
IN RE: NON-BINDING ARBITRATION PURSUANT TO THE FINAL SETTLEMENT STIPULATION, KANSAS v. NEBRASKA and COLORADO

No. 126 Original, U.S. Supreme Court

TRANSCRIPT OF ARBITRATION PROCEEDINGS

before

KARL J. DREHER, ARBITRATOR

Monday, March 9, 2009

VOLUME I

BE IT REMEMBERED that the above-entitled matter came on for Arbitration before KARL DREHER, Arbitrator, held at Byron Rogers Building, 1929 South Street, Room C-205, Denver, Colorado on the 9th day of March, 2009.

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P R O C E E D I N G S

ARBITRATOR DREHER: At this time we're ready to begin the hearing in the nonbinding arbitration being conducted pursuant to the Final Settlement Stipulation approved and adopted by the U.S. Supreme Court on May 19, 2003 in Kansas v. Nebraska and Colorado, Original No. 126.

It's approximately 8:12 a.m. on March 9.

I'm Karl Dreher, I'm the Arbitrator.

To start with, if counsel could please identify themselves.

MR. DRAPER: Good morning, Your Honor, I'm John Draper, here on behalf of the State of Kansas, and I have with me today Sam Speed, Burke Griggs, Chris Grunewald, Dale Book, Donna Ormerod, Scott Ross, Dave Barfield, Angela Schenk, Terry Kastens and John Leatherman. I didn't forget anybody? That's who we have this morning.

ARBITRATOR DREHER: Thank you.

State of Nebraska.

MR. WILMOTH: Good morning, Mr. Arbitrator.

Tom Wilmoth for the State of Nebraska. I also have with me Don Blankenau, Justin Lavene from the Attorney General's Office, as well as

Marcus Powers who joined me.

In the way of conditional folks, we have Tom Riley from the Flatwater Group, Dave Sunding from Berkeley; Jasper Fanning in the back; Director Brian Dunnigan, from DNR; Marc Groff, also from the Flatwater Group, and Mr. Lavene will be joining us shortly.

ARBITRATOR DREHER: All right, thank you.

Colorado?

MR. AMPE: Thank you, sir.

My name is Pete Ampe, representing the State of Colorado. With me at counsel table is Ms. Autumn Bernhardt.

ARBITRATOR DREHER: Okay, thank you.

Now for some preliminary matters.

On Wednesday, March 4 the State of Nebraska filed two motions. The first was Nebraska's Motion in Limine to exclude the report of David W. Barfield entitled "Ensuring Future Compliance By Nebraska."

The second was Nebraska's Motion to Preclude the testimony of Messrs. Marvin Swanda and Aaron Thompson, both of which are employees of the Bureau of Reclamation.

Kansas did submit responses to those motions and then Nebraska submitted a reply to its -- to the response from Kansas regarding the Motion in Limine.

Starting with the Motion in Limine, the stated reason for seeking to exclude -- well, there were several reasons stated, but the motion sought to exclude it peremptorily from these proceedings. And the timing was -- I thought was a little odd, given that Mr. Barfield's report was submitted on January 20, I believe, at least in terms of to the other states, and then it was submitted to me on February 23. And by the time that I received the Motion in Limine, I had already read and considered Mr. Barfield's report. So I don't see how I can peremptorily exclude it, given that I have already read it.

And while I appreciate the issues that Nebraska has raised, and I also understand Kansas' response, given the fact that I've already read it, my decision is not to exclude it at this point in time. And I'm perfectly capable of weighing the factors that both Nebraska and Kansas identified and giving -- considering those factors, giving the material that's in the Barfield report appropriate

weight.

So I am not going to grant the motion to exclude that report.

And similarly, I won't exclude the -- any testimony that Mr. Barfield may offer; but again, I will weigh it in light of the factors that have been identified.

Regarding the Motion to Exclude the testimony of the employees of the Bureau of Reclamation, that one is a little more difficult for me from two standpoints.

Number one, I would very much like to hear what the Bureau of Reclamation has to say about all of this, on the one hand; but on the other hand, I can appreciate the fact that if Nebraska has not been given an opportunity to explore the foundation and basis of the opinions that would be expressed by the Bureau of Reclamation employees, that that could, in fact, prejudice Nebraska.

And I'm not sure what is going to work the best. I've identified a couple of different alternatives for proceeding, given that I really would like to hear what the Bureau of Reclamation people have to say.

One possibility it seems is that, given

that there are multiple attorneys representing both the states of Kansas, Nebraska, and Colorado, I'm wondering if it would be possible to schedule a deposition of the Bureau witnesses during the pendency of this hearing. And then once that -- those depositions have been taken, then to have the Bureau employees offer whatever testimony they would provide towards the end of this proceeding.

If that's not sufficient time for everyone, then the second alternative seems would be to schedule the depositions when they can be scheduled and then to have a supplemental hearing for the purpose of taking whatever testimony they would have.

And let me explain my rationale for approaching it this way. I do not want to miss any information that would be pertinent to the decisions that I have to make here, on the one hand; but on the other hand, I certainly don't want to do it in a way that puts any one of the three states at a disadvantage.

And so the alternatives I've identified, particularly the latter one, would seem to give ample opportunity for Nebraska to explore the foundation of the Bureau's positions and then would still allow me

to hear or consider whatever information the Bureau thinks would be pertinent.

So having laid out those alternatives, I'm not sure what the reaction would be.

Maybe we'll pause here for a few minutes while they confer.

MR. DRAPER: Your Honor, perhaps we should take a short break. It might be useful for the States to confer briefly.

ARBITRATOR DREHER: We'll go off the record and take a short break for maybe five minutes. Do you think that's enough? All right.

(Break was taken from 8:17 to 8:22.)

ARBITRATOR DREHER: Okay, we can go back on the record.

State of Nebraska, what is your response to the proposal here?

MR. WILMOTH: Mr. Arbitrator, I think your latter alternative is consistent with something that we had proposed as a potential way to handle the situation in our motion. The upshot of it is, very simply, that it's impossible for us to try and take a deposition during the time that we're conducting this hearing. Although we have multiple lawyers, there is a reason for that. This is a very complex matter

and, of course, it requires our undivided attention, as it has for the last couple of weeks.

ARBITRATOR DREHER: But there is only one of me.

MR. WILMOTH: I understand that, but the problem is that trying to conduct a deposition currently with doing this when we have -- we're going to be in this room for nine or ten hours a day -- and I can assure you that we will not be ending our days at that point in time -- there is really no way we can do that without prejudicing ourselves.

Moreover, it will be impossible for us to do any kind of document research that we need to conduct to try to find information for the ensuing testimony that you might hear. We just need more time to do that.

That said, we will make ourselves available sometime after the hearing.

I would just point out that this condensed timeframe is the State of Kansas' timeframe and we have been trying very hard to work within that timeframe. You know, we were told that this might be a possibility some time ago; but the fact of the matter is, we didn't know that they were actually going to show up until two days ago, or

four or five days ago. So as a logistical matter, we were focusing on the issues that we had to focus on to be ready for this trial.

And, as I say, we will make ourselves ready and available. We think we can do that, conduct the deposition and conduct a subsequent hearing between the time that we complete this hearing and submit our posttrial briefs.

So on the whole, I don't think it's going to present a problem, at least from our standpoint, the overall timeframe. But it will provide us a full and fair opportunity to do our deposition and be prepared to deal with that testimony, which we currently are not.

ARBITRATOR DREHER: Okay. How does the State of Nebraska see this affecting the schedule for posthearing briefs? What would you -- would you propose the schedule be maintained for that?

MR. WILMOTH: Well, I believe it could be. I don't have a copy of the timeframe designation in front of me. I believe it was April, mid-April, to late April for the posthearing briefs -- April 17. Yes, I think we can make ourselves available, certainly, before that period of time for both the depositions and the hearing; but again, if the

schedule needs to slide, that's fine with us.

This is Kansas' timeframe and, as I said, we're trying to live within it. But the one thing we really can't do is allow ourselves to be prejudiced by trying to do two things at once during these next two weeks.

ARBITRATOR DREHER: This hearing is scheduled to conclude on March 20 and, as I recall the timeframe designation, there was a four-week time period then following the conclusion of this hearing and the submittal of posthearing briefs. So that's the issue.

Can this be fit into that four-week time period and still meet the deadline for filing those posthearing briefs?

MR. WILMOTH: Well, again, we'll make it work on our side.

ARBITRATOR DREHER: All right.

State of Kansas, what is your reaction?

MR. DRAPER: Your Honor, I think we need to keep in mind that we are -- we are proceeding on a somewhat abbreviated schedule here; we're not allowing ourselves to take all the time that we might in a normal proceeding. We have set a certain time period in which we would like to fully pursue the

Dispute Resolution process that is set out in the Decree. And so some of the preparations that we would normally make in terms of depositions and so on have had to be shorthanded in this proceeding. So we need to keep that in mind with respect to this issue also.

If the -- if the general timeframe can be maintained, I think we would be willing to work with that. I think we need to check some things just to see, one, if the Bureau of Reclamation would make them available for deposition; and if so, on what schedule; and whether that could -- that schedule could be accommodated within our present schedule.

So my recommendation at this point is that you allow us a little bit of time to check on those matters, confer further with the State of Nebraska and see if we can't propose a mutual solution to this issue.

ARBITRATOR DREHER: Okay. But, you know, at least for now, I do think Nebraska should have the opportunity to conduct the depositions, and I guess I'll wait to hear back from the States, either tomorrow or the next day. I'm not sure how long it will take you to check with the Bureau in

terms of what their availability would be.

I would be very surprised if they wouldn't make them available for deposition, given the fact that they were going to make them available for the hearing. So I would expect that they would make them available for the deposition, and I would hope that the deposition would be -- could be scheduled at their -- to maximize their convenience.

So, you know, I would hope that the attorneys involved could travel to them, for example. And so that, again, the idea being to do this in as short a time as possible to preserve that four-week time period for the posthearing briefs, that would be my goal, is to try to complete this within that timeframe and yet give Nebraska the opportunity that they feel they need to explore the underlying foundation and opinions.

MR. DRAPER: Very good. Just to be sure I'm understanding how you're approaching this, we would set up the depositions, get those taken and then reconvene in front of you for a short supplemental hearing for presentation and cross-examination of their testimony.

ARBITRATOR DREHER: That's correct. And the one thing that we would still have to decide is

when the States would want to offer their -- any closing statements that they would have, whether you would want that to follow that supplemental hearing, or whether you would want to go ahead with those here.

I would think you might want to wait and do that as part of the supplemental hearing as well. And the supplemental hearing, again, to make time work, from my perspective, it would not have to be conducted here in Denver, if that would help to expedite things.

We're talking about something no more than a day certainly, probably less than a day, I would think. And to expedite it, it makes sense to have that in Nebraska, for example, that would be -- that's acceptable to me.

MR. DRAPER: Very good. We'll pursue that. and I would expect that we might have something to report by tomorrow.

ARBITRATOR DREHER: Okay.

By way of introduction, and we talked about this during our last prehearing telephonic status conference, but by agreement amongst the States, the time for this hearing will be divided into three periods of three days each corresponding

to each of the major disputed issues in the following order:

First, will be the quantification of Nebraska's violation and Kansas' damages in 2005, 2006.

Second issue will be Kansas' proposed compliance plan.

And then third, Nebraska's proposed changes to the Republic River Compact Administration Accounting Procedures.

During the prehearing status conference that was held telephonically on Thursday, March 5, it was further agreed that, at least preliminarily, time during each three-day period for each major issue would be allocated as follows:

Nine hours for the direct case, six hours for the responsive case, and three hours for rebuttal. At least, preliminarily again, each State participating in a hearing on a major issue would generally be allocated equal time during the direct case. The State having the primary burden of proof on a major issue would have as much as about two-thirds of the time for the responsive and the rebuttal cases.

So using the first major issue of

Nebraska's violation and Kansas' damages as an example, Kansas would be allotted about three hours in the direct case for direct and redirect. Nebraska and Colorado would each be allotted about three hours for cross-examination. Then Nebraska and Colorado would be allotted about one hour each in the responsive case for direct and redirect, and Kansas would be allotted four hours for cross-examination. For rebuttal, Kansas would be allotted two hours for direct and redirect and Nebraska and Colorado would collectively be allocated one hour for cross-examination.

So preliminarily, for the first major issue, Kansas would be allotted a total of nine hours and Nebraska and Colorado would each be allotted about four and a half hours each.

And again, I want to stress that that allocation is preliminary and it's just a starting point and we'll collectively modify the time allocation, as we find necessary, for thorough examination and equity.

So is that description consistent with how you thought we had reached an agreement to proceed?

Mr. Draper?

MR. DRAPER: I think so. It's complicated enough that I'm a little confused, but I think that's right.

We did submit to you a hearing outline, and I actually sent a corrected one, I had failed to put in one of the changes requested by Nebraska. So that the latest one is the one that has the date on the lower right-hand side of the page. And I think what you said is consistent with that.

We do indicate, as Nebraska suggested, some of the timeframes set there, I think it's set up in a way that is consistent with what you said, if I understood you.

ARBITRATOR DREHER: Okay.

State of Nebraska?

MR. BLANKENAU: It's consistent, Mr. Arbitrator.

MR. AMPE: It's consistent, to the best of my recollection.

MR. WILMOTH: There is one point I would like to make, clarify, I guess, Mr. Arbitrator. And that is essentially what we have agreed happens to unused time.

We haven't really addressed this issue among ourselves, or with you; but it occurs to me

that there could be a circumstance in which a block of time is not utilized by one party, for some strategic reason or other. And we would like to suggest that if that is the case, that it not be summarily reallocated to another party. In other words, if one State decides that they would rather not utilize their entire block of time, that decision should be respected as the strategic decision it represents.

ARBITRATOR DREHER: Okay. So are you suggesting that that State then would reserve that time for some other issue then, or what?

MR. WILMOTH: Not necessarily. My suggestion is simply that that block of time not be reallocated to another State.

ARBITRATOR DREHER: Okay, understood.

MR. AMPE: I would have to request the State not using that time, but be willing to allocate it to another State.

MR. WILMOTH: Yes, correct.

ARBITRATOR DREHER: Okay.

We'll also take on each day a 15-minute break in the morning, as we talked about, and another 15-minute break in the afternoon. And then depending upon where we are, we'll take either an

hour or an hour-and-a-half break for lunch, depending upon what needs to be done in terms of giving the States opportunity to discuss amongst themselves how best to proceed with wherever we're at.

So with that, Mr. Draper, you can call your first witness.

MR. DRAPER: Thank you, Your Honor.

I might just say a few words to begin with, just to summarize the evidence that we're going to come with now in our direct case, and try to limit those to maybe five minutes at the most --

ARBITRATOR DREHER: That's fine.

MR. DRAPER: -- and then present our first witness.

By the way, would you like us to address you from the tables or from the podium?

ARBITRATOR DREHER: However you want to do it, whatever is most comfortable for you.

MR. DRAPER: Well, my first urge was to go to the podium, so I will do that. Thank you, Mr. Arbitrator.

I would like to briefly summarize the evidence that we expect to present. This will be very brief.

Our first witness today is Dale Book, one of our experts. He will testify with regard to the amount of the violation of the Final Settlement Stipulation and Decree, and as to the amount of water that was lost to users in the state of Kansas as a result of that violation.

He will be followed by Scott Ross, who will be testifying as a nonexpert describing the Kansas Bostwick Irrigation District and its operations. We'll often refer to that Irrigation District as KBID, K-B-I-D, if that's all right with you. And he, Mr. Ross, will generally describe the water operations that are relevant to this proceeding.

Mr. Ross will be followed by Professor Terry Kastens, our lead economic expert. He will testify with regard to the economic impacts of the Nebraska violation on the state of Kansas.

In addition, following Dr. Kastens will be Dr. John Leatherman, who will specifically address the secondary economic impact, that part of the violation that caused kind of a ripple effect through the state of Kansas as a result of the direct impacts to the farmers and water users.

So that's a brief listing of the

witnesses and the general areas of testimony. And if you don't have any preliminary questions, we'll call our first witness.

ARBITRATOR DREHER: You can go ahead and call your witness.

MR. DRAPER: We'll call Mr. Dale Book.

DALE BOOK,

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

DIRECT EXAMINATION

BY MR. DRAPER:

Q. Please state your name for the record.

A. Dale Book.

Q. What is your professional position and address?

A. I'm a consulting water resources engineer with the firm of Spronk Water Engineers. My address is 1000 Logan Street, Denver, Colorado.

Q. I would like to ask you and the examiner to turn to Kansas Exhibit 7, which is your CV.

Do you have a copy of that?

A. No, I don't.

Q. Mr. Book, in just a few words, would you describe your education and experience that relates to the matters in this hearing.

A. Yes. I have a bachelor's and master's degree in civil engineering. My master's degree was received in 1980. Subsequent to that, I began employment as a consulting water resources engineer in Denver, Colorado. I worked for a couple of firms before starting the firm with my partner, Spronk Water Engineers in 1984. I have been employed since 1984 as a principal of Spronk Water Engineers specializing in hydrology, water resources, water rights engineering.

Q. What is your current position at Spronk Water Engineers?

A. I am currently president and principal engineer at Spronk Water Engineers.

MR. DRAPER: Your Honor, I'm not going to belabor the qualifications of the witness. If it's an acceptable procedure to you, as with the following experts, I'll offer Mr. Book as an expert and it would be in the areas that we've already indicated to you and the parties, of water resources engineering, water rights engineering, hydrology and river basin modeling, including hydrologic modeling.

ARBITRATOR DREHER: Okay, that's fine.

Q (BY MR. DRAPER) I would now ask you to turn to Kansas Exhibit 1, Mr. Book. Do you have a

copy here?

A. Yes, I do.

Q. What is Exhibit No. 1?

A. Exhibit 1 is a report that I prepared describing the analysis of losses to Kansas water users resulting from overuse of the Republican River supply in Nebraska for the years 2005 and 2006.

Q. Did that include an analysis of the amount of the violations of the Final Settlement Stipulation?

A. Yes, it did. We relied on the accounting sheets from the RRCA, the Republican River Compact Administration, for the two years '05 and '06 to determine the amount of overuse in the state of Nebraska for the water short-year test at Guide Rock.

Q. And would you describe briefly the information that you relied upon for your analysis?

A. Yes. We started out with the RRCA accounting for those two years. We also utilized information regarding the Kansas Bostwick Irrigation District water supply for those two years. This is information that is supplied from the U.S. Bureau of Reclamation, as well as information that the District itself compiles.

I also obtained information from Kansas

Division of Water Resources related to water rights in the state of Kansas. In addition, we relied on some streamflow records which would be USGS-based information.

I have also relied on my personal experience and knowledge of the Republican River Basin and specifically the affected area in the state of Kansas in the Kansas Bostwick service area and on the Lower Republican River below the stateline in Kansas.

Q. Is the information and data from the Kansas Bostwick Irrigation District with regard to water use contained in Appendix C to your report?

A. Yes, it is. Appendix C is a set of tables with data or records for the Kansas Bostwick District for the years 1994 through 2007. Most of this information is compiled by the U.S. Bureau of Reclamation, and this includes information on diversions from the river, as well as deliveries to the water users in the KBID service area.

Q. And did you rely in part on the KBID Annual Reports for the years 2005 and 2006?

A. Yes, I did. I have provided a brief summary of information that the KBID District had compiled for these two years on the bottom of page 4

in the main text of my report.

MR. DRAPER: Now, I would note for the record that the two Annual Reports of KBID are Exhibits 24 and 25, Your Honor.

Q (BY MR. DRAPER) Did you rely on any input from members of the Kansas Department of Water Resources in developing your report?

A. Yes, I did. In preparing this analysis, I have relied on information and discussions that I have had with Scott Ross and David Barfield with the Kansas division.

Q. Was RRCA -- and when I say that, I should say, for the record, that stands for Republican River Compact Administration.

Was RRCA a Compact accounting part of your analysis?

A. I relied on the compilations of the RRCA Compact accounting to obtain the initial figures for overuse, which are presented in Attachments 1 and 2 at the back of the report. As part of that reliance, I am somewhat familiar with that accounting process and the basic content of that information.

The significant results that are necessary for my analysis are summarized in Attachment 1 and Attachment 2.

Q. And did you rely, in part, on the RRCA accounting spreadsheets for 2003 through 2006, which is Kansas Exhibit 22?

A. Yes, I did.

Q. Generally, how did you go about the accounting with respect to Compact compliance?

A. Well, the primary piece of information that I needed for this analysis was the status of Compact compliance for the two years '05 and '06, and that is summarized in Attachment 1. And the total that we're using for that year is 78,960 acre-feet of overuse at Guide Rock shown on the back of Attachment 1. So that forms the starting point for the analysis then of impacts to the state of Kansas.

Q. Just for clarification, Attachment 1 and Attachment 2 are the last two pages of your report?

A. Yes.

Q. And Attachment 2 includes what additional information?

A. In Attachment 2, we show the statewide status of allocations and CBCU for the state of Nebraska for each of the years 2003 through 2006.

Q. And how much did that amount to?

A. This shows a difference which represents an overuse averaging 35,320 acre-feet for those four

years.

ARBITRATOR DREHER: Excuse me, Mr. Draper. Can I ask Mr. Book a question?

MR. DRAPER: Please.

ARBITRATOR DREHER: The Attachment 2 values came from what was previously referenced as Exhibit -- I don't remember the exhibit number, but it was a spreadsheet that Mr. Draper referred to previously. Is that accurate? Am I getting -- which exhibit was that?

MR. DRAPER: That was Exhibit 22, I believe, Your Honor. Kansas Exhibit 22 is the RRCA Accounting Spreadsheets 2003-2006.

ARBITRATOR DREHER: And which of these -- if I understand this correctly, it's really only the values for 2003, 2004, 2005 that had been agreed to by the RRCA; is that accurate?

THE WITNESS: 2003 and 2004 were agreed to. I believe 2005, there was an outstanding issue related to the nonfederal evaporation, which you may have addressed in your ruling for this proceeding. My understanding was that that was outstanding for the year '05.

ARBITRATOR DREHER: Okay. At some point I would like clarification as to which -- I don't

care if it's from this witness or a different witness, but I need clarification which of these numbers have been formally adopted by the RRCA.

MR. DRAPER: We'll make sure to do that.

Q. (BY MR. DRAPER) Mr. Book, let me ask you to briefly describe, if I may, the features of the Kansas Bostwick Irrigation District that are important for your analysis?

A. Yes. I provided a map which shows the Kansas Bostwick Irrigation District, among other features. That is attached as, I believe it's Figure 1B, which is the KBID service area map.

KBID service area is served by the Courtland Canal beginning nearly at the Nebraska/Kansas stateline. It consists of about 43,000 acres of authorized acreage. Water supply is primarily storage regulated through both Harlan County Reservoir, which is upstream of the Courtland Canal, and Lovewell Reservoir, which is located in the state of Kansas.

The District is separated for purposes of recordkeeping and nomenclature to the Upper and Lower KBID area. Approximately one-third of the acreage is in the upper area above Lovewell Reservoir and about two-thirds of the acreage is below the

Lovewell Reservoir.

Water is diverted in the state of Nebraska and crosses the stateline in what I will be referring to as the stateline delivery location on the Courtland Canal. This is some 15 miles down the canal from the point of diversion.

Water is released from Harlan County Reservoir and delivered for direct irrigation to the Upper KBID service area, as well as through Lovewell Reservoir, with some reregulation in Lovewell for service in the Lower section.

At times when water supply is lower, wintertime diversions are made from the river to store water in Lovewell. During other parts of the record, there basically were not winter diversions when Lovewell was able to fill with White Rock Creek, which is the major tributary into Lovewell.

Q. Did you make an investigation of whether the KBID area has any significant access to groundwater to supplement project water?

A. Yes, I did. There is not significant groundwater available to serve the KBID service area. The area is not underlain by a river alluvium, per se, and the Ogallala aquifer does not extend into the KBID. So, by and large, the water supply for this

authorized acreage is the surface water from the project.

ARBITRATOR DREHER: Excuse me, Mr. Draper.

Mr. Book, when you say "not significant," significant is a relative term, so I mean, is there any groundwater available?

THE WITNESS: I believe you're going to hear testimony from Mr. Ross that on the order of 1500 acres may have access to groundwater through water rights that the State of Kansas administers. That's a relatively small amount. These are not large-producing wells because of the nature of the materials.

So, yes, there is some access to groundwater; but, in my view, it's not significant.

ARBITRATOR DREHER: And your understanding is it's about 1500 acres?

THE WITNESS: Yes.

ARBITRATOR DREHER: Please.

Q. (BY MR. DRAPER) Mr. Book, how did you determine the delivery efficiencies for the KBID system in determining how much water actually reached the fields, or would have reached the fields if the violations had not occurred?

A. Yes. As you're referring to the term "efficiencies" in the report, I have referred to that in relation to the Courtland Canal system, referring more to losses in the canal and lateral system. So when we're referring to the efficiency of the system, we're referring to the canal losses relative to the amount of water supplied to the District. That's different from on-farm irrigation efficiencies, which is also used in the analysis.

I relied on the fairly extensive data that the Bureau of Reclamation provides about water deliveries to the District. They do keep records of deliveries to the farm. So in addition to the diversions and the water available at the stateline and the releases out of Lovewell Reservoir, there are records of deliveries.

The Bureau then calculates from those records losses on the canals and the lateral systems. Those losses actually consist of both seepage as well as measured spills, wasteways or spills; and those are -- I'm not exactly sure of the level of measurement, but those are documented by the Bureau.

So there is good record of both diversions and deliveries which you can then use to develop the system efficiency for delivering water.

I use the efficiencies from the condition of the canal system under what I would characterize as more normal deliveries. Typically, the project strives to deliver 12 to 15 inches to the lands, and there is a fairly long record of the operation and the efficiency of the system under that mode of operation. The losses that did occur for the two years in question were considerably higher in terms of the ratio of losses.

The losses that I have calculated are based on efficiencies that the system can provide under the more normal water supply conditions, which reflects the amount of water that we calculated is available for these two years.

ARBITRATOR DREHER: If I may, Mr. Draper.

So you're saying that -- if I understood you correctly, the losses in 2005, 2006 were higher than normal; is that what you said?

THE WITNESS: They're proportionately higher.

ARBITRATOR DREHER: And that's because the water supply was reduced; is that my understanding?

THE WITNESS: Yes.

ARBITRATOR DREHER: Okay.

Q. (BY MR. DRAPER) Can you summarize your results with respect to the deliveries that would have occurred in the Kansas Bostwick Irrigation District if there had not been the violations that you determined?

A. Probably the best place to efficiently provide that description is on Table 2. I provide annual totals for a -- basically summarizing the entire analysis in that table.

Q. Where is Table 2 located in the report?

A. If you go behind the figures, there should be another divider page labeled "Tables," and then Table 2 is the second page in that section.

This provides for each of the two years of the total, basically a summary of the entire analysis starting with the overuse in Nebraska; but the additional farm deliveries to KBID are summarized as for the year '05, 22,384 acre-feet, and for the year 2006, 18,988 acre-feet.

Q. And how did those compare to the actual deliveries during those years, if you know?

A. Yes. Actually, I have tabulated the historical deliveries on the bottom of Table 1, which shows both historical, as well as combined with the

additional water.

The supplies for the two years respectively were approximately 12,600 acre-feet for 2005, and then the total with the additional is 34,985.

For the year 2006, the historical was 17,963, and with the additional supply that increased to 36,951.

Q. Now, in addition to the losses in the Kansas Bostwick Irrigation District, did you also analyze losses below KBID?

A. Yes, I did. The KBID area drains and provides return flows to the Republican River. You can see this on Figure 2, I believe -- Figure 1B, I'm sorry, which shows the Republican River through the bottom end of the -- east end of the KBID system.

The additional water that would have been available for delivery to KBID would have generated irrigation return flows, both from canal and the lateral seepage, as well as from on-farm return flows.

I made an estimate of the quantity of that return flow based on irrigation efficiencies reasonable for the mix of irrigation types in KBID.

The next step that I did was to obtain a

list of water rights and some information about the administration of water rights in this reach for these two specific years. That information was provided by Mr. Ross.

One note that I should make is the reference to MDS administration, minimum streamflow administration in the state of Kansas. This reach around the Concordia gage below KBID was under MDS administration, meaning that water rights junior to a certain priority were curtailed.

For that reason, I looked at the availability of senior surface water rights in this reach, and that's what I provided in the Appendix D table.

Q. And where are the results of your analysis of the losses below KBID shown?

A. Those are summarized on Table 2. Table 2 shows an estimate of the net return flows to the stream resulting from the additional water for these two years. And then in the fourth entry down near the bottom, a row entitled "Downstream Diversions" indicates the amount of those return flows that I estimated could have been diverted by this category of water rights on the river below KBID.

Q. Can you give us an example on Table 2,

say, for 2005 what those numbers are?

A. Yes. We estimated the return flows to the stream of 20,202 acre-feet and the diversions of that water of 4431 acre-feet. And then the remaining balance is listed in this table as additional flow available at Concordia.

The downstream diversions in this table were then used by the economists in their calculations in a similar way to the use of the KBID delivery data or estimates.

Q. So with respect to the downstream diversions below KBID for 2005, just comparing those numbers, somewhere in the area of 25 percent you considered would have been diverted?

A. Yes.

Q. Now, we will hear later about the Nebraska analysis of this.

Have you looked at what your major differences are between your analysis and Nebraska's?

A. Yes, I have.

Q. Would you list those for the Arbitrator, please.

A. I would classify that as four significant differences between the analysis that Nebraska is submitting and this analysis that I have

described here.

Now, the first relates to the year 2006 Harlan County evaporation allocation, as to whether that would be allocated in part to Nebraska and in part to Kansas. I believe Nebraska assumes that that is entirely allocated to the state of Kansas.

The second difference relates to how the conveyance loss between the Guide Rock diversion dam and the stateline is accounted for in the analysis.

My analysis deducted the consumptive use portion of those return flows consistent with the Compact administration accounting which charges that portion of the canal loss in Nebraska to the State of Kansas. Nebraska's analysis deducted an entire amount of canal loss in determining how much water was available at the stateline in the Courtland Canal.

The third difference is the effective system efficiency between the analysis that I have provided and the Nebraska analysis for deliveries from the canal and lateral system to the farms.

The Nebraska analysis assumed additional water would be assessed at an average loss rate, which resulted in overall losses for these two years higher than the usual loss rates for a better water

supply.

And the fourth difference relates to the amount of diversion on the Republican River below the KBID service area. The Nebraska analysis reduced the amount that was estimated to be diverted significantly from my result.

ARBITRATOR DREHER: Mr. Draper, if I could interrupt for a second.

So if I understand -- understand your testimony, Mr. Book, for 2006, you divided the Harlan County Lake evaporation in some fashion between Kansas and Nebraska; is that correct?

THE WITNESS: Yes, that's correct.

ARBITRATOR DREHER: And how was that division made?

THE WITNESS: It was under the proposal that the State of Kansas had made to the RRCA. I believe it's a 51/49 split, roughly. I didn't go back and check the exact percentage on that.

ARBITRATOR DREHER: And you also talked about the loss from the canal below Guide Rock in Nebraska, and you refer to the consumptive use portion. I'm not sure I completely understand that yet.

Could you help me out there?

THE WITNESS: Sure. There is a calculation that is done in the RRCA accounting sheets which determines CBCU and allocations of CBCU to the State of Kansas and to the State of Nebraska. There are two components charged to the State of Kansas that occur within the state of Nebraska.

The first is Harlan County Reservoir evaporation that we just discussed.

And the second is a portion of the transit loss that occurs between the river and the stateline on the Courtland Canal. And that is calculated in the RRCA accounting and charged to the State of Kansas, as opposed to consumption within the State of Nebraska that is charged to the State of Nebraska.

Basically, the RRCA accounting tabulates and charges consumptive use, including return flows from canal seepage. That's generally done throughout the basin. For this particular canal, that consumption is charged to the State of Kansas, instead of to the State of Nebraska.

ARBITRATOR DREHER: Let me rephrase it to make sure I understand it, then.

Let's say that hypothetically there were two units of consumptive -- of calculated

consumptive beneficial use in Nebraska and one unit of the calculated consumptive beneficial use in Kansas. Then Kansas would be assessed one-third of the losses that occurred in that portion of the canal in Nebraska; is that what you're saying?

THE WITNESS: Yes. It's physical consumption, so you take the transit loss and then you multiply that by an 18 percent consumption factor. The 18 percent is a factor that reduces the total canal seepage to a consumptive use part.

And actually, most of that is assessed against Kansas because much of the water in the Courtland Canal is delivered to the stateline.

ARBITRATOR DREHER: But if I recall -- and this is a question I was going to ask you a little later, but I'll ask it now.

If I remember correctly, the losses that -- in your analysis, that occurred in Nebraska that are attributable to Kansas were about, I think 2.33 percent of the additional water. And if I understand the Flatwater analysis, it was like 15 percent or something like that --

THE WITNESS: That's correct.

ARBITRATOR DREHER: -- of additional water?

So again, what you're saying is the losses that occur in the canal below Guide Rock in Nebraska, they're proportioned, or they're allocated in proportion to the consumptive use of that water in both states. Is that --

THE WITNESS: No.

ARBITRATOR DREHER: That's still not right?

THE WITNESS: When I'm referring to consumptive use, I'm referring to the actual consumption of transit loss in the state of Nebraska seeping out of the canal.

ARBITRATOR DREHER: But that has to be apportioned between the two states and that's what I'm trying to make sure I understand, is how that's apportioned between the two states.

THE WITNESS: Yes, there is -- there is also an apportionment between the Nebraska Bostwick and the State of Kansas to split that loss, you're correct.

ARBITRATOR DREHER: And it's split in proportion to the consumptive use that occurs or not?

THE WITNESS: I believe it's split in proportion to the deliveries --

ARBITRATOR DREHER: To the deliveries,

okay.

THE WITNESS: -- which would be the delivery to the Nebraska users and the delivery to the stateline.

ARBITRATOR DREHER: Okay. And I didn't -- I'm not sure I still understand this 18 percent factor that is referenced in one of the -- in one of your -- yeah, it's in Appendix B, the right-hand side of that table that's shown there, it says: Transportation losses that do not recharge 18 percent, in parenthesis. I assume that's the same 18 percent that you just referenced?

THE WITNESS: Yes.

ARBITRATOR DREHER: Can you explain that to me a little more what that means, what that 18 percent means.

THE WITNESS: Yes. That's a factor that's used in the RRCA accounting to determine how much of the canal seepage occurring above the stateline is consumed and chargeable as consumptive use.

ARBITRATOR DREHER: So it's consumed by growing crops or other vegetation; is that the idea?

THE WITNESS: It's before you get to the field, so it's evaporation of seepage.

ARBITRATOR DREHER: Okay.

THE WITNESS: It's just a factor to account for some consumption of canal seepage.

ARBITRATOR DREHER: So it's evaporation; is that correct?

THE WITNESS: Yes. There may be some phreatophyte use along the canal banks.

ARBITRATOR DREHER: Okay. And you also identified one of the major differences between your analysis and Nebraska's subsequent analysis is the diversions from the Republican River below KBID. And why the differences? Do you know why there is so much difference there?

THE WITNESS: Yes. Nebraska used a different assumption than I did in assessing the water that would be diverted of those return flows.

And if you would like, I can get to a detail of that right now. It relates to the tabulations of records made in Appendix D. And the assumption that I used was to compare the total diversions by these water rights in this reach for the two years '05 and '06 and compare them to the maximum annual diversion, which occurred in the year '94 to '04.

And as I show on the bottom of Appendix

D, I have taken the difference there as the amount diverted for '05 and '06. I believe Nebraska simply used the average number, as opposed to the maximum number. That's a simple way of stating the difference in the calculation.

ARBITRATOR DREHER: And why did you use the maximum diversion and why is that a better number, in your opinion?

THE WITNESS: I was trying to define the limitation on how much of that water would be used. My consideration is that this was an extremely dry period of time with low available water in this reach of the river and these water rights, generally in this area, were under MDS administration, meaning that water rights on some of the properties that may have been junior to the MDS date were off. And in my opinion, comparison of the return flows to the maximum amounts of diversion in this period is a reasonable estimate of what could have been diverted in this reach of the river by these water rights.

I believe when you take the final result and compare that to the amount of calculated return flows, it gives you a reasonable proportion. It's about 25 percent of the total return flows.

ARBITRATOR DREHER: Mr. Draper, do you

have other questions, or should I continue with mine at this point?

MR. DRAPER: I have no further questions of this witness, given the fact that you have had an opportunity to look at his report prior to today.

ARBITRATOR DREHER: I ought to clarify that the reason I didn't make a more formal acceptance of the witness as an expert is because the other States have already essentially accepted him, because they didn't object. So that's why I didn't go through any more than that.

I'm assuming that because, as of last week, there was no objection; I mean, he is considered an expert in these areas that you have offered him to testify.

MR. DRAPER: Very good.

ARBITRATOR DREHER: Mr. Book, let me start with, it's a disconnect that I have, and it may be my problem, not yours, okay. And the same thing occurs with Nebraska's evaluation of this.

During my deliberations on the legal issues that were raised, one of those issues had to do with the use of the dry-year administration for 2005.

And the way that I understand the Final

Settlement Stipulation is that the only reason to look at dry-year administration or dry-year compliance for 2005 is for the purpose of determining water-short year administration compliance in 2006 using a two-year average.

And yet, the shortages that you have calculated are based upon the RCA -- or RRCA accounting procedures for dry-year administration in 2005.

And I'm not sure I understand why. I mean, let me kind of lay out what I had in mind when I made the decision on the legal issues, and I was intending that during the hearing we would flush the technical facts out, you know, with some background.

I had expected to see the so-called shortages for 2006 calculated using the two-year average of 2005 and 2006. So if I would take the numbers as you presented them, I would have averaged the 2005 number of 42,860 with the 2006 number of 36,100 for a two-year average of 39,480. And whereas that is a calculated number, I mean, it is -- my understanding is it is how compliance with water-short year administration is supposed to be measured. It's supposed to be measured using a two-year average. So the shortage in 2006 would

have been the average of 2005-2006, not just the 2006 number. If that's correct, then the question is, well, what do you do about 2005?

And in the decision that I made on legal issues, it's clear to me that there was no grace period, as alleged by Nebraska. There couldn't have been, because the FSS could not change the obligations and responsibilities under the Compact; it couldn't do it.

So whatever the Compact obligations were in 2005, they were what they were. But I didn't, and I still don't, think it's appropriate to calculate the Compact obligations in 2005 using the water-short administration procedures in the FSS that, by the terms -- the expressed terms of the FSS, are not applicable until 2006. So what would I have done for 2005?

And what I expected to see, I guess, was an analysis that set forth Nebraska's computed consumptive beneficial use, including both surface water and groundwater, less imported water supply credits, comparing those against the allocations that are set forth directly in Article IV of the Republican River Compact with adjustments provided -- as provided at the end of Article III.

So, in other words, for 2005, where the water-short year administration procedures of the FSS, in my view, clearly don't apply, I would have compared the computed consumptive beneficial use subbasin by subbasin, less imported water supply credits, with the allocations that are set forth in the Compact.

Now, I recognize that that's sort of my construction because the FSS is silent what to do with Compact compliance prior to the schedule that is set forth in Appendix B of the FSS. That was the compliance schedule, and it didn't say, you know, what you're supposed to do before that.

So I simply took, backed up and said, Well, before then, the provisions in the Compact apply; it's clear that under the Supreme Court litigation that led to the FSS, that groundwater is to be included. And so I would have, again, determined the calculated beneficial use using both surface water and groundwater and then compared it, taking into account imported water supply credits, compared that against the allocations that are set forth in the Compact directly.

And I wouldn't have based -- and I'm interested in your reaction to that -- because I

don't think I would have based the shortages in 2005 on the water-short year procedures of the FSS, which I don't think are applicable until 2006.

THE WITNESS: Our view is that we're looking at the total amount of water, it's the 78,960, which is the total overuse for the two years '05 and '06, when the two-year test becomes applicable, that's for the year 2006.

When we're quantifying damages based on impacts to the State of Kansas, it seems to be the most reasonable way to split it into the two years and allocate the total between the two years.

There may be different ways you could allocate that total impact, but there is some effect on the calculated losses based on how much individual water you're looking at and distributing through the system for any given year.

And so to actually translate overuse into the water use conditions in the state of Kansas, you do need to split that into two years, and this seemed like a reasonable way to do that for us.

ARBITRATOR DREHER: But isn't it the same as what you -- what Kansas had proposed originally, that you take the two-year average and

multiply it by two? Isn't that the same number?

THE WITNESS: It's the same total, but it gives you a different number for each year. And maybe we're being more precise in the analysis of the conditions in '05 and the conditions in '06.

We had to make a decision about how to split this water between two specific years, two specific fact conditions. And so we did it based on this accounting for each of the two years.

ARBITRATOR DREHER: I'm looking for a specific provision here, bear with me a moment.

By using the method that you did, then essentially the overuse that you're calculating is the amount that Nebraska used beyond the supply from sources above Guide Rock?

THE WITNESS: Yes.

ARBITRATOR DREHER: And I don't have a sense for how different that is from the method that I outlined where you would calculate computed consumptive beneficial use for both surface water and groundwater in Nebraska, less imported water supply credits on a subbasin-by-subbasin basis and compare those numbers with the allocation set forth in Article IV of the Compact.

THE WITNESS: Yes. I don't have that

analysis with me. I -- you can compare the totals between Attachment 1 and Attachment 2 because Attachment 2 shows basinwide overuse and Attachment 1 shows that comparable calculation above Guide Rock, but that's on a total-basin basis without looking at the subbasins individually.

ARBITRATOR DREHER: And where is that again? I'm sorry.

THE WITNESS: On Attachment -- these are the two pages of the report. If you compare Attachment 1, which is above Guide Rock, with Attachment 2, which is basinwide for those same two years.

ARBITRATOR DREHER: There is some difference there. I mean, above Guide Rock the difference is 42,860 for 2005. And the difference -- and then in Attachment 2 the difference between allocation and computed beneficial consumptive use, minus imported water supply is 42,330 acre-feet.

THE WITNESS: Yes.

ARBITRATOR DREHER: And so that would be -- the difference of 42,330 acre-feet in Attachment 2 would be calculated based upon the total of the Nebraska allocations, as set forth in Article IV of the Compact?

THE WITNESS: Yes.

ARBITRATOR DREHER: I'll have to think about that, but if that's the case, then I guess using the process that I kind of outlined and using your numbers, which I guess are subject to disagreement at this point, but using your numbers, then, the shortage -- with the way I would have done it, the shortage for 2005 would have been 42,330-acre feet and the shortage for 2006 would have been the two-year average or 39,480 acre-feet, which would have resulted in about 530 acre-feet less overuse in 2005, but would have been 3380 acre-feet more overuse in 2006 --

THE WITNESS: Right.

ARBITRATOR DREHER: -- if I have done the math here correctly.

Well, since I expect to see you again during the rebuttal part of this, I guess I would ask you to think about that approach. And I would like your opinion, as well as Nebraska's opinion, on which of these two procedures are the most appropriate and why.

Okay. Setting that aside for the moment, do the 2006 values shown in Attachments 1 and 2, do those reflect credits for Nebraska making

additional water available from Harlan County Lake to the Kansas Bostwick Irrigation District through Nebraska's purchase of all of the water stored in Harlan County Lake for the Nebraska Bostwick Irrigation District? Was there any credit given for that?

THE WITNESS: Yes, it would. That would be in the records. The Compact accounting is done on the basis of records, both of consumptive use, as well as stateline deliveries, whether it is at Hardy or in the Courtland Canal. So whatever use is not done in Nebraska and whatever deliveries occur to the State of Kansas are reflected in the Compact accounting and in the allocation CBCU and the computed overuse.

ARBITRATOR DREHER: Somewhere I read, or I dreamt that I read it -- I read so much in the last weeks -- and maybe it wasn't a direct statement, maybe it was just an implication that the water that Nebraska provided in Harlan County Lake for use by the Kansas Bostwick Irrigation District was provided somewhat late, or the Kansas Bostwick irrigators didn't know it was going to be available to them. And the implication that I got out of whatever it was that I read was that the Kansas Bostwick Irrigation

District did not, or was not able to fully utilize the water that Nebraska had purchased in 2006.

And so the question is -- you know, Nebraska provided a certain amount of water, additional amount of water in Harlan County Lake for use by the Kansas Bostwick Irrigation District.

And the question is: Did the Kansas Bostwick Irrigation District fully utilize that water?

THE WITNESS: Yes. The issue you're describing actually, I think, applies to the year 2007. My -- my understanding of the records of Harlan County for 2006 is that it was drawn down to about the minimum that it could be drawn down in August; there was some water allocated. NBID did not use their water in 2006 and the Bureau made note that that water was available for KBID. It didn't result in very much water. I think the total release in '06 was a little over 12,000 acre-feet of water for KBID, which would have included both the NBID and the KBID water out of Harlan County; but the '06 operation was to draw Harlan County down as far as they could in '06.

Now, that was not the case in '07. And my recollection was your information related to '07.

ARBITRATOR DREHER: That could be. I just can't put my hands on where I had read that.

And you've already indicated that in your accounting, you split the evaporation in Harlan County Lake for 2006 between Kansas and Nebraska --

THE WITNESS: Yes.

ARBITRATOR DREHER: -- as opposed to assigning it 100 percent to Kansas?

And, you know, my prior decision on that issue, I mean, I think the accounting procedure should be modified so that the evaporation is split between the States, based upon how the water is used between the States, regardless of how it is used.

But having said that, I mean the language that was in the FSS is pretty explicit. And at least for the time being, I don't see that there is a basis in the FSS for dividing the evaporation between Kansas and Nebraska when only Kansas diverts water from Harlan County Lake for irrigation. I just don't see that.

So I am not sure how to make that adjustment in your numbers, but I would like to know how much -- and I don't think I can find it -- I'm reasonably confident I can't find it in your report -- how much of the evaporation from Harlan

County Lake you assigned to Nebraska that, under my interpretation of the FSS, would have been assigned to Kansas. So I would like to know what that number is.

THE WITNESS: I will check the details, but my understanding is it's about 8000 acre-feet.

ARBITRATOR DREHER: On page 2 of your report you outline the steps and the process that you used to compute the shortages that you presented, and there is a statement that says, quote, Compare the available supply with the normal demand and existing supply in KBID.

I guess to start with, I'm not sure what you mean by "normal demand," and I'm not sure what you mean by the phrase "existing supply in KBID." I am a little confused by that.

THE WITNESS: Yes. Maybe as an introductory comment, I would just refer you to a set of figures which are the loss factors or relationships that we used in our analysis between Figures 2, 3, 4, 5 and 6, and those show us specifically the application of the loss -- losses for the projected water supply.

Going back to item No. 2 on page 2, when I'm referring to the "available supply," that's the

amount of water that would have been available without the overuse in Nebraska.

When I refer to the "normal demand," that refers to the water supply that KBID can provide to its water users under full water supply condition, which has been 12 to 15 inches. And when I refer to the "existing supply," I'm referring to the specific water conditions for 2005 and 2006 when the amount of water available was somewhere on the order of about a third of the normal water supply.

And so what I am referring to here is the analysis of system efficiency, when we look at the available supply. If you would look at Figure 2, this is the first in these sets of loss charts, and this is a relationship between the canal loss between the stateline at Lovewell Reservoir as a function of the stateline flow for the season of April through September. And this plots to a fairly -- in my view, a significant relationship which shows the percentage of loss as a function of the amount of water. And this is based on the actual historical record.

The two points high on the graph are likely the '05 and '06 data, and the losses for those two years were significantly higher when you

compared the percentage of loss to the water supply available at the stateline.

When you go to Figure 3, which is a plot of the lateral losses, and this is separated between surface water, which we're referring to as waste, which is the measured tailwater, and the seepage, which is the lateral loss, we did not use a variable relationship with supply for those losses because it plotted fairly constantly, and so we used the constant percentages of 30 and 10, indicating a total lateral loss of 40 percent.

That relationship was assumed to hold over a range of supplies, in contrast to the canal loss, which is shown in Figure 2.

When I calculated the total canal loss for Figure 2, that was based on where the water supply would have been with the additional available water.

ARBITRATOR DREHER: Well, I guess part of what I'm struggling with is this idea of normal demand, and you have said that normally, KBID provides -- how many inches did you say?

THE WITNESS: 12 to 15.

ARBITRATOR DREHER: 12 to 15 inches.

And, you know, even in a dry-year

precipitation at an opportune time can reduce the amount of water that is actually needed.

So I'm struggling a little bit in basing the shortages from what -- from what would be a normal year without having a very good understanding of how the precipitation in 2005-2006 occurred, and what effect that had on the demand for irrigation.

So, you know, a cleaner approach -- and I'm not suggesting that -- I mean, I haven't decided yet what I think about all of this -- but a cleaner approach for me would have been to simply compare the available supply with the actual demand in each of the years 2005-2006, and not look at this concept of what would be a normal supply, I guess. I mean, what was the actual demand? What was the actual supply? That would have been easier for me to get my mind around.

THE WITNESS: Well, we didn't -- we didn't hit the full supply with the additional water in these two years. I would have done that if we would have reached the full 12 inches over the entire acreage. I didn't determine the acreage; the economist did that.

I determined the split between Upper KBID and Lower KBID and applied different loss

factors between the two, and then I determined the farm headgate delivery. And it was less than 12 inches on the full historically irrigated acreage.

Once it came in less than 12 inches, I didn't take the next step and evaluate whether there was enough precipitation in either of those two years to reduce the demand below the -- what they consider a normal supply.

ARBITRATOR DREHER: Right. And that's my point, I guess, is that even though those years were dry, again, if you had late season precipitation, the overall precipitation might have been less, but it could have served to reduce the actual demand from what might have been a considered a normal demand.

And you've already alluded to kind of my next question in Figure 2. You used this regression of historic losses to come up with a loss for the additional water supply and you pointed out that the two highest points, in terms of around the 40 percent area for loss, are likely 2005-2006.

And again, I just was wondering why not use the actual -- the actual values for 2005-2006. Why use the kind of a weighted average, I guess?

THE WITNESS: My conclusion, in looking at the data, was that for the canal losses, the loss totals are a function of the water supply. And as the water supply is lower, the loss percentage is higher -- the losses are not necessarily higher, but the loss percentage is higher. And so we wanted to use a loss percentage that represents the amount of water that we were going to have available here.

And I found that relationship for the canal loss above and below Lovewell. I did not find that relationship for the lateral loss, and so I used a constant loss rate for the laterals.

ARBITRATOR DREHER: Right. No, I understand what you did. I just was wondering why not use -- if it was possible to use actual values for 2005-2006.

And I think you've answered my next question. The procedures that you used to calculate the additional transportation losses from the Courtland Canal in Nebraska assigned to Kansas, that follows the procedures -- the accounting procedures in the RRCA accounting; is that correct?

THE WITNESS: Yes.

ARBITRATOR DREHER: Some of these questions you've already answered, that's why I'm

pausing to find one that you haven't.

In the fourth paragraph on page 5 you state that it was assumed that only one-half of the annual derived rate would occur for the additional loss in Lovewell Reservoir associated with a postulated additional supply.

Why was it assumed that only one-half of the annual derived rate would occur, rather than the whole annual rate?

THE WITNESS: The analysis that I did, because these two years had already significant amounts of wintertime diversions to get water from the river into Lovewell Reservoir, was that the additional water was going to be diverted during the diversion season of May through September. And these amounts of water fit within the capacity of the canal. That assumption reflects water available in Harlan County upon demand, and the operation at Lovewell during the irrigation season is to run water through the reservoir.

When I looked at the records and calculated the losses in Lovewell, I was using annual data, and it's a fairly complex comparison of inflows from White Rock Creek, inflows from Courtland Canal, which historically were mostly in

the summertime, except in dry years. And comparing that to spills and to deliveries into Courtland Canal below and doing a mass balance on the reservoir, I calculated an annual loss, which is reflected in Figure 3, I believe. And then based on my assumption that this water was going to be delivered through Courtland, I reduced that to half. I believe I still overestimated the incremental evaporation that would have occurred at Lovewell Reservoir with that operation.

ARBITRATOR DREHER: I think I see the subtle thing that I missed when I first saw that and that -- the annual losses reflect year-round deliveries from Harlan County Lake. And this additional water would not be delivered year-round; it would only be delivered during half or less of the year; is that accurate?

THE WITNESS: That's not quite correct on the first part.

They don't -- they don't actually release from Harlan County Lake to Courtland Canal in the wintertime. When they're running water in the wintertime, it's just river flow. There is a certain reach of river downstream of Harlan County above Guide Rock, and so wintertime operations are

limited to run-of-the-river type diversions that are at low rates.

And so when they divert in the wintertime, it's fairly low rates, but it's for storage in Lovewell Reservoir; whereas, during the irrigation season they're running it through the reservoir with a little bit of the realtime reregulation for the actual operations in Lower Courtland.

ARBITRATOR DREHER: Well, then maybe I don't understand what is the -- what is the quantity of water included within what you term the annual derived rate? Maybe I don't understand that.

THE WITNESS: Could you refer me to the --

ARBITRATOR DREHER: It would be the fourth paragraph on page 5.

THE WITNESS: Yes. I took the results from Figure 6, which is the Lovewell Reservoir loss relationship that we developed on an annual basis, and reduced that to half.

ARBITRATOR DREHER: Figure 6, though, shows the annual losses over what period of time?

THE WITNESS: This is the study period that we used, 1994 through 2007.

ARBITRATOR DREHER: But within a given year, what period of months do these losses occur?

THE WITNESS: This is annual.

ARBITRATOR DREHER: Okay, all right. That's what I thought --

THE WITNESS: Yes.

ARBITRATOR DREHER: And so the idea of the half, is that reducing it to half is that the additional water would only be in the system half of the year or less?

THE WITNESS: That's right.

ARBITRATOR DREHER: Okay, we're on the same page.

For the sake of counsel, the reason I'm getting into so much detail on this is because it really is the foundation for what comes after this. I mean, I want to make sure that whatever overuse occurred or didn't occur, whatever the case may be, that I understand how these various determinations were made, because it's foundational for what comes next. But I likely won't go into this much detail with all of the witnesses.

In the last paragraph on page 5 of your report you mention the fact that the Bureau of Reclamation records for 2005 indicate water -- some

water deliveries to the section of the Kansas Bostwick Irrigation District above Lovewell Reservoir, but the records of the Kansas Bostwick Irrigation District indicate that there were no deliveries in 2005.

Why the discrepancy? We're probably not talking about very much water, but it's curious to me, if water was delivered, why isn't it reflected in the Irrigation District records? And if it wasn't delivered, why is it reflected that it was in the Bureau records?

THE WITNESS: The quantity of water that was recorded by the Bureau records as being delivered is shown on Table 1, and there are two categories. There are water diverted by the -- from the upper canal directly out of the canal, and then there is water delivered through the laterals.

There were no diversions into the laterals. There was a total recorded of 561 acre-feet in the Bureau records, which I did not investigate the details of what that 561 acre-feet was and why the KBID did not register that water in their Annual Report.

ARBITRATOR DREHER: This is in Table 1?

THE WITNESS: Yes.

ARBITRATOR DREHER: And show me again -- oh, there it is.

THE WITNESS: Under the "Historical" column in 2005 --

ARBITRATOR DREHER: Yes.

THE WITNESS: -- in the "Above Lovewell," there is a category called "Upper Main Farm Headgate Delivery 561."

ARBITRATOR DREHER: Okay.

THE WITNESS: There was no water delivered into the laterals in that section, but that 561 showed up in the detailed Bureau records.

ARBITRATOR DREHER: And we don't know why it doesn't show up in the Irrigation District records?

THE WITNESS: I don't.

ARBITRATOR DREHER: And you may have said this already, and I just didn't catch it. What irrigation efficiency did you assume in estimating on farm return flows?

THE WITNESS: I didn't actually get that into the report. I used a weighted value between 65 percent for gravity systems and a return flow factor off of pivots of 12 percent, which reflects 85 percent irrigation efficiency and 3 percent

sprinkler loss.

I believe the weighted return flow was very close to 25 percent, but the District provides information on a periodic basis about the acreage under each type of system, sprinkler and gravity, and we used that to derive a weighted number.

ARBITRATOR DREHER: Tell me what those on farm efficiencies were again for flood irrigation numbers.

THE WITNESS: 65.

ARBITRATOR DREHER: And for sprinkler?

THE WITNESS: 85 percent, with an additional 3 percent spray loss.

ARBITRATOR DREHER: So how does that 3 percent, how do you factor that in? You subtract it from 85 percent?

THE WITNESS: No. The return flow is 12 percent of the amount applied.

ARBITRATOR DREHER: Okay. On page 6 of your report dealing with KBID Return Flows, implicit in your description for return flows resulting from the postulated additional water supplies associated with deep percolation, implicit in your description is the assumption that those return flows from deep percolation will reach downstream reaches of the

Republican River during the same irrigation season that any additional water supplies are used for irrigation.

Is that accurate?

THE WITNESS: Not totally. We looked at lagging it out a number of months, not multiple years, though. And so some of this water was considered unavailable because it came back after August of '06.

ARBITRATOR DREHER: And how did the lagging factors, were those based upon the Republican River Groundwater Model, or how did you determine what those lagging factors were?

THE WITNESS: No. The Republican River Groundwater Model does not cover this area. It does not extend downstream into Kansas and there is no Ogallala aquifer under the KBID.

I just used the uniform response over the year. It's basically a very simplified assumption. The primary assumption I'm making here is that return flows from this area reach the river in a fairly short timeframe, because of the existence of drainage systems and draws.

ARBITRATOR DREHER: Is it possible that you could provide me with the lagging analysis that

you used?

THE WITNESS: Yes, that's possible.

ARBITRATOR DREHER: And although Nebraska didn't seem to take issue with this, what was the basis for the assumed percentages of reduction of 10 percent for evaporation from canal and lateral losses and 5 percent for transmission losses for return flows reaching the Republican River?

This is the third paragraph on page 6.

THE WITNESS: I would say that's primarily my experience with modeling, river basin modeling, and sort of incidental loss factors.

Some modelers may assume all that water gets back, but there are -- there are aspects out there in the system that reduce the amount of water that returns back to the stream. And those are both evaporative effects on canal losses, as well as transmission losses, between the point of return flow into the drains and discharge back to the draws in the river. So those are approximations to account for some loss.

ARBITRATOR DREHER: So they're based on your judgment, rather than some particular analysis?

THE WITNESS: That's correct.

ARBITRATOR DREHER: Okay, that's the end of my questions.

MR. WILMOTH: Mr. Arbitrator, could we maybe take a five-minute bathroom break.

ARBITRATOR DREHER: It's actually 10 o'clock, and this is a good time for our 15-minute morning break.

(Break was taken from 10:00 to 10:20.).

ARBITRATOR DREHER: Mr. Wilmoth for the State of Nebraska.

CROSS-EXAMINATION

BY MR. WILMOTH:

Q. Good morning, Mr. Book, how are you?

A. Good morning, Mr. Wilmoth, I'm fine.

Q. Can you hear me all right with no microphone?

A. I prefer the microphone.

Q. Very good.

I wanted to refer your attention to the report which I believe will be Kansas Exhibit 1, Book report. Are you familiar with that document? Do you know which one I'm referring to?

A. Yes.

Q. I wanted to start with a couple of assumptions that you made in this report, if I may.

The first assumption appears to be that most of the water that you identify in your report would have been routed through Harlan County and made available during the irrigation growing season; is that correct?

A. Yes.

Q. And is that pattern of water delivery necessarily consistent with the historical delivery pattern?

A. Yes, I believe it is, for the most part. And in years of what I would consider to be normal water supply for the District prior to the dry years starting in '02, most of the water was taken through the Courtland Canal during the irrigation season.

Q. And is any water delivered at Guide Rock outside the irrigation season?

A. Yes.

Q. And do you have any idea what proportion is delivered outside the irrigation season?

A. It varies from time to time, depending on the water supply. If they don't need the water in Lovewell, then they don't divert outside the irrigation season. If you're in a period of low water supply, as started in about '02, then they were diverting available streamflow. Most of the time

during the winter, in those later years.

Q. So you don't think it's necessarily reasonable to expect that water would arrive outside the irrigation season?

A. Well, for purposes of this analysis, we assume that the additional water would have been made available upstream of Harlan County and available for regulation in Harlan County Reservoir. It's possible that some additional water could have been produced below Harlan County. I don't think that would have been a significant amount of additional water.

Q. But is it possible that in a normal year, that some of that water would be brought down the system outside the irrigation season?

A. Into Harlan County Reservoir. I think the normal operation at Harlan County is to limit releases to the irrigation season, so I would not expect that you would get water delivered through Harlan County in the off-season.

Q. One of the things that you heard Mr. -- the Arbitrator ask you about was this Harlan County evaporation issue.

Do you recall that line of questioning?

A. Yes.

Q. And do you have an opinion about how

your analysis would change if the Harlan County evaporation were charged to Kansas in 2006?

A. I think, as I mentioned, the difference is approximately 8000 acre-feet. And if the RRCA accounting is to be interpreted or redone such that all of the Harlan County evaporation is assessed against the State of Kansas, then you would simply reduce, at the front end of the analysis, that amount of water from the overuse.

I haven't worked through the accounting to see exactly what the specific number would be.

Q. But using your estimate of 8000 acre-feet, you would essentially go from 78,960 down to 70,960, give or take?

A. Yes.

Q. And how would that translate through the rest of your report? How would it affect the final numbers in your report as to the on-farm deliveries and the below KBID losses?

A. Well, it would create a reduction. The translation to the stateline is basically a linear calculation, so that would be proportional.

The reduction in deliveries to the farms would not quite be proportional because of the variable loss function we're using for the canal

losses. I have used a constant factor for the reservoir loss and for the lateral losses. So to that extent, it would be a linear -- or proportional effect. It would not, in my view, significantly affect the amount of water considered divertible of return flow.

Q. And why is that?

A. Because that estimate was limited based on the diversions by the water rights in Appendix D, and it was limited to an amount significantly below the computed return flows.

Q. I would like to direct your attention to page 3 and talk to you a bit about transit losses between Guide Rock and the stateline.

You have a table at the top of page 3, and I believe the right-hand -- I'm sorry, the second column in from the right identifies that number; is that correct?

A. Yes.

Q. And for 2005, what is that number?

A. 1000 acre-feet.

Q. And so I understand that, that is the amount of losses that you attributed to that reach between Guide Rock and the stateline in the Courtland Canal?

A. That's the amount of losses that I deducted from the amount of water Kansas would have received at the stateline, and it reflects the consumption portion of the canal loss in Nebraska.

Q. And is that number, in fact, approximately 2.3 percent of the total?

A. Yes.

Q. And was that figure derived from Appendix B in your report?

A. Yes.

Q. And if I look at Appendix B, it appears that actual -- actual losses for 2005 were somewhere on the order of 17.8 percent; is that correct?

A. Yes, that's correct.

Q. So if actual losses in 2005 in the Courtland Canal were 17.8 percent, why did you elect to use the 2.3 percent figure?

A. We deducted the amount of consumptive use which is allocated to the State of Kansas, and I basically made the assumption that the balance of the overuse in Nebraska would be available at the stateline for use in Kansas.

Q. What is that assumption based on?

A. That the amount of diversion into the Courtland Canal is not limited by the amount of

overuse by the State of Nebraska, so there is an assumption there that the water would have been available to provide the overuse amount at the stateline.

Q. Is that somewhat equivalent to saying that that additional increment would have kind of floated on top of water that went into the canal and reduce the losses; is that what you're saying?

A. I think that's -- that's the sort of result of that assumption. There were significantly larger transit losses in the canal for '05 and '06.

Q. Because the conditions were dry; is that correct?

A. Yes, the amount of diversion was significantly lower than the normal diversion.

Q. And so if I'm understanding your testimony, you have essentially segregated this additional block of water from the block that actually flowed in the canal; is that correct?

A. I don't know what you mean by "the additional block of water."

Q. The block that you determined would have been available, but for the violation.

A. Yes. The assumption was that the overuse would be available at the stateline, and

there may need to be some additional water to carry that to the stateline.

Q. What I'm having a hard reconciling is how the actual losses would not have operated on that water?

A. Well, they would have. My calculation didn't actually calculate the amount of river headgate diversion at the head of the Courtland Canal.

Q. So your calculation is not based on the actual gaged data?

A. Yes, it is. The calculation basically starts at the stateline, but this amount of water would be delivered to the stateline, which is the amount of overuse reduced by the amount of consumption assigned to the State of Kansas. And then physically some additional water may have been needed at the headgate or the losses that were already accruing would not have increased that much more with this larger supply of water.

Q. Do you understand that Nebraska's compliance point is the Guide Rock gage?

A. Yes.

Q. And all losses in the Courtland Canal are assigned to Kansas, are they not?

A. I don't understand what you mean by "assigned."

Q. Seepage losses are accounted for on the Kansas side of the ledger?

A. Well, not in the RRCA accounting. In the RRCA accounting, the only loss that is attributable to Kansas is the 18 percent consumptive use part of the seepage.

Q. In terms of actual water, though, which is what we're trying to talk about, if the compliance point is Guide Rock and we are trying to come up with an increment of water that would have been at the stateline, don't we need to look at the physical amount of water?

A. It's possible. But as I said before, the amount of water diverted at Guide Rock is not limited by -- it's not necessarily limited to the amount of the Nebraska overuse.

Q. But if we just do a straight application, for example, of the 17.8 percent loss that actually occurred in '05 to that water as a physical matter, why would that be incorrect?

A. Well, that would calculate a physical loss between the headgate and the stateline, but that does not necessarily mean that the headgate would

have been limited to that amount of the overuse by Nebraska.

Q. But aren't you trying to determine how much water would have been delivered to the stateline? And in doing that, would it not be reasonable to apply the actual gage data?

A. Yes. It's also possible that additional water would have been available -- could have been available above and beyond the amount of overuse at Guide Rock.

ARBITRATOR DREHER: Let me interrupt for a minute.

What additional water could have been available?

THE WITNESS: Water above and beyond the amount of overuse of Harlan County, for one example.

In this case for these two years, the amount of the -- the percentage of transit loss was quite a bit higher for these two years than would have occurred. So some of the transit loss had already accrued because the percentage of transit loss was quite a bit higher.

ARBITRATOR DREHER: I'm not sure -- I mean, you talked about some additional water could have been available, and I'm trying to figure out

from what source. And I assume you mean at Guide Rock, some additional water could have been available at Guide Rock?

THE WITNESS: Yes.

ARBITRATOR DREHER: From what source?

THE WITNESS: Possibly from Harlan County Reservoir.

ARBITRATOR DREHER: Go ahead, I'm sorry.

Q. (BY MR. WILMOTH) Under what circumstances would Nebraska make that overdelivery of that additional water?

A. Well, if it was available.

Q. But then there wouldn't be a violation, would there?

A. Well, the amount of overuse is based on the Nebraska consumptive use.

Q. But if Nebraska had delivered the volume that you're referring to, why would she send out additional water?

A. Well, it's possible that that water was available already.

Q. What I'm suggesting, I guess, is if the compliance delivery point is Guide Rock and we're trying to ascertain physically how much water would have reached the stateline from that point, I'm not

talking about a matter of accounting procedures, but physically how much water would have reached the stateline, which number would you apply from your Appendix B?

A. Well, if you limited the diversion to the amount of overuse at Guide Rock, then the diversion at stateline would be less.

Q. By how much, do you have an opinion?

A. 10 percent. That would be the 12 -- I believe it's 12 percent in round numbers for historical physical loss and we took the 2.3 percent, so it would be the difference between those two numbers.

Q. So you would elect to apply the 12 percent, rather than the actual loss of 17.8 percent that occurred in 2005?

A. Yes. The 12 percent would correspond to a more normal or larger water supply that we would be discussing here with these quantities of water.

Q. So if I'm understanding you correctly, just to finalize this point, we're talking about trying to ascertain the physical amount of water that would have reached the stateline, the loss number would be 12.9 percent, correct?

A. Yes.

Q. Thank you.

And I don't suppose you have got a calculator up there, but in round numbers, that would be about 5000 acre-feet?

A. That sounds right, yes.

Q. Thank you.

If I understand the way that you did conduct the analysis of this Guide Rock to stateline loss, you based that on some percentage relating to how NBID and KBID would have -- Nebraska Bostwick Irrigation District and the Kansas Bostwick Irrigation District would have diverted or consumed that water; is that correct?

A. That may be a reasonable representation. We derived it in the table in Appendix B, which shows the historical amount of the consumptive use attributable to the State of Kansas as a function of the total Courtland Canal diversion. So I guess you're right, that some of those years, probably most of those years, have some small amount of KBID diversions in those.

Q. And using your allocation of that volume, how did you account for the fact that Nebraska Bostwick did not take water in '06?

A. I used the average percent over this

entire '95 to '06 period, so to the extent that KBID diversions would affect that number, they're not factored out separately.

That might be another way of saying there is an assumption that KBID may have been diverting with compliance.

Q. One of the things I believe I heard you indicate in response to questioning from the Arbitrator was that there was approximately 1500 acres that had access to groundwater within KBID; is that correct?

A. That's my understanding from KDWR.

Q. And how did you take that into account in your report?

A. I consider that to be an insignificant amount of potential acreage that could receive pumped water and simply calculated the additional farm headgate delivery of this water and then provided that number to the economist. The economist did not ask me, nor did I calculate, any potential offsets of shortage by additional pumping in KBID.

Q. Is that another way of saying it's not accounted for in your report?

A. My report, the purpose is simply to calculate how much additional surface water would

have been delivered to the KBID fields. So, yes, it didn't deal with any changes in irrigation well pumping associated with the 1500 acres.

Q. Thank you.

Keeping on this theme of potential alternative water supplies, I believe you heard a question from the Arbitrator about the timing of precipitation that was received in KBID during 2005 and 2006.

Do you recall that line of questioning?

A. Yes.

Q. How did you account for that potential alternative supply in your report?

A. I calculated the amount of additional water that was available without the overuse. And then when I completed that calculation, I compared that to the amount of acreage that was not served actually in these two years but, based on the records, would have been served from normal water supply; and also looking at the depths of water that this result indicated; and because that was less than the normal water supply of 12 to 15 inches, I did not do any separate calculation of precipitation event in these two years.

Q. Assume for the sake of my next question

that there were 45 inches of precipitation in 2005.

Would your report reach the same conclusion?

A. I suspect the calculation of the amount of water available for delivery to the fields would have been the same. I probably would have stepped back and looked at whether it would be reasonable that they would have pulled that much out of Harlan County.

Q. I believe your testimony earlier indicated that you did not believe in 2006 that any water was left in Harlan County Lake?

A. That's correct, yes.

Q. Do you know whether that was true in 2005, specifically whether KBID elected not to call for water in 2005?

A. That was not true in 2005. I believe there was water not taken from Harlan County Reservoir that year.

Q. Do you have any idea how much water that would be?

A. My recollection of the records is approximate, but it seemed to be on the order of 10,000 acre-feet, which was full. I don't know how much of that was NBID water and how much of that was

KBID water. The water in Harlan County was split between the two Districts.

Q. Do you know why that water was not taken?

A. I believe the Bureau had said it would not be available to take that year.

Q. Do you know why?

A. I don't know the details of that, no.

Q. But to your knowledge, that wasn't a conscious decision by the State of Kansas?

A. Could you repeat that question.

Q. To your knowledge, it was not a conscious decision by the State of Kansas to leave water in Harlan County Lake?

A. No, it was not.

Q. Or by KBID, I should say?

A. I don't know about KBID.

Q. So it's possible that KBID voluntarily elected to leave some water in Harlan County Lake in 2005?

A. As I said, that would depend on what -- what limitations the Bureau had placed on releases that year.

MR. WILMOTH: Mr. Arbitrator, if I may, I have an exhibit to hand to the witness.

ARBITRATOR DREHER: Please, that's fine.

MR. WILMOTH: And I have copies for everyone. I'm not sure, since we haven't really started the official exhibit list, if you want to maybe hold this in abeyance until we do that, or if you want me to -- I would hate to think this would be Exhibit 1, when we have a report.

ARBITRATOR DREHER: Since he is going to submit the exhibits for Kansas at the end, let's hold off on the formal submission --

MR. WILMOTH: Okay.

ARBITRATOR DREHER: -- at the end, but you can proceed to hand it to the witness.

MR. WILMOTH: For sake of argument, we can call this Nebraska 1.

ARBITRATOR DREHER: Sure. Do you have a copy for, me by chance?

MR. WILMOTH: I do, of course. I should have six for everyone. Does anyone not have one?

Q. (BY MR. WILMOTH) Mr. Book, could you please take a moment to look at this document and tell me if you recognize this document.

A. Yes, I recognize this. I believe we discussed it in my deposition.

And do you have an opinion about the

meaning of the bullet point on this first page?

A. No, I don't.

Q. Do you see in the middle of that bullet point where it says "not call for 2005 irrigation season storage releases from Harlan County Lake"?

A. Yes, I see that.

Q. And does it appear to you that that is a request from the Kansas Bostwick Irrigation District?

A. I believe it's a request from the Kansas Water Office to the Bureau. I don't -- I don't know if there was any participation by KBID in this -- on this point or not.

Q. Are you familiar with this kind of program, in general?

A. No, not really.

Q. If Kansas Bostwick Irrigation District had elected not to call for water in 2005, would that have affected your report at all?

A. No, because I did my calculation based on the availability of the amount of overuse by the State of Nebraska. I suspect that if a water supply at that level would have been available, that this type of an activity would not have occurred.

Q. A little bit farther down the system now, let's talk a little bit about Lovewell Reservoir

operations for a moment.

I believe you mentioned, in response to a question by the Arbitrator, that you reduced evaporation by about half of the annual derived; is that correct?

A. Yes. I don't think that should be characterized solely as evaporation loss, because it was based on a mass balance of the reservoir, so it's probably some combination of evaporation and seepage.

We didn't specifically calculate the evaporation loss, and it was based on an annual mass balance that we then reduced to half for our calculations.

Q. And if you could repeat the basis for that reduction, the 50 percent reduction.

A. Yes. That was based on the assumption used in the analysis that the additional water would have been provided primarily, if not entirely, within the irrigation season and essentially delivered through Lovewell Reservoir with minimal retention time.

Q. And in your experience, typically does evaporation increase or decrease during the summer months?

A. It's higher in the summer months.

Q. Does your analysis take that into account?

A. Yes, I believe it does.

Q. How so?

A. Just that I was assuming very limited reregulation of this water through Lovewell was going to be necessary. So effectively, there wasn't going to be the opportunity for much evaporation from Lovewell Reservoir.

Q. So the residence time in the reservoir would be very short; is that what you're suggesting?

A. Yes.

Q. And that assumption was based on what?

A. The assumption that this water would be delivered primarily during the irrigation season and used concurrently -- not exactly concurrently, but within the season with limited storage necessary.

Q. Are there any other limitations on Lovewell storage that you're aware of?

A. Well, yes. There is the limit on capacity, so you can only hold so much water in Lovewell and Corps does allow for storage in the flood control pool, at times.

Q. And to your knowledge, during 2005 or 2006, was that ever occurring?

A. I'm not sure.

Q. If that were occurring, would it affect your analysis at all?

A. No.

Q. So the inability to put additional water in Lovewell Reservoir would have no bearing on your analysis?

A. The basic assumption I made was that the water was going to be available during the irrigation season on call from Harlan County Reservoir and the operation at Lovewell would be, or could be a pass-through operation if there was not available capacity.

Q. You mentioned earlier that in Appendix D in your report you relied on the maximum historical use for the period 1994 to 2004 to determine the volume of water used below KBID; is that correct?

A. Yes.

Q. And what analysis did you conduct to determine that that water might actually be utilized?

A. I relied primarily on the descriptions provided to me by KDWR, Mr. Barfield and Mr. Ross, about the nature of the water rights in that reach of the river, the low streamflow conditions that were prevalent during those two years and the

administration of MDS. And then in compiling the records and reviewing those, convincing myself that there were active surface water rights in that reach of the river that were diverting less than they could have.

Q. And do you have a copy of your report handy?

A. Yes.

Q. Could you please look at Exhibit D for me for a moment?

ARBITRATOR DREHER: Excuse me, do you mean Attachment D?

MR. WILMOTH: I believe this is Appendix D, excuse me.

ARBITRATOR DREHER: Appendix D, okay.

MR. WILMOTH: Appendix D.

Q. (BY MR. WILMOTH) And if you look down about the tenth, right down, you see an irrigation right that looks to be numbered 32412?

A. Yes.

Q. Do you see that right?

A. Yes.

Q. And when was the last time that that individual utilized water?

A. 1999.

Q. And that was the volume that you used in determining what they would use in 2005 and 2006?

A. That was the volume that went into calculating the maximum amount of diversions which we then see at the bottom, yes.

Q. And did you make any effort to determine why that individual had not utilized water for the past six years?

A. No, I did not.

Q. Do you know if anyone in the state of Kansas did?

A. I don't know.

MR. WILMOTH: I believe that concludes our cross.

ARBITRATOR DREHER: Thank you.

Colorado?

MR. AMPE: No cross, thank you.

ARBITRATOR DREHER: Mr. Draper, would you like five minutes?

MR. DRAPER: Yes, please.

ARBITRATOR DREHER: Go off the record.

(Break was taken from 11:00 to 11:12.)

ARBITRATOR DREHER: We can go back on the record.

Mr. Draper, before you begin your

redirect, can I ask one last question of Mr. Book.

This is a follow-up to Nebraska's question that was asked pertaining to your use of Appendix D. And they used the example of Water Right No. 32412.

THE WITNESS: Yes.

ARBITRATOR DREHER: If you would, go down another five or six lines to Right No. 6592.

THE WITNESS: Yes.

ARBITRATOR DREHER: So in that case, their maximum diversion from 1994 through 2004 was 124.8?

THE WITNESS: Yes.

ARBITRATOR DREHER: And so you would have assumed that they could divert up to 124.8?

THE WITNESS: Yes. I notice that they're over their authorized quantity there and that there is probably a group of three water rights there with equivalent -- well, actually, there is more than three. So this analysis of this water rights list was not close enough to look at overlapping water rights and things like that; but yes, I assume that the diversion of 124 was part of the maximum that I assumed.

ARBITRATOR DREHER: Even though the

authorized rate was limited to 83?

THE WITNESS: Yes. And again, that's because there is overlapping water rights out there.

ARBITRATOR DREHER: How can you tell that this has overlap with other water rights?

THE WITNESS: I don't know specifically that that's the case. I just know generally that that happens out there.

ARBITRATOR DREHER: So if you back up to, say, Right No. 51273, the maximum diversion between 1994 and 2004 was 393.9?

THE WITNESS: Yes.

ARBITRATOR DREHER: And again, that's well over the authorized maximum rate of 212. And your assumption, again, is that it's part of an overlap?

THE WITNESS: Yes. There is a number of water rights in this list with zero maximums.

ARBITRATOR DREHER: And again, this follows kind of along the line of the question that Nebraska posed to you; but back now to this 6592 right, the last year that that right diverted was 1996 -- or no, excuse me --

THE WITNESS: 1997.

ARBITRATOR DREHER: 1997?

THE WITNESS: Yes.

ARBITRATOR DREHER: So that right -- as of 2006, that right hadn't diverted for nine or ten years; and you assumed that if water had been available, that right would have diverted up to 124.6?

THE WITNESS: Yes, the diversions would have occurred up to that level. This is indicative of water use in this reach.

ARBITRATOR DREHER: All right, thank you.

MR. DRAPER: One clarifying question, if I may.

ARBITRATOR DREHER: Sure.

REDIRECT EXAMINATION

BY MR. DRAPER:

Q. The numbers that have been referred to as "water rights" in the first column on the left-hand side of the table, which is Appendix D, are those water rights? Does that indicate water rights or something else?

A. That's a point of the diversion identification number, which is distinct from a specific water right number in the Kansas system.

Q. And so does that help explain

why you made the assumptions you did in your analysis?

A. Yes, I believe it does.

Q. And would you say just once more why you felt it was appropriate to make the assumptions you did for the points of diversion, as opposed to the authorized quantities for the water rights?

A. Well, we are looking at physical facilities on the stream and the Kansas water right system has multiple water rights per point of diversion, and it's possible that water right diversion amounts get totaled when reported to specific points of diversion corresponding to multiple water rights.

MR. DRAPER: Thank you.

ARBITRATOR DREHER: You may proceed.

MR. DRAPER: No further questions of Mr. Book.

So we would call our second witness, if we may. Mr. Scott Ross, if you would come to the stand.

MR. WILMOTH: Mr. Draper, this is a point where I understand that Mr. Ross is testifying as a nonexpert lay witness.

MR. DRAPER: That's correct.

SCOTT ROSS,

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

ARBITRATOR DREHER: Thank you. You may be seated.

MR. DRAPER: One housekeeping matter. We're compiling a list of exhibits that Mr. Book testified to, and we'll move that at some point shortly.

If I may, I'll go ahead and try staying at the table. See how that works for everybody.

ARBITRATOR DREHER: That's fine. Whatever you feel most comfortable with, that's fine with me.

DIRECT EXAMINATION

BY MR. DRAPER:

Q. Mr. Ross, please state your full name and your business position and address.

A. Scott E. Ross, Water Commissioner, Kansas Department of Agriculture, Division of Water Resources, 820 South Walnut, Stockton, Kansas.

Q. Mr. Ross, do you have with you a copy of Kansas Exhibit 30, your curriculum vitae?

A. No, I don't.

Q. Referring to Kansas Exhibit 30, would

you please state briefly your background as it relates to this proceeding with regard to the Republican River Basin.

A. Yes. I graduated with a bachelor of science degree in geology in 1977. Initially worked in U.S. Fish and Wildlife Service at Kirwin Reservoir. In 1978, moved to the McCook field office of the Bureau of Reclamation. Was there until 1981, at which time I took a position as an assistant water commissioner at the Stockton field office and was assistant until 1989. And in March of 1989, I became water commissioner of the Stockton field office.

As water commissioner of the Stockton field office, I have occasion to -- our field office covers the northwest one-third of Kansas, including all of the Upper Republican subbasins and the majority of the Lower Republican.

Q. Let me just ask, do you hail from the Republican Basin yourself?

A. Yes. I was born and raised in the upper basin. I was born in St. Francis and grew up in Atwood and lived there and worked there all my life.

Q. You were an employee of the Bureau of Reclamation during your professional career?

A. That's correct.

Q. What did that consist of?

A. I was the project coordinator for the Young Adult Conservation Corps, and we had occasion to -- or I had occasion to supervise a lot of various projects throughout the basin, including some of the -- supervised some of the design work on various instrumentation of canals, reservoirs; had staff that worked on and I personally did a few of the inspections on the drainage system in Kansas Bostwick during that period of 1978 to 1981.

Q. And when did you move to the Kansas Department of Water Resources field office?

A. In June of 1981.

Q. What were your responsibilities and activities in that position?

A. As Assistant Water Commissioner, I was basically a field personnel. I did a lot of testing of irrigation water rights, certification of water rights. Had occasion to do investigations, hydraulic investigations on impairments, administration of water on various surface water and groundwater systems. Had occasion to inspect diversion works within the KBID system, as well as some of the other systems.

Q. So your responsibilities include the

Kansas Bostwick Irrigation District area?

A. Yes, they do.

Q. And the operations that supply water to that system?

A. Yes.

Q. And have you had occasion to visit various parts of the basin as a result of your duties, both in Nebraska and Kansas?

A. Oh, yes, frequently.

Q. When did you become commissioner for northwest Kansas?

A. March 19, 1989.

Q. And what are your responsibilities in that position?

A. Generally coordinating with various different agencies and our headquarters and supervising 11 staff in the conduct of the duties and the responsibilities of the field office. That includes a water structures engineer in our office. I have a Republican River field person in the office and I have Basin team employee in our office. The remaining staff are in support of the water appropriations section, deal with water rights and certification approval of new apps, that sort of thing.

Q. As part of your responsibilities, do you have occasion to interact with the KBID officers and water users?

A. Yes.

Q. What do those typically consist of?

A. During times of shortage or if there are significant issues as far as some of their patrons or their delivery systems, we will communicate as far as some of the resolution of those problems. That might be various water supply issues.

We occasionally have coordinated with the field office in Nebraska regarding the deliveries to Guide Rock, bypasses going past Guide Rock, those sorts of things. Also have occasion to deal with them in terms of what was part of the contract renewal negotiations for their recent contract renewal with the Bureau of Reclamation. So I -- they vary.

Q. Do you have any responsibilities with regard to the Republican River Compact Administration?

A. Yes. I'm currently a member of the Engineering Committee and have been involved in that since 1985.

Q. You've been involved with the

Engineering Committee since 1985?

A. Actually been on the Engineering Committee since about 2000 and have been involved with the Engineering Committee providing support to the various members of the committee since 1989 -- excuse me, 1985.

Q. And you're currently the Kansas representative on the Engineering Committee?

A. I'm one of them, yes.

Q. Would you please describe the Kansas Bostwick system as it relates to Harlan County Reservoir, how the water is supplied through that project and how it is used within the project.

A. Yes. Beginning at Harlan County Reservoir, it is operated by the Corps of Engineers, but the irrigation portion of it is operated by the Bureau of Reclamation. So Kenny Nelson is the manager of Kansas Bostwick Irrigation District, but he is typically the contact, coordinator for -- the Bureau of Reclamation views Nebraska Bostwick and Kansas Bostwick as cumulatively the Bostwick division.

So Kenny typically acts as a liaison and sort of operator at the Guide Rock diversion dam. So on any given -- any given day during the irrigation

season after they have elected to begin irrigation releases, Kenny will make an assessment of the river supplies, make -- coordinate with Nebraska Bostwick Irrigation District and make an assessment on whether or not he needs to increase or decrease the releases from Harlan County to Guide Rock diversion dam.

Then once it gets to Guide Rock diversion dam, the decision is made how much will go to Nebraska Bostwick and how much will go into Kansas Bostwick. The Kansas Bostwick diversion then travels those some 15 miles down the Courtland Canal, a place where we call the Stateline gage at the Kansas/Nebraska stateline.

There is a gage station operated there by the U.S. Bureau -- excuse me, the U.S. Geological Survey, and that determines the amount of water that is actually being delivered to Kansas at that point.

Then a decision is made depending on the year and the timing and the demand, water is either diverted down the Courtland Canal to the upper part of the basin and various laterals in the upper division, essentially about the upper one-third of the District or the northern one-third of the District.

All or a portion of the water on any

given day may be delivered either to the upper District or delivered to Lovewell Reservoir through a canal going into the Lovewell Reservoir and then redistributed to the Lower District from Lovewell itself. And those operations are regulated on a daily basis.

The ditch rider, or the guy that is actually out there on the ground doing the work, his first order of the day is to determine what the wasteways are doing, and he makes a typically plus or minus 1 cfs measurement through a weir at the end of those wasteways and then puts any call for water. He knows how much is needed and how much is going through the system.

So ultimately, that's the point that Mr. Book referenced as having measured waste. Those are done on a daily basis and reported to Kansas Bostwick as part of their water -- daily water orders.

Then that operation continues through the irrigation season, basically the delivering water either to Lovewell Reservoir or to the irrigators within the District.

Q. Overall, what are the general uses made of water stored in Harlan County Reservoir?

A. To my knowledge, they're all irrigation. I'm not aware of any other -- there are official wildlife uses, of course, and recreational uses by the State of Nebraska; but as far as contracts for water stored, to my knowledge, irrigation is the only one.

Q. The Corps of Engineers operates it for recreational purposes, in addition to flood control; isn't that right?

A. That's correct, yes.

Q. And you mentioned the Kansas Bostwick Irrigation District diverting at Guide Rock. What are the general uses of the Nebraska counterpart District, the Nebraska Bostwick Irrigation District?

A. Well, they're going to be irrigation uses, as well, on the project lands that they have in Nebraska Bostwick.

Q. And do they divert only at Guide Rock?

A. No. They have a couple of -- of pump canals, and they divert directly into the Naponee Canal from the dam itself.

ARBITRATOR DREHER: What was the name of the canal?

A. The Naponee.

Q. (BY MR. DRAPER) Where is that canal

located?

A. It's along the northern part of the valley wall, east of Harlan County Reservoir.

Q. On the north side of the river?

A. Yes, on the north side of the river.

Q. Are there any other Nebraska Bostwick Irrigation District uses above Guide Rock on the south side of the river or elsewhere?

A. Yes. There are some Nebraska diversions from the canal as it comes into Kansas or in that reach between Guide Rock and the stateline.

ARBITRATOR DREHER: While Mr. Draper is looking for his material, is the Franklin Canal part of the Nebraska Bostwick Irrigation District, as well?

THE WITNESS: Yes, it is.

Q. (BY MR. DRAPER) Mr. Ross, are you familiar with the map that is attached as Figure 1B to Mr. Book's report, or Exhibit 1?

A. I'm familiar with his report.

Q. You probably don't have a copy of it?

A. But I don't have a copy of it.

Q. Does that generally show the area that we're addressing now?

A. Yes, does.

Q. Is that a form of the map? I'll just hold it up, because it's a map that we have provided to the States and to the Arbitrator that has color for the irrigated areas, and it's in a little bit larger format.

It's a Bureau of Reclamation Bostwick Division map that I think we all have, and I just wanted to indicate that this may show with some greater detail some of the other features of the Bostwick division that you're describing.

A. That's correct.

Q. Let me ask you in that regard, does the Nebraska Bostwick Irrigation District make any use of the Courtland Canal?

A. Yes. That's part of their diversion works as it comes under the Superior Canal on the north side or to delivery to lands in Nebraska.

Q. Would you describe that in a little more detail as to uses that the Nebraska Bostwick Irrigation District makes from the Courtland Canal as it heads towards Kansas?

A. Well, that's not something that I'm terribly familiar with, because I don't spend a lot of time in Nebraska Bostwick, but they are able to take water into the Franklin -- excuse me, into the

Superior Canal from the Courtland system after it is delivered from Guide Rock and then make use of it in Nebraska.

Q. And they do use the Courtland Canal to directly deliver irrigation water to areas south of the river?

A. Yes.

Q. And just for clarification, the Franklin Canal is on the north side of the river below Harlan County Reservoir and the Naponee Canal is on the south side of the river just below Harlan County Reservoir?

A. I think the Naponee delivers water to the north side. I believe the Franklin Canal delivers water to the north side, as well.

Q. What do your particular duties involve with respect to the Kansas Bostwick Irrigation District?

A. Well, of course, they have a water right in Kansas, just like every other diversion, and so it's our responsibility, to the extent possible, to make sure that those water supplies are secured in priority, and this happens to be a fairly senior water right in Kansas. So in terms of regulation of the river system, they come into play, just like any

other water right user.

ARBITRATOR DREHER: Mr. Draper, could I interrupt for a second.

MR. DRAPER: Yes, please.

ARBITRATOR DREHER: Do they have a natural flow right on the Republican River? I don't quite understand.

THE WITNESS: They have a flow right, yes, File No. 385 in Kansas. And they are able to take water. Some of the diversions that occur, wintertime and at other points in the year when they're not making releases from Harlan County, then they are able to take -- under 385, they take the natural flow storage, and they can either put that in Lovewell or put it to use on their lands.

ARBITRATOR DREHER: And that's the right that you were referring to as being regulated because if water is released from storage in Harlan County Lake, that water isn't administered in priority, is it?

THE WITNESS: No, it's not, that's correct.

Q. (BY MR. DRAPER) In your interactions with KBID water users, is that something that occurs on a daily basis or on a longer period?

A. Well, not exactly on a daily basis, but certainly during times like 2005-2006, as we're under administration, we're talking to those guys because the return flows that are coming from the District are important to other water users downstream because of probably a lesser known facet of the Bostwick Irrigation District is, of course, there are several hundred miles of drains underneath that District that are also routed back to either the river or the smaller tributaries that feed the river.

So their water supply and the interaction with those folks is important to the downstream water users and, of course, knowing how much supply is potentially available is important to regulation of the river.

Q. Does the existence of this set of drains in the KBID area, does that affect the timing of return flows to the Republican River downstream?

A. It is certainly intended to. The original KBID District was -- is built on a big hill -- KBID District is built on a basically upland area that didn't have any particular aquifer underneath it. As the Irrigation District began development and operation between canal and lateral seepage, groundwater levels rose to a formidable

level and the drains were put in place to drain those lands back to the river to alleviate that water logging or high water table.

So yes, I -- it does move water through that system more quickly than one might assume.

Q. And what is the general geology or character of the placement of the Kansas Bostwick Irrigation District?

A. As I said, the District itself is built on an upland area that is intersected by a few small tributaries, but it doesn't have a -- it didn't have an aquifer, per se, until the Irrigation District came along.

So that the -- there is no -- the groundwater that is available up there is largely available on a small intermittent sort of stage because it was individuals trying to utilize wells to irrigate lands that weren't classified in the District by the Bureau of Reclamation as irrigable. And so we see a lot of those very scattered across the District.

There aren't a lot of wells that are within there, until you get to those wells in that portion of the District where water is available downgradient in the Republican River alluvium. And

then frequently, the wells that you might see within the District there aren't associated with the District. The laterals don't feed down there. They're within some of the old original KBID District boundary, but the alluvial wells irrigate alluvial lands typically, not the Bostwick project lands.

Q. Do you have any responsibilities, as commissioner, with respect to groundwater?

A. Yes.

Q. What are those?

A. Kansas Water Appropriation Act is based on conjunctive use. Our system recognizes ground and surface water as one system. So we don't make any distinction in terms of water right priorities; ground and surface water are treated alike.

So we do, we have and we do, especially in the Republican, administrate groundwater rights to protect surface water and vice versa.

So, yes, in terms of how groundwater functions, our office does an awful lot of the investigation to see what sort of impacts groundwater would have on surface water and whether or not those applications should be approved.

Q. Do you do any testing or data collection with respect to groundwater use?

A. Certainly, yes. We -- our office and largely before I became water commissioner, that was my function, was to conduct those groundwater investigations and to test -- test wells for certification. So yes.

Q. And how is the data on the groundwater use maintained?

A. As far as groundwater use -- well, all water use is maintained through our water use reporting system annually. It's a statutory requirement of every water right, that they file an Annual Water Use Report before March 1 and provide us with the quantity of water that was diverted, the number of acres irrigated, crops, crop types. And so that information has been maintained since about 1957.

Q. And do you have this maintained on a database?

A. Yes.

Q. What is that called?

A. You will periodically hear that referred to as WRIS or W-R-I-S, Water Right Information System. It's an Orcale-related database with basically all of the fundamental ingredients of a water right embedded into the database.

Q. And does that include the location of lands associated with groundwater rights?

A. Yes, it does.

Q. Does it include GIS designations in that database?

A. Not in that database. In fact, at this point, the place of use is described in 40-acre tracts in WRIS. So you can -- by 40-acre tract or element of 40-acre tracts, you can determine what the authorized place of use is. That is not available in a GIS format yet.

However, we have a sort of a sister database called WIMAS, W-I-M-A-S. WIMAS is a publicly available, or at least in portion available, to do GIS applications for points of diversion so you can look at individual elements of any particular water right, its location, its location related to other geographic features like canals, rivers, each other.

Q. Is it possible to construct maps from these databases as to places of use?

A. Oh, certainly.

Q. Do you keep records of amounts of groundwater pumped?

A. Oh, yes, annually.

Q. Now, you have mentioned administration -- that systems were under administration in 2005-2006.

What are you referring to there?

A. In Kansas, when we refer to administration of water, it's the regulation of one water right in priority versus another. And so you may have, in a given instance, surface water being regulated by priority in lots of different places in Kansas.

Specifically, what I was referring to in 2005-2006 on the Republican is a bit different in that it was what we called minimum desirable streamflow administration.

The legislature had determined, by statute, that various gage locations with -- along various river systems would have a priority -- would be given sort of a priority date of April 12, 1984. And when flows dropped below a certain level, we would regulate, administer water rights whose priority number was junior to that number -- to that date for the purpose of trying to recover streamflow.

And so the streamflow gages in place on the Republican are at Concordia, which is below Kansas Bostwick, and Clay Center, which is just

immediately above Milford Reservoir on the river.

So the situation in 2005, two thousand- -- well, the situation beginning in May of 2002, the chief engineer issued orders to regulate groundwater and surface water in the Lower Republican Basin for the purpose of maintaining -- establishing and maintaining desirable streamflow at Concordia and Clay Center.

So during -- from that point, May of 2002 through 2007, that portion of what we refer to as the Lower Republican or below Hardy was under MDS administration, and we had, oh, probably on the order of 200 water rights under administration during that period.

Q. And how long did that administration continue, the MDS as you call it? I think it stands for minimum desirable streamflow.

A. MDS administration began in May of 2002 and ended in July of 2007.

Q. You have described, I think, the irrigation season operations of KBID. What are the off-season operations at KBID?

A. KBID would typically, in the fall, take water to begin a process of replenishing Lovewell Reservoir. And once -- typically, they would -- they

have a fill schedule, if you will, by increment by month, and, you know, historically they've been able to fill typically before the end of the year. Generally, in October or November they would have completed and been able to fill up to conservation.

At some point in time, generally along in, oh, probably March or April as flows -- as the ice came off the river, that's the point at which they would be asking or reviewing the river, asking the Bureau of Reclamation to ask the Corps of Engineers for a waiver to store additional water in Lovewell.

Q. Mr. Book referred to the amount of groundwater use that occurs within the KBID District. What is the situation with respect to access to groundwater in KBID?

A. Well, as I described earlier, the geology -- the aquifer there doesn't support bypassing wells. It's basically a fine grain. Some of it is colluvial deposits with some loess deposits, so they don't have a real high transmissivity. And so those wells that were put in there are generally to irrigate lands that are adjacent to, but outside the actual Irrigation District operations.

And so in reviewing those actual

operations, there aren't a significant number of acres that are actually sort of -- the term that is used around here is "commingled" acres that actually receive District water and supplemental groundwater aren't really significant. That number probably is, as Mr. Book testified, on the order of 1000 to 1500 acre-feet annually.

Q. During the period 2005-2006, are you familiar with the conditions and operations in the KBID District?

A. Somewhat, yes.

Q. What were the reactions to the water shortages during that period?

A. Well, the users in KBID are certainly a resilient bunch. They have opportunities to maximize their use and have in the past. They're probably one of the most aggressive groups around. They tend to -- of all the Republican River Irrigation Districts, they have a tendency to invest an infrastructure, both individually, as well as the District themselves. They have more lined canals, more buried laterals.

So typically, they would have been -- they address this kind of adversity by trying to improve their efficiencies: installing pivots,

burying more laterals, you know, trying to make the most out of what land or water they have.

Q. Did you observe whether they sold their irrigation equipment during that low-supply period?

A. I didn't see anybody selling any equipment. I saw people buying equipment and, again, trying to increase their efficiency. And I think that's borne out by the KBID reports indicating annually how many pivots are installed.

Q. How does the irrigation equipment in the KBID area compare to other areas in north central Kansas and in northwest Kansas?

A. The application equipment, center pivots, that sort of thing are generally going to be new equipment, best available technology kinds of things. They have -- they have some drip tape in the District, not a great deal because they've had some difficulties with, you know, making sure the water quality doesn't plug up the drip tape; but in terms of sort of typical surface application with pivot, it's going to be the most -- the best available that they can get.

In terms of their actual operations, they've had occasion to use some of the more sophisticated filtering kinds of devices coming off

of the canal system to try and mitigate some of the turmidity.

In terms of how they would compare with the rest, I think -- I've been talking about application types of equipment. Pumping equipment will be significantly different. Those pivots that are using canal water do not pump water, per se. The water that they -- the equipment that is used to deliver water to the field probably includes a booster pump, because the canal system just simply won't develop enough head, in most cases, to run the pivot. But these are relatively small centrifugal pumps that are run with 10- or 20-horse electric motors, and they're just providing pressure for the pivot system. So there is no real lift of water involved. It's simply a matter of generating that pressure.

Of course, the gravity diversions, there is a few out there that have to have booster pumps because of their actual location. And, in fact, that they have gone to pipe, and this was originally a ditch/tube pipe system. But, for the most part, everyone has gone to gravity-gated pipe, buried underground delivery-type systems. And so you don't -- it's all gravity fed. There is not a lot of

pumping equipment.

When you compare that to outside of the District, for the most part, those are -- those diversions are deep-well turbine pumps, again center pivot systems. Mostly -- the vast majority of the system below KBID is going to be center pivot deliveries. Fairly modern low-pressure drop nozzle technology. Again, a little bit of drip tape, not very much.

Those are turbine pumps driven by, well, down there, probably typically internal combustion engines. Their lift is going to be on the order of 20 or 30 feet from the river valleys.

As far as -- you can you go to far western Kansas where you have the Ogallala formation, as Mr. Book explained. There is no Ogallala right in this neighborhood with KBID.

But Ogallala, those wells are going to be 250, 300 feet deep or 200-foot heads of lift. Those are 2- or 300-horse engines, and they may be delivering 4- or 500, to a thousand gallons a minute, two pivot systems.

Q. And that system tends to pertain in northwest Kansas, does it?

A. Northwest Kansas has the Ogallala, has

very little else. There is a little bit of the alluvium up there, but northwestern Kansas is largely going to have the very deep wells, 2-, 300 feet.

North central Kansas is going to use turbine pumps, but the lift is going to be on the order of, oh, 20 to 50 feet. KBID District isn't going to have a lift, per se. It's going to be mostly just pressure, generating pressure to the pivot.

MR. DRAPER: Your Honor, this might be an appropriate time to take a lunch break --

ARBITRATOR DREHER: Okay.

MR. DRAPER: -- since it's noon.

ARBITRATOR DREHER: Are we thinking an hour and a half and a half?

MR. DRAPER: Maybe we should take an hour and a half today, it's our first day, and see if that's more time than we want to allow on other days. But since we are all getting used to our logistical challenges here, maybe give ourselves a little bit of extra time today.

ARBITRATOR DREHER: How much more direct examination do you have of Mr. Ross?

MR. DRAPER: I would say about 15 minutes.

ARBITRATOR DREHER: All right, we'll adjourn until 1:30.

(Lunch break was taken from 12:00 to 1:30.)

ARBITRATOR DREHER: Mr. Draper, you may continue.

MR. DRAPER: Thank you very much, Your Honor.

As we're getting started, this might be a convenient time for me to move the exhibits from Mr. Book's testimony that I indicated earlier.

In numerical order those are Kansas Exhibits 1, that's the Spronk report; 7, which is Mr. Book's CV; 22, which is the RRCA accounting spreadsheets; and 24, the KBID Annual Report for 2005; and 25, KBID report for 2006.

ARBITRATOR DREHER: Okay. Any objection to those being admitted?

MR. WILMOTH: No.

ARBITRATOR DREHER: Okay, they're admitted.

(WHEREUPON, Kansas Exhibits 1, 7, 22, 24 and 25 were admitted into evidence.)

MR. DRAPER: And then I have a few more questions for Mr. Ross, if I may.

Q. (BY MR. DRAPER) Mr. Ross, I have handed you a copy of the map of the Bostwick Division of Bureau of Reclamation map that I held up earlier today.

A. Yes.

MR. DRAPER: And Your Honor, I would like to mark this as our next exhibit. This is a map that you received some time ago from us, as did the other parties. It's a pretty well-known map in this context. And we would mark that as Kansas Exhibit 41.

ARBITRATOR DREHER: Okay.

MR. DRAPER: For the record, it's a Bureau of Reclamation map of the Bostwick division dated May 1957.

Q. (BY MR. DRAPER) Mr. Ross, I would like you to refer to this map and just briefly summarize the major elements of the Bostwick project, the dams, reservoirs, canals and diverted points.

A. Okay. Beginning at Harlan County Dam, we have the Franklin Canal that runs along the north side of the Nebraska Bostwick project. The Naponee Canal runs along the south side -- or excuse me, the Nebraska Bostwick project and then at a point some distance down the stream on the south side is joined

by the Franklin Pump Canal.

Q. When you say the south side of the Nebraska District, that's also the south side of the Republican River, is it not?

A. That's correct. And then as we near Guide Rock -- at Guide Rock, the sort of combined operations there that Kenny Nelson operates, the diversion works at Guide Rock, and the water that goes to the Superior Canal at the diversion dam at Guide Rock is where the Nebraska Bostwick and the Courtland Canal operates to the south side of the river under Kansas Bostwick.

Q. Now, the Courtland Canal on the south side of the river, ultimately to the Kansas Bostwick District, also serves Nebraska Bostwick on the south side of the river; is that correct?

A. That's correct.

Q. And then this map, in addition to Harlan County Dam Reservoir, also shows Lovewell Dam Reservoir?

A. That is correct. And so you will note there that the Courtland Canal can either deliver water into the upper portion of the Kansas Bostwick or deliver water into Lovewell Reservoir, which is subsequently regulated for releases to the lower

division of Kansas Bostwick.

Q. And are the irrigated areas indicated?

A. Yes.

Q. How are they indicated?

A. Those areas are in green. You recall, of course, that the Bureau of Reclamation treats Bostwick as a unit, both in Kansas and Nebraska, so they're all green.

Q. Did the two Bostwick Districts historically operate in tandem?

A. Yes, they do, because of deliveries and operations that are typically coincided, they -- until the most recent operational changes in 2004 and '5, we saw them operating jointly. They had a common interest as far as delivery efficiencies and typically had common delivery estimates from the Bureau.

ARBITRATOR DREHER: Excuse me, Mr. Draper.

When you say the two divisions, are you referring to the Nebraska division and the Kansas division or the Upper Kansas division and the Lower Kansas division?

THE WITNESS: I'm referring to -- that question, the Bureau of Reclamation looks at this as

the Kansas and Nebraska divisions, and so they operate jointly, until just recently.

Q. (BY MR. DRAPER) Is it correct to say that there is one Bostwick division under the Bureau of Reclamation and there are two Districts that operate -- interact with the Bureau and cooperate with the Bureau; one is the Nebraska Bostwick Irrigation District and the other is the Kansas Bostwick Irrigation District?

A. That is correct.

ARBITRATOR DREHER: And if I might, Mr. Draper.

When did they stop operating jointly?

THE WITNESS: Well, recently when the -- we got involved in this leasing and short-term annual operations that happened in -- first, I think, in 2005 when we saw no water being taken, that was a joint decision by both Nebraska and Kansas Bostwick not to take water.

So 2006 would have been the first year when the Nebraska Bostwick leased their water to the State of Nebraska for Compact compliance, and so that was the first time we really saw those two operations begin to separate.

Prior to that, they -- while they

operate under two joint -- two different boards of directors, both Kansas and Nebraska Districts each have a board of directors, many of those decisions in terms of operations were made jointly for efficiency purposes.

Q. (BY MR. DRAPER) With this all in mind, the question was asked earlier about water that was left in the Harlan County Reservoir unused in 2005; do you recall that?

A. Yes.

Q. Do you know why that water was left in Harlan County Reservoir and whether that was a unitary decision by one of the Bostwick Districts or both and why that decision was taken?

A. The Bureau of Reclamation makes projections -- under the FSS, they make a projection beginning in October of each year. Then they have a contractual obligation under the District contracts to make projections in January, and the projections -- early in the season January, and then the Bureau makes monthly projections after that.

As I recall, the Bureau's projection in January was for very little water to be produced. As I recall, the number was on the order of 2 inches for the Bostwick division.

They -- the board of directors elected to, because of the carryover provisions and dividing water rights after the end of the irrigation season, again those -- those Districts talked to each other because of this division. If you leave it there, it gets divided the following year with your neighbor.

So both of those Districts elected to look seriously at not diverting water and leaving the carryover in the reservoir. And it was about that time that we began to hear the Bureau of Reclamation and their draft mitigation funds that were -- I believe you saw them in the Kansas Water Office letter that Mr. Book was looking at.

So both Districts essentially elected to leave water in Harlan County Reservoir in favor of taking the drought contingency monies from the Bureau.

Q. How much water would be supplied to the fields, if it would have been supplied to the fields if it had been called down?

A. A couple inches. And ultimately with the losses, it may not have even amounted to that much. That's an extremely difficult -- low flows to deliver are really tough.

Q. Would it have been practical to deliver

that amount?

A. Certainly, they didn't think so.

Q. Your name came up in some earlier testimony with respect to Appendix D of Mr. Book's report. Do you have a copy of Mr. Book's report there? It's Kansas Exhibit No. 1.

A. I do.

Q. And would you look at that, I believe it -- I'm trying to direct you to Appendix D, which looks like it might be the fourth or fifth page from the back.

A. I have it, thank you.

ARBITRATOR DREHER: I'm sorry.

MR. DRAPER: I just didn't want to rush you.

ARBITRATOR DREHER: No, go ahead.

Q. (BY MR. DRAPER) What is Appendix D?

A. Appendix D of Mr. Book's report is a tabulation of the active Republican River surface water diversions. These would be individual surface water diversions from the river that are senior to minimum desirable streamflow and it tabulates those by year 1994 through 2006 and gives a number of acre-feet used.

Q. Would you describe what is in the first

column on the left side?

A. The first column is what we call Pdiv IDs. They are unique numbers given to each point of the diversion on -- under any particular water right. Each point of diversion has a unique Pdiv ID number, and that's what's in that column.

Q. So that's to be distinguished from a water right?

A. Yes. You could have a water right and frequently do have water rights from multiple points of diversion and, therefore, a single water right might have multiple Pdiv IDs.

Q. Now, based on your experience with the KBID area and, in particular, during the years that are mentioned here on this table, is the assumption that Mr. Book made with respect to the quantification of how much would have been diverted, is that, based on your experience there, a reasonable assumption on his part?

A. It was probably reasonable to the extent that it -- in my view, it may be a bit conservative because it considers only those surface water diversions. It doesn't consider any overlap in groundwater diversions or the flow or diversions that might have been available from those files.

Yes, so, yes, in terms of that period of time, this look doesn't include a lot of MDS administration period when the -- those water rights would have been a fairly high value --

MR. WILMOTH: Mr. Dreher, I'm sorry, excuse me.

I want to interject here and just object to this line. I thought that Mr. Ross was called to provide nonexpert testimony and now it appears he is opining on an expert report and to the quality of the conclusion embodied in that report.

To the extent that Mr. Ross is enforcing an opinion, or otherwise about that, I don't think that he has been offered in that regard. Certainly, he can speak to what is in Appendix D, because I think he compiled it.

MR. DRAPER: Your Honor, if I may.

I'm just asking the witness about the on-the-ground behavior of the river system and the irrigators during the period in question here. This is something he has personal knowledge of.

I'm not asking him to develop or state any expert opinion, but to talk about the behavior with respect to diversions, and whether that -- whether the assumptions in this table are consistent

with what he -- what he observed.

ARBITRATOR DREHER: The objection is noted. The witness may answer.

A. The diversions that are cited here are senior surface water diversions. During this period of time, those diversions would have been maximized because of their additional value. Frequently, these are overlapped with junior groundwater diversions that would have been regulated because of MDS flows. So they become more valuable during this period, as opposed to the period 2005-2006.

Previous to that, when we didn't have minimum desirable streamflow administration ongoing or we had greater streamflows available, most of these diversions would have preferred to go to overlapping wells.

When we have regulated those wells, then they go back to the surface water, which I think explains two things. One, that the reason that these -- Mr. Book's analysis of the maximums that they would have diverted during that period, in my view, may be a little conservative but for the fact that we were maximizing those senior water diversions during that period of MDS.

ARBITRATOR DREHER: Excuse me,

Mr. Draper.

Now, I'm a little confused again. I thought both your testimony and the testimony of Mr. Book was that there was not significant groundwater use in this area. And yet, now I'm hearing that the reason -- and maybe I'm jumping to a conclusion that you didn't really make -- but the implication that I thought I heard was that the reason for some of these zeros is because they were diverting groundwater instead of surface water and they would have rather have diverted surface, had it been available.

THE WITNESS: All right. Let me clarify it a little bit.

These -- these are direct diversions from the Republican River, and the overlapping groundwater rights are groundwater from the alluvium of the Republican River, not related to KBID.

There is certainly groundwater available in the alluvium, albeit some of it is junior and would be regulated for minimum desirable streamflow.

During -- during -- frequently, in the Republican River at that location, if the farmer comes to a choice between groundwater and surface water, the surface water is more difficult to

obtain. It requires some more centrifugal pumps have to be monitored more closely, and the river system there, of course, is extremely shallow. Under good times, we experience depths of 1 or 2 feet in the river itself. During these low flows, I have personally stepped across the Republican River.

So during those period of times, if groundwater is available, they will make every effort to utilize groundwater if the flows are -- you know, if we had adequate rainfall, they may not need to irrigate at all, which explains some of these zeros, because this tabulation is based on surface water use only. It doesn't include any groundwater.

So to the extent that there are zeros there and there was no use by the surface water, probably indicates that there is an overlap in groundwater right that was being used during that period.

ARBITRATOR DREHER: And that groundwater use would not have been reported at this point of diversion because this is a surface water point of diversion?

THE WITNESS: That's correct, it exercises a separate Pdiv ID.

ARBITRATOR DREHER: Are there any reports available that document how much water was used under groundwater or surface water under these rights?

THE WITNESS: Each water right will -- you will not find a water right in the Republican that has groundwater and surface water. It will either be groundwater or surface water. And yes, there are Water Use Reports that will demonstrate from each Pdiv ID a usage for whatever period of time you would like.

ARBITRATOR DREHER: Well, let me ask it a little differently.

Is there a way to link these point of diversion ID numbers to water right numbers and then subsequently to the amount of water diverted under those water rights?

And is there a way then to link the place of use for those surface water rights to an overlapping place of use for groundwater and determine how much groundwater was potentially applied?

THE WITNESS: And the answer is, yes, but not very easily.

ARBITRATOR DREHER: That's what I was

afraid of.

Along the same lines -- and excuse me, Mr. Draper. But along those same lines, you know, again I'll point to this example that I used earlier where -- I don't remember which right it was, but it hadn't been surface water, it hadn't been diverted since 1997.

And am I to understand that now with a relatively -- I don't mean to minimize it at all, but relatively small amount of return flows, these rights would have been able to divert surface water?

THE WITNESS: Typically, these water rights, notwithstanding -- this water right would have been an active water right in a Kansas system, regardless of that five years or how many years of nonuse. If it's still on this list, it's still active and we protect it.

To the extent that they could, yes, they would maximize that usage of return flows and typically did during this period of time, not without some difficulty.

ARBITRATOR DREHER: Well, I'm thinking of your comment about how shallow the Republican River is at this location and I'm -- while I have not been in this area -- at least not for many, many

years -- it's just hard for me to understand how they -- you know, again, I'm not diminishing the amount, but how relatively introducing a few thousand acre-feet of return flows, I'm having trouble understanding how that would be divertible physically.

THE WITNESS: You frequently will find them creating jetties and levies in the river channel to divert water over to their point of the diversion.

We also have an individual in that particular locale, he is located at Clay Center, that has begun manufacturing a very innovative type of screen collection system for surface water, and I have personally observed what is known as a Wietharn screen operating with about 3 inches of water. It's a collection cleaning system that seems to work very well, but not without some work and some expense.

ARBITRATOR DREHER: Okay.

Q. (BY MR. DRAPER) Mr. Ross, do they use pumps to capture surface water?

A. Oh, certainly, yes.

Q. And is it -- is it reasonable to assume, as the Arbitrator was suggesting, that rights that were not exercised or points of diversion that were not exercised during the period 1994 and later would

have been utilized in '05-'06?

A. Yes, those are -- those are folks who would keep the pump in the shed for the time when they needed to be able to use it, typically because of regulation of their overlapping groundwater rights.

Q. Were the overlapping groundwater rights being regulated in the 1994 to 2000 period?

A. They would have been regulated after 2002. 2003 and '4 they would have been regulated under MDS, but not prior to that.

Q. So they could have been exercised during that earlier period?

A. Yes, and probably were.

MR. DRAPER: No further questions.

ARBITRATOR DREHER: Okay, I have a couple.

Earlier in your testimony you talked about -- I don't remember the -- I believe you said his name was Kenny --

THE WITNESS: Nelson.

ARBITRATOR DREHER: Yes.

THE WITNESS: Yes.

ARBITRATOR DREHER: -- making -- I don't know, apparently it wasn't a unilateral decision, but

somehow making the decision as to how much water would go to the Nebraska Irrigation District or -- excuse me, the Nebraska Bostwick Irrigation District and the Kansas Bostwick Irrigation District.

In 2005 and 2006, what was the criteria for making -- for deciding on what the split would be?

THE WITNESS: Okay. They -- the split is actually determined by the Bureau of Reclamation in terms of supply, how much is available. The actual day-to-day operations can vary.

You could get a rainstorm in Nebraska Bostwick and not one in Kansas Bostwick. The day-to-day operations are a coordinated effort because it's not efficient for Nebraska Bostwick and Kansas Bostwick to try and jointly operate one diversion dam.

Typically, the Nebraska folks have elected to leave Kenny Nelson and his staff. They just simply put in an order for water and say, This is how much we want. And Kansas Bostwick staff operates the diversion dam to get so much to Nebraska Bostwick and then so much to Kansas.

The total amount of water available for diversion is typically based on acreage split.

That's how -- the Bureau of Reclamation is going to look at it and try to secure the same number of inches per acre throughout the whole division, and so it's basically an irrigated acre split by percentage.

ARBITRATOR DREHER: And then a similar question for -- regarding what criteria was used in 2005 and 2006 in deciding how much water went to the Upper section of the Kansas Bostwick Irrigation District versus the Lower section.

THE WITNESS: Okay. Of course, in 2005, you know, they elected not to divert to the District.

So in 2006, again Kansas Bostwick had been diverting wintertime flows into Lovewell. They had been operating virtually year-round at that point. So we have a supply that's available in Lovewell and, historically, the -- well, both Districts and the Bureau of Reclamation make every effort to deliver an equal supply to each acre in each District.

When that was not possible in 2006, the District, Kansas Bostwick, elected to use the maximum available on the Lower, because they already had the storage in Lovewell; they had the physical water available in Lovewell to put on those acres.

They were able to basically operate the diversion dam during the irrigation season to the extent that they could sweep the river, take what minimal water was available and apply essentially whatever they had available to the Upper District. And that turned into a fairly small amount, compared to what was delivered through the Lovewell District.

So it wasn't really a function of an attempt to have an equitable distribution, it was an attempt to just deliver whatever water was available. Because recall, you can't get water out of Lovewell to the Upper --

ARBITRATOR DREHER: Right, I understand.

And the last question I have is: Do you know how much money was received from the drought relief payments that is the subject of this letter dated April 18, 2005, how much money was received by the Kansas Bostwick Irrigation District in the form of drought relief payments?

THE WITNESS: I do not. That letter and a lot of that transaction was involving the Kansas Water Office and that's not the same as the Division of Water Resources, so I do not.

ARBITRATOR DREHER: To your knowledge, is that available from some source?

THE WITNESS: I'm sure it is.

ARBITRATOR DREHER: Okay, Nebraska.

MR. WILMOTH: Thank you.

CROSS-EXAMINATION

BY MR. WILMOTH:

Q. Good afternoon, Mr. Ross. How are you today?

A. Fine, Mr. Wilmoth. And you?

Q. Very good. It's a nicer day outside than it is in here, though.

Mr. Ross, I wanted to continue on a couple of questions concerning Appendix D to the Spronk report.

Are you familiar with that?

A. Yes.

Q. You have a copy of that with you, in front of you, by chance?

A. I do.

Q. I believe you, just a moment ago, explained that these folks typically, in dry periods like '05 and '06, will try to use as much water as they could. Is that what you indicated?

A. The folks that are tabulated here, the senior surface water?

Q. Yes.

A. Yes, they would maximize their combined use.

Q. And that's because the MDS was in effect, is that what you suggested?

A. Yes.

Q. And I guess I would call your attention to the tenth item down again, this is, for lack of a better identification, the Pdiv ID 32412.

Do you see that?

A. Yes.

Q. And is it correct that there was no use -- no water diverted under that point of diversion from 2000 to 2006?

A. That's what's indicated here.

Q. And why would that individual amount maximize surface water use in those prior years before 2005, if your assumption holds true?

A. And this could be an individual who -- during that period of time when we were under MDS, there was some regulations that were adopted by the chief engineer that would allow that individual to essentially provide water under a -- what we call temporary changes so that that would be -- that water could be diverted out of another water right that was junior to MDS. So within certain constraints, we

would have allowed that to happen.

Q. And is that reflected in this table at all?

A. It might be under one of the -- in this case, another surface water diversion that actually is tabulated in here. Without the water rights, I can't tell you which one, I mean, without doing a lot of research, but it's possible that could happen.

Q. So I infer from your answer it's possible that that could not happen?

A. Certainly.

Q. With regard to some of these zeros, zero volumes, direct your attention to one that it is directly -- let's see, I'm trying to recall the one that the Arbitrator asked about.

Let's look at the one directly above that, 51169. Do you, you see that, right?

A. Yes.

Q. I'm sorry, that point of diversion?

A. Yes.

Q. Do I understand from what you had said earlier that on the column on the far right, that "Authorized Quantity" number, is that the water right number? I mean, is that the water right authorized volume?

A. That is the water -- the quantity and acre-feet that is available that is authorized under that Pdiv ID.

Q. So are we still correct in understanding then the maximum use was approximately 50 percent greater than the authorized use under that right through this point of diversion?

A. That -- that could be because you can have multiple water rights associated with particular Pdiv ID; but, yes, that's what that says.

Q. So you see down below that on the far right-hand column the series of 83s. Should we infer that that's the water right -- those are all various points of diversion associated with that water right?

A. That's probably a pretty good assumption.

Q. But it's a single water right that totals 83 acre-feet of authorized use?

A. It could be one of several things. It could be a water right with a particular, let's say four or five points of diversion, each of them authorized 83 acre-feet. Or it could be a single water right -- especially with surface water rights, could be a single water right with five points of diversion that the water right is authorized 83

acre-feet. This would indicate that each one of those points of diversion is authorized 83 feet.

Q. So, for example, point of diversion 51169 we've established diverted more than 50 percent of the authorized right associated with that point of the diversion. And then if you go down to 6592, do you see another 50 percent exceedance associated with that right?

Am I correct in reading this?

A. Yes, that appears to be right.

Q. And these questions of these variables that you just mentioned, did you do that analysis to try and determine which volumes to utilize here?

A. No.

Q. Who did?

A. I assume Mr. Book and his staff.

Q. I thought I heard Mr. Book testify that he just took Appendix D from you and Mr. Barfield?

A. Well, we would have provided him a printout and tabulations from our WRIS database, but I didn't do any analysis on this particular one.

Q. And Mr. Book testified he didn't either.

Okay. Very well, thank you.

With regard to some of these zeros also, I think you said that some of that might be because

groundwater was applied --

A. Yes.

Q. -- or groundwater from the alluvium, depending on if you're from the subflow state, maybe; but essentially, groundwater. Is that essentially the same as saying that, for example, if there was a piece of ground that was entitled to receive 83 acre-feet of water, that volume, or some derivative of that volume, would have been applied with groundwater through a well, instead of a surface water diversion?

A. That could happen, yes.

Q. So it's like an alternative supply source for the same grounds?

A. Yes.

Q. You mentioned earlier that the users in KBID decided not to take water in 2005; is that correct?

A. I believe that's correct, yes.

Q. And did you indicate that that was because it was not practical to do so?

A. That's my understanding, yes.

Q. And why was that?

A. The quantities were small enough -- the projected quantities were small enough that delivery

becomes extremely difficult.

Q. Is that delivery from Harlan through the Courtland Canal to the stateline?

A. Through the whole system. At very, very low flows your efficiencies again, as Mr. Book indicated, drop off significantly. So that making sort of a beneficial use of that water is fairly difficult and they elected to leave it in the reservoir.

Q. Did you agree with Mr. Book's figure of about 10,000 acre-feet that was left in the reservoir, then?

A. I don't recall an exact number. 2 inches sticks in my mind, but I don't recall ever associating a number with that.

Q. But if I understood you, the upshot of that was there was no point in sending it down the Courtland Canal because it would disappear?

A. In essence.

Q. Any idea what the losses in the Courtland Canal would have been?

A. No idea.

Q. Do you think they would have been greater than 3.2 percent?

A. Yes, I would imagine so.

Q. Do you have any idea what the crop irrigation requirement for corn is in the KBID?

A. I know what we use as a guide to approving new applications and that's corn and it's going to be on the order of 1 acre-foot per acre.

Q. That's the crop irrigation requirement?

A. That's probably about the 80 percent net irrigation requirement for corn in that area.

Q. Do you know what the total crop water requirement is for corn in KBID?

A. No.

Q. You mentioned something about the Water Rights Information System in Kansas earlier?

A. Yes.

Q. I believe you indicated that there was a lot of data essentially in that system about various areas in Kansas; is that right?

A. Yes.

Q. What kind of data is that?

A. The WRIS system includes fundamental tenets of every water right. It includes ownership, it includes location of point of diversion, places of use, sort of what we call an action trail when -- dates and times of when specific actions happen in that particular water right. It also includes a

tabulation of historic water use. It will include a listing of any changes that were made in that water right, that sort of information.

Q. Would that include number of acres irrigated?

A. The WRIS report would, yes.

Q. And crop type, perhaps?

A. Crop type is an irrigated -- well, water users are required to file a Water Use Report. It includes a column that water right holders can list crop type.

Frequently, we don't get that information or we don't -- that part of the water report is not required; it's requested. And frequently, we just get multiple crops, so it's difficult to, if not impossible, to break that out to specific acres by specific crop.

Q. And is all that information available for the lands within the KBID boundary?

A. KBID is probably not -- KBID files a separate report that you see as their Annual Report. It includes that data.

Typically, irrigation districts are massive enough that we don't maintain the specific irrigation district information in WRIS, but the

individual water rights will be in there, yes.

Q. But there is no KBID data in the WRIS system; is that right?

A. No. Well, I shouldn't say no KBID data.

Yes, there will certainly be, under Water Right File No. 385, if you brought that up in the WRIS system, it will give you the same information, but it won't break it down by acre. It will break it down by District. So the District will tell you, from their Water Use Report, they irrigated X number of acres, you know, 40,000 acres.

Q. Just at a district level that information is available?

A. Right, it's all district level. It's not individual.

Q. I think I heard you testify earlier that in 2005 folks within KBID were buying a lot of farm equipment; is that right?

A. During that period of time -- and, in fact, for several years -- we have seen a steady increase in the installation of center pivot systems and kind of purchasing more efficient operational equipment. It was during this period of time, I think, that some of the subsurface drip tape, that sort of stuff, was installed.

Q. "This period of time" being '05 to '06?
A. Well, I would probably expand that to say 2002 through 2006.
Q. And so if I understood you correctly, a lot of that money was being spent to improve efficiencies on a farm?
A. Yes.
Q. In the time period of 2002 to 2006, how have efficiencies affected downstream below KBID users -- these increasing efficiencies? Excuse me.
A. Yeah, I think I understand your question.
Probably difficult to say, with these low flow conditions, how much of that is really genuinely attributed to return flows, but probably some.
Q. And do you recall the period of time that Mr. Book used in terms of formulating his on-farm efficiencies?
A. I think we're talking about 2000 -- excuse me, 1994 through 2004.
Q. So would that period reflect this increase in efficiencies or would it not?
A. It should.
Q. How so?

A. Well, as we continue to expand into more and more pivots, then you get a higher -- higher on-farm delivery of the water, higher efficiency.

Q. But I thought we just established that Mr. Book's analysis employed the period that predated 2002?

A. It did.

Q. So how that would reflect efficiencies increasing between 2002 and 2006?

A. Well, as you considered the entire period, you would get a certain amount of increase in the 2002 to 2006 period that would be included in that overall analysis.

Q. But some of that would be washed out by virtue of combining the less efficient period, would it not?

A. Perhaps.

Q. Do you have any idea from whom those center pivots and other irrigation efficiency improvement materials were purchased from?

A. Not specifically. I know there is a dealer in Clay Center that does an awful lot of pivot installations.

Q. If you had to guess how many center pivots went in in the last three years, any idea --

in KBID, excuse me?

A. Oh, 50.

Q. 50, 5-0?

A. That's a guess.

Q. 5-0?

A. Yes.

Q. Any idea what center pivots cost in that part of the world?

A. I don't.

Q. I'm sorry, I believe I may have asked you this, but in case I didn't, bear with me.

Do you know the total crop water requirement for corn in KBID?

A. Well, you did ask me the question. I'm not sure you asked it just like that.

Q. Do you know the total --

A. Total crop water requirement?

Q. Yes.

A. No. That would be more of an analysis that I have not done.

Q. What do you know about the crop -- the water requirements for corn?

A. Well, that the -- from an application review and approval standpoint, Kansas has established a maximum. And in that particular part

of the world, the maximum is based on 80 percent chance rainfall net irrigation requirement, and that is about 1 acre-foot per acre, give or take a little.

Q. Do you know when that maximum number was established?

A. Well, we had a maximum since about 1957, but recent rules and regulations were changed in 2000, I believe, is when that particular number came to place.

Q. Just as a point of cleanup, I believe you earlier made reference to the Kansas Water Office?

A. Yes.

Q. Is the Kansas Water Office an agency of the State of Kansas?

A. Yes.

Q. How does the amount of precipitation received within KBID affect system operations?

A. KBID is a fairly aggressive management operation. If there is precipitation in the community, obviously, you can make it really simple.

From Harlan County, there is no way to call it back if it rains; but to the extent that the Irrigation District personnel are able to make changes to optimize the use of precipitation, they

do. So if it's a -- you know, if the river is rising from a precipitation event, they certainly don't have a problem cutting back releases from Harlan County and using precipitation when they're available.

Q. So the issue of precipitation affects how much water is called out of Harlan, for example?

A. Exactly, yes.

Q. And when that water comes down through the system, if Lovewell Reservoir is full, what happens to that water?

A. Well, it kind of depends on what time of year it is.

Q. Let's say it's in the growing season or maybe say the first third of the growing season.

A. Okay. There is a decision going to be made if you have precipitation in the river and you can -- you can take that water. If Lovewell is full, you may make a decision to try and deliver some water, you know, create some space in Lovewell by making a delivery. You may elect to just deliver to the upper part of the District and, you know, shore up those supplies. Certainly, we cut back Harlan County deliveries. And you may end up just having that precipitation or increase flow in the river move way on downstream through the system.

Q. One of the questions that was presented to you is the quantification of how much groundwater is used in KBID?

A. Yes.

Q. Do you recall that question?

A. Yes.

Q. And could you restate your answer to that question?

A. What you have is groundwater in commingled situations can be fairly limited to 1500 acres throughout the system that has the ability to actually -- or, an annual basis, annually mixes those waters.

Q. And what is the application rate of groundwater on those 1500 acres?

A. Excuse me, I didn't hear the question.

Q. What is the application rate? In other words, how much water does that equate to?

A. Are we talking about gallons per minutes or are we talking about total quantity?

Q. Total quantity.

A. It varies by well. Some of those wells have potentially 100 acre-feet authorized. I would guess that's probably maybe average for those folks. So if you were able to put that water on at 1

acre-foot per acre, 100 acres.

Q. But you're not -- or do you know the total volume of water --

A. On those 1500 acres?

Q. On those 1500 acres.

A. No, I do not.

Q. How many hundred acre-foot wells are out there?

A. I don't know that I can give you an answer to the number, but that's not going to be an uncommon authorization in that area.

MR. WILMOTH: May I approach the witness?

ARBITRATOR DREHER: Yes.

Q (BY MR. WILMOTH) I'm going to hand you a document, which I guess will be Nebraska Exhibit for now 2. Mr. Ross, could you please look at the second page of this -- well, excuse me.

Please take a minute to familiarize yourself with this document.

A. Yes, I'm familiar with this document.

Q. Could you, or do you know what the response to question No. 3 on page 2 means?

A. Yes.

Q. Could you explain it for us, please.

A. You and I have had this discussion before, as you may recall, and actually I appreciate the opportunity to clarify this.

In my -- our previous discussion in my deposition, I speculated that this 13 -- 13,100 -- or excuse me, 13,912 acres was groundwater and surface water combined. I had an opportunity to review the records to retrace where this number came from, and what was speculation at that time was authenticated on two different fronts.

This was a question that was asked by state engineer Dick Wolfe of Colorado, and we gave him an incorrect answer.

Since then, I have been able to determine that the actual number of groundwater irrigators -- or excuse me, groundwater acres was about 5563 acres that are within the boundaries of the Kansas Bostwick Irrigation District system, the remaining acres are surface water.

Q. All right. So the number, if you could again, is 56 --

A. 5563.

Q. 5563?

ARBITRATOR DREHER: Those are pure groundwater acres?

THE WITNESS: Yes.

Q (BY MR. WILMOTH) And how does that relate to your 1500 acre-feet?

A. These are acres -- if you will look at the map that was provided by Mr. Draper, you will note that there are some intervening areas along tributaries and some areas that are within the outside boundaries of the Kansas Bostwick District that do not include certified acres that are actually authorized to be irrigated with District water. And so typically, these are where the wells are located.

The overlapping wells, again, this is a very limited aquifer, fairly small diversions, and so that's what represents the ability for that water to be applied to an acre of ground.

Annually there are about 1500 acres that are -- that receive District water and overlap, commingled groundwater. So this 5563 are acres that are authorized within the District, maybe not necessarily within the certified acres of the District, but within those bigger, larger outside boundaries. And they receive some water to land, but only 1500 acres of that is actually combined or commingled land.

Q. With respect to those commingled lands,

is it accurate to say that under the Kansas formula that you used to permit new appropriations or new groundwater uses, is it accurate to say that those 1500 acres received the crop irrigation requirement that you typically consider in providing those permits?

A. Probably not because they would also be limited to whatever they were able to receive from the District.

So, for instance, if we assume the maximum is 1 acre-foot per acre and the District was providing 12 inches, they would be limited to 12 inches when combined with the District. So when combined with the District and the well, they would only get a combination of maximum of 12 inches.

Q. But they could certainly utilize that groundwater as a supplemental supply to reach whatever the irrigation requirement was?

A. Yes.

MR. WILMOTH: I believe that's all we have, Mr. Arbitrator, for this witness.

ARBITRATOR DREHER: Mr. Wilmoth, if I might, let me ask a question.

MR. WILMOTH: Yes, sir.

ARBITRATOR DREHER: I don't know if

you're going to actually introduce this letter that you preliminarily identified as Nebraska Exhibit 2.

But, Mr. Ross, what is the significance of this number, 13,912 acres? Is it anything, or is it just a mistake or what is it?

THE WITNESS: Oh. It actually represents the total number of acres authorized to be irrigated by individual water rights, private water rights, if you will.

ARBITRATOR DREHER: Surface or groundwater?

THE WITNESS: This includes surface and groundwater. The 13,912 includes both surface and ground water diversions within the KBID boundary.

ARBITRATOR DREHER: Authorized to be irrigated using -- did you call them private water rights?

THE WITNESS: Private, individual water rights.

ARBITRATOR DREHER: Individual water rights, okay.

And it's both surface and groundwater?

THE WITNESS: Yes.

ARBITRATOR DREHER: Okay, thank you.

Colorado?

MR. AMPE: I think you covered it.

ARBITRATOR DREHER: All right. Thank you very much.

MR. DRAPER: Could we take a short break before we do redirect.

ARBITRATOR DREHER: Yes. Five minutes again?

MR. DRAPER: Yes.

(Break was taken from 2:25 to 2:41.)

ARBITRATOR DREHER: We can go back on the record.

Mr. Draper, redirect?

MR. DRAPER: Thank you.

REDIRECT EXAMINATION

BY MR. DRAPER:

Q. Mr. Ross, you were asked by Mr. Wilmoth about the letter from the Kansas Water Office --

A. Yes.

Q. -- regarding retaining water in Harlan County Reservoir in 2005?

A. Yes.

Q. Was that decision not to take the water that was referred to in that letter, was that done only by KBID or was it also done by NBID?

A. Both.

Q. Both of the Bostwick decisions --

A. Both of the Bostwick decisions.

Q. -- indicated they would hold the water in the reservoir?

A. Exactly, indicated that they would like to leave the water in the reservoir.

Q. Now, Mr. Wilmoth also suggested to you that the losses that were part of the consideration in determining whether to call the water down or not would all be in the Courtland Canal. Is that correct?

A. No. This would, of course, be any losses that were incurred throughout the Bostwick division.

Q. Which canals are those?

A. Any of the canals in the Bostwick, I mean, Franklin Pump, Naponee, Franklin, Superior, any canals they deliver to would, depending on the District, experience that loss.

Q. In fact, if water were delivered, it would be distributed --

A. Yes.

Q. -- pro rata to the two Districts, would it not?

A. Under -- under the Bureau's normal

distribution scenario, they have to give an equitable distribution to all acres.

In this particular case, with the possible of exception -- with that small amount of water being available, we may have run into a situation that the Lovewell or down, lower division in KBID would have not received any of that water in favor of trying to equitably distribute that between NBID and Upper KBID.

Q. Would a release that is made like that, given the presence of Lovewell, is it an even split between the Districts or does NBID receive more of the water?

A. No. Typically, NBID will get about two-thirds of the water and KBID will get about one-third and then rely on Lovewell for their makeup.

Q. In the course of the cross-examination on Appendix D to the Spronk report, Mr. Wilmoth asked you about a different subject. And that was the on-farm efficiency calculations in the Spronk report.

Did you understand Mr. Wilmoth to ask you about the on-farm efficiencies?

A. Yes.

Q. I believe you responded with respect to

the period over which those efficiencies were determined, that it was 1994 through 2004?

A. Yeah. I believe I was looking at an Appendix D and just simply gave him the period that these calculations were made from, of 2004 through 2006 -- or excuse me, 1994 through 2006.

Q. And with respect to the other issue of the period over which on-farm efficiencies were determined by the Spronk report, did you know what that value was, or what that period was that was used to determine the on-farm efficiencies?

A. No, I wasn't involved in that on-farm delivery efficiency calculation at all.

Q. And did you know what period that was analyzed?

A. No.

MR. DRAPER: No further questions.

ARBITRATOR DREHER: Okay, thank you.

Mr. Draper, you can call your next witness.

MR. DRAPER: Your Honor, I might also move the exhibits associated Mr. Ross' testimony.

MR. WILMOTH: Mr. Arbitrator, would you like us to do the same with regard to these witnesses as they come out or would you prefer that Nebraska

just submit exhibits?

ARBITRATOR DREHER: No. I think what I would prefer is to have them done at the same time. So if they're going to move to have something admitted, you follow up.

MR. WILMOTH: With your indulgence, we move that the exhibits we have presented with regard to each of the witnesses be included.

ARBITRATOR DREHER: And those will be marked what?

MR. WILMOTH: I believe it's just Nebraska 1 and 2 for now. Thank you.

MR. DRAPER: The numbers of the Kansas exhibits associated with Mr. Ross' testimony that haven't been previously moved are Kansas Exhibit No. 30, curriculum vitae; and Kansas Exhibit No. 41, the Bureau of Reclamation fold-out map.

We would move their admission.

ARBITRATOR DREHER: Barring no objection, they're admitted.

(WHEREUPON, Kansas Exhibits 30 and 41 and Nebraska Exhibits 1 and 2 were received into evidence.)

MR. WILMOTH: Mr. Arbitrator, there is no objection here, but I don't think we have a copy

of the fold-out map.

We do now.

Thank you.

I'm sorry, John, what was the first exhibit?

MR. DRAPER: Kansas Exhibit 30, the curriculum vitae for Mr. Ross, we're making a copy of that.

MR. WILMOTH: We haven't got that yet.

MR. DRAPER: My understanding is that -- or was until this moment -- that we had provided Nebraska with copies of every exhibit in our compendium.

And, Nebraska, if you could check, if there is some gap in there, we would certainly like to know about it. And we'll check our records, too.

With that, Your Honor, may I call our next witness.

ARBITRATOR DREHER: You may.

MR. DRAPER: Call Dr. Terry Kastens.

TERRY LEE KASTENS,

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

DIRECT EXAMINATION

BY MR. DRAPER:

Q. Please state your full name and professional position and address for the record.

A. Terry Lee Kastens, Professor at Kansas State University, address 303 North 2nd, Atwood, Kansas 67730.

Q. What is your present position, Dr. Kastens?

A. Professor of Agricultural Economics, Kansas State University.

Q. Do you have a copy of Kansas Exhibit 11, your curriculum vitae?

A. Yes.

Q. Would you briefly summarize your education and the particular qualifications that apply to your work in this case.

A. I graduated with a bachelor's of economics -- bachelor of arts and economics in 1973 and then a Ph.D. in agricultural economics in 1995. I have also been a lifetime farmer. I've been an irrigator in the Republican Basin for over 30 years on both the side of Nebraska and the side of Kansas.

Q. Let me ask you about your approach to the present project.

How did you approach the investigation

and analysis that was needed to produce your expert report in this case?

A. Well, first of all, we pulled together a team of what we considered somewhat differing skills, people within our Department of Agricultural Economics, because we know that there is a lot of issues that have to be hashed out and thought about very carefully in this kind of a complex situation, and so we wanted a team to do it.

And so we pulled a team together that has experience in land investment, production function modeling, farm management, secondary impacts, economic impacts that go beyond farmers. We pulled together a team that does all of this.

I think we have credentials both on the farm level standpoint, we work heavily with decision makers at the farm level, and a lot of us that make decisions about irrigation, and we also have plenty experience on the academic side.

Three of us on our team taught our top-level Ph.D. course, team taught it, a course that deals specifically with sophisticated modeling techniques, if you will, problems and benefits of different types of models.

So I think that kind of provides our

background of our team.

Q. Let me direct your attention to what has been designated as Kansas Exhibit 5. What is Kansas Exhibit 5?

A. I'm not sure which one is Exhibit 5.

Q. Oh, I'm sorry, it is a report entitled "Economic Impacts on Kansas Diminished Surface Water Supply to the Lower Republican River Basin Caused by Nebraska in 2005 and 2006."

A. Yes, I have that.

Q. And are you one of the authors of this report?

A. Yes.

Q. Who the other authors?

A. Dr. Bill Golden, Dr. Kevin Dhuyvetter, Dr. John Leatherman, Dr. Allen Featherstone and Dr. Tom Johnson.

Q. I would like to refer the Arbitrator and the parties to the curriculum vitae of the other authors of this report. Dr. Golden's CV is Exhibit 10; Dr. Dhuyvetter's CV is Exhibit 12; Dr. Leatherman's is Exhibit 13; Dr. Featherstone's is Exhibit 14 and Dr. Johnson's CV is Exhibit 15.

Are these the gentlemen who participated with you on the team that produced the report which

we have identified as Kansas Exhibit 5?

A. That is correct.

Q. Would you explain how you went about this analysis, please.

A. We considered the issue to be one of different profits associated with differing quantities of water, if you will. And so we considered that, had water been available, there would have been more irrigated acres than what was observed, and some acres that were already irrigated would have had more water than what they actually received. So it was an analysis of difference in farm profits associated with those different classes of irrigators, if you will, or nonirrigators, and totally done within the confines of the Kansas Bostwick Irrigation District, with the exception of the add-on part that dealt with outside; but I mean, our analysis was principally within the KBID.

Q. And would you briefly walk us through the report and describe the key elements.

A. Okay. The key element, first of all, is to consider in a short-run setting, such as where water is short some year and not the next, certain costs are going to be quite fixed, our sunk cost, so to speak.

So a large part of our time was thinking specifically about what those costs might be.

And so we considered each cost category within typical crop budgets, that we do such thinking about farm profitability, we consider which costs would be fixed.

And we considered that irrigation equipment, for example, would be fixed, because it can't be easily sold or rented out to someone else. We considered the depreciation and interest portion of farm machinery to be fixed; not the fuel, but that portion; we considered labor to be fixed in the short run. And basically we thought through each category -- they're listed in the report -- to try to establish very carefully which costs we considered to be fixed, you know, from the farm-level decision framework, thinking about how farmers behave in the absence of water in some year.

That sort of takes care of the cost side of things and then you have to bring in the revenue side:

The revenue side, we were principally thinking about yield differences associated with different quantities of water. We assumed the price would be the same, whether they were short of water

or not -- the crop price. So basically the revenue side is determined totally by our different expectations of crop yields, given quantities of water.

Q. And how did you go about determining the differences in crop yields?

A. Okay, we relied on a model that we call the IPYsim Model, which actually is an enhanced version of a model put forth by Kansas, a number of professors.

There is Stone, in particular, who did the model some number of years ago. His model was -- his model is fairly well accepted as a yield response to irrigation water, a model that also takes into account rainfall or precipitation; but that model is not an economic model, as such.

And we were very interested in not only thinking about prescriptively what happens if this much water is applied to crop yields, we also want to know whether or not that -- whether or not we would observe that, whether we would expect to observe that situation.

And so back, already, actually independent of this current analysis, in 2005 a number of us on the team put together what we --

basically was the foundation of the IPYsim Model, which considered the economics of irrigation.

And we also brought in at the time nitrogen fertilizer, trying to make a very realistic decision framework for farmers, sort of a what-if model, if you will, for farmers to make different profit-maximizing decisions in the face, at that time especially, of higher energy costs and higher fertilizer costs.

It's very important to us that when we did that, we have a model that is very acceptable. That's just the way we tend to work since we work so much with farmers. And so many presentations were done where the efforts of this modeling efforts were actually demonstrated to real-life decision makers.

Just one that comes to mind, in particular, was a presentation to some, I believe it was 80 crop consultants in Hastings, Nebraska, and those crop consultants were covering all of Nebraska and Kansas.

And I specifically asked them whether they agreed with the change in yield associated with changes in irrigation water and changes in fertilizer quantity. And so even though our particular IPYsim has not been really academically

reviewed, in a sense, it has been very critically reviewed by many users who continue to use it on a regular basis for making crop decisions.

Now, I might throw out that the latest version, the one that is on the web today, since these are evolving things, actually brings in, not only irrigation fuel and nitrogen fertilizer, but also phosphate fertilizer.

We did not use it for this present case, partly because we did not develop it until this winter, but also because we didn't have time really to run that one by real-life users to feel -- to be sure we feel that our model is appropriate.

So we just used the nitrogen component and irrigation component that we developed basically back in 2005 and 2006.

So when you -- when you have that kind of an economic framework, then you have now -- you have made it somewhat predictive, because we kind of say this is how we would expect people to behave. And this was important, especially because our task at hand was to evaluate specifically two years, 2005 and 2006.

We know rainfall is distinct across those two years. We know that fertilizer prices

were higher during that time period than they were before.

There are some issues that are very distinct to that time period, so we wanted to be sure that we had a model that did what we felt was adequately representative of decision makers in KBID at the time.

Now, that also required some other, oh, calibrations, if you will. The original Stone model from which our IPYsim model was developed was developed principally from data in western Kansas, not totally. There was some data actually from Manhatten, some from Belleville and some scattered around, but principally it was developed in western Kansas.

And though it's said that, you know, it makes a point, for example, about soil types mattering, we don't believe that the difference in the silt loam soils of western Kansas and those of the KBID area, for example, are sufficiently large that they would diminish our efforts of using this model specifically for KBID.

Also, the model brings in rainfall explicitly, so we also can have rainfall in the model.

We did enhance that just a bit for this particular task by looking particularly at seasonal rainfall to try to get a little bit of the timing of rainfall.

Second of all, we calibrated it so that the -- so that the yield goal would make sense.

Now, let me explain how we did that.

Yield goal, first of all, is the maximum of the quadratic plateau function that defines yield. Now, that's an expectation; that's not the maximum possible yields. That's the maximum expected yield. That is the yield that you would expect if irrigation water and nitrogen fertilizer were free; basically not limited, you had all you wanted.

We established a trend yield for the KBID area by looking at the KBID corn yields going back to 1962, I believe, and just basically did a linear interpolation of the data just to try to get at technological advance. And we determined that that trend yield was something, I think 169 or thereabouts; it's in the report.

But then we calibrated the model so that that would, in fact, be the optimal yield that farmers would get in 2006. So the yield goal was

actually based on calibrating that trend yield back to what would have been economically optimal, given that farmers make decisions in that kind of a profit-maximizing standpoint.

So that provided a yield goal of, I think it's 172 or thereabouts. Now, that again determined the yield model with which we worked.

Now, the only modification we did from thereafter is to use the relationship in the yield model -- proportional relationship between different levels of water to say what would have happened to observed yields in the situations we're interested in.

For example, we observed a particular yield in KBID in 2005. We asked the question, What would have happened? And we rely back on our model and we say, Proportionally, given that we have kind of two different outcomes from the model, one is the water they wish, let's say, and the other one is the water they actually got, they get two different yields -- the model does -- then we use -- proportionally we adjust the yields actually observed.

We did that because there is a lot of reasons for yields to deviate from the expected

values coming from models thereof. And so it's a way of thinking about this issue of it being a particular good year, particular bad year outside of a world, say, irrigation water and rainfall. There is a lot of other things, past temperatures, lots of other things that come in there to make some predictive year that we don't measure and so that's a way of adjusting.

So that's, then, effectively the way we think about modeling yields, which then come in, of course, with price on the revenue and we have already talked about costs, and that's the way it plays out.

Q. Would you describe how that analysis then, what results were produced and review those results, just briefly, since the Arbitrator has already had a chance to look at the report.

A. That, then, basically -- well, I should finish up before I get there.

I should say the only other thing that we did differently that is very relevant is when we did that, we said, How much water would these farmers want, how much would they economically desire.

And then when we look at the number they actually got, the water they actually got, plus the

number that Book's report suggested that they were due, that that quantity together was sometimes less than what they actually desired.

So we kind of revised and we say it's probably more appropriate to say that farmers don't have an expectation of getting every drop of water they actually want. And so we said in that case, perhaps, what they got, plus Book's recommended water, was probably a better expectation of what they could expect for water, given there were no issues between Nebraska and Kansas, let's say.

And so then we revised the model basically by just pushing water back until we got to exactly that quantity and then that's the final numbers we got.

And then from that, we look -- okay, we look at the groups of irrigators that received a lower yield than they would have, had they had the water. We looked at irrigators that were basically -- or irrigated acres, I say, that were forced into a dryland production setting. And then we combined the differences between, you know, what they would have had, had they been irrigating those acres they wanted and irrigating those acres that were forced into dryland, compared that to what

actually what happened.

That then results in the direct dollar impacts that we report, I believe it's in Table -- one of the tables there in the report -- Table 14, for example, and then the only -- the only thing we do different then after that, that gets us back to a dollars per acre-foot of water.

And then we take those other non-KBID water quantities, which came from the Book report that has already been discussed somewhat today. We take that number times the same dollars per acre-foot, add them together. And so then we come up with a direct impact in '05 of about two and a quarter million dollars, and in '06 of about $2.8 million.

And from there, then we go on to consider the secondary impact, which is not the part that I'm an expert in and not the part that I had much to do with other than reading it and reviewing it a bit.

Q. Would it have been possible to take -- to approach this quantification of economic losses using a different methodology?

A. Certainly, there is always different methodology. One -- one that is always -- it's

always appealing to the economist to consider market data, it really always is.

And the first thing that always comes to mind when we think of irrigation versus nonirrigation is rent differences between nonirrigated land and irrigated land. That's a very common thing to think about.

There are a number of problems that made that effectively totally unusable and I will go through those. We did consider -- we did consider starting with that as our number and then kind of making adjustments from that.

It would be partially appropriate if you knew that the landowner owned 100 percent of the irrigation equipment, because the rent difference between -- because irrigated land rents reflect a return to land, a return to kind of the existence of water, and then a return to irrigation equipment, investment. So if you knew that, you could say, okay, the rent is that.

Now, that still leaves -- that would take care of, in fact, the fixed nature of the irrigation equipment, the depreciation and interest associated with irrigation; that would take care of that.

It would not take care of the other things we consider to be fixed: the labor, a portion of some of the other categories that we delineate. So it would only take care of the irrigation.

But more importantly than that, we don't even know who owns the equipment. It's something we struggle with all the time when we consider rent data. It's almost always a mixture of landlord and tenants, which greatly confounds the using rent as a measure of trying to get at what we want to get at.

It's especially tough when you consider that the smallest scale of market rent data that we can get our hands on really that is fairly reliable is the North Central Kansas Crop Reporting District.

Now, about 25 percent of that District's irrigated acres are KBID acres and three-fourths are not. That's, you know, not terribly bad of itself, except that we also know, as testified already to a couple times this morning, that the irrigation equipment is much different in KBID than it is outside KBID but within north central Kansas.

And so we know that, even if we knew who owned the equipment and everything else, we've still got a problem of the rent data that we would work with being representative of the rent data that we

would like to see and that's within the KBID.

And so it means the data were basically unusable to do the kind of tests that needs to be done.

And then the final reason that we just totally ruled out rent as an approach is the rent -- looking at rent difference is really an on/off situation. You have either somebody is an irrigator, somebody is not.

Now, that might be somewhat appropriate in some areas that are extremely arid where, you know, you either use fewer irrigation on fewer acres or whatever. But in an area like Kansas, we have a mixed response to irrigation water. We see basically a reduction in yields coming with just less water on the same acres. Furthermore, it's is kind of unhandy, a lot of times, to, say, shut off one of the towers on a center pivot sprinkler to try to restrict the number of acres.

So we have a situation where we have to assess the impact on yields of limited water; not just water turned off completely, but limited water. And, once again, for that it's impossible to use rent difference to get at that issue. So we completely ruled out the idea of rent differences.

We went to a method that basically totally did not need to know who owned the irrigation equipment and who did not, because we just assume it's fixed and we just assume it, almost from kind of a sole proprietor's standpoint. And we say, There is no difference in a short-run system whether the irrigation equipment is owned by the tenant or the landowner.

So we went down this other road that we believe is much more representative of what actually would have taken place, had water been reduced in 2005 and 2006.

Q. Or if additional water had been available in 2005 and 2006?

A. Yes, that's correct.

Q. Could you just say a word about the costs that you considered fixed and why you considered those fixed.

A. Okay. We considered labor -- we already talked about irrigation equipment investment being fixed. We think that's reasonable because it's pretty hard to do otherwise in a short-run setting; and, moreover, it's often irreversible. I mean, you can't pull up a pipeline and rent it to somebody else. There are so many things that make it

irreversible and make it fixed, especially in the short run and even in the long run, in some cases.

The depreciation and interest on farm machinery we believe should be fixed because it's pretty hard for a farmer who finds himself to be short of this -- water this year to say, I'm going to sell off a portion of my machinery capacity that's associated with more irrigation. It's also very hard to say, I'm going to go do custom work for somebody else when many other farmers in the same area find themselves in the same boot also with overcapacity for the year. And so we held that fixed.

We also -- we didn't hold fixed fertilizer. We kept -- we allowed fertilizer to differ between dryland and irrigated, but we brought back in 25 percent of the difference in the fertilizer between irrigated and nonirrigated, with the idea that when people are making a decision, they probably plan on irrigating part of the lands. We know it's -- it's a tougher decision that people are making in the spring about what they're going to be irrigating and not irrigating.

We also brought in 33 percent of the fuel charges for irrigation to -- basically to represent a demand charge by electric companies.

The fuel component in irrigation in KBID is a small number relative to deep-well areas, and so the demand charge we're assuming becomes a larger percentage. And that's the reason we brought that in, or we believe that was fixed.

The fuel is -- other than that part, the fuel is not fixed. We assume dryland cropping systems fuel for that which was planted, the dryland, seed, herbicide, chemicals. Those things were all basically, if we knew we had to plant these acres dryland, we lowered our cost to represent dryland information.

So we end up with a portion of the costs fixed and a portion of the costs that we actually considered to be not sunk costs and actually varied.

The ones that varied were primarily seed; chemicals; herbicide; fuel, except for the component I mentioned; the fertilizer, except for the component I mentioned. That probably pretty well describes it.

Q. I would ask you to conclude simply by giving us the final conclusion that you reached, that your team reached, that's reported in your report with respect to the losses in Kansas.

A. You mean with the secondary impacts?

Q. Yes.

A. Yeah.

Our final conclusion was, of course, that there were secondary impacts that came in as well. And it came in basically that money we would have been harmed -- Kansas would have been harmed, both by direct effects, indirect effects; and then we finally brought in an interest charge to basically bring the money up to December 31, 2008 or to be used as guided -- to use as a guideline to bring it up whenever such moneys might be paid.

And the bottom line was about, approximately, I think, a $9 million number that is recorded in the report that basically says that that's the amount of money that Kansas was harmed by the -- by the reduced water flows.

Q. And Dr. Leatherman will testify with respect to the secondary impact; is that right?

A. That is correct.

MR. DRAPER: No further questions.

ARBITRATOR DREHER: Okay, I have some.

Dr. Kastens, I certainly don't have any direct experience irrigating in Kansas, so -- if I did, I wouldn't be sitting here, probably.

But I do have some experience here in

Colorado, and during an earlier part of my career I was responsible for some water conservation activities in agriculture and we did some demonstration projects that clearly demonstrated that more water doesn't necessarily increase crop yields.

And I assume that that factor is reflected in your crop yield functions, but I don't have -- I mean, you don't have any illustrative functions.

THE WITNESS: That is precisely correct.

The rainfall and irrigation is both brought in and then they plateau in, we say, a quadratic plateau function and where additional water cannot help you anymore.

So we used in our function -- it's part of Stone's model and it certainly would be part of any model that I would consider, we consider it an absolute necessity to have a function that shows diminishing returns to water, basically what you're mentioning: That the first inch of water gives you higher yield than the next inch. And then in our case, at some point where the next inch gives you no further yield whatsoever, the response goes to zero.

So yes, that is embedded in that.

ARBITRATOR DREHER: And does your

analysis assume that all acres that are classified as irrigable are equally productive when optimal water supplies for irrigation are available?

THE WITNESS: Broadly speaking, yes. You would have to say no when you come to exactly the yield adjustments that were observed. For example, since we were adjusting yields that were observed, you know, in '05 and '06, by what we think they would have been, had we had the water, those numbers I'm sure would imply a different productivity.

But the short answer is yes, we assume the same productivity; but when you think about some of the implications of the model, you might be led to say that they're actually a little bit different in productivity. I wouldn't call that productivity; I would call that the fact that it was a good year in that area.

In general, yes, we assume that all acres would be same productivity.

ARBITRATOR DREHER: And I'm not suggesting that we had a way to do otherwise necessarily, but isn't it true that not all acres are created equal?

THE WITNESS: Oh, most certainly, most certainly. That is, most certainly, a simplifying

assumption. That is.

ARBITRATOR DREHER: And I presume, then, that you didn't do any analysis to try to quantify what level of overstatement of hypothetical productivity you might have simulated?

THE WITNESS: We're -- I have to go back and look at my little notes I did after -- after the deposition, there was some discussion about, perhaps, people are idling the worst productivity land, and so that you can't make an argument that it's equal.

But we looked also at the counties that were surrounding, especially Republic, which has most of the KBID acres, we looked at Cloud and Jewell. And we realized that those yields also went up very much in that year, and there was no -- I can't remember -- I did do an analysis of it, but it was crude and I don't have it in the report. But I did want to verify exactly what you ask is: Was there really some idling of less productive acres? I don't think so. I don't think so.

ARBITRATOR DREHER: Because, I mean, even within a particular county, the productivity wouldn't necessarily be homogenous? I mean, again, this isn't Kansas, but I can think of places where farmers and irrigators that I was involved with would

try to enroll lands in a CREP program, for example, that included rock outcrops that couldn't have been farmed. Now, I don't think you have any desalt outcrops in Kansas.

THE WITNESS: No, I'm very familiar with what you're saying.

Of course, we didn't calibrate specifically to KBID with the trend deal approach, so we kind of -- I would say we kind of nailed the area of KBID adequately.

We did not do anything specifically within our report to look at the issue of are we abandoning or not irrigating those less productive acres.

But, like I said, I did a peripheral thing -- can't remember it right offhand without going back and looking at my notes -- to ensure that what we did was appropriate, and I just don't remember what it is. I can look it up if I get a break.

ARBITRATOR DREHER: At some point, Mr. Draper, I would appreciate if that analysis could be provided.

MR. DRAPER: Of course.

ARBITRATOR DREHER: I don't completely

understand the last sentence in the first paragraph under "A. Water Response Functions" on page, I think it's page 2. And it reads, quote, Put another way, in areas where natural precipitation sufficiently substitutes for irrigation water, producers optimally apply higher rates of nitrogen fertilizer (and achieve higher crop yields) than in areas dependent upon irrigation to meet part of crops' water needs?

Can you explain that for me.

THE WITNESS: If you think about to get the next bushel of acre increase -- let's use corn as an example -- the nonirrigated farmer can do that just by adding another pound of nitrogen fertilizer. The irrigated farmer has to add a pound of the nitrogen fertilizer and more irrigation water to get a higher yield. So the irrigated farmer actually has to spend more money per unit of increased production, if you will.

So the optimal amount, given the situation -- the economic optimum says basically it's kind of like buying nitrogen fertilizer at a lot higher price. If you ignore the irrigation component and just think about it as a nitrogen response, it's like the irrigated farmer has to pay a higher cost.

Well, as economists, we all know the higher priced something is, the less you're going to use optimally.

And so the irrigated farmer will use less nitrogen for the same yield. And basically, that's what that is saying. It's just saying that you have to take that into account, the interaction between irrigation water and nitrogen. And that's why it's a little -- you know, that's the reason we brought in the nitrogen component back in our model back in 2005, is to specifically address that issue, because irrigators are very much aware to get that next bushel of increase, they have to pay, both more water and more nitrogen. And both were fairly expensive in 2005, especially for deep-well irrigators. And so it became very obvious.

That's all that is saying.

ARBITRATOR DREHER: So implicit in that is an assumption that the precipitation would also fall coincident with the crop demand?

THE WITNESS: Oh, yes, yes, yes, precisely.

ARBITRATOR DREHER: I missed that part initially. That's fine.

THE WITNESS: Yes. I should have

focused on that probably.

ARBITRATOR DREHER: And you mentioned that your newer model now has a phosphate component. Do you have a sense for if you brought that in, what kind of effect it would have on your analysis?

THE WITNESS: Actually, I can't even answer the effect the nitrogen has on the analysis in terms of the magnitude, say, of the moneys owed. I have not done that. Too me -- and I'm not even sure that I have the intuition, without going back and studying it and analyzing it, what that would do.

So I certainly can't answer what phosphate -- I can say that the demand for irrigation water would be lower. The demand for irrigation water is lower when I bring in nitrogen for the reasons we just talked about. It would also be lower if I brought in phosphate for the same reason.

The problem is when we're looking at different amounts of water, we would be pushing back on our production function to get the same quantity of water, say, that Book said that we needed to value. And so the -- probably, I might speculate -- without going through it, I might speculate it might actually increase amount of money owed, because

we're pushing back on the production function, and so the value per -- the value per acre-foot would go up. And so holding the quantity of water constant, I think the amount of money they owed would actually go up, but I would reserve the right to do that without -- I mean, I would have to look at it first.

ARBITRATOR DREHER: Also on -- let's see, what page is this on?

It's on page 3 under "Acres," would you where you explain how you estimated the additional acres that would have been irrigated. For the estimate of acres that would have been irrigated in 2005 and 2006, I don't completely understand why you chose the seven-year average of the proportion of the acres classified as irrigable for 1994 through 2000, which were years when there were no expected water use restrictions, while for 2005-2006 those were years of short supply with restrictions at the start of the irrigation season.

THE WITNESS: Okay. First of all, we know classified acres, that we know in 2005 and 2006. What we want to know is what would be irrigated.

ARBITRATOR DREHER: Right.

THE WITNESS: We also know that the percentage of classified acres that are actually

irrigated over the years varies for different reasons.

So what we were after was an expected percentage of classified acres that are irrigated in a more normal situation where waters were not in short supply.

So all we did was just computed that proportion of irrigated to classified acres, the average of that proportion, which was an average of whatever, 19-, whatever those years were, 1994 to 2000. And we said that proportion should probably be our best estimate of what would be irrigated if water were -- you know, if water were available. And that's the way we did that.

ARBITRATOR DREHER: Well, I could understand that if the years 2005-2006 would not have been water-short years, had there not been overuse, but the Kansas Bostwick Irrigation District Annual Report identifies 2005-2006 as water-short years at the beginning of the year. And at the beginning of the year, they couldn't have known that there was going to be potential overuse in Nebraska.

And so I'm just concerned that using that average may not be representative because the average is from a time period when there were not

water-short years.

THE WITNESS: Well, okay. The purpose for getting that average was to say what would happen if they were not in short supply, that was the purpose. We used the actual acres that were irrigated. We used that in the analysis in '05 and '06; but we say that if water were not in short supply in those years, then we would have had thus and so percentage of irrigated -- of classified acres would be irrigated to get at what our expectation would be. I mean, that's --

ARBITRATOR DREHER: Right, I understand. But I don't understand how the expectation would be that there would not be water-short years if they didn't know there would be overuse at the beginning. And I may be confusing it more.

THE WITNESS: I'm not sure I follow you.

Those were water-short years, right?

ARBITRATOR DREHER: 2005-2006 were water-short years with restrictions in place at the beginning of the year.

THE WITNESS: Right. But I think the question is, is what would be irrigated if they were not water-short years, right?

ARBITRATOR DREHER: Well, but that's

only -- from my perspective, that's the question, if Nebraska compliance would have resulted in nonwater-short years? And that's the part we don't know because they were water-short --

THE WITNESS: Sure, yeah.

ARBITRATOR DREHER: -- at the beginning of the year.

THE WITNESS: My assumption is that Nebraska's compliance would have been -- would have led them to be nonwater-short years in that regard, at least within the framework of . . .

ARBITRATOR DREHER: And my only comment is I don't know how you could know that at the beginning of the year when they were deemed to be water-short years because you didn't know that Nebraska was going to potentially overuse its water supply.

So I'm concerned that the acres that you've calculated or estimated as being irrigated in 2005 and 2006 that were not actually irrigated, but that your estimates of what would have been irrigated, had there not been Nebraska overuse, may be an overstatement because they were water-short years.

THE WITNESS: It could be. It's a tough

one to get at for the reasons we've talked.

And then if you take, you know, the part above Lovewell where it was zero, it's hard to conclude that it would have, in fact, been zero. And so we know that it's something higher than that, and so we would have to fall back to some other proportion to work with. And I -- we could have worked with, you know, some other proportion that would have changed the results slightly, certainly.

We -- we used the proportion that we believed to be the most appropriate one for the problem we did.

ARBITRATOR DREHER: Okay. Turning to center pivot efficiency, you used 90 percent, and I looked at the ranges that you cited. I mean, it's at the high end of the range. And I'm wondering why -- why you use an efficiency that was different than the 85 percent efficiency used by Mr. Book.

THE WITNESS: We actually -- it was, call it an expert opinion consensus among us, that after driving around and seeing the newness of the pivots, the type of drops and so forth, we know, as Mr. Ross already attested to, that there is quite a little difference in the efficiency of center pivots, depending upon the sprinkler package and so forth.

So we made the judgment that we thought it was 90 percent, given that, because we do the year people are talking about, '95 occasionally; we believe 90 percent was a reasonable estimate for those reasons.

ARBITRATOR DREHER: But apparently you didn't consult Mr. Book in that?

THE WITNESS: No, we didn't.

We didn't, because part of the reason is the irrigation efficiency was actually important to us independent of -- I know we think about it as kind of water issue, but our goal was to get back to a measure a of water that was consistent with Stone's model and our IPYsim Model.

So we were interested specifically in application efficiency of the two different types of irrigation systems we considered, are flood and pivot. So we were more interested -- we really didn't even need to consult Book on that or anything else; it wasn't an issue of that.

It was an issue of being sure what we were doing we thought was appropriate, given the yield model framework we worked with.

So then we, you know, kind of think about the way Stone's model is built and coming back

to net water, come back to the model, and that's the reason we did it.

And that's the only reason.

ARBITRATOR DREHER: And just a point of the clarification, you define growing season precipitation at the top of page 5 as the precipitation that occurs prior to and during the growing season that can possibly be of beneficial use to crop production?

THE WITNESS: Yes.

ARBITRATOR DREHER: And then in Table 5, you actually set forth the periods used for growing season precipitation calculations for various crops.

And what struck me is that the beginning date in that table is a reasonable beginning date for growing season, but wouldn't precipitation that occurs in the month or maybe even two months before growing season provide soil moisture that would be of benefit?

THE WITNESS: Yes, it would. I mean, we -- the model we work with actually covers it, but we worked with annual rainfall; annual rainfall, not growing season rainfall. But we believe that it would be more accurate if we looked at growing season rainfall as just the difference in growing season

rainfall from some norm and what we observed in '05 and '06 and append that back, add that back to the annual, we thought it would be a more accurate measure, at least to try to account a little bit for the benefits of certainly an inch in July is worth a lot more than an inch in April and certainly a lot more than an inch in February.

And so, yes, you could -- you could have just worked with annual rainfall, because that's the way Stone's model was set up, but we wanted to do it a little bit better than that. And so that's the reason we did it.

And it was kind of arbitrary in that sense. We could have extended that, you know, further earlier yet, if we wanted to, like you suggested, and I don't know what the impact would be. I'm not sure. I think it would be less accurate.

ARBITRATOR DREHER: I was just wondering, you know, if the fact that your definition included precipitation that occurs prior to the growing season was consistent with what you actually did in the table.

THE WITNESS: Oh, okay. Okay, I'm not -- the precipitation that is included is only

what you see in that table, if that's your question.

ARBITRATOR DREHER: It looks like growing season, not prior to growing season.

THE WITNESS: Right. The reason we did that is because people define growing season so much differently, and, you know, they might say the growing season for corn is actually June 1 to September 1. So we just didn't want any misunderstanding, so we kind of were trying to report the dates here in which we used for rainfall. So it was these dates that we used.

So as far as I'm concerned, if our language doesn't say, it's poorly -- poorly structured.

ARBITRATOR DREHER: And for the average irrigated crop mix for the years of 2005-2006, if I understand your analysis correctly, you used the average irrigated crop mix for the period 1994 through 2000?

THE WITNESS: That's only for those acres that we said were dryland that would have been irrigated. Of course, the irrigated acres that were planted, we considered just the way they were; yes, that is correct.

ARBITRATOR DREHER: And I guess this is

a similar concern to one that I have already expressed, that those years were not water-short years with restrictions in place at the start of the season; whereas 2005-2006 may have been.

And at this point I'm still thinking that they would have been water-short years with restrictions in place at the start, regardless of Nebraska's overuse.

And so I just -- I just have a question in my mind as to how representative those averages are. And I don't know how much difference it makes.

THE WITNESS: It's the same issue.

ARBITRATOR DREHER: And then this is just something I've had a question about for some time.

You know, most of the testimony today is describing 2005-2006 as being very, very dry years. And, you know, I wasn't there, so I wouldn't know, but then I look at your Table 6 that reports annual precipitation, and I recognize that annual precipitation isn't growing season precipitation.

But normal, you report, is 28.22 inches. And in 2005, if I read this right, the annual precipitation was almost 32 inches.

THE WITNESS: That's correct.

ARBITRATOR DREHER: And 2006 was a little dryer at 26 inches, but how dry were those years with those kinds of precipitation numbers?

THE WITNESS: That's a good question. I mean, that's the reason we used the model, to sort that out, because these are the numbers we worked with.

ARBITRATOR DREHER: Okay.

Nebraska, Mr. Wilmoth?

MR. WILMOTH: Thank you, Mr. Arbitrator. I notice it's quarter to 4.

ARBITRATOR DREHER: This would probably be a good time for a break. I lost track of time.

MR. WILMOTH: We'll certainly be able to finish up, but I have a number of questions.

ARBITRATOR DREHER: We'll certainly take a break.

(Break was taken from 3:42 to 4:00.)

ARBITRATOR DREHER: Mr. Draper, as I understand it, you have one last question to ask with the witness.

MR. DRAPER: Yes, I checked with Mr. Blaneknau about this. For the record, I wanted to confirm with Dr. Kastens.

ARBITRATOR DREHER: Yes.

EXAMINATION (continued)

BY MR. DRAPER:

Q. Dr. Kastens, the exhibits that we've identified previously that are references to your work which are listed as Kansas Exhibits 17, 18, 19 and 20, I would like to confirm that those are -- those are the references that cover the IPYsim, the Stone yield model and other matters that you relied on in your report?

A. Yes, that's correct.

MR. DRAPER: Thank you.

ARBITRATOR DREHER: Are you offering those now then?

MR. DRAPER: I'm prepared to do that, yes.

ARBITRATOR DREHER: Okay.

MR. DRAPER: The exhibits that we would offer in connection with Dr. Kastens' testimony are Exhibit 5, the report by him and his team; the curriculum vitae for the authors, which are Exhibits 10 through 15; and the references that I just noted, which are Exhibits 17 through 20.

ARBITRATOR DREHER: Any objection to those?

MR. WILMOTH: No objection.

ARBITRATOR DREHER: I assume Colorado has no objection.

MR. AMPE: No objection.

ARBITRATOR DREHER: All right, they're admitted.

(WHEREUPON, Kansas Exhibits 5, 10, 11, 12, 13, 14, 15, 17, 18, 19 and 20 were received into evidence.)

ARBITRATOR DREHER: You may proceed, Mr. Draper.

MR. DRAPER: It's now, I believe, cross-examination by Nebraska.

ARBITRATOR DREHER: That was the only --

MR. DRAPER: Yes, that was the only point that I wanted to make.

ARBITRATOR DREHER: I was so deep in thought I misunderstood, I'm sorry.

Mr. Wilmoth.

CROSS-EXAMINATION

BY MR. WILMOTH:

Q. Doctor, good afternoon, Mr. Kastens.

A. Good day.

Q. Good to see you, again. Thank you for coming. We've only got about 50 minutes, I guess, so we'll try to rip through some of these. I would like

to try to finish with you today and make it little easier on your schedule.

A couple points of clarification, just for the record.

Has the IPYsim model ever been used to calculate damages in a legal proceedings before?

A. No.

Q. And we heard some testimony earlier today about rights that are junior to the MDS and we heard some things about rights below Lovewell Reservoir. I didn't hear any dollar figures assigned to those types of rights in your report; is that correct?

A. We assigned a dollar figure to the outside KBID numbers that we received from Book -- actually, the numbers that you guys were discussing here.

Q. That doesn't include anything for Milford Reservoir, though?

A. No.

Q. So that's not part of your report?

A. That's correct.

Q. And you mentioned that you rely on Mr. Book's report. I believe I asked you in your deposition last time how that would affect your

report if his numbers were altered. Specifically if they were altered downward, how would that affect your report?

A. I can't say exactly. I can say that the dollars per acre-foot likely would go up. The total dollars likely would go down, but I can't say to what magnitude.

Q. Thank you.

ARBITRATOR DREHER: So Mr. Wilmoth, just so I understand.

It's not a linear relationship then?

THE WITNESS: That's correct.

Q. (BY MR. WILMOTH) Is it true, Dr. Kastens, that the IPYsim Model -- for the court reporter's help, it's capital I-P-Y, small s-i-m.

A. Yes.

Q. Is that model designed principally to recommend optimal behavior or to predict actual behavior?

A. Actually, they're one and the same.

Q. How so?

A. Because if you -- part of the reason we design models that incorporate certain causal relationships, whether it's profit maximization or diminishing returns, whatever, they become both a

prescriptive model, saying what happens if this happens; but they also become a predictive model in the sense that if people actually believe in your underlying assumptions or your underlying -- yeah, your underlying assumptions, that it's an indication of behavior.

Q. And what did you do to check your -- to check actual behavior against your model assumptions?

A. I said primarily what we did is we demonstrated it, actually dozens of times, to hundreds of people, farm-level decision makers, agronomists that are very much in the business of advising farmers on applying water and fertilizer. So we relied on feedback from them saying that it looks believable to me.

You know, I mean, that's the kind of framework that we consider designing models to try to get -- to be sure that we're right.

Q. But you didn't conduct any evaluation within KBID, for example --

A. No.

Q. -- '05 and '06, to figure out how, in fact, those aquifers reacted?

A. No. Now, that doesn't mean that there wouldn't have been KBID responding to some of my

demonstrations, but no.

Q. If I understand IPYsim, it's essentially kind of a farm-level scale model and then you scaled it up to a regional level; is that correct?

A. Well, sure. But there is -- you know, KBID is almost a farm in size, you know, really. And then it's a little hard to think about where, you know -- the scaling is an interesting issue, as we know as I already discussed heavily; but 40,000 acres, a couple farms, you know, could be. We know it's a lot more than that in that particular area; but what I'm saying is, we don't really know on -- we assume that KBID kind of behaves as a farm, if you will.

Q. As a single unit?

A. Yes.

Q. So you didn't take into account any difference in soil types --

A. No.

Q. -- or farmer skill level or precipitation received in one area or not another?

A. That's correct.

Q. And you talk a little bit about calibrating the IPYsim Model, calibrating, I believe it was the yield goal, and the -- is it the target

yield?

A. Trend yield.

Q. Trend yield, excuse me.

When you, say, calibrate those two to one another, is it correct that you're calibrating to model results?

A. It was just one model. I'm not sure I'm following.

Q. The trend yield and the yield goal are two model scenarios, correct?

A. No.

Q. Why don't you explain what they represent.

A. Yield goal is the yield that's expected, given that irrigation water and nitrogen fertilizer were free.

Trend yield is the yield that's expected, given that farmers observe the average fertilizer price and crop price and irrigation price numbers that they observed in that period -- whatever number -- 1994 to 2000. And that is the economic optimal yield, given that farmers behave in a fashion to react to those prices that they observed at that time period.

Q. In your experience, do farmers often

behave optimally?

A. On average, I think they do.

Q. And with respect to those, to trend yield and yield goal, did you calibrate either one of those to actual yields?

A. Trend yield was calibrated to actual yield going back from 1962 to 2006, I believe it was, calibrated to get at kind of what fully irrigated yield would be.

So, yeah, it's calibrated to observed yields in the KBID area.

Q. And what number did you derive for that?

A. 169, I think, something like that.

Q. If I understand correctly, your model predicted that actual yields in 2005 would have been something on the order of 150 bushels; is that correct?

A. Repeat that question.

Q. Referring to Table 10, the model yield.

A. Yes, that's correct. The model predicted the actual yield would have been 150, you know, below Lovewell, and so on, different numbers.

Q. Just for the record, I will hand you what I believe will be Nebraska Exhibit 3.

Dr. Kastens, do you see an actual yield

number for 2005 in this document?

A. I presume we're talking about corn yield of 187?

Q. Correct.

A. Yes.

Q. And so although your model predicted that actual yield in '05 would be 150.5 bushels, in fact, it was 187; is that correct?

A. That is correct.

Q. How does that affect your conclusion?

A. My conclusion based on what we looked at the differences in model expected yields, take the proportion times the 187 to get at what we think the yield would have been, had water been available.

Q. If your 150.5 figure were actually 187 in your formula calculation, what would that do to your expected yield?

A. The expected yield would have been exactly 187 in that case.

Q. And so no additional water would be required; is that correct?

A. No. That would have said that -- let me come back again.

You said if the actual yield would have been 187; is that correct?

Q. Yes. If your model would have shown true yield, rather than 150.

A. If the model would have predicted 187 bushels at actual water?

Q. If I substituted, or you substituted 150.5 in Table 10 with 187 --

A. Okay.

Q. -- what would the practical effect of that be?

A. Then whatever the observed yield -- whatever the actual yield was -- just a minute, I have to be careful here so I say the right thing.

Okay. If you put 187, if that was the model predicted yield -- first of all, it's a little bit of a hard question to answer because the model predicted 166 bushels for fully irrigated yield and so you're asking me to hypothesize if the model with less water predicted 187, is that what you are asking?

Q. No. What I'm asking you to do is what we did in your deposition.

A. I know, and I'm having trouble getting back to that same point.

Q. Certainly. Well, perhaps we can refer to that.

What I was asking you in your deposition on February 24, 2009, is if you substituted the 150.5 number with 187, how would it affect your ultimate expected yield?

A. Okay, I got you, yeah.

Q. And I believe your response at that time -- do you have that transcript?

This will be Nebraska Exhibit 4.

I believe your response at that time is on page 42, lines 11 through 17, say.

A. Okay.

Q. Do you stand by that response?

A. Actually, I answered it wrong in the deposition.

The yield would actually go down, because if we -- if the model predicted 187 with low irrigation and predicted the 166 you see with high irrigation, then I would have to infer a drop in yield associated with more irrigation.

So I actually answered that wrong in the deposition, because in the deposition I answered that it would have no effect.

Q. Thank you.

ARBITRATOR DREHER: So let me understand.

If -- this is a hypothetical, but if the model showed the actual -- the yield with available water was 187, then additional water would cause the yield to go down?

THE WITNESS: Well, that is conditional upon the fact that in this same table, you can see the model yield under full irrigation happens to be 166, about the third line in Table 10 of my report. And that's the reason it's a little bit of a strange question because the -- that would be -- actually, it's kinds of an impossibility. Given the quadratic plateau function, I can't predict a lower yield with more water, as -- I think the question is not asked quite right and, certainly, I didn't ask it right either in the deposition.

ARBITRATOR DREHER: Okay.

Q. (BY MR. WILMOTH) I would like to talk to you just a little bit about precipitation.

Do you agree that precipitation and, more specifically, the timing of precipitation plays a significant role in yields?

A. Yes.

Q. And I guess specifically in that regard to what is most relevant is the precipitation in growing season, correct?

A. Yes.

Q. But you didn't conduct any analysis to determine what precipitation actually occurred in the growing season in support of this report, did you?

A. Well, yes. We used difference in growing season precipitation as part of the model, and then we adjusted annual precipitation, because that's what our IPYsim Model called for.

Q. So turning your attention to your transcript of the deposition of February 24, page 38, lines 19 down through the first line on page 39, what did you mean when you said you conducted no analysis?

A. We didn't do it in a finer scale than at the full growing season is what I meant there --

Q. Oh, I'm sorry.

A. -- because we were talking about some specific months, if I remember right.

Q. Very good.

So you did not explore it monthly?

A. That is correct.

Q. Very good. Thank you for clarifying that, I apologize.

So you don't know when the majority of the precipitation fell in KBID in 2005, for example?

A. That's correct.

Q. I'm going to refer to Kansas Exhibit 24.

MR. WILMOTH: Did you provide us copies with all of those, John, that I could use to give to Mr. --

MR. DRAPER: Yes, we did.

MR. WILMOTH: I mean, do we have a stack today, I mean?

MR. DRAPER: Oh, you said today?

MR. WILMOTH: Yes.

MR. DRAPER: We haven't provided you with copies.

MR. WILMOTH: What I would like to do, if it's acceptable, Mr. Arbitrator, is just use my copy of 24 and perhaps get it back.

ARBITRATOR DREHER: That's fine.

Q (BY MR. WILMOTH) Dr. Kastens, I would like to give you a calculator. I would like you to add a couple numbers up for us. Unfortunately, I don't think these are pages are numbered.

But if you look at page 2 of this document, I believe it reflects the monthly precipitation received at KBID in 2005?

A. Okay. Yes.

MR. WILMOTH: Do you have a copy of this, Mr. Arbitrator?

ARBITRATOR DREHER: I do.

Q (BY MR. WILMOTH) It's the third column over from the left -- it looks like the third column, fourth set of numbers over from the left.

ARBITRATOR DREHER: Correct.

Q (BY MR. WILMOTH) That's the actual precip received in '05, I believe. And the average precip is to the right of that, correct?

A. Yes.

Q. And I believe Mr. Ross earlier said that some crops were planted, corn sometimes, in KBID as early as March. Did you hear that?

A. No, I didn't.

Q. Do you agree that that's possible?

A. Yes.

Q. And when do you typically believe the season ends? When do you believe the season ends? Does it continue through October?

A. We work with August 31.

Q. I beg your pardon?

A. You're asking when the season ends?

Q. Yes.

A. We assume, from a water standpoint in the case of corn, August 31 in our Table 5.

Is that what you're asking? I'm not

sure what you're asking.

Q. That is what I'm asking.

I guess, in your experience, does a season typically end at the end of August or does it continue into September or early October?

A. Well, watering in September, typically, doesn't have any impact on yield. My take would be the end of August.

Q. Let's go from March through August for 2005. I would like you to, if you would for us, add the figures in the third column with the actual precipitation column with that calculator, if you could.

A. You want me to add the ones in the precip column.

Q. Correct. From March through August, so 2.39 all the way to 5.38. Does it go through September and October?

A. And you said through August, right? 24.11 inches.

Q. 24.1?

A. 24.11 is what I got.

Q. Could you please conduct the same calculation March through August on the "Average Precipitation" column, which is to the right of that?

A. Okay. 20.66 is what I get.

Q. So am I correct in understanding that for that period 2005, precip was actually quite a bit more, say almost 20 percent or so more than average?

A. Yes.

Q. But you did not take that into account in your report; is that correct?

A. Oh, we certainly did. I mean, that's the whole foundation of our Table 6.

Q. How so?

A. We didn't use March 1 to August, but we used April 15 to August. Effectively we did, because we're showing there an annual equivalent of 31.97, a table against the kinds of normal of 28.22. So we have got, you know, about a 10 percent increase over normal at the annual level, and that's the numbers we used in our model.

Q. But spread that over an annual level and you didn't focus, as we said earlier, on the actual month-to-month precip?

A. The only reason we focused on the annual because that happens to be the numbers used in our IPYsim Model.

The numbers we used to adjust that by, though, was the growing season, which was April --

whatever numbers I showed -- April 15 through, in the case of corn, April 15 through August 31. So other than missing, you know, a month and a half from what you just had me do, we definitely took it into effect, explicitly the way it should have been in our modeling framework.

I mean, we took the difference in the seasonal rainfall, just like you were having me calculate, only over a period of April 15 to August 31, instead of the numbers you just had me calculate, and then we adjusted the annual number by that amount just because our model depends on an annual number.

Q. And the most important months in the growing season for corn are what?

A. I would say July.

Q. What is the second most important?

A. I would say August.

Q. And in 2005, how did the actual precip relate to the average precip in those two months?

A. It was considerably higher in 2005 than the average.

Q. And if you're actually receiving considerably higher rainfall than average, both during the growing season and in these particular

months, how does that affect your crop irrigation requirement?

A. They would go down.

Q. And is that consistent with this general law of diminishing returns that I think you referenced earlier, perhaps, in questions by Mr. Draper?

A. That's really more consistent with the substitution between rainfall and irrigation. It's embedded in the model, as opposed to the diminished returns issue.

Q. So the crop doesn't care where the water is coming from as long as --

A. Well, it does, because the parameters are a little different between rainfall and irrigation. And each, by itself, has diminishing returns, for sure; but the issue here would be the substitution of rainfall for irrigation.

Q. Do you know what the total crop water requirement is for corn in KBID, so that would include precipitation and irrigation and anything else?

A. No, not without going back and revisiting the model, because I didn't print that out.

Q. Do you have anything in the room today that would assist you in doing that?

A. I'm sorry?

Q. Do you have anything today in the room that would assist you in doing that? Did you bring materials with you that you could refer to refresh your recollection?

A. No, because I would have to look at the rainfall. No, I can't pull that out very easily.

Q. Did you hear, I believe it was Mr. Ross indicated that the -- I'll hold that for a moment.

One of the things that Mr. Draper asked you earlier is how people's expectations, farmers' expectations, might be affected by dry cycles.

Do you recall that line of questioning, generally?

A. Yes.

Q. And you indicated that, I think you used a period of '94 to 2000 or so to try and determine as a surrogate measure what might have gone on in 2005-2006; is that right?

A. Yes.

Q. And the idea behind that was to essentially assume that they would have behaved differently, had more water been available?

A. Yes.

Q. Do you have any idea what the water scenario was in 2004 or 2003?

A. They were short.

Q. And it was fairly dry, from a precipitation standpoint?

A. I can't remember the precipitation without looking at it.

Q. Do you think that those periods leading up to the fact that they had been short for two years preceding 2005 might have affected their behavior?

A. Yes.

Q. How so?

A. Well, it might cause them to think it's going to be short longer. Now, the problem is, of course, if they think it's short because there is not enough water coming down the river, then we have to be careful of the Lucas critique that we use in economics, where we find out what -- where we use what we observe to find out what we're trying to answer questions regarding what we don't observe. And if we continue to have an expectation of lower water, then eventually that actually does play out.

But the reason for the water being lower ultimately has to come into play, and that's the

reason we're reluctant to start going down the trail of diminishing expectations too far. We know it happens because wells and everything kind of declines, in general, due to a lot of different reasons, but we want to be careful about going too far down that road, I think, because I'm afraid we won't be measuring what we want to measure.

Q. And what is it you want to measure?

A. We want to measure the damages wrought by Nebraska being short of water to Kansas.

Q. And it seems to me that this measurement is based principally on the model result, rather than an actual physical loss; is that a fair statement?

A. Yes.

Q. Thank you.

MR. WILMOTH: Mr. Arbitrator, may I take three minutes to confer with counsel here.

ARBITRATOR DREHER: Yes, but you have 20 minutes.

MR. WILMOTH: It will be charged against our time. Thank you.

(Break was taken from 4:31 to 4:33.)

MR. WILMOTH: Thank you, Mr. Arbitrator.

ARBITRATOR DREHER: You may proceed, go ahead.

Q. (BY MR. WILMOTH) Dr. Kastens, I have a question about the manner in which you distributed the water in your model that Book identified in his report.

Specifically, if there was this much water coming down the system from precipitation in 2005 or falling on the ground in 2005, how did you assume that the water that Mr. Book identified would actually be delivered?

A. We assumed equally distributed, based on acreage.

Q. Throughout the season, equally in what regard?

A. Well, we didn't assume -- we assumed if it turns out to be a 5-inch shortage for all of KBID, that's what we assumed, 5 inches everywhere on the irrigated acres.

Q. So you didn't consider how the water that Mr. Book identified would actually be brought down through the system at all?

A. That's correct.

Q. Did you investigate whether anybody in KBID received preventive planting payments?

A. No.

Q. Did you investigate whether anyone in

KBID or below KBID received CRP farm subsidy or other comparable farm subsidy programs?

A. No.

Q. Did you investigate whether anyone at KBID relied on alternative water supplies to eliminate any damages?

A. I'm sorry, I don't understand your question.

Q. Did you investigate whether anyone in KBID relied on any alternative water supply, such as groundwater, to offset damages?

A. That discussion we did have with the broader team, Scott Ross and Dale Book and so forth, so that we didn't miss something there by missing a bunch of groundwater that was available for substitute. And so we basically took their word on that and so we did not investigate further.

Q. Thank you.

If these things were taken into account and some subsequent payment were made, how would that affect your analysis?

A. If subsidy payment were made, it would -- it would lower the amount that was owed.

Q. Thank you.

And just one last question, I want to

make sure that I did an adequate job of asking this question.

The question is: Did you consider how Book's quantity of water would be distributed temporally?

A. Do you mean across years or across months?

Q. Over the course of a single year.

A. No. We assumed that it all fell as a representative growing season irrigation, because, actually, our irrigation is done at the annual amount anyway and our models are built on that.

So no, we did not.

MR. WILMOTH: Thank you. I think that's everything that we have, Mr. Arbitrator, and we turn this witness back over for redirect, if Kansas would like.

ARBITRATOR DREHER: Okay. Mr. Draper, would you like a few minutes break or what is your thought?

MR. DRAPER: Yes, the normal five minutes would be good.

ARBITRATOR DREHER: All right.

MR. DRAPER: And that leaves us with how much?

ARBITRATOR DREHER: Ten minutes.

MR. DRAPER: Ten minutes when we come back.

ARBITRATOR DREHER: Right.

(Break was taken from 4:37 to 4:45.)

ARBITRATOR DREHER: You may proceed, Mr. Draper.

MR. DRAPER: Thank you.

REDIRECT EXAMINATION

BY MR. DRAPER:

Q. Doctor, it has been suggested in the questions of you that the fallowed land which lies primarily above Lovewell Reservoir in KBID that, in your analysis, was brought back into production, irrigated production was less productive land than other lands. Is that a valid assumption?

A. No, I don't -- I don't think it is. I mentioned that to the Arbitrator before, although I didn't provide the information behind the other little study I was talking about, but I do recall that actually the area above Lovewell is considerably higher in productivity than the area below when you look at long-term corn yields. So that's where most of the idle acres are. It's pretty hard to argue that they were idling the less productive land.

Q. And what does that mean, for your analysis?

A. Well, if anything, we're probably bias the other direction, because we have assumed the fully irrigated yield for both above and below Lovewell; and, truthfully, above Lovewell is actually higher in productivity than maybe even using our averaging method. We may have even biased it, you know, in -- to showing less damages than there really are.

MR. DRAPER: No further questions.

ARBITRATOR DREHER: Let me ask a question about that then, and maybe it's just my lack of experience with the Kansas Bostwick Irrigation District.

But if those lands were more productive, why wouldn't they have done whatever they had to do to get water to those lands instead of the lands below?

THE WITNESS: Well, my argument, first of all, is I don't know that they're that much more productive.

Historical corn yields would suggest they might be, but we don't -- I don't know a lot of other information about them. You know, I don't

know any other details about them; but I'm guessing the primary reason for those not being idling is probably more logistic associated with Lovewell probably and water flows than it was specifically trying to idle less productive lands or more productive lands or whatever.

That would be my guess.

ARBITRATOR DREHER: Because they could have controlled -- it seems like they could have controlled the delivery of water to lands above Lovewell simply by scheduling releases out of Harlan County Lake?

THE WITNESS: I guess I can't answer that.

I can't answer that.

ARBITRATOR DREHER: Okay.

MR. DRAPER: Just one follow up to that.

ARBITRATOR DREHER: Certainly.

FURTHER REDIRECT EXAMINATION

BY MR. DRAPER:

Q. During these years that you analyzed, were there additional releases that, in particular 2005, that could have been made from Harlan County Lake to supply those areas above Lovewell?

A. Actually, I did not look at that. I

can't answer that.

MR. DRAPER: No further questions.

ARBITRATOR DREHER: Okay. Well, you surprised me, John.

Well, this a convenient point to stop for the day. And let's see, you have got one more -- one more witness in your direct case; is that correct?

MR. DRAPER: Yes.

ARBITRATOR DREHER: So we'll start with him at 8 o'clock tomorrow morning.

(Whereupon, the hearing was in recess at 4:49 on Monday, March 9, 2009 until 8:00 a.m. on Tuesday, March 10, 2009.)

CERTIFICATE

I, Dyann Labo, Registered Professional Reporter, do hereby certify that the above-entitled proceedings were reported by me in stenotype; that the within transcript is true and correct, to the best of my knowledge and belief.

_____
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Dyann Labo
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