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Trial Transcript, Vol. 94, Afternoon Session

Frontier Reporting Service

File 201
4452
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case # 4993

File # 201

4452

IN THE DISTRICT COURT FOR THE FIFTH JUDICIAL DISTRICT

LARAMIE COUNTY, STATE OF WYOMING

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

FILED 8/3 1981

Margaret V. Hampton CLERK

DEPUTY

VOLUME 94

Afternoon Session

Tuesday, July 28, 1981

ORIGINAL

THE SPECIAL MASTER: Okay, Mr. Rogers.

Q. (By Mr. Rogers) Mr. Bliesner, one more question about Big Horn Flats. Did you arrive at a conclusion as to the diversion requirement for the additional acreage you designed for Big Horn Flats?

A. Yes, that's listed in Table 6 at the bottom of that table. The total diversion requirement for the trust acreage is 22,349 acre-feet.

Q. Thank you. Turning to Stagner Ridge, did you design an irrigation system for Stagner Ridge?

A. Yes, I did.

Q. And did that pick up additional acreage that Stetson had not designed?

A. Yes. There were approximately 1500 arable acres on Stagner Ridge for which no system design was completed by Stetson.

THE SPECIAL MASTER: Give me that figure again, will you please.

THE WITNESS: Approximately 1500 acres.

Of that 1500 acres, a system design was completed for 897 acres.

Q (By Mr. Rogers) If you will extract from Tribes' Exhibit 13 the map which I have marked as Tribes' Exhibit Number 13-3, I ask you if that is -- I ask you to identify that.

A. That's the conceptual irrigation development plan for the proposed irrigation project on the Stagner Ridge.

Q. Is that the same map that appears on the top of the board here?

A. It is.

MR. ROGERS: Your Honor, I don't think anyone has observed this anyway; I put a sticker on here to designate it as Tribes' 18, but that won't be necessary because it's not a composite of the map, so we'll just refer to it as 13-3.

Q. (By Mr. Rogers) Did you -- Did you go about your design of Stagner Ridge using the same approach which you used for Big Horn Flats?

A. Principally, yes.

Q. Were there any differences?

A. Yes, there were a few in the nature of design.

THE SPECIAL MASTER: In the nature of the what?

THE WITNESS: In the nature of the design there were a few differences.

Q. (By Mr. Rogers) In other words, just the physical features of the topography and the land you were dealing with?

A. That and the location of the water supply was different, so the diversion features are different.

Q. Did you use the same irrigation requirements for consumptive use calculations?

A. Yes. The highlands crop mix was used here as well, and various climatic conditions, and the on-farm efficiency was the same.

Q. Would it be appropriate then to, for you to tell us what was the design features of this were, just a general overview of those design features?

A. Yes. The best location for water supply for Stagner Ridge was out of the North Crowheart Canal designed by Stetson Engineers. There is an existing pumping plant, Pumping Plant Number 3 which serves arable lands to the northwest of Stagner Ridge and at a lower elevation than Stagner Ridge included in the Stetson design.

That pumping plant and that mainline through that portion, that portion that already existed from the Stetson design was utilized but increased in capacity. Then at the end of that pipeline there was another booster pump installed, an additional pipeline up onto Stagner Ridge to serve seven center pivot sprinklers that were placed on the ridge.

THE SPECIAL MASTER: Just off hand, is this the ridge that is just due north and looks down over the Pilot Butte Reservoir, do you know?

THE WITNESS: Let's see --

THE SPECIAL MASTER: I could find them out.

THE WITNESS: It's close, yes. This, I believe this is a little bit west of Pilot Butte Reservoir.

THE SPECIAL MASTER: Well, is this still north of the river?

THE WITNESS: Yes, it's north of the river.

THE SPECIAL MASTER: Just north of the river.

THE WITNESS: Right.

Q. (By Mr. Rogers) Mr. Bliesner, would you now, beginning at your source of supply from Stagner Ridge, describe for us in more detail the design features of your lay-out and giving us the capacities of the designs and their costs.

A. First of all I think we indicated that the farm delivery requirement and consumptive irrigation requirements were the same for this unit. The distribution efficiency, since it's all pipeline, is taken to be 95 percent as it was in the Big Horn Flats unit, and also as was used by Stetson. The on-farm efficiency was 75 percent, since it's all center pivot.

Now, the conveyance efficiency --

Q. Excuse me, you have no side-rolls in this particular unit?

A. No side-rolls in this unit. The conveyance efficiency is dependant upon the efficiency of the North Crowheart Canal, and from the Stetson designer for the weighted average seasonal efficiency, conveyance efficiency for the canal would be 74.7 percent. So that was used in determining the diversion requirement of 37.6 inches.

* * * * *

THE WITNESS: And then the system capacities again are based on those division requirements.

THE SPECIAL MASTER: 37.6 inches?

THE WITNESS: Per acre.

THE SPECIAL MASTER: Per acre per season?

THE WITNESS: Per season.

THE SPECIAL MASTER: Pardon me, what size of pipe from the North Crowheart Canal down to your Pump No. 38?

THE WITNESS: Oh, I would have to check that in my notes.

THE SPECIAL MASTER: Ten, 12 inches, a 15-inch pipe?

THE WITNESS: That begins with 30-inch pipe and tapers to 8-inch at the most distal end.

Okay, by increasing the diversion out of the North Crowheart Canal, we are increasing the capacity in the first reach of this canal down to this point. We affect the canal and approximately 19 percent of its total length and we increase the capacity in that length of the canal by 1.9 percent. Now, if you assume that the first part of the canal is twice as expensive as the average of the canal since the flows are being taken out of it as it goes down, so the beginning is twice the average, the end is half the average as an approximation of what this reach may cost, then you would have to increase capacity and, thereby, the costs by approximately -- excuse me.

We would increase the capacity by 1.9 percent, but it would increase the average cost of the canal by 3.8 percent.

Q. (By Mr. Rogers) Double the 1.9 percent?

A. Essentially what we are doing is increasing that first reach of the canal by 1.8 percent, but it's twice as expensive as the average, so we apply a 3.8 percent increase to 19 percent of the total canal cost to arrive at the cost of the canal system that would be associated with this unit. That's how much additional money we would have to put into that canal to increase the capacity to get sufficient water to serve Stagner Ridge.

Q. Now, you figured a supplemental cost, that which Stetson or Dr. Mesghinna have already testified to about the North Crowheart.

A. That's correct.

THE SPECIAL MASTER: Let me ask a question, please. As an alternative to the costs, the millions of dollars of costs, both of the earlier project you testified to this morning and this one now, have you done an analysis on whether or not deep wells could be drilled right on Stagner Ridge and waters obtained from the alluvium to do the annual irrigating and do away with the pumps and canals and the 60-inch pipe and just generally the total of -- well, in excess of what was it, $14,000,000?

THE WITNESS: We did not do an independent study of water availability from the aquifer.

THE SPECIAL MASTER: The only source of water study you made and rejected for the entire study was from surface diversions from surface streams?

THE WITNESS: That's right. I was led to believe from discussions from HKM and from Dr. Mesghinna that yield of wells in the area would probably not be sufficient to meet the demands of irrigation in those areas.

THE SPECIAL MASTER: But no one has made that an evidentiary fact.

THE WITNESS: That is possible. If you look at the economic analysis, the cost of drilling the wells plus the additional wells of the energy to pump from that level, since there doesn't appear to be any evidence of a water table any higher, at least in this area, than the river, you would have to lift the water at least that distance from any groundwater that would be in the river alluvium, so you would have at least that much left. By taking the water out of the North Crowheart Canal, we decreased that list by the elevation difference between the canal at that point and the river at this point. So we are using somewhat less energy from that standpoint. But no independent study was done to determine the groundwater supply.

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All right, that increase in the canal cost is calculated to be $93,180. That is taken to be the canal cost that would apply to this additional land on Stagner Ridge.

Q. (By Mr. Rogers) This doubling of the average cost of the canals for the purposes of the initial part of it you would be using to irrigate Stagner Ridge is a -- lends a conservative cost to your calculation of costs, does it not?

A. I can't say really whether it's conservative or not. It's appropriate in light of the information we had on the canal cost. Without knowing the cost of each reach of the canal and the features that were in it, it's the only way you could come up with a number. The fact that you are increasing the capacity by 1.9 percent and assume that that increase causes a linear increase in cost is conservative. In all probability the next incremental element of capacity in a canal once you have established the routing and you have the diversion dam in and so on, that incremental cost would not be as great. So from that standpoint, it's conservative.

Q. Thank you. That's the main canal. What is the next feature of the system?

A. Okay, the next feature would be the pumping plants and the approach we took here, there's an existing pumping plant, which is Pump Plant No. 3 from the Stetson design. We

took the specifications from the Stetson design for that pumping plant and designed a pumping plant to meet those conditions. Then we increased the capacity sufficient to supply water for Stagner Ridge, and that's an increase of 5738 g.p.m., and we designed the pumping plant again. Then we took the difference in those two costs as the cost of that pumping plant that would apply to Stagner Ridge. Okay, and then to that then we designed the pumping plant, this booster pump here, to provide the additional pressure needed to supply the water to the center pivots on Stagner Ridge, and that required an additional 150 feet of total dynamic head. And again, the 5738 g.p.m. of capacity, and that pumping plant was designed. But the sum of the two costs for both pumping plants was $97,760.

Now, a similar approach was used on the pipeline network. The pipeline network with this mainstem of the portion of the pipeline that was in the Stetson design was run through our computer optimization programs and the prices and costs determined for that without any additional land on Stagner Ridge. Then the rest of the pipeline was added and the full system was put into the computer and the pipe sizes and costs generated for the full system, and then the difference in those two costs were applied to Stagner Ridge. And the pipeline costs, the additional

cost to increase the size of the length from the main pumping plant to the booster pumping plant plus all of the cost for this additional pipeline was $654,716.

Okay, the on-farm design was done just like Big Horn Flats, the same technique was used. Table VII on Page 22 lists the system lengths and field acreages for each of those systems. The unit costs that applied to those same system lengths on Big Horn Flats would apply here for a total estimate cost of $294,319.

The other feature is the drainage requirement for this area, and field investigation by Dr. Willardson and myself and his analysis of the natural drainage features were such that he felt that in all probability no drainage would be required. However, since for the reasons I discussed on Big Horn Flats, there may be some areas where barriers come closer to the surface than investigations would indicate, so a contingency fund was allowed here in case any of those things came up, and we used the same contingency fund we used on Big Horn Flats, which is $14 per acre.

Q. So then you do not have a map then that shows a design -- excuse me -- a drainage design for Stagner Ridge?

A. That's correct.

* * * * *

THE SPECIAL MASTER: What you're saying is this don't need a drainage system but you're going to put a 14 hedge down just in case you're wrong, crank it in.

THE WITNESS: Just in case when you get in the field there actually are some minor problems developed, yes.

What happens in drainage investigation is you can never drill enough holes to absolutely define where the barrier is at every point in the system. There will be some little anomaly someplace that you won't have accounted for, and that's what the contingency fund is there for.

That brings the total capital cost for construction to $1,152,533.00. To that we apply the engineering and contingency multiplier that we used for Big Horn Flats of 20 percent, and the total then is $1,383,040.00.

Then Table 8 on Page 23 summarizes those capital costs on a per acre basis, and the total capital cost for this development $1542 per acre.

Q. (By Mr. Rogers) Did you also consider operation and maintenance costs?

A. Yes, we did.

Q. And the same ones you considered in Big Horn Flats?

A. Energy costs were calculated on the same basis as they

were for Big Horn Flats, only with the pumping requirements for Stagner Ridge, and the total pumping cost, the power cost was $22,976 per year, or $25.62 per acre on the 1897 acres.

The operation costs, since this falls within Stetson's North Crowheart Unit, the operation and maintenance for project features was taken to be the same as the O & M calculated by, shown in the Stetson report at $6.84.

The on-farm system maintenance was estimated by the same technique as Big Horn Flats, and the number there is $6.56 per acre. Those are tabulated in Table 8 also.

Q. Did you arrive at a final irrigation diversion requirement for these 897 acres in Stagner Ridge?

A. I did, and that's also listed in Table 8, total diversion requirement would be 2810 acre feet.

Q. Is the work that you have done in designing systems for Big Horn Flats and Stagner Ridge of any unusual nature from that you have performed for other commercial clients?

A. No. The techniques we applied here, the computer optimization program both in center pivot design and main line design are ones that we have applied since, well, in a computer sense, since 1970, '71, and in a hand sense the process for doing this was developed in the sixties some time, so the techniques that we use are presently the same

that we use in every commercial design that we've done, since I've been in business and for a while before that with Doctor Keller.

Q. Thank you. Were there -- Did you do any other functions for the Tribes in connection with Big Horn Flats or Stagner Ridge that we haven't discussed?

A. Other than determining the impact on the stream flows.

Q. Well, we'll come to that as a third part of the report.

Then I'd like to turn to your review and cost estimates of the Stetson conceptual irrigation development plan. Could you outline for us the approach you used in reviewing these Stetson costs.

A. There were five major areas of Stetson conceptual irrigation plan that we analyzed for adequacy of design and appropriateness of cost. They were the on-farm systems, the pipe line networks, the energy costs, the pumping plants and the drainage system.

Q. Did you arrive at general conclusions about the Stetson design of these features and costs of these features?

A. We determined that the Stetson design was a workable design, but it was more expensive than necessary to accomplish the job that needed to be done.

Q. These are the designs for the five major project areas?

A. That's true.

Q. North Crowheart, South Crowheart, all the five that you identified this morning.

Were there features of the Stetson design that you did not examine?

A. We did not examine the canals and related structures.

Q. Why not?

A. We just didn't have enough time.

Q. Thank you. Would you indicate for us then how you went about making these cost estimates on the various design features.

A. Probably the first thing we should discuss is the analysis of the -- of three of the elements that were sort of done as one package. The on-farm system design, the pipe line network design and the energy costs were all analyzed in one review, and the way we approached this is, is during my visit to Stetson Engineers in San Francisco, Doctor Mesghinna and I identified several pumping units, that is a pump unit and its associated acreage that it serves from his design that would be representative of the system in a general sense.

And we identified ten of these individual pumping units that would be appropriate to analyze, that would -- that would be reflective of the average conditions in the project.

This totaled about 5586 acres of fifty-three some odd thousand acres included in the design that we analyzed. And for those systems we completely redesigned those systems under those pumping plants.

Q. Is that about 10 percent then of the Stetson design system?

A. Just over 10 --

Q. That you analyzed?

A. Just over 10 percent, yes.

Q. And with respect to that 10 percent, you redesigned based on your own work, his design; you redesigned his design?

A. That's essentially right. We took the arable lands boundaries that were included in those areas and laid out another system for those. With the system layout then we used the optimization pipe line network program.

Q. Excuse me a second. You took the arable -- You took the arable lands within these areas that you identified with Doctor Mesghinna?

A. Yes.

Q. And you -- Did you then use those arable lands as if Stetson had not designed a system for it and you redesigned a system or --

A. Essentially, yes. In some cases, the designs were for all practical purposes the same layout. We ended up with the same irrigated acreage, the main line placement was very

similar, the layout was similar. Others, the main line layout was somewhat different, the field layout was different, and in many cases there was slightly more acreage irrigated from the arable lands from our design than theirs, but it was in tune to one or two percent.

Q. These were in different geographic areas as well, these lands within your 10 percent?

A. Yes. One unit in the Riverton East Unit, and the rest of the units were in the North Crowheart Unit.

The geographic location not being as important in this case as whether or not the features of that design would be representative of the average. The systems were designed to the specifications listed in Table 9 on Page 25 of the report. Maximum allowable depletion, the soil moisture between irrigation was taken to be 50 percent, the rooting depth for determining the irrigation cycle was taken to be four feet, the peak consumptive use was calculated by the same means as Doctor Mesghinna calculated it.

Q. Did the maximum allowable depletion criterion and root depth criterion, was those the same as Doctor Mesghinna --

A. Yes.

Q. -- as well?

The first three items were the same as his?

A. Yes. Now, I used the same average season efficiency that Doctor Mesghinna did. However, we used for peak use period a higher system efficiency. The average system efficiency includes management error in timing of irrigation. In other words, there is a certain amount of overirrigation that occurs. If you design the system to just meet the peak consumptive use requirements, then you don't have to account for that timing error in determining system capacity. So we used a 70 percent system efficiency for peak season.

It's the same approach that we used on Big Horn Flats and Stagner Ridge.

The sprinkler spacing of 40 feet by 60 feet is the same as Doctor Mesghinna used. We used two sets per day, eleven and a half hours per set, and I don't know if that's the same as Doctor Mesghinna used or not. And we used lower average sprinkler pressures than Doctor Mesghinna did. The sprinkler pressures were based on the flow rate required on each individual system. In other words, we select a sprinkler with a given nozzle size to give us a certain flow rate, depending on what the design was, and the pressure at which that delivery would occur for these areas. Nozzle sizes ranged anywhere from 40 to 48 psi.

Q. Is it a sound engineering practice to, in designing such a system then, to lower pressure requirements?

A. Standard sprinklers on the market today operate satisfactorily as low as 40 psi and give adequate uniformities. And it is well in line with energy conscious designs these days to save as much energy as you can without sacrificing performance.

In addition to that, there's considerable work being done now on improving uniformity at even lower pressures, so in the near future it will be possible to use lower pressure.

Q. Lower than 40?

A. Lower than 40.

Q. And you used a figure here of 45 --

A. Yes.

Q. -- psi?

A. That's the average. We ranged from 40 to 48.

* * * * *

THE WITNESS: Okay, the additional assumptions at the bottom of this table, the first two assumptions, the assumption that the average crop mix is grown under each pumping plant is an assumption that was used by Dr. Mesghinna in that no laterals can be moved from pumping unit from pumping unit was also used. The third assumption is an addition to Dr. Mesghinna's assumption and has bearing basically on cost in that we included sufficient cost for gated pipe to be used on corn after it reaches a certain height, after essentially four feet or so.

THE SPECIAL MASTER: What kind of pipe?

THE WITNESS: Gated pipe for furrow irrigation.

THE SPECIAL MASTER: What is dated (sic) pipe?

THE WITNESS: Gated, G-a-t-e-d. It's pipe that has small openings in the side of the pipe with a gate on it, and you control the amount of water that comes from that gate, and that runs down a furrow. It's like the standard --

THE SPECIAL MASTER: In place of siphons?

THE WITNESS: In the place of siphons, exactly.

THE SPECIAL MASTER: Wholly commoly.

THE WITNESS: Now, the reason that cost was included is there may be farmers that would opt to use that rather

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THE SPECIAL MASTER: In place of siphons?

THE WITNESS: In the place of siphons, exactly.

THE SPECIAL MASTER: Wholly commoly.

THE WITNESS: Now, the reason that cost was included is there may be farmers that would opt to use that rather

than move hand lines in corn when it gets too tall. And just as a conservative estimate we included costs to do that if they actually chose to do that. Either practice is done. It's quite common to sprinkle irrigate corn at a certain height and then convert to furrow irrigation.

Q (By Mr. Rogers) Did that, in fact, add a cost to what Dr. Mesghinna had done?

A Yes, it did.

Q What else did your analysis of the on-farm energy design pipeline involve?

A Those are the basic elements. In relaying out the system, then we determined the number of wheel lines and number of hand lines that would be used to irrigate a different parcel, and essentially hand lines were included in irregularly shaped pieces where wheel lines would be difficult to manage, and wheel lines were used in the more rectangular areas, and the costs calculated for those hand lines and wheel lines were based on the costs, the unit costs in Table A-2. The pipeline costs that were generated used the unit costs in Table A-1. What resulted from this optimization design is that on the average we had a reduction of 23 percent in pipeline cost from the Stetson cost. This information

is summarized in Table 10 on Page 26.

Of that 23 percent, approximately seven percent is due to the optimization technique itself, and the way we determined this is we took Stetson's input costs for pipe and put it into our optimization program and ran the program, and we came up with an average of a seven percent reduction in cost. The remainder of the cost is a result of using lower installed materials prices. There are several reasons for this. The P.V.C. pipe prices used by Dr. Mesghinna were for Class 160 P.V.C., which means it is designed to handle a working pressure of 160 p.s.i. In an analysis of the pressure requirements of the systems, the average pressure requirements in the systems was under 125 p.s.i. Now, that's not to say that some locations wouldn't use 160 p.s.i pipe or some locations may use 80 p.s.i. pipe, but the average of those would come closer to 125 p.s.i. than 160 p.s.i. So Class 125 pipe prices were used in our designs, and that was one area of cost reduction.

The other area was in estimation of installation prices, and we went to dealers and installers of on-farm systems and pipeline systems to determine the installation costs for P.V.C. pipe, for transite or asbestos cement pipe and for steel pipe, and the remainder

of the reduction is basically in that area of reductions in installation costs from the Stetson cost estimates

Q What other variations or differences did you develop as a result of your work of those costs arrived at by Dr. Mesghinna and the Stetson firm?

A Well, that summarizes what just the results out of the strict analyses were on the pipe network cost comparisons. Based on that, we could have taken a 23 percent reduction. We chose not to take that large of a reduction to be somewhat conservative. Obviously we did not analyze every field. We reduced that and took a 15 percent reduction in pipeline costs from the Stetson costs as a conservative estimate on the basis of our analysis.

Q For all of his --

A For all of his pipeline costs.

Q All of his pipeline costs, not just the ten percent you analyzed?

A That's right.

Q You might have used 23 percent on the entire Stetson thing, but you chose to cut it back to 15 percent reduction?

A Yes. Then the next stage was the on-farm cost analysis. Basically here the results indicated an average reduction of eight percent in the on-farm costs, which

is due essentially to the reduction in materials cost, and again, we used bid prices for large quantity purchases from equipment suppliers, and those sources are listed in the appendix table, and found a significant reduction in cost. Essentially this eight percent reduction is due to that reduction in bid prices from --

THE SPECIAL MASTER: Eight percent reduction?

THE WITNESS: No, this is an of-farm cost. We are done with pipeline. We have a 15 percent cost reduction.

THE SPECIAL MASTER: Yes. I thought I heard you say 80 percent.

THE WITNESS: No, no. I would have liked to have an 80 percent reduction. No, eight percent. Now, this also includes, again, the increase in cost, to include the gated pipe. Again, we did not choose to use the full eight percent since we had not analyzed all the systems.

THE SPECIAL MASTER: What if the row crops don't come out to the same place the gates are, does the farmer have to do some work with a shovel to get to where a furrow is?

THE WITNESS: Yes, that's commonplace practice.

THE SPECIAL MASTER: Are there gated pipes installed now on the Reservation anyplace?

THE WITNESS: There are on the Riverton Reclamation Project.

THE SPECIAL MASTER: Do you know where on the project one might see some in action?

THE WITNESS: I can't give you an exact location. I know in driving through it I observed gated pipe, and that's all I can say.

Q (By Mr. Rogers) Again, gated pipe is an additional cost to you above and beyond what Dr. Mesghinna had designed in his system?

THE WITNESS: In other words, our reduction would have been greater than this five-percent reduction that we implied had we not included this gated pipe. In fact, it would have been approximately ten percent.

Now, the analysis also indicated an energy cost reduction of ten percent on the average, and it is due essentially to what we talked about on the lower operating pressures of the sprinklers. The head losses in the system worked out to be the same. Depending on the pipe configuration, some maybe a little higher or some a little lower, but on the average we came up with a ten percent reduction in energy cost, and that was used straight in.

Q And had you adopted a lower standard pressure than

45 p.s.i., the figures I assume would have been even -- there would have been even a greater reduction again than even ten percent?

A That's true.

Q Is that the sum of all the cost changes that you determined?

A That's the --

Q On these --

A -- that's the summary from that one analysis, from the analysis of those sample systems.

Q From those systems?

A The next area that we reviewed were the pumping plant designs and costs, and in reviewing the initial costs in Stetson's reports we felt that those prices were higher than needed to be for the type of pumping plant that would be required on the project. We did --

THE SPECIAL MASTER: Did you go to anybody in Riverton who sells the pumps to ask about the prices of them?

THE WITNESS: In Riverton?

THE SPECIAL MASTER: Yes.

THE WITNESS: No.

THE SPECIAL MASTER: Did you go to anybody in Lander?

THE WITNESS: No.

THE SPECIAL MASTER: In Casper?

THE WITNESS: No, we used sources that were normally used. You have to understand in a project of this magnitude that very often the local suppliers won't be the successful bidders. As a matter of fact, a project of 60,000 acres in magnitude that may be constructed over several years, it is very conceivable the Tribes themselves would establish their own dealership and they would buy all those materials essentially at dealer cost. Of course, they would have some cost associated with distributing the equipment, but using prices from local distributers that are not geared up for a large agricultural base and a high development scheme generally will result in higher unit costs than will be realized in a project of this size.

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THE SPECIAL MASTER: The basis for your feeling that the pumping plant costs were higher at Stetson's than they should have been is based on what specific conclusions and factual case?

THE WITNESS: Okay. If you'll recall Stetson's testimony, or, excuse me, Doctor Mesghinna's testimony concerning the pumping plant designs, they used an estimating technique for pumping plant costs. They did not specifically design pumping plants. They used an estimating technique that was a modification of the Bureau of Reclamation method, and that method assumes, for one thing, enclosed pumping units. In other words, you have a cinder block or equivalent building over each pumping unit. If it's a five horsepower pump, you've got a several hundred square-foot building to enclose that five horsepower pump. The pump may be a thousand dollars and the building thirty thousand dollars.

THE SPECIAL MASTER: You have changes in specifications and plans that result in a lesser cost; you put a shade cover on them and not a building.

THE WITNESS: That's right.

THE SPECIAL MASTER: That's a long, far difference than just saying the cost difference is -- You've changed the plan.

THE WITNESS: That's exactly right.

THE SPECIAL MASTER: Okay. Then we have a different plan that you're suggesting costs 10 percent less, a different plan.

THE WITNESS: We have a percentage cost. The energy cost is 10 percent less. We haven't talked about what the reduction cost is.

THE SPECIAL MASTER: All right. Very good.

THE WITNESS: That's true. What we have said is the type of pumping plants that we're building here will, for the most part, be farmer operated. They're small in nature, they will supply individual farm units or maybe a couple of farmers will share a unit, or maybe one farmer will have three or four units, but that they should be designed and built on the basis that we would build them in commercial agriculture, and so we designed the pumping plants with the specifications that are shown in Figure 1. If you remember, we looked at the pump configurations, that's the equipment that's included, and that -- and that's the configurations that we based our costs on. If you look at the Bureau of Reclamation estimating techniques, the costs for prime movers and pumps is quite reasonable. You can buy pumps and prime movers cheaper than that on a large scale, but it's

reasonable. But then you include automatic switching equipment, you include a switch yard, you include a building, you include a crane to move the building, you include an all-concrete sump, all of those mount, increase the costs beyond what is necessary to bear, to have a very adequate design.

As a matter of fact, the shade structures are in addition to what is commonly done for commercial type pumping stations in most areas. The farm I worked on in Superior -- in California, Superior Farming Company, had 126 deep wells, averaged 200 horsepower, wasn't one shade structure. But they were designed to similar standards that we're designing here, adequate to accomplish the job but not excessive, not Cadillac. And that's the basis for our costs, and the unit costs are shown in the appendix tables in the back that were used for each of the components. We included adequate pressure regulation on each pumping station, pressure relief equipment, screening equipment, the necessary controls to operate the pumps, and came out with significantly lower prices.

Now, there are many pumping stations, and what we did is we took the individual pumping conditions for each station from Doctor Mesghinna and put it in our computer program that selects pumping components and

prices the pumping station, and all of the unit prices that go into that, as I indicated, are listed in the appendix and then operated the computer program to --

THE SPECIAL MASTER: What page are you on now?

THE WITNESS: I'm on Page 29 in the text.

THE SPECIAL MASTER: Thank you.

THE WITNESS: On Page 29, then the reductions in per acre pumping unit costs are tabulated in Table 11. And those are significant reductions. On the average, we reduced pumping unit costs by 60 percent, based again, mainly on the differences in the components that are included in the pumping plant. And we feel that the cost that we've included in the design that we have come up with is adequate and very appropriate for the type of system that we have.

Q. (By Mr. Rogers) Just to clarify, Mr. Bliesner, you redesigned all pumps?

A. Yes.

Q. In the Stetson design of the five future areas, not just 10 percent?

A. No, all pumps were redesigned.

Q. And those conclusions are in Table 11 on Page 29?

A. That's true.

Q. Without the revised costs.

THE SPECIAL MASTER: What you just said is the basis for your statement that the drainage system design procedure by Stetson results in a more expensive drainage system than you feel is necessary for the project?

THE WITNESS: That's the next category.

MR. ROGERS: That's basically going to be Doctor Willardson's testimony with respect to the drainage redesign.

THE SPECIAL MASTER: Yours is on pumps?

THE WITNESS: We were just discussing pumps.

MR. ROGERS: The section we've completed is pumping plant design.

THE SPECIAL MASTER: And you feel that -- I see, it's a difference in cost there.

THE WITNESS: It's the difference in costs and in the equipment that's used. In other words, we don't have cinder block buildings, and we don't have automated switch gear and some of those kinds of things.

MR. ROGERS: That entire discussion concludes on Page 29, begins on Page 28.

THE SPECIAL MASTER: Yes. That -- Okay.

MR. ROGERS: You don't have any other question on the pumping?

Q. (By Mr. Rogers) Do I understand Doctor Willardson will be testifying on the drainage analysis of the Stetson system?

A. Yes, that's correct.

Q. You're aware that a portion of the report that he prepared on this?

A. I am.

Q. And supervised its inclusion in this report?

A. Yes.

Q. Moving beyond the drainage then, which we'll leave for Doctor Willardson, did you -- I notice on Page 32 of the report, section on engineering and contingency costs, were you responsible for that --

A. Yes.

Q. -- portion of the report?

What did your review of that result in?

A. Well, we chose to use a slightly different approach than Stetson used on engineering and contingency. The Stetson study included an additional 25 percent of all but on-farm costs for engineering and contingency, and for this study we used 20 percent of all costs as an average. Again, 10 percent of that for engineering and 10 percent for contingency.

Now, when you compare those two, they come out

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very close percentage wise. By the time you include on-farm costs in the analysis by Stetson, theirs works out to be about 22 percent, so that's fairly close. Twenty percent is just a standard number that we use for projects of this complexity.

Now, however, those engineering and contingency percentages are applied to our capital costs, which are lower than Stetson's. So the reduction in engineering and contingency is considerably greater than just the difference between 20 and 22 percent since they're applied to our numbers and not Stetson's numbers.

Q. Are those cost differentials reflected in the report in tabular form?

A. Yes, they are.

Q. Where?

A. As a matter of fact, in Table 14 all of the individual -- This is on Page 35. All of the individual analyses that we made and the individual system components are summarized, their costs are summarized both for the revised costs that we have calculated and for the original cost as calculated by Stetson.

Q Looking at Table 14 then, your revised costs are for each of these system design features, O & M costs and the like, are broken down at the top of it, and

Stetson costs paralleling it at the very top of the page?

A. That's correct. Now, what the end result was, if we take the weighted average of all the projects, we reduce total investment cost by 22 percent.

Q. What do you mean, that would be the way to average --

A. That would --

Q. -- of all the projects?

A. That would be North Crowheart average cost plus its acreage, plus South Crowheart average cost plus its acreage and so on through all the projects, and divided by the total acreage, so it's average per acre cost for all of the projects.

Q. Just looking at it as an example, taking on-farm systems with your -- looking at Table 14, Page 35, the top line under "Revised Cost", "Revised System", you have a weighted average of 160, and that compares to Stetson's cost for on-farm system of weighted average of 169?

A. That's correct.

Q. And each of the other lines on the table would be done in the same fashion?

A. Yes, that's true.

Q. What was your overall --

THE SPECIAL MASTER: Isn't there one example on

here whatsoever, not a single solitary example in all of the six programs and in all of the twelve or fifteen subject matters where you might have been a few dollars above Stetson?

THE WITNESS: In the analysis on Table --

THE SPECIAL MASTER: But on Page 35, the answer is no, there isn't?

THE WITNESS: That's right, on the average, no.

THE SPECIAL MASTER: That's remarkable.

THE WITNESS: You have to remember that the area -- There are a couple of areas there that we did not have time to analyze, and the results that would have, you know, what would have resulted from that analysis we don't know since it was not done.

Q. (By Mr. Rogers) Those areas are the -- are not geographic areas, you're talking about areas of system designs?

A. Yes.

Q. Meaning the canal systems and related structures?

A. Canals and related structures.

Q. What were -- What were your final conclusions then on total investment difference and total annual operation costs as compared with Stetson?

A. On the total weighted average, Stetson's total investment

cost was $1891. Our revised costs were $1470, for a 22 percent reduction, and the total annual operation costs for Stetson's costs were $25.99; ours was $25 -- excuse me, $24.20, for 7 percent reduction.

Q. And those are per acre differentials?

A. Yes, those are per acre costs.

Q. So in total investment costs, the difference is over $400 per acre?

A. That's correct.

Q. Your cost is $421 less per acre?

A. That's correct.

* * * * *

THE SPECIAL MASTER: Can you give me that question or observation again?

MR. ROGERS: I'm sorry, Your Honor. I was comparing the two numbers under "Total Investment" between Mr. Bliesner's work and Stetson's work on per acre cost of total investment under the weighted average crop.

THE SPECIAL MASTER: What page?

MR. ROGERS: This is Table 14, Page 35.

THE SPECIAL MASTER: Yes. You get the twenty-five ninety-nine vis-a-vis the twenty-four twenty?

MR. ROGERS: Total annual operation. I was looking at the line entitled --

THE SPECIAL MASTER: Total investment?

MR. ROGERS: -- total investment.

THE SPECIAL MASTER: I see. The initial costs are about $400 an acre difference? And the fact this is the result of your study used to warrant your conclusion, these others become then affordable for appropriately a proper project, the additions?

THE WITNESS: The additional lands?

THE SPECIAL MASTER: Yes.

THE WITNESS: No, this is an independent study from that.

THE SPECIAL MASTER: I see.

THE WITNESS: These stand on their own merit, and they will be handled by the economist as far as demonstrating their economic feasibility. As far as their engineering feasibility, we feel that they are feasible to irrigate as an engineering matter.

Q (By Mr. Rogers) So is it correct to say then you furnished these figures to Dr. Cummings?

A Yes, that's true.

Q For an economic analysis?

A That's true.

THE SPECIAL MASTER: Well, do these figures include the -- these are figures that you applied to the entire North Crowheart area, not just that which you are doing on the North Crowheart?

THE WITNESS: No, that's true. In other words, what we have done is provided a new set of economic numbers to the economist to demonstrate benefit cost analyses and economic analyses on what we believe is a more realistic cost.

THE SPECIAL MASTER: Accurate reflections of cost, and you can appreciate that if the figures that were to be given to your economist, for that matter, were those that Stetson conclude were more realistic figures,

he may not very well come up with an economic feasibility of your additional project, or is that out of your province?

THE WITNESS: Yes, it really is. Since Stetson did not complete a design on these other projects, it's a little hard to make a comparison.

MR. ROGERS: Our economist would not have had an opportunity, if your question was directed to what our economist would do, he would not have had an occasion to review what Mr. Stetson's costs would be on Stagner Ridge.

THE SPECIAL MASTER: Mr. Rogers, what is the purpose of material like this on Page 35, Table 14? Is it merely to put into question the accuracy of Stetson Engineers? Why would you want to do that?

MR. ROGERS: We believe the work Stetson Engineers did, and our witness has testified, is a workable design, and as applied to his five projects: North and South Crowheart, Arapahoe, Riverton East and Big Horn Flats, or 2,600 some acres of Big Horn Flats, the economist for the United States, Mr. Dornbusch, has testified that those are economically feasible even using the Stetson costs. We, nonetheless, felt that there might be some justification, and that's why we

asked Mr. Bliesner to look at those Stetson costs to see if they were maybe too high. He has done so, and the result of it is he found they were high, which would seem to indicate if the Government economist, Mr. Dornbusch, were to use these figures in his economic analysis of the five project areas, he would find their economic feasibility even more likely than he had testified to.

THE SPECIAL MASTER: Very well. Thank you.

Q (By Mr. Rogers) I'm looking at Page 36 of your report, Table 15, which appears to provide some of the features of Table 14 which we have just been discussing, as well as some additional information. Does this table reflect your conclusions as to the additional irrigation diversion requirements, additional net acreage that you designed in as a result of the Stagner Ridge and Big Horn Flats additional land work?

A It does. What this does is combine the results of the two major areas of study, the design of the additional lands and the analysis of Stetson designs and costs; puts them in the same table, and then calculates the weighted average for all of those project lands, both the reduced costs on the Stetson -- the lands designed by Mesghinna and presented in the Stetson report, and

the additional lands that we have demonstrated in this report.

Q So looking at the net acreage total in the last column on the second line from the bottom, net acreage total of sixty three thousand seven hundred thirty thousand acres (sic), that reflects Mr. Stetson's work, as well as the acreage you added in at Big Horn Flats and Stagner Ridge?

A That's correct.

Q And looking at the line just below that, again under the final column of "Average Total" of 234,531 acre-feet for diversion requirement, that reflects the additional diversion requirement above what Mr. Stetson -- Dr. Mesghinna, rather, found to include Stagner Ridge and Big Horn Flats?

A That's true.

MR. MERRILL: Your Honor, I'm not clear on that last point at all. As I understand it, the Witness has stated that Stagner Ridge and the additional Big Horn Flats land would require --

THE SPECIAL MASTER: Let's do it this way: Instead of asking the Witness "Does this table show," and then go on, Mr. Witness, what does this table show? Would you tell us what it shows?

MR. ROGERS: That is a much better approach.

THE WITNESS: This shows the combination of the two projects in the final claim. What is shows is the additional acreage of 9,073 acres on Big Horn Flats, 897 acres on Stagner Ridge --

THE SPECIAL MASTER: Not too fast, please. Where is the first 9,000 acre item found?

THE WITNESS: On the net acreage line, Big Horn Flats addition. Come clear down to the second line from the bottom.

THE SPECIAL MASTER: Net acreage, 9,000 --

THE WITNESS: Seventy-three acres. Okay, then we also add Stagner Ridge acreage, 897 acres, for a new total of 63,730 acres.

THE SPECIAL MASTER: Where is the old total reflected?

THE WITNESS: Well, it does not show --

THE SPECIAL MASTER: You get that by adding the first five figures, is that right?

THE WITNESS: Or by subtracting the Big Horn Flats addition and Stagner Ridge from the total.

MR. ROGERS: I believe, Your Honor, that figure is stated in the report, however.

THE SPECIAL MASTER: Oh, yes. I just wanted to see

what the difference was.

MR. ROGERS: As stated on Page 1, 53,760 acres.

THE WITNESS: No, there has been an increase of diversion requirement then due to the additional irrigation on Big Horn Flats and Stagner Ridge to a new total for all of the 63,730 acres, for a new total now of 234,531 acre-feet.

Q (By Mr. Rogers) Could you give the Court the total of what the diversion requirement was without Stagner Ridge and Big Horn Flats?

THE SPECIAL MASTER: It's 24,000 less -- 25,000 less.

THE WITNESS: Yes, 25,159 less.

THE SPECIAL MASTER: All right, thank you.

MR. ROGERS: Your Honor, that concludes our direct on this second portion of Mr. Bliesner's work, and I wonder if it would be appropriate to take a five or ten minute break. We have been at it about an hour.

THE SPECIAL MASTER: Very good. We will take a short break.

(Whereupon, a short recess (was taken.

* * * * *

THE SPECIAL MASTER: Come to order, please.

Q. (By Mr. Rogers) Mr. Bliesner, did you -- Did you prepare a, conduct a study and prepare a report in connection with the effects of the additional irrigation from Big Horn Flats and Stagner Ridge on the study done by Mr. Billstein?

A. Yes, I did.

Q. The operation study of which river system?

A. Of the Big Wind River system.

Q. Did that study also include a determination of the effects of Indian-owned fee land?

A. Yes, it did.

Q. On the Big Horn or the Big Wind system?

A. On the Big Wind system.

MR. MERRILL: Your Honor, I'm going to interpose the same objection at this time that I raised this morning and on which you reserved ruling, and object to this witness testifying any further about any river system models that he may have evaluated, any return flow assumptions or calculations that may have been done, effects on stream flows, adequacy of supply and the overall hydrologic effects of irrigating these additional areas or the Indian-owned fee lands testified by Mr. Higginson on the grounds that Mr. Bliesner was qualified as an irrigation engineer and not as a water resource engineer or hydrologist, and

we've seen from the testimony of the United States they've brought in specialists in depletions, in natural flow studies and in hydrology, three very complex specialized areas to back up their studies that they have done, and I think it's inappropriate for a witness who's been qualified only as an irrigation engineer, which in itself is a highly specialized but separate discipline, to testify about these matters.

THE SPECIAL MASTER: To testify about drainage; to testify about drainage.

MR. MERRILL: Your Honor, I believe that Dr. Willardson will testify about drainage separately.

MR. ROGERS: Your Honor, this is a factuous objection and Mr. Merrill knows it. The work --

THE SPECIAL MASTER: If he knows it, he doesn't believe it.

MR. ROGERS: The work that Mr. Bliesner has done is based, goes from the study that Mr. Billstein has done and Mr. Bliesner hasn't been able to testify yet as to what he did so, so I don't see how Mr. Merrill can say whether he's qualified to do it or not. But I will tell the Court now it's based on the work that Mr. Billstein did and it was done in conference with Mr. Billstein, it takes certain data and the study that Mr. Billstein did

and adds in the changes to it that will be affected by the additional acreage from Indian-owned fee land and to future areas that Mr. Bliesner has earlier testified to. The Billstein study, portions of that require other expertise, the hydrologists, the depletion studies was built into the Billstein report. Mr. Bliesner is not testifying on any aspects of that as to how the Billstein report was built. That's in the record. All he's doing, in conference with Mr. Billstein, is to show these additional acreages, where the return flows would be, what diversion points would be used and how that is going to affect it in the same way that Mr. Billstein testified to. There is no reason that an irrigation engineer can't do the simple mathematical steps, which is all that's being done here.

THE SPECIAL MASTER: Mr. Merrill, I'm going to let it in for whatever probative value it has.

Q. (By Mr. Rogers) I don't recall, Mr. Bliesner, whether you answered that last question or not. I think you did; that you have, that your study included the effects of the Indian-owned fee land on the Big Wind system?

A. Yes.

Q. Thank you. Is that portion of the study relating to Indian fee land, is that in the report that has been marked as Tribes' Exhibit 14?

A. A portion of it is, a portion of that has direct bearing on supply to the lands that I have designed systems for is included in this report. The other impacts at other control points in the system are not included in the report.

Q. Thank you. How did you go about determining -- Let's take, first, the effects of the additional irrigation you designed for Big Horn Flats and Stagner Ridge. How did you go about determining the effects of those diversions and return flows and other effects from them on the Billstein study?

A. Well, in general we have increased acreage, irrigated acreage, by 9970 acres, and we have increased diversion by 25,159 acre-feet per year from the information that was used to, for the operation study conducted by Mr. Billstein.

So what we have done now is taken that operation study and examined the control points from operations studies that would be affected by the diversions and return flows from Big Horn Flats and Stagner Ridge and determined the effect on stream flow and any effect on water supply, adequacy of water supply.

The first step in that -- in that obviously is to determine the average monthly diversion requirements.

THE SPECIAL MASTER: Is that what Page 8 is all about, Table IV?

THE WITNESS: That's the summary of the effect, yes.

The monthly diversion requirements for Big Horn Flats and Stagner Ridge are shown in Table I of the report.

Q. (By Mr. Rogers) Is that on Page 2 of the report?

A. That's on Page 2.

Now, these diversions correspond directly to control points in the Billstein study. If you look at Figure No. 1, you'll see there Control Point 4 which is the diversion for the North Crowheart Canal and Wind River A Canal.

Q. This is on Page 3 of your report?

A. Yes, Page 3 of my report.

Q. And these are the control points designated by Mr. Billstein?

A. Yes.

Q. Now, Control Point 4 is the diversion point for the diversion that is supplied to North -- excuse me, to Stagner Ridge. Control Point 29, which is on Bull Lake Creek, is the control point used for the diversion to Big Horn Flats. Okay. So those are the two points from which we take diversions from the operation study.

And those monthly diversions are distributed as indicated in Table I. Now, there are also return flows from

those projects. The return flow, as a percentage of the total diversion, is calculated slightly differently than the Billstein study, although the result is principally the same. And if I may, I'd like to put up a blown up reproduction of an equation that appears on the Page 2 of the report.

This is labeled Tribes' Exhibit No. 18.

MR. ROGERS: Your Honor, let me add at this point -- excuse me, Mr. Bliesner --

THE SPECIAL MASTER: Tribes' Exhibit 18?

THE WITNESS: Yes.

MR. ROGERS: It's a new exhibit, Your Honor. What I was interrupting to say was the Page 2 in the report, Tribes' Exhibit 14, the report which I distributed this morning is a slightly amended page from that that was furnished to the parties a few days ago before the trial. It was substituted this morning. The differences appear from the heading Return Flow at the bottom of Page 2 on down.

THE SPECIAL MASTER: Okay. I'm sure that's appreciated by those that received it. Go ahead.

THE WITNESS: The method used to calculate diversion -- excuse me, recoverable return flows appear in this equation. Now, the return flow

itself, an estimation, essentially the deep percolation losses from the irrigation system is from -- is calculated, the part of the equation to the right of the 0.8, and we'll discuss that first. We have here the irrigation efficiency in percent. Okay. We subtract that, divide that by 100 and subtract it from 1, and that gives us the component of the diversion that goes to consumptive use.

Okay. Then we also reduce the amount of the diversion that would go to return flow by the amount that is lost due to direct evaporation from the water surface of the canal and from any leakage out of the pipe lines and then evaporation losses from the sprinklers themselves. So that element is also deducted. That gives us the deep percolation losses. Not all of those losses are recoverable to the -- to the stream flow, and we have used an estimate of 80 percent of the deep percolation losses as recoverable.

* * * * *

THE SPECIAL MASTER: On Stagner Ridge you don't have any drainage because you left if for a natural drainage situation?

THE WITNESS: That's true.

THE SPECIAL MASTER: Yet you suggest that you feel the return flow from that is estimated at 29 percent of diversions?

THE WITNESS: The larger percentage of that is due to the canal leakage in North Crowheart canal, which is fairly close to the river and should exit, even though it may not be through a drain, to the river. The same thing will in all probability happen at Stagner Ridge. Just because there is not a drain there doesn't mean that water is not going to get back into the river system. The natural drainage will conduct the water out at some point and then into the river system. It is a similar assumption that is applied in other areas.

THE SPECIAL MASTER: I appreciate that.

THE WITNESS: Now, this is different than the equation presented by Mr. Billstein, but is appropriate for the sytems that we have used for this reason. In estimating recoverable return flows, the Billstein equation subtracts 20 percent of the diversion requirements

as nonrecoverable to return flows, and that is appropriate for the average irrigation efficiency that he's seeing in his study. If you apply this equation to the average irrigation efficiencies that occur in the study area, you will get within one or two percent of the same answer he gets as far as recoverable return flows. However, on high efficiency irrigation systems, to say we just -- regardless of the irrigation efficiency, 20 percent of the diversion won't get back into the system, it is conceivable you will end up with, if you had high enough irrigation efficiencies, you will end up with negative return flows, which is not logical. So this equation gives you a little better estimate of what the return flows would be from the higher efficiency units.

MR. MERRILL: Your Honor, the estimates just made by Mr. Bliesner point out exactly my objections to his testifying about this area, which is essentially hydrology. He states in his own testimony and in his report that he used a different approach from HKM for calculating return flows. We are talking in the case of Stagner Ridge about lands that are way high above the river. The Witness nor the report has said anything yet about the aerial or temporal distribution

of the return flows. There is absolutely no testimony in the record, and I don't believe there will be any based on what I know from the depositions, and I believe at this point to have an irrigation engineer telling the Court the methods used by HKM's professional hydrologists are inappropriate to certain lands and so forth puts the Court in a conflict as to whether you believe Mr. Bliesner's method of computing return flows or should you use Mr. Billstein's, or should you use Mr. Higginson's which yesterday he told us he had a totally different method, yet a third one, for computing return flows.

Anticipating you will let this evidence in for whatever probative value it has, I will ask the Court for a continuing objection to this line of testimony.

THE SPECIAL MASTER: I will grant the continuing objection, but I appreciate you making it just the same. This is not an exact science, it's almost as inexact as the law or a search for a cure for cancer, and I see where the textbooks come up with more and more formulas or contributions of men who seek to get a better efficiency in an irrigating system and a better way to feed humanity, so we will let it be a continuing objection.

MR. ROGERS: Also there is in the report and

Mr. Bliesner will testify about the timing of return flows and prices of return flows.

THE SPECIAL MASTER: I just hope this science does a better job than the science of petroleum and conversion of energy has done in the last 45 or 50 years, because I'm beginning to think it is one big heist. Congress buries its soul and goes through agony for four years in order to solve the energy crisis in all matters of law in regard to natural gas, oil, conversion to wind, conversion to solar, limitation on import, and then we turn around and find we have a glut of oil and gas unprecedented in this country five years later, but costs are five times more, and I hope to God this isn't the result in the future for these systems, too. These are big, big challenges to you young people about where we are going in this country, and keep it a little more responsive to the people.

Forgive the little aside, it comes from my former activities. Go ahead.

MR. ROGERS: Thank you, Your Honor.

THE WITNESS: By applying this equation to the diversion requirements from -- for Big Horn Flats and Stagner Ridge, we have estimated that we will have recoverable return flow of 15 percent of diversions

for center pivots from Big Horn Flats and 22 percent from wheel line acreage, and from Stagner Ridge the return flow is estimated at 29 percent of diversions.

Now, the return flow from these two irrigation systems don't necessarily come in at any one point in the system, and obviously the designation of the control points in any operation study are illustrative in nature, not meant to be the exact location of where that drop of return flow will come back into the system, but as a reasonable approximation of where it will return.

The points of return for return flows was taken depending on, first of all, if there were drains, where the drains were discharging; and secondly, on the natural lay of the land. Discussions with Mr. Billstein indicated that to be a reasonable approach on distribution from Big Horn Flats, specifically since it was different than some of the other areas that had been analyzed, and an indication that the depth to barriers and so on follow fairly closely to the ground surface contours, so it was divided on that basis.

And in Table 2 on Page 4 we have listed here the control points to which we expect return flow to accumulate. Listed in that table are the acreages

associated with each of those control points. The location of those control points are indicated on Figure 1. Now, you will notice that -- I see there is an error in the table. There is a Control Point 7 listed there.

THE SPECIAL MASTER: You mean 4?

THE WITNESS: On Page 4 there's a Control Point 7. It should say over on the river system column "Little Wind".

MR. RADOSEVICH: Your Honor, while we are on that, may I make -- my heart about dropped when I saw where Control Point 29 is with respect to my client. It's down there on the Popo Agie River. You have two Control Points 29 on Figure 1, Page 3 in the same --

THE WITNESS: Yes. Control Point -- Control Point 29 down on the Popo Agie is the confluence of the Little Wind and Popo Agie. That's Control Point 29 from the Little Wind Study. The other control point is Control Point 29 from the Big Wind Study. There were two separate studies.

THE SPECIAL MASTER: All the referrals so far in your testimony are to the one just down from Bull Lake?

THE WITNESS: Yes, to Control Point 29, that's true.

Q (By Mr. Rogers) As a matter of fact, Mr. Bliesner, you are not going to testify about the Little Wind System at all, are you?

A Only that we do have some return flows entering into the Little Wind System.

THE SPECIAL MASTER: Since you have Control Point 7 identified?

THE WITNESS: That's right.

Q (By Mr. Rogers) But nothing about control points from it?

A What happens is if we look at -- I think we can see it in a general sense from this system map (indicating). Sage Creek is a tributary to Little Wind and comes in here (indicating). Return flows from several of these upper lands discharge into that area. Big Horn Draw also discharges into the Little Wind System, and return flows from several of these lands will discharge back in that location.

Then again some of these, depending on where the ground surface contour breaks, it's assumed that they will go back into the Big Wind, and this drain actually discharges into the Johnson Draw, which goes back into the Big Wind.

THE SPECIAL MASTER: The Big Wind?

THE WITNESS: Into the Big Wind, yes. Those control points listed for return flow are Control Points 32, 34 and 35, are the return flow points for Stagner Ridge and Big Horn Flats into the Big Wind System, and Control Point 7 is return flow to the Little Wind System.

MR. ROGERS: Could I ask, Your Honor, at this time that the Witness mark the change he noted on Page 4 in the original copy?

THE SPECIAL MASTER: We will do the same on ours.

(Witness complied.

MR. ROGERS: Thank you.

THE WITNESS: Now, a schematic representation of where these diversions come out and where the return flows go back in appears in Figure 2 on -- excuse me, on Page 6. And this is essentially a reproduction of the Billstein operation study schematic diagram for the Big Wind System, with the additional assumptions made concerning these additional lands, and you can see that Stagner Ridge diverts from Control Point 4, returns to Control Point 32. It's listed just under North Crowheart at the top, if you follow that area. And the Big Horn Flats is diverted out of Control Point 29, some return flow goes to Control Point 32, some to 34,

some to 35, and then the balance to Control Point 7 on the Little Wind System.

Q (By Mr. Rogers) Mr. Bliesner, is it correct to say that the amounts of return flow at those control points are listed on Table 2 in your report?

A Yes, those are the annual return flow quantities.

* * * * *

Q. (By Mr. Rogers) What did you next determine?

A. Well, there are, due to the lag in the ground water component, the hydrologic system, these return flows do not occur in the same month of the diversions, and for the purpose of this study, the assumptions used in the HKM operation study for the percentage, just monthly percentage distributions were used, and those percentages are listed in Table 3.

Now, by applying those percentages to the annual return flows in Table 2 and then converting to cubic feet per second, we end up with the results that are demonstrated in Table 4 on Page 8.

These are the effects at the various control points from the irrigation of these additional lands. You'll notice that principally during the month of diversion, we have a negative impact or an increase in the depletions in the stream flows for most of the control points. The exception is the Little Wind system. Listed under the control points for the Little Wind System, for example, we have Control Point 7, Control Point 9, 13, 15, 27 and 29. That's essentially all of the control points downstream of Control Point 7 where the return flow is assumed to occur.

And we have an enhancement of flow in the Little

Wind that amounts to as much as 4.7 cubic feet per second in the peak month. This is in cubic feet per second. And the average annual flow is approximately 2.3 increase.

All of the other control points listed in the Big Wind System have a negative impact during the diversion months of May through September and a positive impact or increase in stream flow during October through April for all of the points downstream of the return flows.

MR. ROGERS: Would the Court like any more explanation of that?

THE SPECIAL MASTER: I'd like some referral to Page 9.

THE WITNESS: That's where we're going. Okay. Having determined the -- the effect on stream flows, it next became important to determine the adequacy of supply at each of the control points where we had an effect, to see if we created any shortages or increased any shortages due to the diversions from these two control points.

Now, the analysis of the Big Horn Flats diversion at Control Point 29 indicates that there are no shortages in the 34 years of record indicated in the Billstein

study due to the diversion from Big Horn Flats. All of the claims put forth by the -- by the United States on behalf of the Tribes and these additional irrigated lands can be met without any shortages downstream of Control Point 29.

In fact, in the month of greatest demand and in 1977, which was the shortest supply, each month of diversion there were at least three times the amount in Bull Lake Creek as was needed.

The story is a little bit different at Control Point 4. There are shortages that periodically occur at Control Point 4 under the assumptions of the Billstein operating study.

Q. (By Mr. Roger) Those shortages occur even without the irrigation for the additional lands you've identified?

A. That's right. The irrigation of the additional lands on Stagner Ridge are the only ones that affected the supply at Control Point 4. Prior to any additional diversions for Stagner Ridge, there were shortages in eight years, I believe.

THE SPECIAL MASTER: I notice you deal with shortages in percentages on the material on Pages 9, but on feet per second in the tables prior thereto. I guess that is not inconsistent. What would four and two-tenths

percent be in feet per second of the annual shortage of all diversions at Control Point 4?

THE WITNESS: What we look at then, if you'll go on to Table 5, it presents the information that is summarized on Page 9, and that lists the cfs --

THE SPECIAL MASTER: And the percentage?

THE WITNESS: -- shortage. In other words, the demands in the years shown on this table for those months were that much greater than the supply.

THE SPECIAL MASTER: Yes. That answers my question, it shows both the percentage and the cfs.

THE WITNESS: Right. Now, this shows the cfs both without Stagner Ridge and with Stagner Ridge, indicating that the impact by adding Stagner Ridge is not great. However, we do have eight years of shortage. The worst shortage in any given month is 17.6 percent of the demand, converting to an annual shortage in that year of 4.2 percent. Now, if we average all of those over 34 years of record, we come up with six-tenths of a percent average annual shortage. Now, that's under the operation assumptions of -- in the Billstein study. There was one assumption made for ease of calculation in the Billstein study that is not actually how the system operates. If we

go back to Schematic No. 2 -- in Figure 2, the way the Billstein study handled the operation of the Dinwoody Bench Canal, which diverts water from Dinwoody Creek over into Dry Creek, picks up flows there, goes on to Meadow Creek and goes on to Willow Creek and then spills any excess down Willow Creek into the Big Wind at Control Point 13. The way the Billstein operation study operated this area was to take all of the stream flow in Dinwoody Creek through the Dinwoody Canal. In other words, no flows were allowed to come down Dinwoody Creek past the diversion. And in fact, in the months of August, in the years that we were short, we're actually dumping excess flows from Control Point 22 over here on Willow Creek back into the system at Control Point 33, where these excesses could have actually been allowed to flow down Dinwoody Creek, which have entered the Big Wind system above Control Point 4 and been available for us to divert at Control Point 4. So by operating the system more realistically and allowing those excesses to enter the system at a point where we can use them, as indicated on this modified schematic, then we significantly reduced the shortages at Control Point 4.

THE SPECIAL MASTER: I can't find Control Point 33

on my --

THE WITNESS: Point 22?

THE SPECIAL MASTER: 22 and 33.

THE WITNESS: In 13.

THE SPECIAL MASTER: Oh, I hope you'll correct that.

THE WITNESS: Now, if we go to Table 6, this lists the excess flows that are available to us at Control Point 22, and it also lists the shortages at Control Point 4 with Stagner Ridge included, assuming that these excess flows are released down Dinwoody Creek rather than routing them through the canal and dumping them downstream of the diversion where they can't be used.

You'll notice that we eliminate the shortage in all but two years, and we reduce the shortage in those two years to the point where we have a maximum monthly shortage of 6.4 percent, that converts to an annual shortage of one and a half percent. The 34 year average is six hundredths of a percent. In other words, for all practical purposes, it eliminates the shortage.

Q. (By Mr. Rogers) The .06 percent shortage is not considered significant?

A. That's correct.

THE SPECIAL MASTER: Who manages the flow at Dinwoody Canal? One of the irrigation projects or the Tribes, or does Midvale or does anybody know?

Okay.

THE WITNESS: I can tell you that in fact all of the flows are not now diverted through Dinwoody Canal. Some releases do occur down Dinwoody Canal from the diversion, so it's not a significant change in the operation from that that is presently being done. It would require a closer monitoring to make sure that those excesses weren't released lower in the system.

Q. (By Mr. Rogers) So that is the -- That would be then the final conclusion with respect to your study on the effect of Big Horn Flats and Stagner Ridge on the Big Wind System?

A. That completes the study as it relates to the trust lands.

Q. Right. You also continued to study with respect to the effect of the Indian owned fee lands?

A. Yes, that's correct.

Q. Can you tell us how you approached that?

A. Well, this foregoing analysis doesn't know anything about the diversions required for the fee lands that

Mr. Higginson testified to yesterday.

Q. I'm sorry, what do you mean by that?

A. The flows aren't included in that analysis, the diversion requirements and return flows from irrigation of those.

Q. You mean what you just testified to?

A. What I just testified to.

Q. Yes, I understand.

A. So to include those effects and determine the combined effects at the control points that we were concerned with, required an analysis of the diversion requirements and return flows from the Higginson work. The diversion requirements for each parcel of the Indian owned fee land that Mr. Higginson testified to as being considered irrigable are shown in Appendix C of his report.

Those diversion requirements were used and in conference with Mr. Higginson, we used the map that was attached to his report showing the locations of those lands to determine the most probable location of diversion for those parcels.

In other words, if a parcel fell in an area between Dinwoody Creek and Dry Creek, yet it was on the bench, it was taken out of Control Point 2, which

is the Dinwoody diversion. If it came between Dry Creek and Meadow Creek, it was taken from Control Point 8, which was the Dry Creek diversion, and so on, whether in fact those are now served by that canal, we're not absolutely certain, but in all probability, we've taken the diversion at, as high a point as makes sense. So it's, if anything we've taken it in areas where it will have a greater impact than it would if you actually designed the system and drew a ditch to each of the pieces and knew which piece was being supplied by what canal.

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THE WITNESS: The distributions of diversions is the same percentage distribution as his consumptive irrigation requirement specified for those lands, and his assumption of 75 percent of the difference between consumptive irrigation requirement and diversion requirement as an estimate of recoverable return flow was used. Since he is the one who developed his irrigation efficiencies, he knows that's what portion of that would return to the system.

Again, when you look at the number, the results from that approach, from our approach, from the HKM study, the answers are principally the same, well within the accuracy of the technique.

Okay, making those assumptions, then we have the effect, the combined effect of both the irrigation of the additional trust lands that we have designed and the fee lands indicated by Mr.Higginson, and that combined effect is shown in Table VII on Page 13 for the various control points affected. This, again, is just a study of the Big Wind system.

Now, it's really -- Again, we see depletions excessive -- excuse me -- extra depletions, additional depletions, occurring in the irrigation months and a positive impact in the nonirrigation months due to return flow as would be expected.

THE SPECIAL MASTER: This is in cubic feet per

second?

THE WITNESS: This is all in cubic feet per second.

Now, again, we have to analyze these from a shortage standpoint, and from the control points that we were interested in : for adequacy of supply for the additional lands, Control Point 4 and downstream control points and Control Point 29 and downstream control points were the only ones we were concerned with. Of those, only Control Point 4 has shortages, and they are impacted by the additional diversions for the fee lands. If you look at Table VIII on Page 15, the excess flows at Control Point 22, which include now the diversions for Indian-owned fee lands, are listed, and the subsequent shortages at Control Point 4. As you can see, we have increased -- we have added a shortage year, we have now increased it to three years of shortage in 34, and we have increased the maximum monthly shortage to 14 percent, which gives you a 3.3 percent annual shortage. The average annual shortage for the 34 years of record would be .2 of a percent, which is well within the concepts of manageable shortages.

Q. (By Mr. Rogers) Does this constitute all the work you did on the Indian fee lands?

A. No. Now, that completes the impact on the areas we were diverting from. To take the study a little bit further,

in the Dinwoody Bench area there are periodically shortages -- peridocial shortages in the months of May and September without any additional fee lands or any additional trust lands as they occur now. As a matter of fact, there are 13 years out of 34 years of record that show shortages in either May or September at Control Point 17 -- excuse me, Control Points 8, Control Points 17, and Control Points 22, which are all on the Dinwoody Bench area. The worst year without any fee lands is 44.2 percent shortage in May, which is a significant shortage. The average annual shortage for the 34 years of record is 1.2 percent. The worst annual shortage occurred in 1974 -- '75, excuse me, and that was 7.4 percent.

Now, when we add the fee lands, we obviously are going to increase those shortages. The average annual shortage then with fee lands goes from 1.2 percent up to 1.7 percent for the 34 years of record. The worst year goes from 7.4 percent to 8.4 percent, and the worst month goes from 44.2 percent to 48.4 percent, and we increase the number of years of shortage from 13 years to 20 years of the 34 years of record. So it is a significant impact.

However, the shortages occur in the months that make the shortages much easier to manage. The shortage occurs -- the larger shortage occurs in the month of May. The

consumptive use happens to be very low in May, fairly low, at least considerably below system demand.

THE SPECIAL MASTER: Any from runoff or from precipitation?

THE WITNESS: We are getting some precipitation, but even with that, with the efficiencies that are shown in that area, exceeds the supply. However, we have available to us some stored soil moisture. We have sufficient flow in April to come into that use period in May with a full soil moisture reservoir. If we managed the irrigation such that one inch of the soil moisture is depleted during the month of May, and that's what would occur during the worst month on record, if we irrigated with the full supply at the same efficiency that is listed, we end up depleting about an inch of that soil moisture out, then we have excess flows in June, far in excess of the demand.

Then in June when those flows start picking up, we increase the diversions to the full capacity of the systems, which the minimum would be approximately 120 percent of the average July demand. So we operated it with that assumption, increasing the diversion to that level, and by the end of June we had wiped out any of the depletions that we had and we were back to a full soil moisture in any of the years of record without any shortage.

In September a similar thing can be done. It's a very common practice at the end of an irrigation system to deplete out the soil moisture. There's no point in irrigating grain; for example, after it's starting to ripen, you deplete it out. It's also a common practice in areas that have short rainfalls to fall irrigate, to build the soil moisture up, so when springtime comes you've got a full moisture reservoir and there are no shortages.

So what can be done then is the flows in October can be used to make up those shortages in the months they occur in September, and again there are no shortages that occur.

Q. (By Mr. Rogers) So the result is, with a management technique the shortages can be either eliminated or reduced to a level that you would call insignificant?

A. That's right. It falls within the terms --

THE SPECIAL MASTER: Mr. Rogers, you are testifying and not him. If he is going to call the shortages insignificant, let's let him do it, don't put the words in his mouth. I would say "manageable" would be a word I would be ready to accept.

THE WITNESS: I think the "manageable shortage" is a term that's been used before in the case, and the term "manageable" means you can operate the system such that

any shortages that appear to occur will not have any effect on the crop, and that's essentially what will happen. We can manage the shortages without them appearing to be shortages by moving the diversions around.

MR. ROGERS: Thank you.

Your Honor,that completes Mr. Bliesner's direct. We have a matter with the exhibits that's a little bit out of the ordinary. One of the exhibits, and that's Tribes' Exhibit 13, which is that thicker report this morning, because it contains material which will be testified to by another witness who will be the next witness after Mr. Bliesner -- nonetheless, Mr. Bliesner has had the responsibility for preparing the entire report -- it is our intention to move the admission of Tribes' Exhibit 13. We propose to do that after Dr. Willardson has completed his direct examination. However, since it's a two-man effort and we would like to avoid having to call Mr. Bliesner back, we think it's perfectly in order for any voir dire about Tribes' Exhibit 13 to be conducted now while Mr. Bliesner is on the stand.

I would at this time, however, would not only move the admission of Exhibit -- Tribes' Exhibit 13, but move the admission of Tribes' Exhibits 13-1, 13-2, which are two maps of system designs for the Big Horn Flats irrigation

system; also Tribes' Exhibit 13-3, which is the design map for the irrigation system of Stagner Ridge.

* * * * *

MR. ROGERS: I move the admission of Tribes' Exhibit 14.

THE SPECIAL MASTER: 4 or 14?

MR. ROGERS: 14.

THE SPECIAL MASTER: You're going to have four or five of the other 13s?

MR. ROGERS: No, Your Honor, those are drainage maps, which again -- actually that will be in the same, more or less the same category.

THE SPECIAL MASTER: The exhibit itself.

MR. ROGERS: Exhibit 13, except basically I think the voir dire on those would be entirely through Dr. Willardson and not Mr. Bliesner.

THE SPECIAL MASTER: All right. 14.

MR. ROGERS: 14, which is the report we have just discussed on the effect of stream flow from irrigation of additional trust lands and the addition of the Indian fee lands.

Although it's duplicative, I have marked and so I will move the admission of Tribes' Exhibit 15, which is a composite map of putting together the Tribes' Exhibit 13-1 and 13-2.

All of the Tribes' Exhibit 14 -- All the maps I have just mentioned, we would move they be admitted for the truth of their contents.

Tribes' Exhibit No. 16 is a blowup of a figure that appears in Tribes' Exhibit 13. We move its admission for illustrative purposes. Tribes' Exhibit No. 17 is a photograph of the center pivot operation simulation, which does not appear in the report. We move its admission for the purpose of, for illustrative purposes, and Tribes' Exhibit No. 18 is a formula derived from the report which is Tribes' Exhibit No. 14. We would move its admission for the truth of its contents as to the formula used by Mr. Bliesner.

THE SPECIAL MASTER: Okay, you may voir dire, Mr. --

MR. CLEAR: I have no voir dire.

THE SPECIAL MASTER: -- Mr. Clear.

You may voir dire, Mr. Radosevich. Do you have any questions?

MR. RADOSEVICH: I'd like to voir dire on cross-examination.

THE SPECIAL MASTER: All right. And, Mr. Merrill, would you include 13 at the same time, too, in your voir dire, even though it's not going to be offered into evidence at this time?

MR. MERRILL: Yes, Your Honor, but as I have done in the past, I'll reserve my voir dire since it incorporates cross-examination and reserve my objections until I can complete the cross.

THE SPECIAL MASTER: You may begin then with cross-examination.

THE WITNESS: Would you mind if I got a drink of water?

MR. ROGERS: Should we take a short break, Your Honor?

THE SPECIAL MASTER: Yes, a short ten-minute break.

(Thereupon a ten-minute recess was (taken.

* * * * *

THE SPECIAL MASTER: Come to order, please. That completed the direct case of the Tribes.

MR. ROGERS: It does, Your Honor. Apparently, I may have misspoken myself when I identified one of the exhibits I was moving for admission. I identified what -- I may have identified the graph that's been titled, "Center Pivot Operation Simulation", I may have identified that as Tribes' Exhibit No. 14, when it is Tribes' Exhibit No. 17, but I move its admission.

THE SPECIAL MASTER: All righty. It is in the same category here, awaiting voir dire. All right, thank you, Mr. Rogers.

Mr. Merrill, cross-examination?

MR. MERRILL: Your Honor, I believe Mr. Radosevich will go first.

THE SPECIAL MASTER: On cross, all right. It is for the State or for his own --

MR. RADOSEVICH: No, for my clients, Your Honor.

THE SPECIAL MASTER: All right.

MR. RADOSEVICH: Thank you, Your Honor.

CROSS-EXAMINATION

BY MR. RADOSEVICH:

Q. Mr. Bliesner, this morning we started out quite some time back and went through quite a bit of detailed

information. You mentioned that part of what you did was to determine the availability of water on the stream flows for trust and fee lands, is that correct?

A. Yes.

Q. How did you take into account or how did you extrapolate out the non-Indian or non-trust lands in determinig this availability?

A. The study assumed that the trust lands and the Indian owned fee lands had the prior right, and did not account for any other diversions, other than those for either Indian owned fee or trust lands.

Q. You made the assumption then that you could take the entire virgin flow?

A. If necessary, yes.

Q. You also stated that one of your responsibilities was to look at areas that were excluded by Stetson Engineering, and I believe you stated that for economic reasons that was not included in the Stetson Engineering reports, is that correct?

A. It was my understanding that Big Horn Flats was not included for those reasons. Stetson had completed a preliminary design, an entirely different system design, I might mention, that we had designed, and on that basis

of those estimates, it was excluded for economic reasons.

Q. Were there any technical reasons why they were excluded?

A. Not that I'm aware of.

Q. Nothing with respect to soil structure, water supply, anything of that nature?

A. No.

THE SPECIAL MASTER: Let me ask a question of this witness at this point.

When you assume -- When you make the assumption that you have the right to total virgin flow if necessary, did anything shock your conscience about the fact that since 1905, the United States of America, in conjunction with the Tribes and as a result of a conference with them, invited settlers from all over the nation to come and make their homes in part of the open area and use water to make their livelihood and invest their future?

THE WITNESS: I simply followed the instructions I was given.

THE SPECIAL MASTER: I just wanted to know. I don't mean this to be reflecting on any of this, but we are all, you and me both, are all good Germans on

certain occasions in this good world of ours.

Go ahead, Mr. Radosevich.

Q. (By Mr. Radosevich) Mr. Bliesner, just to clear up in my mind with respect to both the Big Horn Flats and the Stagner Ridge, at least from the point with respect to Bull Lake -- with the Big Horn, that is entirely a closed system?

A. I beg your pardon?

Q. A closed system in the sense that from the time it leaves Lily Pond, I believe you explained, to the time the water is discharged out of the sprinkler, it's in a closed system, or encased system?

A. No. It's in a closed system or lined canal.

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Q. (By Mr. Radosevich) A lined canal?
A. Yes.
Q. And as far as when it reaches, what we might call a farm turnout, which you mentioned is a pivot point, it's either earthen encased or enclosed?
A. That's right.
Q. And all of the control structures are designed to operate throughout the entire system as one unit or as individual units?
A. No. The control -- I'm assuming that -- by control structures, you mean the individual turnouts to the pipe lines?
Q. Yes.
A. Those are operated as individual units.
Q. So the system can be operated on what's called a demand basis?
A. It can.
Q. It can?
A. Yes.
Q. And then this is somehow interpreted back to some management unit that's managing the diversion out of Bull Lake into Lily Pond?.
A. It can be done that way, there's actually adequate automatic controls to control that with some monitoring

by a operational personnel, but it could function that way.

Q. With respect to the Big Horn project area that you designed, to your knowledge are there any irrigated acreages in this project area?

A. Not on the flats where our existing lands are.

Q. There are no wells in existence that are being used for irrigation then?

A. Not included in the area that we have designed.

Q. Okay. In the design, particularly with respect to your Tribal Exhibit No. 13, aside from the sprinkler, the designation where the pivot sprinkler is located or the side roll, there's a darker border in both 13 and 14 which I presume may be called project lands; is that correct?

A. That's -- If you look at the legend, that is indicated as arable trust lands.

Q. What I'm referring to is --

A. Yes.

Q. All of this area within this area?

A. Yes, that's arable.

Q. That is arable?

A. Arable trust land.

Q. It has potential for irrigation?

A. It has.

Q. Did you take into account, in calculating the water supply, the possibility of that land being brought under irrigation?

A. No, only the additional of what was actually designed for.

Q. I have a question with respect to the design of the system, whether you designed this with the idea that this would be one unit or individual farm units. What was your intent when you did design it?

A. It's immaterial. It would operate under either scenario.

Q. The costs, the operation costs that you have right now, are they calculated for one unit operation?

A. Again, it makes no difference how it's operated, whether it's a single owner that operates the whole thing or a single operator or whether there are several. The operating assumptions would be essentially the same.

Q. In other words, to efficiently operate the system?

A. That's right.

Q. In actuality, if it were separate owners, would the operating costs increase?

A. Not necessarily.

Q. But there would have to be an irrigation, a planning schedule that would be complied with by all of the

owners, almost the same farming practices employed as you had calculated in order to keep those operating costs the way you have it calculated; is that correct?

A. No. There's no reason the farming practices would have to be the same to maintain the operating characteristics. The only requirement is that they operate them to the seasonal efficiency that's indicated, which may require irrigation scheduling, although we are allowing for some management error in timing of irrigation. But making that assumption, whether there's an irrigation service that provides that, those recommendations to individual farmers or one farmer as a whole, it doesn't affect the way it's operated or the energy cost due to how it's operated.

Q. Okay. You mentioned that this could operate as individual farms. If an individual farmer has, say one of the center pivot sprinklers at the far end of the system and he wishes to shut it off for a while, say he doesn't wish to irrigate due to a storm that came up, precipitation, you mentioned it's automated enough to where it could handle this. How come, in fact, will that happen through your diversion structures from Bull Lake up?

A. Okay. What would happen is if you shut off a system

at the distal end, that would have an effect on the pumping plant that was supplying it or if it was a gravity turnout, at that turnout. There is a pressure regulation valve at that point which would modulate to give you a constant pressure at the point you were taking water from the canal. If it was a pumping plant, then at that point someone who was operating it would have to make a decision on how many pumps to run. It would modulate itself, but it may be more efficient to go shut off one of the small pumps. They are not automated in that sense.

Q. What you're saying is there will have to be some central management of this?

A. No, because the small pumping plants, you'll notice, serve one to three pivots, and that's generally within the concept of a farm unit, and so they would be farmer operated. So he would make the decision on how many pumps he's going to run to supply his own fields.

The pressure regulation would take care of anything that was happening in the system that may cause problems in the system due to somebody shutting off a pump -- or shutting off a center pivot someplace. Then once it gets to the canal, the automation would take over from there and control the regulation back to the

main pumping plant.

Q. Does this system require that there be a technician on board in order to insure that the system functions, to manage it?

A. Oh, anytime you have a system of that magnitude, there would be an operation maintenance supervisor that would be on staff; water master concept.

Q. Okay. And what, what would you anticipate would be the level of skill that man would have to have then?

A. Well, that depends on whether you're going to require him to -- to do all of the maintenance on the individual components or if you're going to contract to have that done or how it's going to handle.

The skill level would not have to be significantly great. It wouldn't have to be a registered engineer, for example, to learn the operation characteristics of the system and be able to operate. A well-trained technician could handle the operation.

Q. You referred to, in your report, it states that it's going to take a 12,either centrifugal or turbine pumps from the canal, presumably to build up the pressure to the sprinkler system.

A. Twelve pumping units. There may be more individual pumps than that, but twelve stations.

Q. And the report also implies that some of those sprinkler units may be gravity fed; is that correct?

A. That's true.

Q. In your analysis to determine the least cost, did you look at, I think engineers refer to it as a surge tank system for feeding these sprinkler systems?

A. Well, the only thing the surge tank does or it's -- surge tank is not the proper term, it's a regulating tank or reservoir, either elevated or captive air tank that allows the system to demand the change and leave the pumping rate reasonably constant and have this thing take up the slack. The inclusion of those on systems such as this really aren't cost effective. They're very expensive to install and the fact that you have pumping plants serving fairly small acreages means that the man running the system is also running the pumping plant and making the correct selection on how many pumps he's running to efficiently operate the system.

The small surges that occur from periodically shutting off the system and restarting or something like that would be about all that would be accounted for in the surge tank or elevated steel regulating tank anyway. So they're just not cost effective for

this type of design.

Q. You took that into account and determined yourself that was more expensive than the system you designed?

A. That's true. You would still have all of the other components you input, you just added those for regulation, and the only thing they save you is possibly a little energy cost, and for the type of systems we have, they don't even do that.

Q. During the last five years a lot of these sprinklers have been modified to catch what has been called the corners. Can these systems be modified to put on such device at the end of the pivot sprinklers you designed here?

A. It would be possible to design them such that they would, but in my opinion, it was not cost effective in this design. It's very expensive to pick up that extra acreage.

Q. It's expensive but in fact in many areas, many farmers are doing that, aren't they?

A. That's true.

THE SPECIAL MASTER: What is it, a special nozzle as it comes around the corners?

MR. RADOSEVICH: It's -- Well, Mr. Bliesner, you can explain it.

THE WITNESS: There are several concepts of how this is done. Some of them have a trailing arm, another tower on the system that follows the system around. Valmont Industries, for example, manufactures one that follows a varied wire, and this swings out and follows whatever shape the field is. Another concept is pull it around in the corner, mark it, the rest of the machine shuts off, this one turns on, circles out, comes back and then it goes on.

The other concept is you put a big gun sprinkler and just spray some water out there as far as you can get it.

Q. (By Mr. Radosevich) In fact, if this were done, this would increase the acreage, given the number of sprinklers you have, it would increase it quite significantly, wouldn't it?

A. That's true.

Q. What would that do to your water supply calculations that you built into the system now?

A. Well, you'd have to triple the acreage up there before you'd have a problem with water supply.

THE SPECIAL MASTER: Technically, I should be alerting you, I guess, that this is beyond the scope of the direct.

MR. RADOSEVICH: Well, that's true, except, Your Honor, we're talking about the entire area that is irrigable.

THE SPECIAL MASTER: Except I joined you in the sin, I asked him too.

Q. (By Mr. Radosevich) So your system is sufficiently designed, it can handle it?

A. No, I didn't say that. I said there is sufficient water if someone wanted to do that. The capacity would have to be increased at the various pumping plants if you were going to increase acreage.

Q. Okay. I have a question I had with respect to an answer you gave this morning. You mentioned these in line regulators on the pivot sprinklers.

A. Yes.

Q. That if you have a variation of elevation of 20 degrees, whatever it may be. Does that adjust for inundating the lands then?

A. Yes.

Q. It may vary back and forth considerably?

A. That's right. What it does is regulate pressure to a constant preset pressure regardless of what the input pressure is within a normal operating range. So if you have the end of a system that runs up on

top of a hill, you obviously have to apply enough energy to have sufficient pressure at the top of the hill. When it gets to the bottom of the hill, you're going to have too much, the regulator squeezes it off and doesn't let any more in the nozzle.

* * * * *

Q. (By Mr. Radosevich) This 97 -- let's see, I got the figure here -- 9700 acres, plus or minus, that you indicated would be the result from those two projects, does that include only the land covered by the pivot sprinkler, covered by the side-roll, or does that also include the corners?

A. No, it's only the actually irrigated lands under the systems.

THE SPECIAL MASTER: All circles and three little squares, as I recall.

THE WITNESS: That's right.

Q. (By Mr. Mr. Radosevich) Okay. Now, I have some questions with respect to the costs that you derived or reported in your report here. How did you determine the cost, did you poll a number of suppliers and get the lowest price, or what technique did you employ?

A. Well, there are several suppliers that I work with on a continuing basis that provide me with cost information, and over the years I have found them to be competitive and their costs to be accurate. Once you develop a working relationship with suppliers, it's nice to continue that. You trust the numbers that they give you.

So there are some such suppliers, and those suppliers are listed in the appendix tables for each of those

components for which the costs were derived.

Q. Is the cost effectiveness of the calculations you gave and that you later have passed on to the economist dependent upon dealing with those suppliers, though?

A. No, those costs are representative of the industry for the level of -- excuse me -- for the volume of materials that we are dealing with. If you are around the irrigation industry very much in an area you work -- and having been in the industry myself, you will find that in a different area you will have a group of suppliers that are very competitive and you can go from one to the other and the cost won't vary more than 2 or 3 percent. You go outside of that area to another area where there isn't as much competition, it may be higher, or you go to an area that has less competition or more competition, and the prices may be lower.

THE SPECIAL MASTER: May I make an observation on that? It isn't much doing, but I can't resist it, and it is this: When you go to four or five -- when you said there's lots of competition and you go to them all and find they are very competitive, their prices are all the same, are they, in fact, competitive or are they collusive?

THE WITNESS: Judging from the number of them that go broke each year, I would judge they are competitive.

Q. (By Mr. Radosevich) But what you are implying to me then is, in fact, the success of keeping the costs down,as the way you did listed in your report, depends a lot on your knowledge of knowing who is a competitive buyer?

A. That's true.

Q. So this pretty much depends on your knowledge of who the suppliers are?

A. No. If you look at a project like this, we've got roughly a hundred million dollars in this total package if it was going to be constructed as of 1979. You would attract, if you were going to put it up for bids, a very wide category of people to supply products. You would have a lot of people knocking on your door wanting to sell you stuff. You would generate the most competitive situation you could imagine in the irrigation industry from a project of that size. When that happens, then if you have chosen even the absolute lowest price in the industry, you are probably very reasonable in your cost estimate. If -- and then in all probability what you would end up doing on a project this size where it's all under one ownership essentially, under the Tribes' ownership, as I mentioned before, you would probably have a distributorship within the Tribe itself which you would have a cost-plus operating expenses on all of your costs,

and that's distributor costs and not dealer costs.

THE SPECIAL MASTER: I suspect your factories will have their men in immediately talking to some of the members of the joint business council talking about tribal owned distributorship on some type of a cost-plus basis.

Q. (By Mr. Radosevich) Is there quite a bit of difference of quality between the products, the pumps, the sprinkler, the pivot sprinkler systems that might reflect a difference in price?

A. There are quality differences. These are for all high quality materials. The major manufacturers of equipment are used. We use those always in estimating the prices. It's not, you know, we go around and find the sleezy little shops around the corner that have something that's made in the neighborhood's blacksmith shop and he can make it real cheap, they are major brands.

Q. You testified this morning these are all based on 1979 costs?

A. Yes.

Q. Did you or the suppliers provide you with cost estimates in 1980 or 1981, 1985, 1990? Did you do any of those calculations yourself?

A. No, I didn't.

Q. Do suppliers normally do that?

A. No. They will give you current prices and that's about it. If you even ask them to go back to '79, they are hard-pressed. What I have done, and since I'm in this business all the time, I have files on unit prices from each year that I work with, so I just referred to my files for the year -- for the year of this study, which was 1979, and pulled the costs for that year.

Q. I see. Okay.

Going on to this issue of drainage that you testified, you mentioned that you doubled the cost for the unknown, for this drainage contingency. Is this standard in the irrigation and drainage process or business?

A. The standard for this area for the Bureau of Reclamation in the Riverton Reclamation Project is to add 15 percent, but that is to an area that has considerable amount of drainage, so 15 percent will cover a lot. Where you don't have hardly any drainage specified, you need a little heavier pad for that contingency level; and whether it's 50 or 45 or 37 or -- I can't say. It's just our best guess.

Q. It's just a guesstimate then?

A. That's all you can do.

Q. You mentioned that several of the areas have a natural drain. I realize that there will be a fellow who's going

to testify on the drainage issue, but you alluded to it that you didn't have to take into account drainage in certain areas because of the natural topography. Does this also include the erosion aspects if you don't put in an artificial drain? Was this included in your assumption that erosion, the other --

A. You mean you are going to have erosion from the seeps that will occur from the natural drainage?

Q. Of course, you won't have till water runoff with the sprinkler system.

A. That's essentially true. The small seeps that would occur would be distributed in major such that there would not be a significant accumulation created, a large erosion hazard.

Q. Okay, going to this issue of O & M, the operation and maintenance costs that you described, at one point you made the statement that you took into account a 4 percent interest rate for annualizing the costs.

A. That didn't have to do with operation and maintenance, that had to do with the annualized capital costs.

Q. Is that 4 percent realistic in your point of view?

A. That is what I was directed to use by the economists in the analysis.

Q. And do you know if it is based on any replacement costs as a factor or --

A. No, that would have no bearing on replacement costs. The life is the only thing that has any effect on when you replace an item.

Q. How did you take into account the life of some of these components of the system, because obviously they are not all going to deteriorate at the same time? Is that calculated into your costs?

A. It was calculated in the annualized cost, which the economist will deal with. In other words, when you determine the annualized capital costs, that takes into account the replacement factor, that's handled in the economic analysis.

Q. So then your figures on operation and maintenance really are -- or they include operation, maintenance and replacement costs then?

A. No, just operation and maintenance. Replacement cost is handled through the annualization of the capital cost of the item. If we estimate that a pump is going to last 25 years and it's amortized over that basis, then the replacement is built into that amortized cost.

Q. If you estimate a sprinkler system under the lines is it going to last ten years and you have to replace it at ten years, how is that incorporated?

A. The same way as an amortized cost. The only thing

maintenance includes is enough money to keep it running for ten years.

Q. Going to the Stagner Ridge Project that you have, are there any irrigated acreages or any irrigation wells located on that area?

A. Not that I'm aware of.

Q. Okay. Is this project contingent upon the North Crowheart Canal being constructed?

A. The way it's designed for Stagner Ridge, yes. An alternate supply would be out of the Wind River with a direct pumping plant, and that would be a possibility.

Q. Did you calculate the cost for that alternate supply in the event the North Crowheart is not distributed?

A. I did not calculate it, no.

Q. The design capacity in the canal is such that it could be modified to include the Stagner Ridge Project, is that right?

A. In all probability, the 1.9 increase in flow could be handled in the free board, but we included some cost increases in capacity.

Q. Okay. And I have a question with respect to in the report it does not indicate you are going to have any pumps as you have in the former project to pump the water into the sprinkler systems themselves, is that correct?

A. Well, what you have is a totally closed system, so that booster pump that is just below the ridge there in the middle of the line will supply the additional pressure needed to pressurize the system as well as raise the water to the level of the ridge.

* * * * *

Q (By Mr. Radosevich) Was there any question of the land tenure being considered when you designed this, whether it's one unit or individual units?

A No.

Q Same with the Big Horn Flats Project. And in your professional opinion will it make any difference if there are, if there are seven sprinklers, if they have seven different families, will it make any difference in the operation?

A No, it shouldn't.

Q It won't increase the cost?

A Again, with using the same concept of irrigation management it won't.

Q I'm not sure whether you alluded to it this morning or not, and this is just a projected project, but what is your estimate of how long it would take to construct this project?

THE SPECIAL MASTER: I don't think he said.

THE WITNESS: I didn't -- I didn't say.

THE SPECIAL MASTER: Money saved, 20 percent, I think he can answer that for you.

Q (By Mr. Radosevich) Nine thousand acre project, what would you estimate?

A Oh --

THE SPECIAL MASTER: Let's assume that it were funded.

A Under that sort of average development conditions, it would be conceivable to develop 10,000 acres in a year without any real strain.

Q (By Mr. Radosevich) So it could be done in one year?

A Ten thousand acres in one year, yeah, so the additional lands could be done in one year.

THE SPECIAL MASTER: This project, if it were to be funded and staffed and everything went without delay it could probably be completed in one year?

THE WITNESS: The additional lands I'm talking about.

THE SPECIAL MASTER: Yes. And you would put your 10,000 acres per year probably on the other projects too, if that's what you use as a professional opinion?

THE WITNESS: Yeah. There is no reason that it couldn't develop faster, but just from the logistics of getting up to speed and operating it and developing it, 10,000 acres per year sort of is an average number that could be used for developing.

It could be slower or faster, just depends on how interested you are in getting it up and running.

Q (By Mr. Radosevich) In your review of the Stetson design,

I believe on several of the other systems you'd indicated you looked at the side roll system and modified it to put in pipes in places. Why was not pivot sprinkler considered since it appears to be more cost effective?

A Well, it's more cost effective in these areas that we find it because it's high lift and associated higher efficiency. The areas where you don't have significant energy input the center pivot itself is more extensive than the wheel lines, capital cost wise. If the energy input is fairly low then side roll, a combination of side roll and hand lines may be a more cost effective approach, and the nature of many of the other lands does not lend itself as well to center pivots as to these two parcels.

Q So you just accepted the assumption that Stetson made, that side roll would be the best alternative?

MR. CLEAR: Your Honor, I object. It's not an assumption that Mr. Stetson made or that Stetson Engineers made.

THE SPECIAL MASTER: Well --

Q (By Mr. Radosevich) Well, their recommendation.

A That's a perfectly valid design concept. Now, that is not to say that when you actually build it that there

would not be any center pivot itself, but it would be very conceivable to develop without it. It would also be conceivable to have some in there, either way is a perfectly appropriate approach.

Q One other answer that you provided this morning that's in your report, you stated that you were looking, that you accepted a 15 percent error instead of the 23 percent since you only looked at 10 percent of the Stetson, analyzed 10 percent of the Stetson project, what rationale do you have to back it down to 15 percent? Does that allow you a 75 percent error?

A Well, that's a judgment factor basically. We -- We could have reasonably justified the 23 percent. The 15 percent is essentially the minimum reduction it would be because just the reduction in the input costs are essentially 15 percent. And we had then the additional advantage of the optimization technique, so it was just a conservative estimate, conservative reduction from the 23 percent.

THE SPECIAL MASTER: Are you about to wind up? Do you think one or two more --

MR. RADOSEVICH: I just got a few more questions.

THE SPECIAL MASTER: I want to make an observation. I don't say this in criticism, but as an observation

in my lifetime experience, certainly the last 20 years, I have never known a project, whether it be public funded or private funded, no matter how well engineered, designed, conceived and executed, that it didn't have a cost over-run. And I find it interesting and unusual to find someone shaving off someone else's estimate, saying we can do this cheaper. I have not seen anything done cheaper in the last 20 years.

THE WITNESS: Well, my experience --

THE SPECIAL MASTER: Whether in the military, civil.

THE WITNESS: -- is different than yours.

THE SPECIAL MASTER: Whether it's -- Wherein have you had the experience to justify that kind of a cut on somebody else's projects?

THE WITNESS: My design estimates are based on my experience in commercial design and installation.

THE SPECIAL MASTER: Right, but that is not to say that your experience finds that others have been too high. You're saying affirmatively that you know yours are in line, that's what you're saying.

THE WITNESS: That's exactly right.

THE SPECIAL MASTER: That's right.

Q (By Mr. Radosevich) When you calculated these plant

pump costs and redesigned the scheme, did that change the life of the pumping portion of that project at all?

A No. If you -- If you look at the life of the pumping plant, the component that requires the most maintenance and is really replaced the most often is the part that's under water anyway, whether or not it's in a shelter is immaterial. The motor life is a function generally of temperature and humidity, and the fact that there is a building around it actually, if you compare the shade structure to the building structure, you have a more difficult time controlling the temperature inside of an enclosed building than you do just in a shade structure. So, if anything, you increase the maintenance cost by putting a building up, not only that, but you make it more difficult to get at the motor and pump. To do it you have to have a crane inside to pull it, and it's difficult to get the equipment in and out, so the exposed pumping plants do not tend to be more expensive to maintain in the long run unless you're in an area where you're worried about vandalism or some crazy thing and you need to keep it all locked up or, armed guards, whatever.

Q The net effects from what you've done, it looks like you proposed, in other words, a better mousetrap, so

so to speak, an improved system.

A I would say a more cost effective mousetrap.

Q But it would also be in your professional opinion. Another consulting firm could come in and do precisely the same with your figures and come up with yet a more better cost effective system?

A It's possible that somebody could demonstrate a lower cost. However, based on my experience in commercial design I feel that our costs are very appropriate for the kind of system that would be installed. He could very easily design you a pumping plant that would be cheaper than the ones we've got, but then you would start getting into maintenance problems. You know, the typical farmer constructed irrigation pumping plant is to go out with a backhoe and dig a hole and stick a pipe in there and set a pump in on a couple of timbers and weld up a little pipe and away he goes in business. And that's considerably cheaper.

Q So it is possible then?

A It is possible, but we feel that this is the appropriate level of design for this system.

MR. RADOSEVICH: Thank you, Your Honor, I have no further questions.

THE SPECIAL MASTER: All righty. Mr. Merrill,

would you rather start fresh in the morning or do you want to go an hour tonight? You're welcome either way.

MR. MERRILL: Why don't I start up, Your Honor, and see how many areas I get through and try to stop at a convenient breaking point around five if that's agreeable.

MR. SACHSE: Maybe we ought to take a five-minute break now.

THE SPECIAL MASTER: You want one?

MR. MERRILL: That's fine with me.

THE SPECIAL MASTER: We'll take a five-minute break, resume at 4:05.

(Thereupon a five-minute (recess was taken.

* * * * *

THE SPECIAL MASTER: Come to order, please.

Cross-examination by Mr. Merrill.

MR. MERRILL: Thank you, Your Honor.

CROSS-EXAMINATION

BY MR. MERRILL:

Q Mr. Bliesner, I would like to begin this afternoon with a discussion of your revised project component costs for the project areas based on your review of the work done by Doctor Mesghinna and Stetson Engineers, and I would like you, if you would, to turn to your report, your big report, that is Exhibit No. 13, to Table 14 on Page 35.

THE SPECIAL MASTER: What page again?

MR. MERRILL: Page 35, Your Honor.

THE WITNESS: Yes.

Q (By Mr. Merrill) And as I understand the description of your study, you have estimated new costs for the on-farm systems for all the new areas, including the South Crowheart, the Arapahoe and Big Horn Flats, is that correct?

A. That's correct.

Q. Isn't it true that as part of your study, you didn't actually investigate any of the plans developed by Doctor Mesghinna for South Crowheart, Arapahoe and

Big Horn Flats?

A. That's true.

Q. And isn't it true that your on-farm system revised costs for North Crowheart are based on an investigation of approximately five thousand out of thirty-eight thousand acres in the North Crowheart project?

A. That's correct.

Q. Isn't it further true that your revised cost for Riverton East on-farm system is based on the investigation of one area of six hundred acres out of approximately thirty-eight hundred?

A. That's correct.

Q. If I were to ask you the same questions with respect to the pipe network figures you developed for each of these areas, would your answers be the same?

A. That's correct.

Q. If I were to ask you the same questions with respect to the annual energy cost for these five areas, would your answers also be the same?

A. Yes.

Q. So in sum, you revised all of Doctor Mesghinna's costs based on an examination of approximately ten percent of the areas for which he developed irrigation systems, is that correct?

MR. SACHSE: Your Honor, that question assumes a fact absolutely contrary to what the witness has testified to, namely that he revised all of Doctor Mesghinna's costs based on this percentage when the witness has testified that he revised some of Doctor Mesghinna's costs based on percentage study, but others based on a study of every single thing done, for instance, the pumping costs. The question should not presume an inaccurate alleged fact.

THE SPECIAL MASTER: Mr. Sachse, if the question is in error, I'm sure the witness will call the error to Mr. Merrill's attention.

MR. MERRILL: Your Honor, Mr. Sachse is correct. I will withdraw the question and restate it.

Q. (By Mr. Merrill) Mr. Bliesner, isn't it true you developed revised costs for the on-farm systems, the pipe network and the annual energy costs based on your review of approximately ten percent of the area for which Doctor Mesghinna developed irrigation systems?

A. That's true.

Q. Do you know how much time Doctor Mesghinna spent developing the irrigation systems for the five new project areas?

A. I don't have a log of his time, no.

Q. Are you aware he spent approximately two years of his time developing these systems?

A. That's entirely possible.

Q. How much time did you spend during the portion of your work program for this case reviewing Doctor Mesghinna's work?

A. Somewhere in the neighborhood of a month.

Q. And based on your one month analysis as a professional engineer, you are coming in and telling the Court that your revised figures are better than those developed by Doctor Mesghinna over two years of work, is that correct?

A. That's correct.

Q. Mr. Bliesner, is it a common practice in the engineering profession to develop costs for a major engineering project like this one based on an examination of only ten percent of the components?

A. It's not common practice to develop costs, but it would be very common practice to review costs based on that type of analysis.

Q. As a professional engineer, if you were presented with cost estimates for a major irrigation project, one which was based on comprehensive designs of the entire project and the other of which was based on a review of ten

percent of that project, in which figures would you have more confidence?

A. That would depend on the assumptions that were used to develop the two studies. If I felt that the basic cost assumptions and the unit costs that went into the one that studied the entire acreage were inappropriate, then I would not give it any more weight than I would one that analyzed ten percent of the acreage. My argument is not with the design and the work that he has done with the design, but the unit costs that went into the system, and I do not have to analyze one hundred percent of the acreage to apply a difference in unit cost.

Q. (By Mr. Merrill) Mr. Bliesner, if you were representing a construction firm that specialized in the engineering or the construction of major agricultural systems, would you make a bid to construct these systems based on the analysis that you have done, based on your prices?

A. I would not -- If I was representing an engineering company and I was to bid on a job, it would have to have the specifications for the components that I was going to bid on. It would not make any difference what some engineer's estimate was as to the cost of it, whether it would be based on ten percent or one hundred percent

of the acreage.

Q. In other words, the work you have done in the figures you have developed are not sufficient information on which to prepare a bid to bid -- or to -- excuse me, to construct this project, is that correct?

A. Nor are Doctor Mesghinna's if you are going to talk about bidding on the job. You have to have a complete materials list to be able to bid as a contractor.

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Q (By Mr. Merrill) Let's talk for a moment about the redesigns that you did for the pumping plants in the Stetson Irrigation Systems Designs. Would you please tell the Court all of the components which you have omitted from Dr. Mesghinna's designs or those areas which you have changed from Dr. Mesghinna's designs that would account for the 60 percent average reduction between your costs and Dr. Mesghinna's.

A I can't do that, Mr. Merrill, because I don't know of each and every component that went into Dr. Mesghinna's design. I have not seen a typical design that gives me a list of the components that were included in his design. All I know is that my cost estimates for the pumping plants that I've designed are accurate and that the pumping plant is adequate for the type of system that we are dealing with.

Q For each of the pumping plants that you designed, did you develop a list of the pieces of hardware and the operations such as excavation and so forth that would be required to construct each plant?

A The excavation, construction of the structures were based typical cost. The component costs of the manifolds, the pumps, the controls, any pressure regulation that we have on the systems, the screening devices, all were

based on individual material lists developed for each of those pumps.

Q Do you have those lists with you?

A No, I don't.

MR. MERRILL: Your Honor, I would ask for an order directing Mr. Bliesner to provide those lists, and my grounds for it are that we are talking about what is admittedly a very hasty review of work that was developed over several years. As the Court pointed out this morning, I think that the costs involved in Mr. Bliesner's projections and the unit costs as well as the list of units required to construct each component system are integral to his analysis and I believe that we are entitled to see those since his acreage costs of the pumping plants set forth in Table 11 and in later tables in his report are based on those.

THE SPECIAL MASTER: Let me ask a question or two on your work papers, about them. What are they, catalogs or ten or 15 pages?

THE WITNESS: This is a computer run. The computer output does not list each individual component. The output -- The cost is developed on individual component construction.

THE SPECIAL MASTER: Well, you mentioned, though

you took this from literature giving you costs of each individual component.

THE WITNESS: The unit cost for each individual component is already in my report.

THE SPECIAL MASTER: Yes, but Mr. Merrill wants to know where you got that from.

MR. MERRILL: What components.

THE WITNESS: What he wants to know is what components are included in each pumping plant that I designed.

THE SPECIAL MASTER: Yes, and you said you had that on your work papers.

THE WITNESS: NO, he said on what are those costs based. He asked me if it was based on the individual components costs and I said, yes, it was.

THE SPECIAL MASTER: And review that took place. Your memory's better than mine, you're younger.

You said you don't have the work papers.

What did you ask him for, Mr. Merrill.

MR. MERRILL: Your Honor, I would like a list of each of the components that would be included in each pumping station so that we can multiply those by the costs.

THE SPECIAL MASTER: What did you ask the Witness

for, without having Merissa go back and review the question?

MR. MERRILL: A list of the components required to construct each of the pumping stations.

THE SPECIAL MASTER: And what did you respond in that inquiry?

THE WITNESS: What I said was this was generated, these costs were generated from our computer, the computer model --

THE SPECIAL MASTER: I thought you said you didn't have the papers because the next question was, well, have you got the papers with you and you said, no, I don't.

THE WITNESS: That's what I was starting to explain before you interrupted me.

THE SPECIAL MASTER: Well, I beg your pardon for interrupting you, but will you let us know -- I think I'll sign the order if you'll draft it and you'll get the material you want.

MR. MERRILL: Thank you, Your Honor.

MR. SACHSE: Could we ask for some clarification from Mr. Merrill as to just what he is asking for? As I understand it, he's asking for a list of the component parts in each of the pumps that Mr. Bliesner

has designed for the project. He's not asking for costs, he's asking for a list of components.

Now, we need to know exactly what's being asked for so we can try to produce it.

MR. MERRILL: That's precisely what I'm asking for, a list of components required to construct each of the pumping stations.

THE SPECIAL MASTER: Pumping stations not the pumps.

MR. MERRILL: Both the main pumping stations out of canals and out of the Lily Pond and also the components required to construct all the other pumping stations for which he developed costs.

MR. SACHSE: Now, since Mr. Merrill has asked for a motion and you've indicated that you're inclined to give it, could we have a five minute recess to talk with our Witness to see what we can do to try to comply with that?

THE SPECIAL MASTER: I would think that's in order and I'll be glad to grant that. We'll stand in recess, but will the Court Reporter please stay with us in case we start earlier.

(Thereupon a three-minute
(recess was taken.

THE SPECIAL MASTER: Okay, we're ready to resume,

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are we?

MR. ROGERS: Your Honor, --

THE SPECIAL MASTER: All right, on the record. Then please proceed, Mr. Rogers.

MR. ROGERS: The Tribes are prepared, through Mr. Bliesner, to have Mr. Bliesner furnish the request as we understand it stated, a list of component parts of pumping stations. It will involve, because of the nature of Mr. Bliesner's situation, a computer printout which he has to personally be there to do because it will involve some adjustments in the inputs, and once he is able to get back and do it he advises it will take about a day to do and furnish, but we can furnish it.

THE SPECIAL MASTER: Very well. Proceed, Mr. Merrill.

MR. MERRILL: Thank you, Your Honor. I would simply point out for Mr. Bliesner's convenience that we have computer terminals located in Cheyenne and if it would be more convenient for him to use one of the terminals to dial into our system, he's welcome to use it.

THE SPECIAL MASTER: Very good, either one; whatever is more convenient.

Q (By Mr. Merrill) Mr. Bliesner, as I understand the description of your work program, you used several different computer programs to do such tasks as optimize the pipeline network designs and simulating the passing of center pivot sprinklers over points, and I wasn't sure if you also had a program that did something about optimizing the life cycle and the costs of center pivot sprinklers. Was that also a separate computer program?

A Yes, it is.

Q And you mentioned earlier on in your testimony that you used some sort of a sprinkler simulator machine to conduct infiltration tests at six locations on Big Horn Flats; is that correct?

A That's correct.

* * * * *

Q. (By Mr. Merrill) Let's talk for a little bit about this sprinkler simulator machine. What is it and how does it work?

A. It's basically a broad jet spray nozzle similar to those found on some center pivot systems, and mainly it has a narrow pattern so we can contain the application in a smaller area; mounted on a tripod, and it is supplied water through a small battery-operated pump that is connected to it, pickup battery or whatever, delivering water from a barrell. It is controlled by a microprocessor that times the cycle of operation -- or, excuse me -- or the sprinkler to determine an average application rate of some predetermined amount.

Q. How big an area does this little device operate or does it irrigate when you run it?

A. It operated in about a 3-foot radius -- excuse me -- in about a 3-foot diameter.

Q. Who developed this machine?

A. A fellow by the name of Ron Beggs.

THE REPORTER: How do you spell his last name?

THE WITNESS: B-e-g-g-s.

Q. (By Mr.Merrill) Do you know when it was developed?

A. It was completed the spring of this year, early spring, at least a species was completed at that time.

Q. And this is the device that you used to determine the intake rates of the soil in the areas that you tested, is that correct?

A. Not quite. Now, what we were determining is the time to ponding, which is an indication of the intake rate under the early time phase of the intake function, so we are talking about operating through about the first ten to fifteen minutes of the intake function.

Q. I see. Okay. How many different times has this device been used to determine time to ponding; in other words, in how many other cases than the one you used it in?

A. Only in his research.

Q. Has this device ever been used to help design a sprinkler system which has been successfully constructed and operated?

A. This particular device has not. Others similar to that have.

Q. Okay. Is this device that Mr. Beggs developed in the spring of this year a testing device that's commonly used and accepted within the engineering profession to determine time to ponding?

A. It is, as far as I know, the only device yet -- and others like it -- the only device by which you can make those determinations.

Q. When you operated this device, was Mr. Beggs there to help

you set it up and make sure you were running it correctly and measuring the results correctly and so forth?

A. No, he was not.

Q. Did he instruct you at some point in the correct use of this machine?

A. No, he did not.

Q. What steps, if any, did you take to ensure that you were operating the spray nozzle correctly and timing it correctly and setting up sort of all of the control situations of this experiment?

A. You make it sound like a very complicated process.

Q. Well, I don't know anything about it and that's why I'm asking you.

A. It's actually a very simple process. You can do the same simulation by manual control. The microprocessor just turns the sprinkler on and off at some predetermined cycle. You can do the same thing by cycling it. The observation is just a matter of watching the surface conditions of the soil and determining the point to which it ponds. There is a very good operating description in his thesis on both setup and operation for the unit, a very simple piece of equipment to run.

Q Now, as I understand it, you operated this machine at six different locations on the Big Horn Flats area, is that

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correct?

A. That's correct.

Q. How did you determine each of the sites at which you were going to set this thing up and run it?

A. What we did was we had the textural classifications from the auger hole studies done by HKM and the sections in which those studies were done. We tried to select the points to do the studies that were representative of the general textural class changes. So that was the rationale behind setting up the test.

Q. Okay. Did you record the surface soil textures at the sites where you performed these time to ponding tests?

A. Not independently of the study.

Q. Well, without having recorded the surface soil textures, would you please explain to the Court how you could determine that these sites were representative of the surface soil profile in the Big Horn Flats area?

A. Well, if you do six studies and they are all within 5 or 10 percent of each other in their results and they are spread out over a 15 to 20-mile area, then you have a pretty fair indication that the results that you have are representative of the average conditions in the area that you are studying.

* * * * *

Q. (By Mr. Merrill) Does your system design, in other words, the speed and size and so forth of these center pivot sprinklers make any allowance for the possibility that within this ten thousand acre area on the -- I'm sorry, about a nine thousand acre area on the Big Horn Flats, that not all of the land is going to perform the way you think it is based on your intake rate tests?

A. No, it does not take that into consideration, but it is based on the average such that there would be areas of soil that would have higher intake rate systems, possibly allowing longer -- excuse me -- intake rates possibly allowing longer systems. Some may be shorter and require slightly shorter systems with lower intake rate tests, but the average would be representative of what we have done, and the costs thereby representative.

Q. Has there ever been any irrigation upon the area of Big Horn Flats that you studied?

A. Not that I know of.

Q. When you conducted these intake rate tests, did you make any attempt to duplicate the soil moisture conditions of the field as it would be under irrigation as opposed to the field under virgin conditions?

A. Well, interestingly enough, we were out there about

four to five days behind a rain, so the areas that we were studying were very close to the soil moisture content you would expect in the field at the time you would be irrigating. After long term irrigation development, you would expect the intake rates to improve as the till of the soil improves with working it, with deep rooting of alfalfa, with a cover crop on. As we did these tests, they were done on bare soil, which is the most difficult situation. They were raked down, they were not fluffed up, tilled in any way other than the surface cover removed, so we ran the tests under the toughest conditions that would occur under field conditions after the system is in operation.

Q. When you conducted your intake rate tests, did you make any study or empirical evaluation of the soil moisture content after this rain had passed so you would know it was roughly in the same condition as it would be in an irrigated state?

A. No, just essentially by observation in the field. We did not make a laboratory analysis.

Q. Did you adjust either the assumptions or the results of your intake rate tests to compensate for the lateral and vertical capillary action of the soil to pull the

out from where you were applying it under virgin conditions as opposed to irrigated field conditions?

A. Under the scheme that we operate in, there are several areas in the circle that you look at. There is an outside area which receives some extra moisture in dripping from the field around the unit. There is a central area which receives some excess water due to dripping from the sprinkler as it cycles, so the span that we use to determine the time to ponding is central between those two locations which are receiving excess water. If anything, the capillary movement would be towards the area that we are analyzing, and we would end up with a conservative result.

Q. Other than the intake rate tests that you conducted in these six locations, did you make any other field investigation or laboratory analysis of the soils and drainage properties of the Big Horn Flats or the Stagner Ridge areas?

A. Not independently, no.

Q. During the course of your work, did HKM supply you with land classification and soils information?

A. Yes.

Q. What information did you get from HKM?

A. We received their report on arable lands, and also

their information on hydraulic conductivities and depth to barrier, and then the actual hole logs from Big Horn Flats from the auger hole studies that were done.

Q. Is that the hole logs from the shallow holes that were hand-augered, or did you also get --

A. From both.

Q. -- from deep holes that were drilled to barrier?

A. Also deep holes.

Q. Did you use any of this information in your systems design?

A. The textural class information from the hole logs was used in determining the holding capacity for the areas of wheel lined sprinkler systems. Other than that, other than in determining where we would do the intake rate tests, there was no reason to use that soil information in systems design.

* * * * *

Q. (By Mr. Merrill) Did you use the depth to barrier and hydraulic conductivity information supplied by HKM?

A. I did not, no.

Q. Did HKM supply you with any of this information concerning Stagner Ridge area?

A. We had the arable lands classification and the depth to barrier hydraulic conductivities and general textural class of surface soils I received from Ross Waples by telephone.

Q. Okay. You said you got the results of the hole log and some of the tests that HKM did in the field. Did you also receive a set of aerial photographs or photomaps from HKM?

A. Not that showed any designation. I did receive a set of stereo aerials to aid in the layout of one of the alternatives. We were looking at an alternative to bring a canal in from the Little Wind system and we had stereo aerial photos to help in that routing, and determined that was not the best alternative, so they weren't used. But they did not show any arable lands boundaries or hole locations or anything of that nature.

Q. Did you receive a set of what are called hydrographic photographs from Ron Billstein at HKM?

A. No.

Q. Did you receive a set of soils photographs from Mr. Billstein or Mr. Waples?

A. I received Xerox copies of aerial photo boundaries in some areas on Big Horn Flats where there were some discrepancies between Stetson's maps and the arable lands maps on boundary.

Q. How did you use that information?

A. I used that as an overlay on our quad sheet to determine where the boundary really was.

Q. During the course of your study of the Big Horn Flats area, how much time did you actually spend out in the field in that area?

A. Well, the first visit we spent about three hours on the Big Horn Flats just overviewing it. The second trip, about two and a half days, and these were 12 to 16-hour days.

Q. Any other visits to the area?

A. No.

Q. Okay. How about to the Stagner Ridge area?

A. That was a matter of a few hours actually there.

Q. Okay. Let's go back to some of these computer models that we were talking about earlier.

You've spoken quite a bit about the use of pipeline optimization program.

A. Yes.

Q. And I believe you stated in your direct testimony that this program uses pipe sizes and pressures and rates and various things to optimize, at the lowest cost, a pipe network based on certain diameters and pressures and flow rate; is that correct?

A. It doesn't give the lowest cost pipe network, it gives you the lowest total annual cost, including energy cost and annualized capital cost.

Q. Okay. Who developed this pipeline optimization program?

A. The technique was developed by Dr. Jack Keller and it is applicable either by computer or by hand. I developed the model that is used in this study.

Q. By that you mean you wrote the program --

A. I wrote the program.

Q. -- systems?

When did you write this program?

A. The first components of it I wrote at Superior Farming Company in '76 and '77.

The program as it now stands was written in '78.

Q. Does the computer model make predictions as to the flow rates and the pressures that will be encountered in each segment of the pipeline that it designs?

A. The pressure input requirements and flow input requirements

at nodal points in the system are required as input. If it happens to be a wheel line or hand line system, you put the specifications for that lateral in and it calculates the head loss and the laterals, then determine the, from the length of that lateral and the flow rate requirements per foot or whatever, the flow rate that is required at that nodal point, and it also calculates the input pressure at that point and then works upstream combining all of the pieces.

* * * * *

Q. Have you ever used the pipe line optimization program to develop a pipe network which was actually constructed and operated?

A. Yes.

Q. What systems has the program been used to design?

A. It's been used in Georgia on pipe networks there, on a system in Idaho, a system developed by Keller that uses the same techniques; has been used on roughly twenty thousand acres of system design that I know of that have been installed.

Q. Is this computer model that optimizes the pipe network design, based on the assumptions that you make in operating it, the type of model that's generally accepted within the engineering community for designing pipe networks?

A. Yes, I believe it is. As a matter of fact, it seems to be in fair amount of demand.

Q. Do you have a copy of the listing of the computer program steps by which the model actually operates?

A. I don't know if I have it with me. I have a listing, but I'm not sure if it's here with me or not.

Q. Would you please check and see.

A. Yes.

(Brief pause.

A. Yes, I have it here.

Q. Can you share that program listing with us so that we can understand what assumptions a program makes, what variables and values it uses and how it works.

A. That's a proprietary item.

MR. MERRILL: Your Honor, I would move the Court for an order directing Mr. Bliesner to turn over the program listing of the model that he used to develop the pipe network, since that system is integral to his study and that it sets the sizes of pipe and lengths of pipe that are going to be used and pressures, and that determines what size pumps you have to have and how much the cost will be.

THE SPECIAL MASTER: I think we can direct him to give you the answers on the sizes of pipe, the results of his program, but the actual program itself, I think, becomes the property of his company or him, one or the other, and we'll have a problem with that. I want to -- I want to do that which is appropriate and would not be committing error.

Q (By Mr. Merrill) Mr. Bliesner, do you have with you a diagram, schematic or other descriptions of the pipe networks that you actually designed using this program and upon which you based your pipe network costs in

your analysis?

A. Well, they're shown on these drawings for the additional lands, and I have sketches of those areas that were redesigned from the Stetson --

Q. Can you share those sketches with us?

A. Yes.

Q. Do you have them with you?

A. I do.

Q. May I see them, please.

(Witness complied.

Q. Why don't you pull out just that material from your notebook, I don't want to take your whole notebook.

A. These will have to be reproduced and returned to me.

Q. All right. Why don't you let your lawyer look at them.

(Brief pause.

MR. MERRILL: Your Honor, while Mr. Bliesner is finding these diagrams, perhaps this would be a good time to break for the day, and we can photocopy those tonight and return them first thing in the morning and resume the cross-examination in the morning.

THE SPECIAL MASTER: Very well.

MR. ROGERS: Your Honor, I want to confer with the witness, whether he's going to need them tonight.

MR. MERRILL: Oh.

MR. SACHSE: They can photocopy them in just a few minutes.

MR. ROGERS: There's some colored notes that may not reproduce very well. You may have to do those in by hand.

MR. SACHSE: Your Honor, before we adjourn for the day, there's a matter I want to raise.

Mr. Merrill, this morning, as you'll recall, said that his cross-examination of the witnesses was going to be very fast, and he was going to warn us that we should have Doctor Cummings, who's our next to last witness, available for this week. We objected to that, saying this was -- we thought this was unreasonable, and I want to go into this a little further because I think -- and ask you to make a decision on this this evening. I don't think that anyone can say that the Tribes have been slow in the presentation of its case. We got started two weeks ago, we've put on four witnesses in the day and a half that we had.

We've planned four major witnesses for this week. We've been very expeditious in our presentation of Doctor Higginson's testimony. We've now presented our testimony in chief here, and we have two more witnesses lined up, one coming in tonight, and one coming in

tomorrow.

The pace of the trial previously has, at one point, was that a witness would take a day or two and there would be a week or two weeks of cross-examination. We're not trying to hark back to that period.

* * * * *

MR. SACHSE: We made -- we agreed to make Dr. Cummings available for his deposition two weeks ago, three weeks ago -- I have forgotten which it was -- and because of changes in the State's plan they didn't take his deposition then. They led us to believe that, and we even made arrangements, that his deposition would be taken during the August break. We have not asked him to get his report into final shape, we have told him he could attend to other things he had to do because we were expecting him to be the first witness after the August break. I think it is very unlikely, in any event, that we will finish with the witnesses that we have or more than finish with the witnesses we have --

THE SPECIAL MASTER: Do you want Mr. White and Mr. Merrill to hear what you are saying?

MR. SACHSE: I assume they are listening through one ear anyway.

MR. MERRILL: I am listening, Your Honor.

MR. WHITE: We have a good guess at what's coming.

THE SPECIAL MASTER: Did you say it's quite logical we will be completing Mr. Bliesner tomorrow on cross-examination, and with the two witnesses you have for the balance of Wednesday, Thursday and Friday morning we may fill up this week without Dr. Cummings?

MR. SACHSE: What I am saying is I don't know, I

can't predict whether we are going to finish Thursday and be able to go home Friday or whether we will finish at ten o'clock Friday morning or something like that, but I think -- we are talking about expert witnesses who have other things they have to do, who have to be paid for their time, who have to make arrangements to come, and we are also talking about time of lawyers to work with the witness right before he testifies, and I think we have made reasonable expectations that bringing four expert witnesses to testify during what's really a four-day period of trial was reasonable.

Now, we have had many instances in the trial in this case previously where the State has said they wanted an afternoon off, another period of time off to work with a witness, to save time by getting his work properly prepared, and all of this just -- but I want to say one other point. The conclusion I'm leading to here is obvious. The other point here is the State is saying they don't want us to cut into their time. Well, I think we have a right to two weeks of this trial, and we are not even going to take a whole two weeks of trial, so we are not cutting into anybody's time.

But further than that, two other things: One,

the State, if really concerned about one day of cutting into their time, we will be glad to agree to starting the resumption of the trial the last day of August instead of the first day of September, make that a full week that week. In addition, both the United States and we have some rebuttal time at the end of the State's case and we are cutting into that time, too.

THE SPECIAL MASTER: Mr. Sachse, this morning I didn't respond to Mr. Merrill's demand saying yes, I will sign that order to produce the Doctor this week. I did say -- I think I said this -- if I were you, I would be well disposed to try to have him available in case we ran into some time on Thursday. That was my thought. If we consume all of tomorrow and almost all of Thursday, that's fine, we don't have to bring him here for a few hours Friday morning and have a month before he can resume the stand.

MR. SACHSE: The point I want to make is, A, I've spoken to Dr. Cummings, and after he got up off the floor and recovered from a heart attack --

THE SPECIAL MASTER: Where is he?

MR. SACHSE: He's in Albuquerque. And just frankly, not playing any games about it, if we brought him in there would be no way to have him properly prepared to begin his testimony, no way to complete the report which

we have every intention of completing and giving to the State well in advance and so forth. We would be putting on a witness just because we have to fill up those hours, and I think our expectations that we wouldn't get that far were reasonable, and this is courtesy that ought to be done between the Court and lawyers and expert witnesses to let us go as far as we can.

THE SPECIAL MASTER: Mr. Merrill, in view of the progress we are making and in view of the sublime request for cooperation, are you ready to reconsider your feelings of this morning.

MR. MERRILL: I have one alternative proposal, Your Honor, and that is the Tribes have endorsed a Doctor Stewart in Boulder, Colorado who is also going to testify. Perhaps he could be brought in this week and we could do Dr. Cummings in September.

MR. SACHSE: There is no way we can do that.

THE SPECIAL MASTER: I appreciate your attempt for thinking that way, Mr. Merrill.

Anyway, how much more cross-examination do you have of this witness? Will we be here all day Wednesday? See, we are going to knock off tomorrow at one o;clock, I have to go and do other things.

MR. MERRILL: Your Honor, it's difficult to be

predict both direct and cross-examination time. I anticipate that both the direct and cross of Dr. Keller and Dr. Willardson will be very short due to their minimal participation in Mr. Bliesner's work.

THE SPECIAL MASTER: Is one of those the man I want for my drainage problems?

MR. MERRILL: Yes.

THE SPECIAL MASTER: Yes.

MR. MERRILL: You might have several hours of questions.

THE SPECIAL MASTER: I have a few things to take care of.

MR. MERRILL: Your Honor, I would agree to that. I expect we will be extended the same courtesy when we put on our case.

THE SPECIAL MASTER: My reason for being a little firm this morning, I don't want to cost the State or loose them a day or two and then have them justify having --

MR. SACHSE: I agree. We would like to put on our evidence, let them do their cross, get done with it. And if we go home a half day early or something, we go home, and we'll start, and guarantee you we will be expeditious in our testimony.

THE SPECIAL MASTER: Thank you both very much.

Let's start at nine o'clock in the morning again.

Thank you very much.

(Whereupon the proceedings
(were recessed for the
(evening.

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WITNESS: RONALD BLIESNER

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REPORTERS' CERTIFICATE

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We, Merissa Racine and Mary Nelson, Registered Professional Reporters and Notaries Public, in and for the First Judicial District, State of Wyoming, hereby certify that the facts as stated in the caption hereof are true; that we did at the time, date and place, as set forth, report the proceedings had before the Honorable Teno Roncalio, Special Master Presiding, in stenotype; that the foregoing pages numbered 8241-8487, inclusive, constitute a true, correct and complete transcript of our stenographic notes as reduced to typewritten form under our direction.

We further certify that we are not agents, attorneys or counsel for any of the parties hereto, nor are we interested in the outcome thereof.

Dated this 28th day of July, 1981.

Merissa Racine
MERISSA RACINE
Registered Professional
Reporter

Mary Nelson
MARY NELSON
Registered Professional
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