [left by the fire] down from the hillsides and canyons. There no longer was any marsh or tree growth to hold it back, so it brought all the loose material fromthe hillsides down into the canyons and there was sufficient flow to wash the canyons clean. Tremendous amounts of debris and detritus came out of the mouths of the canyons. It filled the channels. The channels were small anyway, perhaps ten or fifteen feet wide and three or four feet in depth, and it filled them immediately with both water and debris. These channels generally went right down

the top of one of the cones that you were speaking of, so when the channels were filled with debris the water could go either way and did.

Simms: And spread out all over those cones.

Hedger: No one was safe, no matter where they were on the cone because no one knew where the flood was going to go. That was one of the very difficult problems that we had to face in ruling on flood hazards in connection with proposed subdivisions.

That's a story in itself that ought to be given a little more attention, but you can see that in a case like that, with a cone and an unrestricted flow of mud and debris out of a canyon, no one could anticipate where the flood waters would go if the channel were filled [with mud or debris]. So it became necessary to rule that anywhere on the cone, even though it might coverseveral square miles in area, was subject to flood hazard. That was a very difficult problem to resolve in ruling on proposed subdivisions.

Simms: Today, does that hazard still exist? I know we have the forest fires in the Angeles Forest area up there and that periodically it burns off a great deal of watershed. Could we still have a washout like that, a detrital outwash that would fill up thesechannels and still overflow them?

Hedger: Well, I don't think anybody could answer that question specifically. I'd answer it this way. Insofar as a flood volume or mud flow that we have a record of is concerned, the protective projects that have been built could handle

such a situation without any particular damage in the areas where they've been built. And they've been built in probably eighty percent of the exposed areas. But I'll say frankly, too, that when we look at the size of some of these cones, you can't tell, of course, [whether they were gradually] created over milleniums, or whether they resulted from a few tremendous floods. In other words, to be factual, you must consider the possibility that there may have been floods that occurred that were much greater than anything that has been experienced since the white man came to this country. These could happen in just one fell swoop and wipe out all the protective measures that have been taken. But when we get into that, it's virtually an act of God.

Simms: Right. Well, we have glacial melt and things like that that could cause a great many things, but we're not going to experience that now without having some human control over those things.

Hedger: Well, it really is getting down to the question of how big can a flood be, and a lot of effort has been made to determine that. It's still just mathematical computation and nobody really knows how big one could be.

Simms: We've got quite a bit of detail here for about the beginning of the Flood Control District, now I'd like for you, if you will, to reflect on some of the more personal, more humorous aspects of the survey crews, chain gangs, and so on.

Hedger: Well, there were quite a few exciting incidents that

occurred around the Flood Control offices [in the early days]. I remember there was quite a feud that went on between Mr. Reagan and an organization known as the Municipal League. The Municipal League was constantly after his scalp. The main spring of the League's [opposition was its] secretary. I can't think of his name at the moment, but he came into the office one day to demand to see something or the other, and Reagan was there and simply grabbed the guy by the seat of the pants and threw him out.

Simms: [laughter] So much for the Municipal League.

Hedger: That's the way those engineers operated in those days.

Simms: Reagan sounds to be pretty much like a go-getter. He wasn't there to put up with any foolishness from his contemporaries or his colleagues or from the opposition. He seems to be a stalwart thinker.

Hedger: He was a very positive thinker, and a rather astute political thinker too. He was very much [anxious to have] his program adopted over others. And if my memory is correct, he wouldn't hesitate to pull any strings he could politically to obtain that objective. Eaton, on the other hand, was a very sincere man but perhaps politically a little inept, and I don't think he attempted to pull strings politically. Reagan was always working on the editors and the newspaper readers and people that were of some influence.

Simms: Keep the activities of the District before the public?

Hedger: Yes, and there was no civil service in effect at that time in the District, as today, and I can remember when

bond issue elections were called, particularly in 1924, everybody in the District office was sent out to campaign. They probably knocked on doors and rang doorbells and so forth. That isn't permitted today.

Simms: No, not any longer. That was one of the ways of getting the thing started though.

Hedger: Yes; yes, it was and it was effective. And, too, there was so little known about flood control measures at that time, that somebody really had to pioneer in that field. Strangely enough, the engineering societies apparently were on the opposite side of the fence from Reagan. I notice in some of these things I've been reading that there was apparently an Engineering Council of Founders Societies, as they called themselves at that time, and they took a strong position against some of the plans that were drawn up for the San Gabriel Dam originally. And civic organizations took a petty strong part in the picture.

During my period of activity as chief engineer the Los Angeles Chamber of Commerce was quite active in supporting some measures and in opposing others. There was an organization called the Conservation Association which I think is affiliated with the Los Angeles Chamber, and it was quite a powerful influence in the flood control and conservation field.

Simms: I'm a conservationist in that respect. There are various groups who now take a very active part in beating the drum legislatively on things like the San Gorgonio wild area there. It's good that we have a certain amount of

restrictions, you know, checks and balances and things like that.

Hedger: We haven't gone to any extent into the conservation activities of the District. I think all of the chief engineers have felt that the responsibility for flood control measures and conservation measures were about equally weighted. That is, it was just as strong an objective to acccomplish the conservation of water as it was the control of water, particularly in the last twenty-five or thirty years. The District's budget allocations have been pretty strong for the conservation measures.

Simms: I suppose that you'd sort of be unable to separate conservation and flood control because with the very idea of channeling away water you could use, you would begin to reflect on conservation methods.

Hedger: Well, that is true on certain phases. It's not so difficult to distinguish when it comes to reservoir operation. You know pretty wellthat your conservation phase has to give way to the flood control phase in the early period of winter if a conflict arises. For instance, if your reservoir fills in early December, you must get rid of the water you have stored and empty the reservoir just as quickly as you can, even though that may mean wasting some of it.

Simms: Because it will top out.

Hedger: Right. In other words, you just can't accept a situation where you hold the stored water so long that your reservoirs [are deprived of flood control storage space and]

aren't operable for flood control purposes. So there, conservation has to give to safety in flood operations. However, toward the end of the season, when the need for storage [of major flood flows] is largely past, conservation takes over and most everything is devoted to it. Of course, a lot of the conservation activities are devoted to sources of supply other than flood waters in more recent years. The purchase of surplus water available from the Colorado River aqueduct, for example, and use of this water for recharging the groundwater basins. You perhaps know that a water reclamation project has been built in Whittier Narrows which reclaims some of the better sewage outflow that would otherwise waste into the ocean. That's also used for recharge water. Another conservation measure of very considerable importance is that which is devoted to preventing the inflow of sea water into our ground water basins.

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Simms: Very good. Where did we leave off?

Hedger: I think we spent most of the time in the first interview talking about the olden days, the way Los Angeles County looked prior to 1900, we'll say. And, at the moment, it would be well to take up from the time of the organization of the District, say from 1915 and bring it up to date. So, let's go on. Before I do that, though, I'd kind of like to give you a little personal touch of some of the memories I have of the earliest work I did for the Flood Control District.

Simms: Good.

Hedger: As a surveyor on a field crew, first as an instrument man and later as chief of party, I did a good deal of topographic work, as I mentioned. We did our work from camps in the mountain areas. We had a camp at Pacoima Canyon, about four miles east of the City of San Fernando.

I remember going up there with a crew of surveyors. We were supposed to stay at a laborers' crew construction camp, and it was nothing but a bunch of tents with a few laborers and a foreman. We brought our own tents for our own survey crew, and when we went to place them, the foreman called me over to one side and said, "You'd better pitch them down this way a little ways. Don't get too close to the far end of that camp. There's a fellow there with smallpox."

[laughter] That shows how differently things were done in those days than they are now.

Simms: They just let him live up at his own end.

Hedger: Another thing I remember about that camp is that, one Sunday morning, I was awakened by a heck of a furor, barking and whining of dogs and all kinds of cries and noise. I went out to see what was the trouble. One of the laborers had brought some traps along with him (they were almost bear traps in size), and he'd caught a cougar, a mountain lion. He was trapping for the bounty that the state paid on them at that time. This wasa female cougar, and she weighed, oh, 135, 140 pounds. He had a .22 pistol, and he wasn't doing much good with it. [laughter] He shot the cougar several times with that pistol and it just kind of slowed her down and that's about all it did. But after shooting at her for an hour or so, I guess, it finally killed her. In those days, there was all kinds of wild game back in these hills, and the minute you got away from town, you were right back to nature.

Simms: Being an animal lover and seeing the way the cougars have disappeared in this country, it's filled me with a little despair, but that was a good number of years ago when cougars were more unfavorably looked at.

Hedger: Right. Well, of course, they killed a lot of stock. Cattle would range right up through the foothills and the cougars would go after the small animals.

Then we had a camp up in San Gabriel Canyon above the

Forks. To get to it, you had to take the stagecoach. This was back in about 1920, 1921. We'd travel about ten miles up the canyon by stagecoach over the roughest road you ever saw, but it was worth it because there was a beautiful stream flowing into the canyon at that time, and there was good fishing. You could go 150 feet from camp and get a mess of fish without much trouble. So I mention those things just to give an indication of how much of a change there has been.

Well, now to pick up the story from the time the Flood Control District was enacted and became operative. I think I covered the point that, for the first ten or fifteen years, this District operated pretty much on a piecemeal basis. That is, a decision would be made by the Chief Engineer that a dam was needed in one canyon or another, that protection work was needed at another point, and a survey party would go out and take some topography. Then the Chief Engineer or perhaps the chief designer in the office would decide how high the dam should be, not based on record hydrology at all but just on what the physical aspects of the ground would seem to indicate. And the result was that the works that were installed were not interrelated at all, but were constructed generally at the point of greatest need all right, but solely for the purpose of correcting a specific condition that existed there and with no thought as to fitting it in with other portions in the general flood control program.

That method of planning continued until the late '20's and early '30's, at which time the second chief engineer, E.C. Eaton, had the District designers develop the first comprehensive plan for flood control in Los Angeles County. This plan took the structures that had been built in previous years and used them as a base but went further and did include hydrologic computations as to [the major flood flows that] might be encountered on each stream, and what good the existing structure would do, and what would be needed in the way of channel capacity downstream. That plan was made public, as I remember, in about September 1931. And while it was more of a skeleton, at the time, ithhas served as a basis for virtually all the planning by the various flood control agencies that operate in Los Angeles County, including the Flood Control District and the federal government, that is, the Corps of Engineers, the State and even the cities, and even the latters' storm drain plans.

Very little was accomplished toward implementing the comprehensive plan, however, from the time it was introduced until about 1935. The reason was that the proposed bond issues of 1926 and 1933 had failed and the only funds the District had [available for construction were] the bond funds that had been voted in '24 which were allocated for certain specific structures, primarily the San Gabriel Dam, and there were no funds to start any other projects. On New Year's Day, 1934, however...

Simms: Came the flood.

Hedger: Yes, came the flood. In one rather isolated area. It was concentrated in a seven-square-mile area around Montrose.

Simms: It got the Montrose American Legion Hall and most of the people up there.

Hedger: Yes, that's right. It destroyed something like 300 houses, killed about forty people and created damage that was estimated at around five million dollars, all in the course of about fifteen or twenty minutes time. The peak of the flood hit right at midnight between New Year's Eve and New Year's Day. And strangely enough, very little was known about it outside of the area affected. For instance, on New Year's Day, the Rose Bowl game was played about five miles to the east, and I don't suppose that five percent of the people in the Bowl knew that disaster had struck [a few hours before] at just that close distance to the west.

Simms: Jim Mink, the University Archivist, was telling me that in that particular disaster, a husband and wife had gone to a New Year's Eve party and had left their twelve-year-old daughter with her two younger brothers. The daughter had put the kids to sleep and, when the flood began to come, she was awakened by the logs banging up against the house. She saw the water in the front and back, and dressed the two boys, and waded through the water, which hadn't quite peaked yet, to a treehouse their father had built and climbed up into to the treehouse. And when the flood crested, well, of course, it wiped the house and everything completely out,

and then the boys and girl were later rescued. When the parents returned and found the whole place a shambles and a complete nonentity, the woman refused to believe that the children were alive for three days after they had actually found them. She was shocked out of it.

Hedger: Well, that was certainly a serious tragedy to everyone in that area. It so happened that Mrs. Hedger and I lived with our children right in the center of Montrose at that time. Of course, my presence was required in the Flood Control office to help direct the operations, but she was there. In selecting this as a home site, I had looked at it from the standpoint of being high and dry from any possible flood and it turned out that it was. It served as an island of refuge, and all the neighbors came there. I think there were as many as twenty or twenty-five people in the house by midnight of New Year's Eve. I was able to keep in touch with them by telephone until, just at midnight, the phone service went out. And for a period of oh, at least twelve hours, I didn't know whether they were still safe or not.

That flood caused considerable revision of the handling of emergencies in this county. We had patrols out in the area, had emergency storm patrols set up, and would send people out, surveyors primarily, to report back in as to what conditions were. And I kept receiving these reports, and it finally developed that a real disaster was occurring. In fact, I was talking to people onthe telephone when there would be a scream and the connection would be broken off. Their

houses were gone the next day.

But I tried to get in touch with the sheriff and with the police chief of Glendale. It was late New Year's Eve and I couldn't find anybody. When I finally did arouse somebody at the sheriff's office, I just couldn't make them believe that a disaster had occurred. And, finally, Gene [Eugene W.] Biscailuz was located. We knew each other personally, and he passed the word on, and they did start getting police and sheriff's deputies out to the area. But, at that time, there was no system developed for meeting such a situation at all. It was pretty frantic.

Simms: I can imagine. What was the actual cause of that localized situation?

Hedger: Well, the primary cuase I think was the brush fire that had occurred in the watershed a month or so before the flood struck. It burned off practically the entire watershed of this seven-square-mile area, you might say, all the way from La Canada to Tujunga on the slope of the Sierra Madre Mountains. And with that fresh burn and the terrific rainfall that occurred in the last twenty-four hours preceding New Year's Eve (I mentioned eleven inches in eleven hours, following several days of preceding rain), it just brought the whole hillside down and dumped it into the canyons and then out onto the cones.

Actually, measurements made by our District after things dried out indicated the ash and rock and boulders and debris that had been washed out on the flood plains, or cones,

averaged about 100,000 cubic yards per square mile of watershed, an occurrence which was unheard of at that time. No report had been made or was available on such an occurrence in any part of the world that we could determine. It undoubtedly has occurred, but it wasn't recorded anywhere.

Simms: That's a startling amount of detrital material.

Hedger: Yes, it is. It was the debris content, the mud flow, rather than the pure water flow that caused much of the destruction. The tendency with a mud flow, traveling at fairly high velocity, is to go straight ahead and not follow the meanders of the stream, and it would tend to leave the channel even though there was still a little capacity in the channel. It would tend to leave the channel and follow the course that it had been taking. It would go right through houses. There were a number of stone houses, very substantially built houses, that were just washed clean from their foundations by this mud striking into them. It carried them right along with it.

Another thing that was not realized here before was the ability of the mud flow to carry boulders! When the flood subsided in this area, we found a boulder right in the middle of Foothill Boulevard very close to Briggs Avenue, that must have been six feet in diameter. It weighed fifty-nine tons, as I remember. The reason for it being there was that the density of the mud flow was sufficient to support a boulder of that size and let it roll or carry it along.

Simms: It works like a turbidity current.

Hedger: Yes. Same idea.

Simms: Yes, I know personally at first hand that can happen. I was crossing Arizona in 1947 on a Greyhound bus, and a flash flood took the bridge out right smack in front of the bus as we came down the road. It had boulders in it the size of that chair. They were a good four feet in diameter, and where they got boulders like that in those washes, it's hard to imagine.

Hedger: They come from miles away.

Simms: They must have; I mean it had giant saguaro cactuses that must have been twenty feet tall and they were just rolling and tumbling around. It took the concrete bridge out across that road down there by Gila Bend, and it just socked through one of those culverts.

Hedger: Well, this Montrose flood, destructive as it was and causing the sad loss of life that it did, nevertheless, was productive in one way, in that the comprehensive plan that had been developed up to that time [was changed]. While it recognized that mud flows had to be expected, it had made no attempt to control or to protect against their effects. Study of the situations that existed after the 1934 flood soon convinced our engineers that control of the mud content of these flood flows was absolutely essential before any [flood protection could be effective]. Without that control, [mud and debris is] bound to settle out somewhere along the path of the stream flow. If you line your channels and carry it downstream a few miles further, it's going to settle down as soon as the velocity slows down there and you have the

same problem just a few miles further downstream.

Fortunately, the flood itself had pointed the way as to how it might be handled because, at the very western point of the watershed that received this terrific cloudburst, [there was located a] flood channel, what was known as Haines Canyon. It had a rock and gravel pit at the mount and aggregate had been mined from this pit for quite a few years, so it was quite a substantial pit. I don't have the dimensions, but I would guess that it was in the order to one hundred to one hundred and fifty feet in depth and maybe three hundred feet across. It straddled the canyon so that, when the cloudburst occurred and the first flows came down this canyon, they plunged into the pit and the pit had to fill before the water could flow out. The pit didn't hold all the water, but it held all the debris and only clear water passed on downstream. Fortunately, it was not in sufficient quantity to pick up a new load in the unlined channel of the stream, so there was virtually no damage sustained along Haines Canyon Wash because of the protection afforded by this pit.

So that gave birth to the idea that the best way of meeting the situation was to construct such pits at the mouth of each canyon at the point above where the flow would discharge out onto the cone and out onto the flood plain, and trap the material there. They were called debris basins. The comprehensive plan was revised to provide for such debris basins at the mouth of every canyon in the metropolitan area, and I would estimate that forty or fifty of them are in

existence at the present time.

It was realized, however, that once the pits, the debris basins, had been established, it was essential that a lined channel be constructed from the spillway of that debris basin on downstream to a point where the velocities were low enough where they would not cause any great erosion. Otherwise, if we'd turned the desilted water into an unlined channel [at high velocity] it would merely pick up similar material [from the streambed] and you'd create a Grand Canyon down below to contend with. So the system that we devised was to provide these basins with lined channel from [the debris basin] on downstream to a point of non-erosive velocity in each channel. Efforts were made at once to get federal help to construct such a system in the Montrose area.

This was right after the peak of the Great Economic Depression, and the government had set up the Emergency Relief Authority, ERA, which had matching funds to provide for construction of such a system as well as other types of public works. The Flood Control District was able to obtain the assistance of the federal government in financing a program, and I think they raised about thirteen or fourteen million dollars in this way, of which the District had to put up about half, for the construction of a complete system of these debris basins and the lined channels in the Montrose area, primarily in the headwaters of the Verdugo Wash which runs through the Glendale area. The Corps of Engineers was put in charge of that program and finished its construction

in about two years, three years at the most. Strangely enough, we had another big storm in March, 1938. It came close to equalling the high intensities of the 1934 flood in that area and produced almost as much debris discharge, but this time the basins caught it all. Most of the basins were completely filled with debris in the storm and a bit of overflow occurred, but not a bit of damage was occasioned in the area.

Simms: It paid for the fourteen million dollars, just like that.

Hedger: So it really proved the efficiency of that system, too, which was a vital factor, because you can't afford to spend millions and millions without any testing of your product.

Well, that was a breakthrough in perhaps the most difficult part of the flood control program here. It enabled theDistrict to proceed with refinement of the Comprehensive Plan, and also it started us on a working relationship with the Corps of Engineers. Within the following year or so, the demand for flood control work over the whole country had reached the point that Congress was ready to consider the first [country-wide flood control financing legislation]. This was the Omnibus Flood Control Bill of 1936, I believe. Our District, of course, submitted our Comprehensive Plan, and asked for authorization for the Corps of Engineers to construct it as part of the federal program. I believe that our program was the largest submitted in 1936 by any state or other government, because it had been developed on the basis of comprehensive planning and a considerable amount of design had already gone

into it. In other words, we were just plain ready to move if funds were provided. It received special attention, and it was authorized in the amount of about seventy million dollars in the '36 act. And the Corps of Engineers received appropriations for work in that year which initiated the federal phase of flood control appropriations in Los Angeles County.

Simms: Is that what resulted in all these dams like Prado Dam?

Hedger: Yes. The Corps of Engineers, in studying the problem, used a somewhat different type of hydrology than our District had developed, the District's hydrology being based on the maximum intensity of rainfall that had been recorded on the average of once in fifty years, falling on a saturated watershed. That is, it assumed that that high intensity [of precipitation] would fall on a saturated watershed, which would project the frequency of flood flow to well over a hundred-year period.

The Corps, however, had developed its own methods of [hydrologic determination, but fortunately the results were not] too far apart and we had very little difficulty on that score. [However, Corps engineers] felt that the flood volumes in the main river channels, such as the Los Angeles River, the San Gabriel, and the Rio Hondo, were too large to be left unregulated, so they cast around for reservoir sites [in valley areas, since such sites were not available in the in the mountains]. The first that was selected was one that

had been considered by our District, in fact, had been included in our comprehensive plan. That was what is now the Whittier Narrows Reservoir site which was strategically located because it brought about the confluence of the Rio Hondo and the San Gabriel Rivers and thus controls [flood waters from] the whole eastern part of Los Angeles County above that point. It's located just west of the City of Whittier. The Corps decided to propose a dam at that site and went on and located other sites; one was the Santa Fe Reservoir, which was on the San Gabriel River near Azusa, and one was the Sepulveda Reservoir, which is in the San Fernando Valley, Hansen Dam and Reservoir, which you've probably seen, is located out on the Tujunga Wash. [By preparing these dams, the Corps was] able to reduce the flood peaks below these reservoirs to more reasonable proportions.

The revised plan was studied simultaneously by the District and the Corps, and they got together and agreed on it. That has been the official comprehensive plan [both agencies have followed] ever since. It has been a tremendous help to all concerned, because it was a common agreement and there was no dissention over the results.

With the start of the Corps' first appropriation in '37, the costs, estimated of course, began escalating because of the change in the value of the dollar and the inflation that has been experienced. Since then [it has risen] to the point that the total estimated cost of the plan has reached a figure of around 320 million dollars. That included the additions

of these dams that created regulating reservoirs, plus the lining of most of the main channels.

Originally, the comprehensive plan was based on unlined channels in the lower Los Angeles River and the lower San Gabriel, but we quickly agreed with the Corps that the certainty of [being able to confine] flood flows to an unlined channel with flows of the magnitude involved and the velocities they attained was unrealistic and there would be no assurance that the bank protection would remain in place. You might have a river taking off as it did in the 1880's. So of course that really increased the cost, too.

But nevertheless, Congress has consistently authorized additional funds for the project until it is now, I guess, about ninety percent completed. And it should be finished in another two or three years.

I'd like to point out while I'm talking about this problem that the Corps and the District, in their joint endeavors, have been dealing primarily with the flood hazard. That hazard comes from the potential overflow and the destruction created by overflow of flood waters which come from the mountain watersheds or from large watersheds such as the San Fernando Valley. There have always been floods incidental to heavy rains in those areas, and whether people lived here or not, such floods would occur, as we know from the early statements of the old-timers. That hazard can be overcome by provision of the flood control works that have been included in the comprehensive plan. When the plan is

one hundred percent completed, it should forestall any further damage to lives and property due to flood waters from the [greatest of historical storms].

But there's another hazard that comes along with occupancy and development of land by people, and that is the sheet-flow runoff that is created simply because of the construction of houses, streets, parking areas, and things of that sort. It's easy to [demonstrate that such development] greatly increases the runoff, because it seals the ground from absorbing any water, and it also accelerates the concentration of rain-water and rapidity of its runoff. And that's what we call the storm-drain problem.

This was called rather forcibly to the District's attention in the late '40's and early '50's. The Corps program had proceeded along well by that time [and the system's backbone of improved major channels was capable of handling a major flood], when we had a pretty fair flood in early '51. The main river channels were [found to be flowing with far less water than they should]. But, back there a mile or two, or maybe ten miles away from the river channel, the water was flooding over homes and streets. It simply couldn't get to the river channels for [lack of adequate drainage. This situation stressed] that flood control system is not complete unless it has--

Simms: Dendritic drainage.

Hedger: That's right. It has to be able to drain the whole area. You have to get the water to it as well as carry it

along through the system. Every part of Los Angeles County was suffering from that [deficiency, that is, every part that had undergone] any development, because [the need for storm drains is created by the] development of the area. For instance, let's say Ballona Creek, which is the stream that runs from West Los Angeles down to Playa Del Rey, near Venice. I can remember the first time I saw Ballona Creek, in 1920, I could jump across it at many points even when there was a pretty good storm going. It had a watershed of about 120 square miles, as I remember, but the ground was so absorbent that even with an inch or two of rain there was practically no runoff. Now, today, with that area all built up, the homes and streets and supermarkets and things of this sort, a quarter-inch of rain will produce a stream that will be a hundred feet wide and several feet deep. And that's just typical of what happens when man comes in and develops an area.

Simms: My house in Orange County is down in a sink and the water (it must be from eight blocks in any direction) piles right up under the aerial, right there. And there's one little old storm drain about the size of this end table here, and you know that's going to overflow in the first minute and a half of intake. Then the thing just lakes out all over the road.

Hedger: [laughter] It's not an easy thing to handle either, because there aren't enough records to get a good idea of frequency of occurrence of storms. We still lack records

that are sufficient to do that. When the Corps of Engineers first started its program back in about the late '30's, one of the projects that was needed on an emergency basis was in an area in the northeast part of Long Beach, near Signal Hill. There was a depression there, just like the one you're talking about in Orange County. The City of Long Beach, I believe, had puta four-foot pipe in to drain the bottom of the depression out to the [Channel of the Los Angeles River].

Well, it didn't take care of the flooding, so the Corps came in and, basing its estimates on the rainfall records that existed for a few years before that time in that area, came up with a proposal to build a reservoir at the head end of the depression which would be sufficient to impound the excess water and let it drain off gradually. That was estimated to take care of the worst storm that could be expected in a ten-year period. Well, it finished constructing this project, as I remember, in about February of '39 or '40, somewhere in there, and it overflowed twice before that winter season was over. So it goes to show the hazards of trying to estimate the frequency of the periods of high runoff [with insufficient hydrologic data].

Simms: The hydrology is really bad. I did some small dam design down at work. I've done debris dams, and when you'd figure hydrology, you'd always add a safety factor of ten percent. Then somebody would come along and erase that and put another ten percent on. Well, you have to.

Hedger: Well, to go on: the District then was instructed by

the Board of Supervisors to investigate the need for storm-drain construction throughout the county, including all the cities, and to make a recommendation as to what should be done about it. That was along in about '52.

To go back a little, the first thing we did was to go into each of the cities and to the County Engineer's office and ask what they considered to be the storm-drain needs of their cities. Since our District had confined its hydrology and its studies to the Flood Control program before his, we had no data at all on storm-drain needs. Well, we got good response and totaling their estimates all up, it ran, as I remember, in the neighborhood of four hundred million dollars. This was too big a chunk to handle. But by working with the cities and the County Engineer, we boiled it down, finally, to a total of about 140 projects so that the estimated cost was about 179 million dollars. We presented that program to the board with the understanding that the planning would be done by the cities under criteria to be set up by our District so that it would be uniform. The construction would be done by the District so as to centralize that activity. [The $179,000,000 bond issue was submitted to the electorate in 1952 and] was approved by about a four-to-one majority, and it took a little better than ten years to complete all the construction involved in that program. It was our estimate when [the program was presented] that it would take about five years to complete, and the majority of the construction was done in five years. There are, of course, always certain projects

that have difficulties attached to them [and some carried over] two or three years longer. At any rate, when the program was finally finished up here a couple of years ago and the bids on the last project were taken, if was found that there was a surplus of sixty thousand dollars left out of the $179 million dollars, and everything had been built according to plan.

Simms: That was about as close as you could figure.

Hedger: I think I mentioned the other night, too, that subsequently we were called on to make a more extensive additional study of the storm-drain situation. That was in '58, and we found that the total need for storm drains had gone up to something eight hundred million dollars. That was not unexpected, because as you add new land development, you have to provide for more storm drains, too. [And Los Angeles County had] added several hundred thousand people [between '52 and '58. So a storm drain] program of 225 million dollars and seventy-five projects was presented and approved by the voting public.

To phase that subject [out I'd like to point out that] just in the last few months the public has just recently approved an additional program for still more storm-drain construction. So the public in Los Angeles has demonstrated a willingness to support a realistic flood-control and storm-drain program. It was factually presented to them, and they could see the reasons for it and the need for it. And I think one thing that has helped establish its success with the public is that these programs specify where the funds will

be spent. There are no unallocated funds. The [presentation of the bond] issue includes a plan and typical sections of each drain to be built and an estimate for each one, and the District is required to provide that amount out of the bond funds provided. So the public has every confidence that the money will be spent for what they expected it to be. That has been very helpful.

Simms: You said that you took over as Chief Engineer in '38?

Hedger: Yes.

Simms: Between being party chief, on survey crew, [and becoming Chief Engineer] in 1938, what transpired?

Hedger: I may reiterate a little bit of what I said the other night, but I got my first professional job when I returned from a year of enlisted service in the Navy in 1919. I first went with the San Joaquin Light and Power Corporation to work on some dam construction in Fresno County on the San Joaquin River. Then I returned to Los Angeles, I believe in May of that year, to work with the County Road Department; and then I went on to the Flood Control District and entered service there as a surveyor and instrument man. I had only completed two years of college schooling before I went into the service, so I worked a year or two and then went back and finished a year and then went back to work. Finally I graduated in 1924 [with a degree of B.S. in Civil Engineering] from the University of California at Berkeley. I'd been working for the Flood Control District at the times I wasn't

in school, so when I graduated I returned to theDistrict and was reemployed as a draftsman.

At that time Mr. Reagan was still Chief Engineer. (I think he remained there until 1927 or 1928). I was first engaged on topographical mapping of the San Gabriel reservoir site, the Pacoima Dam site, and other reservoir sites in the area, and also some channels. Then I went to the construction division where I designed and constructed some small bridges and some channel protection works. Then, strangely enough, along about in '26 or '27, the District wanted someone to acquire rights-of-way, and I guess no one else would handle it, so I was assigned to that. [laughter] I undertook that activity which gave me a familiarity with the operation of many of the activities of the District, and when Mr. Eaton became Chief Engineer, I was moved into the position of Office Engineer. That was about 1928. I remained there until Mr. Eaton left and Mr. Samuel Fisher was made Chief Engineer on sort of an interim basis in 1934.

At that time, two positions of Assistant Chief Engineer were created, and I was appointed to one of those positions and remained in that position until Mr. Fisher left. Mr. Cleves H. Howell then became Chief Engineer. That was in 1935. Shortly after his arrival, he revised the titles to Senior Assistant Engineer and Junior Assistant Engineer for these two positions, and my position was made Senior Assistant Engineer. Mr. Howell had been an engineer for the Bureau of Reclamation for most of his life and been brought out here by

the Board of Supervisors to build and complete the San Gabriel Dam which was in a terribly difficult situation at the time and had brought much political--

Simms: Grief.

Hedger: --grief to the Board. Yes. And Mr. Howell did a fine job of completing the construction of the San Gabriel Dam; he said that was what he was here for and that he didn't care to remain on the job any longer. So he resigned in October, 1938.

I was appointed Chief Engineer by the Board of Supervisors at that time and remained so until I retired January 5, 1959.

Simms: You seem to be about the longest man in residence.

Hedger: Yes, it was a little over twenty years. However, I was on active duty with the Corps of Engineers for three years during the period from March, 1941, to March, 1944, and Mr. Markham E. Salsbury, who was the Senior Chief Engineer during my regime, was Acting Chief Engineer during that period.

Simms: Was that service experience during the war?

Hedger: Well, yes, I had been in the Army's Engineer Reserve for a number of years and [had the rank of] captain. [At the request of] the Board of Supervisors, in the early part of the war Ihhad been placed in what they called the War Department Reserve Pool, and had sort of a protected status. As soon as the episode of Pearl Harbor happened, I felt that [it created a war situation that fitted] the reason that I'd been--

Simms: Hanging around the Reserves?

Hedger: --hanging around the Reserve for many years, so I

wired for release from the War Department Reserve Pool and asked to be ordered to duty. That was granted, but I had to first pass a physical examination. I went to Camp Haan, near Riverside, and was talking to the sergeant in charge of the medical detail who was asking me all the questions they ask you, whether you ever had whooping cough and so forth, and finally came to hay fever. Did I ever have hay fever? I said, "Oh yes, once in awhile, but nothing serious." I thought nothing of it until two days later I got a wire: "Medical discharge granted because of history of hay fever." [laughter] So I wired an appeal to that to Washington and I got it, but it was subject to what they call restricted duty. It was restricted to the United States. I couldn't serve outside. So I was sent to Washington to the Office of the Chief of Engineers, and I stayed there in an armchair all during the war, much to my disgust.

But this service turned out to be a very valuable asset to the Flood Control District later on for the reason that I was put in charge, back there, of military construction, first as the Captain of Engineers of the area here in the Sixty Service Command, that's the west coast, and later as a Lieutenant Colonel in command of all military construction in the continental United States for the Corps. And in that position, my responsibility was to defend the budget for construction purposes for the Corps. So of course I got well acquainted with [the procedure entailed in preparing and defending a budget] and that didn't hurt a bit when we were

defending the Flood Control District's application for Federal funds a few years later.

Simms: That's quite a responsible position, especially in wartime, to have that area.

Hedger: Well, yes. Of course, I had considerable experience in construction on major works. We were still building some dams and lots of major channel works while I was Assistant Chief Engineer and during my Chief Engineership between '38 and the start of the war. The Corps knew that, and they were looking for somebody with that type of experience. So I was just shoved right into that spot and [had to take it] over.

It was a challenging thing, all right, and it was certainly vital to the war effort. When you stop and consider, you can't start to develop an Army until you have training aids, airports, cantonments, arsenals, hospitals, and so forth. You have to have all of these things before you have a place to move the men to and start training them. So the immediate construction of these facilities by a trained organization is vital to the war effort. It turned out to be a very interesting assignment. It was a tough one, but I enjoyed it just the same.

Well, to get back to the Flood Control: I think that brings us up to date pretty much on the flood control phase of the District's work. We haven't touched on the conservation end and I would like to say a little about that. The conservation of flood waters, particularly, was not too important in this area until the population expansion started in 1910--well, let's say from 1900 on, because the LosAngeles City water

authorities began to realize about 1900 that they had to have more water than just that supplied from local resources, and they started planning on the Owens Valley aqueduct at that time. But of course that helped only the City of Los Angeles. It didn't help the rest of the county. Nothing was done for the rest of the county, and as people moved in and settled in areas outside of the City of Los Angeles, they either got their water from some local water district or water company that pumped water from underground for its supply, or these people installed their own pumps. Everything was obtained by pumping, or in a few cases by direct surface diversions. Pasadena, for instance, diverted water from Millard Canyon up in the Arroyo Seco [into its water system,] and there was quite a large diversion of water at the mouth of the San Gabriel Canyon which went to Azusa and to the irrigation of many of the orange groves and lemon groves in that area. But no imported water supply was available at all.

The ranchers and the outlying people began to realize that they were draining water faster than it was being replenished. So conservation was written into the flood control act [of 1915 as an equal partner with control of flood waters]. After the [build-up of ground water levels due to the] flood years of 1914 and 1916 had subsided for while, conservation became more and more pressing as the water levels began to drop. In the earliest days that I can remember, there were two fairly sizable water replenishment operations underway, by private interests in Los Angeles County. One was at the mouth

of the San Gabriel Canyon and was run by an organization known as the Committee of Nine, mostly Azusa ranchers, I think. And then, out on the San Antonio Wash, on the east line of the County, a large spreading grounds was operated by the Pomona Valley Protective Association. The replenishment operations in general at those points consisted of diverting water from the river channel by means of a weir, and turning it into a series of ditches and just letting it run down and spread out over the area from these ditches.

The District did a little research seeking better methods, and came up with a decision along in the early '30's that a more efficient method of replenishment was to use basins instead of the channelization system. It still involved diversion of the water from the main river channel by means of weir or other structure and of a canal to connect the point of diversion with the basin, but the actual spreading was accomplished by turning the water into a basin and letting it seep into the ground and allowing it to dry up perhaps once every month so it could be plowed and renewed as to its effectiveness.

TAPE NUMBER: TWO, SIDE ONE

July 8, 1965

Simms: I talked to Louis Alexander today for about two hours, and we discussed his position in the Southern California Water Company and some of his personal background and some of the remembrances he had of Mr. Lippincott.

Hedger: My aqquaintance with Louie Alexander goes back to my high school days. I've forgotten at the moment if we were in the same class [at Long Beach Polytechnic High School]. I think he was a year ahead of me, if my memory is right; but we knew each other casually, and then, of course, we began to see more of each other in the '30's when I moved into a position inthe Flood Control District that gave me contacts with the water company representatives. I would say that since the '30's our contacts have been quite frequent. I've always enjoyed Louie, both as an individual and as an engineer. He's a very good engineer and he certainly has a fine background of water development work.

I mentioned previously that the Flood Control District has [two prime areas of concern]: one, flood control; the other, water conservation. We have tried to build up the water conservation activities over the years, far more than they were when I started into the organization. As a result, we had quite close connections not only with the water companies but also the associations developed by the companies. After six years it's a little hard to remember some of thenames

but there are two or three organizations that cover the pumping interests of the coastal plain--the Santa Monica-Redondo area. Louie has always been active in that group, and I think perhaps he has done as much for water, particularly ground water development, as any individual in the county.

I meant to say something more about the conservation activities of the District. I think we passed over them somewhat lightly in previous discussions. When theDistrict was first formed, there were only two major water spreading operations underway in southern California that I was aware of. One was conducted by the Pomona Valley Protective Association out in the San Antonio watershed, and the other was called the Committee of Nine, a spreading activity at the mouth of the San Gabriel Canyon. We realized that not only should those activities be continued and expanded to take care of all of the water that might reasonably be considered available from the natural watershed but also that we should go much farther and attempt to obtain foreign water, such as surface water from the Colorado River and othersources, to use for replenishment of ground water supplies. We also finally wound up getting into the sewage reclamation program, which is an active phase of the operation today.

I think that Los Angeles has been a leader in that direction. I know that there are one or two other agencies throughout the country that have undertaken some similar activities, but I think they are mostly in the industrial field rather in the field of domestic water supply, and the operations here are

considered pretty much of a pattern likely to be followed in other parts of the country. Actually, the ground water resources of this county are tremendous. Again, remembering that my memory [as to statistics] is getting a little rusty, there is something in the order of four million acre feet of ground water storage in the county, whereas I imagine the total surface water storage from all the reservoirs (that is, water supply reservoirs) in the county wouldn't total more than two hundred thousand acre feet, or something of that sort. So you can see the tremendous amount of underground storage capabilities that you have. Furthermore, ground water supplies are less vulnerable to destruction by earthquake, military action, and disasters of that sort. They are less subject to contamination in general. They can be subjected to contamination all right, but if watched carefully they're less vulnerable than surface sources. And in the last analysis, they are the principal water reserve that you must depend onif something happens to your imported water supply.

Simms: This is why Louis was so prominent and active in the West Basin and the Central Basin areas in building ground water barriers against saltwater encroachments, because if those things hadn't been done we would have lost more wells than we actually have.

Hedger: That is dead right. In the West Basin, they lost several wells [through seawater intrusion] before we got started, and we were very fortunate to get the State Legislature to give us some financial aid in getting that project started.

Simms: El Segundo has lost all of their wells. They are one hundred percent on MWD.

Hedger: Is that so? I hadn't been in on that. Well, certainly [the trend of seawater intrusion] was going inland, all along that coast. I think that the Flood Control District in another year or so will have a system completed that will develop a barrier to stop any further encroachment of saltwater [in the El Segundo area]. Of course, that's not only expensive but, in addition, it's a water user in itself. That is, you must have clean water, fresh water, to inject in order to stand off the saltwater intrusion. So it's self-defeating to some extent in that respect.

The water conservation activities of the District finally evolved around to building and operating the large number of water spreading grounds which you may have seen.

Simms: Whittier Narrows.

Hedger: Whittier Narrows is one location, yes. The [spreading grounds are composed of] basins mostly, which are served by diversion structures that turn the water out of the natural channel into the basin area. [Water is then alternated from] one basin to another so that the basins will have a chance to dry up and restore themselves. If you keep pouring water in indefinitely, it slows the percolation rate and finally will practically seal up the basin. So you have to alternate them to keep them from doing that.

Simms: Orange County is doing that down on the Santa Ana, near Yorba Ridge.

Hedger: Yes. Actually, they've been in that business as long as has the Los Angeles County Flood Control District, perhaps even longer, because they had water from the Santa Ana River before the District had a supply. The Azusa organization, I think, was the first one in the field [in this County] and perhaps we were next.

We soon realized after getting into the water conservation activity as strenuously as we did that our own flood control works were defeating our purpose in some respects. That is, in building concrete-lined channels, we were sealing off the percolation of flood water that went into them in their natural state. One of the activities that was undertaken while I was [Chief Engineer was the] making of a study of each proposed project that contemplated a lined channel to determine the amount of ground water replenishment that would be lost as a result, and to consider if the loss were of any substantial nature, and the development of a plan for a spreading grounds which would serve that same purpose, off channel, [as had the old natural] channel. I would estimate that by now the Flood Control District must have at least fifteen or twenty spreading grounds and probably a total of around three or four thousand acres of land devoted to that purpose. So it's quite a major activity of the District.

Simms: You were mentioning that the dams are often drained to keep them from overflowing.

Hedger: Yes, there are several factors that occur from time to time that cause the release. [One of the most common

causes for complete] release of water from the reservoirs is that after a major storm has occurred, it is commonly found that enough silt has entered the reservoir [and deposited so as to interfere with operation of the outlet] works. You must open the valves and release all the water in the reservoir so you can get down to work in the dry to restore [outlet works to operable condition, for] without them, you have no control over the storage in the reservoir at all. So quite frequently it's necessary to remove the water from the reservoir for that purpose. However, it's always done in a way that permits you to [route the water to] a spreading ground and put it into the ground water.

Simms: I was wondering if there was some method by which at the end of these major flood control channels, instead of having this water just all run off all the blacktop, it could be collected in a system of siphons at the end of the channels and pumped right back up into the reservoirs rather than let it get out into the ocean.

Hedger: Well that has been studied and found to be impractical from the standpoint of the cost of the pumping capacity that would be required for that purpose. Your pumping capacity would lie dormant for many years, and then you'd have to have a huge capacity for just a one-shot operation for a short period of time. It wouldn't prove practical from that standpoint.

Also, another factor that comes into the picture is that much of the runoff from paved areas, streets, apartments and so forth, is contaminated from gas and oil drippings and so on,

and it has to be so handled that it doesn't contaminate the ground-water supply that it's put into. Of course, we have various grades of ground-water purity. In many areas the water is just as good as nature provides it. In other areas it has deteriorated due to industrial waste. [And, if it is for industrial use or something similar], you can afford to put water underground that you wouldn't dare put [into use requiring] a cleaner source of supply. You'll find that there are spreading grounds located just short of the sea [to serve this purpose]. For instance, along in the Dominguez Hills area, near Long Beach, the flow from the Los Angeles River is diverted and put underground, but it's in an area where the water is used more for industrial purposes than for domestic purposes.

Simms: I was thinking of a series of these big storage tanks like theSouthern California Gas Company has down here. Every once in awhile, you could just run these things off into the siphon and fill up these tanks. They must have at least a ten-million-gallon capacity in them or something like that. That wouldn't be a very sizable amount of runoff, but that could be held up in a series of tanks and then later filtered and reclaimed that way.

Hedger: Yes, but you still have to work within the confines of economics, because you can usually buy water for domestic purposes [from someone] and the District can't afford to spend more money to provide a similar amount of water [with such works than it would spend getting that water elsewhere]. So your economic limits do have some significance there. Well,

I would say that the District is now doing just about everything that can be economically justified in the field of water conservation and replenishment.

Simms: In areas like New York, certain schemes like this might be more feasible than they would probably be here.

Hedger: Have you ever been on Long Island?

Simms: Yes.

Hedger: I think they have developed water replenishment about to as high a degree as any place [outside the Los Angeles area that] I know of. All over Long Island you'll find little water spreading basins that are fenced off. They pick up, just as you were suggesting, runoff from storm drains and street runoff and put it underground where it can be pumped out again from the local supply.

I had some pictures I took last year of some of the installations they have, and I think they've developed them perhaps a little more highly than we have in the spreading areas here. But they are small. There are lots of them, but in small units, because they don't have large watersheds in New York; they have to develop the smaller ones.

Well, I'm pleased that you talked to Louis Alexander. I imagine that Louie can give you as a good a background of the early water pioneers here as anybody you could find.

Simms: I didn't get a chance to talk to him a great deal about them, but he's proposed that once he gets this draft that he will go back over it and say some more about Lippincott and a few of the these other people that he has known.

Hedger: Yes; I would say the two outstanding personalities in the water field from earliest days here in Los Angeles were Lippincott in the private field and Mulholland in the public field.

Simms: Did you know these two individuals?

Hedger: I knew Lippincott. I didn't know Mulholland.

Simms: What can you tell me about Lippincott?

Hedger: Well, I was just a young engineer breaking in, I first met him, and I didn't know him well, but I was very much impressed by the influence he exerted. He was the type of person that, once you entered the room with him, you [immediately recognized] his knowledge of water and his authority in dealing with it. I think he was a great person to help other engineers, too. The chap that can give you more information on him, I believe than anyone is Kenneth Q. Volk. He worked in Lippincott's office for many years. But Lippincott not only led the field of private practice in water; he was also an outstanding professional man. That is, he was active in professional society work and things of that sort and did a great deal, I think, for the engineering profession here in Los Angeles.

One thing I was going to add to what I told before was that I've been thinking about what factors might be considered as the most important in the success that's been experienced in flood control and water conservation work by the District. I came up with these thoughts, for whatever they're worth.

Probably the most important factors were the floods themselves and the droughts--that is, the demonstration,

the public got by the havoc the flood wrought and by the serious water shortage that came from drought. But you have to add to that as very important, I think, an informed and enlightened public, and one that would respond and would be willing to move forward in solving these problems, which you don't always find. By "public," I mean not only the electorate, but the public organizations like the Chamber of Commerce and the Municipal League, organizations of that sort. They have to have the foresight to see a long way ahead of the time when the need actually develops that things must be done to meet the water requirements and the flood control requirements, too.

Then, of course, I'd want to add the fact that the District has always enjoyed [the service of] dedicated personnel; I guess that is what you'd call them. I've worked for a number of organizations and I don't think I've ever been in any, except perhaps the Army, where people were more interested and devoted in carrying on their work, even to the extent of jeopardizing themselves in so doing during some of the flood periods that we've had. We had some pretty fair flood years in the '30's, as we've discussed, and it was a very difficult thing to expect [of District employees] to go to rescue people from homes when they were jeopardizing their own lives in getting them. We certainly had an outstanding group of people willing to do that, and others who were also vitally interested in getting the engineering work done that was needed. I'm sure that the personnel of the Flood Control District, and I'm talking

about the engineers that were out on the desk, the fellows that do most of the detail work, are entitled to a large share of the credit for what has been developed here.

Then, of course, the entry of the Corps of Engineers into flood control work gave us a tremendous boost. Without their entry into the flood control scheme of things here, it would probably have taken at least twice as long. [Even with the Corps' help], it's taken from 1935 to about 1967 to finish [the Comprehensive Plan] as it is. So there's thirty-two years [of joint effort]. But it would have taken much, much longer than that if the county had [had to go it alone]. One thing that mustn't be overlooked is the value of the Comprehensive Plan, the basis for the flood control and conservation program that was developed by the District. It was started in 1933 or '34 and expanded after that, but it served this purpose. It was a comprehensive review and plan of what would be needed all over Los Angeles County in the way of flood protection and also water conservation.

The Corps of Engineers was authorized to undertake flood control works on a national basis by Congress in 1936, which was the year of the first Omnibus Flood Control Bill. We were one of the few local agencies in the country that had a plan of that nature developed and, as a result, the first Omnibus Bill included the entirety of the Los Angeles County Flood Control plan, which gave us a big head start. And it served, of course, as a guide to all the work that the Corps of Engineers has done and all the drainage work, everything that has been

accomplished since. So I'd say that has been invaluable to the work that has been accomplished, and I think that it served as a very effective example for other agencies considering flood control programs of their own.

Then, finally, I think that the system set up by the District to acquire lands and rights-of-way has been a very important factor. That seems quite technical, and in a way it is; but if you will observe the activities of some of the other public agencies in acquiring lands, you will note that it takes years to get the rights-of-way cleared for a project. When the U.S. Congress authorized flood control work to be undertaken by the Corps of Engineers as a national activity, it was financed on the basis of annual appropriations which would revert to the Treasury if they weren't utilized. So it became incumbent on our District, which had to supply the rights-of-way needed for the work, and to make certain that the right-of-way was available at the time the funds became available. Otherwise, a year's delay would [cause the loss of] the entire appropriation. So we devised a method of utilizing eminent-domain proceedings in every instance.

In each case, we would prepare our drawings and plat descriptions of the property we were taking, have an appraisal made by independent appraisers, file condemnation proceedings in court, and obtain a court order for immediate possession. We would then negotiate with these owners for a settlement within the limits of the appraisals, but a settlement came afterwards--after the order of possession was obtained. And

that, I think, has been one of the key factors in [making the rights-of-way available when needed for Corps of Engineer construction].

Simms: I can see an awful lot of stalling around on those things.

Hedger: Well, it's natural. Many agencies have the feeling that people resent eminent-domain proceedings, or condemnation proceedings, as they're called. But we never found that to be true. In fact, the people we dealt with, and there were thousands of them each year, seemed to appreciate the fact that everything was conducted in an orderly manner, everybody was treated the same way, and no favoritism or exceptions were made. Furthermore, when we went to court to get an order of immediate possession, we had to deposit funds with the court in the amount of the value of the property as set by the appraisers. So the owner knew that amount of money [was available to him and] that he could count on it [in fact, could draw upon it promptly if satisfied with the appraisal].

Simms: Well, I've always been against eminent domain. You remember the guy that they tossed out of his house to build a museum out there. That type of eminent domain has never been really in the best public interest. But I believe in it absolutely where the public affords the private owner a fair remuneration for his property. Then there is nothing wrong with eminent domain, because it benefits everybody.

Hedger: Well, really it should be based, of course, on public necessity--the absolute necessity of the development. But

once that's established, it's a fairer way, I think, than going out and trying to make a deal with each owner as is often done.

Simms: There are too many cases where some high mucky-muck wants to condemn somebody else's property to put a gas station on it, you know. Then you're in bad trouble.

Hedger: You've talked to Max Bookman, haven't you? No doubt he gave you some interesting material.

Simms: Yes, he gave some commentary on eminent domain that I can recall. Max is one of the key people in this area of litigation activities. I mean, he's had a lot of experience with legal aspects. Of course, there are a lot of things he can't say simply because litigation is bound to a certain amount of ethics.

Hedger: He's now being retained by the City of Glendale in its water dispute with the City of Los Angeles. I happen to be a member of the Glendale Public Service Commission, so we're on the same side in this activity.

There is another subject connected with the flood control-water conservation problem that I'd like to discuss briefly and that is the disposal and waste problem. I think that Los Angeles's future is going to depend upon how efficient a system is developed for disposing of all kinds of waste products. Now, probably the flood control wastes are only minor elements in [the total problem of waste disposal], but they are still an important source of waste products. By flood control waste, I mean the mud and debris that comes out

of the mountains and fills the channels and reservoirs during major storms. You can see, with a moment's reflection, how important that is. Take the largest flood control reservoir that we have, for example, at the San Gabriel Dam. The reservoir it created had a capacity of 55,000 acre feet at the time it was built, and just a few days after the dam was completed, it had to handle the great storm of March 2, 1938, that filled about a quarter of its capacity with sump and debris. So when you consider that the dam cost seventeen and one-half million dollars, then, in effect, you're paying over three hundred dollars for each acre foot of reservoir capacity; if you lose twenty-five percent of that, it's a pretty expensive loss.

Simms: One storm costs about five million bucks.

Hedger: Yes, that's right. We devoted much study to seeking ways and means of overcoming that [type of loss]. I received authority from the Board of Supervisors to set up a special study group to study the possibility of first keeping the trash back in the mountains where it belonged, and then finding economical ways of removing and disposing of it after you had held back all you could. Quite a bit of progress has been made in that respect.

One thing that I think will be very helpful in time is that the material that's trapped is essentially the same kind of material that's used for concrete aggregate. The companies that mine aggregate down in the valley floor aren't interested in it at this time because it's cheaper for them to operate

in their own locality. But some day, they'll mine these locations out of material, and I think they'll be looking for new sources of aggregate. In fact, such an operation has already been started at Devil's Gate Reservoir, which is about half full of rock and sand. About half [the flood control regulating] capacity is gone. Then the District devised ways of sluicing much of the finer materials away during years of plentiful rainfall. That requires a careful balance because, in sluicing, you have to let all of the water out of the reservoir; you hv have to provide a sluiceway through the dam at the bottom of the reservoir, and then flush the water through. That silt [that is flushed through], of course, is either going clear down to the ocean or it's going to be trapped somewhere along the way. You don't want to waste the water that carries it either, so you have to operate so you can pick that water up and get it back into a spreading ground [somewhere along the line]. It makes a neat problem to handle.

Simms: These pits downstream should do something because you can siphon the water off about as fast as it rises, and the debris of any real nature sinks. Of course you're going to have filtration for all your fines, because even though you get your heavy sink out, of course, your fines will go on and on.

Hedger: Yes. It's surprising how well the material distributes itself in these reservoirs. The heavy stuff, as you would expect, deposits itself immediately upon entering the upper end of the reservoir. Then it grades down until the stuff

that gets down to the [lower end of the reservoir] is generally the finest sediment. So from the standpoint of the rock and gravel producers, they would have an excellent grading of deposited material. If they want rock, they can go upstream to get it, and if they want sand they can go downstream.

Of course, that is only one phase of the waste problem that Los Angeles County faces. Rubbish disposal is a much greater problem and a continuing one. While I think the cut-and-cover bill has done a tremendous job here, obviously, it's going to get tougher and tougher to find places for it as time goes on.

Simms: Not only that, but as you get more and more of these big rubbish areas, you have to be tremendously careful that they don't contaminate the water basin, because there is a lot of that.

Hedger: Very careful.

Simms: Especially over here around the West Basin, Manhattan Beach, in that area over there. They used to have some garbage sites that now have rotted through and it has gotten into the aquifers. Water-quality people down there are highly concerned about this.

Hedger: Yes. Of course, other forms of this waste disposal problem include sewage reclamation. Air pollution is another, but from the observations that I've made in traveling in other parts of the world, it just seems to me that nearly all of the ancient civilizations have been covered over by their own wastes and that was their downfall. I firmly believe it

could happen here, if there aren't some strenuous efforts made to find practical and economical ways of disposing of these [wastes instead of letting them] cover up what's already there. And really, I think that's one of the greatest problems Los Angeles faces in the future.

Simms: We need to invent a thing like these two coils that disintegrate anything you pitch into the center of them.

Hedger: Yes. [laughter] Well, I really think the best answer, if one can be found, is consumption of the waste; that is, utilization, like this debris in these reservoirs. Utilize it for building materials and things of that sort. That's really the perfect answer, if it can be done. But you always have to face up to the economics of the situation, too, and that's what defeats a lot of the ideas as to how it should be done.

Simms: You have traveled around a bit, haven't you? Jamaica isn't the only stop on your run.

Hedger: Well, this is my third trip down there. They had an interesting problem there, in that the City of Kingston is a growing city, with a population of 400,000 people; and it's on the harbor, which is hemmed in by steep mountains. The only way they can expand is to the west, which is in a flood zone. There are about eighteen square miles there that are flooded by the Rio Cobre and a stream that's called Sandy Gully. I went down there first to helpon the design for the project for Sandy Gully which runs right through the City of Kingston and, in 1963, which tore out a good part of the town. They

are constructing a thirteen-million-dollar project there now and have it about sixty percent completed. Its design is similar to our Los Angeles River--looks a great deal like it and is about the same size. It has a concrete-lined channel about two hundred feet wide and twelve feet deep, and it turns out into Kingston Harbor through a system of levies and jetties. Now they're getting ready to undertake similar planning on the Rio Cobre, which is the next flood channel out of town. [These projects are absolutely mandatory for] that's the only area that is available to them for expansion.

These Jamaica problems have been interesting, [as most foreign flood control and water conservation problems seem to be]. I was in Cyprus two and a half years ago on a water conservation mission and set up a scheme of development in water resources there, and also spent some time in the Philippines on a similar mission, setting up a water resources development program.

Simms: Specifically, this has to do with ground water?

Hedger: No, all types of water resources development in both cases. The need in Cyprus was not for flood control. It was for water supply. It's a peculiar situation, in that the island, which is rather small, has mountains that rise to around six thousand-foot elevation and have a fair amount of snowfall. But the runoff is [fast and of short duration, particularly] on the steep slopes to the north, whereas the capital, where most of the water is needed, is on the other side. And yet nobody is willing to have any of their water

diverted. So it was a case of trying to show them how to make a water resources study in a way that would convince the people that live on the north side that they will still hv have enough water.

Simms: It's a northern California-southern California thing.

Hedger: Yes, it's the same situation. In the Philippines it was a little different, in that much of the country is virtually undeveloped in many of the outlying areas. In fact, when we went down to Mindanao, they'd just opened up a road two weeks before we got there. It was the first road through an area of several hundred square miles.

Simms: I've walked around on the paths that they probably used to build the roads on. You know, the one big trouble they have over there is that they have quite a bit of rainfall but their problem is that they can't store it. Their ground is minimum anyway, and it's all volcanic underneath. So it's all saturated, what soil they have, and if they dig cisterns and try to store the stuff, it contaminates so fast in that subtropical atmosphere and it breeds so many mosquitoes, especially a malaria-bearing mosquito, that they can't have these cisterns.

Hedger: They are building some dams and reservoirs in Luzon, but only for power development. So far, they haven't gotten into the water storage. But we set up a program whereby they would spend the next few years in analyzing and locating all the best damsites and reserving these for future development--in effect, working out a comprehensive plan for water resources

development which would be their guide for the future. And in these nations, I've tried to work it out in such a manner that this country would not send over somebody to do it for them. We sent a trained crew to teach them, to take one specific project and go through it with them, and let them develop to where they could handle their own studies after that. It's worked out pretty well.

Simms: You know, when you start looking around today at the different kinds of water problems, you realize there are more facets to this thing than you first think.

Hedger: There's growing recognition among engineers for a need for more sociological studies in connection with their planning. For two years since I retired [from the Flood Control District], I have served as chairman of the Water Resources Planning Committee, a national committee of the American Society of Civil Engineers, and probably the most important work done in that time was the preparation of a resumé of basic principles of water resources planning which has served as a text, almost, to carry along with me when I was on these missions. It's been very enjoyable work, and I feel that a lot of progress has been made in the last few years in water resources planning. Well, I think I must be overloading your system here with personal details.

Simms: Oh no. There are two facets to this whole program. One is the history of water resources from you people that were pioneers,and the other is the personal background of you people as members of this historical sphere. The fact that

you were voted Los Angeles's Engineer of the Year in 1966 is as important to us, really, as far as our objectives are concerned, as how we spent fifteen million dollars on the last flood control project. In that respect, I've been trying to get people like yourself to tell us more about what you personally recollect of what happened to you.

Louie, for example, was telling me of an incident when he got out in the Mojave and found his canteen was empty. He figured, "Well, I can't make it back under these circumstances," so he found the biggest creosote bush that he could find and he lay up to it until the sun went down. He chewed some rocks, and the people back home got terribly worried about him. They built a big fire and put a reflector behind it and shined it up in the direction where they knew he had gone. He zeroed in on that as soon as the sun went down and found himself back at camp about nine that night. He later discovered that his canteen had a pin-hole leak in it that had just soaked the water out into this canvas cover and evaporated. His bones could have bleached easily, you know; but he played it pretty cool and got back to camp.

Hedger: You remind me of an episode that was connected with water in a general way. In 1923, I was engaged by the Los Angeles Department of Water and Power to join a survey force that was sent up to the upper Kings River to take the topography of some prospective reservoir sites and run some penstock profiles, and so forth, for water and power development. I wasn't out of college at the time, just in my

junior year, I believe. And so I signed on as an instrumentman. We went up, I believe in mid-June or July. At that time, you had to drive to a place called Hume which was a lumber camp [in the mountains east of] Fresno. Then we had to ride pack animals in for five days.

I've never forgotten that because I had to carry a twelve foot stadia [laughter] with my hands and still ride the horse. We packed into the South Fork of the Kings and part of the group split up into several survey parties. Two or three parties went over the divide and down into the Middle Fork of the Kings to a place called Tehipite. It's a dome something like El Capitan in Yosemite Valley. We were up there for better than a month and a half, maybe two months, and we didn't see a soul there besides ourselves. The territory was absolutely unexplored at that time, we thought. Butone day I remember sending a couple of rod men up to run out a penstock line. I was with the transit down in the bottom of the valley, but they got up about two thousand feet above the valley floor and it was so wooded that they had to climb a tree before I could see the rod. When they came back, they told me that they set their rod on a hand-made spike that they found on a limb of this tree, maybe twenty-five feet above ground. Apparently some miner or somebody had been in their many years before and had driven that into the tree when it was a small tree.

But, at any rate, I was going back to Berkeley for my senior year in late August and I didn't look with any anticipation

to the five-day pack trip, astride a horse, to get back. Looking at the maps, I found that above Tehipite Dome there was a mountain called Spanish Peak, about ten thousand foot in elevation, and a ridge that ran straight down to the junction of the Middle and North Forks of the Kings. It had a trail marked on it that was called Rogers Ridge Trail, and it was about thirty miles in length. It dropped, well, practically nine thousand feet, because the elevations at the bottom were about one thousand feet above sea level. So I decided I'd take that trail as a shortcut. I got one of the packers to get some food fixed up for a lunch and got him to take me up to this mountain on a horse. We camped overnight there, and then the next morning he turned around and went back and I started down the Rogers Ridge trail afoot.

How I happen to be here to tell the story is beyond me, because it was the wildest kind of country. I didn't see anybody, of course, during the trip, and I made it down to the bottom by that night, but going downhill, nine thousand feet in thirty miles, is really something. My toes wore their way right through the shoes, and were just a bloody mess. I saw bear and wolves and kinds of wild animals, but fortunately all at a distance. There was no trail evident, but I saw some ancient diggings that some early miners had made.

Everything went well and it was a fair route to follow until I got to about the last three or four miles. Then it pitched right down. There was no ridge; it just broke off in cliffs. So I had to start going down gullies and occasionally,

I'd come to a waterfall and have to back up. The middle of August is awfully hot, and there were rattlesnakes all over. But someway or another, somebody held my hand and I got down to the bottom all right. Of course, I was completely exhausted. There was a powerhouse on the North Fork and a road leading up to it. I stumbled across the road and just fell right into the cool water and lay there completely exhausted. I guess [I stayed there for an hour or so before] I dragged myself out and into the sun to dry out. As I did, here came an old Ford. The driver pulled up, picked me up and drove me into Fresno. So it all worked out fine. That's probably the most desperate situation [laughter] I've been in.

It leaves you, though, with a tremendous love and respect for that kind of country. I've never lost my admiration for it.

The following material was added by Mr. Hedger in written form:

Before this interview is closed, I think that something more should be said about some of the people that have taken leading parts in bringing flood control and water conservation to Los Angeles County.

The Board of Supervisors of the County, serving exofficio for the Flood Control District, has been one of the strongest factors in support of these programs. Each board has selected one of its members to have responsibility for flood control

matters, and in nearly every instance the Supervisor so named has been a powerful influence in advancing the planning and submission of flood control and storm drain bond issues, the adoption of the Comprehensive Plan formulated by the District, and other important phases of flood control accomplishments.

My earliest memory of a County Supervisor having responsibility for flood control affairs was R.F. McClellan of the Fourth Supervisorial District, who held this post most of the period of J.W. Reagan's tenancy as Chief Engineer. I do not know if he was in office and active in securing passage of the Los Angeles County Flood Control Act by the State Legislature in 1915, but I understood that he was a strong and influential supporter of the first flood control bond issue proposed in 1917 by Mr. Reagan. This issue was approved by a small majority in the amount of $4,450,000.

Supervisorial responsibility for flood control affairs was subsequently shifted to the incumbent from the First Supervisorial District located in the easterly part of the County, and outstanding leadership in the submission of later bond issues and other flood control programs has been exercised by a succession of these Supervisors. Supervisors Herbert Legg and William A. Smith were particularly effective in advancing both flood control and water conservation programs during the 1930's and 1940's, one of the most critical periods of the Flood Control District's history due to the hysteria and political pressures attributable to the loss of life and heavy damage suffered in many parts of the County during the great

floods of 1934 and 1938. Supervisor Frank Bonelli has carried on this tradition of strong leadership, and has been a mainspring in the successful submission of three bond issues for construction of storm drains to the electorate of the Flood Control District since 1952.

Other County Supervisors who in the past have contributed importantly to flood control and conservation achievements were Roger Jessup, John Quinn, Hugh Thatcher, and John Anson Ford, all active in the critical years of the 1934 and 1938 floods.

The Los Angeles Chamber of Commerce and its subsidiary organization, the Conservation Association of Southern California, have consistently supported flood control and conservation programs in Los Angeles County, primarily through such able representatives as Harold Wright, Manager for the Chamber for many years, Howard Miller of his staff, and Washington representatives of the Chamber, including Ronald Ketcham, Gordon Suiter, and Eleanor Buhler. The latter were particularly effective in assisting District officials in placing local flood control needs before federal agencies in Washington and in obtaining helpful federal legislation. George Cecil, Secretary of the Conservation Association for many years, was a forceful advocate of conservation measures. William Rosecrans, a businessman who came from a pioneer family in the Los Angeles County area, served as president of the Conservation Association for a number of years, and in this capacity gave tremendous support to the programs and bond issues that have led to the

success of flood control work here.

Another businessman, Mr. C. A. Griffith of Azusa, stood out in the San Gabriel Valley as a strong proponent of better flood control and conservation measures during the 1930's, and later, when appointed to the California Water Commission, presented local flood control requirements to the appropriate Congressional committees in a businesslike manner which had much to do with obtaining successful legislation and appropriations.

A great number of other businessmen, city officials, ranchers, and so on, including the mayors and city engineers of the many cities within the Flood Control District, rendered most valuable assistance in supporting the raising of flood control funds throughout the period from, say 1920, to date. This has been particularly true in San Gabriel Valley, San Fernando Valley, Ballona Creek Watershed, and the Coastal Plain. During the crisis in flood control affairs that followed the damaging 1934 flood in Montrose, civic officials in Glendale and businessmen in Montrose gave leadership to a drive for corrective measures, Mr. Haakon Berg of Montrose acting as coordinator. Concern of officials of the City of Los Angeles has in general been devoted to improvement of storm drainage, rather than control of flood waters, since the flood control system which protects San Fernando Valley has been installed.

Members of Congress from both Los Angeles County and other parts of California have played important roles in the

early development of flood control measures. Congressmen who took the lead in such efforts in the 1930's would include Senator William Knowland and later, Senators Richard Nixon and Thomas Kuchel. Practically all members of the House of Representatives have always given fine support for federal aid in behalf of local efforts for relief of flood hazards in the Los Angeles area, and in particular Representatives Cecil King, Richard Nixon, Chester Holifield, Carl Hinshaw, Donald Jackson, Thomas Ford, John Phillips (from Orange County), Gordon McDonough, and Jerry Voorhees were outstanding in the effort devoted to this cause at one time or other during their terms in office.

Probably the most interesting episode of the early 1940's that took place in flood control matters before Congress was the legislation to authorize construction of Whittier Narrows Dam and Reservoir by the Corps of Engineers. This dam, first proppsed by the Flood Control District as part of its Comprehensive Plan of Flood Control in 1933, and subsequently deleted therefrom by action of the Board of Supervisors due to opposition from landowners and business interests in the El Monte area, was adopted by the Corps of Engineers as a unit of the program it submitted to Congress in 1940 for authorization for federal appropriations and construction. The dam was to be located across the Rio Hondo and San Gabriel River several miles south of the City of El Monte, and this location raised fears that backwater during major flood periods might result in flooding of parts of El Monte and cause ground-water levels

to rise to damaging elevations. Strong opposition again developed from city officials, the local Chamber of Commerce and others, including the owners and interests occupying the land that would have to be condemned for construction of the dam and reservoir site. Jerry Voorhees was at that time Congressman from the Whittier area and his district extended into El Monte. He was therefore subjected to the opposition from the El Monte group and also to advocacy of the project by other constituents who resided along downstream sections of the Rio Hondo and San Gabriel River and needed the flood protection that would be afforded by the dam. Leaders of the El Monte group included the secretary of the local Chamber of Commerce, a Mr. Van Tongeran, and the Reverend Dan Cleveland, pastor of a church located in the area to be occupied by the Whittier Narrows Reservoir, as well as El Monte officials and businessmen.

Mr. Voorhees was placed in a difficult position by the pressure brought from both sides, and the project did not advance by the time the next Congressional elections were held. His principal opponent, Richard Nixon, also of Whittier, became involved in the controversy and gave his support to the El Monte group. Mr. Nixon was elected and promptly took steps to block authorization or appropriations of funds for the project. The Los Angeles County Flood Control District then took leadership of project advocacy and was joined by representatives of the Cities of Long Beach, Compton, Whittier, Lynwood, South Gate, and other communities located in those

portions of the Coastal Plain that needed flood protection from Rio Hondo and San Gabriel River floods. The Los Angeles Chamber of Commerce joined in this effort, and after working out a relocation of the damsite downstream about two miles, the advocates convinced Mr. Nixon that the project was essential to a great majority of the people involved. He obtained the support of Senator Knowland, who succeeded in obtaining authorization for the Whittier Narrows project in the Senate version of a flood control measure then pending, and the long fight was over. The dam was completed a few years later and since has served as one of the major flood protective measures that benefits the Coastal Plain from Whittier to Long Beach. Individuals that took a leading part in presenting the need for the project in behalf of the Coastal Plain included City Manager Sam Vickers of Long Beach, Brennan Thomas, and Walter Brown of the Long Beach Water Department, City Engineer Marshall Bowen of Whittier, Harlan Cate of the San Gabriel River Protective Association, and Supervisor Smith of Whittier.

Looking back over the years of flood control and water conservation activities since I first entered Flood Control District employ in 1919, I would conclude that the individuals that stand out in my mind as having contributed most of the planning, solicitation of public support, financing and successful culmination of the Flood Control District's Comprehensive Plan for Control and Conservation of Flood Waters in Los Angeles County during the nearly forty years this has taken to accomplish, would be County Supervisors Herbert Legg, William A. Smith,

and Frank Bonelli; and businessmen William Rosecrans and C. A. Griffith, omitting, of course, the Flood Control District employees that conceived it and have so diligently pressed it forward to fruition.

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