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Trial Transcript, Vol. 93, Morning Session

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4451

IN THE DISTRICT COURT FOR THE FIFTH JUDICIAL DISTRICT

WASHAKIE COUNTY, STATE OF WYOMING

IN RE:	)
THE GENERAL ADJUDICATION OF ALL RIGHTS TO USE WATER IN THE BIG HORN RIVER SYSTEM AND ALL OTHER SOURCES, STATE OF WYOMING.	) Civil No. 4993

FILED 8/3 19 81

Margaret V. Hampton CLERK

DEPUTY

VOLUME 93

Morning Session

Tuesday, July 28, 1981

ORIGINAL

APPEARANCES

FOR THE STATE OF WYOMING:	HALL & EVANS 2900 Energy Center Building 717 17th Street Denver, CO 80202 BY: MR. JAMES MERRILL
FOR THE UNITED STATES OF AMERICA:	MR. JAMES CLEAR Attorney at Law Land and Natural Resources Division Department of Justice P.O. Box 7415 Benjamin Franklin Station Washington, DC 20044
FOR THE ARAPAHOE TRIBE:	WILKINSON, CRAGUN & BARKER 1735 New York Avenue, N.W. Washington, DC 20006 BY: MR. R. ANTHONY ROGERS
FOR THE SHOSHONE TRIBE:	SONOSKY, CHAMBERS & SACHSE 2030 M. Street, N.E. Washington, DC 2006 BY: MR. HARRY SACHSE
FOR THE PRIVATE WATER HOLDERS:	MR. GEORGE RADOSEVICH Attorney at Law 910 15th Street, Suite 866 Denver, CO 80202
CLERK TO THE SPECIAL MASTER:	MR. LEO SALAZAR Attorney at Law 701 Rocky Mountain Plaza Cheyenne, WY 82001

THE SPECIAL MASTER: May we please come to order. Is there a new appearance, Mr. Merrill?

MR. MERRILL: Yes, Your Honor. I'd like to introduce to the Court Mr. Mark Brennan, who is a third year student next year at Stanford University Law School, who is working with us this summer.

THE SPECIAL MASTER: Welcome to the case, Mr. Brennan.

MR. BRENNAN: Thank you very much.

THE SPECIAL MASTER: All right.

MR. SACHSE: I just wanted to correct what may have been a misimpression as a part of Mr. Higginson's testimony. We tried to correct it on redirect examination. Mr. Higginson's testimony completes our testimony on the re-acquired -- excuse me, on the fee lands owned by members of the Tribe and their direct --

THE SPECIAL MASTER: Decendants.

MR. SACHSE: -- decendants. We do not intend to present further testimony on that issue.

The testimony that will come now will be on the programs for future development.

THE SPECIAL MASTER: Programs for future development of lands owned in fee by Indians and

decendants -- their direct decendants?

MR. SACHSE: No. We now turn to trust lands, to lands owned in trust by the Tribe and by allottees.

THE SPECIAL MASTER: So this has to be added to the futures to which Dr. Mesghinna and others have testified about in their reports?

MR. SACHSE: That is correct.

One other announcement, if you can call it that, that I want to make. We will be referring in Dr. Willardson's testimony, which I assume will begin tomorrow or the next day, to the drainage maps prepared by Dr. Mesghinna. So in order to avoid having to make a lot of additional copies, it you'd bring Dr. Mesghinna's report with you tomorrow it would be useful.

THE SPECIAL MASTER: And the exhibits are here in the building, we have to haul them in, they're down the hall.

All right, Mr. Merrill.

MR. MERRILL: Your Honor, while we are speaking of preliminary matters, I want to point out and put on the record that I anticipate that our cross-examination of Mr. Bliesner, Mr. Willardson and Mr. Keller, the next three Tribal

witnesses will be rather short, and I want to put the Tribes on notice that depending on the length of their direct examination I expect we could arrive at Mr. Cummings' testimony by Thursday, and I just thought we ought to have it on the record that he ought to be available by then because we are going to make a pretty good pace.

THE SPECIAL MASTER: All right. If I compress tomorrow's hearing from nine in the morning until about one and then adjourn, I hope that doesn't discombobulate you because I have to do that tomorrow.

MR. SACHSE: I should state on the record too that this comes as something of a surprise to us, given the length of cross-examination we've had previously. We are not prepared to present Dr. Cummings this week. We are prepared to go forward with Dr. -- with Mr. Bliesner, Dr. Willardson and Dr. Keller. We have another week of trial set for the first week in September, we will only have two witnesses to present then, Dr. Cummings and Dr. Ohmar Stewart. And if we finish with what we have lined up for this week this week, I think if we can go home Thursday we

should go home and we'll finish up on Monday and Tuesday, probably that first week -- No, we start on Tuesday and Wednesday of that first week in September.

MR. MERRILL: Your Honor, I would strenuously object to that. As the Court is well aware, you have set forth a schedule for the remainder of the year and instructed all the parties that the case will be submitted to you by December.

THE SPECIAL MASTER: That is right.

MR. MERRILL: We've got hearings scheduled for all of this week. I don't think that the length of our cross-examination of, for example, Mr. Higginson, has been indicitive, necessarily that we would not get to Mr. Cummings this week. I think its been known for a long time how the Tribes case would go together. I think that what's going to happen is we'll take up some time that week in September, and each time we get the schedule pushed back a little bit further or quit a week a little bit short it ends up being the State of Wyoming's case or the private parties' cases who are going to suffer when we get up against the wire in November and December of this year. And I would move the Court for an order today

telling them to either put on Mr. Cummings when we're done with Mr. Keller or Mr. Willardson, whoever is the previous witness, or conclude their case in chief.

THE SPECIAL MASTER: I'm not ready to rule that harshly on them, but if you could find Mr. Cummings you would be well advised to get him here for the Friday hearing or Thursday, if you think you can. If we're ready for him Thursday by noon you would be well advised to do so.

All right. Where is the witness?

MR. CLEAR: Your Honor, I have one matter.

THE SPECIAL MASTER: All right, Mr. Clear.

MR. CLEAR: The last session, Mrs. Echman, the title plant lady from the Bureau of Indian Affairs, from the Billings office in Montana, she testified, I believe it was four boxes of land title indices which apparently were not entirely up-to-date and she has now sent to us the supplement to those. They're all certified copies.

THE SPECIAL MASTER: If you give those to Mr. Salazar I suppose we'll put them with the four boxes. We're not going to interpolate them.

MR. CLEAR: No, Your Honor. Each page has the section and township, and I've marked them U.S. Exhibit WRIR C-317-1 and WRIR C-317-2.

THE SPECIAL MASTER: All right. They'll be admitted. The documents to which they are -- The exhibits to which they are a part of have already been admitted so these will be admitted along with them.

(Whereupon, U.S. WRIR
(C-317-1 and C-317-2 were
(hereby admitted into
(evidence.

MR. SACHSE: Your Honor, one other thing on the Cummings question. I assume that if we do get to Dr. Cummings this week that the State will then waive the five-day rule on the exhibits that he will present because we certainly -- We made informal arrangements with the State that they would take his deposition over the August period. We intended to present his exhibits to the State over the August period and to have him as our last witness in the beginning of the September session. We certainly will make every effort to get him here if necessary for this week, though I think this is --

THE SPECIAL MASTER: Well --

MR. SACHSE: -- pushing it a little bit.

THE SPECIAL MASTER: It would be pointless to get him here this week and have you raising objections to anything he says on the five-day rule, so you're -- the ball's in your Court, you can chip it or top-spin it or --

MR. MERRILL: I'll hit it straight back Your Honor. We'll waive the five-day rule.

THE SPECIAL MASTER: There you are, all right, thank you very much.

MR. MERRILL: We'll also waive our right to redepose Mr. Cummings which we had under the little go-around which we had a couple of weeks ago about second depositions. We were not able to do that second round of depositions of Mr. Cummings because none of the three Tribal attorneys were to be available last week.

* * * * *

THE SPECIAL MASTER: All right, Mr. Bliesner, will you stand up, please, and take the oath? Raise your right hand.

RONALD D. BLIESNER

was called as a witness by the Tribes, and, having been first duly sworn, was examined and testified as follows, to wit:

DIRECT EXAMINATION

BY MR. ROGERS:

Q Would you please state your name for the record?

A Ronald D. Bliesner.

Q Spell your last name, please.

A B-l-i-e-s-n-e-r.

Q Would you give us your address, please, Mr. Bliesner?

A Route 1, Box 72K, Logan, Utah.

Q What is your business -- is that your home address?

A Yes, it is.

Q What is your business address?

A It's the same.

Q What is your -- excuse me, strike that.

Mr. Bliesner, what is your educational background?

A I received a B.S. in Agricultural and Irrigation Engineering from Utah State University in 1971 and an M.S. in Agricultural and Irrigation Engineering at Utah State University in 1975.

Q Before we proceed any further, Mr. Bliesner, I will show you a copy of a document that's been marked as Tribes' Exhibit No. 12 and ask you to identify that.

A That's a copy of my resume.

MR. ROGERS: If the Court please, I will pass out copies of his resume to Counsel. Is this the original, Your Honor? Are we keeping that over here?

THE SPECIAL MASTER: Yes, for our files.

Q (By Mr. Rogers) Mr. Bliesner, did you grow up in a rural setting?

A Yes, I was raised on an irrigated farm in southern Idaho.

Q Have you had any other experience living and working on an irrigated farm?

A I operated my father's farm from the time I was a senior in high school through the completion of my Bachelor's Degree.

Q I would like to review, if I could, from your

earliest point forward your professional experience other than educational experience. What was your first professional job out of college?

A My first job after completing my B.S. degree was with Ames Irrigation Service in Twin Falls, Idaho, as a sales and design engineer.

Q What sort of work did you do for Ames?

A I designed, supervised installation and sold irrigation systems in southern Idaho, northern Utah and northern Nevada. That included design of pipeline networks, farm systems, pumping plants and supervision of the construction.

Q Did that involve becoming familiar with how costs of these various pieces of engineering equipment are determined?

A Yes.

Q What did you do after your experience with Ames?

A I returned to Utah State University as a research engineer part-time while working on my Master's Degree, and I was a research engineer for Utah State University then for two years.

Q Did you -- what exactly did you do in connection with your work on the research farm?

A I operated a drainage research farm in Vernal, Utah, conducting research on the effects of irrigation management on the quality of irrigation return flow.

Q Following that, what did you move to?

A Upon completion of my Master's Degree, I went to work for Superior Farming Company first as an irrigation engineer and later as manager of irrigation services and their farming company operating approximately 36,000 acres in the central valley of California near Bakersfield.

Q Your resume mentioned initiation of a computerized irrigation scheduling program. Could you explain that a little more?

A The company had a fairly large acreage of permanent crops, fruit crops, net crops, grapes, that type of thing. We started a computerized irrigation scheduling program to better manage the irrigation on those units, trying to reduce operating costs of the systems and improve yields through more sophisticated techniques in irrigation management. That program was later expanded to include row crops and surface irrigated tree crops, as well.

Q I believe your resume also mentioned you were manager of irrigation services for Superior Farming, and was there other computerized irrigation management that you were involved in other than what you just mentioned?

A Well, that was the main irrigation scheduling program. We also developed during that time a computerized model for optimizing the cotton production, reducing input costs, gaining better utility in farm equipment, determining the impact of various inputs on yield and trying to make yield projection at early stages in the production cycle.

Q Are you still with Superior Farming?

A No, I'm not.

Q What are you doing now?

A I'm a private consulting engineer.

Q Has that been up to the present ever since you left Superior?

A Yes, from 1978 until the present.

Q Could you describe to us to some extent what you have done as a private consulting engineer?

A I have conducted optimized irrigation system designs on approximately 30,000 acres of land,

conducted feasibility studies to determine the practicality of irrigation on some 60,000 acres. I was involved in writing a pumping plant design manual for diesel powered pumping plants, I've done design research in optimizing system design, have done hydraulic transient analyses and have developed both hand-operated and computer-operated irrigation scheduling programs for individual farmers and large corporate farms.

Q Have you ever testified as an expert witness in litigation before?

A I have.

Q What was that?

A It was in the Aamodt case in New Mexico in January and February of this year.

Q Could you spell that?

A A-a-m-o-d-t, I believe.

Q What was the nature of that litigation?

A It was to determine and quantify reserved water rights for Fort Puebloes in northern New Mexico.

Q Who were you retained by as an expert witness?

A By the United States.

Q What was the scope of your assignment?

A I was to design irrigation systems, and that included wells, canals, on-farm systems for roughly 12,000 acres of arable land on the Fort Puebloes and determine costs associated with those irrigation systems.

Q Step back one moment, Mr. Bliesner. What was the general subject of the thesis you prepared for your Master's Degree?

A It was the affect of irrigation management on the quality of irrigation return flow.

MR. ROGERS: Your Honor, I would respectfully ask the Court that Mr. Bliesner be recognized as an expert in the field of irrigation engineering. I would also move the admission of Tribes' Exhibit No. 12 in evidence.

THE SPECIAL MASTER: Does the other Tribe's or United States' Counsel wish to voir dire?

MR. CLEAR: No, Your Honor.

THE SPECIAL MASTER: Does the State of Wyoming wish to voir dire or Counsel for the defendants?

MR. MERRILL: I have just a few questions, Your Honor.

VOIR DIRE EXAMINATION

BY MR. MERRILL:

Q Mr. Bliesner, at any point in your career have you received any training in benefit cost analysis?

A Only briefly in engineering economics classes.

Q Have you received any specialized instruction or had experience in the costing techniques appropriate for use in benefit cost analysis?

A If you are referring to the costing techniques of determining the cost of irrigation systems, yes.

Q I notice from your resume that you have conducted a fair number of irrigation feasibility studies.

A Yes.

Q Have any of the feasibility studies that you have performed ever included consideration of the economic feasibility of the installation of an irrigation system?

A Not that I conducted. That portion that I -- that I did was to determine the costs and that information was then provided to economists to determine economic feasibility.

Q Of all of the feasibility studies that you have

undertaken, how many of these projects have actually been constructed?

A. I'm trying to recall. I'm aware of construction, have been involved with the construction of about 5,000 acres of those studies that were conducted.

Q Is that one project, 5,000 acres?

A Yes.

Q Isn't there --

A There are other small projects, several hundred acres for individual farms that have been constructed, but the total is roughly 5,000.

There may have been three or four of the total projects that were analyzed that have to date been constructed. Others are scheduled for construction.

Q Of the projects which you have done feasibility work on and which have actually been constructed, what is the largest project in terms of irrigated acreage?

A It's roughly 5,000 acres.

Q Is that project located in Georgia?

A Yes, it is.

THE SPECIAL MASTER: Where, Mr. Merrill?

MR. MERRILL: Georgia, Your Honor.

Q (By Mr. Merrill) Mr. Bliesner, have you ever conducted an irrigation feasibility study prior to this work for lands located in the State of Wyoming?

A No, I haven't.

Q Isn't it true that most of your professional experience in the design and installation and management of irrigation systems involves systems located in the State of California?

A No, it's not.

Q What other areas are these systems located in?

A I have designed and had some systems constructed in Idaho, Utah, Nevada, Texas, Georgia, Arkansas and have evaluated irrigation systems in all of those areas, as well as Libya.

* * * * *

Q. (By Mr. Merrill). Okay.

A. And I've designed irrigation management programs for California and Georgia. Excuse me, some of those systems designs were in New Mexico as well and Colorado.

Q. Have you ever designed an irrigation management program for a system in the State of Wyoming?

A. No.

MR. MERRILL: Your Honor, I have no further questions, do not object to the qualification of the witness as tendered or to the admission of Tribes' Exhibit 12.

THE SPECIAL MASTER: All right. Mr. Bliesner is recognized as an expert witness in this case for the purposes stated, irrigation engineering.

MR. ROGERS: Thank you, Your Honor, and Tribes' Exhibit 12 is admitted?

THE SPECIAL MASTER: And Tribes' Exhibit 12 is admitted into evidence.

DIRECT EXAMINATION (RESUMED)

BY MR. ROGERS:

Q. Mr. Bliesner, what -- Have you been retained by the Shoshone and Arapahoe Tribes in this case?

A. I have.

Q. In connection with that retention, were you

retained in association with any other individuals?

A. Yes, the retention came through Southwest Research & Development.

Q. What is the -- What is the assignment you were given or the directions you were given by the attorneys for the Shoshone and Arapahoe Tribes in this case?

A. It was to examine the engineering work, the irrigation system design and cost estimates prepared by Stetson Engineers for the future trust lands in the Wind River Indian Reservation; to identify areas of -- or arable lands that had not been included in the irrigation system design.

Q. Excuse me, Mr. Bliesner, are those -- Could you identify by name for the Court the five future land project areas you referred to?

A. Yes. Those areas we reviewed were North Crowheart, South Crowheart, Riverton East, Arapahoe and Big Horn Flats Units.

Q. Is it your understanding that these were lands that were presently not under irrigation and had not been developed for that purpose?

A. That's correct.

Q. Excuse me for interrupting.

A. Okay. The second phase after identifying those areas that had been exluded from the original design was to --

THE SPECIAL MASTER: Pardon me. From what original design?

THE WITNESS: From the design conducted by Stetson Engineers. There were arable lands that were not included in their design. We identified -- We were asked to identify the areas that it would be possible to design irrigation systems for, and then we were also instructed to examine the designs conducted by Stetson for appropriateness of costs and designs.

Q. (By Mr. Rogers) Let me clarify one thing on the business of additional lands. You reviewed work of HKM only identifying arable land that HKM had done for this case for the United States?

A. That's correct.

Q. And found arable lands they had identified that Stetson Engineers had not designed irrigation systems for?

A. That's true.

Q. And then you were instructed to see if there were any additional undesigned lands that might be

designed for us; is that correct?

A. Correct.

Q. Were those -- Which project lands were those located in?

A. The two major areas that were identified were Big Horn Flats and Stagner Ridge. There are other small parcels scattered throughout the project, but they were not analyzed.

Q. So you focused on the Big Horn Flats additional lands and Stagner Ridge?

A. Yes.

Q. You also said you reviewed Mr. Stetson's design work for appropriateness of design and appropriateness of cost.

A. Yes.

Q. Could you elaborate just a bit on that?

A. Our original instruction was to see if there was a possibility of reducing costs on the system designs that were completed by Stetson. Apparently the final costs that had come in were higher than accepted by the Tribes.

THE SPECIAL MASTER: I have a question I think should be asked now. The word "appropriateness" of designs is interesting in my experience

in engineering and construction and design work. Appropriateness of design, does that regard appropriateness as to propriety or is it engineering correctness or is it economic feasibility or is it aesthetic values? Just what do you include in that interesting adjective?

THE WITNESS: Basically, what we were doing in that analysis was to determine if the design that they had designed was a workable design --

THE SPECIAL MASTER: Workable.

THE WITNESS: -- as an engineering matter.

THE SPECIAL MASTER: All right, thank you.

Q. (By Mr. Rogers) And then you were also to examine their costs to determine whether they were too high or too low --

A. That's correct.

Q. -- or exactly right?

That would be the second phase then of your assignment?

A. Yes.

Q. Incidentally, Mr. Bliesner, what were you asked by the Tribes to do with the information you developed or what precise information were you to develop and then what were you to do with it?

A. My requirement was to develop irrigation system designs for the additional areas that we identified with the associated costs; to analyze the costs and designs of Stetson and, if appropriate, recalculate costs on the basis of the assumptions that we felt were most appropriate for the situation and then to supply that information to Ron Cummings, the economist retained by the Tribes so that he may perform an economic analysis on the cost.

Q. Did you understand part of your instruction to do an economic feasibility study on any of this work?

A. No, I did not.

Q. Thank you. And one last point of clarification. The comparative work on the Stetson system design and cost, was that to be on just the Big Horn Flats area and the Stagner Ridge area?

A. No, that was in all areas.

Q. All five of the project areas?

A. All five of the project areas.

Q. Thank you. Those are two areas then, the additional lands for Big Horn Flats and Stagner Ridge and the analysis for system design and costs. Was there any other work that you were asked to do by the Tribes?

A. Yes. Then upon completion of this work, we were asked to determine the effect of the irrigation of these additional lands on the stream flows in the system, to determine availability of water supply. That was done in two levels, both the impact following the trust lands as included in HKM's operations study and then also with the addition of the Indian-owned fee lands testified to by Mr. Higginson.

Q. So, in fact, we will learn later through your testimony, you did, in fact, identify some additional lands in Big Horn Flats and Stagner Ridge?

A. Yes.

Q. And it was those additional lands, the irrigation for which you were asked to determine their effect on Mr. Billstein's testimony --

A. Yes.

Q. -- about the operations studies and water availability.

Was that restricted to a particular drainage?

A. Yes. We restricted ourselves to the Big Wind system since that is the only area we had impact on stream flow, was the only area that we had diversions from, from streams at least.

Q. And you also then, as an additional step, reviewed the fee lands owned by Indians that Mr. Higginson identified --

A. That's true.

Q. -- to determine their effect on these flows as well as your additional lands?

A. Yes. That was necessary to sort of sum up everything that was going to be diverted from the stream.

Q. Again, on the Big Wind system?

A. Just on the Big Wind system.

Q. Thank you. Were you doing all of this work alone?

A. No. We had a team of people that were working on this project. The principal investigators were myself, Dr. Jack Keller and Dr. Lyman Willardson.

Q. Could you explain for a moment the roles of these other two gentlemen?

A. Yes. Dr. Willardson was charged with the responsibility of the drainage review of the Stetson design. And --

Q. As well as drainage costs?

A. As well as drainage costs. And Dr. Keller works as a coordinator and strategist in overall planning for the approach that we would use in the designs and analyses.

Q. Thank you. All right. If we can move then to the first area that you worked on, that is the examination of the arable lands identified by HKM and the system design of

Mr. Stetson and Dr. Mesghinna. Could you tell us in a general way what your approach was to determining whether there were any additional lands in the future project areas?

A. Well, the first thing that was done shortly after we were first contacted about participating in this case was to review the reports that had been prepared by Stetson and by HKM concerning arability and then irrigation system designs.

It was fairly obvious that the two major areas that we've been discussing, the Big Horn Flats additional area and Stagner Ridge, had significant quantities of arable lands that had not been included in the designs, so that was sort of the first key. Then in mid-May I took a field trip to visit the Reservation. The visit was very short, was to get an impression of the overall area, both of the additional lands that were were looking at to design and the lands that had been included in the Stetson design. I spent a day in the field with Richard Harbour from the BIA.

Then visited HKM in Billings to obtain additional information from them on arable lands and any work they had done in investigation for drainage.

Then met with Stetson Engineers, principally Dr.

Mesghinna, in San Francisco to further review the work that he's done and gain additional information that I needed to do the analysis.

* * * * *

THE SPECIAL MASTER: May I ask a question? Did you and Dr. Mesghinna have careers that crossed prior to this time or were you acquaintances on the campus at Logan or just friends?

THE WITNESS: No. Dr. Mesghinna was in school at Utah State after I was. We both attended Utah State and know many of the same people, but prior to this had not formally met. We may have met in passing, but had no professional relationship.

THE SPECIAL MASTER: Had no professional relationship?

THE WITNESS: No.

Q. (By Mr. Rogers) After you met with Dr. Mesghinna in San Francisco, what did you do after that?

A. Okay, then I returned to Logan, and Dr. Keller and I examined the information we had collected and developed the general strategy, the general approach for the analyses that would be done. We then set up, made arrangements for an additional field trip to further investigate the areas that we were concerned with, and the first week in June I spent the entire week in the field examining both the additional lands that we would be designing for and the previously designed lands looking for information that would guide us in the types of irrigation systems we would use, where the

diversion points would be for the additional lands, and then we also with Dr. Willardson spent two and a half days roughly in the field examining the lands from a drainage standpoint so he could physically see the lands and aid in the determination of the natural drainage capability.

Following the field trip -- additionally in the field trip we conducted some intake rate tests on Big Horn Flats. Since we were anticipating using center pivot sprinklers, intake rate is a critical issue. We conducted in-place intake rate tests at that time. We then returned to Logan and began the work on the analysis, the systems design and the analysis of the existing systems, working the remainder of June and up to the present on completion of those studies and preparation of the reports.

Q. You were asked to prepare a report, then?

A. Yes, we actually prepared two reports.

Q. What was the first report? Could you describe that?

A. The first report is an "Irrigation System Design and Engineering Review of the Conceptual Irrigation Development Plan for the Wind River Indian Reservation".

Q. As long as we have done that, Mr. Bliesner, let me show you that and ask you to identify what I have marked for

identification as -- or have you just identified what I have marked for identification as Tribes' Exhibit Number 13?

A. Yes.

MR. ROGERS: I would like to point out that Tribes' Exhibit Number 13 also contains in the back in the pocket part some ten maps, which I will mark shortly as separate exhibits keyed on number 13. It will be 13-1 through 13-10. For the moment we are just identifying the initial report and its textual matters, figures and tables.

Q. (By Mr. Rogers) So you have read into the record then the title of Tribes' Exhibit Number 13. Was that report prepared under your supervision?

A. Yes, it was.

Q. What input did you receive from anyone else working with you, particularly Drs. Willardson and Keller?

A. Dr. Willardson principally prepared the narrative on the drainage review analysis of the Stetson plan, and Dr. Keller generally reviewed and made editorial comments on the total report.

Q. But you were in charge of the final preparation of the report and the integration of all this material?

A. Yes.

Q. In addition, you prepared yourself -- or who prepared the remainder of it that Dr. Willardson did not prepare?

A. I prepared the remainder of the report.

Q. In connection with the work on the additional lands also, did you identify various system costs associated with the irrigation design of these additional lands in Big Horn Flats and Stagner Ridge?

A. Yes, I did.

Q. Are they contained in Tribes' Exhibit Number 13?

A. Yes, they are.

Q. Could you identify just generally where that is located?

A. That will be in the first two sections.

Q. Well, are there places where costs are listed in tabular form in the report?

A. Yes, at several locations.

Q. Well, let's strike that and we will come back to that later.

A. Okay.

Q. Now, as a general overview of all of your assignments, you have basically described what you did to identify the additional lands. Was this roughly the same approach you also took in making the comparative review of Mr. -- of the Stetson firm's work in appropriateness of design and cost?

A. Yes. The field trip and discovery of information was done simultaneously for those two tasks.

Q. Is the result of that work also contained in Tribes' Exhibit Number 13?

A. Yes, it is.

Q. Now, with respect to the work you indicated you have done on the review of Mr. Billstein's operation studies of the water availability, what was your general approach to that?

A. We obtained copies of Mr. Billstein's computer runs of the operation study, and also the assumptions that he used in development of that study, descriptions of the control points that were identified in the study, and then applied our diversions and the diversions of the fee lands to that study to determine the effect of the additional diversions and return flows from those diversions.

MR. MERRILL: Your Honor, at this time I'm going to object to any more testimony concerning any water supply studies that this witness may have conducted. He was offered and accepted as an expert in the field of irrigation engineering, not in the field of water resource engineering or hydrology or depletion studies or any of those other fields in which we have seen other experts

come forth and testify as to these matters. I think it's beyond the scope of this witness's competence and expertise to start talking about hydraulic studies he may have performed during the course of his work.

MR. ROGERS: Well, Your Honor, I think --

THE SPECIAL MASTER: I will rule without having you respond. I believe there is an inevitable overlapping in the science of agricultural engineering, be it irrigation, hydrology or the various component parts of the overall field that one spills over into the other somewhat. I don't expect this gentleman to give us great testimony on nonconsumption, percentage of return flow and what goes to deep aquifers and what returns to the river system and whatnot, but I think it's sufficient -- a few more questions on this line I think will be proper, so I will overrule for the time being your objection.

MR. ROGERS: Thank you, Your Honor.

Q. (By Mr. Rogers) Mr. Bliesner, I believe you testified that you did prepare a report of this review.

A. Yes, I did.

Q. I show you what I have marked for identification as Tribes' Exhibit Number 14 and ask you to identify it for the record.

A. That's a report prepared by Keller Engineering entitled

"Estimates of the Effect on Stream Flow from Irrigation of Additional Trust Lands on Big Horn Flats and Stagner Ridge, Wind River Indian Reservation, Wyoming".

Q. I would like to move now, Mr. Bliesner, into some detail on the actual work you did on identifying additional irrigable lands in the Big Horn Flats' Stagner Ridge area. I believe you testified that you did identify some additional acreage in this area.

A. I did. There was approximately 17,000 some odd acres of additional arable lands that were identified by HKM that were not included in the systems designed by Stetson Engineers.

Q. Did you, in fact, design an irrigation system for these additional acres?

A. For a major, more a major portion of them, yes.

THE SPECIAL MASTER: Before you did that, did you find out why Stetson did not include the lands and respond professionally to their reason?

THE WITNESS: The information that I received from Dr. Mesghinna was that he was instructed from the preliminary work that they had done on Big Horn Flats that it would be not an economic project and they did not complete it. There was no engineering reason for not completing the design on Big Horn Flats.

THE SPECIAL MASTER: Based purely on economics?

THE WITNESS: Yes.

THE SPECIAL MASTER: That is they excluded arable lands?

THE WITNESS: Excluded it, yes.

Q (By Mr. Rogers) When we say "purely economics", Mr. Bliesner, what exactly do you mean by that? Do you mean that he felt costs were too high or exactly what?

A I understand he received instruction from the economist that he was working with that for the analysis that he conducted, that the costs would be higher than benefits.

MR. MERRILL: Your Honor, I object and move to strike the answer.

THE SPECIAL MASTER: It comes late. I'll sustain it, but Dr. Mesghinna's in the courtroom, we'll ask him tomorrow or later, undoubtedly.

MR. CLEAR: Your Honor, I believe there was -- Dr. Mesghinna has already testified to that effect so it's not hearsay.

THE SPECIAL MASTER: It's not hearsay. Well, it's close.

MR. MERRILL: If that's the case, Your Honor, it's already in the record and the testimony is duplicative.

THE SPECIAL MASTER: Duplicative, one or the other. But go ahead, Mr. Rogers.

MR. ROGERS: Yes, Your Honor.

Q (By Mr. Rogers) I ask you, Mr. Bliesner, if you will open up towards the back of Tribes' Exhibit No. 13 and pull out the first two maps that --

THE SPECIAL MASTER: First few maps?

MR. ROGERS: First two, there are two pockets there, Your Honor, and there are three maps in the first pocket.

THE WITNESS: That's the wrong pocket.

THE SPECIAL MASTER: Next will be the wrong map.

THE WITNESS: That's the wrong map too.

THE SPECIAL MASTER: I know, let me get them all out.

Q (By Mr. Rogers) I ask you if you would identify what I have marked as Tribes' Exhibit No. 13-1 and 13-2.

A Those are the two sheets of the maps and they're

entitled Proposed Irrigation Project, Big Horn Flats Unit, Conceptual Irrigation Development Plan.

Q Does these two maps constitute what you designed as the irrigation system for Big Horn Flats?

A Yes.

Q I would also like to refer you to the --

(Inaudible.

MR. ROGERS: I'm sorry, who said what?

MR. CLEAR: I said slow up a minute.

Q (By Mr. Rogers) Mr. Bliesner, I would also like to direct your attention to the poster board, to what I have marked as Tribes' Exhibit No. 15, and ask you if you would identify that.

A That's a composite map of those two sheets that we just previously identified.

Q Are there any differences between the two sheets, between Tribes' Exhibit 15 and the maps on Tribes' Exhibit 13-1 and 13-2?

A No. The information presented is the same. The only difference is one of them is trimmed so they fit together at the match line.

Q And I ask you to do that for convenience of presenting your testimony here today?

A That's correct.

Q Thank you. With reference to Tribes' Exhibit, what has been identified as Tribes' Exhibit 15, however it's convenient for you to do so, would you please identify for us the general features of the design for Big Horn Flats for the additional lands.

A Yes, I will. The irrigation system design for Big Horn Flats, first of all there were two alternatives explored for water supply for the project. One was from the Little Wind System with the canal diverting from the North Fork of the Little Wind, and the other was a pumping station from Bull Lake Creek just downstream of Bull Lake Dam.

Preliminary analyses of the two approaches indicated first of all that the more reliable water supply was from Bull Lake Creek, and secondly, the cost for diversion was cheaper from Bull Lake Creek. So that option was chosen.

The major features included Diversion Dam on Bull Lake Creek, a short canal diverting into Lilly Pond, then a main pumping station pumping water from Lilly Pond through a steel pipeline

up onto Big Horn Flats. It then enters a lined canal that traverses Big Horn Flats to a point near the highway in the center of the project.

Off of the main pipeline and the main canal are individual pumping plants or gravity turnouts supplying water through pipeline distribution systems to individual center pivot sprinklers, for the most part. However, there are three fields of wheel-line sprinkler included to sort of fill in some holes in these three locations (indicating).

A total of 9,264 acres had irrigation system designs completed for them on Big Horn Flats; that's the irrigated acreage.

THE SPECIAL MASTER: By Stetson or by you?

THE WITNESS: By me. And of this you'll notice there is one parcel here of arable fee land. The irrigation system irrigates those. However, for determination of additional acreage and diversion requirement only, the trust lands are included. So there is 9,073 acres of trust land and 191 acres of fee land that are irrigated by the project.

Q (By Mr. Rogers) What was the reason that you

withdrew the acreage from the fee land from your total?

A They were included in Higginson's report.

Q Does that complete your description of the --

A That's the general description project features.

THE SPECAIL MASTER: I'd like to see where the additional acreage is compared to where the existing Stetson acreage was for Big Horn Flats. Your map includes all of Big Horn Flats, does it not?

THE WITNESS: No, it doesn't.

THE SPECIAL MASTER: A combination of the two.

THE WITNESS: This just shows the arable lands of the addition. There are parcels off the map in this direction on the Big Horn Flats Unit of the Stetson (indicating).

There are parcels in this area, I believe, and then there are some over on the other side of Big Horn Flats that don't show on this map either (indicating). So this is sort of the center, the parcels that were included by Stetson are on either side of this piece.

Q (By Mr. Rogers) All right, Mr. Bliesner, let's

run through exactly how you designed this system then. What was your -- What was your first step in designing this system for the Big Horn Flats additional lands?

A The first step is to determine the irrigation water requirements for the development, and for this the irrigation consumptive use used by Stetson in their design was used. The highlands crop mix identified by Stetson in their report was the crop mix used since the elevation for the most part is above 5,900 feet here.

Q Did you use the same climatic zone?

A The climatic zone used here was the Burris Station since it was closest in elevation and location to the project and felt to be most representative of the consumptive irrigation requirements or the demands that would be calculated for this area.

And the irrigation consumptive use requirements by month appear in Table 1 of our report and are esentially the same as those from Stetson for that crop mix, averaging 20.0 inches per year consumptive irrigation requirement.

Then the next step was to determine the

farm delivery requirement. To that we applied the irrigation efficiency for the individual systems. The side roll sprinkler systems we used the same efficiency as Stetson did, 67 percent for the seasonal efficiency.

Q Refers to three special tracts in your system design?

A Yes. Then on the additional lands for the center pivot lands, since the bulk of the area is in center pivot design, we determined additionally the efficiency for center pivot, and center pivots operate more efficiently than wheel lines do or side roll laterals in which the uniformity of water in center pivot is much better, it's more uniform.

The irrigation efficiency used for center pivots for seasonal efficiency is 75 percent in this project. That gives us farm delivery requirement for center pivots of 26.7 inches per acre. For side roll laterals, 29.9 inches.

Now, having to go on and determine the diversion requirements there are two other elements that are included in the efficiency. One if the distribution efficiency, the other is

conveyance efficiency. Here our definition of distribution efficiency differs somewhat from the Stetson concept. The distribution system is taken as everything downstream for the main pumping plant. The reason that is so is because we had to apply energy to all of that water, so this becomes the distribution system from that main pumping plant to the main pipeline, the lined canals and pipeline distribution systems. Since this is a lined canal and seepage losses for all practical purposes are eliminated, the irrigation efficiency for that is taken to be 95 percent since the rest of the system is all closed. Now, the conveyance efficiency is applied to that to determine the diversion requirement and the conveyance efficiency is the efficiency of this unit here, whatever leakage we would have out of this earth lined canal and the Lilly Pond, which is the forebearer here, since this is a very short canal, we use 95 percent efficiency for the conveyance efficiency. The diversion requirement then, by applying these numbers, is approximately 20.6 inches per acre, and there is a typographical error in the report.

Q. (By Mr. Rogers) Could you identify where that is?
A. It's on Page 5, top of the page. The report indicates 29.2 inches. That is a typographical error and it should read 29.6 inches.
Q. Is it on the second line on Page 5?
A. Yes. And that gave us the diversion requirement then for designing the systems.
Q. In reviewing the system then, would it now be appropriate to move to each of the system components or design features?
A. I think that's probably the easiest way to describe it.
Q. Can you then do so and tell us how you went about designing these various features?
A. Okay. If I may, I would like to do that and then also give the costs of each of the units as we go through so we don't have to go through it again, if that's satisfactory.
Q. I would like you to do that and as we go through, also where capacities do apply to the various features, if you could identify the capacities as well as their costs.
A. Okay. Beginning here at the diversion, there is a 1350-foot long canal designed for 147-feet capacity, delivering water to Lily Pond. That canal and the diversion dam on Bull Lake Creek are both estimated to cost $730,000.

MR. MERRILL: Your Honor, due to the narrative nature of what I understand his answer is going to be, I will interpose an objection now to the witness testifying to the costs of each of the significant features of the irrigation and delivery system since there is no foundation as to what components are involved, what the unit costs of those components are and how the costs were determined.

THE SPECIAL MASTER: I'm inclined to sustain that. I don't like to go through all the -- I'm not sure, first, that -- Is this the only witness that is going to testify as to costs?

MR. ROGERS: Well, Your Honor, he's going to testify as to costs of the system. He is not performing the economic analysis, however. It is our intention as we go through these, when we reach that point of discussing the first item of cost, to discuss at that point how he arrived at it. If that is appropriate, I will go ahead and will show now --

THE SPECIAL MASTER: All right, we will overrule the objection for the time being, but I'm beginning to believe that testimony on costs of new irrigation systems is going to be so uncertain and so fraught with the inevitable questions as to financing, feasibility of financing, costs -- what dollar costs are we

talking about, 1981 dollars or what that will be at the time of construction? It's a fuzzy field.

MR. ROGERS: The witness is prepared to tell us that. Maybe it would be appropriate if we --

THE SPECIAL MASTER: Go ahead.

THE WITNESS: Okay. The unit costs used in the system are all 1979 costs, from the same basis as the Stetson design as far as the year the costs were taken. The unit costs that are included in the major components appear in the appendix of this report. Some of the unit costs, however, are not included for lump sum items, such as diversion dams, some of the major canals and that kind of thing. If necessary, we can take the time to go through and generate the individual unit's costs and the volumes involved to develop those costs.

MR. MERRILL: Your Honor, at this point I'm going to interpose another objection to any further discussion of costs since it now appears the costs are going to come out in 1979 dollars. As an evidentiary matter, the basis of my objection is the costs of 1979 dollars don't have any probative value with respect to a system that isn't built in 1981, and if it's ever built, would be built sometime afterwards, and the costs are going to be obviously much higher than 1979 costs.

As the Court has pointed out, we have enough problems

dealing with the accuracy of the costing of the components of the systems and the whole setup of vagaries that you apply to economic analyses, but it aggravates the problem to go back a couple of years in time when costs were much, much lower, since we have had the last two years a very high rate of inflation in this country, particularly with respect to costs of things used to design systems like this, and I think that it's not probative of anything to come in and talk about 1979 costs. Why don't we talk about 1930 costs or 1968 costs? I think that the costs that we are talking about to evaluate these systems ought to bear a little more realism to some time that these projects are projected to be developed. Maybe 1981 costs would be all right, maybe 1985 costs would be even more realistic.

THE SPECIAL MASTER: I see that we are going down that same road again because if we do that, we have to go into the benefits and what is hay going to sell for in 1986, and we are back through the same stuff we have been through.

I want to hear the other side of this.

MR. SACHSE: Yes, I want to speak to this because I was here during -- as you know, we have divided to some extent which lawyer has covered which witness and so forth, and I was here during the entire testimony of

Dr. Mesghinna. I don't know whether Mr. Merrill was or not, but I think he was. If he was, then his objections at this point are particularly surprising because all this was gone through in the testimony of Dr. Mesghinna. What we have asked Mr. Bliesner to do is essentially the same thing that Dr. Mesghinna had been asked to do. Where he is presenting plans for areas left out of the Stetson report, he's gone through the exact same procedures that Dr. Mesghinna went through in planning his part, but these are plans for pumping and center pivot, and he's explaining that.

But if we had come in with figures from a year other than 1979, there would have been no way to compare them with the testimony already admitted for Dr. Mesghinna's work and for Mr. Dornbusch's work.

So it's not in any way to seek any advantage, but simply to have comparable figures to the figures already fully admitted in evidence that Mr. Bliesner was asked to do 1979 figures. That also means, of course, the returns, which will be discussed by Dr. Cummings, have to be in 1979 figures, too.

So the point I'm trying to make is there's nothing new in what Dr. Bliesner -- Mr. Bliesner is testifying to. He's following the same procedures in testimony, presenting the same kind of evidence that already has

been admitted into evidence for all of the Stetson testimony, including the costing figures. It's the engineer who figures out how much this would cost, how much that would cost, how much the other thing would cost. The engineer then supplies those figures to the economist. We have not differed at all from that procedure.

THE SPECIAL MASTER: I appreciate that. If there's one thing in life that's worse than making one error, is making two errors, and I don't want to do that if I ruled improper the first time. But I do believe we are at the crux of the business of additional lands now, and that's going to be the costs and that's the reason they were excluded in the first place was the costs, so maybe the proof of this is going to require some particularly larger effort or a higher test, a higher degree of test of acceptability since it's already been rejected once.

I think I'm going to reserve ruling on this and go ahead and hear some of this.

MR. MERRILL: Your Honor, I would like to point out --

THE SPECIAL MASTER: To see how thoroughly these costs were gone into as to the -- and then, of course, you have your chance to try your lawsuit as far as if you believe them or not.

MR. MERRILL: We will, Your Honor. I would simply like to state for the record that I was here during the

beginning of Dr. Mesghinna, but I did not conduct the cross, so I don't know if Mr. White made an objection on those grounds. I did make an objection on Mr. Dornbush's testimony based on the use of 1979 figures.

MR. CLEAR: Your Honor, I'm getting a little confused now. Now, he's saying we have to go to a future date. Now, when I recall Mr. Billstein was testifying, the objection was he was using current stream flow information and not 1868 stream flow information. Now, the State started this lawsuit, and if they didn't want to get involved in this, they didn't have to do it. What we are talking about here is practicably irrigable acres. The State shows the date they started this fight, and I think we are entitled to put on evidence on that date.

THE SPECIAL MASTER: Well, on those harmonious notes, let's take a ten-minute break.

(Whereupon a short recess was
(taken.

* * * * *

THE SPECIAL MASTER: Okay. Shall we resume, please. I've reserved the ruling so go ahead with the testimony.

Q (By Mr. Rogers) Mr. Bliesner, before we proceed in the manner I asked you, I wonder if you could tell us why you chose, as a general proposition, since we've -- it's the first we've heard in this case, why you chose center pivot sprinkler irrigation for this additional land?

A With this approach, with the diversion out of Bull Lake Creek, there is a significant amount of energy involved in lifting the water up to the plateau. How efficiently you use that water once it gets there has a great bearing on the cost because the more inefficient you use it as it gets to the top the more water you're going to have to pump up there and the more it's going to cost you.

So what we did, we looked for an irrigation system that was a low energy requirement system, that would operate at low pressures, that operated very uniformly so we would keep our efficiencies high and that was a reasonable approach for the lay of the land. And center pivots are sort of a natural for that big flat. They have all of those components, they are the highest efficiency method of sprinkler irrigation available.

They operate at the lowest pressures of this sprinkler system available and they're ideally suited to the way the lands lay.

Q Let's go back to the river, the initial diversion and I'll ask you, instead of what I asked initially, if we could review the design features of this system, just exploring their capacities and why you chose what you did, not get into cost at the moment.

A Okay. If I remember right, we were -- we had just talked about the canal and the Diversion Dam. We have designed a pumping plant here to operate off of Lily Pond, and it is designed as a wet sump type pumping plant with automated trash racks (Indicating). It will employ line shaft turbine pumps and included in the design, it's an open type pumping plant with just a shade structure, it's not an enclosed pumping plant design; very typical of river pumping stations all up and down the Snake and the Columbia River.

Included in the design is surge control equipment for supplying water through this main pipeline. What happens when you have a major pipeline that increases in elevation very rapidly, and actually crosses a couple of summits in here, then drops back down and comes back up again on the flat, if something happens to

these pumps and they shut down suddenly to you, you have a large volume of water, 140 second feet moving up the hill at five feet per second. If you don't have some protection for that, that moves up the hill and it stops at some point and turns around and comes back down, and without surge protection you end up with a pumping plant in Lily Pond instead of at the side of Lily Pond.

So we went through a very rigorous analysis in determining the surge requirements for this design, and what we ended up with is five air chambers. There will be nine pumps, 1,000 horsepower pumps. They will pump into the main line through a manifolding assembly and there will be five air chambers there. And an air chamber operates like a captive air tank on a private water system. If you have a well at your house or have been associated with those where you have a pressure system and there is a pressure tank, the pump comes on, pumps into the tank and the air pressure will deliver water out of the tank. Well, the air tank works the same way. When the pumps shut off the water is going. What happens is the water then displaces out of the tank into the line and gradually slows the flow of water as it goes up.

Then when the flow reverses, the tanks are now full of air, they act like a giant shock absorber, when the flow is reversed, they absorb the shock on the river's flow. That would do it if we just had a straight uphill line that discharged at the top, but this line comes over two summits, one right here, then it drops down a few feet, then summits out again here near this pumping plant A as indicated on Tribes' Exhibit No. 15 (indicating). Then drops again down Winchester Draw and exits at elevation 6,220 here (indicating).

THE SPECIAL MASTER: A and B also have pumps?

THE WITNESS: Yes. Those pump out of the main line; they're booster pumps to supply the additional pressure to get water to those locations shown.

Now, the additional surge control features that are included, we have at each of those points an open-ended surge tank with an altitude valve for filling. It's like a float valve on the thing, so you got giant tanks up there full of water, so when the system shuts down what it tries to do is separate the wate r column at that point and water drops both ways. Well, you don't want that to happen because you get large negative pressures in the pipeline and then those

will reverse and become positive pressures and a tremendous surge develops. So what happens when the pressure there drops down to atmospheric pressure, in other words, zero gauge pressure, the water flows from that tank into the system, filling it up until equilibrium is reached so you don't have column separation at those points.

And the cost to install these surge tanks and the air chambers here are included in the pumping unit costs and are designed for the pumping plant.

Now, this canal, this main pipeline then with the routing shown on Exhibit No. 15 is designed to be a steel pipeline coal tar enamel coated and buried, 72 inches in diameter, half-inch wall thickness applied.

Discharges here into the canal at elevation 6,220.

The canal is designed as a dead level canal. There is no gradient on the canal. The flow is generated by gradient of the water surface. The reason for that is there is no place to waste water out of the downstream end of the canal, no convenient place. If there is an operational accident, the most logical place to waste is back into Winchester Draw. The other reason to design it at dead level is because it can be automated to operate very efficiently. It

acts like a large reservoir then. So with very simple liquid level controls at this point in the canal, controlling points at this point, you can regulate the number of points that are operating and maintain a constant water level in the canal, thereby there are no spillage losses in the canal.

The pumps operate to keep this thing between set levels and that's one of the reasons we can keep such high efficiency on the canal. Again, once you get it up there you don't want to spill it back on the bottom. The wasteway is included here, again a 72-inch steel line.

Q When you identify, when you say "here" on the record, where is it on the map you're pointing?

A Okay. It's located in Section 33 and is indicated as labeled on the Exhibit No. 15. This is an emergency wasteway only, in case all of the pumps fail on the individual pumping plants, the main pumping plant continues to operate and the liquid level control levels fail, the water will waste back into Winchester Draw.

THE SPECIAL MASTER: And stay there?

THE WITNESS: Well, you'll actually have whatever flow rate you're pumping at the present time move down

Winchester Draw and move into Big Wind, but that design would be akin to an emergency spillway on a dam which generally is not protected from erosion because it's emergency in nature.

Other than just an apron of riprap at the outlet of the wasteway, there is no protection features designed for Winchester Draw. It's supposed to be a very unlikely event. It's better to waste in there rather than down through the middle of the arable lands.

Okay. Then each of these pumping plants were separately designed and if you'll look in the report at figures -- excuse me, Figure 1 --

Q (By Mr. Rogers) Page 8?

A Page 8 in the report, you'll see some typical layouts for pumping plants. Now, these individual pumping plants will, in all probability, not look exactly like this. Each one will be configured slightly different but the same components will be included in the same one.

* * * * *

THE WITNESS: We begin at the canal with the headgate supplying water through a 24-inch concrete pipeline to an automatic trash rack, which then spills water into a small settling basin, and in the settling basin is a submerged screen. That is then connected to the main pump stand in the case of the upper unit, which is a turbine pump installation, then the pump is set in that reinforced concrete pipe pump stand. There is a shade structure over the pump. Then included on the discharge side of the pump there is a flow meter, a pressure regulating valve. There's a butterfly valve shown there, and a continuous acting air vent.

Also included, but not shown on the drawing is the pressure relief equipment in case something should happen and shut off all the irrigation systems downstream and the pump continues to operate, then there's a pressure release valve in, in some cases at the pivot locations and some cases at the pump location, depending on where the highest pressure is.

Now there are two types of pumps shown here in the drawing. Depending on where you are at on the canal, you will use a different kind of pump. The upper pump in this drawing shows a turbine pump, and that particular installation is somewhat more expensive

than a centrifucal pump shown in the lower installation. So where you can, it's advantageous to use the certrifical pump. However, centrifucal pumps are not self-priming unless their water supply is above the case of the pump, the Volute case, so therefore, any location we have where we are on the downhill side of the canal, we have used centrifucal pumps with what is termed flooded section or the water surface elevation above the Volute case of the pump. Again, this is a measure to reduce cost.

Then anyplace we're on the uphill side, since it's a little difficult to excavate out and provide drainage for the pump and whatnot, we use the lined shaft turbines as shown in the upper portion of Figure 1. Then in addition, we have some booster pumps indicated on Exhibit No. 15 as pump numbers A, B, then there are two other booster pumps, K-1 and K-2. Those are in line centrifucal boosters where the pipeline is supplying the system directly upstream, and then a pipeline coming out of the downstream end. So what you do in Figure 1 there is eliminate the settling basin and that structure assembly and connect it directly into the main line.

Q Mr. Bliesner, before we move to another area, have you included in your report, Tribes' Exhibit 13, specifications

for certain of these features that we have already gone through, such as I don't believe you mentioned capacity lists in tabular form for the main pumping plant.

A Yes, excuse me. Back when we were talking of the main pumping plant, the design specifications of that pumping plant appear in Table 2 on Page 6 of the report listing discharge capacity, total dynamic head, total horsepower, pump efficiency, the number of pumps, the size of pumps, the types of pumps that will be used.

Q This is the main pump that actually carries the water from roughly the water level at Bull Lake Creek up the hill?

A That's true, it's the main pumping plant at Lily Pond.

Okay, then the individual specifications for these pumps we have just been discussing appear in Table 3 on Page 7 listing the type of each of those, whether it's a booster pump, whether it's a centrifucal canal pump or turbine canal pump, showing the design capacity and head requirement in nominal horsepower or motor horsepower of each of those units.

Now, from the pumping plants we go into the pipeline network. The design of the pipeline network was done utilizing a computerized optimization pipeline

network design program. If I may, I have a reproduction of I believe it's Figure 2 in the report.

MR. ROGERS: On Page 10, Your Honor.

THE WITNESS: The figures demonstrate the rationale behind the optimization program, and we use a term called life cycle costing here.

Q (By Mr. Rogers) Excuse me. For purposes of identification, you have prepared a blowup or a larger drawing of Figure 2 from Tribes' Exhibit 13, and is that what I have identified as Tribes' Exhibit No. 16?

A It is.

Q You were saying about life cycle cost.

A Until pipeline designs are in, any system design, life cycle costing applies to any system, any engineering system that has both capital input and operation maintenance inputs, specifically energy inputs in this case. What you do then in life cycle costing is you are looking for the minimum annualized cost of that system-- well, in a pipe system that is related to the pipe size that you are using for a given flow rate. So in the program it operates like this: As the pipe size increases for a given flow rate, the fixed cost goes up, obviously. You are buying bigger pipe, it's more expensive. But as the pipe size increases, the

power cost goes down because it takes less energy to overcome the friction in the pipeline to push water through a big pipe than it does in a small pipe.

What happens then is you are looking then for the annualized fixed cost plus the annual power cost, and you are looking for a point that gives you the minimum sum of those two. Okay, our computer program essentially applies that technique to design what is termed as the critical leg in a pump -- or excuse me, a pipeline network. For example, if we take this pipeline network here (indicating), which supplies from Pumping Plant G, it supplies Field Numbers G-1, G-3, G-2 as indicated on Exhibit No. 15. What the program will do, based on the flow rates in the individual pipelines, it will determine the most economic pipe size to use in each of those cases. It will then calculate the pressure requirements at each point and it will identify the legs or the pipeline segments that are in the critical path, where the most energy is required. Then it will find out what the excess pressure is in one of these other legs, and in this case the leg to G-1 would be the highest pressure leg since it is discharging at a higher elevation.

Then the program will come in and look at all of

the other segments and determine how much excess pressure there is available in those. Now, that's excess pressure that you have had to generate and had to supply at this point (indicating) to end up with enough pressure out at the distal end. So the excess available energy you have here you can't do anything with. So the logical thing is to put a smaller pipe in there and burn it up since you don't need it down here.(indicating) to operate this pivot. If you put a smaller pipe in, then it's less expensive. So the program goes in and squeezes down these pipe sizes in the areas it can within a volocity limitation of six feet per second. So what we end up with at the end result is the least cost pipe network for those particular conditions, and you have to include what the pumping requirements are, how many hours a year the pump operates, what the energy cost is, and we include the interest rate and the life of the pipe systems to arrive at the annualized cost. All of that goes into the program, and each of these pipeline networks that you see shown on Exhibit No. 15 were designed utilizing that computer program.

Okay. Now, the next step, we go on down to the individual field requirements, the on-farm irrigation

systems. We applied some fairly specialized design techniques to determine the optimum center pivot for the particular conditions that we have here. As I mentioned earlier, when we were in the field we conducted some in-place infiltration tests. A graduate student at Utah State University has developed a piece of equipment that simulates sprinkler irrigation in a small contained unit, so we can determine what the intake rate of those soils are under sprinkler conditions. We took that piece of equipment to the field and set up in six locations and ran three tests to determine intake rate. What happens is this unit has a small spray nozzle and it has a micro-processor that operates it to obtain a given application rate by pulsing the sprinkler on and off, and you set this thing up and you operate it at a given rate, and it's generally at a fairly high rate since we are simulating center pivot operations, and they apply water at a high rate.

We operate that at whatever rate we have set until we start to get ponding on the surface, then we note the time to ponding. We run that for three individual rates, and when we get done we end up with a relationship that looks like that one shown in Figure 3 on Page 13

indicating the time to ponding for those application rates of the various sales. This Figure 3 happens to be the average of all of those tests that we ran.

THE SPECIAL MASTER: But none of those tests were run on this specific soil?

THE WITNESS: Yes.

THE SPECIAL MASTER: They were?

THE WITNESS: They were run at locations indicated by the triangles on Exhibit No. 15. You will see we were in Sections 35, 34, Section 4 and Section 11 of Township -- well, excuse me, there are two different townships.

MR. ROGERS: There are two different townships there.

THE SPECIAL MASTER: K-5 is sprinkler?

THE WITNESS: We are in Township 2 North, Range 2 West, Section 11 and Section 4. We are in Township 3 North, 2 West in Section 35 and 34, and we are in Range 2 North -- excuse me -- Township 2 North, Range 1 West with Test No. 6, which is in Section 11, and we are in Township 3 North, Range 1 West with Test No. 5, and that's in Section No. 34. Those are the six locations where we actually ran tests in the field with this equipment on that specific soil in place.

End bliesner-direct-rogers

Q. (By Mr. Rogers) Just for clarity, again, Mr. Bliesner, the sites of intake rate tests are where the triangle appears?

A. That's correct. It's indicated in the legend.

Q. Not the squares that had the letters in them. Those refer to the pumping?

A. That's correct, and circles with the numbers in them refer to the field numbers.

Okay. We took that information, then generated this relationship that is shown in Figure 3 and we then applied that to another computer model to simulate the operation of a center pivot on that type of soil. And if I may, we have, for demonstration purposes, developed a graph that's labeled Tribal Exhibit Number 17, entitled "Center Pivot Operation Simulation".

Q. Mr. Bliesner, does that graph appear in the report?

A. No, it does not.

Q. Thank you.

A. Now, that intake rate function that you see on Figure 3 appears on that figure as a straight line, that is a log log plot. It's a power function, so on linear scales it appears as a curvilinear line and in a general sense this is the shape or the form of that intake function.

What happens now in our computer simulation is we

then operate a center pivot across that point. The maximum point of application rate on a center pivot is right out at the end because that piece of system is covering more ground than any other piece.

So that is the point that we're simulating. Okay.

What happens then is we start out at time zero and as this center pivot passes the application rate at the leading edge of the sprinkler pattern it's fairly low, the water is just starting to hit the ground out there in the front where the water is reaching. As you come closer and closer to that point you're getting closer and closer to the sprinkler and the rate is increasing.

Well, for -- for simulation purposes this pattern is most closely represented by an elipse. So that shape is indicated as an elipse in the model.

What happens, we start out in time zero and application rate is considerably lower than the intake rate, but as we put more water on, the intake rate decreases very rapidly and we get over here at some point in time where the application rate may actually exceed the intake rate. And then as the pivot passes on past, then the application rate drops off again at the tailing edge of the sprinkler pattern.

Okay. Where those two curves overlap right there

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is the required surface storage.

Now, if you've watched center pivots operate closely at all, if you stand out right behind the system as it passes, you'll notice water standing around on the field in nearly every case. And that's a very common technique to see, it's not very long before that water disappears, but there are some limits on how much water you can store in that surface microtopography, the little dents and dips and holes in the ground.

Several studies have been conducted. One study that is referenced in the report by Dillon indicated surface storage could range between a tenth of an inch and five-tenths of an inch, depending on how much slope you have.

Another study that was conducted by Gale and Skaggs, did a very detailed analysis of the surface storage on weather bedded lands. They took corn fields in North Carolina or someplace and had the nice level beds and the furrows, and then they let rainfall occur on it all year and then after, harvested, and all the trucks run across it and everything, and the tractors, then they determined that the minimum amount of storage that was available on the average was .04 inches.

Well, on the Big Horn Flats area we have no row

crops, so it's all -- it's either grain or alfalfa crops, so the microtopography is more conducive to holding water there. It's not smoothed off like a bedded surface is. So we have an opportunity to store more water. In the study we set a maximum limit of .05 inches as the storage requirement we would allow.

Okay. Then we operated this simulation program to determine the maximum length of system we could have at each of the different sprinkler configurations that we used.

Now, I talked earlier about the pressure requirements of center pivots being very low these days. Well, there are several concepts in center pivot sprinkler design. You have the low pressure sprinklers which are just a single line of spray nozzles on the system. Okay. That's a very low pressure system, but it has a very high application rate because it doesn't spread the water over a very wide area.

The next level then to go to to keep the pressure low, yet get a large area, one of the techniques used is to put booms across the center pivot's bands with several sprinklers on them, smaller nozzles. We spread the water out and apply it uniformly over the boom. Okay.

9-5

That was the next level that we looked at. And the third and final level was intermediate pressure low angle impact sprinklers, which have the widest spread of all, and those were used only in the area on the east end of Big Horn Flats where we had sufficient pressure available from gravity to supply the pressure required for the higher pressure requirement systems.

The reason we do that is they get a little larger area coverage, we can use a little larger system and they're a little cheaper since you don't have to put booms on. So where we had pressure available we used those.

Okay. We determined then for, for each of those configurations what the longest length of system we could have and it turns out that for the spray boom concept, for one example, 1660 feet or 189 acres of irrigated area was the maximum system length. So in areas where we could only use spray systems, then that was the maximum length used.

Some of -- of the center pivots are actually smaller than that, but depending on what the field configuaration was. Obviously you want to use as long a system as you can within limits because the longer the system is the more acres of irrigated ground

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you have per unit length of system and their initial cost.

You also hit a point of diminishing return on long systems if you get too long because the head loss gets too high in the system. And we analyzed this in this case and we're fortunately on the economic side of the low point.

Okay. That determined the maximum length. Then we applied the same life cycle costing techniques from the computer design program for pipeline network design to determine the pipe sizes in the center pivots. And this is something that is just starting to be done now among center pivot manufacturers. We've been designing systems this way for about five years now, since center pivot manufacturers are now making center pivots with different sizes of pipes, you have the same option in center pivot design that you have in pipeline network designs. You can determine the most optimum pipe size for the flow rate in the system.

So we apply again another computer program to determine the pipe sizing of each of these pipes.

Now, the results of the general systems specifications for the center pivots appear in Table 4, and those are all of the lengths of the systems that are used.

And that lists the length of eight inch pipe, the length of six and five inch pipe, the type of sprinklers, the pressure requirement at the pivot point. And you notice there's a column there that says with regulators and without regulators. If you have those very low pressure center pivots where the minimum pressure at the distal end is 15 psi, and you have a small change in elevation of, say ten feet, it can significantly affect the distribution of the water under that system. It will reduce the pressure and when it comes on the high point it won't get enough water, so what you do if the elevation variation is in excess of 20 percent of the, of the distal end pressure of 15 psi, then we included pressure regulators. And when you do that you have to add some extra pressure because they burn up some pressure in the regulating process.

THE SPECIAL MASTER: Are you addressing drainage on this too?

THE WITNESS: Not at this point. I will later on.

THE SPECIAL MASTER: Okay.

THE WITNESS: Also shown there are the individual unit costs.

Okay. Also included, as we mentioned before, are three fields of side-roll lateral systems, and those are

designated as field number K-4, K-15 and K-22. And it's fairly obvious the reasons for not using center pivots in those locations; the shape is just not conducive to it. One reason more weren't used is some of the areas have fairly low holding capacities, and if we had to extend a mainline, say for the additional mainline plus the increase size in mainline about, and space the lateral lines closely enough together to adequately irrigate the area, we started getting more expensive on the total system.

So the wheel lines were, for the most part, included, where either there was reasonable good soil moisture holding capacity or the line extension was not excessive.

And these are designed with a -- with similar techniques that were used by Dr. Mesghinna. Their side-roll laterals are 40 feet by 60 foot sprinkler spacing, sprinklers on the pipeline are 40 feet apart, the sprinkler moves 60 feet.

We used two moves per day in the design and they're designed for the same peek application rate as the rest of them. I guess I didn't touch on that.

The system is designed to meet the peak consumptive use requirement for alfalfa.

Now, that differs from the Stetson design, but there's

a very good reason for that. You don't have the option under one of these center pivots to raise the average crop mix. It becomes a little difficult to manage if you have a pie shaped piece of 17 percent grain in the center pivot, so you reduce the system capacity so the system capacities are designed sufficient to handle alfalfa.

* * * * *

THE SPECIAL MASTER: You can't put a crop on one half of a circle and a different crop on the other half?

THE WITNESS: You can. It's more difficult to manage. If you had a large unit like this and you are operating it as a single farm, you would probably not do that. You would try to plant them so you had one crop under one machine.

THE SPECIAL MASTER: Do you know of a farm that size operated as one unit, outside of Russia, that you have had some experience in with center sprinkler -- center pivot sprinklers that close together, that volume and that size?

THE WITNESS: Well, one I have designed in Georgia was approximately 5,000 acres, and it's all center pivot.

THE SPECIAL MASTER: Is it finished or not even completed?

THE WITNESS: There are two or three systems that are not in. It's roughly 4,300 acres, or something in that category that's completed.

THE SPECIAL MASTER: What is your total acreage for this one?

THE WITNESS: Ninety two hundred sixty four.

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THE SPECIAL MASTER: That's not true because you're irrigated acreage totals on Table 4 comes to at least 1,400 acres, from what I can count quickly.

THE WITNESS: This is just the individual tables. If you will flip over to Table 5, this summarizes all of the individual fields.

THE SPECIAL MASTER: Well, how many acres do you have under irrigation that totals up on Table 5?

THE WITNESS: Ninety two hundred sixty four, the bottom total there. Now, that's just the acreage that is actually irrigated under the machine. That does not include --

THE SPECIAL MASTER: Do you know of any system that is 9,200 acres or more and operating side by side of the size of this in actual reality?

THE WITNESS: I can't give you the name of one specifically. Whether it's operated as one unit or two units when it gets to that size is sort of immaterial. You define the efficiencies from operation of the irrigation system per se, farming it. I don't know about those efficiencies, where the breaks are on land size.

Q (By Mr. Rogers) Mr. Bliesner, in your professional opinion, is there any reason this system design you

have prepared would not operate as a single unit or as two units?

A It could be operated essentially under the scheme you decided. If you wanted one farmer on each center pivot, that would be possible. If you wanted to farm them all as one, that would be possible.

THE SPECIAL MASTER: If you wanted one farmer on each center pivot, that would be fine?

THE WITNESS: I'm saying the system could operate that way.

THE SPECIAL MASTER: That would be a little monsterous, wouldn't it? That would out-deal the new deal. I don't follow that.

THE WITNESS: I'm just talking about the flexibility of the irrigation system design, not what is practicable from a farming standpoint.

THE SPECIAL MASTER: But what is a practicably irrigable acre, that's my charge in this.

THE WITNESS: Okay, then from that standpoint that would probably not be the way it would be operated.

Well, that completes the systems specifications.

Q (By Mr. Rogers) Just a moment. Let me get my place here.

Mr. Bliesner, let me ask you, the total on Table 5 --

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on Table 5 the total acreage figure you have there that you are capable of irrigating with this system is 9,264 acres, is that correct?

A Yes.

MR. ROGERS: I would like to inform the Court again that there is a footnote in Mr. Bliesner's report that notes this on Page 3.

THE WITNESS: Page 3.

MR. ROGERS: That we had extracted from the Tribes' claim with respect to this additional acreage on Big Horn Flats for 191 acres of the fee land, and that has been made a part of Mr. Higginson's testimony yesterday. While Mr. Bliesner is capable of irrigating this system, we are not claiming it under his part of the report, despite this total on --

THE SPECIAL MASTER: Is that included within the ninety two sixty four?

THE WITNESS: It is.

MR. ROGERS: It is included, yes, sir.

THE WITNESS: The one ninety-one is included in all of the cost calculations and presentation of total acreage. It is only deducted in the values where the diversion requirements are shown or total acreage where a claim is shown.

Q (By Mr. Rogers) Mr. Bliesner, I think we can now appropriately step back and begin the review of the features from the cost standpoint. I would like to ask you if we could -- I assume the best place to begin would be at the river again -- and move through each of the features and tell us how you arrived at the costs.

A Okay. We will begin back here (indicating) at the Diversion Dam and the short canal into Lily Pond. The unit costs used for canal excavation, access road construction, fencing, placement of top soil and seeding, all of those elements dealing with canal construction costs were the unit costs supplied by Stetson and used in their study. The Diversion Dam cost at Bull Lake Creek is taken to be the same as the diversion cost from the Stetson plan at South Crowheart and Riverton East essentially. He lists a cost of $669,600 for those diversion dams. This one is approximately the same capacity and the same size, and that cost was used for this diversion dam.

The unit excavation costs for -- from the Stetson report were used in determining the cost of this earth canal coming from Bull Lake Creek to Lily Pond. The cost of that canal using those unit costs is

estimated at $30,000; the Diversion Dam at $700,000, and for a total of those two together is $730.000.

MR. MERRILL: Your Honor, I object to the cost figures and move to strike them on the grounds that there is still no foundation for the testimony based on what unit costs were actually used, how many units were required of each of the particular cost items. What we are getting is a bottom line with no indication as to how it was reached.

THE SPECIAL MASTER: Well, for purposes of --

MR. ROGERS: Your Honor, I believe Mr. Merrill is free to go into that on cross-examination if he wishes, and the Witness has testified that he has relied on the same cost figures that were used by Stetson where appropriate.

THE SPECIAL MASTER: Yes. I will allow them to be answered.

THE WITNESS: The next component is the main pumping plant. Included in the costs of this is the concrete structure for the wet sump and pump support, and the reinforced concrete prices from Stetson were used in these areas. Of course, there is excavation and backfilling around structures, and again, the unit costs from Stetson were used for those. The cost

includes road work into the site, and the Stetson costs were used again. It includes a shade structure at $10 per square foot.

THE SPECIAL MASTER: A shade structure?

THE WITNESS: Shade structure over the pumps as indicated in Figure 1.

THE SPECIAL MASTER: Thank you.

THE WITNESS: Also included are automatic trash racks and related structures associated with those, and then there are nine 1,000 horsepower pumps, and the component prices were generated from information in Appendix Table A-7 -- A-6 and A-7 --

MR. ROGERS: Those are on Pages 40 and 41 of the report, Your Honor.

THE WITNESS: -- to determine the pumping unit costs, and this includes motor controls, pumping plant panels, necessary wiring and installation.

The manifold assemblies are also based on prices from the Appendix, Table A-8 under header and control valve costs. The air chambers and surge control equipment were --

THE SPECIAL MASTER: That's header, H-e-a-d-e-r, if you are looking for the spelling.

THE WITNESS: Yes. The costs were included

individually for the five air chambers and the surge tanks. Then also a lump sum of $100,000 was included for automation controls between the point at the wasteway and the main pumping station.

* * * * *

A. (Continued) The total estimate of the pumping plant, including all of those features, is $2,200,000.

Q. (By Mr. Rogers) What is the next feature?

THE SPECIAL MASTER: Is that what you would call the end of your systems work and the beginning of your on-farm or is there such a classification?

THE WITNESS: No, no. The systems work in this case goes all the way to the center pivot. The pipeline network, since these are such large fields, all of the pipeline network would be considered a project feature.

THE SPECIAL MASTER: Since this isn't breaking up into units of 160 acres in individual ownership, so you really don't have an on-farm classification, do you?

THE WITNESS: The on-farm, if you were going to separate it and consider these as fields, then the normal concept of the project features are to deliver water to the field boundary, and so you would deliver it to the pivot point, and that would be the responsibility of the landowner to take over at that point.

Okay. The next feature is the main canal -- excuse me, the main pipeline. And that pipeline is 72 inches in diameter. It's 14,000 feet in length, steel pipeline is indicated at a price of $2,377,400, including installation.

Those costs, the unit costs of the pipeline appear in

Table A-1, Page 38.

Okay. The next feature is the major canal. Again, the excavation components, any reinforced concrete work, such as the transition from the pipeline to the canal and headwall for the wasteway were used, the unit costs from Stetson were used. The lining cost came from bid prices given the Bureau of Reclamation in Riverton on 12 mill PCV lining in place. It's designed with that 12 mill lining in place and placement of 12 inches of selectively graded fill material over that for protection.

The cost of the canal with lining is estimated at $1,500,000, and it's 16,500 feet long.

Okay. The next elements of design that we need to discuss are the individual pumping plants that are indicated by the squares with the letters inside them, and the specifications for those appear in Table III. I've previously discussed what was included in the unit costs used to generate those, the costs of those individual pumping plants appear in Appendix Tables A-5 to A-8.

THE SPECIAL MASTER: How many of them are there, individual pumping plants?

THE WITNESS: There are -- Let's see. I believe there are twelve. Yes, there are twelve.

THE SPECIAL MASTER: Thank you.

THE WITNESS: And the total estimated cost for that is $512,840. The pipeline system, again as designed by the optimazation program, using unit costs in Appendix Table A-1 were installed costs. The total costs of that pipeline network, as shown on Figure 15, as the pipe network is shown on Exhibit 15, the total cost for that component is an estimated $3,526,200.

THE SPECIAL MASTER: How deep are these pipes put to go to the center pivot, two feet?

THE WITNESS: Two feet of cover generally. Of course, the depth of trench varies depending on how large the diameter of the pipe.

Okay. Then the on-farm system costs, we discussed the individual unit costs of the various systems, and that was listed in Table IV by length of system. Table V then summarizes the length of system by system number, so you can't apply an individual unit cost to each of those and --

THE SPECIAL MASTER: Roughly translated, you're talking -- You're about to talk now of the cost of the sprinklers themselves?

THE WITNESS: Yes, yes. This is the sprinklers themselves. The on-farm system costs; then added to that cost, those unit costs that are shown in, in those tables would be the cost of the wheel lines and the unit costs for those appear in Appendix Table A-2.

Total on-farm system cost, which includes the side-roll laterals and the center pivot systems is estimated at $2,678,330.

Q. (By Mr. Rogers) For the 9,264 acres?

A. Yes. Now, the other element that we haven't discussed is the drainage system design. We've been talking just about irrigation system. If we're going to summarize the costs for all of this, you need to look at the drainage requirements.

The drainage requirement for Big Horn Flats, the drainage system design is shown on the drainage system maps in the back of our report.

MR. ROGERS: Your Honor, these -- Let me see which one. These are the --

THE WITNESS: Sheet 3 of 7.

THE SPECIAL MASTER: The back jacket?

THE WITNESS: The back jacket, yes, Sheet 3.

MR. ROGERS: Your Honor, these are the drainage maps which I have marked for identification as Tribes' Exhibit Nos. 13-4 through 13-10.

THE SPECIAL MASTER: Yes.

Q. (By Mr. Rogers) And this is, Mr. Bliesner, this is Sheet 3 of 7?

A. Yes.

Q. So this would be Tribes' Exhibit No. 13-6. Is that the drainage plan for the proposed irrigation project of Big Horn Flats?

A. It is. And they are shown, if I may indicate their location on Exhibit 15 since it's on the board, if you'll look, there is a break in the ridge that runs diagonally through Sections 33, 3, 2 and 1, all of those with the exception of 33 being in Township 2 North, Range 2 West. There's a drain that runs diagonally through there and discharges over at the head of Big Horn Draw.

THE SPECIAL MASTER: Point to the head of the Big Horn Draw, would you, please?

(Witness complied.

Q. (By Mr. Rogers) Could you identify that on the map for the record?

A. That is in Section --

THE SPECIAL MASTER: 6, I think.

A. -- 6 of Township 2 North, Range 1 West. The discharge point for that interceptor drain, there's another interceptor drain in Range 1 West, Township 2 North, Section 1 and 2, and it discharges into Johnston Draw.

The drainage requirement for Big Horn Flats is, is reduced by several means. One is we're using very high efficiency systems, so the deep percolation losses on Big

Horn Flats is reduced. Drainage coefficient, the amount of water we have to remove with the drains is fairly low. The other thing is the natural drainage features of the Big Horn Flats is very good, it's highly elevated from surrounding lands, isolated from additional irrigated lands. The subsoil is composed of a fairly thick layer of gravel overlying fractured sandstone.

MR. MERRILL: Your Honor, I'm going to object at this point to any further testimony about the drainage requirements or the drainage characteristics of Big Horn Flats and move to strike that testimony that's already been adduced on the grounds that Mr. Bliesner himself has testified that Dr. Willardson did the drainage investigation and analysis as well as the determining of the artificial drain.

THE SPECIAL MASTER: I'll sustain that.

MR. ROGERS: May I ask the witness one question on that?

THE SPECIAL MASTER: It just overlaps.

Yes.

Q. (By Mr. Rogers) Mr. Bliesner, how much work did you do with respect to the drainage studies on Big Horn Flats and Stagner Ridge, the additional lands you've placed there?

A. I've previously testified that Dr. Willardson conducted the drainage selection and analysis of Dr. Stetson's plans. Dr. Willardson and I developed the drainage requirement for Big Horn Flats and Stagner Ridge.

THE SPECIAL MASTER: All right. I'll sustain --

THE WITNESS: We did the field investigation together. He did the placement of the drains and I wrote the discussion.

Q. (By Mr. Rogers) I believe you also testified that you were, you had overall supervision of the preparation of the report?

A. That's true.

Q. Did Dr. Willardson prepare the drainage discussions with respect to Big Horn Flats or did you?

A. I did under his guidance.

Q. Did he review it?

A. Yes, he did.

Q. Did he review any of the work with respect to the costs of the drainage system?

A. Yes, he did.

MR. ROGERS: Your Honor, I believe that for two reasons --

THE SPECIAL MASTER: It is of no great moment, frankly, whether it stays in the record or stays out.

MR. ROGERS: Well, Your Honor, we would like to get in the record the cost figures at this point just to have a complete picture, and Dr. --

THE SPECIAL MASTER: All right. The cost --

MR. ROGERS: Dr. Willardson will be on the stand and can be cross-examined on this.

* * * * *

THE SPECIAL MASTER: Proceed.

THE WITNESS: Okay. With those natural drainage features available, interceptor drains were all that was felt was necessary. Those were included, again, using the unit costs that were used by Stetson Engineers, and the cost estimated for those interceptor drains was $129,621. Since there may be other isolated instances of drainage problems that crop up after the system is installed, barriers that were not identified in any subsoil investigation that may come close to the surface, that figure was doubled to allow a contingency fund to handle any of those particular problems that may arise. So the total drainage cost then is estimated at $259,382 on the 92,000.

THE SPECIAL MASTER: Can I hear that again?

THE WITNESS: $259,382.

MR. ROGERS: Your Honor, just for the record, each of these totals he has given up here are at their pertinent subject areas in the written report.

THE SPECIAL MASTER: All right. Is what you just said in the written report regarding --

THE WITNESS: Yes.

MR. ROGERS: Yes, sir.

THE SPECIAL MASTER: What page?

THE WITNESS: Page 17.

MR. ROGERS: That particular figure -- yes.

THE WITNESS: Page 17.

Q (By Mr. Rogers) Mr. Bliesner, from the Diversion Dam up through the sprinklers and the drainage costs, do those constitute all of the capital costs?

A They do, with the exceptions of the engineering and contingency.

Q Could you explain those then, please?

A Okay. The total to this point is $13,784,152. We used as a contingency ten percent or -- excuse me -- we used for engineering contingency ten percent for engineering and ten percent for contingency on the full project and on-farm features. In other words, we increased these total costs by 20 percent for engineering and contingency for a total of --

THE SPECIAL MASTER: What is the basis of increasing all costs 20 percent?

THE WITNESS: Engineering fees for projects of this size we estimate from previous work that we have done and data we have analyzed to be approximately ten percent of the total project cost. Ten percent for contingency is just sort of an average number that is used to cover any unforseen costs that we may not have

included.

Q (By Mr. Rogers) Obviously, Mr. Bliesner, then if the actual cost of the project doesn't use up that contingency, it's a matter of money not spent?

A That's right.

Q But you planned them in the system in case?

A That's right.

THE SPECIAL MASTER: If you find that the two main drainage structures are going to be insufficient, for example, if you find that the very last field of the right-hand lower corner of Exhibit 6 should not be adequately drained by one drainage a mile and a half to its northeast, what do you propose to do then to make these free of being alkali or being --

THE WITNESS: What happens here is you have significant elevation drops away from those fields to a natural drain. In all probability, unless there is an unforseen barrier, a shale barrier that crops up in the middle of the field, drainage would not be a problem. It's on the border of a non-irrigated area creating natural drainage away from those points. If it was, that's what that contingency fund is for.

THE SPECIAL MASTER: Do you know if there has been any augered holes or drillings to ascertain whether any

barriers do exist in these areas?

THE WITNESS: Yes. HKM has conducted drill holes in those areas, but I really think I should defer this discussion to Dr. Willardson. He will be able to further enlighten you on that area better than I.

Q (By Mr. Rogers) Then with the engineering and contingency costs added to the capital cost, does that -- do those conclude the totals of the capital costs?

A That gives you a total capital cost, including engineering and contingency, of $16,540,982.

Q Could you read that one more time?

A $16,540,982.

THE SPECIAL MASTER: Translate it to acres. How much an acre.

THE WITNESS: That is shown in Table 6, $1,785 per acre.

Q (By Mr. Rogers) Is that in the first column of Table 6 on Page 19?

A It's in the first column of Table 6 on Page 19.

Q I notice also in Table 6 you have calculations based on Project O & M. Could you please explain to us how you drew up those costs?

A Yes. There are two major components -- well, three actual major components of operation and maintenance.

The biggest single item in this instance is energy costs required to pump up to that area. The energy costs are based on a 75 percent application efficiency, average for the season, and 85 percent distribution efficiency from the pumping plant out, assuming that all of that water has to be pumped then. Then it's based also on 1,890 hours of pumping per season at the designed flow rates. Using that 1979 electrical hour rates from Riverton Valley Electrical Association for both energy charge and demand charge, we have a total estimated cost for electrical power and demand of $535,206 or $57.77 per acre per year.

THE SPECIAL MASTER: Does the company have capacity to take care of that in the present -- or would it throw it into peaking, or do you know whether that's available?

THE WITNESS: I'm not sure what their generating capacity is. I had discussions with them concerning line construction and supplying especially this main pumping plant at Lily Pond, and they indicated that it would not be a problem. They are a member of Tri-State Co-op, which has generating capacity, and that's where they buy their generating capacity, so I didn't make any independent determination of their capacity there.

Okay, the next piece of operation and maintenance

cost is the project features, and that's everything up to the actual on-farm systems, and that was estimated as percentage of capital costs as indicated in Table A-3 or in the case of pumping plant maintenance, on the basis of $2.00 per horsepower per season.

And the pipeline and canal maintenance is based on one percent of the capital cost per season. That gives you an annual O & M for project acres of $11.88 per acre, then the on-farm maintenance is estimated at two percent of the on-farm captial cost or $5.78 per acre per season.

Q (By Mr. Rogers) Where are your total O & M costs then reflected?

A Then the total, both O & M and capital costs, are summarized in Table 6.

Q On Page 19?

A On Page 19. We have a total capital cost of $1,785, and then each of those units of operation costs are also shown.

Also shown in that table are the annualized capital costs, and these are annualized over the life of the various system components as indicated in Table A-4 at a four percent interest rate.

Q Did you do any further work with respect to any costs on

Big Horn Flats?

A Well, that summarizes the costs that were conducted.

Q What did you do with the information about costs that you developed?

A That information was provided to Ron Cummings.

Q Was it furnished to him in the form either contained in this report or on Table 6?

A Principally. There was one other breakout provided to him on costs, and that was a separation of all project costs from all on-farm costs. The capital costs split fairly easily here. He was also given a split between on-farm and project costs for power.

THE SPECIAL MASTER: In a project of this kind, what is the reason for the distinction between total project cost and the on-farm costs? We are not setting up a system whereby the operators or government can charge an annual O & M, so why is it done?

THE WITNESS: You would have to ask Mr. Cummings that. I just supplied the information he requested.

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MR. ROGERS: Your Honor, we have concluded the discussion on his design for Big Horn Flats. Our next area will be the discussion of the Stagner Ridge area which will move somewhat faster, although it's going to take some description and probably would put us beyond the noon hour if we started it now. We're willing to start it at Your Honor's pleasure.

THE SPECIAL MASTER: All right. Why don't we adjourn now and is 1:00 a little too fast or do you want 1:30?

MR. RADOSEVICH: 1:00.

MR. MERRILL: 1:00 would be fine, Your Honor.

THE SPECIAL MASTER: All right. Let's try to be here at 1:00. If we don't we'll start a few minutes after.

(Thereupon a lunch recess was
(taken at 11:40 a.m.