Gila
4-17-05
Mark McGinnis

Deposition of HJALMAR HJALMARSON

January 16, 2003

Tumbling-T v. Paloma Investment

Page 1 to Page 125

CONDENSED TRANSCRIPT AND CONCORDANCE
PREPARED BY:

Mary Meyer, RPR, CCR 50225
Meyer, Lumia & Associates
100 North Stone Avenue, Ste. 802
Tucson, AZ 85701
Phone: 520-623-1100
FAX: 520-623-2067

024

Page 1

IN THE SUPERIOR COURT OF THE STATE OF ARIZONA
IN AND FOR THE COUNTY OF MARICOPA

A TUMBLING-T RANCHES, an Arizona general partnership; et al.,

Plaintiffs,

vs. No. CV 95-00253
No. CIV 97-07081

PALOMA INVESTMENT L.P., a limited partnership; et al.,

Defendants.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY,

Plaintiff,

vs.

PALOMA INVESTMENT L.P., a limited partnership; et al.,

Defendants.

PALOMA INVESTMENT L.P., a limited partnership; et al.,

Counterclaimants,

vs.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY,

Counterdefendant.

(Judge O'Melia)

DEPOSITION OF HJALMAR HJALMARSON
January 16, 2003
Phoenix, Arizona

MARY MEYER, R.P.R.
Certified Court Reporter 50225
MEYER, LUMIA & ASSOCIATES
100 North Stone Avenue, Suite 802
Tucson, Arizona 85701
Ph (520) 623-1100 Fax (520) 623-2067

Page 2

I N D E X

E X H I B I T S

Page 3

APPEARANCES:
Mr. Emery Barker, Attorney at Law
Mesch, Clark & Rothschild
259 North Meyer Avenue
Tucson, Arizona 85701
For Defendant Paloma Investment

Mr. Reed King, Attorney at Law
P.O. Box 34401
Phoenix, Arizona 85067
For Plaintiffs

Mr. John Helm, Attorney at Law
Helm & Kyle
1619 East Guadalupe, Ste. One
Tempe, Arizona 85283
For Plaintiffs

ALSO PRESENT: Mr. George Sabol, Mr. Glenn Tarbox, Mr. Joe Tram, Mr. Doug Littlefield, Mr. Michael Stevens, Mr. John Haapala

* * * *

BE IT REMEMBERED that pursuant to Notice of Taking Deposition in the above-styled and numbered cause, the deposition of HJALMAR HJALMARSON was taken upon oral examination at the Hilton Suites, 10 East Thomas Road, in the City of Phoenix, County of Maricopa, State of Arizona, before me, Mary Meyer, Certified Court Reporter 50225, in and for the State of Arizona, on the 16th day of January, 2003, commencing at the hour of 9:10 a.m. on said day.

* * * *

Page 4

HJALMAR HJALMARSON,
having been first duly sworn, was examined and testified as follows:

EXAMINATION

MR. BARKER: Why don't we, this morning, do our usual routine, go around the table and have everybody identify themselves for the record.

THE WITNESS: Winn Hjalmarson. I'm a consultant hydrologist. I'm on the hot seat this morning.

MR. HELM: John Helm representing Maricopa County.

MR. SABOL: George Sabol, Stantec.

MR. TRAM: Joe Tram, flood control district.

MR. KING: Reed King, attorney for farmers downstream.

MR. TARBOX: Glenn Tarbox.

MR. STEVENS: Michael Stevens, consultant for MWH.

MR. HAAPALA: John Haapala, MWH.

MR. LITTLEFIELD: Doug Littlefield, historian for MWH.

MR. BARKER: Attorney for Paloma Investment Limited Partners and others.

MR. HELM: Et al.

MR. BARKER: Et al.

Q. *(By Mr. Barker) Winn, you've stated your name for the record. Would you tell us your educational background*

Page 5

after high school?
A. After high school? I have a Bachelor of Science in engineering from Arizona State University, and I have some university graduate work at Arizona State University, and then I have a lot of government type training under my belt.
Q. Okay. Would you tell me your work history professionally?
A. Uhm -- I hired on with the US Geological Survey as a hydrology engineer in 1962, upon graduation from Arizona State, and I was with them until 1993. And I put my feet up for about six months upon leaving them, and then decided to go into consulting on a part-time basis. So I've been an independent consulting hydrologist, basically, ever since.
Q. Okay. Would you tell me a little bit about the duties that you had at USGS?
A. Uhm -- I had a wide variety of duties during the early part of my career, both in groundwater, surface water and water quality.
I eventually leaned toward surface water hydrology, open channels, alluvial channels, alluvial processes and so forth. And the last, oh, 12, 13 years with the Survey, I was the surface water specialist for Arizona.
Q. And as the surface -- excuse me. I thought you were finished.
A. Well, I've done a lot of technical publications and

Page 6

so forth as -- during my career with the Survey and since I left the Survey.
Q. Tell me what -- when you were the surface water specialist for the district, what would you do, what was your job, what did it entail, what kinds of things does that job call for?
A. I was basically a working manager in quality assurance of primarily all the surface water activities in the state. Most everything would go through me in conceptualizing projects and scoping them out. And then when the work was completed, it would pass through me. So primarily quality assurance of all the work activities in the surface quarter.
Q. So you're really kind of in charge of all those operations in Arizona?
A. Well, I assisted the district chief of the water resources division of the USGS in Arizona in those activities, yes.
Q. Okay. Have you ever testified in a matter in court?
A. Yes.
Q. Tell me about those or that incidence, whichever it is.
A. I've testified twice where I was sworn in. The most recent time was in the Superior Court of Yavapai County

Page 7

over a -- the issue was a lawsuit over some flood damage in Sedona.
The first time I testified was in regard to the Tanque Verde flood in the Tucson area where a large number of people were killed by a flash flood. And I testified on behalf of the, I guess, Department of Interior.
Q. Do you remember about when that -- the Tanque Verde flood was?
A. I thought it was, let's see, '80s, late '80s, I believe.
Q. And for whom did you testify in the Yavapai County case?
A. I was working directly for Mr. Scanlan. He was the defendant.
Q. Okay.
A. And the homeowner in -- he was a homeowner in Sedona.
Q. And was he being sued for having diverted water or something like that?
A. Yes.
Q. And who was suing him?
A. I don't recall.
Q. Governmental entity or private people?
A. Private. A neighbor.
Q. Kind of a dispute between neighbors over who

Page 8

diverted the water?
A. Who might have affected the runoff characteristics that resulted in the flood damage that occurred.
Q. Okay. And how about -- have you ever given your deposition before, aside from those cases, where I assume you might have given depositions before you testified in court?
A. Uhm -- I'm slightly confused over -- after the 1983 floods in Central and Southern Arizona, I was involved with attorneys several times. And, frankly, I've forgotten all the things that went on there. I was working 12 hours a day, seven days a week there for about a year. And I don't remember -- I'm a little confused over what actually happened, so I can't -- I can't say. But if it would -- it would have been in connection with Pima County people.
Q. Okay. And were you involved in the Rillito or Santa Cruz or which of the -- the Tanque Verde? Do you remember which area in Pima County you were involved in the '83 floods?
A. The '83 floods were primarily the Santa Cruz River, but also the Rillito Creek, but it was primarily Santa Cruz River I was involved in, down below Tucson and Marana area.
Q. Okay. Was it farmland you were mostly involved in or built up?
A. It was related to the farmland and the landfill and the water that left the banks of the Santa Cruz River and

Page 9

flowed out all over the farmland in the Marana area.

Q. That was probably Jim White and Pima County. Does Jim White ring a bell, Jim White, landowner who had a farm that got washed away?

A. Could have been. Chinese people, too.

Q. Either Ki (ph) --

A. Yeah, Ki, I think Ki might have been involved in that.

Q. And one of the lawyers involved was Robert Stubbs and Larry Schubart, his partner. Did you work for Stubbs and Schubart, or did you work for Pima County?

A. I was with the federal government.

Q. Federal government?

A. Yeah.

Q. Okay.

A. I was with the USGS, yeah.

Q. Okay.

A. I honestly can't say. I was doing so many things. I gave 20 talks all over the state and all sorts of stuff. I lost track. In fact, I ended up in the hospital.

Q. Some of us had the same problems in 1983.

MR. HELM: Missing a building, maybe?

MR. BARKER: Personal experience with that one.

Q. (By Mr. Barker) All right. So, since you have given your deposition and testified in court, I won't go through all the rules of depositions. I'll just ask that if you don't understand my question, please ask me to rephrase it or restate it so that you're sure that you understand what it is I'm asking you. And then if you would reply audibly and with yes or no instead of uh-huh and uh-uh. Other than that, any time you need to take a break, just let me know. This is not an endurance contest, not a time test. So we'll move along. Fair enough?

A. Fair enough.

Q. Okay. The court reporter has handed you what's been marked as Exhibit 1 to your deposition. If you'll note, about the middle to the bottom half of page 30, your name appears, followed by, it looks like, a page and a tiny bit of a statement which says this is what you're going to testify about. Have you seen this before?

A. Yes.

Q. Did you write the material that was in there following your name?

A. Yes, or I signed off on it. I wrote it, it was edited, and I signed off on it.

Q. Okay. I didn't think you typed it up, but I figured you had some hand in it.

A. Yeah, I'm basically the -- I'm the author of this, yes.

Q. Of the text?

Page 11

A. Yes.

Q. Okay. I want to start -- I'm not going to do this in order because of certain time constraints we have. So what I'm going to do, if you go to the second page, to the sentence that is kind of in the third paragraph, I'll call it, "Mr. Hjalmarson will opine that the natural channel of the Gila River was navigable under federal standards for navigability under the equal footing doctrine." Do you see that?

A. Yes.

Q. And I've also seen an affidavit that you've signed that discusses that same subject matter, in paragraph four of your affidavit.

MR. HELM: Do you have a copy of it?

MR. BARKER: I don't, but I think the witness does, right in front of him.

MR. HELM: Okay.

Q. (By Mr. Barker) I think it's paragraphs four and five with five A, B and C, and that addresses the navigability issue, those two paragraphs with their subparagraphs.

MR. HELM: Object to the form. Go ahead.

A. Okay.

Q. The affidavit that you've been looking at is an affidavit dated July 24, 2000; is that correct?

Page 12

A. Yes.

Q. It was furnished in connection with --

A. Okay, July 24th or 26th, I can't tell which.

MR. HELM: Yeah, it looks like --

Q. I'll agree with you. I have no idea. I agree with you. I just assumed 24, but I'm looking with one eye. Let's say sometime in July of 2000. Fair enough?

A. Yes.

Q. Okay. Tell me what you reviewed in connection with the navigability issue that you set forth here in your affidavit.

A. Oh, what I did was basically a three step procedure. The first step or stage was to define the natural hydrology of the Gila River from the confluence of the Salt on down to the mouth.

And I was aware of some work that US Geological Survey had done, so I went to three publications that described the, let's say, the predevelopment or natural hydrology of the Gila. And I used that information to develop a flow duration which I felt would represent the average natural hydrology of the -- of that particular portion of the Gila.

The second phase then was to utilize that hydrology in developing a hydraulic model of the Rillito River, using a technique that's commonly referred to as hydraulic geometry.

Page 13

And then the third phase was utilizing that information, which basically defined the width, depth and velocity characteristics of the river, I applied federal standards for navigability.

And the result -- the result was that I concluded that the river was navigable under natural conditions at the time of statehood.

Q. Had you ever performed any studies in the area of navigability before you undertook this task?

A. No.

Q. Never testified on the subject?

A. No.

Q. Under the equal footing doctrine -- and that's basically what we're talking about, this navigability issue, is the equal footing doctrine, correct?

A. Uhm -- I guess so, yes. I think of it as an engineer, not -- not necessarily in those terms.

Q. So you think of it as whether it's navigable or not?

A. Yeah, if it was susceptible to navigation, yes.

Q. And you understand the issue that -- the legal issue that underlies that to be, if it is navigable, then the state owns the title to the bed and banks of the river or the body of water that is navigable; and if it's not, whoever else owns it owns it. Is that --

Page 14

A. I understand that much of it, yes.

Q. All right. That's all we're asking.

Did you study to determine whether or not -- did you look at any documents or materials to determine what type of watercraft may or may not have been used in or about the Gila River?

A. You mean what -- only in a casual way. I became aware of the use of watercraft on the Gila, mostly in terms of ferries.

You know, everybody -- I'm a native Arizonan, and everybody knows about Hayden's ferry on the Salt, and I'm aware there were some ferries used down below. And then there's the Bucky O'Neal story that I've known about since I was a kid and stuff like that.

But, no, that wasn't one of my assignments, to go into, you know, what may or may not have been used on the river.

Q. Okay. And did you look into -- and it's your understanding all we're talking about here is what was happening on February 14, 1912, when Arizona became a state, correct?

MR. HELM: Object to form.

A. Uhm -- well, I looked at the natural -- I used the natural hydrology, yeah, at the time of statehood, yes.

Q. Okay. I'm just trying to make sure that we're all

Page 15

on the same page, that we're talking about 1912, February 1912, for the things that you've studied and have come to an opinion that you're going to express or have expressed.

MR. HELM: Object to form. Never believe his representations.

A. UM -- I hesitate to say yes or no on that, and the reason is --

Q. Tell me what your response is. You don't have to say yes or no. You can say whatever you'd like.

A. Well, okay. Probably.

Q. Okay. All right. We'll go from there.

Do you know whether or not the use of ferry boats across the river constitutes a test for navigability under the equal footing doctrine?

A. No, and I didn't consider that.

Q. Did you consider any types of watercraft and their use on the Gila River in reaching your conclusion?

A. The two -- two of the -- I used three federal tests --

Q. Okay.

A. -- for navigability. Two of them were rather simple tests, and they -- they were basically for very simple type, you know, rafts or canoes or pleasure craft.

So, yes, there was some -- there was a type of watercraft related to that.

Page 16

Q. Okay. You said you used three federal tests. Tell me what they are and how you identified them.

A. I'd prefer to pull out my report.

Q. Oh, absolutely. Absolutely. You can refer to anything you want to in connection with this.

A. Okay. There was a Bureau of Outdoor Recreation method. That one's on page 24 of my report.

Q. Okay.

A. There's a Fish and Wildlife Service method. That's on page 26.

And there's a Geological Survey method on page 26.

Q. Okay. And page 24 was the --

A. Bureau of Outdoor Recreation.

Q. Outdoor Recreation. And what's that test?

MR. HELM: Object to form. You mean the Bureau?

Q. The test of the Bureau of Outdoor Recreation, what is that test?

A. Uhm -- it's shown in figure 4.1 of my report, and the source of that is the US Bureau of Outdoor Recreation Report, and it's simply a relationship between stream gradient and discharge.

Q. Okay. And then the -- does that differ from the test imposed or suggested by the Fish and Wildlife Service that you referred to on page 26?

A. Uhm -- yes, the criteria are different, yes.

Page 17

Q. *Okay. And what are the differences between the two?*

A. Uhm -- well, they're basically shown by the -- just compare the differences between 4.1 and 4.2. Like I said, the first figure is the relation between gradient and discharge. And then they also show on there classes related to the use of boats, the difficulty of the use of boats, for navigation.

And then the second method shows relations between channel width and flow duration, and what's used there is simply a width versus -- or excuse me -- simply a channel width, and then the other criteria is simply a channel depth, their minimum, for a particular channel.

Q. *And those were mostly for modern recreational boating, weren't they?*

A. You know, they were both done in the mid '70s.

Q. *Okay. Nothing like that was being done in 1912?*

MR. HELM: Object to form.

A. I didn't really -- I don't know precisely what was available in 1912.

Q. *Did you make any investigation to determine what was available in 1912?*

A. I didn't think it was important.

Q. *Okay. And the third one, the USGS method that you looked at that you talked about on page 26, how does that*

Page 18

differ from the other two?

A. The USGS method is a very comprehensive method that is used on a -- it was used on major rivers in the United States, and it incorporates the hydraulic characteristics of the river and the boats.

Q. *And when was the USGS method devised, if you know?*

A. 1962.

Q. *Okay. And in reaching your conclusion, did you use all three of those, or did you select one over the other, or what did you do?*

A. I used all three, and all three showed the same thing, that it was navigable.

I want to qualify on the US Geological Survey method. It shows navigability both upstream and downstream, and I understood that the criteria that I was working with was just --

Q. *One direction?*

A. -- one direction, but it passed the test both directions.

Q. *Who instructed you as to what you were looking for in connection with this matter?*

A. John Helm provided me with a federal definition of the natural and ordinary condition type thing.

Q. *Is that the definition that's contained in your affidavit?*

Page 19

A. Oh, let's see. Yes, I -- yes.

Q. *You got that from Mr. Helm?*

A. Yes, or from his office, yes.

Q. *Sure. Did you review any of the legal cases that talked about navigability and the equal footing or same footing doctrine?*

A. Let me think. After I did this analysis, I got on the Internet and did some searching. I've done that within the last year or maybe a year or so ago. It had no effect on what I did here, but I have, you know, looked at some cases.

There was -- I'm having trouble answering this, because there was one case I looked at in the Shenandoah River, where the Geological Survey method had been used. I examined that, the use of the USGS method there. I can't answer if the -- I don't know if the equal footing doctrine or whatever it is was ever applied there. I don't know if that's ever become an issue. I don't remember.

Q. *That's okay.*

Were you told, or do you know, where the quote that's contained in your affidavit that was supplied by Mr. Helm or his office came from?

A. Yeah. They gave me the quote -- they gave me the source. It's in my report. Defender's Wildlife, is that it? Let's see. Wait a minute. It's slightly different. That's slightly different. I had -- I had assumed these were from

Page 20

the same source. They might be. But the natural flow condition in my report is slightly different than this.

Q. *Than is in the affidavit?*

A. Yeah.

Q. *Okay. Now that you've reviewed that, do you prefer one over the other or do you think there's a difference, other than just semantics?*

A. For the work I did on this, all I cared about was natural flow, the natural condition, pre-development condition, which was basically the pre-Anglo condition, is what I used.

Q. *Okay. We've been handed a document from your production which is WH0072(a). It's entitled Confidential Notes.*

A. Oh, I guess that drew your attention, didn't it?

Q. *Yes, it did. Everything that you did, Mr. Hjalmarson, drew our attention.*

Did you prepare these notes before or after you did your report?

A. Those are -- what I did in the production of the report and because of the way I -- because of my history of commonly producing reports from the work I do, the way I go about doing the job is I put things together as if it's going to be published.

Q. *Okay.*

Page 21

A. So those notes are put together in that manner, where a report may result.

Q. So I assume then the notes came first and the report came after?

A. Yes.

Q. Do you remember about when you completed this set of notes in relation to when your report came out?

A. Roughly a year or -- let's see. A year or two, something like that.

Q. Okay. On the first page of the notes -- let me read it.

A. Okay.

MR. HELM: Can we make one thing clear here, that the report was not done for this case.

MR. BARKER: I have no idea what it was done for. I'm just asking what was in it.

MR. HELM: My point is it was filed for ANSAC.

THE WITNESS: Yeah.

MR. HELM: I think it needs to be on the record so that anybody reading this thing is going to have a time frame.

MR. BARKER: We'll get to it, John.

THE WITNESS: Yeah, I have two employers on this.

Q. (By Mr. Barker) Okay. You have Helm and Kyle and Maricopa County?

Page 22

A. Helm and Kyle and George Sabol, Stantec.

Q. Stantec. Okay.

A. Helm and Kyle on the navigation report.

Q. Okay. And the title of the confidential notes, The Ability to Navigate the Gila River Under Natural Conditions Below the Confluence with the Salt River to the Mouth at Yuma, Arizona, correct?

A. Yeah.

Q. It's by you, and it says it's for Helm and Kyle, correct?

A. Yeah.

Q. Okay. Let me show you on the first page, because I want to make sure I get your handwritten notes correct.

My limited research on the -- I don't know what that word is, history?

A. History of navigability.

Q. -- of the Gila River suggests it was not used on a regular basis for any kind of water transportation for commodities such as furs, covered wagons or people. Correct?

A. Correct.

Q. Did you later change your opinion from that?

A. Yes.

Q. And when did you change it?

A. When the -- when this -- when I realized this was going into the ANSAC, or when I -- well, when I realized it was going to be a final report on this.

Page 23

Q. Okay. Who did you talk to? Did somebody persuade you to change your opinion?

A. Uhm --

MR. HELM: Object to the form.

A. No, not really. That is, let me go back to the -- what the nature of those notes are.

Q. Okay.

A. That's all -- all that is is my method of compiling information and going about doing the work I do. It's not -- you do not want to infer that that is a report. It says right there, Confidential Notes, and that's really the intent of it.

But I am in the habit of, like I say, putting together things in a logical manner as if it was going to become a report.

Q. On the bottom of that sheet, which is the second sheet of WH-00072(a), is that your signature?

A. Yes.

Q. And it says so many pages?

A. 72 pages, yes.

Q. And the date shown --

A. Right.

Q. -- is July 2001?

A. Uhm -- yes.

Page 24

Q. Okay. And I assume you put your -- you wrote that on there?

A. Right.

Q. And you mentioned ANSAC, and that's the Arizona Navigable Stream Adjudication Commission?

A. I guess so, yes.

Q. The report that you did, WH-000284, that's the document you're looking at in front of you?

A. Okay.

Q. Is that correct?

A. Yes.

Q. And this, the date on this is October 24, 2002?

A. Yes.

Q. On page nine of your report, if you take a look at that, in the first full paragraph, about two-thirds of the way in that paragraph: There are only a few available recorded observations of the river hydraulics and morphology made by explorers, period.

A. Right.

Q. However, there are many surveyed channel widths by land surveyors that provide very useful supportive information. Do you see that?

A. Yes.

Q. Did you take into account any observations made by explorers in reaching the conclusions that you reach in your

Page 25

report?
A. No, I included them, a few, in the report, but I considered rather seriously excluding them; however, because they had been made, it was kind of a customary thing to look at that. I did throw them in there just to show how they match up to what I did.
Q. Okay. Looking at -- I assume those are the remarks that you included in appendix C at page 47 in your report, Accounts by Explorers?
A. Yes, and these are from the Corps of Engineers report, yes.
Q. The list of years, the widths, the remarks, all come out of the Corps of Engineers report of 1995?
A. I believe so, yes.
Q. Did you ever look at any of the original documents?
A. No. Like I said earlier, I didn't really -- I didn't go into this, no.
Q. So --
A. No.
Q. -- do I understand it then you relied entirely upon the Corps of Engineers report and not on any of the original sources?
A. That's right. Let's see, that's -- that's right. That's what I said here, yes.
Q. And that's what you did?

Page 26

A. Yes.
Q. In the next sentence, you talk about many surveyed channel widths by federal land surveyors. Did you look at any such surveys in connection with the preparation of your report?
A. Yes.
Q. Are you familiar with the US Government's rectangular survey system --
A. Yes.
Q. -- done by the USGS a lot?
A. Yes. Township and range and section, section lines and all that.
Q. Right. Are you familiar with plats and survey notes that federal land surveyors prepare?
A. Uhm -- I have some knowledge of them, yes.
Q. Okay. Do you know what the manuals that govern the federal land surveyors work required them to show on their field notes, plats and surveys?
A. I'm familiar with the presence of several manuals that were issued to the land surveyors, yes.
Q. Okay. Based on your understanding of how the land surveyors operated under these manuals, do you have an opinion as to whether the field notes of an individual land surveyor are generally more accurate than the plats that they prepared from their field notes?

Page 27

A. I don't really know.
Q. Do you know which federal surveyors instruction manuals governed how surveys were to be conducted in Arizona by federal land surveyors?
A. Specifically which ones?
Q. Yes.
A. No.
Q. Do you know how many manuals there were in existence issued by the federal government before Arizona became a state?
A. No. I know there were a few.
Q. Okay. Do you know whether or not any of the federal surveyors had surveyed lands along the Gila before Arizona became a state?
A. Oh, yes.
Q. And were any of the lands along the Gila River not surveyed until after Arizona became a state in 1912?
A. Along the Gila, you said?
Q. Yes.
A. I'm aware that most of it was surveyed. It's possible a section or two wasn't. I don't know.
Q. Okay. Do you know how many federal surveyors actually surveyed lands along the Gila River prior to Arizona statehood?
A. Uhm -- several. If you want a number, no, I don't

Page 28

know the number.
Q. Are you familiar with the term "meander" as it relates to a river?
A. Yes, the setting of meanders that -- yes.
Q. Do you know whether or not, under the manual issued by the federal government, that federal surveyors were required by law to meander the banks of navigable streams and rivers?
A. I understand that the -- there were rules for setting of meanders in some of the surveyor's books, instruction books, yes. I'm not sure if they were in all of them.
Q. Okay. And do you have any idea when that was first put in those books by the federal government?
A. No, not -- somewhere -- sometime in the 1800s.
Q. Okay. Do you know if the -- if the instructions on meandering in the federal survey manuals ever changed?
A. I understood it changed, yes.
Q. And do you know how it was changed?
A. I believe -- I believe that they might have changed it from setting one on -- one meander post or whatever on one bank to two, set it on each bank, or something like that, something like that.
I didn't -- you know, I didn't go into great detail on that.

Page 29

Q. Do you know whether or not there were any instructions in any of the federal manuals for federal land surveyors on whether they were to set meanders for non-navigable rivers?

A. I don't know.

Q. Are you familiar with the homesteading process that was used throughout the American West?

A. No, well -- no.

Q. Okay.

A. I know very little about it.

Q. Okay. You didn't do any research into that area?

A. Didn't -- no.

Q. Okay. Have you done any research into any of the federal land patent records in connection with your work here?

A. No.

Q. Have you ever done any research into federal land patent owners?

A. No, not really, no.

Q. Are you familiar with the Desert Land Act?

A. I think I've heard the name, but, no.

Q. Are you aware of the act of Congress which created Arizona as a state? Did you do any research into that law --

A. No.

Q. -- that established -- okay.

Page 30

A. No.

Q. Are you aware that at the time states are created, that the federal government may or may not grant certain lands to the state, title to certain lands to the state in connection with establishing statehood?

A. In a very general way I'm aware of that, yes.

Q. But specifically as relates to Arizona?

A. Not really, no.

Q. Did you review any publications by the United States Department of Agriculture in connection with the work you did on navigability?

A. Well, I used soil surveys, you know, so, yes.

Q. Okay. And did you -- are you familiar with the University of Arizona Agricultural Experiment Station 1911 report about the Gila?

A. No.

Q. Didn't use that --

A. No.

Q. -- or review it?

A. No.

Q. You mentioned earlier the Bucky O'Neal legend or story.

A. Yeah.

Q. What's that?

A. I heard he went down the Gila on a raft. He and a bunch of guys got drunk in Phoenix and went and supposedly went down the Gila. But I heard that one a long time ago. I forget when I heard it.

Page 31

Q. That's the one where they took whiskey and bacon and ran out of the whiskey?

A. Something like that.

Q. Did you review that in connection with your research here, or was it something you knew?

A. No. It's something I knew. I could have -- it's possible I ran across it. But, no, that wasn't a factor in what I did here.

Q. Are you familiar with a book called Rivers of the Southwest?

A. Yeah, I think I've seen that.

Q. Did you review it in connection with what you did here?

A. No.

Q. In your notes, this is not in your report, but in your notes, which is -- it was given to us as Exhibit 4, index of Winn Hjalmarson documents, it shows WH-00022, there were seven pages from a book called Rivers of the Southwest.

A. Yeah. I may have -- like I said, I may have -- you know, I may have looked at it, but I didn't really -- I didn't use it for what I did here.

Q. Okay. Oh, that just -- just let me hand it to you just to look at it. It's WH-00022. And there's -- the first pink, I guess, or salmon colored flag talks about, I think it's Captain Cook's expedition or something.

Page 32

A. Oh, yeah, I remember seeing -- I've read this, yes, that's right, but it had nothing to do with what I did.

Q. Okay. How about Captain Cook, that was the Mormon Battalion?

A. I didn't know he was Mormon, but I don't know.

Q. You don't recall?

A. No, I don't.

Q. Okay. Did you look at any documents prepared by William H. Emory, E-M-O-R-Y?

A. I remember the name, yes.

Q. Did you look at any of his documents?

A. Yeah, maybe I did some casual reading, let's say, when I was looking at this, but, yeah, I do remember seeing something about Emory. It could have been in the Corps of Engineers report. They had a lot of stuff in that.

Q. But you didn't look at any of his original documents. It would have been in something else that you looked at.

A. It's possible, but it -- I didn't use anything, you know, for this particular engineering report from Emory, other than what I've referenced here.

Q. In the index of documents you have WH-0021, 1890s

Page 33

boating on the impracticable Gila. Let me hand you a copy of that.

A. Impracticable Gila, yeah, I wonder where I got that.

Q. That's a question I was just about to ask you.

A. Yeah, okay, I didn't use this. It's possible -- there was a young fellow who was doing some of the history work on this for Flood Control District, or he worked for the Flood Control District, I believe. He may have handed that to me, but I didn't use it.

Q. But you didn't use it?

A. No.

Q. Do you know who these guys are, Larry Christianson and David Pettes, P-E-T-T-E-S?

A. Not really.

Q. Did you attempt to find out who they were?

A. No, no, I didn't.

Q. Didn't use their materials, don't know who they are?

A. No.

Q. Did you read Dr. Littlefield's report in connection with your work on navigability for Helm and Kyle?

A. Yeah, I read Dr. Littlefield's report, yes.

Q. Okay. Did you disagree with anything other than the conclusion that was in his report?

Page 34

MR. HELM: Object to form.

A. Uhm -- well, I disagreed with things in the report, yes.

Q. Okay. Tell me what you disagree with. I have his report, if you want to review it so you can point them out, so you can answer it.

A. I can answer this in a general way. Save -- I think I can save some time on this.

Q. Okay. That's fine.

A. A lot of the historic observations of conditions along the Gila River were made without the knowledge of what the discharge was. If you don't know the discharge, you don't know much, unless you have a whole lot of observations, be it width, depth, or whatever.

So, in a general sense, I take issue with many, many historic observations of where an explorer came up to a river and said it's 500 feet wide, and in regard to transferring that into something related to navigability, I'd say it's of extremely limited value, because you don't know what the discharge was. So, in that context, I take issue.

Q. Okay. Dr. Littlefield's report, he cites maybe hundreds of observations by all sorts of people from all walks of life. Are you telling us, unless they know the discharge of the river, you have to disregard all those observations?

Page 35

MR. HELM: Object to form.

A. From an engineering -- for the engineering type approach that I used, the value of those and the accuracy of those is, I consider, unknown.

Q. Unknown?

A. Unknown, yes.

Q. Okay.

A. I -- yeah.

Q. Okay.

A. So I just don't know the accuracy of it.

Q. And, thus, did you disregard them?

A. Uhm -- they -- those types of observations entered my analysis only as I have shown them in this report, my final report here, in that I decided just to include a few observations that were in the Corps of Engineers report, and that was it.

Q. Okay. So just -- is what you're saying that unless it was reported in the Corps of Engineers report that you've cited to us and pointed out to us in your -- in here, you disregarded any other observations that you may have reviewed in connection with your work that you did?

A. They were not used in my analysis, that's correct, that's right, other than -- well, except as I referenced here, the federal land surveys.

Q. Unless -- unless it's in your report as something

Page 36

you relied on, then you discarded it. Is that what you're saying?

A. No, I -- no, it did not -- it was not used in the production of this report.

Q. Okay.

A. Now --

Q. That's all right. I don't want to cut you off. I want you -- if you need to explain something you've said, I'll be happy to have you do it, because, as I told you, this is not a time test here.

A. Yeah.

MR. HELM: Is there a question out here?

MR. BARKER: Um-hum.

MR. HELM: Are you done with your answer?

THE WITNESS: Yeah, I'm done with the answer, yeah.

Q. (By Mr. Barker) I thought you wanted to make an observation about what you just said, to clarify something. But if you didn't, that's fine. I'll move on.

A. No, move on.

Q. Okay. ANSAC, we've talked about ANSAC, the Arizona Stream Navigability Adjudication -- whatever it's called.

MR. HELM: Arizona Navigable Stream Adjudication Commission.

MR. BARKER: Mr. Helm always knows the answer. He may not be right, but he knows the answer.

Page 37

MR. HELM: We'll take the first admission.
Q. (By Mr. Barker) Did you review any of the documents that are on file with ANSAC concerning the Gila River and the stretch or the reach that you reviewed?
A. I looked at some documents, yes.
Q. Did you go down to look at them, or did people furnish them to you?
A. I was furnished something, yeah, and I believe it was from ANSAC, yeah.
Q. And did you get that from Stantec or from Helm and Kyle or where did you get it?
A. It may have been Helm and Kyle.
Q. Okay. Have you attended any of the hearings at ANSAC?
A. No.
Q. Have you testified in front of ANSAC?
A. No.
Q. Are you familiar with the published reports of the Federal Commissioner of Corporations on Transportation by Water?
A. I don't think I am, no.
Q. Okay.
A. Doesn't ring a bell.
Q. Did you do any research on the type of watercraft in use in the Western United States in 1912?

Page 38

A. Just because I was involved in it, in this, yes, I did some reading, but I -- yes.
Q. Do you recall what you reviewed in connection with that investigation?
A. No, I don't.
Q. In connection with your work, did you do any reconnaissance along the Gila River to actually look at it from any of the reaches that -- any of the areas within the reach that you testified about?
A. Yes.
Q. And tell me what you did in that regard.
A. I drove the Gila down to where it was totally messed up and then gave up. And I collected a few sediment samples and mainly looked at material. I kind of -- it was the kind of thing where I've been on the Gila all my life and I just wanted to revisit it with this in mind.
Q. Okay. Did you review any records of the State of Arizona Land Department as to patents that it may have issued to citizens for land along the Gila River?
A. No, I don't -- no.
Q. Do you know whether or not the State of Arizona issued patents to folks of land that either bordered or was crossed by the Gila River?
A. I kind of assume so, but I don't know for a fact, no. It's out of my area.

Page 39

Q. Okay. Did you look at any of the records at the Arizona Land Office?
A. At the Arizona Land Office?
Q. Yes.
A. No.
Q. Do you have any knowledge whether any land that was granted to a citizen of the State of Arizona by the State of Arizona that had all or part of the Gila River running through it had any reservations from the state reserving any portion of the Gila River to the state?
A. It had nothing to do with what I was doing. I don't know.
Q. Is it your understanding that if the river was navigable, that the State of Arizona would own the land within the bed and banks of the Gila?
A. That's what I've been told, yeah.
Q. And if the state land department granted a patent to a citizen of the State of Arizona and did not reserve the bed and banks area of the Gila, would you find that contrary to what you testified to here?
MR. HELM: Object to form.
A. It had nothing to do -- nothing to do with what I was doing. I don't know.
Q. Okay. Would you think that was some indication by the State of Arizona that they didn't think they owned it?

Page 40

MR. HELM: Object to form.
A. I don't know.
Q. Were you aware of the right of a state at the time of statehood to ask the federal government to give it additional property from what was granted to it because some of the property granted to it was covered by a navigable body of water?
MR. HELM: Object to form.
A. No, I'm not.
Q. Did you review a USGS report called united -- it was written by Edward Charles Murphy and others, entitled "Destructive Floods of the United States in 1905" with a discussion of effluent discharge and frequency and an index to flood literature?
A. I could have.
Q. It was referred to in Dr. Littlefield's report, and I can hand it to you so you can see the quote, see if that refreshes your recollection. It's a quote starting just ahead of the footnotes at the bottom of the page. The footnote is at the bottom.
A. I may have seen this. I didn't follow up on this. It didn't -- it wasn't something that I focused on in regard to what I was doing here.
You have to realize, I've worked -- you know, I've read a lot of stuff about floods in Arizona.

Page 41

Q. *I'm sure you have.*
A. You know, and if I say no to something, I'm probably lying, because I probably read it at one time or another.
Q. *What I was really driving at, Mr. Hjalmarson, is whether or not you recall reviewing that in connection with the report that you prepared.*
A. No.
MR. BARKER: Okay. Why don't we take a morning break, and we'll switch subjects when we come back.
(Break taken.)
Q. *(By Mr. Barker) Let me just finish, hopefully, a couple of questions with your report, and then we'll move on to another subject for a while. You have your report in front of you?*
A. The navigability?
Q. *Yes.*
A. Yes.
Q. *Would you look at page six of your report, at the bottom. This is the conclusion of your executive summary. It says: Based on all the hydrologic and hydraulic information, data and analysis contained in this report, it is the author's opinion that the natural channel of the Gila River from the confluence with the Salt River to the mouth of the Colorado River, was susceptible to navigation at the time*

Page 42

of Arizona statehood in its ordinary and natural condition. Correct?
A. Yes.
Q. *By what type of watercraft?*
A. It's by the three criteria I used that are referenced in the navigability portion of the report.
Q. *Did you -- are you able to tell us, as you sit here today, in 1912, what watercraft was available to somebody who wanted to conduct commercial navigation on the Gila River in that reach?*
MR. HELM: Object to the form.
A. It -- it wasn't a criteria I used.
Q. *Okay. Do you know anything about that subject? In other words, did you do any study into what type of watercraft was available in 1912 that you could actually conduct a navigation in the form of commerce on the Gila River?*
A. I did -- I did, let's say, casual reading related to being involved in this subject. Also, I'm aware, for example, that Kit Carson, you know, used a canoe to transport furs on the upper Verde River, and he may have gone down the Gila. You know, as a kid, I've been aware of things like that. I'm also aware of the paddle wheels that are -- that were on the Colorado and that type of thing.
But, you know, that's the kind of reading I did.

Page 43

So I'm kind of -- you know, I'm aware of logs being lashed to wagons during the Forty-niners, you know, the Gold Rush stampede and all that. So, yeah, I'm aware of things like that, but it didn't enter into what I did here.
Q. *So you're not prepared to, nor do you intend to, nor have you been asked to, testify about what type of watercraft would have been used to conduct commercial activities on the Gila River in that reach in 1912?*
MR. HELM: Object to form.
A. Yeah, that wasn't part of what I did.
Q. *Okay. Is it your opinion that the Gila River was capable of navigation at all times during the year 1912?*
MR. HELM: Object to form.
A. In 19 -- during flood flow, it would be very difficult to navigate it. And in 1912, when there were a lot of diversions occurring in the summer, during very dry periods, it's possible, you know, under heavy diversion activity, that there wouldn't be enough water in there to navigate.
So the answer: It would not be navigable during the entire year.
Q. *Okay. In your opinion, was the Verde River predictable enough to have someone regularly conduct commercial navigation on the Gila River in the reach you reviewed?*

Page 44

MR. HELM: You just said Verde River.
MR. BARKER: I didn't mean to say that. I'll start over. I guess I'm still thinking about Kit Carson.
Q. *(By Mr. Barker) Mr. Hjalmarson, in your opinion, was the Gila River predictable enough for someone who wanted to conduct commercial navigation on it in 1912 to be able to do so on a regular basis?*
A. I don't know.
Q. *Okay. I'm going to go back to Exhibit 1, your statement on the disclosure we received, and at the top of page 31 -- this is that thing that talks about --*
MR. HELM: Are we switching now off of navigation?
MR. BARKER: For a while. There's some other navigation questions, but not of the same type, that come later.
A. Alrighty.
Q. *(By Mr. Barker) On page 31, in the first paragraph, at the very bottom of that, it talks about Manning's n -- initial n, small -- values. And it states, "Mr. Hjalmarson will opine that the defendants' experts selected incorrect magnitude and location of Manning's n values. He will explain what Manning's n is and how it is determined.*
Do you see that?
A. Yes.

Page 45

Q. What is a Manning's n?

A. Well, it's a coefficient of roughness, and it's a hydraulic -- a hydraulic term, coefficient of roughness, that's been around over 100 years.

Q. And as I understand it, and you correct me if I'm wrong, it's used by folks who are figuring things in hydrology to determine how fast water can move through an area that's got stuff in it, such as rocks or trees or brush or nothing, correct?

A. Well, in a general sense, that comment would be kind of correct, yes.

Q. That's about as much as I know about it, so that's why I ask you.

It's also my understanding from testimony that we heard earlier that you have provided advice on Manning's n coefficients to other experts retained by the Flood Control District of Maricopa County in this litigation and that they have relied on those Manning's n's that you have given. Were you aware of that?

A. Uhm -- I produced a map of the -- showing Manning's n in the -- at and above the Gillespie Dam in the area of this -- of this issue.

Q. Okay. And did you discuss that map and your findings with, like, Dr. Zevenbergen and Dr. Richardson and others, or did you just furnish them a map?

Page 46

A. Basically, I furnished the map. There may have been some discussion about it, yes. There was some discussion about it, yes.

Q. But from everything I understand about this case, you're the one that said, here's the Manning's n's, and this is what I recommend you use when you run computer models or whatever you need these for; is that correct?

A. Not exactly.

Q. Okay. Please correct me.

A. The Manning's n that I showed was for -- for more classic one-dimensional hydraulic computations, like the standard step method and so forth, and I believe it so stated on the -- on the map I produced. Basically 1-D modeling, it's for.

Q. Is that something like the HEC-2, is that a model that utilizes that?

A. Yes. Yes. And -- well, and for a specific purpose to, for the computation of large surface elevations, is the primary purpose of it.

Q. Let me hand you what's marked as Exhibit Number 2 and ask you if you'll look at that. I'll hand you a pen. In this particular photo, I would like you to assume that the depth of flow is 4.1 feet. Would you please estimate for us a value or a range of values for Manning's n for that flow?

A. So you said 4.1?

Page 47

Q. 4.1.

A. 4.1, all right.

MR. HELM: Do we know the scale of this picture so we can know where the 4.1 falls at?

Q. Don't know. So assume whatever scale you want to assume.

A. Yeah. I wonder what the direction of flow is.

Q. Assume what you want for the direction of flow.

A. Well, I would -- hhm. It's a little out of the type of floodplains that I'm really familiar with. This looks like southeastern United States conditions. This came out of the Snyder and Ackerman Report, I believe. You know, I would go along with -- I'd say something on the order of .1.

Q. Okay. And would you just initial it, so that we know we have the right one.

A. (Witness complies.)

Q. Let me hand you what's been marked as Exhibit 3 and ask you to assume the depth of flow is 5.0 feet.

MR. HELM: Once again, we don't have any knowledge on the scale or the direction of flow?

MR. BARKER: No. No. And you can assume whatever you want in that regard.

MR. HELM: Do you want him again to tell you what the Manning's n would be?

Page 48

MR. BARKER: I do.

MR. HELM: Do we know where the picture was taken?

MR. BARKER: It's from a standard reference.

MR. HELM: Which standard reference?

A. I'd say about point --

MR. HELM: Wait. Wait. One thing at a time here.

MR. BARKER: It's from a USGS publication, estimation of Manning's n in open channels and overbank areas.

MR. HELM: Okay.

A. Yes, I've seen these before. It's from Snyder and Ackerman, I believe.

I want to say, again, that in the performance of the selection of Manning's n, in areas like this, what you would do is, and what I would do is, pick up a standard reference like this, get yourself calibrated from known Manning's n's, and then you go out in the field and do your thing. And when you come back in, you compare your photographs and so forth to what you have here. So it's not a thing you do blind like this.

But I would say this is a little rougher. I give it about a .12.

Q. Okay. I'm handing you Exhibit Number 4. I want you to assume the depth of flow was 2.9 feet, and if you would provide for us a range or a Manning's n value.

Page 49

MR. HELM: Do we assume the same --
MR. BARKER: Same assumptions.
A. Okay. Oh, you want me to initial it?
Q. (By Mr. Barker) Yes, please, if you would.
A. I forgot to initial it.
MR. HELM: What did you determine it to be?
THE WITNESS: .13. If these were real low gradient streams, the values would be pretty low. Manning's n is a function of gradient and velocity.
Q. Exhibit 5, assume a depth of flow of 2.9 feet and whatever other assumptions you think you need to make.
A. Okay. .13.
Q. .13 again, okay. Thank you.
I'm handing you a photograph and what I can tell you of it, it is obviously in the area of the Gila, and it was taken in 1982. What I would like you to do is compare the roughness characteristics of the vegetation in those photos and what you would estimate, if you can, from the photographs, the roughness coefficients to be.
MR. HELM: Once again, we don't know scale.
MR. BARKER: You have what I've got.
MR. HELM: We don't know the location, whether they're even at the same location.
Q. (By Mr. Barker) And on Exhibit 6, use only the lower picture, ignore the first picture.

Page 50

A. And what did you say the depth was?
Q. I have no idea what it is. What we -- this is a photograph that we just received, and we know it was taken in 1982, and we would like you, if you can, from the lower photograph of Exhibit 6, to estimate a Manning's n coefficient for what you see in that photograph, based on a visual inspection.
MR. HELM: For the whole photograph?
MR. BARKER: Whatever you can conclude. If he says part of it is one and part of it is another, that's what we have. The lower photograph.
MR. HELM: That's what -- it goes three miles away, too.
MR. BARKER: Just whatever you want to delineate, and he can delineate what he wants to.
A. Well, okay, this is Salt cedar?
Q. (By Mr. Barker) At the Lucky Dam, I would assume it is.
MR. HELM: Do you know what depth the water is in the photograph?
MR. BARKER: I do not. All I know exactly about this photograph is what you see.
MR. HELM: They want to know whether your question is supposed to be a composite for the whole area or sections out of it?

Page 51

MR. BARKER: No. What I asked him to do is, those areas, if he can give us a Manning's n coefficient or estimate one, please do so, and then indicate for what area.
MR. HELM: Object to form.
A. All right. Let's see. Okay. What I'm going to do is circle an area, and then I'll make a -- an estimate of depths and/or I'll make an estimate of the height of the vegetation, and then I'll do an estimate of Manning's n for -- for different heights of water level along that vegetation. Is that okay?
Q. (By Mr. Barker) Okay.
MR. HELM: And you want -- you want it determined for the conditions that exist in the photograph?
MR. BARKER: Exactly.
A. Do you want me to do it without referring to anything, any materials I have here?
Q. (By Mr. Barker) You can use whatever you need to.
A. Whatever I need?
Q. I'm not -- as I told you, there's no trick questions here, and this is not a time test.
A. Okay. All right.
Q. We just want your best estimate based upon those questions I asked. So if you need to look at something, feel free to do so.
A. Okay. Let's see.

Page 52

MR. HELM: By the by, since we're going to make these exhibits, would you provide me with the appropriate foundation.
MR. BARKER: As soon as I get it.
MR. HELM: Appreciate it.
A. Okay. I've done it in one spot.
Q. (By Mr. Barker) Okay.
A. Is that okay? Let's see. All right. Yeah.
Q. Okay. Would you do -- for the record, Mr. Hjalmarson, if you would, kindly tell us what your notations on the photograph show, the assumptions you made and tell us what you've written. And you've identified an area that you're providing this opinion concerning.
A. Okay. I'm assuming that this is dense Salt cedar vegetation, 15 feet high. I'm assuming -- for the first case here, I'm assuming that the flow depth is five feet, and the velocity is less than seven feet per second, and that would have a roughness coefficient of approximately .2.
The second condition I've included is at a flow depth of 10, with a velocity less than seven, which means the vegetation is still standing, it would have a roughness coefficient of approximately .15.
And the third condition reflects the condition of the combination of higher depth and greater velocity, where it would, the vegetation would start to bend. And in that

Page 53

condition, the Manning's n would drop significantly. And as the flood -- as a flood progressed, and it continues to be laid down, it could -- it could drop down to maybe .05, something in that vicinity.

So you need to know the height -- the height of the vegetation, the depth of flow and the velocity of flow are critical in making an estimate of what's going on with Salt cedar.

Q. Okay. Can you contrast or compare Exhibit 5 with Exhibit 6 and tell us whether you think -- whether you think what's shown in Exhibit 5, under the circumstances that we've provided you with, is greater, lesser? How do you compare the two?

A. Based on my experience here, what's in Exhibit 5, it's not as rough, but a lot of this vegetation wouldn't bend. A lot of this vegetation wouldn't bend, in Exhibit 5. It's going to remain in place. The smaller stuff might, but, again, I don't know the gradient of this river.

I do know where Vern Snyder did his work, and in that area, this stuff may not bend. The gradients and velocities are going to be pretty low.

So, in a general sense, at Exhibit 5, that vegetation, at a depth of 2.9, isn't going to bend. And the Salt cedar, when you expose it to depths -- well, I have a table here that's from USGS publication for Maricopa County

Page 54

here, and it -- it shows that you have to consider velocities and heights of vegetation to determine if it's going to be upright or not.

Q. Okay.

MR. HELM: Is that it?

Q. That's it. You've answered my question. Thank you very much.

Did you do, in connection with your charge from either Helm and Kyle or Stantec, any work involved with HEC-2 runs or models or anything of that nature?

MR. HELM: Object to form.

A. I didn't do any HEC-2.

Q. Did you review any HEC-2s out at the Flood Control District or any HEC-2 work that's been done?

MR. HELM: Object to form.

A. I looked at a HEC-2 run, yes.

Q. Okay. Do you recall the date of that run?

A. Not -- not precisely. I believe it was a run where that -- that established the water level for FEMA regulations.

Q. Okay.

A. '70s or '80s, I forget. 1970s or '80s, I honestly forget.

Q. What we've handed you is Exhibit Number 7. This is a partial copy, and I'm only going to ask you questions about

Page 55

a partial copy. It shows a file save date. It came from the Flood Control District of Maricopa County, and it shows a file save date on October 14, 1992.

And my question is: Do you know if you ever looked at this particular run out at Flood Control District?

A. I don't know.

Q. Okay.

A. I don't know.

Q. You're familiar with the HEC-2 water surface profile program?

A. Uhm -- yes.

Q. Okay. Do you -- are you familiar with how input data is developed to run that program?

A. Yes.

Q. I've handed you Exhibit Number 8. Have you had a chance to look at that?

A. Yes.

Q. Okay. And this is a document that comes along with the HEC-2 that tells you about certain features that are available for a HEC-2 to operate and the data that you'll receive from it once you utilize those optional features. Is that correct?

MR. HELM: Object to the form.

A. Uhm -- yes, it appears that way, yes.

Q. In field 10 of the J2 record, would a value of 15

Page 56

mean that the flow distribution option is turned on?

MR. HELM: What was your reference again? What number?

Q. If you look at field 10, on the second page.

MR. HELM: Oh, field 10. We're looking for field 15.

Q. And if you look down to 15.

A. I am very rusty on -- when you ask the question, I didn't input data. I thought you meant what kind of field data goes into HEC-2 that I know.

As far as the inner workings of making HEC-2 run like this and giving it these type of instructions, it's been 15, 20 years since I've done this. And most of my experience is with J-635 and E-341, the US Geological Survey programs.

I had a class, week long class at Arizona State University on HEC-2. I've examined a lot of HEC-2 stuff, but I don't -- I'm not up enough on it to answer much of anything with regard to these input instructions at this time.

Q. Okay. Well, let me just walk through it, and if you can't answer it, you tell me -- you tell me you can't answer it. Because all I'm trying to do is ask you to look and see if what I've provided you tells you the answer and if you agree with it or you don't. If you don't know, you'll tell me, "I don't know."

A. Well, you're going to hear a lot of "I don't know."

Page 57

Q. *That's not a problem.*
A. Okay.
Q. *As I told you, there's no wrong answers here.*
A. Okay.
Q. *All right. But the third sheet of Exhibit 8, it reflects that, in field number 10, which is toward the bottom, that the value shown is 15, and there the description says, "Flow distribution printout for all cross-sections." Do you see that?*
A. Yes.
Q. *And it's my understanding -- and you think you're rusty. I have absolutely no understanding what we're talking about. So my understanding of what that means is that, if that shows up, that the flow distribution option is turned on for the running of the HEC-2 program that's under consideration.*
A. It would look like it, yes.
Q. *Okay. Would you go back to Exhibit 7, which is the exhibit, the other exhibit I handed you.*
A. Yes.
Q. *And does that option appear to be turned on over in the far right-hand portion of Exhibit 7?*
A. There is a 15 there, yeah.
Q. *Okay. If you look down in the corresponding line from across, you see it says J2?*

Page 58

A. Yes, yeah, it appears to be, yes, field 10. Okay.
Q. *Do you recall what in the HEC-2 program the flow distribution option does?*
A. I'm not 100 percent sure, but it would -- it seems like it would show the flow in the different subdivided portions of the cross-sections.
Q. *Okay. What I've handed you as Exhibit 9, which it's my understanding is a portion of a user's manual for 1991 for the HEC-2, and I'd ask you to look at -- if you'll look at the second sheet, it shows you the program output. Look at output, flow distribution. Look at page 39, and then at the bottom of page 39 and onto page 40 is a description of flow distribution.*
A. Okay.
Q. *At the top of page 40, there's a sentence that starts, right in the middle of the first line, starting, "When the flow distribution...." Would you read that sentence, please, into the record?*
A. "When the flow distribution option is requested, the program prints out the lateral distribution of area, velocity, percent of total discharge, and depth for up to 13 subdivisions of the cross-section."
Q. *And it's my understanding from what you told me earlier, I mean, that's the same thing you told me earlier?*
A. Yes.

Page 59

Q. *Okay.*
MR. HELM: Does this mean you didn't believe him?
MR. BARKER: No, I'm just making sure we're all on the same page. I believe everything he tells me. I'm not questioning Winn, trust me on that. I'm just making sure we're all on the same page.
Q. *(By Mr. Barker) What I've handed you is Exhibit 10. I will tell you it's a partial copy of the output. The entire output was 161 pages long. And would you look -- if you look at page two, about halfway down the page following the break, it says, "Crest of Gillespie Dam"?*
A. Yes.
Q. *And you see X1, 166.58?*
A. Yes.
Q. *And then below that, after the next break, it says X1, 166.61?*
A. Yes.
Q. *And then, if you look at the next page, three, X1, 166.64?*
A. 166, okay.
Q. *If you go back to the sheet, page two, where we started, the last break, where it says X1, 166.61, it's my understanding that in the center, if you go over -- if you call the 166.61 column one, and you go over five columns on that same line, is the number 160?*

Page 60

A. Yes.
Q. *The next column is 120?*
A. Yes.
Q. *And the next column is 140. Do you see those three columns?*
A. Yes.
Q. *And it's my understanding that's distances upstream from the crest of the Gillespie Dam.*
A. Really?
Q. *Excuse me. From the previous cross-section. You see, when I wing it here, I get in real trouble.*
A. The 160 is the distance from the previous cross-section?
Q. *Okay. Distance of channel and left and right overbank.*
MR. HELM: Object to form.
MR. BARKER: I tell you what, I don't know what I'm saying.
MR. HELM: That's why I'm objecting, because I don't either, and I can tell you my witness doesn't.
MR. BARKER: He'll tell me if he doesn't.
A. What was your question again now?
Q. *(By Mr. Barker) I have no idea. What we're attempting to do here is to locate this particular cross-section with relation to its location to Gillespie Dam,*

Page 61

and my question is: Do you understand that, and is that -- have we done that right?

MR. HELM: Do you want him to locate it for you?

MR. BARKER: No. I'm asking him if that's what is shown here, and does that have a reference with the location on these columns as to Gillespie Dam.

A. The 160 and the 120?

Q. (By Mr. Barker) Yeah.

A. I don't know.

Q. Okay. On the top of page three, the one I asked you to look at previously.

A. The top of page three?

Q. The 166.64, again, in those same three columns --

A. And are those the distances -- you're saying your question is: Are those the distance from Gillespie Dam?

Q. No, that's --

A. What are they?

MR. HELM: Let him ask you the question.

Q. Yeah, I will. I'm just trying to tell you, it's my understanding those are the distances upstream from the previous cross-section.

MR. HELM: Object to form.

A. I don't know. I'd have to -- I'd have to see output instructions for HEC-2.

Q. Okay. Mr. Hjalmarson, in that same exhibit that

Page 62

we're talking about, which is 10, if you'd look at page eight. Up in the upper right-hand corner, you'll see that the pages are numbered. If you'll look at page eight --

A. Okay.

Q. -- about two-thirds of the way down on the left-hand side, you'll see, "Flow distribution for," and the same number, 166.61, that we looked at previously.

A. Okay. 166.61?

Q. Yes.

A. Yes.

Q. Would this be the flow distribution for the cross-sections that we previously looked at in the two or three prior instances on pages two and three?

MR. HELM: Object to form.

A. Let's see. The flow distribution for cross-sections, plural, you said?

Q. For cross-section 166.61.

A. Oh, yes, it appears to be, yes.

Q. The third line -- if you go down three lines from what we just read, flow distribution for 166.61, you see per Q equals 74.2.

A. Yes.

Q. Do you know what that means?

A. A percent of discharge that -- whatever this discharge is, I don't know what it is, but the percent of it

Page 63

that's being used for this computation -- well, 74.2 percent of it is in that sub-area.

Q. Would that indicate that the 74.2 percent of the total flow that's being measured here, and if you'll go back to the first page, down under QT, just following a couple of line breaks, it shows 240,000 --

A. Oh, okay.

Q. -- that would be measuring 76.8 percent of the total flow of 240,000 cfs in the channel that's being measured in that section?

A. It would -- it would appear, yes, apparently so.

Q. Let me just show you Exhibit 11. I've handed you Exhibit 11, and I will tell you the only difference between the two, if you look down on the front sheet, I mean, the numbers are different, but the change, the only change that has been made between Exhibit 10 and Exhibit 11 is in the item that we just referred to, the QT item.

A. Okay.

Q. And the QT item in Exhibit 11 is 178,000 cfs.

A. Okay.

Q. And then if you go to page, it should be eight again, page eight again, the per Q section that we looked at previously would reflect a 73.8.

A. Yes.

Q. And that would indicate, based on what we've said

Page 64

earlier about Exhibit 10, that 73.8 percent of the total flow now of 178,000 cfs is in the channel that's being examined by that particular section?

A. Yes.

Q. Okay. Let me give you a hypothetical. Assume that the channel that's being measured at those two sections is 960 feet wide. That would indicate the percentage of flow that's in the 960 foot wide section at those two different velocities?

MR. HELM: Object to form.

Q. Is that correct?

MR. HELM: Same objection.

A. Yes.

Q. Okay. You reviewed the two-dimensional model that was prepared by Harza in connection with this litigation?

A. I reviewed the report. I looked -- I didn't look at the, you know, the RMA-2. It's -- no, I did not look at that.

Q. Did you review any of those flow distribution results in the RMA-2 model?

A. I saw the results, yes.

Q. Do you recall the flow distribution results that Harza reported in the RMA-2 model?

A. Do I recall them? No, I'd have to look at the report.

Page 65

Q. *Okay. Let me just ask you then, hypothetically, if the two-dimensional hydraulic model prepared by Harza actually showed less flow in a 960 foot area than is shown on the HEC-2, would that tend to indicate that the flow distribution that Harza found was actually less than is shown on the HEC-2?*

MR. HELM: Object to the form.

A. Well, you're just -- you're -- you know, one model shows one, and one model shows the other, yes, you know.

Q. *Let me just on this subject ask you one more.*

MR. HELM: Is this 12?

Q. *I'm handing you Exhibit Number 12, and I will tell you this is an excerpt from HEC-2 Water Surface Profiles User's Manual of 1976. It's from November of 1976. I'd ask you to look at the second sheet and the third sheet.*

MR. HELM: Did you say it was 1982?

MR. BARKER: 1976.

Q. *(By Mr. Barker) Okay. Have you had a chance to look at that exhibit?*

A. Yeah.

Q. *Okay.*

A. Yes.

Q. *Does that indicate that in November of 1976, the flow distribution option was available for the HEC-2 water surface profile program?*

Page 66

A. Yes, there was an option available.

Q. *Okay. I think, to speed it up, it's a quarter to 12, my thought is, if we take a break --*

MR. HELM: You're done?

MR. BARKER: Oh, no, no.

MR. HELM: That would speed it up.

MR. BARKER: What I'm trying to do is to speed it up and make sure I'm not getting redundant or asking the same question I've asked, because I've got several sources. I need to take a little time just to make sure I discover each subject once.

MR. HELM: Would you like to come back at one o'clock? Is that your suggestion?

MR. BARKER: Yeah, why don't we break now and come back at one and move right along.

(Lunch break taken.)

Q. *(By Mr. Barker) Mr. Hjalmarson, what effect did the flow distribution downstream of Gillespie Dam have on the flow distribution upstream of Gillespie Dam during the January 9, 1993 flood?*

A. Downstream of the crest?

Q. *Yes.*

A. None.

Q. *During the 1993 flood, would you have expected there would have been a significant variation in the flow*

Page 67

distribution across the top of the dam?

A. I would expect a variation in the distribution of discharge across. I think you said "significant".

Q. *Yes.*

A. What do you mean?

Q. *I don't know what significant is to an engineer or a hydrologist.*

MR. HELM: Object to the form of the question.

Q. *So whatever your definition is.*

A. I would expect a variation, yes.

Q. *Let me ask it this way. Do you expect, during the 1993 flood, that the unit discharge near the dam was higher in the cleared corridor or in the vegetated areas?*

A. It would be higher in the cleared areas or open areas.

Q. *Do you think it's reasonable for model results to show a much higher unit discharge at the dam immediately downstream of the cleared area than at the dam in the area downstream of the vegetated areas?*

MR. HELM: Object to form.

A. Let's say it again.

(Whereupon the following was read by the court reporter: "Do you think it's reasonable for model results to show a much higher unit discharge at the dam immediately downstream of the cleared area than at the dam in the area

Page 68

downstream of the vegetated areas?")

MR. HELM: Same objection.

A. Yes.

Q. *For a variation to occur in the two areas, what, in your opinion, would you ascribe as a variation that was significant? Can you give a percentage to it?*

MR. HELM: Object to form.

A. In what two areas?

Q. *I'm talking about unit discharge coming across the crest of the dam, contrasting the cleared area with the vegetated areas. For you to consider a variation in unit discharge to be significant, what type of percentage factor would you ascribe?*

You asked me to define significant, and I can't do it. So I'm asking you if there is a percentage that you would say is significant.

MR. HELM: Object to form.

A. Are you talking about, say, average unit discharge or -- you see, within the vegetated area, there are open areas --

Q. *Yes.*

A. -- and I would expect high unit discharges in those areas.

Q. *Okay.*

A. So would you -- you know, I would expect -- okay, I

Page 69

would expect a higher average unit discharge in the cleared area versus the average unit discharge in the, what you call the vegetated area.

Q. Okay. Let me change horses now and ask you some -- if I can ask you some questions about navigability for a minute.

In your -- according to your studies, did you determine that the Gila River -- did the Gila River ever dry up during its natural state, in other words, where it did not have any flow in it?

A. Under its natural and normal condition, it's -- during an extreme drought, I would think it would -- it could be possible, yes.

Q. Okay. Are you familiar with --

A. No, I'm not.

Q. Okay. I've handed you Exhibit 13, which is an article from the Journal of the Hydraulics Division of the Proceedings of the American Society of Civil Engineers entitled, "Flow Losses in the Lower Gila River," by Lawrence F. Pratt, and I think this was in 1960. Have you seen this document before?

A. No.

Q. In it Mr. Pratt reports a drought where he states at page -- I think it's 26, but it's hard to tell. It's the third sheet, down on the left-hand side, "The Gila River was

Page 70

dry at Gila City, (Dome)..." Do you see that, about the second line?

A. Yes.

Q. There he describes a period of at least 210 days where the Gila was dry at that location.

A. Right.

Q. Is that consistent with the things that you found in your studies concerning the Gila River?

A. After about 1860, Anglo diversion started occurring throughout the Gila River waters. So all the flow that you experience in the Gila after about 1860 reflects the effects of these many diversions, Verde, Salt, Gila, so forth. And, yes, so I would expect, under those conditions, to have the Gila dry.

And, in fact, in my report I show examples for 1905 where, because of diversions, the Gila, you know, goes dry. It was quite common after those diversions occurred.

Q. Is it your opinion that without those diversions, the Gila was never dry at any time during the year?

A. As I said to your first question in regard to this, navigation, I would expect, under the natural conditions, that it would go dry in ex- -- during extreme droughts. It could go dry in extreme droughts.

Q. Let me show you a document that was included in your materials. I've marked it as Exhibit 14 ,and I'd call

Page 71

your attention to the page, the second sheet, and I will tell you that that's from the publication entitled "Pre-Development Hydrology of the Gila River Indian Reservation, South Central Arizona." Do you see that?

MR. HELM: This is the table labeled Precipitation at Tucson?

A. Okay.

Q. This seems to report that around the turn of the century, that based upon the precipitation in inches at Tucson, during the period 1876 to 1984, that there was a period of six years in which the rainfall in Tucson was below normal.

A. Okay.

Q. Okay. Would you have expected the rainfall in the Gila River Basin that affects the flow in the Gila River that you monitored or measured, by your calculations, to have been below normal for that same period?

A. There's a general correlation in Arizona between precipitation at sites scattered all over the state. So if there's a long-term trend like this, I would -- I would expect something similar at other precipitation gauges throughout much of the state.

Q. Would a rainfall deficiency of that length or duration have caused the Gila to dry up?

MR. HELM: Object to form.

Page 72

A. I have -- I have no idea.

Q. When, in your opinion, did diversions of the Gila River water for non-Indian use begin?

A. About 1860 is when the first -- the Anglo diversions began, yes, about that.

Q. In the -- on the third sheet of Exhibit 14, and in the second paragraph, if you go down six lines, and about midway in, it says, "Prior to the development of the area by non-Indian settlers...," do you see that?

A. Yes.

Q. It shows water levels were 10 to 70 feet below the land surface, and the water table was a surface of low relief. Do you see that part?

A. Yes.

Q. What would have happened to the stream flow through that same area at that time under those conditions?

A. The stream, the water in the -- in the stream would be above the groundwater levels, so you would expect some losses in the amount of flow in the stream. You'd expect infiltration into the ground.

Q. I've handed you Exhibit 15, which is a document entitled "Hydrologic Evaluation of the Gila Bend Basin, Maricopa County," by Paul Manera, PILP document 006709.

Have you seen that document before, Mr. Hjalmarson?

A. I believe I have, but I -- I can't recall if it's

Page 73

in regard to this case or if I'd seen it previously.

Q. Okay. I've copied only page six out of it for the indented -- second indented paragraph on that, down at the very bottom, "Most of these canals..."

A. Okay.

Q. The author of this report, as I understand it, is reporting that there were diversions, mostly brush diversion dams, which were abandoned by the farmers who had constructed them.

MR. HELM: Object to form.

MR. BARKER: I'm not finished yet.

MR. HELM: Well, you're still mischaracterizing, but go ahead.

Q. (By Mr. Barker) And my question to you is: Based upon what the author reports, do you think the folks who abandoned those diversion dams would have done so if there had been adequate water?

A. Probably not, unless their -- unless their diversions weren't, you know, sufficient for -- to, you know, make the diversion without, you know, consistent repairs or something.

Q. Okay.

A. But, I mean, what are the time periods here? Did you want me to respond to the time period?

Q. No, I just -- I just asked you that question.

Page 74

A. Okay. That's fine.

Q. That's all I wanted to know about that.

MR. HELM: And you've now told him too much.

A. Well, no, he's -- I think he's --

Q. Is it your opinion that the width of the Gila River is a function of the mean annual flow?

A. The width of the Gila River --

Q. Yes.

A. -- is a function of the --

Q. Mean annual flow.

A. Yes, there is a -- under the natural conditions, yes, there would be a relation.

Q. I think one of the citations that you report on is a publication by Burkham.

A. Um-hum.

Q. Is that correct?

A. Um-hum.

Q. You have to say yes or no.

A. Yes.

Q. Just like writing on the exhibits.

A. Sorry.

Q. Would you agree that Burkham's description of the Gila River said there was width instability due to the existence of large floods?

A. Yes.

Page 75

Q. Doesn't that contraindicate that the width of the Gila River would be a function of the mean annual flow?

MR. HELM: Object to form.

A. No.

Q. Can you explain how they're not inconsistent, those two statements?

A. During floods, the sediments and so forth are moved, and the channel, you know, changes some. Then, as the floods recede, the channel readjusts and so forth, and its size becomes related more to the mean annual flow or lesser discharges. And the mean annual flow would be an index of the lower discharges.

Q. Are you familiar with a methodology of relating river width to the bankfull discharge of a mean annual flood?

A. Uhm -- yes.

Q. And would you -- why wouldn't you use that methodology in your study rather than the one that you've selected?

A. I feel the one I selected is superior to that, to that method.

Q. You think so, even in the face of profound changes in river width due to significant floods that occur periodically?

MR. HELM: Object to the form.

A. It's superior to the bankfull method, yes.

Page 76

Q. I've handed you Exhibit 16 for the purpose of figure 7.2, a cross-section, showing a cross-section before and after the flood downstream from Gila Dam -- or from Gillespie Dam on the Gila River.

As I recall, this cross-section is about 8,000 -- 8,000 feet wide.

MR. HELM: Object to the form.

Q. What do you estimate for the mean annual natural flow for this 8,000 foot wide reach?

MR. HELM: Object to the form.

A. The natural mean annual flow?

Q. Yes.

A. I'd have to go to the figures in my report.

Q. That's fine.

MR. HELM: Do we know where this is?

THE WITNESS: He said about 8,000.

MR. HELM: It's 8,000 feet wide, is my understanding, but he hasn't told us where on the Gila River this cross-section is taken. Is it in Safford or is it in Yuma?

MR. BARKER: No, it's below Gillespie Dam.

MR. HELM: Do we know where?

MR. BARKER: It says in the report. I thought he was familiar with it.

MR. HELM: We can start there.

Page 77

Q. *(By Mr. Barker) This is upstream from Painted Rock and below Gillespie, but I don't know exactly. It doesn't really matter for the purposes of this question exactly where it is.*

MR. HELM: You can understand, I don't know that at this point.

A. Okay. As long as it's in the reach from below the confluence of the Salt to the mouth, I used a constant mean annual flow of 2,330 cubic feet per second.

Q. *(By Mr. Barker) Looking at Exhibit 16, how many channels would you assign to the black cross-section?*

MR. HELM: You mean the black line cross-section?

MR. BARKER: Black line cross-section. Excuse me.

A. Oh, I would assign -- there's a couple of -- there's at least two that are about the same elevation. There is one on the -- on my right side that doesn't say what the distance or -- okay. The west side. The lowest one appears to be on the west side. So there is one distinct low flow channel there, and then there's another one a little higher up at station 250, roughly.

Q. *(By Mr. Barker) Okay. So that's where you'd assign -- you'd assign two of them in those two --*

A. I'd have -- I would expect flow in maybe two of them there, yes.

Q. *How about the pink line cross-section?*

Page 78

A. Well, your low channel is still on the west side. It's a little deeper. And then you might have -- in this case, you might have a total of three, or maybe five possibly. You'd have one distinct one on the west side, and then possibly there would be a couple of others, but you can't really tell from one cross-section.

Q. *Would you agree with me that the water would not extend bank to bank?*

A. Uhm -- probably not.

Q. *Can you tell from this cross-section where the ordinary water level would be?*

A. Well, I'm having a little trouble with the logic on this, because this is a cross-section for conditions that aren't natural. This is with a highly modified watershed above this point, and this ordinary water level seems to be related to natural conditions. So I -- it's not logical for me to make that determination.

Q. *Would you agree with me that the Gila River, though, is a braided river?*

A. No.

Q. *It's not a braided river?*

A. Well, it might -- it has a braided appearance. Now it's becoming braided, because the flow environment has been changed so severely. In some places it has a braided appearance, yes.

Page 79

Q. *Is it your opinion that under the hypothetical situation, with your estimated mean annual flow, it was not braided?*

A. Under the hypothetical?

Q. *Well, yeah, because what you've given us for navigability is hypothetical.*

MR. HELM: You mean is normal and natural.

Q. *Right, which is a hypothetical number that you worked up with your calculations.*

A. No, I wouldn't call it hypo- -- I don't think of it as hypothetical.

Q. *Nobody had a gauge out there at that time, because the condition did not occur that you're describing.*

A. Well, it's an estimate based on data.

Q. *Okay. Your estimated flow. Is that -- are you more comfortable with that?*

A. It's, in essence, an estimate of the natural flow.

Q. *Okay. I'll accept that, not a problem.*

In utilizing your estimated flow, is it your position that there would have been a bed and banks and the stream and the river would not have been braided, the Gila River, under your estimated condition?

A. I would -- in most places, I would expect it to not be braided. But because of the nature of the channels like the Gila, I would expect to have localized areas of braided

Page 80

like conditions following large floods. You'd get increases in gradient and so forth from some deposition, and braided -- and braiding-like conditions might -- might -- might occur.

Q. *Under those conditions, where would your navigability defining flow occur?*

A. Well, the discharge remains the same. All we're talking about is an alteration in the geometry, and so I would expect, like in this case, like in both of these cross-sections you have, there is a low channel here where you would have water.

Q. *At all times?*

A. It would certainly appear that way, yes.

Q. *Do you think the Gila River is a good river for hydraulic geometry analysis?*

MR. HELM: Object to form.

A. I think hydraulic geometry analysis is appropriate for the Gila River.

Q. *In its natural state, didn't the Gila River dry up during every significant drought?*

MR. HELM: Object to form.

A. Yeah, with emphasis on "significant".

Q. *What I've handed you is Exhibit Number 17, which includes a page from a publication called "The Variability of Large Alluvial Rivers" by Stanley Schumm of Ayres Associates and Colorado State University. Are you familiar with this*

Page 81

publication?
A. No, I'm not.
Q. *Are you familiar with the types of calculations that appear on the charts that are figure 2-7 and 2-8 --*
A. What calculations?
Q. *-- or the survey results plotted on there.*
MR. HELM: You're talking about the ones for Cairo, and I assume that's Egypt.
MR. BARKER: No, it's Illinois. It's the Mississippi River.
A. So you have -- yes, I mean, this is a -- yes, I'm familiar with plots like this.
Q. *Okay. I'll tell you, according to the text, these are plots of the Mississippi River widths over nearly a century in which the flows can be considered natural.*
The Mississippi, would you agree with me, is not as unstable a river as the Gila River?
MR. HELM: Object to form.
A. I don't know.
Q. *Okay. Well, you'd agree that probably the Mississippi hasn't dried up in conditions of drought in the Midwest, at least in recorded history that we know about in the last hundred years? It's flowed consistently throughout that period of time?*
A. I would -- that would be a reasonable guess.

Page 82

Q. *Okay. What these surveys indicate is that the width of the Mississippi River changed by a factor of about two in 35 years or less, after having been fairly stable for 60 years. Look at the surveys.*
MR. HELM: Object to form.
A. Okay.
Q. *My question is: If the width of the Mississippi River can change so much in time and space, that is, by a factor of two, do you still believe that the utilization of hydraulic geometry is acceptable in attempting to calculate the same type of information for the Gila River?*
MR. HELM: Object to form.
A. I need to qualify conditions before I make this -- make my answer, and that is --
Q. *Absolutely.*
A. -- I'm not sure if what I'm looking at here is natural.
However, the Mississippi River, I believe -- well, let me -- I can look at a reference right now.
Q. *Help yourself. As I told you, you look at whatever you need to look at.*
A. The method I used, the hydraulic geometry method I used, one of the earliest users of this method was Walter Langbonn (ph). He's the author of the US Geological Survey Report, the third navigation study report that I used.

Page 83

In his report is the Mississippi River, where he used the hydraulic geometry method. So the answer's, yes, I'd expect it to be useable in both.
Q. *Both situations?*
A. Both Gila and the Mississippi.
Q. *Despite the differences in the characteristics between the two rivers?*
A. Yes.
Q. *Would you assign a factor or a degree of the possibility of error in the utilization of the same thing, the same type of methodology, in the Gila River as contrasted to the Mississippi River?*
MR. HELM: Object to form.
A. I don't know. There is some error in the method, of course, but I don't -- I don't know the relative numbers.
Q. *Would you suspect that the degree of error would be higher in using the method in the Gila River than it would be using it in the Mississippi River?*
MR. HELM: Object to form. What error? What error are you talking about here?
Q. *Well, what you're attempting to do is to calculate, as I understand it, a bankfull width of the river, what you're doing in your study here to determine if you've got navigable water in this river, correct?*
A. So you're talking about the error in the estimate

Page 84

of width?
Q. *Yes.*
A. Okay. You can have -- let me answer it this way. You can have a lot of error in the width, and it'll still be navigable.
Q. *How so?*
A. Because the criteria for being navigable, like one of the criteria I showed you has a minimum depth of one foot and a minimum width of six feet.
Q. *Well, what I think you told me also, at that point, that you had not done any study of watercraft that was available in 1912 that could be -- excuse me -- that could be commercially used to transport goods or services or people.*
MR. HELM: Object to form.
A. I was using results of a publication that considered several types of watercraft, of which I didn't really care about, and I -- and I looked at the result of their criteria, is all I looked at.
Q. *Okay. Do you know any other ways of determining whether a river is navigable or not, aside from the one you used?*
A. Well, I'm sure there's -- I can't think of one in particular, but, yes, there must be other methods.
Q. *Let me go to another subject. On page 30 of Exhibit 1, that's your statement.*

Page 85

A. The statement?

Q. Um-hum. And page 30 is the first page, the third line down in the bottom paragraph on page 30, right towards the far right, it says, "He is further expected to testify that his rating curve analysis indicates that the clearing performed by the FCD had no impact on the flow of water over the dam...." Do you see that?

A. Yes.

Q. I'll ask you my question this way. Did the cleared corridor area focus the flow of the water?

MR. HELM: Object to form.

A. Again, I'm back to -- I can't answer that because it's not specific enough. Are you talking about like an average focusing?

Q. Well, did it focus it at all?

A. I think it probably de-focused it in terms of it probably decreased the intensity of unit discharge over the dam in places, because it widened the -- several of the small channels that were over there.

Q. Okay. Let me ask you the question this way. As contrasted with an area of the river which is vegetated and an area which is cleared, I think we talked earlier that you would expect there to be some variation between the cleared area and the vegetated areas, and you would expect it to be larger in the cleared areas, but --

Page 86

A. Cleared or open areas.

Q. Or open areas?

A. Yeah, I like to use --

Q. That's fine. And would you agree with me that under that situation, talking about cleared versus non-cleared, that the flow over the dam during floods is not the same all the way across the crest of the dam?

MR. HELM: Object to form.

A. Well, I would expect a variation, yes, of unit discharge or discharge of velocity across the crest of the dam, yes, and I would expect it to be higher in the open or cleared areas.

Q. Was the US -- do you know why the USGS gauge at the dam was moved?

A. Well, the dam broke.

Q. It's my understanding that it was not there before the dam broke.

A. The gauge was relocated to the highway bridge downstream to gauge total flows.

Q. Okay. Do you know when that took place?

A. It may have occurred after I retired. No, I don't know precisely when it did, but it was probably early 1990s.

Q. It was before the flood, wasn't it?

A. Yeah, it was before the -- oh, definitely before the flood, yeah.

Page 87

Q. And it was moved, as I understand it, after the cleared corridor construction had been completed by the Flood Control District.

A. I don't -- I don't know. Well, let me think. Yeah, I believe it was installed after -- yes, after, in -- perhaps in the late 1980s it could have been installed.

Q. Do you know if it was moved because there would have been a variation in flow across the top of the dam because of the clearing?

A. Had absolutely nothing to do with it.

Q. Okay. Do you know why it was moved?

A. Because -- okay. They couldn't gauge the total flow at the site. The old gauge at the dam recorded -- or above the crest, recorded high flows, but there were a lot of things going on in regard to lower flows.

And they had two weirs, one that was installed in the early 1970s where a 1,600 foot, one foot high wall was built at the toe of the apron, and then there was a 30 foot opening on the east side. Well, that washed out. And so then they rebuilt a new measuring device in the sluice, and then that washed out. So the third attempt to gauge all the flow was the one down at the highway bridge.

Q. That was put on the bridge?

A. Yes.

Q. In your notes, it indicated that at times you were

Page 88

looking for variations in flow depth across the length of Gillespie Dam.

A. At times I was looking for variations in flow depth?

Q. In flow, flow depth.

A. I was wondering if you could see it, yes, from photographs and so forth. Pretty hard to see.

Q. Did you ever see any variation?

A. I -- I think you could see little hints of it, but kind of localized stuff. Couldn't -- I couldn't get what I was hoping to get from it.

Q. Did you ever calculate any variation?

A. No. Now, this is -- this is a -- you're talking about an observation looking at it vertically.

Q. Sure.

A. Okay. Yeah, I want to make sure of that. That's what I'm talking about.

Q. I think we found some information that we thought that the USGS gauge was moved to the Highway 80 bridge in 1985.

A. Could be, yeah.

Q. Okay. Do you know why the peak flow of the 1980 flood wasn't measured at Gillespie Dam?

A. Wasn't directly measured?

Q. Yeah.

Page 89

A. Well, there was a measurement of 121,000 cfs made on February 16, 1980, and that plotted right on rating number four, which was in use at that time, and rating number four extended up to the peak, so they felt everything was fine. They didn't need to do any indirect measurement or anything down there. It verified the rating, and rating four was fine. I believe that's it.

Q. That's your best recollection?

A. That's my best recollection.

Q. That's fine. Do you know why the peak flow of 1993 was not measured at Gillespie Dam?

A. Uhm -- that's after I retired.

Q. I figured you might know some folks there, though.

A. Yeah. If you noticed, I retired four days before it hit.

Q. That's what I call serendipity.

A. No, I don't know why they didn't.

Q. I think you estimated the peak flow on January 9, 1993 at 132,000 cfs.

A. I did a flow routing that suggested that was -- that was the peak.

Q. If the flood peak was that, what would a gauge reading at the dam have been, do you know?

A. This is -- oh, let's see. This is assuming the peak got there before it failed?

Page 90

Q. Right.

A. So I would have to go to the rating. You know, it would be something less than eight feet. Six, seven feet, somewhere in there.

Q. Okay.

A. I think the -- yeah, six, seven feet, somewhere in that range. I can go -- I can get the rating, if you want, or I saw Michael had one.

Q. We have one. We'll ask you about it in a minute.

A. Okay.

Q. On the next page of Exhibit 1, which is page 31, right about in the middle of that first paragraph is this sentence, "He will testify that none of the defendants' computer modeling took into consideration the changes in vegetation and topography that occur during a flood." Do you see that sentence?

A. Yes.

Q. How do you know the changes in vegetation during a flood were not considered?

A. It's based on the report, the Harza report, and their testimony when they were deposed.

Q. How would you make changes to the topography during the modeling of flood peak?

A. I could say that tongue-in-cheek: Very carefully.

Q. Besides that?

Page 91

A. It is, in a river like that, very difficult. But you know it occurs.

Q. Is it possible to do it when you're modeling?

A. Yes, it's -- it's possible.

Q. How do you do it?

A. I've not -- I'm not a 2D modeler.

Q. So you wouldn't know?

A. I've heard that from the two Z's.

Q. Z and Z?

A. Z and Z. I've heard, yeah, and I've heard it can be done.

Q. And so we'd have to ask them, the Z's, how do you do it?

A. Ask Zorro.

Q. Z squared. I like that.

Again, on page 31, in this last sentence in the second paragraph, that sentence says, "Mr. Hjalmarson will critique Mr. Stevens' methodology in doing his flood attenuation study." Do you see that?

A. Yes.

Q. Please give us your critique.

A. Well, Mr. Stevens used Canal CAD, which is a very awkward model to use. There's scaling problems with it, and the name alone ought to tell you that it's for canals, where you have flow overtopping banks. And the Gila River, you

Page 92

have a big alluvial channel with water rising and extending out into floodplain areas.

So it's kind of an obvious mismatch there.

There are many other simpler models that would give probably better results than Canal CAD. There are effusion wave type models, for example, that are just hydrologic based models that would do it. You wouldn't have to go into a full hydraulic model like Canal CAD is.

There's another thing that Mr. Stevens didn't seem to do, and I certainly never saw it in a report or heard it in testimony, and that is there is a lot of USGS hydrographs around for various floods that define attenuation and the velocities of flood waves moving through. And the speed of those flood hydrographs doesn't agree with what he came up with.

Q. Did you do any work in that regard by looking at hydrographs and comparing your findings versus what Mr. Stevens reported?

A. Did I? Well, I just did what I just said. When I did my flood routing earlier, I, of course, looked at existing USGS data in previous peaks to calibrate what I was doing.

Q. What do you think the attenuation from the Salt River to Gillespie Dam should be for the 1993 flood?

A. From the Salt River?

Page 93

MR. HELM: Confluence?
Q. *Confluence.*
A. Confluence of the Salt.
Q. *To the Gillespie Dam.*
A. I don't remember.
Q. *You're welcome to look at your report --*
A. Well, let's see.
Q. *-- or your notes or whatever you need to look at.*
A. I'm not sure if I brought my flood routing or not.
Q. *Surely we got it in there.*
MR. HELM: Don't bet on it. We got rooms full of stuff. We take our best shot every time.
A. Okay. In the routing I did, it looked like it was something on the order of a decrease in peak discharge of 5,000 cubic feet per second.
Q. *And what percentage would that be?*
A. A couple of percent.
Q. *Two, three?*
A. Well, let me see. Five -- maybe three percent, three or four, something like that.
Q. *Do you recall the attenuation that Harza used?*
A. No, I don't.
Q. *If I suggest 5.5 percent, would that refresh your recollection?*
A. It could be, yeah.

Page 94

Q. *Do you think 5.5 percent's inappropriate?*
A. On the attenuation? No.
Q. *Yes.*
A. No, it would agree with what I had done, yes.
Q. *In this study, was it important to have the attenuation accurate?*
MR. HELM: Just what study are we talking about?
Q. *The Harza study or this study of this reach for attenuation, is it necessary to have it accurate for what you're trying to calculate?*
A. Well, it's important to have things accurate. Precision is a different thing, you know. You know, plus or minus five, 10,000 cfs I don't think is going to influence most of what was going on here.
Q. *Okay. And that's really my question. Both numbers that we're talking about, the three to four percent or the 5.5 percent are not that far apart to create a problem?*
A. Well, you're talking about attenuation.
Q. *Attenuation.*
A. We're not talking about the peak discharge, but just attenuation.
Q. *Just attenuation.*
A. No. Attenuation's all right.
Q. *For what distance -- if you're going to do a model, for what distance would you need to calculate attenuation?*

Page 95

Would you do it from the Salt down to Gillespie Dam, or would you do it for less distance or would you require more?
MR. HELM: Object to form.
A. Well, it depends on the nature of the peak. If it's a real sharp peak, then the distance could be, you know, shortened. But it's also related to where you have gauges, where you have control points in your flow routing. So, you know, you know, yeah, so there's no set answer to that.
Q. *Okay. So I guess the answer is you have to -- you have to put some distance in, but there's no bright line that you have to do it within a mile or within two miles or three miles, anything of that sort.*
MR. HELM: Object to form.
A. The sharper the peak, the shorter the reach, would be a general rule --
Q. *Okay.*
A. -- rule of thumb.
Q. *How much attenuation would occur in, say, the river 1.5 miles upstream of Gillespie Dam? Anything significant?*
A. From there on down on this peak?
Q. *From 1.5 miles upstream down to Gillespie Dam.*
MR. HELM: Object to form.
A. It would be quite small.
Q. *Insignificant?*
A. Well, it would be small, yeah, very small.

Page 96

Q. *It's my understanding that the United States Geological Survey report of the mean daily flow on January 9, 1993 to be 130,000 cfs; is that correct?*
A. Yes, that's what is shown in the data book, yes.
Q. *And it's my understanding that, in your report, you estimated the mean daily flow for January 9, 1993 at 122,000 cfs?*
A. It could be, yes. Sounds about right.
Q. *10,000 cfs less than USGS estimated; is that correct?*
MR. HELM: Object to form. It's eight, if you just do your subtraction.
Q. *Excuse me. Whatever it is. You're right, 8,000. See, I can't add or subtract. 8,000 cfs.*
MR. HELM: We'll get that established before this is over.
MR. BARKER: No, I've admitted it.
A. Yeah, 8,000, yes.
Q. *(By Mr. Barker) Why do you have that difference in your report from what the USGS published?*
A. Because I didn't agree with the discharge the USGS came up with at the Estrella Gauge, the Gila River at Estrella.
Q. *The USGS published 162,000 cfs at Estrella Parkway Gauge; is that correct?*

Page 97

A. Yes.
Q. *And you think that's inaccurate?*
A. Yes.
Q. *Why?*
A. I think the rating curve they used wasn't right.
Q. *Why?*
A. I did an analysis of that and sent it to them, and I don't know whether I have it with me, but I did a hydraulic analysis of that, of that rating, and how they drew it through the current meter measurements they had.
Q. *The USGS -- no, it's the Corps of Engineers reported 204,000 cfs at Painted Rock; is that correct?*
A. I think that was a preliminary report, to the best of my memory, and I could go off the book, and that was realized very shortly after that. I think they have a lesser peak, if I'm not mistaken.
Q. *Do you think it's less?*
A. Yeah, I sure do.
Q. *I mean, if you want to check it, you're certainly welcome to.*
A. Let's see if I can thumb through it and catch it real easy. 186.
Q. *186?*
A. 186,000.
Q. *Okay. I've handed you Exhibit 18, which is a table*

Page 98

of USGS flood records at Gillespie and some other numbers that have been put in. Have you had an opportunity to look at that?
A. Okay.
Q. *Should the peak discharge be higher than the mean daily flow on the same day?*
A. Yes.
Q. *Why is your peak discharge estimated for January so much more different than could be expected from the USGS and Corps records?*
A. The ratio of mean daily discharge to peak discharge is a function of the shape of the peak. '93 flood, it was a huge flood that came in from all areas and was a very rounded peak. It was not a very sharp peak.
Q. *I've handed you Exhibit 19, which is from your materials, and this is the rating curve that I think we talked about earlier, and I said we had one. Is that correct?*
A. Yeah. Yeah.
Q. *Figure one, you've identified two points on figure one. Could you tell us, what's the significance of the two points that you've addressed?*
A. Well, figure one is rating number four, which is the rating that had been used for many years by the USGS. The lower point is the peak discharge they computed for the

Page 99

1983 flood. The higher point is a point using a recorded gauge height at the stilling well above the crest. And the peak that you -- that Harza came up with of 175,000, it's right on the rating, right on rating four.
Q. *The 2-16-80 flow was not measured, though. Did you tell me that earlier?*
A. The 2-16-80 flow is what Harza came up with, the 175,000.
Q. *Yeah, but I mean --*
A. No. No. Wait a minute. What am I thinking of here? No, that's the -- that's the peak. Excuse me. There's two points on that. There's two at that one spot, and that's what got me confused. Yeah. The 2-16-80 is the US Geological Service peak for the 1980 flood.
Q. *Based on this rating curve?*
A. Yeah, yeah, which is indiscernible from what Harza came up with for '93.
Q. *Was that measured or calculated, the '80?*
A. The '80 is from the rating curve, but there was -- it's -- the rating curve is based on measurements and the weir characteristics of the crest of the dam. That's why the gauge is there.
MR. HELM: Bates 232, Emery? Is this plain 232?
MR. BARKER: I have no idea. This is Winn's document.

Page 100

Q. *(By Mr. Barker) Would you agree, Exhibit 20 is your document?*
A. Yes.
Q. *Okay. I mean, we just got it from the materials. I guess what we're having trouble deciding is the last sentence of the blue printing, "40 percent of the channel is waves indicating F one for 40 percent of the width of the dam," is that -- do you mean the extent of the yellow lines or at those points identified by the yellow lines?*
A. Okay. If you -- if you put all the yellow lines back to back and lined them up with no spaces between them, they would add up to 40 percent of the total width.
Q. *Okay.*
A. So add up all the little increments, and the total is 40 percent.
Q. *Okay. So what you're saying is at each point there's a yellow line --*
A. There's standing waves.
Q. *Standing waves. Okay.*
A. Some mighty big ones in there, by the way.
Q. *Does the Froude number have to be greater than one for waves to form, this type of wave?*
A. No, they can form at slightly less. And what happens is, is that the trough, you'll get -- if you're a number greater than one, at the top you'll get less, and the

Page 101

average can be less than one, and they'll be formed. To have them this healthy like this, this would be a few numbers greater than one.

Q. Are you familiar with Froude criteria used so waves do not form in canals?

A. I'm not a canal person, no.

Q. What do you mean by, "Flow chutes over the crest and rushes over the four foot wall"?

A. Well, that's in the middle there. That's what certainly appears to be occurring. It's going right -- I don't see any evidence of the four foot wall there. It looks like it's just coming right on over. You know, it's hell-bent before election, so to speak.

Q. And you're talking about the darkened area right towards the center?

A. Yeah. Yeah. And I -- there's hints of it in some other areas, that it's just going right on over.

Q. What do you believe the velocity to be as it sweeps over? You say high velocity as it sweeps over the concrete apron. Have you calculated what that velocity would be?

A. No, no, I haven't. This is only -- this is just visual.

Q. All visual from just your inspection of this area?

A. Yes.

Q. In your opinion, would the velocity on the apron be

Page 102

the same all the way across the apron from east to west?

A. Oh, no way, no, I wouldn't expect that, because the flow distribution -- the distribution across the crest would be different, and what would be occurring down there at the apron would reflect that variation.

So it would be quite -- it would be different.

MR. BARKER: Let's take a break.

(Break taken.)

Q. (By Mr. Barker) I have to go back over a couple of questions that I asked you earlier, because I did not understand your answers.

A. Maybe I didn't either.

Q. Well, let me go back one more from that, and then I'm going to come back to this picture. You had given me a number that I had forgotten. I think you said that the USGS peak at Estrella parkway was 162,000 cfs?

A. Sounds about right.

Q. Okay. Yeah, it's in that little table three. It's not that one. There. It's not that one. It's -- there you go. It's in exhibit whatever that number is, Exhibit 18.

A. No, it's not there.

Q. Okay. I understood you to say that the USGS peak at Estrella parkway was 162,000 cfs, and you wrote them something about that.

A. I did a little analysis of that and sent it to them

Page 103

for their consideration.

Q. Okay. And then the Corps of Engineers adjusted the peak at Painted Rock to 186,000 cfs as opposed to the originally published 204,000 cfs.

A. Apparently so.

Q. Because you looked at it in your report and read it to me.

A. Yeah, I showed you the published report.

Q. Correct. Can you explain to me why the Gillespie peak shouldn't be somewhere between the 162 cfs from the USGS and the 186 peak from the Corps of Engineers?

A. It could have been. My routing didn't show that. The analyses I was doing didn't show that, but it could have been.

Q. Okay.

A. I've been wrong before. But if the peak at Painted Rock is correct, and if the peak at Estrella is correct, then it would make sense to have a higher peak or a peak like, you know, 175, or whatever, at Gillespie.

Q. As Harza calculated?

A. Yeah. However -- never mind. That's good.

Q. You can "however," if you want to. I don't care what he thinks.

MR. HELM: You get to ask the questions.

Q. I get to ask the questions, and if -- is there

Page 104

something you wish to add?

A. Well, I'm kind of --

MR. HELM: The question is: Does he wish to add?

Q. That's my question.

A. In order to have an increase in peak discharge on a big rounded flood like that, wouldn't you think you would have to have in-flow from Estrella to Painted Rock to have it increase from 162 to 180, whatever it is? You show me the in-flow.

Q. So that's the basis of why you dispute it and wrote your letter off to USGS and said, I think you need to adjust your number?

A. Yes, there's no in-flow.

Q. At least there's no measured in-flow, is that what you're saying?

A. Um-hum. It was measured. Many USGS gauges were being operated there on tributary streams and stuff. It wasn't there.

Q. Now, if you go back to the photograph which was Exhibit 20, which is this one.

A. Okay.

Q. In the very center, where these large rippling waves occur, almost in the center, and you talked about what you -- the dark area just below the crest, but I'm looking at the waves just above the crest.

Page 105

A. Yeah.
Q. *In your opinion, those are waves that are with a Froude number greater than one?*
A. Yeah. It certainly looks like everything through there is really stooping, yes.
Q. *And the Harza model shows waves in that area with a Froude greater than one, does it not?*
A. The Harza model?
Q. *Yes, for the 1980 flood.*
A. RMA-2 doesn't work for Froude numbers greater than one.
Q. *Doesn't it show waves of that type in that area?*
A. I'm not -- I have no idea.
Q. *Okay. This was the '80 flood, and what you've told us is that the flow chuted over the crest and jumped the four foot weir wall.*
A. It looks that way, yeah, to me.
Q. *Do you think it looks the same way in the 1993 flood?*
A. No. There's a difference in the '93. The '93 looked more like all of the weir wall failures to me. It looked more like that than this.
Q. *Okay. I gave you a document. Here we go. Exhibit Number 21, this was from your -- some of the materials that you furnished to us. On this there's, it looks like, an*

Page 106

e-mail, and then there's bold text starting out, "The two-dimensional model used by Harza...," et cetera, et cetera. Did you write this bold text?
A. Yeah, I think I did.
Q. *Okay. Can the Harza model compute super-critical flow?*
MR. HELM: Object, object to the form. Are we talking about the RMA-2 or some other model? It's the RMA-2 model, not the Harza model.
Q. *The RMA-2 model that Harza used.*
A. Well, the one that was presented to and available to me at the time was RMA-2.
Q. *Right. That's what I'm talking about, the two-dimensional model used by Harza.*
A. Yeah.
Q. *My question to you is: Can that model compute super-critical flow?*
A. Based on what I was told by the two Z's, no. And there's an M at the University of Maryland, that other fellow, that told me it doesn't work either, the modeler over in Maryland.
Q. *Okay. But that's what you've been told. You know nothing --*
A. I was told by experts, yeah, and I read it, too. I got the instructions for RMA-2 and read that, and it clearly

Page 107

said in there that it's for subcritical.
Q. *It can't do it or it's not generally recommended to use it for that purpose?*
A. I believe it alludes to the fact that it's -- the results are highly uncertain, not supposed to be used for those conditions.
Q. *Okay. I've handed you what's been marked as Exhibit 22. Are you familiar with this document?*
A. Yes.
Q. *Are these graphs made from the Colorado State University flume data that was reported by Simons and Richardson in 1966?*
A. Yeah, it looks like there's -- it says they're modified from Simons and Richardson, yes. They're from USGS.
Q. *Are you familiar with the CSU flume?*
A. I've seen photographs of it. I've never seen it for real.
Q. *Do you know anything about it, I mean, size, dimension?*
A. I know it's a pretty healthy flume.
Q. *It's eight feet wide, 400 feet deep, 200 feet long. Some of the walls are plexiglas.*
A. I think you said 400 feet deep. It's not that deep.
Q. *No, it's not. Eight feet wide, four feet deep, 200*

Page 108

feet long.
A. Yeah, it could be, yeah. I don't know for sure, but I know it was impressive like that.
Q. *Okay. Do you think -- do you know of any difficulties in extrapolating information from a model of that type to field conditions when you're involved in trying to figure out what sediment transport is going on?*
A. Sediment transport?
Q. *Yeah.*
A. I've never done that, that type of modeling. Based on my experience, I'd say it could be very tricky.
Q. *I've handed you Exhibit 23, and I think this has to do with the same material as the flume material from Exhibit 22.*
A. Yes, I think it does.
Q. *There's no question.*
MR. HELM: Moving right along.
MR. BARKER: I told you I'd speed it up.
Q. *(By Mr. Barker) Have you had a chance to look at Exhibit Number 24?*
A. I'm scanning it, yeah, it's pretty hard to look at it in detail. Yeah.
MR. HELM: Is there a question?
MR. BARKER: He said he's still looking at it.
A. Yes, I've been looking at it, yes.

Page 109

Q. *(By Mr. Barker) Are you familiar with this document, the figure that's on there and the information that's depicted on there?*

A. I remember reading this. This is fairly recent from the Journal of Hydraulic Engineering. But I remember scanning this, yeah. Okay, I'm looking at the relation, yeah. Yeah, let's see variables here. I need help on what they are again. They're not defined on this page.

Q. *Why don't we just have Michael tell him what the variables are.*

MR. STEVENS: It shows the relationship between the height of the sand dunes and the depth of water and the properties of the flow and sediment. It's all based on CSU flume data.

A. Okay.

Q. *All right. Were you aware of this and the revisions to the curve in the graph from those additional things that Michael told you about?*

MR. HELM: Object to the form.

A. The curve in the graph?

MR. STEVENS: This is all flume data. There is now a body of field data, and this curve has been revised based on field data.

Q. *Are you familiar with that?*

A. No.

Page 110

Q. *Okay.*

MR. HELM: I guess I'm -- I just want one thing clarified. Is there a flume in Missouri, Michael?

MR. STEVENS: No, that's Missouri River.

MR. HELM: That's not flume data?

MR. STEVENS: No, most of it's flume data.

Q. *A couple more items. On Exhibit 1, in the fourth paragraph down, down here, the sentence reads, "Mr. Hjalmarson will testify that the dynamite event in 1973 caused the pen on the USGS recording gauge to bounce off the chart indicating locally a disturbance equivalent to a large seismic event."*

A. Yes.

Q. *Where, at the time, was that gauge located?*

A. The same place it is right now. It's the gauge on the wall between the sluice gate and the Gila River. It's the old USGS gauge.

Q. *Okay. What level of particle velocity or ground acceleration would cause a recording pen to bounce off the chart?*

A. I don't know, but USGS gauges pick up, at regularity, especially groundwater gauges, seismic events.

Q. *Okay.*

A. And this particular one marked the pen right up.

Q. *Do you know of any materials published anywhere*

Page 111

that indicate what size of an event it would take to do that?

A. Uhm -- no, no, I don't.

Q. *Do you know whether the manufacturer of the gauge says be careful of an event of this kind of magnitude, it'll jiggle your thing --*

A. Uhm --

Q. *-- whatever you call it?*

A. No. But let me answer this. That's an A35 recorder that was on there as a backup recorder at the time. A35 recorders have been used all over for, you know, USGS forever, until they started taking them out in favor of digital equipment 20 years ago or so. And I'd never heard of the pen being knocked off anywhere in the country in my experience, except there. It's kind of unusual. Never forgot it.

Q. *You don't know of any other reported instances where the pen was bounced off?*

A. Like that? No, not like that, no, never heard of it.

Q. *Is it possible for a pen to be bounced like that just due to localized vibrations?*

A. It would take a pretty good jolt. You could set up a recorder and bang it and stuff, see what it would take. It would take a good jolt to do it, I guarantee it.

Q. *Like if one was on a bridge and heavy trucks went*

Page 112

over, would that jiggle the pen?

A. No, I never heard of that, because they've been on -- operated on bridges like that. They were operated like that for many, many years, no problem.

Q. *I'm going to ask you a question. How do you define a large seismic event? Is it significant? Can you give me a number?*

MR. HELM: It's a 20 on the Richter scale.

A. Uhm -- I guess, you know, it's pretty big jolt. You know, it's something you would feel. Kind of like the way he grabbed me when I was scribbling on the exhibit.

Q. *Not that big.*

A. That's a large one.

MR. HELM: That's a large jolt.

MR. BARKER: That's an actionable jolt.

MR. HELM: Put cracks in a dam.

Q. *(By Mr. Barker) Oh, and in that same paragraph, on page 31, just in the sentence above the dynamite event, it says that you will testify you frequented the dam as a part of your duties with USGS since about 1964, and in that time, you never saw any riprap placed or any surface mainstream activities aimed at repairing, replacing or maintaining riprap. Do you see that?*

A. Yes.

Q. *Do you know of any reason why there -- do you know*

Page 113

whether there would have been a reason for such activity?

A. Well, at 1980, it was all washed out. There was very little of it left. In some places, there was more than a four foot drop between the edge of the apron and the stream channel. It was torn up, torn up real good. So, in my opinion, there was reason to re-riprap it, because it had been washed away.

Q. And you had seen it before and after the 1980 flood?

A. Oh, yes.

Q. And it was there before the '80 flood and then not replaced after. Is that your recollection?

A. Well, I'd seen riprap there, yes, probably from the mid '60s, when I first saw it. And I am aware that it was removed by flood water, especially by the '80 flood. And during that period, I never saw fresh riprap in place there. You know, I never saw any activities in that regard.

Q. What would have been the frequency with which you visited Gillespie Dam during that period of time?

A. I've given that some thought, and I can't say with certainty, but I -- I would estimate at least once a year, I would have visited, on the average. And there's a few times I walked the -- walked the dam, the crest and so forth. And, like, for example, in 1973, I put together all those photographs and everything describing what everything was.

Page 114

So I was over every inch of the dam at that time. And then during the construction of the little weir that I mentioned earlier, this one foot high weir, I was on the dam, you know, along the whole thing more than once during that. And when I did the n value study, there's a photograph of me standing on there. That's me in that photograph. Might not be able to recognize the skinny guy, but that's me.

Q. Yeah, I think those are in those slides that you -- all we have are black-and-whites of a slide about that big. So I was going to ask you for copies of those.

MR. HELM: You just tell me what they are, and I'll get them to you.

Q. Did you think it was significant that the riprap was not replaced?

A. Oh, I don't really know. You know, I can't really -- I wasn't really looking at it from that -- as an engineer, you know. I -- you know, it kind of stuck in my mind, you know, a dam, you should have riprap in there.

And, well, I had a general impression of Gillespie Dam, that the whole thing was just rotting away. Nobody was -- you know, I saw a lot of rusted rebar the times I've been on Gillespie Dam.

Q. Okay.

A. It was pretty bad.

MR. BARKER: Okay. No more questions.

Page 115

EXAMINATION

BY MR. KING:

Q. You just have answered in the responses to the question from Mr. Barker, and it was related in Exhibit 1, that you frequented that area over the period of your employment with the USGS, and especially, the thing I'm interested in is your observation as an engineer that the dam appeared to be rotting away. When would you say that those thoughts first began to occur to you?

A. I can't say with certainty, but I -- you know, over a period of years, I had that impression. You know, so I can't say the first time I saw it I had that impression or not.

Q. How far back does your work that took you to the Gillespie Dam go?

A. Probably about 1964.

Q. Okay. And was it fairly consistent or did you have long periods of time, years and years, that you didn't see the dam?

A. Uhm -- it was fairly consistent until I moved to Tucson, and then it became less frequent.

Q. When was that?

A. That was in 1989.

Q. Okay. So before 1989 --

A. No. Excuse me. I'm sorry. '79.

Page 116

Q. Okay. Before 1979?

A. '79.

Q. Would you say that you were down there once a year, once a month, once a week?

A. Well, I'd say, on the average, I was there at least once a year.

Q. Okay.

A. During the -- during my tenure with the USGS. When I moved to Tucson, oh, three, three years could have easily gone by between visits.

Q. And by being there, at least on a significant number of those occasions, your duties took you out, literally, on the dam, walking across the crest?

A. A few times I was actually out there, yes.

Q. So your observations of the exposed rebar and those things were direct, not from the bridge downstream.

A. Well, they were on -- I was on the dam or on the spillway there. You could see leaks through it, too. That would catch your eye, you know, leaks in the arches. I remember those.

Q. Which would suggest to you that there was some deterioration of the structure of the dam?

A. Well, it just suggests that, yeah, there's a crack in the concrete.

Q. Okay. Are you aware of any studies by the Flood

Page 117

Control District that, prior to the clearing project that took place in the mid '80s, any studies by the Flood Control District that evaluated the potential impact on the dam because of that clearing? Have you seen any such studies?

A. I haven't seen anything like that.

Q. Have you been told of any studies like that?

A. I don't recall being told.

Q. Are you aware of any studies by anyone, Corps of Engineers, anyone else, that, as a part of the clearing of the channel, that evaluated the impact that might have on the dam or downstream?

A. I don't -- I don't recall anything that specifically addressed an impact, you know, where it said it in those terms, no.

Q. Now, you say you went to Tucson in 1979, so in -- and your contact was less frequent. Were you aware that either the clearing was being planned, being considered, or actually took place? Is that something that you had an awareness of?

A. Yes, I was aware of it.

Q. Okay. The consideration had dated back well before that, had it not?

A. Yeah.

Q. With Corps of Engineers studies and other things?

A. Yes, I had an old Corps of Engineers engineering

Page 118

report that had that in it, yes.

Q. Knowing what you knew as an engineer, and your observation that the dam seemed to be badly deteriorating, at any time did it occur to you that somebody ought to take a look and consider what will happen here if we clear this channel? Did that ever occur to you as an engineer?

A. Not -- not really, no. I can't -- I can't -- one of the thoughts I recall having in this regard is that, well, there's no real loss of life if something happened there. I remember having that thought, you know, way back in the '60s or something.

Q. So even if the dam collapsed, probably nobody's going to get killed, so, big deal?

A. Yeah, I remember I had thoughts like that. Being in the flood control profession, you know, you don't like to see people killed.

Q. And I don't want to put words in your mouth, but that would suggest to me that the thought had at least occurred to you that this dam could fall down one day.

MR. HELM: Object to form.

A. I -- no, that wouldn't be fair for me to agree with that. I saw a deterioration of it. I remember that clearly. I saw leaks in the arches, which is -- that's another memorable thing for an engineer.

Q. And as a follow-up to that last question on that,

Page 119

is -- I take it it's fair to say that any engineer, as a part of, I guess, their personal code of ethics or maybe even an engineering code of ethics, you're always taking into consideration whether there are any actions that would have -- that would constitute a threat to life or property.

MR. HELM: Object to form.

Q. Is that a fair statement?

MR. HELM: Same objection.

A. Well, you're trying to think that you might have that high standard.

Q. Okay. I want to clarify one thing and to be clear on the record, Mr. Hjalmarson. I briefly talked about this during the break, and I just wanted to be sure that we've got it on the record. Referring to Exhibit 20, this is the aerial photo.

A. Okay.

Q. And I want to be sure I understand correctly what you meant in response to Mr. Harper's question, that the flow over the four foot wall below the dam would be inconsistent because the flow over the crest of the dam would be inconsistent. Is that -- is that a correct statement of what you intended to say?

A. Well, I was concerned about the use of the word inconsistent.

Q. Okay.

Page 120

A. We're consistently being inconsistent -- pun intended -- but what I thought we were talking about was the distribution of flow across the crest --

Q. Right.

A. -- is non-uniform, and I would expect the same type of non-uniform distribution right below the crest there on the apron, because it's not -- there's not that much difference in distance between the two, you know.

Q. Okay. But it's your opinion that that distribution of flow across the crest and, consequently, across the four foot wall, was not affected in any significant way by the clearing of the vegetation? Is that the opinion you've arrived at?

A. No, the clearing of the vegetation caused a change in the distribution or discharge across the dam, so it did, it did cause a change.

Q. And when you say it caused a change, a significant change?

MR. HELM: Object to form.

A. The change at low flows, lower flows, not during big flood peaks that lay down all the vegetation upstream and all that kind of stuff, like we're looking at here in this Exhibit 20, but the lower flows, the effect of that varied a little more, and you might -- yeah, it could be more significant then.

Page 121

Q. *Now, besides the vegetation -- and I believe one of the things you identified as a question you have regarding some of the other modeling, is during a heavy flow, there will be changes in the channel itself.*

A. You bet.

Q. *And is it reasonable to assume that in the areas of the Gila River where the vegetation had been cleared, there would be a greater change in the channel than in those areas where vegetation still existed, even if that vegetation was laid down?*

A. It would be possible.

Q. *Is that something you considered at all in your studies?*

A. No.

Q. *And is there a reason why not?*

A. I wasn't assigned to, you know, to do that kind of thing. My assignment was to collect data that were available, one of my main assignments.

Q. *It's my understanding that you've reaffirmed your belief that the peak flow on January 9, 1993 was at 132,000 cfs, and you based that on utilizing a flow rating; is that correct?*

MR. HELM: Object to form.

A. The flow routing I did.

Q. *Flow routing.*

Page 122

MR. HELM: You didn't hear as good as you thought up there.

Q. *I didn't write as good as I thought.*

A. The flow routing I did indicated a peak of 132,000 cfs at Gillespie.

Q. *As an engineer, would you normally consider that sort of within a range? I mean, I presume, using a flow routing, it wouldn't come out dead on 132,000. Would the variation be one percent or five percent?*

MR. HELM: Object to form.

A. Well, the variation could easily be five percent, yes.

Q. *So it could be as high as maybe 140,000 or as low as 130 or less?*

MR. HELM: Object to form.

A. It could be.

Q. *Okay. Using that kind of formula?*

MR. HELM: Object to form.

A. Well, using any method of estimation, yes. But, yes, using flow routing, there are potential errors, yes.

Q. *I want to touch on navigability just to be absolutely clear. We've probably plowed that field enough times, but my understanding of the assignment that you accepted and the limits of that assignment is that you were calculating a bankfull depth of the Gila River in its normal*

Page 123

and natural condition. Is that a fair statement of what the parameters of your assignment regarding navigability were?

MR. HELM: Object to form.

A. No.

Q. *No. What were you doing then?*

A. I was asked to assess the navigability. That's what I was hired to do, was to assess, using, you know, my hydrology and hydraulic -- using an engineering approach, evaluate the navigability of the Gila River.

Q. *That's what I wanted to be sure of.*

As I understand your testimony, you excluded a number of things that others have testified that they utilized in trying to determine navigability, historical data and observations of pioneers and things like that, that, as I understood it, you used a hydraulic geometry analysis, and it was an engineering approach.

MR. HELM: Object to form.

A. Yeah, I used hydrology -- hydraulic geometry as part of my methodology, yes.

MR. KING: Okay. I have no further questions.

MR. HELM: I don't think I do, but let me just check.

MR. BARKER: I have one after you.

MR. HELM: I don't have any.

Page 124

EXAMINATION

BY MR. BARKER:

Q. *Mr. King asked you if you were aware of any studies that were done in connection with the cleared corridor project by the Flood Control District which looked to see if there would be any impact from that project on the dam, and you replied you had no knowledge of any such.*

A. Yeah.

Q. *My question is: Do you know of any such studies as to what impact, if any, that cleared corridor might have on the bridge downstream of the Gillespie Dam?*

A. No.

Q. *Okay.*

A. I don't. Nothing comes to mind. However, I'm getting a little groggy.

Q. *I think we're all getting a little groggy. Thank you very much, Mr. Hjalmarson. You'll have an opportunity to read and sign.*

MR. HELM: We'll read and sign.

* * * *

(Whereupon deposition concluded at 3:25 p.m..)

HJALMAR HJALMARSON

CERTIFICATE

State Of Arizona)
)ss
County of Pima)

BE IT KNOWN that I, Mary Meyer, R.P.R., took the foregoing deposition pursuant to Notice at the time and place stated in the caption hereto; that I was then and there a Certified Court Reporter in and for the State of Arizona; that by virtue thereof, I was authorized to administer an oath; that the witness, HJALMAR HJALMARSON, before testifying, was duly sworn according to law, and that the testimony of the witness was reduced to writing under my direction.

I DO FURTHER CERTIFY that I am not of counsel nor attorney for either or any of the parties to said cause or otherwise interested in the event thereto, and that I am not related to either or any of the parties to said action.

WITNESS MY HAND THIS 3rd day of February, 2003.

_____

Mary Meyer, R.P.R.
Certified Court Reporter 50225

Concordance Report

Unique Words: 1,894
Total Occurrences: 8,068
Noise Words: 384
Total Words In File: 24,268

Single File Concordance

Case Insensitive

Noise Word List(s): NOISE.NOI

Cover Pages = 3

Includes ALL Text Occurrences

Dates ON

Includes Pure Numbers

Possessive Forms ON

* * DATES * *

2-16-80 [3]
99:5, 7, 13

* * 0 * *

006709 [1]
72:23
05 [1]
53:3

* * 1 * *

1 [7]
10:11; 44:9; 47:14; 84:25; 90:11; 110:7; 115:4
1,600 [1]
87:17
1-d [1]
46:13
1.5 [2]
95:19, 21
10 [11]
52:20; 55:25; 56:4, 5; 57:6; 58:1; 59:8; 62:1; 63:16; 64:1; 72:11
10,000 [2]
94:13; 96:9
100 [2]
45:4; 58:4
11 [4]
63:12, 13, 16, 19
12 [6]
5:21; 8:10; 48:22; 65:11, 12; 66:3
120 [2]
60:2; 61:7
121,000 [1]
89:1
122,000 [1]
96:6
13 [6]
5:21; 49:7, 12, 13; 58:21; 69:16
130 [1]
122:14
130,000 [1]
96:3
132,000 [4]
89:19; 121:20; 122:4, 8
14 [4]
14:20; 55:3; 70:25; 72:6
140 [1]
60:4
140,000 [1]
122:13
15 [9]
52:15, 22; 55:25; 56:6, 7, 13; 57:7, 23; 72:21
16 [3]
76:1; 77:10; 89:2
160 [3]
59:25; 60:12; 61:7
161 [1]
59:9
162 [2]
103:10; 104:8
162,000 [3]
96:24; 102:16, 23
166 [1]
59:20
166.58 [1]
59:13
166.61 [7]
59:16, 22, 24; 62:7, 8, 17, 20
166.64 [2]
59:19; 61:13
17 [1]
80:22
175 [1]
103:19
175,000 [2]
99:3, 8
178,000 [2]
63:19; 64:2
18 [2]
97:25; 102:20
180 [1]
104:8
1800s [1]
28:15
186 [3]
97:22, 23; 103:11
186,000 [2]
97:24; 103:3
1860 [3]
70:9, 11; 72:4
1876 [1]
71:10
1890s [1]
32:25
19 [2]
43:14; 98:15
1905 [2]
40:12; 70:15
1911 [1]
30:14
1912 [15]
14:20; 15:1, 2; 17:17, 20, 22; 27:17; 37:25; 42:8, 15; 43:8, 12, 15; 44:6; 84:12
1960 [1]
69:20
1962 [2]
5:9; 18:7
1964 [2]
112:20; 115:16
1966 [1]
107:12
1970s [2]
54:22; 87:17
1973 [2]
110:9; 113:24
1976 [4]
65:14, 17, 23
1979 [2]
116:1; 117:15
1980 [6]
88:22; 89:2; 99:14; 105:9; 113:2, 8
1980s [1]
87:6
1982 [3]
49:16; 50:4; 65:16
1983 [3]
8:7; 9:21; 99:1
1984 [1]
71:10
1985 [1]
88:20
1989 [2]
115:23, 24
1990s [1]
86:22
1991 [1]
58:9
1992 [1]
55:3
1993 [11]
5:10; 66:20, 24; 67:12; 89:10, 19; 92:24; 96:3, 6; 105:18; 121:20
1995 [1]
25:13

* * 2 * *

2 [2]
46:20; 52:18
2,330 [1]
77:9
2-16-80 [3]
99:5, 7, 13
2-7 [1]
81:4
2-8 [1]
81:4
2.9 [3]
48:24; 49:10; 53:23
20 [8]
9:19; 56:13; 100:1; 104:20; 111:12; 112:8; 119:14; 120:23
200 [2]
107:21, 25
2000 [2]
11:25; 12:7
2001 [1]
23:24
2002 [1]
24:12
2003 [1]
125:19
204,000 [2]
97:12; 103:4
21 [1]
105:24
210 [1]
70:4
22 [2]
107:8; 108:14
23 [1]
108:12
232 [2]
99:23
24 [6]
11:25; 12:6; 16:7, 12; 24:12; 108:20
240,000 [2]
63:6, 9
24th [1]
12:3
250 [1]
77:20
26 [5]
16:10, 11, 24; 17:25; 69:24
26th [1]
12:3
2d [1]
91:6

* * 3 * *

3 [1]
47:18
30 [5]
10:12; 84:24; 85:2, 3; 87:18
31 [5]
44:11, 17; 90:11; 91:16; 112:18
35 [1]
82:3
39 [2]
58:11, 12
3:25 [1]
124:22
3rd [1]
125:19

* * 4 * *

4 [2]
31:19; 48:23
4.1 [7]
16:18; 17:4; 46:23, 25; 47:1, 2, 4
4.2 [1]
17:4
40 [6]
58:12, 15; 100:6, 7, 12, 15
400 [2]
107:21, 23
47 [1]
25:8

* * 5 * *

5 [6]
49:10; 53:9, 11, 14, 16, 22
5,000 [1]
93:15
5.0 [1]
47:19
5.5 [3]
93:23; 94:1, 17
500 [1]
34:17
50225 [1]
125:23

* * 6 * *

6 [3]
49:24; 50:5; 53:10
60 [1]
82:4
60s [2]
113:14; 118:10

* * 7 * *

7 [3]
54:24; 57:18, 22
7.2 [1]

****Q****

****R****