
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

Wednesday, March 18, 2009

VOLUME VIII

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 18th day of March, 2009.

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1 P R O C E E D I N G S

2 ARBITRATOR DREHER: Good morning.

3 This is the eighth day of hearing in the
4 Nonbinding Arbitration stemming from Kansas v.
5 Nebraska and Colorado, Original No. 126.

6 I believe we are ready to start with
7 cross of Mr. Larson by Nebraska.

8 MR. BLANKENAU: Yes, we are prepared to
9 proceed.

10 ARBITRATOR DREHER: Please.

11 MR. BLANKENAU: Thank you.

12 CROSS-EXAMINATION

13 BY MR. BLANKENAU:

14 Q Good morning.

15 A Good morning.

16 Q I really just have a few items to go
17 over with you, should be pretty quick.

18 Mr. Larson, your expertise is in
19 modeling; is that correct?

20 A Yes. I'm a groundwater hydrologist, but
21 a lot of my experience has been in modeling, the
22 development of models and use of models, yes.

23 Q You are not here today as an expert on
24 compact accounting procedures; is that correct?

25 A No. Only to the extent that I

1 understand how the modeling results -- the end of
2 those procedures, but I'm not an expert on the
3 procedures.

4 Q And you understand that Nebraska's
5 accounting change proposal isn't altering the model
6 itself, but rather the accounting procedures?

7 A It alters the way the model is used to
8 calculate the inputs to the accounting procedures.

9 Q And you also reviewed Nebraska's earlier
10 iterations of the accounting changes; is that
11 correct?

12 A At least some of them, yes.

13 Q Including the one provided to the RRCA
14 in 2007?

15 A I suspect so. I can't -- since I wasn't
16 there when they offered it, I don't know specifically
17 which one we are referring to, but I suspect so.

18 Q Given your understanding of the
19 accounting procedures and how the model functions, do
20 you agree that subbasin accounting is important to
21 Compact compliance?

22 A I know there are certain subbasin
23 calculations that aren't made as part of the process.

24 Q Well, but keeping CBCU within the
25 State's particular subbasin allocation can sometimes

1 be important to Compact compliance; is that not true?

2 A I know there are calculations that bear
3 on certain elements of the compliance. I don't know
4 all of the details.

5 MR. BLANKENAU: That's all we have.

6 ARBITRATOR DREHER: All right.

7 Mr. Ampe, for Colorado?

8 MR. AMPE: No questions.

9 Actually, one question.

10 CROSS-EXAMINATION

11 BY MR. AMPE:

12 Q Mr. Blankenau asked you about -- I'm not
13 sure if he intended to but I took it as a question --
14 whether any other proposed changes would have altered
15 the model.

16 Is it true that change in the model
17 accounting points would change the model itself?

18 A I assume so. I don't know about that
19 either.

20 MR. AMPE: Nothing further.

21 ARBITRATOR DREHER: Mr. Draper,
22 redirect?

23 MR. DRAPER: Thank you.

24 REDIRECT EXAMINATION

25 BY MR. DRAPER:

1 Q Mr. Larson, Mr. Dreher asked about the
2 possibility -- when you were looking at Figure 6 of
3 your expert report, the possibility of a trend in the
4 percent of, I guess I will call it residual that is
5 shown in that graph.

6 Have you had a chance to review that
7 question further?

8 A Yes, I have.

9 What I did is, I looked at some of the
10 projections -- the future projections that we have
11 made -- you may recall that we had made some future
12 projections going out under a status quo scenario and
13 under the remedy scenario.

14 When I looked at this same kind of
15 calculation going out, at least over the period of
16 those projections, the trend does not persist. So
17 that's what I saw in reviewing that.

18 It was obviously a range of results, or
19 potential results from lower pumping to higher
20 pumping and the trend did not persist over the whole
21 period.

22 Q And further follow-up to Mr. Ampe's
23 question -- it may just be my misunderstanding, but
24 to be -- to be clear, I think -- I think the question
25 was whether changing the selection of groundwater

1 model accounting points that are used in the
2 accounting procedures, whether that would change the
3 model itself?

4 A It wouldn't change the construction of
5 the model itself. What it would do is it would
6 change the calculational procedures that are tied to
7 the model to provide the data that goes into the
8 accounting process -- or it could.

9 Q Would it strike data at a different
10 point?

11 A That's correct.

12 MR. DRAPER: Thank you. Nothing
13 further.

14 MR. BLANKENAU: May we have just a
15 little recross on that, just to clarify a few points?

16 ARBITRATOR DREHER: Limited to that
17 issue, yes.

18 MR. BLANKENAU: Yes, just on the issues
19 that were brought up.

20 RECROSS-EXAMINATION

21 BY MR. BLANKENAU:

22 Q Mr. Larson, when I asked you the
23 question whether the model would be altered, I
24 intended to limit that question just to Nebraska CBCU
25 accounting.

1 With respect to the CBCU issue that
2 Nebraska raised, is the model in any way altered?

3 A I don't know if I can answer that
4 question without knowing more detail.

5 As I said earlier, the structure of the
6 model doesn't change. Only the points that are used
7 to feed into the accounting process may change, and I
8 don't know specifically if they would or not.

9 Q Why would they change in Nebraska's CBCU
10 accounting proposal?

11 A Oh, in the proposal?

12 Q Yes.

13 A They wouldn't change the structure of
14 this calculation, if that's what you are suggest --
15 asking.

16 Q It wouldn't change the model; is that
17 correct?

18 A It would not change the model.

19 Q With respect to your Table 6, is that a
20 basinwide analysis?

21 A Yes, it is.

22 Q What about the analysis you conducted
23 last night; was that also basinwide?

24 A Yes.

25 Q What was the time scale on that?

1 A It went out to 2057.

2 Q Starting when?

3 A Well, starting basically at the time of
4 1971.

5 MR. BLANKENAU: Thank you. That's all I
6 have.

7 ARBITRATOR DREHER: All right.

8 Thank you, Mr. Larson.

9 Mr. Draper, you may call your next
10 witness.

11 MR. DRAPER: Your Honor, we would recall
12 to the stand Mr. Dale Book.

13 ARBITRATOR DREHER: Mr. Book, you are
14 still under oath.

15 DALE BOOK,
16 having previously been sworn, was examined and
17 testified as follows:

18 THE WITNESS: Yes.

19 DIRECT EXAMINATION

20 BY MR. DRAPER:

21 Q Now, Mr. Book, as part of your work in
22 this proceeding, did you participate as an author in
23 what has been marked as Kansas Exhibit 28?

24 A Yes, I did.

25 Q This is the same expert report that was

1 testified to, in part, by Mr. Larson?

2 A Yes.

3 Q And in which the Figure 6, for instance,
4 is a part?

5 A Yes.

6 Q Just as a matter of housekeeping, are
7 there two figures that need correction before we get
8 started?

9 A Yes. I prepared correction figures for
10 Figure 2 and Figure 5 that were submitted yesterday.

11 Q And we submitted those yesterday and as
12 we go through, will you be able to explain what the
13 changes were there?

14 A Yes.

15 ARBITRATOR DREHER: Mr. Draper, what
16 exhibits are those?

17 MR. DRAPER: In Exhibit 28, Figures 2
18 and 3 -- 2 and 5, sorry.

19 ARBITRATOR DREHER: Now, I recall that I
20 had left those loose in here.

21 MS. ORMEROD: I put them in the binder
22 for you this morning.

23 ARBITRATOR DREHER: All right.

24 Just so I'm clear, you actually replaced
25 the old Figure 2 with the new Figure 2, and the old

1 Figure 5 with the new Figure 5.

2 MS. ORMEROD: Yes. Carol has the old
3 ones.

4 MR. DRAPER: And for the record, the new
5 version in the lower right-hand corner has the date
6 3/17/09, so those can be differentiated.

7 ARBITRATOR DREHER: I apologize for --
8 okay. Thank you. You didn't remove the old Figure
9 5.

10 MR. DRAPER: I believe that's correct.

11 ARBITRATOR DREHER: All right, you may
12 continue.

13 Q (BY MR. DRAPER) Before I ask you a more
14 general question about the report, there was an
15 issue that came up as a result of a question by Mr.
16 Dreher during Mr. Larson's testimony relating to
17 statements on page 7 at the bottom of that page.

18 These were the statements in the last
19 couple of sentences on that page that related to the
20 diversions from the Platte and the amount of those
21 diversions, the number of acres to which they were
22 applied.

23 There was a question raised by Mr.
24 Dreher as to whether it was correct to assume that
25 there was a diversion of water of 17 acre-foot per

1 acre based on the figures that were recorded --
2 reported there. And I would note for the record that
3 Mr. Larson corrected that 120,000-acre figure to
4 141,000.

5 Would you explain what the situation is
6 with respect to those matters.

7 A Yes. As Mr. Draper indicated, the
8 correct acreage there under the canals being served
9 by irrigation shown on the map on Figure 1 as
10 141,000 acres. The quantities of water that are
11 referred to here as being diverted are primarily for
12 power use. There are two power districts that divert
13 from the Platte -- or the South Platte River. Those
14 are the Central Nebraska Public Power and the
15 Nebraska Public Power District.

16 The total of 2 million acre-feet per
17 year of diversion is primarily for power use.
18 Approximately 1 1/4 million of that is discharged
19 back to the river as power discharge. There is about
20 400,000 acre-feet a year of canal loss and
21 evaporation seepage attributable to that specific
22 diversion. And the balance, which is about 240,000
23 acre-feet per year, is diverted for irrigation,
24 primarily in the central system under three canals
25 that are shown on the map referred to as E65, E67 and

1 the Phelps canal.

2 Q Could you show us, using Figure 1 in
3 your report, the canals and areas that you are
4 referring to in this paragraph? Is Figure 1 a map of
5 the Republican River Basin showing the canals that
6 you were just naming?

7 A Yes. Figure 1 was prepared by me to
8 show the location of the various structures for which
9 seepage figures are input to the Republican River
10 Compact model. This shows the canals -- the largest
11 ones are the Nebraska Public Power. It's referred to
12 on the map as NDPP. That acronym should be NPPD.

13 That diversion is made up high on the
14 South Platte and the North Platte and including
15 Sutherland Reservoir in Lake Maloney to regulate and
16 discharges back to the Platte near North Platte.

17 The second Nebraska diversion is located
18 near the North Platte and delivered water through the
19 Tri-County supply canal and all the way down through
20 a couple of reservoirs: Elwood Reservoir and Johnson
21 Lake. Most of the water is discharged back to the
22 river for power production.

23 That system also supplies the E67, E65
24 and Phelps canals. Those three canals constitute the
25 bulk of the 141,000 acres.

1 I should add that after Mr. Dreher's
2 question last night, I did go back and review the
3 records regarding irrigation deliveries under these
4 systems.

5 And the diversions are averaging on the
6 order of 4 acre-feet per acre, after deducting canal
7 loss. And based on delivery records, typically, we
8 see deliveries of 15 inches up to 2 feet for the
9 irrigated lands under the systems.

10 So the large discrepancy between the
11 amount of diversion and the irrigated acreage is
12 related to the use for power and the canal loss, the
13 significant amounts of canal and reservoir seepage
14 that become inputs to the Republican River model.

15 Q And the canal seepage from the various
16 canals that you have mentioned and reservoirs are
17 actual input values for the RRCA Groundwater Model?

18 A Yes.

19 Q More generally, Mr. Book, were you a
20 member of the Modeling Committee that was charged
21 with developing the RRCA Groundwater Model and the
22 associated accounting procedures?

23 A Yes, I was.

24 Q In your opinion, was it an error that
25 the individual CBCU and IWS credit don't always add

1 up to the all-on versus all-off condition?

2 A No, that's not an error.

3 The accounting principles -- excuse me,
4 the accounting procedures require that the individual
5 impacts for each of the three States be computed for
6 input to the model, as well as the impact for the
7 imported water supply. And those are the
8 calculations that are very specifically outlined in
9 the Appendix C to the FSS that were developed, in
10 large part, by the committee for use in the
11 accounting procedures.

12 Q Looking now again at your report, Kansas
13 Exhibit 28, what features of this report is it
14 important to bring up for the purpose of this
15 proceeding that Mr. Larson has not already addressed?

16 A Well, I think the primary points are
17 spelled out in the Executive Summary on page 1.

18 I assisted in the preparation of this
19 report and the Executive Summary provides a summary
20 of the issues raised by Kansas for this proceeding.

21 The points here are that the specific
22 model runs to be used for the calculations are
23 specified in the FSS.

24 The -- as I just mentioned, it's
25 necessary for the accounting to have the individual

1 impacts from each of the three States, as well as the
2 imported water supply credit.

3 The primary impact of the Nebraska
4 proposal, as we see it, relates to the imported water
5 supply credit. And that's described in more detail
6 in Section VI of this report that's highlighted in
7 the third paragraph of the Executive Summary.

8 The final note to make on the imported
9 water supply credit is the view that the imported
10 water supply credit needs to be calculated off of an
11 actual pumping or with pumping stress on in order to
12 have appropriate heads in the model to calculate the
13 imported water supply credit.

14 Q Turning further back into the report,
15 are there particular portions that should be
16 mentioned, in particular?

17 A Well, Section III provides a summary of
18 the development and use of the model to provide the
19 input for the accounting procedures and some
20 background on how that is done and how it's specified
21 in the FSS.

22 Section IV is a summary of the proposals
23 to date that have been received by Nebraska for
24 consideration and how those have evolved.

25 Q They have been received by Kansas?

1 A Either through the Engineering Committee
2 or by Kansas for this proceeding.

3 Q Okay.

4 A Section V is the description -- a
5 summary description of the proposed change by
6 Nebraska.

7 Section VI is the section I will
8 concentrate on related to the imported water supply
9 credit.

10 Q And why is it important to focus on the
11 impact of the Nebraska's proposal on the imported
12 water supply credit calculations?

13 A Well, as I mentioned, the -- the
14 resulting effect of the Nebraska proposal impacts
15 primarily the imported water supply credit.

16 When you go through and review the
17 result of all of their changes to the various impacts
18 between groundwater CBCU to each of the three States,
19 the largest impact percentagewise is to the imported
20 water supply credit. And that is an issue for which
21 Kansas has always been concerned, as to how that
22 credit is calculated.

23 Q And why does it make a difference to
24 Kansas whether the imported water supply credit is
25 done correctly?

1 Does that -- for instance, does that
2 take water away from Kansas if the imported water
3 supply credit is increased?

4 A Well, the imported water supply credit
5 is an offset to CBCU in Nebraska. So the larger that
6 credit is calculated, the more water is available to
7 Nebraska for consumption under its allocation.

8 Q And what effect does that have on the
9 amount of water available for consumption in Kansas?

10 A That reduces that availability to
11 Kansas.

12 Q And what are the major conclusions that
13 you have reached with respect to the effect of the
14 Nebraska proposal on the imported water supply
15 credit?

16 A Well, quantitatively, the effects are
17 shown on Figures 3 and Figure 4.

18 Figure 3 is a comparison of the imported
19 water supply credit under the current accounting
20 procedures and with the proposed accounting
21 procedures for the period 1918 through 2006.

22 Q Would you say again which Figure you are
23 referring to?

24 A Figure 3.

25 Q And that's entitled what?

1 A "Nebraska's Computed Imported Water
2 Supply Using the Current and Proposed Accounting
3 Methodology."

4 Q And over what years is that covered?

5 A That covers the period 1981 through
6 2006.

7 Q And what are the units on this
8 comparison?

9 A These are total annual acre-feet.

10 Q There is a blue line and a red or orange
11 line on this graph.

12 A Yes.

13 Q What do each of those represent?

14 A The blue lines are the results under the
15 current accounting procedures and the red line on
16 this graph shows the result of making the change that
17 Nebraska proposes.

18 Q And how would you describe that -- the
19 effect of the Nebraska change on the imported water
20 supply credit?

21 A The difference over the earlier part of
22 the period amounts to a few thousand acre-feet per
23 year. And then starting in the late 1990s, the
24 difference becomes larger. And then starting in
25 about 2001, there is larger differences yet, which

1 are summarized quantitatively on the following Figure
2 4, totaling approximately 8000 acre-feet per year of
3 increased imported water supply credit.

4 Q So the effect of the Nebraska proposal
5 with respect to imported water supply credit would
6 be, on average, to increase it by how much?

7 A Well, I didn't calculate an average over
8 the entire '81 to 2006 period; but over the six years
9 that Nebraska included in their report, it's an
10 increase of 7554 acre-feet per year.

11 Q And that's what is shown for each of the
12 years on Figure 4?

13 A Yes.

14 Q Now, is there also an effect on the
15 calculated consumptive beneficial use computed --
16 computed beneficial consumptive use for each of the
17 three States?

18 A Yes. The tabulations in the Nebraska
19 report provide the numbers available that can be
20 compared to determine the statewide differences for
21 each of the three States.

22 Q And for this period, what are those
23 differences?

24 A For the State of Nebraska, the impact on
25 the groundwater CBCU is a reduction of 857 acre-feet

1 per year; for the State of Colorado, the average is
2 an increase of 3346 acre-feet per year; and for the
3 State of Kansas, the impact is an increase of 3201
4 acre-feet per year.

5 Q And those averages are based on the
6 figures presented in the Nebraska expert report?

7 A Yes.

8 ARBITRATOR DREHER: Mr. Book, what were
9 you referring to when you cited those figures?

10 THE WITNESS: I believe those are in
11 Appendix C of the Nebraska report. They are
12 tabulations for each year, each of the six years by
13 subbasin which shows the existing accounting
14 procedures and the proposed change.

15 So we simply went in and totaled those
16 by State for each year and averaged them.

17 ARBITRATOR DREHER: So I'm looking at
18 Appendix C entitled "Results of Current and Proposed
19 Method for 2001 and 2006."

20 THE WITNESS: Yes.

21 ARBITRATOR DREHER: And then there is a
22 Table C1, Table C2, C3, C4 and so on. And those are
23 the numbers that you said you totaled and averaged?

24 THE WITNESS: Yes.

25 ARBITRATOR DREHER: All right.

1 Q (BY MR. DRAPER) Just the figures are
2 shown in those tables in Appendix C, there is no
3 totaling or averaging in that appendix, is there?

4 A That's correct.

5 Q And, in summary, just to confirm, it
6 would increase the amount of credit to Nebraska,
7 decrease the consumptive use of Nebraska and increase
8 the computed consumptive beneficial use of both
9 Colorado and Kansas?

10 A Yes.

11 Q Back in the Figure section of your
12 report of Kansas Exhibit 28, I would ask you to take
13 us through each of the figures that haven't been
14 described so far and tell us what those consist of
15 and what conclusions can be drawn from those figures.

16 A Well, going back to Figure 2, this is a
17 plot of the data which is the source of the imported
18 water supply credit going into the model.

19 I plotted three categories. The top
20 shows the Platte River diversions for both the
21 Central and the Nebraska Public Power, as well as
22 category called "Other Canals." There are certainly
23 small canals diverting.

24 Q Let me make sure I'm on the same Figure.
25 This Figure 2 in your report, Kansas Exhibit 28?

1 A Yes.

2 Q And what is the title of Figure 2?

3 A "Platte River Diversions and Calculated
4 Mound Recharge."

5 Q What is the time period over -- that is
6 covered by this Figure?

7 A 1971 through 2006.

8 Q And the units used for the graphs?

9 A These are all in acre-feet per year.

10 Q And there are three graphs on this
11 Figure?

12 A Yes.

13 Q And would you take each one in turn and
14 describe their purpose and the conclusions that can
15 be drawn from that.

16 A Yes.

17 The top graph shows the diversions for
18 each of the three categories in systems: the Central;
19 the Nebraska Public Power, shown in red. And
20 thirdly, a category of "Other Canals," which is shown
21 in green at the bottom of the graph. These are the
22 amounts of water diverted from the river.

23 The second graph down --

24 Q Just the legend, is that provided in a
25 single line at the bottom of the graph -- at the

1 bottom of the whole Figure here on this page?

2 A Yes.

3 Q Just to continue, I think you corrected
4 the NDPP of the acronym to the NPPD that we saw on
5 the map. That refers to Nebraska Public Power
6 District?

7 A Yes.

8 Q So the same change would be appropriate
9 here?

10 A Yes.

11 Q And with respect to the first graph,
12 these quantities are provided over the period 1971
13 through 2006.

14 How would you describe what that graph
15 shows with respect to the Platte River diversions?

16 A Well, this graph shows the relatively
17 constant amounts of diversion with annual variability
18 over this period, starting in 1971. It also shows
19 declines in available supplies starting in about year
20 2000, which is indicated by what I would consider to
21 be a significant dropoff in the last six years of the
22 period of record, which my understanding is driven,
23 in large part, by available supply of Platte River
24 water for that period.

25 Q And are these diversions the starting

1 point or driving force for the water that actually
2 ends up, in part, becoming the mound credit?

3 A Yes.

4 Q And if the diversions go down to these
5 canals in the Platte River system, in general, what
6 effect would that have on the amount of water
7 available to the mound?

8 A Well, the general effect is a
9 relationship between seepage and diversions, which is
10 reflected below in the canal and reservoir seepage
11 graph; the general supply of water is less and so the
12 amount of recharge is also less.

13 Q And then your third graph?

14 A The third graph is a separate source of
15 recharge.

16 These are amounts of water that are
17 sourced or derived from actual irrigation return
18 flows, separate from the canal and reservoir seepage.

19 The difference between the prior Figure
20 2 and the revised Figure 2 is in this category. I
21 correct the estimated recharge figures in this graph.

22 What is significant is the order of
23 magnitude difference between the amounts of
24 irrigation return flow going into the model of Platte
25 River water. When you compare that to the canal and

1 reservoir seepage in the graph above, the amounts of
2 water sourced from reservoir and canal seepage are
3 significantly larger for model inputs.

4 Q Are the scales different on those bottom
5 graphs?

6 A Yes, they are.

7 Q So the recharge that you are showing
8 from the canal and reservoir seepage is on the order
9 of an order of magnitude greater than the irrigation
10 return flows?

11 A Yes.

12 Q And, in both cases, you are showing
13 decreasing amounts of seepage in returns flows in
14 recent years?

15 A Yes.

16 Q Any further conclusions to be drawn from
17 these graphs?

18 A Not specifically these graphs.

19 Another way to view this information is
20 the plot on Figure 5, which compares the imported
21 water supply credit generated from the Compact model
22 to the amounts of recharge.

23 Q Let's see. You are turning us to about
24 three pages later, labeled Figure 5 in your report?

25 A Yes.

1 Q And what is the title of Figure 5?

2 A This is a plot of "Imported Water Supply
3 as a Percent of Total Platte River Recharge" and
4 these are five-year running averages.

5 Q And what are the units on this graph?

6 A The -- what is plotted here is a ratio
7 in percentage of the imported water supply credit
8 derived from the Compact groundwater model for both
9 the current procedures, as well as the Nebraska
10 proposal. And that is as a ratio to the recharge --
11 the total of the recharge that we were looking at on
12 Figure 2.

13 Q Is this, in each case, the imported
14 water supply credit as calculated by the RRCA
15 Groundwater Model --

16 A Yes.

17 Q -- under the current procedure versus
18 the proposed procedure?

19 A Yes.

20 Q And which line is which?

21 A The bottom line corresponds to the
22 current procedures. And the top line is for the
23 proposed procedures.

24 Q And what conclusions do you draw from
25 this comparison?

1 A Two conclusions.

2 First, that the amount of imported water
3 supply credit being calculated by the model is a very
4 small percentage of the total amount of recharge
5 estimated to be occurring and as input to the model
6 ranging from 2 percent to 4 percent.

7 The second is the changes at the end of
8 the period. Starting in about 2000, the proposed
9 Nebraska method results in an increasing imported
10 water supply credit as a percentage of the source of
11 supply. The existing method shows a slight decline
12 over this period.

13 Q And the percentage is based on the ratio
14 of the imported water supply credit as calculated by
15 the RRCA Groundwater Model as a percent of -- is that
16 total Platte River recharge in the model domain or
17 just in the Republican Basin?

18 A That's the total in the model domain.

19 Q So it includes those areas within the
20 model domain that are topographically outside the
21 Republican River Basin?

22 A Yes. The model goes all the way to the
23 Platte River.

24 Q In summary, based on this report, what
25 are your primary conclusions with respect to the

1 proposed Nebraska change to the accounting procedures
2 with respect to the computed beneficial consumptive
3 use and imported water supply credit?

4 A Well, the primary conclusion that I have
5 related to this issue relates to the calculation of
6 the imported water supply credit.

7 It is important that the credit be
8 calculated with the pumping stresses on, because the
9 imported water supply credit is dependent on water
10 level conditions.

11 And to consider a scenario with the
12 model where the pumping is not on results in higher
13 water levels and an overstatement of the amount of
14 imported water supply credit that would be calculated
15 with the model.

16 MR. DRAPER: Thank you. No further
17 questions.

18 ARBITRATOR DREHER: Mr. Book, returning
19 for a moment to Nebraska's proposed changes in the
20 accounting procedures using output in the groundwater
21 model, I have looked at the procedures, but not in as
22 much depth as I have looked at some other aspects of
23 this.

24 As I recall, there is not a separation
25 of virgin water supply from groundwater and virgin

1 water supply in total.

2 In Nebraska's illustration of their
3 proposed method, they separate out -- for purposes of
4 clarity, they separate out the virgin water supply
5 available from groundwater. But I don't see that
6 separation in the procedures.

7 However, when I look at -- when I look
8 at how virgin water supply is calculated, essentially
9 based upon gage flows, changes in storage,
10 subtracting out flood flows, but then adding in
11 calculated beneficial use, less imported water supply
12 credits -- so when I look at this approach, if I was
13 to ask how the existing procedures would calculate
14 the virgin water supply from groundwater, isn't it
15 essentially the sum of the consumptive beneficial --
16 of the calculated beneficial consumptive use from
17 Nebraska, plus the calculated beneficial consumptive
18 use from Kansas, plus the calculated beneficial
19 consumptive use from Colorado, less imported water
20 supply credits?

21 THE WITNESS: Yes, that is the algebraic
22 results of that. And those elements are all included
23 in that calculation of the virgin water supply.

24 So as a subcomponent, you are correct,
25 that would be what Nebraska has termed the

1 "groundwater component," which is all derived from
2 the RRCA Groundwater Model -- all of those terms are.

3 ARBITRATOR DREHER: And when I look at
4 how virgin water supply is defined, both in the
5 Compact, as well as in the FSS in the accounting
6 procedures, it's the water supply within the basin
7 undepleted by the activities of man.

8 And with that as the definition, isn't
9 the direct calculation that Nebraska proposes for
10 virgin water supply for -- for groundwater alone,
11 isn't that consistent with that definition?

12 THE WITNESS: It could be consistent
13 with that definition. I'm not sure that that
14 definition specifies one calculation over another.

15 I would point out the term "undepleted"
16 is a one-sided characterization of the water supply.
17 I think there is some significance to that word, but
18 certainly, it's possible that you could look at that
19 definition and consider a -- a run that Nebraska has
20 proposed as one definition that could be consistent
21 with that definition, yes.

22 ARBITRATOR DREHER: Help me understand
23 what you the mean by "one-sided" definition. I'm not
24 sure I follow.

25 THE WITNESS: It's undepleted -- the

1 water supply of the basin undepleted by activities of
2 man, which that is referring to consumption of water.

3 ARBITRATOR DREHER: But not the mound,
4 not the imported water supply credit?

5 THE WITNESS: Well, "undepleted" has a
6 definition associated with that. And I think as it
7 relates to water seeping into the basin, that may or
8 may not be covered by the term "undepleted."

9 ARBITRATOR DREHER: Well, I'm not sure I
10 understand why the distinction, but I don't think it
11 really matters for my purposes.

12 But certainly, a depletion by man's
13 activities, it would be presumably net depletion, so
14 it would be potentially gross depletion, less
15 imported water supply credit?

16 THE WITNESS: It could be read that way,
17 yes.

18 ARBITRATOR DREHER: Turning to your
19 Figure 2, you know, sometimes when we use the
20 terminology "return flows," we are not very careful
21 about what we mean.

22 I'm presuming here when you show the
23 return flows in the lower Figure, the lower panel of
24 your Figure 2 titled, "Platte River Irrigation
25 Returns Flows," those are returns flows through the

1 ground, as opposed to return flows across the
2 surface; is that correct?

3 THE WITNESS: Yes. It represents
4 discharge going into the model. The model doesn't
5 deal with surface water returns from irrigation; it's
6 limited to recharge.

7 ARBITRATOR DREHER: No, I understand
8 that.

9 But what I couldn't determine directly
10 was whether what was labeled "Return Flows" in Figure
11 2 did or did not include surface water returns. And
12 you are saying it doesn't, which is fine.

13 Now, turning to Figure 5, I'm not
14 focusing so much on the differences between the
15 proposed methodology from Nebraska versus the current
16 procedures. I'm trying to make sure I have a good
17 understanding of what is happening here.

18 And I'm puzzled by the generally
19 increasing imported water supply credit as a percent
20 of total Platte River recharge that occurs, beginning
21 in 1981 and then seems to accelerate in 1992 to 1996,
22 and then begins to decline.

23 And what drew my attention to this is,
24 looking at what is calculated using the current
25 procedures since 2001, there is a slight decline,

1 which, listening to your testimony and looking at
2 Figure 2, is potentially consistent with the decline
3 in Platte River diversions, associated Platte River
4 Canal and reservoir seepage recharge, and then a
5 decline, as well, in the Platte River irrigation
6 return flows.

7 But why the increase? I don't
8 understand the increase from 1981 through 1996,
9 particularly in the period 1991 to 1996. I don't
10 understand it because when I look at your plots, I
11 just don't see why that increase would occur.

12 Can you explain that for me.

13 THE WITNESS: Yes, I can give you my
14 view of that.

15 I haven't spent as much time looking at
16 model output, but there are two key factors that
17 determine the calculated credit.

18 One, of course, is the amount of
19 recharge; but the second is the water level
20 condition. In my view, the calculated credits are
21 highly dependent on water level conditions.

22 So you need to look at what the water
23 table conditions in the mound area are and,
24 obviously, those are a function of both
25 precipitation, as well as pumping.

1 I believe we noted in the report that
2 pumping in the mound area had continued to increase
3 after the date of the settlement, after 2000, at the
4 same time that the course of water was declining from
5 the Platte River, due to the water supplies in the
6 Platte River.

7 So I believe that may explain part of
8 the decline after about 2001.

9 I attribute the increase during the '90s
10 to be primarily hydrology- or precipitation-related,
11 but I have not personally looked at water levels for
12 that period, either being predicted in the model or
13 actual water level data. But I suspect it's largely
14 driven by the water levels: The higher the water
15 levels, the higher the calculated credit.

16 And that's why the Nebraska proposal has
17 generally higher values than the current method
18 because it incorporates a no-pumping scenario in part
19 of the calculation.

20 ARBITRATOR DREHER: I understand the
21 influence of water levels, but I would have thought
22 that in this period of 1990, water levels would have
23 been declining, not increasing.

24 THE WITNESS: Not in the mound area.

25 ARBITRATOR DREHER: Not in the mound

1 area?

2 THE WITNESS: That's correct. That area
3 is driven by Platte River supplies, as well as
4 precipitation. And I know there are some years in
5 that period where the precipitation was somewhat
6 high. We had a very high year in 1993, which
7 influenced water levels of that for a while.

8 ARBITRATOR DREHER: But this period of
9 rapid increase, it looks to have begun prior to 1993.
10 So it's a little puzzling to me, but I will consider
11 your response.

12 That's all I have.

13 Mr. Blankenau.

14 MR. BLANKENAU: I would suggest a slight
15 change in the lineup. Because Colorado and Kansas
16 are aligned on this point, I wonder if it wouldn't be
17 more appropriate to have Colorado go next.

18 MR. AMPE: Sure.

19 No questions.

20 MR. BLANKENAU: That's what I thought
21 you'd say.

22 In that case, can I have the morning
23 Draper 5?

24 ARBITRATOR DREHER: I'm sorry?

25 MR. BLANKENAU: Would it be appropriate

1 to have the morning break at this point?

2 ARBITRATOR DREHER: Sure, that would be
3 fine.

4 MR. BLANKENAU: Thank you.

5 (Break was taken from 9:55 to
6 10:15.)

7 ARBITRATOR DREHER: Mr. Blankenau,
8 please proceed.

9 CROSS-EXAMINATION

10 BY MR. BLANKENAU:

11 Q Mr. Book, did I understand you correctly
12 that you were a member of the modeling and accounting
13 committees?

14 A I don't recall specifically any
15 accounting committee being set up. I was
16 specifically a member of the Groundwater Modeling
17 Committee, which is described in the FSS. And I
18 attended many meetings and assisted in the
19 development of the accounting.

20 Q Let me take you, then, first to your
21 report. Do you have that handy?

22 A Yes.

23 Q Looking at Figures 2 and 5, they end
24 with the years 2006.

25 Why didn't you include 2007 and 2008?

1 A On Figure 2, I didn't have the data.
2 And on Figure 5, I simply went to the end of the
3 period that was included in the Nebraska report,
4 which basically documented the effects through 2006.

5 Q And then in response to some questions
6 by Mr. Dreher, you talked about the meaning of
7 "undepleted" with respect to the Compact itself.

8 Doesn't that really refer to what we
9 would see in a state of nature, absent human
10 interference?

11 A It may or it may not.

12 Q Under what circumstances would it not?

13 A "Depleted" is a specific engineering
14 term that I use, which relates to consumption of
15 water, which is diversion minus return flows.

16 Q And that's not human activity?

17 A That is human activity, yes.

18 Q In which cases would it not be?

19 A Depletion is always associated with
20 human activity.

21 Q Okay. Let me take you to your
22 examination of the mound.

23 We have spoken a lot about legacy
24 effects with regard to groundwater pumping.

25 Are there legacy effects associated with

1 groundwater recharge in the growing mound area?

2 A There would be legacy effects related to
3 the Platte River recharge. I don't know if you could
4 characterize that as a growing mound area.

5 Q Have you examined the groundwater heads
6 in the area?

7 A No, not specifically.

8 Q Does an increase in the imported water
9 supply change allocations under the Compact?

10 A The calculation of imported water supply
11 does not change the allocation, but it does have an
12 effect on the physical calculation of the allocations
13 because you start with the gage flow and you subtract
14 the consumptive use -- or the beneficial consumptive
15 use that we calculate as part of the accounting
16 procedures. Then you adjust for the imported water
17 supply, which is assumed to be at the gages. So it
18 does have an effect.

19 Q It has an effect, but it doesn't
20 actually alter the allocations, does it?

21 A Well, the allocations are not altered,
22 but the allocation part of what is computed from the
23 virgin water supply because you are starting with a
24 fixed gage flow, to the extent numbers are different
25 from one scenario to another, you are calculating

1 different allocations.

2 Q Is there any change in the imported
3 water supply determination that you would agree to if
4 the imported water supply would increase?

5 A Possibly. I'm not aware of any other
6 alternatives, besides the proposal that has currently
7 been provided by Nebraska.

8 Q Going back, then, to your participation
9 on the Modeling Committee, is it your recollection
10 that that committee drafted the accounting
11 procedures?

12 A No. That committee did not draft the
13 accounting procedures, but there was input from
14 members of the Modeling Committee to people who were
15 drafting the accounting procedures.

16 From our point of view, Dave Barfield
17 was the lead person in that process and Dave was also
18 on the Groundwater Model Committee.

19 Q Mr. Larson testified that, from his
20 personal standpoint, he didn't consider superposition
21 failure to be a problem.

22 Do I understand you would testify the
23 same?

24 A I didn't testify about superposition or
25 any assumptions about that.

1 Q What is your view on that?

2 A I concur with Mr. Larson's statement,
3 that it was not assumed, for the purposes of
4 utilizing this model, that superposition would hold.

5 Q And is that your personal view, or that
6 of the modeling -- or the -- yeah, the Modeling
7 Committee?

8 A I know that from my participation on the
9 committee, that it was not assumed that superposition
10 would hold.

11 Q Switching gears again to your report.
12 Nebraska addressed its CBCU concerns at
13 various times.

14 Do you recall when it raised these
15 concerns in 2007?

16 A Yes.

17 Q And Kansas rejected Nebraska's change at
18 that time for the reasons set forth in September 18,
19 2007 memo; is that correct?

20 A I don't recall the memo. Don't know if
21 I referred to that in my report or not.

22 Q Let me have Mr. Powers hand you a copy
23 of that. This would be Nebraska Exhibit 35.

24 Do you recall this memo?

25 A I do recall that this memo exists. I'm

1 not familiar with the details of all of the
2 description or discussion in this memo.

3 Q I would refer you to the second page of
4 this memo, and the fourth paragraph.

5 Do you see that first sentence that
6 begins with "The ultimate goal"?

7 A Yes.

8 Q Would you read that for us.

9 A "The ultimate goal of the RRCA
10 Groundwater Model is to provide a measure of what
11 baseflows would have been if the States had not
12 pumped groundwater or recharge imported water."

13 Q Can you read the next sentence as well,
14 please.

15 A "That overall measure could be
16 determined by comparing the model-computed historical
17 streamflows to the model-computed streamflows with
18 all pumping and recharge of imported water removed
19 from the analysis hereinafter referred to as the
20 virgin water supply metric."

21 Q And then the first sentence of the
22 following paragraph, please.

23 A "This measure does provide a metric for
24 comparing the accounting method agreed to in the
25 settlement with Nebraska's alternative accounting

1 proposal."

2 Q Isn't Nebraska's proposal closer to the
3 virgin water supply metric expressed by Kansas in
4 this memo than to the existing method?

5 A Yes, I believe it is.

6 Q Let me then refer you to Nebraska's
7 report. Do you have a copy of that available?

8 A No, I don't.

9 MR. BLANKENAU: Mr. Powers, could you
10 see if you have a copy of the Ahlfeld report.

11 This is the David Ahlfeld expert report.

12 MR. DRAPER: Oh.

13 MR. BLANKENAU: Yes, Exhibit 31, I'm
14 sorry.

15 MR. POWERS: 30.

16 MR. BLANKENAU: 30.

17 Q (BY MR. BLANKENAU) Let me refer you to
18 page 19 of that report, please.

19 A Okay.

20 Q That Section 3.1.3.2 deals with Beaver
21 Creek; is that correct?

22 A Yes.

23 Q And are you familiar with the hydrology
24 of Beaver Creek?

25 A Yes.

1 Q Is there much in the way of surface
2 water diversions in that subbasin?

3 A I don't know if you would characterize
4 it as "much." Relative to other parts of the basin,
5 such as the mainstem, probably no. There are some
6 surface diversions in the basin and they may be
7 significant relative to the available flow in the
8 basin. I know that the stream is often dry.

9 Q About how much do you think annually is
10 diverted from surface water sources in that subbasin?

11 A I don't know.

12 Q Would it be fair to say that since that
13 stream is often dry, that oftentimes the virgin water
14 supply g is, in fact, the virgin water supply,
15 ordinarily so?

16 A I don't -- I don't know if it's possible
17 to compare that. The virgin water supply consists of
18 the runoff and surface flows created by precipitation
19 events, as well as the computed groundwater
20 depletions.

21 And I -- while the stream may be often
22 dry, at times when there are events there may be
23 large volumes of water. So I'm not in a position to
24 compare the quantities of water.

25 Q Let's use your often-dry scenario, which

1 would have been the case in 2003, which, again, is
2 the year that is being examined at page 19.

3 If you were to sum the CBCUk and the
4 CBCUn, what would you get as a result?

5 A Well, those two numbers add up to about
6 a 1050 acre-feet, I believe.

7 Q Would that, in your opinion, be a
8 reasonable estimate of virgin water supply g for that
9 subbasin?

10 A I don't have a way to estimate what the
11 virgin water supply g would be, based on the
12 information I have. So I can't answer that.

13 Q So you would disagree with the way it is
14 presently being computed?

15 A Well, there is not a virgin water supply
16 g component. So it's a function of the streamflow,
17 as well as the beneficial consumptive use calculated
18 by groundwater use.

19 Q The stream was dry, then, correct, in
20 2003?

21 A I don't know how often it was dry, but
22 it probably was dry some significant part of the
23 time.

24 Q But in any event, you would agree that
25 if you summed those two CBCUs together, you would be

1 approximately under the virgin water supply for that
2 subbasin?

3 A Well, I said I don't know that.

4 Q I'm going to refer you to Article III of
5 the Compact. Do you have a copy of that handy?

6 A No, I don't.

7 MR. BLANKENAU: We will get one for you
8 in just a moment.

9 MR. WILMOTH: For the record, that is
10 the version republished in the Nebraska Revised
11 Statutes?

12 Q (BY MR. BLANKENAU) Mr. Book, are you at
13 Article III?

14 A Yes.

15 Q That's the section that deals with
16 virgin water supply, is it not?

17 A Yes, that's correct.

18 Q And those virgin water supply numbers
19 were derived by taking -- averaging annual streamflow
20 from the period 1929 to 1940, were they not?

21 A I believe that's correct, yes.

22 Q If you look down the list in Article III
23 of the various subbasins, do you see Beaver Creek?

24 A Yes.

25 Q And what is the virgin water supply for

1 Beaver Creek listed at there?

2 A 16,500 acre-feet per year.

3 Q And that's actual stream-gaged flow, is
4 it not?

5 A I'm not sure. There may have been some
6 correction at the time for consumptive use in the
7 basin.

8 Q Okay.

9 A I don't recall if it's all stream gage
10 or not.

11 Q Can you explain what happened to Beaver
12 Creek, why it shows 16,500 acre-feet for that period
13 and now it's essentially dry?

14 A I believe it's primarily due to water
15 use and development in the basin -- in the Beaver
16 Creek Basin.

17 Q The existing methodology would have
18 depletions of groundwater use being over just 1000
19 acre-feet, would it not?

20 A Yes.

21 Q Doesn't the Nebraska methodology or the
22 Kansas virgin water supply metric bring us closer to
23 the 16,500 acre-feet number than the existing method?

24 A Yes, it may.

25 Q I ask you then to stay with page 19 of

1 the Ahlfeld report.

2 As you just have done, the sum of the
3 Nebraska and Kansas CBCU is equal to 1050 acre-feet,
4 correct?

5 A Yes.

6 Q And by Nebraska's methodology, the total
7 virgin water supply g would be 6445 acre-feet.

8 Do you see that?

9 A Yes, I see that.

10 Q If Kansas had not developed groundwater
11 irrigation using the Nebraska methodology, what would
12 the baseflow be in Beaver Creek?

13 A I don't know what the baseflow would
14 have been. It would have been dependent on
15 conditions in Nebraska, as well as precipitation
16 conditions.

17 Q Let's take it at the stateline, then.

18 If, indeed, the Beaver Creek was dry in
19 2003, if Kansas had not developed groundwater
20 irrigation, what would the flow be?

21 A I don't know.

22 Q Using Nebraska method, what would it be?

23 A Well, you are computing a term called
24 "the groundwater component of the merging water
25 supply," and I'm not too sure what -- how that

1 methodology would result in a calculation of the flow
2 at the stateline.

3 Q Isn't the purpose of determining
4 groundwater depletions to find out what the virgin
5 water supply would be? Is that not a factor?

6 A It is a factor. I mean, the first --
7 the first purpose is to calculate the depletions due
8 to well-pumping, and then those depletions are added
9 to the gage flow to provide an estimate of the virgin
10 water supply.

11 Q And the virgin water supply was
12 intended, was it not, to be, as near as possible, an
13 accurate determination of what flows would be, absent
14 human activity.

15 A I don't know if I agree with all of that
16 characterization about what the intention of the
17 virgin water supply has to be, a calculated number,
18 because the gage flow, which is measured in the
19 field, is a depleted number. And so to that, you
20 have to add the impacts of those activities that are
21 being regulated, which includes surface water
22 diversions and pumping for irrigation.

23 There are other factors that affect the
24 water supply in the gage, such as land use, practices
25 that have changed over time which are man-made

1 activities.

2 So I'm not sure I can state exactly what
3 the intention was with the virgin water supply.

4 Q You were on the Modeling Committee and
5 you participated in the accounting. Are you unsure
6 what the purpose of the virgin water supply is? Did
7 I understand that?

8 A No, that's not correct.

9 Q Tell me what virgin water supply is
10 supposed to mean within the compact.

11 A It's the gage flow, plus the impacts due
12 to surface and groundwater use.

13 Q It's just a mathematical calculation, in
14 your mind; is that correct?

15 A No. It's the virgin water supply that
16 is calculated for the purpose of implementation of
17 the Compact and regulation of use within the States.
18 And it considers the impact of pumping and surface
19 water use.

20 Q So if you have no surface well and are
21 on surface water diversions, then isn't the only
22 factor related to virgin water supply -- the only
23 stress groundwater pumping? And again --

24 A Yes, I believe that is correct.

25 Q So if we know, then, the effect of

1 groundwater pumping in that circumstance, we would
2 know what the virgin water supply would be; is that
3 not also correct?

4 A Yes.

5 Q So then again back to page 19, if you
6 were to take the Nebraska method and subtract from
7 that the impact associated with Kansas pumping, what
8 would you get?

9 A You would get approximately 6120
10 acre-feet.

11 Q Okay. So there would be, then, just 323
12 acre-feet of water in the stream and Nebraska's
13 actual impacts would be 6122; is that not correct?

14 A No. That -- the Nebraska impact under
15 the current accounting procedures is listed here as
16 727. And the Kansas impact is 323. So I don't
17 understand how the virgin water supply groundwater
18 component would factor into that calculating.

19 Q Let me take you back, then.

20 Let's take the Nebraska determination,
21 the total impact of 6445, and let's use the existing
22 methodology and subtract from that the impact of
23 Kansas pumping. So you would have 6445 minus 323,
24 correct?

25 A Yes. I wouldn't do that calculation

1 because that is mixing different approaches. So it
2 would be --

3 Q I'm not asking you to accept the way I'm
4 doing it. I'm just asking you to go through the
5 exercise with me for a moment.

6 A Yes, that would be internally
7 inconsistent to do that calculation for purposes of
8 accounting.

9 Q Then if you were to accept that
10 proposition, the Nebraska pumping impact would
11 necessarily be 6122; that is the number of Nebraska
12 impacts, plus the impact of the Kansas impact under
13 the existing method? Would you agree with that?

14 A No, that wouldn't be characterized as an
15 impact to Nebraska under any accounting that I'm
16 familiar with.

17 Q I'm not asking you to -- I'm just going
18 through an exercise with you. Do you understand
19 that?

20 A You are asking me to characterize that
21 as the Nebraska impacts.

22 Q Yes. Combining both the Nebraska
23 methodology to determine the overall impact to Beaver
24 and then the respective impacts as determined under
25 the existing method. Are you with me?

1 A What is the question?

2 Q First, are you with me on what I'm
3 getting at?

4 A I disagree that that would be an
5 appropriate calculation of the Nebraska impacts.

6 Q Yes, I understand that. You made that
7 clear. I'm just trying to walk you through a little
8 exercise. All right.

9 And this is, by the way, what Kansas did
10 in the 2007 memo with the diversion water supply
11 metric. So suspend your imagination for a moment and
12 work with me.

13 Now, the sum of the Nebraska impacts of
14 6122, plus the 323 impacts, would equal 6445, would
15 it not?

16 A Those two numbers add up to that, yes,
17 that's correct.

18 Q Okay. So the current accounting
19 procedures would match the 6445 acre-feet, if only
20 one State had developed a groundwater irrigation?

21 A That's possible. It could be close to
22 that. I'm not sure how the calculation would work
23 out precisely under that scenario, but it's possible
24 you could get to that result.

25 Q And then the way it's done now, the

1 existing methodologies with both States having
2 developed, we would account for only 1050 acre-feet
3 of groundwater depletions, correct?

4 A In this particular year, that's correct,
5 yes.

6 Q Correct.

7 Accounting changes were also anticipated
8 when the FSS was entered into, were they not?

9 A I believe that there were -- at the time
10 there were some indications that some corrections
11 were necessary and, certainly, there is reference to
12 the RRCA making future changes, if they were agreed
13 to.

14 Q Sure.

15 I refer you to Kansas Exhibit -- I will
16 find it in a moment here -- 31. This is the
17 transcript of a hearing before Special Master
18 McKusick.

19 Do you have a copy of that before you?

20 A No, I don't.

21 MR. BLANKENAU: Mr. Powers, can you
22 provide him one.

23 Q (BY MR. BLANKENAU) I will refer you to,
24 I believe that is page 65, is that not correct,
25 Mr. Book?

1 A I'm just taking a look at the document.

2 Q Yes.

3 A Yeah. You had it open to page 65.

4 Q All right. Do you see where I drew a
5 red arrow on the right margin?

6 A Yes.

7 Q Can you read that to the end of the
8 paragraph?

9 A "While the settlement team have worked
10 hard to make the document comprehensive and
11 significant changes are not expected, it is expected
12 that there will be some modifications with the
13 completion of the model to fully conform with its
14 output and other changes may occur from time to time,
15 as well as the possibility that advances in
16 technology, for example, could allow for improved
17 methods."

18 Q Thank you.

19 And isn't subbasin accounting important,
20 at least in some instances, to maintaining Compact
21 compliance?

22 A Yes.

23 MR. BLANKENAU: We don't have anything
24 further.

25 Thank you, Mr. Book.

1 ARBITRATOR DREHER: Mr. Draper, do you
2 need a brief break?

3 MR. DRAPER: Yes, Your Honor.

4 ARBITRATOR DREHER: We will take five
5 minutes.

6 MR. DRAPER: Thank you.

7 (Break was taken from 10:45 to 10:53.)

8 ARBITRATOR DREHER: Mr. Draper, you may
9 proceed.

10 MR. DRAPER: Thank you.

11 REDIRECT EXAMINATION

12 BY MR. DRAPER:

13 Q Mr. Book, Mr. Blankenau asked you about
14 a document that they labeled Nebraska Exhibit 35.
15 This indicated --

16 MR. BLANKENAU: I should correct the
17 number on that. It should have, in fact, been No.
18 36. I apologize.

19 Q (BY MR. DRAPER) He asked you several
20 questions about this.

21 Would you turn to the last page, to the
22 concluding paragraph. This is the two-line paragraph
23 just above the table designation on the page.

24 A Yes.

25 Q Would you read that?

1 A "It remains our view, based on the
2 understanding of the agreement of the States at the
3 time of the settlement and these results, that the
4 current accounting methods are appropriate."

5 Q Thank you.

6 Relative to the discussion during your
7 testimony of the virgin water supply, is -- are the
8 gaged flows -- gaged surface water flows, do those
9 flows contain groundwater discharges?

10 A Yes, they do.

11 Q Is it important to keep that in mind in
12 considering the Nebraska proposal?

13 A Yes, I believe it is. There is some
14 reference to a new term that they introduced, the
15 "virgin water supply groundwater components," and my
16 reading of the proposal is that was intended to
17 represent model output and some of the model output
18 is flow that is existing in the stream gages out in
19 the basin.

20 Q The question Mr. Dreher raised during
21 your testimony had to do with Figure 5 of your
22 report, which is Kansas Exhibit 28.

23 A Yes.

24 Q In this regard, I have asked Mr. Ampe if
25 he would provide you with the RRCA Model

1 documentation volume, which is labeled Final Report
2 of the Special Master with Certificate of Adoption of
3 RRCA Groundwater Model, dated September 17, 2003."

4 In response to Mr. Dreher, you referred
5 to changing precipitation recharge.

6 I would ask you to look at page 15, if
7 you would, of this document. The Table of RRCA model
8 global water budget on the first page, which is on
9 page 15, includes a column of inflows designated as
10 precipitation recharge.

11 Does this help illustrate your answer to
12 Mr. Dreher?

13 A Yes, I believe this is consistent with
14 my response that the precipitation part of the water
15 budget was higher during the 1990s, which contributed
16 to higher water table levels.

17 The values on this table are shown by
18 decade and indicate higher than previous decades of
19 precipitation recharge in the '90s.

20 MR. DRAPER: Thank you very much.

21 No further questions.

22 ARBITRATOR DREHER: All right.

23 Thank you, Mr. Book.

24 Call your next witness.

25 MR. DRAPER: Thank you, Your Honor.

1 We recall to the stand Mr. Dave
2 Barfield.

3 ARBITRATOR DREHER: And Mr. Barfield,
4 you are still under oath.

5 THE WITNESS: Yes, sir.

6 DAVID BARFIELD,
7 having previously been sworn, was examined and
8 testified as follows:

9 DIRECT EXAMINATION

10 BY MR. DRAPER:

11 Q Mr. Barfield, were you a member of the
12 Modeling Committee that developed the RRCA
13 Groundwater Model?

14 A I was.

15 Q And did you have responsibilities in
16 connection with your work with the Modeling Committee
17 with respect to drafting the accounting procedures?

18 A Well, we have spoken about my role with
19 respect to interstate water issues, and Republican
20 River Compact matters were a central part of those
21 matters in the 15 years I have been a part of it.

22 So I was involved with -- very
23 significantly involved with every aspect of
24 negotiations during this time.

25 Q Based on your experience as a member of

1 the Modeling Committee and your other work related to
2 it, does the fact that the individual impact of each
3 State's pumping and the IWS credit don't always add
4 up to the difference obtained by running the model
5 all-on versus all-off? Is that considered to be a
6 problem or error?

7 A Well, a couple of responses.

8 First of all, you know, we had output
9 from the model -- from the Modeling Committee that
10 was available to the committee and all. And it
11 showed that, in certain years in certain tributaries,
12 there were effects that -- for individual years, that
13 were nonlinear or whatever. You know, the nonlinear
14 effects we have been speaking about were quite
15 apparent in the output.

16 One of the aspects of the settlement --
17 and I think it's tied to that -- is for the multiyear
18 averaging aspect of the accounting and, particularly
19 in the tributary and particularly, I think, in
20 northwest Kansas, those streams are intermittent and
21 there are significant storage effects that occur
22 because of that.

23 In certain years we are drawing from
24 storage and a year like 2003, the dominant
25 groundwater use is going to be drawing from storage,

1 as opposed to depleting streams in that individual
2 year.

3 And then there will be a subsequent year
4 when there is a larger precipitation when storage
5 will be replenished and the depletions will be larger
6 than otherwise they would be.

7 So because of that, there are no
8 tributary tests that are imposed on any State that
9 relate to a single year, or even a two-year. They
10 are all related to five-year averages. And I think
11 these nonlinearities, especially in the response of
12 pumping to streamflow depletions in these,
13 particularly, intermittent tributaries is, I think, a
14 reason why we need five-year averaging in those -- in
15 those particular tests of compliance under the
16 settlement.

17 Q Are the values reached here of the CBCU
18 for each State and the imported water supply credit,
19 are those outputs of the RRCA Groundwater Model that
20 become inputs to the accounting procedure?

21 A Could you just repeat the question.

22 Q Are the individual State-computed
23 beneficial consumptive use amounts and the imported
24 water supply credit, are those outputs of the --
25 obtained by runs of the RRCA Groundwater Model that

1 become inputs to the accounting for Compact
2 compliance?

3 A That's correct. As Dale Book mentioned,
4 you know, the virgin water supply is determined
5 through taking the streamflows that exist and adding
6 to them the various effects of man that are included
7 within the accounting procedures, and they include
8 depletions due to surface water, changes in storage,
9 evaporation from storage and then the outputs of the
10 groundwater model to determine the streamflow
11 depletions due to each State's impact, as well as the
12 imported water supply.

13 Q The difference between the all-on
14 condition and the all-off condition of the model, is
15 that an output from the modeling that is used as an
16 input to the compact accounting procedures?

17 A It is not.

18 Q In this regard I would like to ask you
19 to turn -- and perhaps with Mr. Ampe's help -- turn
20 to the Final Settlement Stipulation, Volume 1 of 5.

21 A I believe I have that volume.

22 Q You have a copy. Thank you.

23 I would like to ask you that we turn to
24 page 25, which is subsection Roman iv.f.

25 Would you explain, Mr. Barfield, what

1 the significance of this provision of the FSS is for
2 the current issue?

3 A Yes. Section iv. of the FSS relates to
4 the aspect -- the general aspect to the Compact
5 accounting. Section v. has additional aspects with
6 respect to water-short year accounting, but this
7 provides for the sort of general aspect of how the
8 Compact accounting will be done.

9 And Section f. of Section iv.
10 specifically relates to the imported water supply
11 credit determination and how it will be conducted.

12 I guess I would like to go through this
13 portion; but before I get very far, let me read the
14 first sentence and then go back to the definition
15 section, because the definitions of the specific
16 terms are important in understanding this section.

17 Let me read the first sentence first.

18 It states that beneficial consumptive
19 use, which has a specific meaning -- beneficial
20 consumptive use of imported water supply shall not
21 count as computed beneficial consumptive use or
22 virgin water supply.

23 So we have several terms there,
24 "beneficial consumptive use," as well as "computed
25 beneficial consumptive use" and imported water supply

1 is also contrasted with imported water supply credit.

2 Let me turn us back, then, to the
3 definition section that starts on page 3 of the same
4 document.

5 At the bottom of page 3, then, we have
6 the definition of beneficial consumptive use is
7 stated as that use by which the water supply of the
8 basin is consumed through the activities of man and
9 shall include water consumed by evaporation from any
10 reservoir, ditch -- canal ditch or irrigated area.

11 So this is sort of the traditional
12 Western definition of beneficial consumptive use, the
13 diversion of water for some -- some purpose.

14 The next definition I would like to just
15 review is computed beneficial consumptive use, page
16 4. It's stated as the streamflow depletion resulting
17 from the activities of man as listed in the
18 definition of computed beneficial consumptive use in
19 the RRCA accounting procedures, Section II.

20 So here, computed beneficial consumptive
21 use is a very specific term that means the activities
22 -- the impacts of man's activities on streamflow --
23 on Republican River streamflow and its tributaries.

24 Okay, page 5, then, lists the definition
25 of imported water supply. And it is stated as the

1 water supply imported by a state from outside the
2 basin resulting from the activities of man.

3 So this is an 600,000 acre-feet of canal
4 leakage that occurs, you know, from the Platte to
5 that ridge between the Platte and the Republican; at
6 least that is a form of imported water supply, and
7 the only one that is currently considered in the
8 Compact accounting.

9 And then finally, imported water supply
10 credit, the accretions to streamflow due to water
11 imports from outside of the Basin as computed by the
12 RRCA Groundwater Model. The imported water supply
13 credit of a state shall not be included in the virgin
14 water supply and shall be computed as an offset -- as
15 a credit/offset against computed beneficial use of
16 that State's allocation, except as provided in
17 subsection V.B.2. of the stipulation, in subsection
18 III.I. through J. of the RRCA accounting procedures.

19 So with all of those definitions in
20 mind, I will go back to page 25 and this Section
21 iv.f. on how we do the imported water supply credit
22 determination.

23 Again, "Beneficial consumptive use of
24 imported water supply shall not count as computed
25 beneficial consumptive use or virgin water supply."

1 This states that the fact that the State
2 of Nebraska is using, through wells and perhaps other
3 means, a significant part of the water they import;
4 that that, in and of itself, will not count against
5 the State of Nebraska. They may use that water in
6 the mound.

7 So it's a general principle that is
8 stated there.

9 The next two statements, then, tell us
10 very specifically, then, how this imported water,
11 then, is applied to the accounting.

12 Let me read the second sentence. It
13 says, "Credit shall be given for any remaining
14 imported water supply that is reflected in increased
15 streamflow, except as provided in subsection V.B."

16 So now this is related to the specific
17 credit. And it says that credit is for any
18 remaining -- any water that has not been used, not
19 been consumed, in the first sentence, and makes its
20 way to the Republican River streams.

21 This means that the imported water
22 supply credit must be evaluated with Nebraska pumping
23 on, because it says: Any remaining imported water
24 supply that is reflected in the streams.

25 And then finally, the last sentence

1 says, "Determinations of beneficial consumptive use
2 from imported water supply (whether determined
3 expressly or by implication) and any imported water
4 supply credit shall be calculated in accordance with
5 the RRCA accounting procedures and using the RRCA
6 Groundwater Model."

7 We specifically said this is how we are
8 going to determine the credits, using the procedures
9 attached.

10 Q And what are the implications of this
11 language to the present issue, then?

12 A Well, in the Nebraska proposal, as they
13 are evaluating imported water supply credit, they use
14 a combination of runs that is not as prescribed
15 currently. And half of the runs that they use in
16 that evaluation have Nebraska pumping on and half of
17 the runs that they use in that evaluation have
18 Nebraska pumping off. Therefore, they overestimate
19 the imported water supply with respect to how it's
20 prescribed in the accounting procedures because of
21 that merging of all of those different run
22 differences.

23 Q I would now like to turn your attention
24 to what has been marked as Kansas Exhibit 29,
25 "Kansas's Responsive Expert Report Concerning Haigler

1 Canal Annual Groundwater Modeling Accounting Points,"
2 dated February 17, 2009?

3 A Okay, I have that.

4 Q Would you please briefly describe the
5 purposes of this report and the conclusions reached.

6 A Well, this report was prepared by
7 myself, with some assistance from Mr. Ross, to
8 respond to Nebraska's Expert Report on Accounting
9 Issues for the Haigler Canal and the Groundwater
10 Modeling Accounting Points.

11 With respect to the Haigler Canal, my
12 finding, in essence, is that Nebraska's proposal is
13 incomplete and, therefore, should -- should not be
14 accepted at this point, but I believe should go back
15 to the Engineering Committee for additional
16 consideration.

17 It has already been noted that my
18 Table 1 provides just sort of a very cursory review
19 of some of the data that Nebraska provided, merged
20 with gaged data that we have available and shows that
21 in the last six years, that the strict application of
22 the methods that they project would result in
23 negative Arikaree streamflow values. Therefore,
24 their method does not really deal with the reality of
25 the conditions that exist there.

1 Q Are negative gage flows an acceptable
2 result?

3 A No, they are not. And as a result of
4 that, they, of course, would reduce or eliminate the
5 virgin water supply and the allocations that are
6 provided to the State of Colorado dominantly, but the
7 other States have some share, as well.

8 Q In addition to the Haigler Canal issues
9 in your report, you also discuss the proposed changes
10 to the groundwater model accounting points.

11 A Yes, I do. And we have had -- I have
12 heard the testimony yesterday with respect to the
13 accounting procedures and Nebraska's recommendations.

14 And I guess I -- it is my belief that
15 the current accounting procedures are, in fact,
16 consistent with the Compact and consistently account
17 for both surface water and groundwater at the
18 confluence with the mainstem and appropriately so.

19 And so, except for the North Fork, which
20 I will maybe discuss separately here, I think -- and
21 conclude in my report -- that Nebraska's
22 recommendations, except possibly the North Fork,
23 should be rejected because I believe it is
24 appropriate and consistent with, both the current
25 accounting procedures and the Compact, that the

1 confluence is where the virgin water supply should,
2 in fact, be measured.

3 As was mentioned, the Compact accounting
4 procedures, in certain subbasins, the existing gage
5 is right at the confluence and there is no need for
6 adjustments. In certain cases, the gage is some
7 distance upstream and there are specific provisions
8 for considering surface water consumptive use above
9 and below the gage.

10 In these cases, that is not specified.
11 I believe that is the case because there is no
12 significant surface water use below those gages. At
13 least that's my recollection of our work in
14 developing those -- those formulas and our review of
15 those formulas in 2003 and 2004.

16 If, in fact, there are any significant
17 surface water uses below the gage, I believe the
18 proper thing to do would be to adjust the formulas to
19 reflect the Beaver and Sappa Creek, where we say
20 there should be an adjustment for uses below the
21 gage.

22 One more thing here. You know, I quote
23 the specific portion of the accounting procedures
24 that indicate we will, you know, make such
25 adjustments with respect to the North Fork. My

1 reading of the Compact is that the North Fork is
2 divided into two parts: That portion that is in
3 Colorado and that portion that is in Nebraska that is
4 included within the mainstem -- the terminology is
5 the "North Fork in Nebraska and mainstem."

6 So I don't disagree that, should the
7 Compact be able to agree, that that accounting point
8 should be shifted.

9 Q But the proper approach on that would be
10 for the RRCA itself to agree on that change?

11 A Yes, that's correct.

12 Q Now, do the proposed changes with
13 respect to groundwater accounting points, looking at
14 the South Fork tributary, do these have any practical
15 -- if they were adopted, would they have any
16 practical effect?

17 A Well, they would. As Mr. Williams
18 indicated yesterday, they -- in fact, if we shift
19 where the beneficial consumptive use occurs from one
20 subbasin to another, its principal effect is to shift
21 the allocations and in the case of the South Fork,
22 very significantly.

23 If I might, I might maybe draw on the
24 board, just illustrate what that effect might be.

25 Q Yes, if you would, please.

1 A And I'm going to be taking from -- just
2 to let you know the source, in Table 2 of the
3 accounting procedures on page 60, there is a Table
4 that essentially provides for the specific
5 allocations provided in the Compact and the
6 percentages and each tributary that was assigned to
7 each State. And this is used in the accounting
8 procedures to make allocations of the virgin water
9 supply.

10 So I will be using numbers from this
11 Table 2 that is page 60 of the Volume 1 of the Final
12 Settlement Stipulation.

13 Q And that is actually page C60, isn't it?

14 A Yes, page C60. I'm sorry. Thank you.

15 Let me start by just drawing sort of a
16 schematic of what I'm going to explain here.

17 We have the main -- and if you can't
18 hear me, please let me know.

19 We have the mainstem going through here
20 and the South Fork tributary. We have the current
21 gage where we do surface water and then we have the
22 current groundwater model accounting point located at
23 the confluence.

24 Nebraska would have us move the
25 groundwater model accounting point to the same

1 location as the gage in their proposal.

2 Q So those two are, first, the current
3 groundwater model accounting point --

4 A Yes.

5 Q -- and the proposed?

6 A Right.

7 And in this reach, then, we have a
8 number of wells that currently exist and are
9 currently modeled in the groundwater model.

10 And for purposes of this illustration,
11 I'm going to assume that the groundwater CBCU of
12 these wells is about an acre-feet. Obviously, it
13 varies from year to year, but that's -- that's sort
14 of in the range of the effect that these wells can
15 have.

16 Okay. What I would like to do is sort
17 of go through the accounting and how the allocations
18 are done under the current procedure and then how
19 they would be done under Nebraska's proposal.

20 First, I need to go through the
21 allocations. So on the mainstem, which Nebraska's
22 proposal would have us put the CBCU on the mainstem,
23 the allocations are 48.9 percent Nebraska and
24 51.1 percent for Kansas. Then on the South Fork,
25 they are 44.4 percent for Colorado; 40.2 percent for

1 Kansas; 1.4 percent Nebraska; and 14.0 percent
2 unallocated.

3 Now, unallocated means unallocated in
4 the tributary; essentially, you really allocated a
5 reserve for mainstem use, okay.

6 So under Nebraska's proposal, this
7 thousand acre-feet of CBCU would be assigned to the
8 mainstem. And, therefore, Nebraska's share of the
9 allocation from that thousand acre-feet would be a
10 thousand acre-feet times .489, or 489 acre-feet.

11 Okay. Well, that is Nebraska's
12 proposal.

13 The current procedure, which I should
14 have done first, you know, would be assigned to the
15 South Fork.

16 Okay, Nebraska's allocation, then, would
17 be in two parts. It would get a thousand acre-feet
18 times .014, or 14 acre-feet, from -- from the South
19 Fork directly. And then it would get a thousand
20 acre-feet times its share of the unallocated water,
21 which would be .14 times .89, or 68 acre-feet, for a
22 total of 82 acre-feet.

23 Under the current procedure, Nebraska
24 would derive, in terms of allocation, 82 acre-feet
25 from the current procedure and 489 acre-feet from the

1 -- from their recommended procedure.

2 Q So the effect on the South Fork, as you
3 have illustrated here, would be to increase the
4 Nebraska allocation of 1000 acre-feet as applied from
5 82 acre-feet currently under that example, to 489
6 acre-feet.

7 A That is the allocation that they would
8 derive from the beneficial consumptive use under
9 their proposal, as opposed to the allocation that
10 they would derive from that consumptive use under the
11 procedure.

12 Q So this shows the effect of either
13 retaining the current procedures as agreed to in the
14 accounting procedures, versus adopting the Nebraska
15 proposal?

16 A Right. It shows the effect on
17 Nebraska's allocation. I might add, the total
18 allocation is the same with respect to the total
19 virgin water supply. And so this -- this is a
20 zero-sum deal.

21 If somebody is gaining allocation,
22 somebody's a loser, and the loser is the State of
23 Colorado. Again, if this thousand acre-feet is in
24 the South Fork, then the State of Colorado derives
25 44.4 percent of that, or 444 acre-feet.

1 So this shift would deprive the State of
2 Colorado with 444 acre-feet and, actually, we would
3 actually have a small reduction as -- no, I'm sorry.
4 We would actually have a small gain from Nebraska's
5 procedure versus the current procedure, but it would
6 be relatively small.

7 Q Thank you.

8 One final question.

9 Has there been a postsettlement review
10 of the accounting procedures by the RRCA?

11 A Yes. At the 2003 Annual Meeting, the
12 first meeting after the adoption of the FSS and the
13 accounting procedures in the model, actually -- I'm
14 sorry.

15 At the 2003 Annual Meeting, the States
16 adopted as rules of the Compact, the accounting
17 procedures, as well as the model. At that same
18 meeting, the administration assigned the Engineering
19 Committee to conduct a comprehensive review of the
20 accounting procedures to ensure that all of the i's
21 were dotted and the t's crossed and all of the terms
22 were consistent and so forth.

23 So that work was conducted in the fall
24 of 2003 and the spring of 2004, as I recall.

25 Q And did that result in agreed revisions

1 to the FSS accounting procedures?

2 A It did. Ultimately, they were
3 ultimately adopted by Compact Administration. For
4 the most part, those corrections were, you know,
5 again, just sort of completing it and making sure all
6 of the terms were consistently applied. We reviewed
7 gages.

8 One -- as I recall, the only significant
9 change that we made was to determine how Harlan
10 County evaporation would be divided when no State
11 diverted water.

12 The original accounting procedure did
13 not consider that that would ever happen because it
14 had never happened historically since the project
15 began full operation; but in the intervening period,
16 it became obvious that that would occur.

17 So the States agreed to a methodology
18 that would apply when no State diverted water from
19 Harlan County.

20 Q Did the review conducted by the
21 Engineering Committee at the request of the Compact
22 Administration, did it include the accounting
23 procedures that are at issue in this proceeding?

24 A Yes. That's what I was -- that's what
25 the review was about, was the accounting procedures.

1 And as a result, the Compact
2 Administration adopted the -- the revised accounting
3 procedures recommended by the Engineering Committee.

4 Q And did the Engineering Committee of the
5 three States' representatives, did it recommend any
6 change with respect to the issue that we are dealing
7 with in this proceeding?

8 A It did not.

9 Q And were those revised accounting
10 procedures reporting requirements adopted, as revised
11 August 10, 2006?

12 A The 2006 -- I cannot recall whether
13 there was another minor change that -- change between
14 2005 and 2006, or whether that was the time of the
15 final adoption of the committee's work.

16 Q Would that version that is revised as of
17 August 10, 2006 be the latest adopted version of the
18 accounting procedures and reporting requirements by
19 the RRCA?

20 A That is the current version. At this
21 summer's annual meeting, there were a couple of
22 issues that were approved by the Administration and
23 the Engineering Committee was instructed to make
24 revisions. So there should be another version of it
25 being prepared this year. But that's the current

1 version we are operating under.

2 Q The version right now is the one that I
3 mentioned?

4 A That's right. Mr. Williams referenced
5 two items, I believe -- the Riverside and the
6 accounting point for Guide Rock -- that were approved
7 this year.

8 MR. DRAPER: And the accounting
9 procedures, as revised August 10, 2006, for
10 reference, are Appendix 3 to the Kansas Opening Brief
11 on Legal Issues in this proceeding, just for
12 everyone's reference.

13 Thank you very much, Mr. Barfield. No
14 further questions.

15 ARBITRATOR DREHER: Mr. Barfield, as I
16 understand your testimony, you were on the Modeling
17 Committee?

18 THE WITNESS: I was.

19 ARBITRATOR DREHER: And the Modeling
20 Committee recognized that there could be nonlinear
21 responses of the model?

22 THE WITNESS: There are nonlinear
23 responses of the model, and I'm -- yes. And I
24 believe that should have been apparent to everybody
25 involved.

1 ARBITRATOR DREHER: Well, there are
2 nonlinear responses that have been described by
3 various witnesses at the hearing and then, of course,
4 there is some description of that in the Dr.
5 Ahlfeld's report, which is Nebraska Exhibit -- I have
6 to find it.

7 MR. BLANKENAU: Nebraska 30.

8 ARBITRATOR DREHER: -- Nebraska's
9 Exhibit 30; that's correct.

10 And there are minor nonlinearities, say,
11 associated with the initial recharge associated with
12 the onset of irrigation is one example that causes, I
13 think, what Dr. Ahlfeld referred to as a bump. And
14 there is nonlinearity associated with phreatophytes
15 and drains and all of that. But the nonlinearities
16 identified by Dr. Ahlfeld seem to be pretty
17 significant.

18 I guess my question to you is: Did the
19 Modeling Committee specifically consider instances or
20 conditions when superposition, it would, in fact,
21 fail because of nonlinear model response?

22 THE WITNESS: Well, the Modeling
23 Committee -- and I believe the broader team that put
24 this together -- had outputs from the model that were
25 available for the year 2000. Some of these nonlinear

1 features and some of these responses to streamflow to
2 pumping and so forth, and things not adding up, I
3 think were apparent and accepted by the Modeling
4 Committee in their report where they said that this
5 model is sufficient -- I could go back to the report
6 if we want to look at the Compact terminology they
7 use -- for purposes of determining the impact of
8 groundwater pumping on streamflows and the imported
9 water supply credit.

10 So the Modeling Committee recognized, I
11 believe, sort of these effects, and said they were
12 sufficient -- the model was sufficient for the
13 purposes that they were asked to create it.

14 ARBITRATOR DREHER: I believe that you
15 also testified this morning that this nonlinear
16 response of the model was one of the reasons why a
17 five-year moving average was adopted?

18 THE WITNESS: Yes.

19 ARBITRATOR DREHER: And yet, I don't
20 recall reading anything in any of the Special Master
21 reports about that. And I -- am I wrong?

22 Is there a reference somewhere that the
23 States pointed out to the Special Master that there
24 were nonlinear effects, but they were going to accept
25 them -- or some reference to it?

1 I mean, for example, while you were
2 testifying, I turned to page 49 of the Second Report
3 of the Special Master, which -- where he specifically
4 addresses use of the five-year running average. And
5 he says, "One reason for this change is the
6 groundwater pumping may cause stream depletions a
7 year or more after the pumping occurs, so the use of
8 averaging will allow the states to manage groundwater
9 and surface water depletions together."

10 And he goes on to say, "A second reason
11 is averaging can account for changes in streamflow
12 caused by storage in and releases from Federal
13 reservoirs that did not exist at the time the Compact
14 was drafted."

15 Those are pretty elementary reasons.
16 I'm not saying they are wrong; I'm just saying they
17 are elementary and certainly not -- don't have the
18 subtly associated with this nonlinear response.

19 Is there something I'm missing here that
20 this was specifically brought to his attention and
21 the approvals were made knowing that these
22 nonlinearities existed?

23 THE WITNESS: Well, I'm not an expert in
24 the reports; I haven't studied them. There may be
25 some references or not.

1 Actually, I think the reference you read
2 alluded to what I'm speaking about.

3 It says that in the groundwater system
4 there are effects of pumping that are outside the
5 particular year in which they occur.

6 So, in Beaver Creek, as we have been
7 talking about, we have been looking at one specific
8 year and which frequently occurs in the Beaver Creek
9 system where there was very little streamflow to
10 deplete and, therefore, groundwater must come -- it
11 must deplete the storage. But that is, in subsequent
12 wet years, replenished, so you will see that the
13 depletions in some wet years, even when pumping is
14 less, is higher. And that's because the groundwater
15 system that is being depleted is being replenished.

16 So I think his first statement there is
17 sort of reflecting that reality and, again, is one
18 reason why we have five-year averaging in these
19 tributaries, why it's necessary for the State of
20 Kansas to have some flexibility in our northwest
21 Kansas streams for more than just annual compliance
22 or even two-year compliance.

23 ARBITRATOR DREHER: Okay.

24 Mr. Ampe, does the State of Colorado
25 have any questions?

1 MR. AMPE: No questions. Thank you.

2 MR. BLANKENAU: I think we can break for
3 a few minutes, if it's all right, and still finish up
4 with Mr. Barfield before lunch.

5 ARBITRATOR DREHER: That will be fine.
6 We will take five minutes or so.

7 (Break was taken from 11:36 to 11:45.)

8 ARBITRATOR DREHER: Mr. Blankenau.

9 CROSS-EXAMINATION

10 BY MR. BLANKENAU:

11 Q Mr. Barfield, how are you?

12 A Well. How about yourself?

13 Q I'm fine. This will be fairly short.

14 I want to start off with your experience
15 with the Modeling Committee itself.

16 Did the Modeling Committee use the
17 adopted accounting procedures to actually evaluate
18 the impact of the nonlinear effects of the model?

19 A The Modeling committee, in its report,
20 prescribed a procedure by which the model should be
21 used to determine groundwater CBCU and imported water
22 supply credit.

23 So they did computations according to
24 that methodology they were recommending.

25 Q How would they do that without the

1 accounting procedures?

2 A Well, their task was to build a model
3 that was to be used to determine the depletions to
4 streamflows -- to baseflows, due to groundwater
5 pumping and the imported water supply credit. That's
6 an input to the accounting that can be done, that
7 they could do.

8 Did I answer your question?

9 Q Yes and no.

10 Let me look at it a little differently.

11 Did the Accounting Committee make any
12 provisions in the accounting procedures, given
13 Mr. Book's testimony, that the Modeling Committee
14 should have known that a superposition would not
15 hold?

16 A Repeat the question, please.

17 Q Sure.

18 Did the Accounting Committee make any
19 provisions in accounting procedures, given Mr. Book's
20 testimony, that the Modeling Committee should have
21 known that a superposition would not hold?

22 A Well, I think the answer is no. The
23 model was -- the Modeling Committee was tasked with a
24 certain task and the Accounting Committee knew what
25 that task was and, you know, developed accounting

1 procedures that used that input in the total
2 accounting.

3 Q Doesn't Nebraska's proposal now make an
4 accommodation to deal with that nonlinearity for the
5 failure superposition?

6 A Well, the Nebraska proposal develops an
7 alternative method to determine the same inputs, the
8 groundwater CBCU and the imported water supply
9 credit. It develops alternatives to have as its goal
10 to achieve the difference between two runs that are
11 not currently done.

12 Q Okay. Turning to the Nebraska Exhibit
13 36, which is the 2007 Kansas memo.

14 A That's Kansas review of Nebraska's
15 report?

16 Q Correct.

17 A Yes, I have that.

18 Q Kansas, as I understand that memo,
19 rejected Nebraska's then-accounting-change proposal
20 because it was further from the virgin water supply
21 metric than the existing method; is that not correct?

22 A Kansas, in this memo, provided a
23 critique and its opinion of that proposal at the time
24 and states, in summary, that -- at the end of the
25 memo -- "It remains our view, based on our

1 understanding of the agreement of the States at the
2 time of the settlement and these results, that the
3 current methods are appropriate."

4 It does find, yes, that their proposal
5 at that juncture had a significantly greater
6 difference with the metric than the current approved
7 method.

8 Q And do you recall your deposition?

9 A Yes, I do. Both of them.

10 Q And with respect to the deposition that
11 dealt with this very question --

12 A Well, they both did.

13 Q All right. Let me refer to you to one
14 that occurred on February 23, 2009 in Kansas City.

15 A Thank you.

16 Q Does that ring a bell?

17 A Yes.

18 Q I'm going to hand you a copy of that and
19 ask you to turn to page 36, please.

20 A Okay.

21 Q Line 14, sentence beginning with "We
22 were," could you read that for us, please. And this
23 is in answer to a question and this is your response.

24 A Okay. If I might read the full question
25 and answer.

1 Q Sure. Go ahead, sure.

2 A The question is:

3 "And on September 18 of 2007 did you not
4 agree with that?" I think it's referring to --

5 Q Tell you what, just to make it clear,
6 why don't you start with line 6, start with the
7 previous answer.

8 A Okay.

9 Answer: "Well, I think the Ahlfeld
10 report, as I understand it, assumed that the metric
11 is the right answer and goes about finding a
12 mathematical way to get there."

13 Next question: "And on September 18 of
14 2007, did you not agree with that?"

15 Answer: "We did not in this document
16 say it was the right answer and advocate moving to
17 such a procedure. We were just saying Nebraska's
18 proposal at that time, you know, produced a result
19 that was further away from the metric than the
20 current procedures and, therefore, should be
21 dismissed."

22 Q Would you agree that Nebraska's new
23 proposal is closer to the metric than the existing?

24 A It is, by definition. It goes about
25 finding a solution that is exactly the same.

1 Q Let me, then, switch over to the Haigler
2 Canal issue.

3 A Okay.

4 Q You indicated that Nebraska's Haigler
5 Canal proposal was incomplete and in your testimony
6 you observed that the concern -- or a concern that
7 Kansas had was that the Arikaree gage would show
8 negative flows at certain time; is that correct?

9 A Well, my critique evidenced that in six
10 years of running, it would have, you know,
11 significant negative values.

12 Q And do you have negative values
13 presently appear at other stream gages across the
14 basin?

15 A Not at stream gage. Stream gages cannot
16 be negative, by definition.

17 Q Sure, but are they not zero in some
18 locations?

19 A Well, certainly.

20 Q Let me then refer you to, if I may, the
21 Compact itself. And I think we had one available
22 earlier and probably pulled it down from the stand.

23 A I have a copy of the Compact.

24 Q Would you pull that up for us, please,
25 to Article III?

1 A I have it.

2 Q That is the determination of original
3 virgin water supply for certain select subbasins, is
4 it not?

5 A Yes, it is.

6 Q Could you find me an Arikaree River
7 drainage basin on that list?

8 A Yes.

9 Q And what was the virgin water supply
10 under the original Compact?

11 A 19,610 acre-feet.

12 Q And you would agree that the Arikaree is
13 now occasionally dry near the stateline?

14 A It is.

15 Q And if there are spills from Haigler
16 Canal into the Arikaree and a portion of that gets to
17 the gage, why shouldn't that be accounted for as
18 North Fork water?

19 A Well, I do not say in my report that
20 that should not occur. I think it's incumbent on the
21 State of Nebraska to produce a proposal that more
22 fully considers all of the complex matters that
23 occurs in this Basin.

24 If it can, in fact, show that North Fork
25 water is getting to the Arikaree gage, I think the

1 Engineering Committee and the Administration should
2 consider those matters very carefully.

3 Q Should consider or adopt them?

4 A Well, if it's a complete proposal, I
5 believe that the State of Kansas would support those.
6 It's probably going to require additional study to
7 consider the factors that, I think, Mr. Slattery's
8 report, in particular, considers and may require
9 additional gaging to be done because it is a complex
10 system.

11 It's fairly unique; it's the most
12 westerly, and most of the canals in the system, you
13 know, flow to live streams. In this case, you know,
14 we are discharging to a stream, as you suggest, is
15 dry much of the time.

16 Q Typically, what is an annual diversion
17 water supply for the Arikaree?

18 A I don't have that number in front of me
19 here.

20 Q You don't have a ballpark idea then at
21 all?

22 A I wouldn't want to speculate. It's in
23 the records.

24 Q All right. I just want to take a piece
25 with regard to the groundwater mound area.

1 There has been a lot of talk about the
2 magnitude of canal losses from Platte River
3 diversions.

4 Isn't it true that in many cases, the
5 canal losses from Platte River diversions approach
6 and, in some cases, even exceed the virgin water
7 supply for the Republican River Basin?

8 A My understanding is they are on the
9 order of 600,000 acre-feet, the canal leakage; that's
10 in the range of what the virgin water supply to the
11 Republican is in many years, yes.

12 Q And then switching to the accounting
13 point exercise that you performed. I just want to be
14 clear.

15 The allocations, as prescribed by the
16 Compact itself, don't change in this process, do
17 they; that is, the relative proportions to each
18 State?

19 A I think they do. I think that is the
20 point of the exercise.

21 Q The volume changes, but does the -- can
22 the proportions under the Compact change?

23 A The total virgin water supply would not
24 change with this accounting change, the total virgin
25 water supply of the basin. It's a thousand acre-feet

1 of consumptive use, whether it's in the mainstem or
2 the South Fork. But the respective allocations
3 between the States does change with -- between the
4 current procedures and Nebraska's proposal.

5 Q The volume changes, but in any event,
6 Nebraska would still need to stay within its
7 allocation, correct?

8 A That's correct.

9 MR. BLANKENAU: We have nothing further.

10 ARBITRATOR DREHER: Mr. Draper, I would
11 like to try to finish with this witness before we
12 break for lunch, but if you need a short break, we
13 will certainly give you one.

14 MR. DRAPER: Give me a moment.

15 ARBITRATOR DREHER: Okay.

16 (Pause in the proceedings.)

17 MR. DRAPER: We have no questions on
18 redirect.

19 ARBITRATOR DREHER: All right.

20 MR. BLANKENAU: Mr. Dreher, if we could
21 just offer our exhibits.

22 ARBITRATOR DREHER: That is just what I
23 was going to suggest.

24 MR. BLANKENAU: Perfect. We would offer
25 Exhibit 36.

1 MR. DRAPER: It might be appropriate for
2 us to start with the exhibits that we offered on
3 direct, and I'm prepared to do that, if you would
4 like.

5 ARBITRATOR DREHER: All right.

6 MR. DRAPER: There is, first of all, the
7 Kansas Exhibit 28, which is the expert report by
8 Mr. Barfield, Mr. Larson and Mr. Book. Second, there
9 is the responsive report by Mr. Barfield and Mr. Ross
10 concerning the Haigler Canal and groundwater
11 accounting point issues. And finally, the flip chart
12 sheet, which is being marked as Kansas Exhibit No.
13 70.

14 We move their admission.

15 ARBITRATOR DREHER: Any objection?

16 MR. BLANKENAU: No objection.

17 MR. AMPE: None.

18 ARBITRATOR DREHER: They are admitted.

19 Nebraska?

20 (WHEREUPON, Kansas Exhibits 28, 29 and
21 70 were admitted into evidence.)

22 MR. BLANKENAU: We would offer Exhibit
23 36, which I think we may have previously -- initially
24 mentioned as 35. It's the 2007 memo from Kansas.

25 ARBITRATOR DREHER: Any objection?

1 MR. DRAPER: No.

2 (WHEREUPON, Nebraska Exhibit 36 was
3 admitted into evidence.)

4 MR. BLANKENAU: I would also, just to
5 make sure the record is clear, yesterday when Dr.
6 Ahlfeld drew some documents we identified his drawing
7 as Exhibit 32. I just wanted to make sure that that
8 was clear on the record. And it does include two
9 pages, correct. I believe they were received
10 yesterday.

11 ARBITRATOR DREHER: They were. I have a
12 note in the record to that effect, so . . .

13 MR. BLANKENAU: Thank you. That's all
14 we have.

15 ARBITRATOR DREHER: This is Exhibit 36?

16 MR. BLANKENAU: 36, correct.

17 ARBITRATOR DREHER: And what do you want
18 to do for a lunch break?

19 MR. BLANKENAU: We are fine with an
20 hour.

21 MR. DRAPER: An hour is fine with us.

22 MR. AMPE: That's fine.

23 ARBITRATOR DREHER: All right. We can
24 break for lunch and start again five minutes after
25 1:00.

1 (Lunch break was taken from 12:05 to
2 1:07.)

3 ARBITRATOR DREHER: Mr. Ampe, please
4 proceed.

5 MR. AMPE: Colorado would call James
6 Slattery.

7 JAMES SLATTERY,
8 having been first duly sworn, was examined and
9 testified as follows:

10 MR. AMPE: Mr. Arbitrator, one minor
11 point. Mr. Slattery has a few pins in his back so he
12 may wish to stand up and answer some questions, if
13 that's all right with you.

14 ARBITRATOR DREHER: That will be fine
15 with me.

16 DIRECT EXAMINATION

17 BY MR. AMPE:

18 Q Good afternoon, Mr. Slattery.

19 In front of you is an exhibit marked
20 Colorado 10, which is your curriculum vitae?

21 A Yes.

22 Q Since you are the first new witness we
23 have had in a while, can you tell us a little bit
24 about yourself, understanding we have all seen your
25 CV already.

1 A I suppose my -- some of my most relevant
2 experience actually was before I went to college, in
3 terms of irrigation.

4 I grew up on a small farm between
5 Loveland and Fort Collins. I grew up setting
6 irrigation water, both on my family farm and for the
7 neighbors.

8 I graduated with my bachelor's in civil
9 engineering in 1984 from Colorado State University.
10 I got my master's from Colorado State University in
11 1986, with a specialty in groundwater modeling. I
12 went to work for Boyle Engineering in 1982. I worked
13 for Boyle Engineering from 1986 through 1995.

14 The first project I worked on was the
15 Kansas v. Colorado case on the Arkansas River. After
16 about five years, I testified on that case.

17 Mr. Draper had the opportunity to
18 cross-examine me and torture me several times. I
19 think I'm only missing three toenails over that.

20 In 1995, I went to work for a firm
21 called Helton & Williamsen. I worked there for 12
22 years. In 2007, I started my own firm, just myself.

23 Generally, I have worked in groundwater
24 modeling, surface water models, water resources. I
25 have probably worked in about 15 groundwater models

1 in Colorado, Central Valley of California, Florida
2 and in North Carolina. I worked in surface water
3 models.

4 In 2001, I started working for the State
5 of Colorado in the Republican River litigation in the
6 Kansas v. Colorado v. Nebraska case. I was a member
7 of the Groundwater Committee on behalf of the State
8 of Colorado. I represented the State of Colorado in
9 that. I still represent the State of Colorado on
10 different issues in that case, as I represent them
11 today.

12 In 2005, I started working for the
13 Republican River Water Conservation District. That
14 was formed in -- to really assist the State of
15 Colorado to come into Compact compliance. And we
16 have looked at different issues of different ways of
17 assisting the State of Colorado to get into Compact
18 compliance.

19 Q Thank you, Mr. Slattery.

20 I believe you have your report with you,
21 which is Colorado Exhibit 11.

22 A Yes.

23 Q Again, keeping in mind that the
24 Arbitrator has, in fact, read your report, could you
25 sort of hit the highlights and the most important

1 parts of your report.

2 A I prepared this report in response to
3 the report that Mr. Williams testified to yesterday.
4 I think I will just respond in the order that
5 Mr. Williams testified.

6 First was the groundwater modeling
7 accounting points.

8 First of all, on the report -- on this
9 report there may be some of the issues we have heard
10 earlier. This is all about -- it's -- it's all about
11 moving the pie around, if you will. We are not
12 talking about making it bigger or smaller in
13 Mr. Williams' report or my rebuttal to the report.
14 It's all about let's talk about making -- who gets a
15 bigger piece of the pie.

16 The net result of the Nebraska proposal
17 is -- from Colorado's perspective, is they want to
18 make Nebraska's piece of the pie bigger and it comes
19 out of Colorado's portion of the pie. We get it
20 smaller, as you probably gathered, out of it.

21 Let's talk about the groundwater
22 modeling accounting points.

23 To me, the groundwater modeling
24 accounting point comes down to the issue of the --
25 it's very clear to me in the Compact that the Compact

1 allocates water on the subbasin accounting --
2 subbasin basis. The Compact does not say what a
3 subbasin is.

4 I believe a subbasin is everything
5 upstream of the confluence with the mainstem on that.

6 So what I did is I went back to the
7 Republican River Compact Administration Reports, as I
8 reference in my report, to see if they gave some
9 guidance to that because that is where they did the
10 original first Compact accounting.

11 You can go through those reports. Back
12 in 1960, was the first Compact Administration
13 accounting reports. They talk about the -- they
14 immediately assigned to the Engineering Committee to
15 come up with Compact accounting procedures. And it's
16 clear, from going through the first two or three
17 years of those reports, that the Engineering
18 Committee understood that the allocation was clearly
19 upstream of the confluence between the mainstem of
20 the subbasin.

21 They understood that the stream gages
22 were not at the confluence of the mainstem, but they
23 also understood that, from a practical standpoint,
24 you can't put the stream gages right at the
25 confluence of the mainstem; just the hydraulics.

1 If you look, for example, on the South
2 Fork, the gage is approximately 3 miles upstream from
3 where the confluence is. It's located at a bridge.

4 If you go to the -- my report, if you
5 would, go to page 6 of my report. I don't think
6 there is any inconsistency in the Final Settlement
7 Stipulation about where they named the gage and how
8 the Final Settlement Stipulation accounts for that
9 stretch between the gage and the confluence with the
10 mainstem. I won't call out the specific sections,
11 but you can read them.

12 The Final Settlement Stipulation clearly
13 states that we are going to account for the
14 groundwater depletions between the gage and the
15 confluence of the mainstem in the subbasin
16 allocation.

17 As it says right there at the bottom of
18 page 6, it's in subsection III.A.2 of the RRCA
19 accounting procedures; there was no confusion in
20 there.

21 The drafters of the Final Settlement
22 Stipulation understood that the gages weren't exactly
23 at the mouth. They also understood that there was a
24 some consumptive use that occurred in that stretch
25 and they needed to account for that.

1 So that's just the overview on the
2 accounting points.

3 On the Haigler Canal issues, I want to
4 just talk a little bit about the Republican River
5 Basin in Colorado.

6 I think it's important when you talk
7 about the Haigler Canal, you understand that the
8 North Fork Basin and the Arikaree River Basin are
9 very different river basins. The North Fork River
10 Basin is a baseflow-dominated river basin. It drains
11 -- it's a -- it's fed by the area what we call the
12 sandhills of Colorado -- I'm sorry, I thought I heard
13 something.

14 It's fed by what we call the sandhills
15 of Colorado. If you have ever been up -- it's in the
16 area of Wray and up towards the north, toward
17 Holyoke. If you have ever been up in that area, it's
18 truly sand and a lot of it can't even be farmed, it's
19 so sandy. If you go up, there is not even stream
20 channel. If it rains, a lot of water soaks in.

21 If you look at the streamflows in the
22 Arikaree and streamflow gages, you can see that there
23 is a pretty constant flow in the Arikaree -- I'm
24 sorry, in the North Fork of 30 to 40 cfs. It's like
25 a baseflow-dominated stream. And it's mainly a sandy

1 channel.

2 I should mention as part of the -- my
3 responsibility when we divided up the tasks in the
4 groundwater modeling thing to calibrate the
5 groundwater model, we went through on each of the
6 streamflow gages in the basin; we did a baseflow
7 separation. We estimated how much streamflow at each
8 -- at each of the gages, how much of the streamflow
9 was rainfall runoff and how much was baseflow.

10 And that was my responsibility. Again,
11 we worked with the other committee members, but that
12 was one of the responsibilities I took the lead on
13 and we worked with the other committee members. And
14 that's what was used as one of the calibration
15 targets in the model. That's the reason I'm very
16 familiar with the characteristics of the basin.

17 The Arikaree is just a flip side. When
18 you look at the rainfall-runoff characteristics and
19 you study the streamflow, it's -- the soil
20 characteristics of that basin is -- there is very
21 little sand; it's more of a clay-dominated basin.

22 And even back in the '50s and the '60s
23 before there was any well-pumping, there was often
24 days when you look at the Arikaree gage, there was no
25 streamflow there. It was a dry streambed. Because

1 what would happen, it was a typical, if you will,
2 eastern Colorado stream channel. And when it would
3 rain, you would get very heavy rainstorms and you
4 would get runoff. Then you would still see some
5 water coming back for days, and sometimes weeks
6 afterwards, because it would collect in the alluvial
7 channels and drain out.

8 So when you take water from the North
9 Fork and you divert it over into the Arikaree Basin,
10 if you are diverting that water over, oftentimes when
11 it was dry and there is very little runoff, you are
12 taking it over to a stream basin where there is very
13 little or no runoff and it's into a dry streambed.

14 So you can't expect, when you propose
15 that I'm going to take water from the North Fork and
16 theoretically run it back to the Arikaree, that's
17 going to hit the Arikaree, hit a live stream and run
18 back to the Republican River, that is not
19 hydraulically what happens out there. I just want to
20 make that clear.

21 Okay. Now, if I could turn to the
22 report.

23 The Nebraska proposal on the Haigler
24 Canal has, really, three components that they are
25 trying to talk about. As I summarized in my report,

1 Colorado disagrees with all three components.

2 If I could ask you to turn to Table 1 of
3 my report.

4 On the first proposal, what Nebraska is
5 proposing to do is redefine how they get charged for
6 diversions on the Haigler channel. The three States
7 signed the Final Settlement Stipulation and for a
8 non-Federal reservoir, they all agreed that you would
9 get charged 60 percent of the diversions. That's
10 diversions -- not net diversions, but the diversions.

11 Q Mr. Slattery, you said "non-Federal
12 reservoir"?

13 A I did say that.

14 Q Yes.

15 A The non-Federal canals.

16 But for the non-Federal canals, the
17 three States agreed that 60 percent of the diversions
18 -- 60 percent of the diversions -- that means
19 60 percent of what you diverted is consumed and
20 40 percent is returned.

21 So if you follow through what Nebraska
22 wants to do in their first step of their proposal is
23 they want to take what was diverted, they want to
24 subtract off what came through the wasteway and then
25 they want to take that times 60 percent.

1 The net effect of that, when you follow
2 through the math, is in Row 1 when I show they divert
3 5170. And these numbers are directly from the
4 Nebraska analysis, their Exhibit No. 36, their
5 measured canal wasteway flume at the Arikaree is
6 1117.

7 As we get into that, there is a quite of
8 a question in my mind whether that 1117 is actually
9 water that came from the North Fork versus water that
10 was rainfall runoff.

11 But going forward from here, you can get
12 to Row No. 3 where you get 4553, which is just Row 1
13 minus Row 2. So you get a total of 4053.

14 So the current methodology that Nebraska
15 would look -- that is employed in approved accounting
16 methodology is take Row 1 times .6, you get 3102.

17 What Nebraska is proposing to do is say,
18 No, I want to change the methodology, I want to take
19 Row 3, which is 4053 times .6. In effect, they want
20 to reduce the consumptive use that they are charged
21 beneath the Compact by 670 acre-feet.

22 If you follow through the math, the net
23 effect is, instead of being charged a 60 percent
24 conservative use which they were agreed to by making
25 this calculation, they only get charged the

1 47 percent consumptive use.

2 If I could ask you to turn to Figure 1,
3 which is the last Figure in my report.

4 What I have tried to do here is
5 illustrate the problem that Colorado has with this
6 proposal.

7 I want to back up for just one second.
8 On the Arikaree subbasin, Colorado gets 78 percent
9 allocation and Colorado gets zero percent allocation
10 on the mainstem -- zero percent.

11 The net effect of what Kansas is -- I'm
12 sorry -- Nebraska is proposing, they want to make
13 adjustment to the Arikaree gage, but the net effect
14 is that they take Colorado's allocation, which we are
15 currently allocated on the Arikaree gage, and move
16 that over to the mainstem and, in effect, reduce
17 Colorado's allocation on the Arikaree and move it
18 over and increase Nebraska's allocation on the
19 mainstem.

20 What is objectionable to Colorado is
21 they want to move water that never shows up at the
22 Arikaree gage and call it mainstem water.

23 I would like to illustrate that in this
24 Figure 1 here.

25 The first thing that they want to do,

1 Nebraska would like to do, is to say that there is
2 water that is return flow. I'm using "return flow"
3 as saying that there is water that is applied to the
4 field, it depercs or surface water runoff and that
5 surface water runoff somehow depercs into the
6 groundwater system, finds itself into the Arikaree
7 River, flows down the Arikaree River to the Arikaree
8 gage and they need to adjust the Arikaree gage for
9 this water that theoretically shows up there.

10 From my analysis of the day that was
11 provided, that water does not show up there.

12 Nebraska did not do analysis to show whether that
13 water showed up or did not show up.

14 The only thing that they did was the
15 geographic analysis that said roughly 50 percent of
16 the fields were located in the Arikaree subbasin.

17 So what I did in this analysis is I took
18 what their analysis was of the return flows that were
19 going to occur in 2002. And I looked at what they
20 said was their return flows.

21 And I said, Well, look, their returns,
22 they didn't do analysis, but they said their deperc
23 was occurring year in and year out and they are
24 saying that this water was coming back to the
25 Arikaree. They did not do any analysis of the lag

1 return flow but they said, Look, if this water was
2 coming back, it was probably coming back at something
3 of a steady rate, because the majority of it would
4 have to be coming back as groundwater.

5 If -- if their hypothesis was right, it
6 was coming back to the Arikaree River, because I have
7 been out there numerous times in this area and it's
8 extremely sandy.

9 And in addition, I have not done a
10 detailed analysis; but when you are out there, the
11 majority of this land has been converted over to
12 center pivot sprinklers. So they run the water from
13 their surface water diversions into small little
14 surface diversions and pump the water into sprinklers
15 and apply the water.

16 And my experience is there is just very
17 little surface water runoff from a center pivot
18 sprinkler.

19 That is what I'm showing on that dark
20 blue band, is I took their deperc that was occurring
21 in 2002 and I said, Look, that must be occurring at a
22 relatively constant rate.

23 The next thing I did is, right or
24 wrong --

25 Q Let me interrupt you for one moment.

1 That blue band, is that what
2 Mr. Williams expressed his concern about when he
3 testified yesterday?

4 A Yes.

5 Q Thank you.

6 A Then the next thing I did is, I took
7 their gaged flows that were coming out of the
8 wasteway -- their gage flows, whether they were
9 actually gage flows that were coming from the North
10 Fork -- I just added those directly on, so the total
11 is -- it's a stacked blue bar. That is what they are
12 claiming on a daily basis in 2002 is flowing through
13 the Arikaree gage, in their analysis.

14 Then what I showed on the red line is
15 the water that actually was recorded on the gage --
16 actually recorded on the gage.

17 And as you can see, almost every single
18 day the flow that Nebraska is claiming is showing up
19 at the Arikaree gage is never showing up at the
20 Arikaree gage.

21 ARBITRATOR DREHER: Okay.

22 A So I did that on a daily basis. I
23 also -- as I point out in my report, this gage does
24 more than just record the flows that may be coming
25 from the Haigler Canal.

1 There is a drainage basin up there that
2 is 1700 square miles that at one time produced quite
3 a bit of rainfall runoff from the basin.

4 Could I turn your attention to Table 2
5 of my report, please.

6 Table 2 of my report is similar to the
7 report that was prepared by Mr. Barfield. I'm just
8 going to walk you through it.

9 Q (BY MR. AMPE) Very briefly, please.
10 Time. Walk him through briefly.

11 A The net result is when you walk through
12 this, you start with Arikaree stream flow gage in
13 Column 2. You talk with -- you go to the Haigler
14 Canal stateline flow, which is shown in Column 3.
15 You talk about the adjustment that they want to do
16 for the return flow, which is in Column 4. You talk
17 about their adjustment, what they want to do for the
18 spill back, which is in Column 5. Column 6 is the
19 total from proposed adjustment to the Arikaree gage.

20 And all I did was subtract Column 6 from
21 the total which is in Column 2, and you can show that
22 it comes out negative. And this is on an annual
23 basis.

24 It doesn't make any sense it would come
25 out -- first of all, you should do it on a daily

1 basis. If you do it on annual basis, it comes out
2 negative. It clearly shows that the flow that they
3 are saying that is going to come through the Arikaree
4 gage does not come through the Arikaree gage.

5 And my one last final comment which I
6 brought on is, when you are looking at the water that
7 comes through the Arikaree wasteway gage, at least a
8 portion of it if not a large portion of it, is water
9 that might not have come from the North Fork. You
10 can't tell from the information. At least a portion
11 of it probably came from rainfall runoff events,
12 storm flow that got into the -- into the canal,
13 because that is usually what wasteways are for, is to
14 waste water back to a drainage basin because you had
15 a very large rainfall event and you want to waste
16 water back to protect your canal. You can't tell
17 that from the data that was made available.

18 Q Thank you, Mr. Slattery.

19 I'm going to hand you what is Colorado's
20 Exhibit 12, which you identified in your report.

21 Mr. Slattery, from the Bates numbering,
22 can you tell where this document came from?

23 A No, I cannot.

24 Q From the -- were you involved in the
25 prior litigation over the Compact, including document

1 collection?

2 A Yes, I was.

3 Q So looking at the Bates number, does it
4 look like it came from Nebraska as part of that
5 litigation?

6 A Yes.

7 Q And there are some annotations on there,
8 some handwritten marks. Are those yours?

9 A No, they are not.

10 Q Do you have any idea whose they were?

11 A No.

12 Q Did they play any part in your analysis?

13 A No, they did not.

14 MR. AMPE: That's all I have.

15 ARBITRATOR DREHER: I guess the only
16 question I have got is your treatment of this return
17 flow as being uniform and it's not.

18 I guess to start with, this is your
19 estimate of return flow from irrigating land in the
20 Arikaree; is that correct?

21 THE WITNESS: The -- it's -- I took Mr.
22 Williams' estimate of the return flows of irrigating
23 lands in the Arikaree. They did not provide what the
24 timing was on those return flows. And so, to at
25 least come up with an illustration, I said, Since it

1 was all groundwater, it probably would come back
2 something on a flat rate.

3 ARBITRATOR DREHER: And then to that,
4 you added the Nebraska estimate of Haigler Canal
5 return flow? No. You added the gaged Haigler Canal
6 wasteway; is that correct?

7 THE WITNESS: Yes, sir.

8 ARBITRATOR DREHER: So, for example, if
9 I look at this -- I'm looking at Figure 1. This
10 spike that occurs, oh, sometime midway between
11 October 1, 2002 and November 1, 2002, that's --
12 that's really the sum of your estimate of Nebraska's
13 estimate of return flows, plus the gage return flows?

14 THE WITNESS: Yes, sir.

15 ARBITRATOR DREHER: And what is the -- I
16 take it, then, that the difference between that sum
17 of the return flows, your estimate of the temporal
18 distribution of their estimate of the return flows,
19 plus the gage wasteway, I take it the reason that
20 it's substantially larger than the Arikaree gage
21 flow is losses in the Arikaree channel?

22 THE WITNESS: Well, first of all, it's
23 losses in the Arikaree channel.

24 And secondly, it's -- as I lay out in my
25 report, the groundwater return flow, if you look at

1 the direction the groundwater returns in this area
2 from the groundwater model, it's actually north.
3 It's not toward the Arikaree River. It's north
4 towards the mainstem, which indicates that the
5 groundwater returns in this area are actually north
6 towards the mainstem, which is exactly how the
7 groundwater accounting is now.

8 So just because the surface topography
9 slopes towards the Arikaree doesn't mean that the
10 groundwater direction is towards the Arikaree.

11 It looks to us like the groundwater
12 direction is towards the mainstem, which is exactly
13 the way the groundwater accounting -- which is
14 exactly the way the accounting is taking account for
15 that and it's properly accounted for and no change
16 should be made for that.

17 ARBITRATOR DREHER: But I don't
18 understand how that relates to this difference
19 between the sum of the Nebraska estimate of Haigler
20 Canal return flow, plus flows at the Haigler Canal
21 wasteway and the Arikaree gage flow. I don't
22 understand how that would affect that.

23 THE WITNESS: I can try explaining it a
24 different way. Would that be okay?

25 ARBITRATOR DREHER: Sure.

1 THE DEPONENT: Said another way, I don't
2 think any of the return flows from the Haigler Canal
3 in the Arikaree drainage Basin even make it to the
4 Arikaree River.

5 As you can see from the gage flows, if
6 any of those return flows ever got there, you would
7 see it in the gage flow, and you don't see it in the
8 gage flows. There are a significant number of days
9 where there are zeros, okay.

10 So the only question now we have is,
11 does any of the wasteway flows ever make it down to
12 the Arikaree gage? And I don't know whether any of
13 it gets down or not.

14 I think there is significant losses in
15 the Arikaree River, because it has a dry streambed on
16 it, and just because you see a spike when they have
17 wasteway, you can't tell whether that spike is
18 because they put water on the wasteway or there was a
19 rainfall-runoff event in the Arikaree that actually
20 caused a little bit of the water to come down the
21 Arikaree. You need some more gage information before
22 you can make that determination.

23 And secondly, the water that came out of
24 the wasteway, you can't tell whether that is a result
25 of a rainfall-runoff event that caused inflow into

1 the Haigler Canal, which is not North Fork water, but
2 rainfall runoff that came in downstream of the
3 Haigler flow and should be counted as Arikaree flow
4 also. You just cannot tell from the information that
5 is presented here.

6 ARBITRATOR DREHER: Okay. Thank you.

7 Mr. Draper.

8 MR. DRAPER: I have no questions.

9 ARBITRATOR DREHER: Mr. Blankenau.

10 CROSS-EXAMINATION

11 BY MR. BLANKENAU:

12 Q Good afternoon, Mr. Slattery. Just a
13 couple of quick items, really.

14 In 2008, didn't Colorado approve a
15 similar accounting change for the Riverside Canal in
16 Nebraska?

17 A Mr. Blankenau, I don't know the answer
18 to that.

19 Q Okay. How would one determine the
20 direction of groundwater flowing in this area?

21 A The way I determine is I looked at the
22 groundwater model.

23 Q And what -- can you tell me what the
24 approximate distance between the Haigler Canal and
25 the mainstem of the Republican would be, or the North

1 Fork?

2 A From Mr. Williams' report on Figure 1,
3 page 2, it looks to me like it varies. Depends where
4 you are at. It's anywhere from 1 mile to 3 miles
5 typical. It varies.

6 Q Okay. What is the cell size of the
7 groundwater model?

8 A I believe it's a half-mile-by-half-mile.

9 Q Are you sure about that?

10 A I get that mixed up with the Rio Grande
11 Basin. I believe it is a mile by a mile. I
12 apologize for that mistake.

13 Q That is quite all right.

14 Given the average distance between the
15 Haigler Canal and the mainstem and the cell size, how
16 reliable is the model for determining groundwater
17 flow?

18 A It's not going to be an exact
19 replication, but it is an indication and it is used
20 to estimate the stream gains and losses in this
21 stretch.

22 Q But you took no actual measurements or
23 did any independent study to determine that flow?

24 A That's correct.

25 Q You mentioned that there was a small

1 basin above the wasteway gage. How large is that?

2 A I'm not quite clear what you are asking
3 me.

4 Q I'm sorry.

5 You indicated, I thought, in your direct
6 testimony that there was a small area that drained
7 above the wasteway gage toward it.

8 Do you recall that?

9 A Well, I don't think I said of the
10 wasteway gage. I think I said upstream of the
11 Haigler Canal.

12 Q Okay.

13 A And I don't recall the number of square
14 miles that I measured.

15 Q I thought you said 1700. That could
16 have just been me.

17 A No. There is 1700 square miles upstream
18 of the Arikaree gage.

19 Q Okay, but not upgradient of the wasteway
20 gage?

21 A That is correct.

22 Q You also said that whatever basin you
23 were referring to used to produce a good deal of
24 runoff. Does that mean it no longer does?

25 A Unfortunately.

1 Q What happened to that water? Does it no
2 longer provide runoff?

3 A Well, I suppose -- we don't know for
4 sure on it, we -- you can look at the streamflow gage
5 records, and it's clear that the -- the surface water
6 runoff has declined from precip events. You no
7 longer see large runoff events like you used to and
8 there has been -- different folks have different
9 estimates, but it's certainly somewhat attributable
10 to man's tillage practices and conservation measures.

11 Q With regard to the water that shows up
12 at the wasteway gage, wouldn't that be fairly
13 traceable to Haigler Canal diversions -- that is, you
14 know when Haigler Canal is taking water.

15 Couldn't you then fairly easily
16 determine whether that water showing up on the
17 wasteway gage is reasonably attributable to that
18 diversion?

19 A No, not until you had measured all of
20 the water at each of the turnouts.

21 Q Would you agree that at least a portion
22 of the Haigler Canal spill-back return shows up at
23 the Arikaree gage, from time to time?

24 A Would you say that one more time,
25 please.

1 Q Sure, sure.

2 Would you agree that at least a portion
3 of the Haigler Canal spill-back return shows up at
4 the Arikaree gage, from time to time?

5 A I think that's possible.

6 Q As a farmer, how much rain falls in a
7 ditch, in your experience?

8 A You mean on the surface of the ditch?

9 Q Yes.

10 A Depends how much it's raining.

11 Q Good answer, good answer.

12 But you would agree that that is not
13 typically dealt with elsewhere in this Compact --
14 direct precipitation into a canal?

15 A Precip on the surface itself?

16 Q Right.

17 A That is correct.

18 Q And are ditches usually elevated or
19 bermed to prevent water from flowing into it?

20 A No.

21 Q You had offered --

22 MR. BLANKENAU: I'm sorry, I don't have
23 the exhibit number., Mr. Ampe.

24 MR. AMPE: 12.

25 Q (BY MR. BLANKENAU) -- Colorado's 12.

1 Do you have that with you, Mr. Slattery?

2 MR. AMPE: Yes.

3 A Yes.

4 Q (BY MR. BLANKENAU) Could you look at
5 Exhibit C in -- it's toward the end of the document.
6 Do you have that?

7 A Yes.

8 Q Do you see where it says, "Arikaree" in
9 the left-hand margin?

10 A Yes.

11 Q Could you walk me across that line of
12 figures, first one being "Water Supply" 1900 --
13 excuse me, 19,610. I'm just trying to figure out the
14 significance of that -- of these tables.

15 A Well, Exhibit C is labeled "Comparison
16 of Stream Flow Records, Republican River." The first
17 column is "Gage Location or Reach," says Arikaree
18 starts out 19,610, minus present use of 2210,
19 resulting in an average flow of 17,400.

20 Then the next column is Bureau of
21 Reclamation Reported Average Flow. It has Bureau of
22 Ag. Economics Reported Average Flow 21,000; Corps of
23 Engineers Reported Average Flow, 22,500; and Soil
24 Conservation Service Reported Average Flow, 23,000.

25 Q What does all of that mean?

1 A I would interpret it to mean that they
2 were estimating the flow in the Arikaree, at least at
3 the time the Compact was signed, was somewhere in the
4 range of 17,000 to 23,000, from the different
5 estimates.

6 MR. BLANKENAU: Thank you, Mr. Slattery.

7 ARBITRATOR DREHER: Mr. Ampe.

8 REDIRECT EXAMINATION

9 BY MR. AMPE:

10 Q Just a couple questions.

11 Mr. Slattery, Mr. Blankenau asked you if
12 you personally investigated the direction of flow of
13 groundwater, and you did not?

14 A That is correct.

15 Q Do you have any evidence that Nebraska
16 did that, to sort of determine where these return
17 flows were going?

18 A No. I believe you asked Mr. Williams
19 that question and he said he had not done that, also.

20 Q And regarding the possibility that some
21 water from this waste canal that passes the wasteway
22 gage would show up at the Arikaree River, has
23 Nebraska provided any sort of evidence or
24 calculations that would show what portion of the
25 Arikaree gage actually comes from the Haigler?

1 A No, they have not.

2 MR. AMPE: Nothing further.

3 ARBITRATOR DREHER: Mr. Slattery, one
4 last question.

5 I thought I heard Mr. Williams testify
6 yesterday that the Haigler Canal was bermed or
7 raised.

8 Did you hear that, as well, or --

9 THE WITNESS: Yes, I did, but that
10 doesn't make any sense to me.

11 I have been out on the Haigler Canal and
12 probably hundreds of miles of ditches along it -- of
13 different ditches in Colorado. And you can see that
14 there -- occasionally, you will see a berm along a
15 ditch, but all that does is concentrate the return
16 flows into a concentrated -- I mean, the runoff to a
17 concentrated point there.

18 There is no way that you can keep 6
19 miles or 7 miles of this ditch of runoff surface --
20 surface sheet flow out of a ditch.

21 Usually, what will happen is you will
22 either berm for a short distance to keep your ditch
23 base from eroding to -- eroding, or a short-term
24 area, but usually what you do is you either do a
25 short bank -- short bank to concentrate the flow into

1 a ditch.

2 But to say that you are going to have
3 6 miles of berm to keep all runoff out of the ditch
4 is completely impractical and I have never seen that
5 in any ditch. And my inspection of being along
6 limited stretches of the Pioneer -- I'm sorry, the
7 Haigler Canal, that is not the case there.

8 ARBITRATOR DREHER: Do you wish to
9 follow up on that?

10 MR. BLANKENAU: Maybe just a quick
11 thought.

12 RECROSS-EXAMINATION

13 BY MR. BLANKENAU:

14 Q I had understood you to testify that the
15 soils were very sandy.

16 A Yes.

17 Q And that there typically is not much
18 runoff?

19 A I don't think there is much runoff from
20 the surface water irrigation when you apply it with a
21 center pivot, but there is going to be some runoff
22 when you get a rainfall event.

23 MR. BLANKENAU: Thank you for that
24 clarification.

25 ARBITRATOR DREHER: Thank you.

1 MR. WILMOTH: Just for the record, we
2 have about ten minutes, by our calculation, for the
3 remainder of the Kansas-Colorado Responsive --

4 MR. AMPE: No. We broke that up into
5 two separate portions. As you recall, the first day
6 we stated that you could not slop over from one to
7 another. So by my calculation, Mr. Slattery used
8 approximately somewhere between 20 and 25 minutes.

9 MR. WILMOTH: Right, but your time
10 doesn't count with their time.

11 MR. AMPE: I don't think -- if you look
12 at the outline, it clearly breaks up the hours and
13 the hours --

14 MR. DRAPER: I would point out also, I
15 think we are moving along ahead of schedule here, so
16 there is no real concern.

17 ARBITRATOR DREHER: And you can't count
18 my time.

19 MR. WILMOTH: I understand that. We are
20 already through three hours, are we not, or two hours
21 of responsive time?

22 MR. AMPE: But it's six hours total.

23 MR. WILMOTH: But four of that, I
24 thought, was dedicated to the cross-examination
25 party.

1 MR. AMPE: Was it four?

2 MR. BRIGGS: 1-4-1.

3 MR. WILMOTH: It was 1-4-1. That was
4 the understanding I thought we had. However you
5 split it up is up to you.

6 MR. DRAPER: We made some estimates, but
7 I think we agreed that we would be flexible and look
8 at how things developed and take measures if we found
9 that we were getting short of time.

10 ARBITRATOR DREHER: My sense is nobody
11 feels that they are being shorted time. It's a
12 matter of whether you are taking too much time. Is
13 that your concern, Mr. Wilmoth?

14 MR. WILMOTH: The issue that we
15 discussed on the first day was to make sure no State
16 was penalized for using less than its total
17 allocation. So going on, because we happen to have
18 more time, would seem contrary to me.

19 I don't want to make an artificial case
20 out of it, but I do want to clarify that at least
21 Colorado doesn't think it has another two hours.

22 MR. AMPE: No, we will not be using two
23 hours for Mr. Schreuder.

24 However, the way it reads, it's split
25 evenly between Colorado and Kansas. And to the

1 extent that Nebraska did not object to Kansas' over
2 use of their time, they should not, in fact, object
3 to Colorado's.

4 MR. WILMOTH: We obviously disagree.

5 ARBITRATOR DREHER: Well, at this point
6 let's proceed so we don't lose any more time.

7 MR. AMPE: We would like less than five
8 minutes to set up a laptop and a projector.

9 ARBITRATOR DREHER: That will be fine.

10 (Pause in the proceedings.)

11 ARBITRATOR DREHER: Before you begin,
12 Mr. Ampe, I need to swear in the witness.

13 Will you give me the correct
14 pronunciation.

15 THE WITNESS: I say "Schreuder."

16 ARBITRATOR DREHER: Schreuder, all
17 right.

18 MR. AMPE: And also I forgot to move the
19 three exhibits we discussed as part of Mr. Slattery's
20 testimony: Colorado Exhibits 10, 11 and 12.

21 MR. DRAPER: No objection.

22 MR. BLANKENAU: No objection.

23 ARBITRATOR DREHER: All right.

24 They are admitted.

25 (WHEREUPON, Colorado Exhibits 10, 11 and

1 12 were admitted into evidence.)

2 WILLEM SCHREUDER,

3 having been first duly sworn, was examined and

4 testified as follows:

5 DIRECT EXAMINATION

6 BY MR. AMPE:

7 Q Doctor, understanding that we have
8 already seen your curriculum vitae, can you just give
9 us a very brief summary of your qualifications,
10 especially as relevant to this proceeding.

11 A My academic background is a Ph.D. in
12 applied mathematics and a Ph.D. in computer science.
13 And I'm also an adjunct professor at the University
14 of Colorado Boulder in the computer science
15 department.

16 My professional career spans about 25
17 years of professional study in modeling, in general;
18 computer computational fluid dynamics, specifically;
19 and the bulk of that is in groundwater modeling, both
20 flow and transport modeling.

21 Q Could you briefly explain your first
22 Ph.D. in mathematics. What was your thesis?

23 A It was about air flow around directly
24 air-cooled power station and looking at numerical
25 simulation of that.

1 Q And your Ph.D. in computer science,
2 which is your more recent, could you give a little
3 background on that, thinking that is particularly
4 relevant here.

5 A Yes. What that was about is using
6 multiple computers to solve groundwater flow
7 problems. Particularly, what my dissertation dealt
8 with is expanding MODFLOW to have a number of
9 different computers work together on the same
10 problem.

11 Doing things in parallel is very easy.
12 Doing things efficiently in parallel is extremely
13 hard. And the idea is that not only do you try to
14 use five, six or eight or ten computers, but using
15 thousands of computers to work together on the same
16 problem. And, of course, the goal is to reach the
17 answer faster or to be able to solve a much larger
18 problem in the same amount of time.

19 Q Do you sometimes refer to this as your
20 "pest nest"?

21 A That is what my good friend Alan Wiley
22 calls it.

23 One of the big challenges in groundwater
24 modeling, of course, is that in estimating these
25 parameters, typically you have to do very large

1 number of simulations and it's typically what is
2 referred to, in computer science parlance, as an
3 embarrassing new parallel problem. You want to make
4 a very large number of model runs and then compare
5 the results to select the best one. And so
6 specifically using available clusters is very well
7 suited in that problem.

8 And so I wrote a version of the PETSc
9 program called BeoFLOW that is well suited to solving
10 this problem on the Linux clusters, consisting of
11 literally thousands of processors.

12 Q And you currently maintain and, for lack
13 of a better term, run the RRCA Groundwater Model for
14 the RRCA?

15 A That's correct.

16 Q And in your career, do you know how many
17 groundwater models you have reviewed?

18 A I have long ago lost track.

19 Q Several dozen?

20 A Probably in the hundreds.

21 Q Are you familiar with what I will call
22 the August 2008 proposal from Kansas, which has been
23 admitted -- sorry, from Nebraska which has been
24 admitted as Kansas 38?

25 A I don't remember the Kansas 38, but I'm

1 familiar with the August proposal.

2 Q Can you give me a brief summary of how
3 you understand that proposal.

4 A This proposal introduced a new concept,
5 which is to take 16 simulations off the model,
6 represent those as eight differences and simply
7 average those results to come up with the individual
8 State impacts.

9 ARBITRATOR DREHER: Mr. Ampe, what
10 exhibit did you say?

11 MR. AMPE: I believe that is Kansas 38.

12 MR. DRAPER: Yes, it's the August.

13 ARBITRATOR DREHER: Okay.

14 Q (BY MR. AMPE) And, of course, you are
15 familiar with the January 2009 proposal that is at
16 issue here?

17 A Correct.

18 Q Can you please summarize the difference
19 between the August '08 proposal and January '09
20 proposal.

21 A Yes. The January proposal uses the same
22 16 runs to again make them up into four sets of eight
23 pairs each; but what it does is -- instead of
24 assigning the equal weight to all eight pairs, what
25 it does is it assigns one-quarter weight to what we

1 have traditionally called a historical comparison
2 where you switch off one run.

3 It takes the predevelopment run and
4 switches on one pumping in one State and assigns that
5 equal one-quarter weight. And then the remaining, it
6 assigns a weight of one-twelfth each so those add up
7 to a weight of 1 total.

8 Q And do you consider the differences
9 between these proposals to be significant?

10 A Yes, they are.

11 Q Doctor, you were a part of the Modeling
12 Committee that we have discussed here before?

13 A Yes.

14 Q Do you recall who else was on that
15 committee?

16 A Yes. For Colorado, we basically had
17 three representatives: Myself, Mr. Slattery and
18 Dr. Knox, myself, being the modeler on that team and
19 Mr. Knox being more on the accounting side of things;
20 Mr. Slattery doing the recharge and other estimates.

21 Our counterparts for Kansas was the
22 modeler being Mr. Larson, Mr. Barfield on the
23 accounting, and Mr. Book on farm issues.

24 For Nebraska, it was a whole slew the
25 modelers. Mr. McDonald, Dan Morrissey, Chuck

1 Spalding and I think Lee Wilson probably would have
2 called himself a modeler, as well; as well as
3 probably about half a dozen other experts in various
4 other fields.

5 Q I won't ask you to list all of them, but
6 they are listed in Appendix A, which is the DVD to
7 the Final Special Master report?

8 A That's correct. It's on the opening
9 page of that DVD.

10 Q And when did the Modeling Committee
11 begin work?

12 A I believe our first meeting was in
13 Lincoln about May of 2002.

14 Q And by December 2002, what state was the
15 model in?

16 A At that time, we had constructed a model
17 that was, at least, giving us fairly decent results
18 -- I wouldn't call it fully calibrated; but it was
19 giving some appropriate results. And we also had run
20 an impact analysis for the period 1981 to 2000,
21 because the RRCA members were interested in exactly
22 what the impacts are that this model is producing.

23 Q And the Modeling Committee operated by
24 consensus?

25 A Yes.

1 Q In other words, everyone had to agree to
2 the final model?

3 A Yes. The goal was to build a model that
4 everybody would hate, but everybody can live with.

5 Q And what was the purpose of that model?

6 A The sole purpose of the model was to
7 quantify those things that we couldn't directly
8 measure, specifically the impacts of groundwater
9 wells on baseflow and the impacts of imported water
10 on baseflow.

11 Q And can you very briefly describe what
12 you consider to be proper modeling protocol.

13 A Well, in general, there are a number of
14 publications that describe that; but you conceive of
15 the model's important components by looking at
16 conceptual model, what all of the important
17 mechanisms represent that will make a difference in
18 those results.

19 Then you proceed to build a numerical
20 model and you exercise it and compare the predictions
21 of the model against observation. And you adjust the
22 parameters that are certainly unknown to match those
23 observations. Generally, we refer to that as
24 calibration.

25 Some of the protocols refer to a third

1 step, which is then application of the model where,
2 after the fact, you now say, I have built this model,
3 now I can exercise it to answer some questions.

4 However, in this particular case, we
5 followed what I thought was a much better approach
6 which is, as early as possible, to actually start
7 exercising the model and seeing what kind of results
8 it produces.

9 The whole purpose of the model is to
10 answer these questions and so the earlier in the
11 procedure that you can actually start exercising it
12 and seeing what the answers are that it is providing
13 and making sure that those answers make sense in
14 terms of how you understand how the system operates,
15 I thought was a good thing to do.

16 Q And in your opinion, is it proper to
17 simply apply a coefficient to a factor with no
18 relationship with the whole goal to reach a
19 conclusion you want?

20 A No, that would not be proper.

21 Q Now, moving back to the current Nebraska
22 proposal dated January '09, do you agree with that
23 proposal?

24 A No, I do not.

25 Q And can you just sort of hit the

1 highlights of why not and perhaps referring to the
2 expert report that I filed on your behalf in this
3 case, which is Colorado Exhibit 7.

4 A Yes.

5 Your Honor, on the first page or at least
6 the first section, there are seven bullet points that
7 are listed. And I will just go through there sort of
8 amplifying a little bit of what each of those
9 paragraphs say.

10 The first point is that Nebraska is
11 using 2003 as an example of how the modeling is not
12 behaving in an appropriate way.

13 That is not correct.

14 In the first place, 2003 is a fairly
15 extreme year; but, nevertheless, none of the behavior
16 that we observe in 2003 -- wasn't known to the
17 committee at the time that the model was put
18 together. If you want to ask me about it, I can walk
19 you through the specific figures and show you where
20 this kind of behavior occurred in the past.

21 But we looked in great detail at the
22 period prior to 2000 and this similar kind of
23 behavior did, in fact, occur and was well known to
24 many members.

25 Q Doctor, when did you first become aware

1 of the nonlinearity of the model?

2 A About 15 minutes after I saw it the
3 first time.

4 As bullet point No. 2 here, is that the
5 way that this has been presented is sort of very
6 magnanimously, that we want to increase everybody's
7 present water supply; but the very important thing to
8 remember is that each of these impacts that we
9 calibrate, the CBCU is actually a burden on each of
10 the States.

11 And so in this particular instance what
12 the calculations proposed by Nebraska does is
13 actually burden the upstream States for impacts that
14 cannot occur and never did occur.

15 So the problem here is not that the
16 calculations, in themselves, don't produce the result
17 that they propose; but when you understand physically
18 what it means, it actually means that Colorado and
19 Kansas are burdened for impacts to dry streams, which
20 is just impossible.

21 It has the second very important side
22 effect that in the calculations, for example, on
23 Frenchman, Colorado is burdened with over 2500
24 acre-feet of impact. However, what the results also
25 show is that if Colorado were to stop anywhere in the

1 basin all pumping going back to 1940, it would only
2 produce an additional 19 acre-feet of flow.

3 So if Colorado chose to come into
4 compliance by complete curtailment of all wells, this
5 method would say, Well, you owe us some more water.
6 And that just doesn't make any sense.

7 Point No. 3 and 4 are closely related,
8 and they relate to the consumption of imported water.

9 The method that is proposed of by Kansas
10 -- or correction, Nebraska actually calculates
11 consumption of imported water as part of those
12 calculations because we are using all of those pairs.

13 So Point No. 3 is that all three States,
14 but particularly Nebraska, is being charged for
15 consumption of imported water, which the FSS
16 specifically says we shouldn't be doing.

17 Point No. 4 is the same point but
18 related to the imported water. Remember, what we are
19 trying to do is look at the actual historical
20 observed baseflows, and we are trying to figure out
21 what fraction of that is native water to the basin
22 and what is imported water.

23 By the calculation proposed by Nebraska,
24 what we would actually do is estimate how much
25 baseflow would have occurred, had there been no wells

1 in Nebraska and subtracting that from actual
2 historical measured flows with the wells on.

3 That just doesn't make any sense.

4 Point No. 5 is that Nebraska's method
5 tries to solve the total problem. So they might want
6 to make sure that Colorado, plus Kansas, plus
7 Nebraska, minus imported water supply adds up.

8 What it fails to solve is the even more
9 fundamental problem, that if you just look at
10 Nebraska pumping, minus imported water, shouldn't
11 that add up to the directly computed impacts for just
12 Nebraska? It fails in that particular test and it
13 doesn't try to address it at all.

14 No. 6 has to do with the uncertainty
15 related to the model.

16 As you have observed, we get
17 increasingly uncomfortable with using the model
18 further and further away from the conditions to which
19 it was calibrated. And so by emphasizing and using
20 more and more of those model simulations, you are
21 introducing an additional uncertainty into the
22 results.

23 What the specific application, as it was
24 approved by the RRCA, tries to do is to minimize the
25 uncertainty by staying as close to the calibrated

1 conditions as you can.

2 And finally, let me get to the bottom
3 line.

4 Even if we assume that the -- some of
5 the pumping impacts minus imported water supply
6 should match some independent estimate of that total
7 water supply; and even if we assume that we need to
8 match that, not just on average as we do with the
9 current method, but we have to do it in every
10 subbasin at every instance in time and we forget
11 about the fact that we don't match the total in
12 Nebraska, as far as the pumping impact, minus the
13 imported water supply is concerned; but all we are
14 looking to do is match the basinwide total for all of
15 the States together. And we assume that the all-on
16 and all-off case is, in fact, the best estimate that
17 we have for the imported water supply.

18 If you make all of those assumptions,
19 you still don't have to accept Nebraska's solution to
20 this problem, because all of this -- all that this
21 does is to say, Well, you don't match it.

22 Well, just because you fail on all of
23 those, if you make these assumptions, that doesn't
24 mean that Nebraska solution is either the best
25 solution or the only solution.

1 In fact, if you were to ask me how would
2 you solve this problem, if you make all of these
3 assumptions, Nebraska's proposal wouldn't even make
4 my top three.

5 Q Doctor, in your experience, have you
6 ever seen a model used in the way Nebraska is now
7 proposing?

8 A Never.

9 Q Doctor, you were here for Dr. Ahlfeld's
10 testimony, I believe?

11 A I was.

12 Q And you saw Dr. Ahlfeld's algebraic --
13 pardon me, I will call it algebra because that is all
14 I understand about it.

15 You were here for that demonstration?

16 A Yes, I was.

17 Q And you have seen the document Mr.
18 Blankenau called a proof, which I think is Nebraska
19 Exhibit 33?

20 A Yes, I have seen that.

21 Q And in mathematics, what is a proof?

22 A A proof is a demonstration that the
23 specific hypothesis that you set out has a particular
24 solution or answer to a mathematical certainty.

25 Q And you believe Exhibit 33 is a proof

1 mathematically?

2 A No, it's not.

3 Q Can you, perhaps, demonstrate.

4 A Yes. The material that was provided
5 simply provides -- provided a solution to the
6 problem. It doesn't demonstrate that it is the only
7 solution to the problem.

8 And what I would like to show you is, we
9 think that just because all of those numbers add up,
10 that there is some magic to it. But it's really a
11 very simple construction, and if I may demonstrate.

12 I will try to stick to Nebraska's
13 terminology just so we don't get confused, but I
14 don't like it very much, but you know, that is
15 neither here nor there.

16 How do I open this?

17 So what we want do is to start with
18 Nebraska's assumption that what we need to solve is
19 the all-on minus all-off case. So theta simply means
20 everything is off. CN means everything is on.

21 And what I would like to do is show you
22 if there were just two states, there is a very
23 simple, fully understandable result that comes out of
24 this.

25 ARBITRATOR DREHER: Are you limiting

1 this to two States, because the all-on would be CMKN,
2 would it not?

3 THE WITNESS: Well, if I showed it to
4 you for just two cases, I can get it done in five
5 minutes. If I do 12, it's going to take me a half an
6 hour. Dr. Barfield -- and I agree with his results
7 if there are only two states, really what you are
8 doing, you are just splitting things in half.

9 ARBITRATOR DREHER: No, I recognize
10 that.

11 THE WITNESS: Basically, what you are
12 trying to do here is say, Okay, we want to split this
13 up. So I'm going to do that because I know that I
14 want to split it up half and half between the two
15 states. I'm going to simply use half a theta, plus
16 another half of theta and I'm going to subtract half
17 a CN and half a CN.

18 All right, so the 2 1/2 makes a whole.
19 All I'm going to do now is have some fun with math.

20 What I'm going to do is going here and
21 subtract -- sorry, subtract half a C and add half a C
22 and subtract half an A and add half an A. Right?
23 Just -- you are just adding zero.

24 ARBITRATOR DREHER: Yes, you haven't
25 done anything.

1 THE WITNESS: Exactly. You know what
2 I'm going to do is say, Well, you know, but I see
3 there is a C here and there is a C there and then
4 this N and C. The only difference here is a C and
5 the only difference here is a C. And the only
6 difference here is an N. And the only difference
7 here is a CN.

8 So all I'm going to do now is to say
9 Well, I'm going to take these two, so half theta
10 minus C, and I'm going to take this here, half N
11 minus CN, and do the same thing here, to add half a
12 theta minus N. And then again a half a C minus CN.
13 All right.

14 So I haven't done anything yet, except
15 now what I'm going to do is to say, I'm going to call
16 this the total impact and I'm going to call this here
17 Colorado's impact. And I'm going to call this
18 Nebraska's impact.

19 So now I had fun with math, but now I'm
20 starting to say, Hey, that's what you owe me. And
21 that is where this boils down, because look what this
22 does.

23 So IC is equal to a half theta, minus C,
24 plus a half of the N minus CN. So I start with the
25 historical case: Everything on. And I just switch

1 off the Nebraska -- the Colorado wells and I'm
2 saying, I'm taking half of that and I'm starting here
3 by saying, This is the predevelopment, so everything
4 off and I'm only turning on the Colorado wells.

5 So I am essentially averaging the
6 perturbation from historical conditions with the
7 perturbation from predevelopment conditions. And, of
8 course, it's symmetric for Nebraska. It's exactly
9 the same thing -- sorry, is minus y.

10 Now, how does that make sense? This
11 says, if you take the historical case and you switch
12 off the wells in Colorado, there is going to be some
13 additional flow that occurs in the stream.

14 Well, that's exactly what the current
15 method does. It says this is what we are going to
16 charge Colorado for. Similarly, for Nebraska.

17 However, in essence, what the method
18 proposed by Nebraska does is to say, Well, but we are
19 also going to charge you for those depletions that
20 would have occurred, had there never been any well
21 development in the state but -- in all of the states
22 and only well development in Colorado occurred.

23 Q (BY MR. AMPE) Doctor, is that fair, in
24 your opinion?

25 A Not at all. And particularly, in

1 Frenchman Creek why this is unfair is demonstrated
2 very detailed. And you can look at my report for the
3 physical reasoning why that is unfair.

4 Q Almost done.

5 Doctor, you were here and saw Nebraska
6 Exhibits 34 and 35, which were the head changes from
7 Dr. Ahlfeld's testimony?

8 A Yes, I did.

9 Q Dr. Ahlfeld, I believe, said that his
10 exhibits showed that his proposed use of the model
11 was within the envelope?

12 A I heard him say that, yes.

13 Q Do you agree with that?

14 A Not at all.

15 Q Why not?

16 A Well, because we are pushing the
17 envelope here.

18 What we are doing is we take the
19 differences that occurred in the current method,
20 which is as close to historical as we can, and we
21 keep on moving further and further away from it.

22 Q And is, in your opinion, the model -- do
23 head changes result in baseflow changes?

24 A They do but, as has been said a number
25 of times, in a very nonlinear way. And essentially,

1 what is happening here is that those very small
2 changes in heads, sometimes on the order of inches,
3 could result in very large changes in predicted
4 baseflow or impacts on baseflow.

5 Q And, in your opinion, that reasonably
6 represents the actual physical reality of the system?

7 A Yes. By necessity, this is a nonlinear
8 system, and so the model, by necessity, has to be
9 nonlinear.

10 MR. AMPE: I have no further questions
11 and I will mark that as Colorado Exhibit 13.

12 ARBITRATOR DREHER: On page 7 of your
13 report, Dr. Schreuder, in the second paragraph
14 underneath Equations 2e and 2f, the last phrase in
15 that paragraph says, "Nebraska does not have a
16 straightforward physical explanation. Specifically
17 the fact that the sum of the coefficient are $4/3$ is
18 troubling."

19 And you didn't elaborate.

20 THE WITNESS: Well, normally, when you
21 do averages, the statistical term that is used for
22 the coefficients is that in order for them to be
23 unbiased, they have to sum to 1. So if you take two
24 halves or four quarters or something like that, they
25 should add up.

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1 The fact that in Equation 2f the -- did
2 I quote the right one? Yes, 2f -- the sum of the
3 individual coefficients in the net Nebraska term
4 doesn't add to 1, just -- I don't know physically
5 that what means.

6 ARBITRATOR DREHER: Well, if you don't
7 know, how am I supposed to know?

8 THE WITNESS: It's not my proposal.

9 ARBITRATOR DREHER: All right.

10 Mr. Draper.

11 MR. DRAPER: No questions.

12 ARBITRATOR DREHER: All right.

13 Mr. Blankenau.

14 MR. BLANKENAU: Could we possibly break
15 for a few minutes.

16 ARBITRATOR DREHER: We can.

17 MR. BLANKENAU: Thank you.

18 (Break was taken from 2:22 to 2:31.)

19 ARBITRATOR DREHER: Mr. Blankenau, you
20 may proceed.

21 MR. BLANKENAU: Thank you.

22 CROSS-EXAMINATION

23 BY MR. BLANKENAU:

24 Q Good afternoon, Dr. Schreuder.

25 A Good afternoon, sir.

1 Q Just a couple of clarification points to
2 start with.

3 Your expertise is as a modeler, not as
4 an expert in Compact accounting; is that correct?

5 A I think that would be a fair assessment,
6 yes.

7 Q And have you taken the time to actually
8 run the model as Nebraska proposes to test any of the
9 propositions?

10 A I -- for the January 20 report, Nebraska
11 had already provided all of those model simulations,
12 so it wasn't necessary for me to rerun any of those
13 cases.

14 Q Okay. You stated one of your initial
15 criticisms or concerns about Nebraska's proposal
16 related to the selection of the year 2003; is that
17 correct?

18 A How did your question start?

19 Q I understood your testimony to be that
20 your initial criticism of Nebraska's proposal related
21 to its use of the year 2003 in its examples?

22 A I don't know whether my initial
23 criticism is any different than my current criticism
24 but that was the first bullet point.

25 Q By "initially," I meant what you just

1 gave us first.

2 A That was the first point, yes.

3 Q And isn't the nonlinearity of the model
4 most likely to become apparent during those extreme
5 years?

6 A In those extreme years, the model would
7 deviate most from linear behavior, if that is what
8 you are asking.

9 Q Did the Modeling Committee at the time
10 you were developing the model use the adopted
11 accounting procedures to evaluate the actual
12 implication of those nonlinear aspects?

13 A The Modeling Committee similarly knew
14 that the model was nonlinear and evaluated the
15 contingencies of that in determining the current
16 approved procedure.

17 Q So you are telling me that they did
18 take, then, the accounting procedures and applied the
19 model to those accounting procedures at that time?

20 A Yes. I previously testified that even
21 prior to the FSS, the model up to December, there
22 were actually applications of the model made and
23 those were evaluated by the people that signed the
24 FSS.

25 Q Were the -- well, number one, were those

1 evaluations retained in any form?

2 A Yes.

3 Q Where are they found?

4 A They are in a stack of CDs that are in
5 my office.

6 Q Don't the actual accounting procedures
7 postdate the adoption of the model?

8 A I'm not sure what you are asking.

9 Q Which came first, the accounting
10 procedures or the model?

11 A They were concurrent.

12 Q Are you sure about that?

13 A Pretty sure.

14 Q Then you also stated that the Modeling
15 Committee never contemplated a year like 2003?

16 A Did I say that?

17 Q You did say that.

18 A When did I say that?

19 Q On your direct testimony.

20 A I don't remember saying that. That the
21 Modeling Committee contemplated a year like 2003?

22 Q That's the way I understood it.

23 A I must have misspoke if I said that
24 because I don't recall saying that.

25 Q Can you clarify that for me, then?

1 A What is the question I was answering at
2 the time?

3 Q Well, you stated that your first
4 criticism of Nebraska's proposal was that it selected
5 the year 2003 as an example and that the Modeling
6 Committee never contemplated a year like 2003?

7 A If I said that, I apologize. I didn't
8 mean to say that.

9 Q Okay.

10 A What I said was -- what I meant to say
11 was that the period that the Modeling Committee
12 actually considered, which was obviously the data
13 that was available at that time, which was up to 2000
14 contained behavior similar to that in 2003.

15 Obviously, 2003 hadn't happened at the
16 time. So, you know, we couldn't have considered at
17 the time that the specific input to the model that --

18 Q There was a concern of yours that
19 Nebraska used 2003 as an example?

20 A It's simply one of many criticisms that
21 I have of Nebraska's demonstration that they show
22 that they used only examples from 2003 to demonstrate
23 this behavior.

24 Q Why is that a problem?

25 A Because I hope that 2003 is not a

1 representative year.

2 Q You are saying that Nebraska's proposal
3 comes out to -- that produces essentially identical
4 results to the existing methodology in normal flow
5 conditions, aren't you?

6 A What do you mean by "normal flow
7 conditions"? The point of my testimony, Point No. 1,
8 was essentially that the behavior that we saw in 2003
9 was similar to behavior that was seen at previous
10 times. So if you define normal conditions as what we
11 have seen in prior years, then I would disagree with
12 your statement.

13 Q I guess, in scope, I don't understand
14 why that, then, is a problem.

15 A It's just a very dry year. I should add
16 to that also that there is another problem with 2003
17 in that it was kind of a transition period in the
18 Nebraska team. So there were a few anomalies in the
19 data generated by Nebraska, the data of Nebraska
20 during that period.

21 So we saw a few strange things that
22 were, perhaps, as a result of the transition in the
23 data analysis that was going into Nebraska.

24 Q If the problem that Nebraska complains
25 of manifests itself and the streams run dry, why

1 wouldn't Nebraska use 2003 as an example?

2 A It's perfectly fair to use 2003 as one
3 of the cases. It's just kind of odd that all of the
4 cases are from 2003.

5 Q During your deposition, you testified
6 that if there were an error in the Compact
7 accounting, the magnitude of that error would not
8 determine whether it should be corrected.

9 Do you recall that?

10 A Yes, I stand by that statement.

11 Q And I asked you whether there were other
12 factors that would determine whether unknown errors
13 should be corrected.

14 Do you recall that?

15 A I don't recall the specific question;
16 but yes, in general, I do.

17 Q Do you have anything to offer in that
18 respect?

19 Are there other factors that would be
20 important to consider changing the accounting
21 procedures if there was a known error of a
22 significant magnitude?

23 A Well, yes. Your Honor, we all obviously
24 have some examples from the last several years of a
25 number of errors that were corrected.

1 The first one I would point to -- you to
2 is the difference between the current version of the
3 model, which is called 12S and 12P. In this
4 instance, Nebraska pointed out that we had omitted a
5 part of Medicine Creek. And we said, Okay, we will
6 add it back in.

7 So whether that made a significant
8 difference one way or the other as to the result was
9 insignificant in making that determination.

10 Another example I would point you to is
11 that in, I believe it was the 2003 update, Kansas
12 pointed out that we were using the incorrect acreage
13 in determining the recharge credit in Colorado.

14 I inadvertently used appropriated acres,
15 rather than the actual acres and it was one of those
16 moments that corrected those.

17 So, in none of those cases did we
18 consider, you know, does this make a big difference
19 one way or the other? Something -- there is a better
20 way to do.

21 Q Isn't the first change that you
22 suggested a model change, not an accounting change?

23 A Both of those were changes to the
24 model -- to the model.

25 Q I'm asking you specifically about

1 accounting changes.

2 A I'm sorry, I misunderstood the question.
3 Would you ask it again, please.

4 Q Sure.

5 Try to get close to it again.

6 Are there any circumstances under which
7 you would recommend changing the accounting
8 procedures if there was a known error of a
9 significant magnitude?

10 A Well, it would be hard for me to
11 enumerate all of the circumstances under which that
12 would be the case.

13 Q Can you give us a handful of them.

14 A Well, the consumption of imported water
15 would be one example. There is very clear guidance
16 in the FSS that none of the States should be charged
17 for consumption of imported water. And, therefore,
18 if there would be a change in the application of the
19 model, that would correct for the consumption of
20 imported water.

21 I, of course, can't speak for the State
22 of Colorado, but I would certainly make a
23 recommendation to the Colorado team that we support
24 such a change.

25 I would point out, though, that the

1 Nebraska proposal exacerbates the problem concerning
2 imported -- consumption of imported water, rather
3 than solve it.

4 Q During your deposition you were unable
5 to give us even one example under which you felt a
6 change would be warranted.

7 A Well, that is the hard part of my
8 deposition, since you asked the question.

9 Q What else do you have? I want to get
10 back to the point, you indicated that the magnitude
11 of the error was irrelevant whether the change ought
12 to be made and you indicated you still stand by that.

13 Do I understand that correctly?

14 A In general, yes.

15 Sorry, did I misunderstand your
16 question?

17 Q No. I think we are together on that.

18 Do you have your expert report before
19 you?

20 A I do.

21 Q Would you turn to page 4, the top of
22 that page.

23 A Yes.

24 Q You indicate that the existing
25 accounting methods show impact on Frenchman Creek in

1 2003 to be 19 acre-feet, while the Nebraska proposal
2 would show impacts of just over 2500 acre-feet.

3 Do you see that?

4 A I do.

5 Q Can you tell me how many wells are
6 located in the Frenchman Creek Basin in Colorado?

7 A I have never tried to calculate that
8 number.

9 Q Or how many acres are irrigated?

10 A I have not tried to make that specific
11 calculation.

12 Q Or how much water was pumped?

13 A Have not tried to make that
14 calculation

15 Q Flip back a page -- let me just find it
16 here myself.

17 The second paragraph, you highlighted
18 something that you state is an important requirement.

19 Do you see that?

20 A I do.

21 Q Is that important requirement enumerated
22 or specified anywhere in the Compact?

23 A I don't believe that that specific
24 phraseology is used explicitly in the Compact. In
25 fact, I don't think the Compact refers to pumping at

1 all.

2 Q But it's your opinion that, even though
3 the exhibit doesn't mention such a requirement, the
4 Compact does necessarily operate within certain
5 principles in order to function correctly?

6 A That was a very long question. Could
7 you ask it again.

8 Q I will try to shorten it.

9 It is your opinion, then, that even
10 though the Compact doesn't mention the word "specific
11 requirement," that there are principles by which the
12 Compact must operate in order to function?

13 A I think that's somewhat of a legal
14 question; but given my expertise, I would certainly
15 agree with your statement.

16 Q And I get that, and you are right. It
17 is somewhat legal, but I think "requirements" state
18 it is somewhat legal, as well.

19 I'm just trying to ascertain whether it
20 is your belief that every requirement has to be set
21 forth in a Compact itself -- every requirement of
22 accounting and modeling?

23 A Yes. Your Honor, I think this is more
24 of a common-sense thing, that if, by curtailing all
25 of the wells in Colorado, there is a certain increase

1 in baseflow; but the way that we do the calculation,
2 there is a requirement of some -- something on top of
3 that, then there has got to be something wrong with
4 the way we evaluate this because if a State cannot
5 come into compliance by stopping pumping, then
6 something is really wrong.

7 Q One final question for you.

8 If you don't know how many wells are
9 located in the Frenchman Basin in Colorado, you don't
10 know how many acres are irrigated, if you don't know
11 how much water is pumped, how is it that you can have
12 an opinion as to whether 19 acre-feet of impact is
13 correct or not?

14 A Because the model doesn't work on a
15 subbasin-by-subbasin basis.

16 In fact, the principle upon which the
17 model works is that it will calculate impacts from
18 wells, regardless of where they are located -- to all
19 streams within the basin, regardless of where they
20 are located and quantified as impact.

21 MR. BLANKENAU: Okay. I have nothing
22 further, Your Honor.

23 ARBITRATOR DREHER: Let me ask a couple
24 of additional questions.

25 One is just for my benefit of knowing

1 what was done here.

2 But if I understand how the groundwater
3 model was calibrated, it was initially calibrated
4 using steady-state conditions to determine starting
5 heads for the transient calibration?

6 THE WITNESS: I would agree with that
7 statement, except that we didn't actually calibrate
8 steady-state conditions. We made a steady-state
9 simulation to provide those initial conditions, but
10 we didn't actually have observations of what that
11 steady-state should be.

12 Instead, what we did was to commence the
13 transient flow and then observe the gradient that we
14 see in the transient run; based on those, make
15 adjustment so that this inferred initial condition
16 will change in such a way that we can match those
17 gradient and absolute values better.

18 ARBITRATOR DREHER: What was the time
19 period used for the steady-state simulations?

20 THE WITNESS: The steady-state sought to
21 present -- represent conditions prior to 1918. Now,
22 we didn't have any data prior to 1918. So the only
23 stresses that really applies during the
24 predevelopment condition is precipitation recharge.

25 And so what we did was to take the

1 precipitation from 1918 to 1940, calculate an average
2 of those and then, through calibration, say, Well,
3 what was the long-term precipitation rate charge for
4 the period prior to that? We couldn't achieve a
5 calibration based on the average of 1918 through
6 1940.

7 So, in fact, we applied this reduction
8 factor and we multiplied the precipitation recharge
9 by .75 and postulated that, for reasons that we don't
10 fully understand, the recharge in the long-term
11 leading up to 1918 must have been 25 percent lower
12 than the average from 1918 to -- of course, 1918 to
13 1940, but we have no explanation for why.

14 The reason why we did that, though, was
15 when you look at the water levels, especially in some
16 fringe areas where there is no production, we observe
17 the counterintuitive behavior that water levels
18 actually rise along the fringes of the basin.

19 The only explanation that we could come
20 up for that was the water levels in 1918 were the
21 result of lower precipitation recharge conditions
22 than occurred later on in the period because we
23 couldn't figure out any other stress that could have
24 changed that would result in that behavior.

25 ARBITRATOR DREHER: And by using the

1 factor of .75, you were able to achieve a
2 steady-state? Is that --

3 THE WITNESS: Yes. Again what is
4 unusual about this basin is that the tide scales are
5 extremely long; that something that happens,
6 especially on the fringes of the basin, could take
7 many decades, if not many hundreds of years, to make
8 its way through the entire basin.

9 So that initial condition in 1918 had a
10 very profound effect on the absolute value of water
11 levels into the '40s and '50s and '60s. By looking
12 at water levels that we had in that later period and
13 looking at the gradient, or the temporal terrain of
14 those water levels, we postulated what the water
15 level had to have been in that 1918 initial
16 condition. And if you had water levels that were
17 either much higher or much lower, those effects would
18 propagate many decades after that period.

19 ARBITRATOR DREHER: On page 4 of your
20 report, in the second paragraph under subsection 2.2,
21 "Nonlinearity in the RRCA Groundwater Model," the
22 last sentence in that paragraph says, "When a stream
23 reach goes dry, well impacts to streams will not
24 increase as well pumping increases, because there is
25 no baseflow to impact, leading to significantly

1 nonlinear behavior."

2 When the stream reach goes dry, there is
3 no surface flow for the groundwater withdrawal to
4 extract from, so it pulls out of groundwater storage?

5 THE WITNESS: That is correct.

6 ARBITRATOR DREHER: And the effect of
7 doing that is to lower groundwater levels?

8 THE WITNESS: Yes.

9 ARBITRATOR DREHER: Which won't those
10 lowered groundwater levels impact streamflow in
11 future years?

12 THE WITNESS: There ain't no free lunch.

13 So, yes, when that occurs, we are going
14 to pay for it somewhere at some other point.

15 However, specifically in terms of the
16 Compact accounting, it is strictly limited to changes
17 in baseflow at these specific locations. And so
18 under these very special conditions that the stream
19 goes completely dry, the Compact doesn't take into
20 consideration that you are taking water from storage
21 that could have impacts at other times.

22 It's simply limited to by how much does
23 the streamflow change.

24 ARBITRATOR DREHER: It strikes me that
25 one of the reasons for the difference between

1 Nebraska's proposed approach and the current
2 procedures is that essentially -- and I'm going to
3 oversimplify this -- but essentially it seems like
4 Nebraska's approach assumes streams are full and it
5 calculates the impact on these full streams.

6 Now, this is an oversimplification;
7 there is always inaccuracies in oversimplifying; but
8 -- that doesn't account for the fact that what is
9 happening under current conditions is that it isn't
10 streamflows that are being depleted; it's groundwater
11 storage that is being depleted?

12 And I think, at least at this point --
13 and I had better put it as a question -- do you
14 believe my understanding is correct on that point?

15 THE WITNESS: Yes. I think the
16 mechanism that they propose is slightly different,
17 but that is essentially the nub of it.

18 So the Frenchman Creek is a good
19 example. By considering the fact that had there been
20 no development of wells in Nebraska, there would have
21 been a live stream and Colorado is charged to impacts
22 to that stream that no longer exist, in reality.
23 That is, in effect, what Colorado is burdened with.

24 Of course, it cuts both ways, because
25 Nebraska also assumes that all you have to do to come

1 into compliance with the Compact is just cut back
2 your pumping by a small amount and suddenly these
3 streams will come live again, there will be flow with
4 the gage and everybody will be happy.

5 Clearly, that is not possible under the
6 historical reality.

7 ARBITRATOR DREHER: Sort of the second
8 piece of this -- and the reason I'm testing that with
9 Dr. Schreuder is to give you an opportunity during
10 rebuttal to address this. That's why I'm doing it
11 this way.

12 The second piece of this -- and it's a
13 question that I asked Dr. Ahlfeld -- is that Nebraska
14 takes these differences that are called residuals and
15 then, in the case of two States, simply averages
16 them; and in the case of all of the States, plus the
17 mound, it spreads them around in such a way that the
18 residual then is zero.

19 But I haven't heard a physical
20 explanation for why that distribution of coefficients
21 matches anything physically that is out there.

22 THE WITNESS: That's my point exactly.

23 There is no physical explanation for
24 those coefficients. It simply tries to make the math
25 work and throws reality to the wind.

1 So the reasons specifically that the
2 Modeling Committee selected the specific procedure
3 that is laid out in the Final Settle- -- the FSS is
4 that what you would do is it would evaluate
5 Colorado's impacts in such a way that we take
6 historical reality and say, If only wells in Colorado
7 was not pumping, what would the effect be?

8 Because that is the historical reality,
9 the assumption is that if we were to then curtail
10 wells in Colorado, this will be the real result and,
11 therefore, Colorado can achieve Compact compliance in
12 that way.

13 The proposal made by Nebraska considers
14 all of these alternative realities that never did
15 occur and tries to evaluate what would the impacts
16 have been.

17 However, because Colorado can't tell
18 Nebraska or Kansas what it is that they should do,
19 the only fair way to estimate both the impacts and,
20 as a result, the distribution of the virgin water
21 supply, is by the method that is currently being --
22 the current procedure.

23 And the Modeling Committee thought about
24 it in those terms and decided that this would be a
25 fair way to make this -- assign the impacts and

1 calculate the virgin water supply.

2 ARBITRATOR DREHER: But the current
3 procedures don't address this depletion to storage
4 that is occurring that would have produced stream
5 flows in the future, had that depletion not occurred?

6 THE WITNESS: Well, the Nebraska
7 proposal doesn't try to do that, either.

8 ARBITRATOR DREHER: No, I didn't say the
9 Nebraska proposal did.

10 But I'm saying the current procedures
11 don't do that, do they?

12 THE WITNESS: No, they don't. But we
13 are simply trying to follow the instructions of the
14 Special Master and the Compact and it doesn't say
15 anything about groundwater storage.

16 ARBITRATOR DREHER: This is going to
17 seem like an odd question, perhaps, to counsel, but
18 where would I go to find out what the technical
19 qualifications were of the Special Master?

20 MR. AMPE: John, do you happen to
21 recall? That was actually a little bit before my
22 time when we started.

23 MR. DRAPER: I don't know. He didn't
24 appear as a witness or anything. We don't have a CD
25 from that proceeding, but I believe I recall a few

1 details; but certain of us know some things about his
2 background and there were times when we had
3 conversations with him, even on the record, about his
4 past history working for the Supreme Court as a
5 Special Master, for instance, in previous cases.

6 But if you were interested in what his
7 background was, I think maybe the best way to address
8 that would be for us to work with the other States
9 and pull together information about him to be sure we
10 cover areas that you are interested in and present
11 it.

12 ARBITRATOR DREHER: All right.

13 MR. AMPE: Let me point one thing out.

14 To the best of my knowledge, the States
15 did not agree on a Special Master; United States
16 Supreme Court picked the Special Master and gave him
17 to the States, so it was not our decision.

18 MR. DRAPER: That's true.

19 ARBITRATOR DREHER: I understand how it
20 works.

21 And let me give you the context of why
22 I'm asking -- and I do not know at this point whether
23 it's going to be pertinent to what I decide or
24 recommend for a decision or not.

25 But it seems to me that there is some

1 reliance by one or more State on one or more issues
2 on conclusions reached by the Special Master.

3 And I'm wondering if on some of these
4 issues that I may have concern about, if he had the
5 technical background to make those conclusions.

6 MR. DRAPER: Well, I think one of the
7 more relevant things then that I could say about that
8 is that while the Special Master made the initial
9 decision and recommendation to the Court that
10 groundwater needed to be accounted for, and that was
11 essentially approved when they approved his
12 recommendation that, on that basis, the motion to
13 dismiss that case was denied.

14 It was when it was returned to him that
15 he began to rule on various legal questions that were
16 outstanding while we did discovery.

17 And that, at some point, converted, with
18 his permission, into the settlement negotiations;
19 that the technical aspects of his ultimate
20 recommendation to the Court were based on a consensus
21 of the States. And those technical recommendations
22 were accepted by all of the States and the United
23 States technical experts before they were presented
24 to him. And he looked at them from the point of view
25 of a judge, essentially to see if there was any -- I

1 think, to see if there was anything clearly wrong
2 with them; but if they made sense after he had
3 addressed questions to the state engineers and so on,
4 and they were supported by all of the States and
5 their experts, he then accepted their recommendation
6 and forwarded that to the Court. Ultimately, the
7 Court accepted it.

8 MR. BLANKENAU: I'm not sure that it
9 really makes a whole lot of difference, but I will
10 say he had no background in water-related issues
11 either before he went to law school or after, that I
12 could tell.

13 MR. DRAPER: Well, he was from Maine and
14 so there was some concern as to whether he really
15 understood Western water law; but I think that
16 concern was quickly dispelled that he understood it
17 better than someone who had been working --

18 MR. BLANKENAU: Speak for yourself.

19 MR. DRAPER: As you know, we were
20 debating very stridently the pros and cons of the
21 question of whether groundwater pumping at all could
22 be considered under the Compact. And he found out
23 reasons why our positions were either good or bad
24 that we hadn't even be able to articulate and,
25 ultimately, those were acceptable to the nine

1 justices.

2 ARBITRATOR DREHER: I mean, it obviously
3 doesn't matter at this point. I think he is right on
4 that point; I'm not concerned about that.

5 But at issue in this proceeding is
6 compliance with the FSS. And, you know, he makes
7 several pronouncements that, from his perspective,
8 the FSS is entirely consistent in all ways -- I'm
9 paraphrasing -- with the Compact.

10 And I guess what you are telling me is
11 that he viewed it from the perspective of a judge; in
12 other words, legally perhaps met the requirements of
13 the Compact, but maybe didn't understand some of the
14 technical subtleties.

15 MR. DRAPER: Well, as to the technical
16 subtleties, I think he took the assessments and the
17 recommendations of Nebraska, among other -- other
18 States, that these were good assumptions; this is the
19 way it should be done to be consistent with the
20 Compact. And when each of the States was saying that
21 with one voice and there wasn't anything obviously
22 inconsistent with that, he accepted the
23 recommendation that was jointly made.

24 MR. AMPE: And that is shown in Nebraska
25 or -- sorry, Kansas Exhibit -- the hearing we had in

1 the Tenth Circuit.

2 Do you happen to recall that exhibit
3 number? The transcript?

4 MR. DRAPER: The transcript is Kansas
5 Exhibit 31.

6 MR. AMPE: And you may, if you are
7 interested, see some of questions and responses back
8 from both, I think, legal and technical
9 representatives of the State.

10 MR. DRAPER: Yes, we did -- each State
11 presented their state engineers, their chief
12 technical representative who was kind of a pyramid of
13 the various experts and staff members of each State
14 and spent considerable time looking into each of the
15 technical aspects of the proposed agreement.

16 ARBITRATOR DREHER: And I believe that
17 exhibit was introduced through Mr. Pope, if I recall.

18 MR. DRAPER: That's probably correct.

19 ARBITRATOR DREHER: And I do intend to
20 read that. I haven't done it yet, but I do intend to
21 read it word for word.

22 But, essentially, then what you are
23 telling me is if all three States agreed, it must be
24 right?

25 MR. BLANKENAU: And that's not what we

1 would say.

2 MR. DRAPER: Well, certainly one thing
3 is Nebraska said it was right.

4 MR. BLANKENAU: I think we said it was
5 acceptable at that time.

6 MR. DRAPER: Nebraska said it was right.
7 You can try to parse that, but they -- when they
8 stood up -- you will see it in the transcript -- they
9 are right there with everybody else leading the
10 proposal to the Special Master and to the Court that
11 this be approved.

12 MR. BLANKENAU: Well, I won't argue with
13 counsel. I will just encourage the Arbitrator to
14 read the transcript.

15 ARBITRATOR DREHER: I will. I will read
16 the transcript and with -- I mean with this
17 understanding from this discussion, I guess I don't
18 feel the need to inquire further about Special Master
19 McKusick technical qualifications.

20 All right.

21 Would you like a short break before you
22 do redirect, Mr. Ampe?

23 MR. AMPE: I would. Thank you.

24 ARBITRATOR DREHER: We -- unless people
25 want a shorter break, we can take our 15-minute

1 afternoon break at this point.

2 MR. AMPE: That would be fine, sure, 15
3 minutes.

4 (Break taken from 3:29 to 3:47.)

5 ARBITRATOR DREHER: Mr. Ampe, before you
6 begin your redirect, I want to make sure I didn't
7 create any misunderstanding by our discussion prior
8 to the break.

9 I certainly am not second-guessing the
10 qualifications of Special Master McKusick. That
11 wasn't the point of my inquiry.

12 I was simply trying to figure out how
13 much weight to give a State's reliance on a
14 conclusion of the Special Master that is largely
15 technical. That is really what I was trying to get
16 at.

17 You know, I certainly understand better,
18 I think, what the situation was; but anybody that
19 heard the exchange, please don't think I was
20 criticizing the qualifications of Special Master
21 McKusick, because I was not.

22 With that, you may begin your redirect.

23 MR. AMPE: Understand.

24 Thank you.

25 REDIRECT EXAMINATION

1 BY MR. AMPE:

2 Q Doctor, I'm not sure if I misheard you.

3 Did you state something along the lines
4 that groundwater model, when the stream goes dry,
5 will not count for future impacts on the stream?

6 A Mr. Ampe, I may have said no to that
7 answer. It makes no sense.

8 Clearly, the groundwater model takes
9 into consideration changes in storage and all other
10 terms as a result of those.

11 So the only effect that that would have
12 is that the changes in storage would manifest itself
13 at some later stage.

14 Q And so the depletions to streamflow
15 would be accounted for temporally?

16 A That is correct.

17 Q Now, Dr. Schreuder, why did the Modeling
18 Committee construct the groundwater model?

19 A The instructions to the Groundwater
20 Committee was specifically to apply the model to the
21 conditions where we would turn off the wells in each
22 of the States, one state at a time, and the impacts
23 resulting from the mound, in isolation from all of
24 the other terms, and then produce some changes to
25 streamflows as a result of those specific conditions.

1 Q And ultimately, what is wrong with the
2 way that Nebraska now proposes to use the model?

3 A Your Honor, as you indicated, basically
4 what it has to do is about the residual.

5 Nebraska's method first quantifies the
6 residual and then it distributes it to the State --
7 to the individual States.

8 And basically, I am questioning whether
9 the quantification of that residual is accurate
10 because it uses the model in the condition that it
11 was never calibrated to.

12 And secondly, the assignment of that
13 part of the residual to the individual States is
14 simply arbitrary and, therefore, not fair.

15 MR. AMPE: Nothing further.

16 ARBITRATOR DREHER: All right.

17 Thank you. You can step down.

18 What is Nebraska's pleasure at this
19 point?

20 MR. BLANKENAU: We would like, I think,
21 to begin our rebuttal case.

22 ARBITRATOR DREHER: You are ready to
23 begin the rebuttal case?

24 MR. BLANKENAU: I think so.

25 MR. WILMOTH: Take five minutes.

1 (Break was taken from 4:08 to 4:16.)

2 ARBITRATOR DREHER: Mr. Blankenau,
3 before you begin, I believe Colorado would like to
4 get some exhibits admitted.

5 MR. AMPE: Yes. Thank you, Mr. Draper,
6 for reminding me I did not move my exhibits.

7 I would move Colorado Exhibit 6, the CV;
8 7, the expert report; and 13, was the mathematics on
9 the tablet.

10 Other documents referenced are already
11 in evidence under Kansas exhibits.

12 MR. BLANKENAU: We have no objection.

13 MR. DRAPER: No objection.

14 ARBITRATOR DREHER: All right. They are
15 admitted.

16 (WHEREUPON, Colorado Exhibits 6, 7 and
17 13 were admitted into evidence.)

18 MR. BLANKENAU: We would call Dr. David
19 Ahlfeld.

20 ARBITRATOR DREHER: And, Dr. Ahlfeld, I
21 would remind you are still under oath.

22 DAVID AHLFELD,
23 having previously been duly sworn, was examined and
24 testified as follows:

25 DIRECT EXAMINATION

1 BY MR. BLANKENAU:

2 Q Dr. Ahlfeld, you were present this
3 afternoon a short time ago when Mr. Dreher asked
4 about Nebraska's proposal and whether it depletes the
5 effect of the groundwater storage.

6 Do you recall that?

7 A Yes, I heard a question something along
8 those lines.

9 Q Would you care to offer any thought on
10 that?

11 A Yes, I would like to. And I would refer
12 -- or just point out that the issue I'm going to
13 discuss is in our report, Sections 3.1.3.3 and
14 3.1.3.4, if I can, a section called "Storage
15 Replenishment and Reestablishment of Baseflow."

16 And this whole question of storage
17 depletion, the relationship of storage depletion,
18 stream-drying and storage replenishment and stream
19 rewetting is, I think, central to understanding the
20 problems with the current method.

21 And if I can go through an example,
22 essentially explain what we attempted to explain in
23 the report, I would like to do that.

24 If you could put the 2003 Beaver Creek
25 board up.

1 So this is the exposure we used -- that
2 I used yesterday morning and it's derived from Table
3 3 of our report. And it will just remind us of some
4 of the numbers involved.

5 So the current method operates by, first
6 of all, saying let's start with the all-on condition,
7 all activities are -- historical activities are
8 present.

9 And, of course, in that, as you can see
10 on the chart here, both States at 100 percent
11 pumping, the baseflow is zero. So the all-on model
12 says the baseflow will be zero and, in fact, as we
13 show in the report, the storage is depleted; in other
14 words, the heads have dropped below the streambed.

15 The current method then says, Okay,
16 let's take that run and you subtract it from a run in
17 which -- and I'm going through the first row here --
18 Nebraska stays on, but we turn off Kansas.

19 Now, what we try to do in the report is
20 visualize, if you will, physically what is going on
21 as the model attempts to represent this phenomena;
22 that is, comparing the all-on condition with the
23 condition where Kansas is off.

24 And, of course, what has to happen as
25 Kansas turns off, storage is -- heads rise again --

1 heads rise quite a bit in order to replenish storage.
2 Heads rise up to the streambed and then storage is --
3 streamflow is initiated. And we do have some charts
4 in the report that does this.

5 Turning off -- turning -- yes, turning
6 off Kansas pumping results in both storage
7 replenishment and replenishment of streamflow.

8 Okay. So you have to replenish some
9 amount of the storage before you can replenish any
10 streamflow, is the point there.

11 The current method would then go on to
12 say, All right, let's compute the CBCUn by doing the
13 parallel analysis -- all on -- and compare that with
14 the case of Nebraska turned off and Kansas remaining
15 on.

16 Again, we start from storage depleted,
17 head dropped. As Nebraska turns off, storage
18 recovers, heads reach the streambed bottom and
19 streamflow is replenished.

20 Now, if you add those two results
21 together, as is done in the current method,
22 essentially what you are doing is adding, or
23 double-counting the storage replenishment component
24 of the -- of the recovery of streamflow.

25 Contrast that with the all-off minus

1 all-on. In that case, we start with the storage
2 depleted. We turn off everything, the storage is
3 replenished once, and the streamflow is then
4 reinitiated and replenished. It's obviously
5 replenished to a much higher level, 6444 acre-feet,
6 because storage has only had to be replenished once.

7 So there is a, I think, a significant
8 difference in what we are proposing and the current
9 method with respect to this issue of storage
10 replenishment.

11 I don't think that they are the same in
12 this regard because our current method again
13 double-counts the storage replenishment.

14 And one way to look at it is the fact
15 that current method does not add up -- as we have
16 shown here, the CBCUs do not add up to the VWSg is
17 because the storage replenishment has been
18 double-counted. And again, those sections go through
19 some detailed numerical analysis of the examples of
20 this idea.

21 That is, in a nutshell, the physical
22 basis for the flaw in the current method -- the
23 problem with the current method in the stream-drying
24 condition.

25 By forcing the individual impacts to sum

1 to the directly calculated virgin water supplies of
2 groundwater in this case of 445, we are better
3 representing the storage replenishment issue.

4 So I would suggest that, in fact, our
5 method -- well, I think I just said this: Our method
6 better addresses the storage replenishment that I
7 understand Mr. Dreher was concerned about -- or
8 asking about.

9 Q Do you have anything more on that point?

10 A Well, I just would point out there is a
11 subtle related issue, but a different issue, if I was
12 following the discussion amongst the attorneys about
13 the Special Master -- I don't know if that is any of
14 my business, so to speak -- if I was following, it
15 is, in fact, the case that both methods -- and I
16 think the whole impact -- I should say the FSS says
17 that in a given year, a State ought to be charged
18 with the impacts on streamflow resulting from all
19 prior year pumping.

20 There isn't any way in the current --
21 any of the current -- in the FSS, as I understand it,
22 to account for the impacts of past pumping on future
23 years until you get to that year in the accounting
24 process.

25 That is a separate issue, I think, and,

1 I guess, would require a change in the FSS; but it's
2 not something I have given much thought to. In any
3 case, it's a different issue.

4 Q Let's go on to the next one.

5 Yesterday you were asked about the
6 all-off method and you provided some psychedelic
7 charts.

8 A Yes. And I have more psychedelic
9 charts, believe me.

10 Q Go ahead and go through them.

11 A Thank you.

12 And could we put up the two charts that
13 we had last time, the two head things?

14 So I will just be -- explain that we had
15 expected to get to this today, and so I have more to
16 say about this than I said yesterday that I wasn't
17 prepared to say. I simply had not collected my
18 thoughts about it yesterday.

19 In any case, let me fill in again.

20 So as I understand the question from
21 Mr. Dreher yesterday, it was: In my opinion, did I
22 think that the all-off run was a valid use of the
23 model for our purposes?

24 Obviously, we use it. It is -- it could
25 be considered an extreme stress of the model from the

1 calibrated condition.

2 Is that a valid use of the model?

3 And, in my opinion, it is a valid use of
4 the model. And I wanted to elaborate further on the
5 basis for that opinion. And I showed these charts
6 yesterday as part of that.

7 I want to be clear in my discussion here
8 that all I'm saying -- and I think all the question
9 was, as I understood it -- was: Does the all-off run
10 produce model-predicted baseflows that are
11 reasonable -- reasonable estimates of what we would
12 expect to occur if, in fact, there never had been any
13 human activities in the basin?

14 That is the question, as I understand
15 it.

16 And, in fact, that's how the model is
17 used: What is a reasonable estimate of what the
18 baseflows would be if Nebraska pumping had never
19 existed, for example, as a current use of the model?

20 Okay. So just, I guess, a little
21 bookkeeping item here -- or housekeeping, I guess is
22 the right word, item, the question came up, I think,
23 from Mr. Ampe -- if I have your pronunciation
24 right -- about the white area on these charts.

25 And just to refresh your memory and --

1 let me start with the chart labeled A -- I will use
2 the pointer here.

3 This chart shows the difference in heads
4 that result from computing the heads with Colorado
5 off and everything else on; and Colorado on and
6 everything else on. So this is basically all-on,
7 minus everything but Colorado on. Of course, if you
8 turn off Colorado, heads go up.

9 So the color scale here indicates the
10 degree to which the heads go up. And the scale goes
11 from up, to a greater than 60. So there is a quite a
12 bit of head increase, as you would expect.

13 Okay. So Mr. Ampe asked about the white
14 area. And on our scale, if you have your copy from
15 last -- from yesterday, that covers the range minus 1
16 to 1. We went back to our graphic's people and said,
17 Please fill in what is going on from minus 1 to 1.

18 And so we have an additional graphic
19 which I think may be even more psychedelic, which I
20 believe Mr. Powers is going to hand out.

21 Q We will refer to this as Exhibit 37.

22 A There are two sheets, by the way.

23 Q 37 and 38, then.

24 A Okay. So obviously, we did this in
25 response to a question, so there may be better ways

1 to depict this. In any case, I will do my best to
2 explain it.

3 Referring back to the poster I have
4 which shows the heads in blue and we will just focus
5 on Figure A, for convenience.

6 What you note -- and again, let's look
7 at the border between Colorado and Nebraska. What
8 you note is that the heads come up in Colorado, as,
9 of course, you expect since we turn off the pumping
10 in Colorado. And that head increase propagates
11 somewhat into Nebraska, as you would expect.

12 And I don't know if you can make out the
13 color scale, but the colors are getting greener as we
14 go more eastward, indicating that the head increase
15 from turning off Colorado pumping is decreasing.
16 Less and less of a head increase.

17 What you see on the handout you just
18 received is that that head increase -- the decrease
19 in the head increase, if that makes sense, continues
20 to drop.

21 Q And you are referring to four-slide
22 handout, we would call it 37?

23 A Let me jot that down. We are calling
24 that Exhibit 37?

25 Q Correct.

1 A Okay. I am referring to it as such.

2 Essentially, what we are seeing in
3 Exhibit 37 is that the impact of Colorado pumping
4 continues to drop as we go further into Nebraska.
5 Nothing surprising here. This is exactly what we
6 expect, which is why we chose 1 as a cut-off point,
7 just as general convenience.

8 The yellow area, simply the change in
9 heads, is between minus point 1 and point -- and .1.
10 And, obviously, we do could go to the final
11 resolution, but I doubt there is anything interesting
12 happening in there.

13 As we go through these -- and perhaps
14 there will be questions about this, but I -- there is
15 nothing surprising in these additional figures, in my
16 view.

17 The main point that I was attempting to
18 make with the head -- the images you have on the
19 poster board --

20 And did this have an exhibit number? I
21 just want to be clear about this.

22 Q Yes, 34 and 35.

23 A 34 and 35.

24 So the main point of Exhibits 34 and 35
25 is that if we turn off pumping in Colorado, virtually

1 all of the impact that we see is in Colorado. It
2 doesn't propagate very far.

3 And similarly, if we turn off Kansas,
4 doesn't propagate far. Or Nebraska, or the mound.

5 And further, that if we look at the case
6 of all-off minus all-on, which is what -- the whole
7 point of this is that a valid run, the all-off run,
8 we see that the changes in head are just about the
9 same as they are in each of the individual cases. In
10 other words, if I'm -- if I'm sitting in Colorado,
11 and I turn off the pumping in Colorado and I turn off
12 everything else -- let me rephrase that.

13 If I'm sitting in Colorado and I turn
14 off the pumping only in Colorado, I get a certain
15 head increase.

16 Second case, if I am sitting in Colorado
17 and I turn off everything, I get just about the same
18 head increase in Colorado.

19 That's the point of the fact that these
20 -- that there is very little propagation of the head
21 increases.

22 Now, just a further clarification on
23 this. One might compute simply the heads under the
24 all-off condition, and that would be an interesting
25 graphic; but I think more directly to the point is:

1 How does it change? How do the heads change from the
2 calibrated condition?

3 And that's why we chose to look at these
4 differences instead.

5 Okay. So let's, perhaps, elaborate on
6 the head images. Now, of course, what we are really
7 interested in here ultimately is the streamflows and,
8 obviously, the heads drive the streamflows, so it's
9 not irrelevant to look at the heads, but let's also
10 look at the streamflows.

11 I would now like to turn to another
12 exhibit -- this is a new item -- which is a series of
13 three tables on a single sheet of paper.

14 Q And we will refer to this as Nebraska
15 Exhibit 39.

16 A 39. And, again, the point here is, I'm
17 explaining why I think the all-off run is a
18 legitimate run to use in our analysis. And by the
19 way, everything in between, all the other
20 combinations, the other ten combinations are not used
21 in the current procedure.

22 So this Table, which is not -- doesn't
23 have a title, per se; but the first line on it says,
24 "Beaver Accounting Point - period of record is 1918
25 to 2006," and there is a Table and another Table with

1 a heading "Frenchman," and another Table with "Main
2 Stem Republican at Accounting Point."

3 Here is what we have done in this Table.

4 Let's look at the Beaver accounting
5 point table, top one. The first row is labeled
6 "Run - CKMN." And if we go across that row, we see
7 two numbers: Zero and 10,960.

8 What we have done is simply look at the
9 historical run; and for the Beaver Creek accounting
10 period, we have determined the annual baseflow in
11 each year 1918 to 2006, and found what is the
12 smallest value -- what is the smallest baseflow
13 that ever occurred over those years? And what is the
14 largest? And we record that in the Table.

15 So, okay. I would postulate, then, that
16 the all-on run stresses, if you will, the Beaver
17 Creek -- Beaver Creek, rather, and ultimately the
18 Beaver Creek accounting point, fields this between
19 zero and about 1000 -- 10,960.

20 The next row is the run that is done in
21 the current procedure with Nebraska off. And you see
22 it runs -- the baseflows are 727 to 11,637.

23 Next run -- row is mound off.

24 Next row is Kansas off, and then
25 Colorado off.

1 So the first five rows, of course, are
2 the returns that are currently done with the model.
3 And what we see is the range of baseflows that you
4 get over all five of those are between zero and the
5 maximum of about 12,380.

6 Now, let's look at the all-off case, the
7 "Theta (All Off)" row. Same idea. We do the theta,
8 the all-off run and we look at the baseflows. And
9 they are -- 884 is the smallest and the largest is
10 16,707.

11 Q Let me stop you right there and take you
12 off track just a little bit.

13 MR. BLANKENAU: May I approach the
14 witness?

15 ARBITRATOR DREHER: Sure.

16 Q (BY MR. BLANKENAU) I am handing the
17 witness what is the Compact, Article III, and this
18 is the virgin water supply determinations as they
19 were originally set forth in the Compact.

20 You see where Beaver Creek is
21 identified?

22 A Yes, I do. This is on page B4.

23 Q And what is the Beaver Creek virgin
24 water supply listed there?

25 A 16,500 acre-feet.

1 Q And how does that relate to your all-off
2 run?

3 A Well, the maximum baseflow that the
4 model predicted in the -- over the period of record
5 was 16,707, as shown on the first table in Exhibit
6 39.

7 If we go to Frenchman, it's essentially
8 the same analysis. In the interest of time, I would
9 just point out that the CKM run has a maximum
10 baseflow of 55,589. The all-off run has a maximum of
11 58,352, which is about a 5 percent increase above
12 CKM. And, finally, the Main Stem Republican, same
13 idea.

14 Again, the maximum baseflows out of the
15 first five rows is 27 -- 278,786. And with all-off,
16 it's 280,587.

17 So I infer from this that in a manner
18 similar to looking at the head-flow files, that the
19 model -- the baseflows computed by the model, in the
20 all-off run, are within the range of reasonable
21 values. In other words, the model is not producing
22 junk. It's producing numbers that are within the
23 range of the -- or, at least, not much above the
24 range of the values that are currently accepted as
25 reasonable out of the five runs.

1 Q Let's then move on.

2 Let me go back to the Nebraska method
3 the. A lot has been made of the coefficient you
4 applied --

5 A Yes.

6 Q -- in that.

7 What happens if you give everybody an
8 equal coefficient?

9 A I believe you are referring to the
10 weighted coefficient we used in the January report,
11 as compared to the equal coefficients we used in the
12 August 2008 report.

13 I think what you find, if you looked at
14 the actual CBCU values, that they are very similar.
15 There is very little difference.

16 There is -- in using the equal
17 coefficients, there is a slight residual that
18 remains. And, as I think I mentioned yesterday, in
19 the interim between the August report and January
20 report, we realized that we could eliminate those
21 residuals entirely with really very minor changes to
22 the actual value of impacts that are computed.

23 Q And I assume if you eliminated the
24 coefficients, each of them an equal weight, your
25 residuals would still bring you closer to the virgin

1 water supply metric than the existing methodology?

2 A Oh, yes, absolutely.

3 Q We will move this along.

4 A I understand. I'm probably long-winded,
5 I'm sorry.

6 Q Dr. Schreuder -- you were here when he
7 did his fun with math, I think is what he called it?

8 A Oh, yes. The flow chart drawings? Yes.

9 Q Can you explain how that is related to
10 Nebraska's proposal.

11 A Yes. Well, I was pleased to see that
12 because what -- what Dr. Schreuder said, because it
13 is, in fact, the case that if you only have two --
14 under our method, if you only have two activities in
15 a subbasin, then the residual will be split in half.

16 And that you can look -- you could look
17 at the method as being one where we take the average
18 of the condition of starting from all-off and adding
19 the activity and starting from all-on and subtracting
20 the activity, which is essentially what he said.

21 In fact, we do exactly that, and the
22 very same equations are in our report and can be
23 derived from our method.

24 In other words, our method is general
25 for four activities. If you only have two

1 activities, then -- and we show this for Beaver
2 Creek, not for Frenchman, which I think was his focus
3 -- the equations that he derived fall out.

4 So the suggestion that they are just
5 some sort of an arbitrary thing that you do in the
6 middle of the equation there is not correct or --
7 well, you can have fun with it, certainly.

8 But the point is that our method is
9 based on a rational examination of all of the
10 combinations of differences that are possible and --
11 and arrives at what he showed.

12 Again, this is on page 50 for the Beaver
13 Creek example, Equations 12 and 13.

14 Q He also mentioned in his testimony that
15 he observed a coefficient of $4/3$.

16 Would you address that?

17 A Well, you know, I saw that, and I didn't
18 understand what he was talking about, really.

19 If I'm recalling correctly, that was a
20 quantity for a combination of model runs that he
21 created. That was not out of our report.

22 And I think it's the case that you can
23 play around with model run variables and get any set
24 of coefficients you want.

25 I'm not sure that that --I -- it's not

1 clear to me his observation has any value or meaning.

2 MR. BLANKENAU: Thank you.

3 We have nothing further.

4 ARBITRATOR DREHER: Let me try to come
5 at this a little differently.

6 Essentially, by distributing the
7 residuals around, you are trying to account for
8 differences that arise between -- or differences that
9 arise because of a nonlinear response --

10 THE WITNESS: That's correct.

11 ARBITRATOR DREHER: -- and the
12 distribution of the residual that you use satisfies
13 the criteria that you established, that the sum of
14 the computed consumptive beneficial use, less
15 imported water supply credit, has to total to the
16 difference between the all off/all on?

17 THE WITNESS: That is correct.

18 ARBITRATOR DREHER: But I don't see the
19 relationship that the criteria -- enforcing that
20 criterion in a nonlinear behavior led to the
21 residuals in the first place.

22 THE WITNESS: Well, let me -- let me go
23 back, if I may, to the Beaver Creek example, because
24 I think that is the most physically based explanation
25 for this.

1 And it has to do with the storage
2 replenishment and the current method, as I was --
3 attempting to describe earlier, double-counts the
4 pumping reduction needed to achieve storage
5 replenishment.

6 And if you count that once, you are
7 going to get the virgin water supply g, as we have
8 done.

9 We don't have that board up. Maybe we
10 could put that back up -- the 2003 Beaver Creek.

11 So I believe -- that's -- that's, to me,
12 the clearest physical basis for what we are doing,
13 that the current method fails because of this
14 double-counting, due to storage replenishment. And
15 -- and the true virgin water supply is correctly
16 computed by the all-off minus all-on because it only
17 accounts for the storage replenishment once.

18 ARBITRATOR DREHER: I understand that.

19 THE WITNESS: Okay. I think a fair way
20 to say this is that we are -- our proposed method
21 essentially splits the storage replenishment amongst
22 the two States -- in the two-State case.

23 ARBITRATOR DREHER: I understand that.

24 THE WITNESS: But is that the right
25 split?

1 As you can imagine, we have talked long
2 and hard about this. And in my opinion, it is the
3 right split.

4 I think algebraically, as several of the
5 other experts have pointed out, there is no -- you
6 could split it other ways, you could split the
7 residual other ways.

8 I think it's the right split because it
9 attempts to account for the combined impacts of both
10 states on storage depletion. In other words, again,
11 Beaver Creek, our posture child, why is storage
12 depleted in Beaver Creek? Because both Kansas and
13 Nebraska have been pumping.

14 If we were to look at just Nebraska
15 pumping and Kansas never existed, I don't believe we
16 would get storage depletion. We don't have a slide
17 of that up and I haven't reviewed that, but it's --
18 the storage depletion occurs because both States are
19 pumping, so both States ought to be liable.

20 And, to me, that is the nub of the
21 fairness issue. That may be moving towards a legal
22 question, I don't know; but that is -- for me, that
23 is where it comes down. And I think that is a fair
24 -- that is fair for the whole team.

25 I think I'm expressing the whole team's

1 view on that.

2 ARBITRATOR DREHER: Well, let me ask it
3 in the context of a hypothetical -- and I don't like
4 using hypotheticals, but to try to get at the center
5 of the differences.

6 If Nebraska had been pumping for -- and
7 again, I'm not suggesting that this relates exactly
8 to what we are talking about, but I just want to use
9 it illustratively to show why I'm concerned.

10 THE WITNESS: Yes.

11 ARBITRATOR DREHER: If Nebraska had been
12 pumping for 20 years, 30 years, whatever, and their
13 pumping had reduced baseflows from, hypothetically, a
14 thousand acre-feet to a hundred acre-feet --

15 THE WITNESS: Uh-huh.

16 ARBITRATOR DREHER: -- and then you have
17 Kansas come along and pump, you know, maybe -- maybe
18 an equal amount -- I guess for simplicity, let's
19 assume that it's an equal amount -- but they only
20 reduce the baseflows, what's left.

21 So when you apply your procedure, the
22 replenishment of storage gets charged half and half,
23 and it doesn't have any relationship to physically
24 what happened; but the main -- the first reduction in
25 baseflow -- and this is a hypothetical -- the first

1 reduction in baseflow was caused by Nebraska pumping,
2 not Kansas pumping because Kansas hadn't even started
3 pumping yet.

4 THE WITNESS: If I may work with your
5 hypothetical.

6 So we are at a particular year. Let's
7 suppose Kansas has been -- rather Nebraska has been
8 pumping for 30 years up to that point and Kansas has
9 been pumping for, say, five. The model would tell us
10 the impact of that Kansas pumping, and it would
11 presumably be small, because it has only been pumping
12 for five years.

13 ARBITRATOR DREHER: Well, but to catch
14 my concern --

15 THE WITNESS: Yes.

16 ARBITRATOR DREHER: -- let's extend this
17 out now. I mean Nebraska started pumping for 30
18 years and now Kansas pumps and we go another 50
19 years --

20 THE WITNESS: Okay.

21 ARBITRATOR DREHER: -- so we are
22 reaching -- hopefully, we are approaching some sort
23 of a state of equilibrium.

24 Now, we come along with the groundwater
25 model and we try to simulate Kansas on/Kansas off,

1 Nebraska on/Nebraska off without any regard for
2 physically how this developed, who depleted the
3 storage in the first place?

4 THE WITNESS: Right. And I would
5 suggest that that is, in fact, captured by the model
6 because the model starts the run with Kansas starting
7 50 years ago, or 80 years ago, or whatever it is --
8 did I say Kansas? I mean Nebraska starting 80 years
9 ago and compute where we would be with that pumping
10 occurring.

11 So the accumulative effects on storage
12 are present in the model. And our method would look
13 at what happens when there is no pumping and you turn
14 on Nebraska? What happens when you have both pumping
15 and then you turn off Nebraska? So you only have
16 Kansas pumping, obviously, and weight them
17 appropriately.

18 ARBITRATOR DREHER: It's without regard
19 to the pumping that caused the depletion in storage,
20 in the first place?

21 THE WITNESS: Oh, but I would suggest
22 that that is built into the model. So the baseflow
23 that you would get under each of the various model
24 results includes the history of pumping that you --
25 that you have.

1 ARBITRATOR DREHER: But if you have
2 reached something approaching equilibrium, if no
3 pumping was turned off, conditions wouldn't change;
4 but now you want to turn off, Nebraska off and all of
5 Kansas off, you come up with a residual and you split
6 it between them. Even on this hypothetical, it was
7 Nebraska that depleted the storage in the first
8 place.

9 And, you know, that's a hypothetical
10 construction.

11 THE WITNESS: Yes.

12 ARBITRATOR DREHER: That may not have
13 much bearing here; but the point is that the
14 algebraic derivation of those coefficients is not
15 able -- at least I haven't been able to figure it out
16 yet, doesn't reflect physical reality of what
17 happened, necessarily.

18 And I tried to construct the
19 hypothetical where it would fail.

20 THE WITNESS: Yes. If I may have just a
21 minute to think about this.

22 ARBITRATOR DREHER: Sure, of course.

23 THE WITNESS: I think I'm going to have
24 to work this through. I don't have an answer to your
25 concern at this point.

1 ARBITRATOR DREHER: Let me give you the
2 second part of the hypothetical, in fairnesses, so
3 you can think about this, as well.

4 And the second part of the hypothetical
5 is going to be closer to the physical reality,
6 although it still is a hypothetical.

7 In the first hypothetical, I tried to
8 construct it in a way that the timing of the
9 groundwater development caused storage to be depleted
10 first, before the second State came along and started
11 pumping; but now I want to extend it to location.

12 The location of the pumping may have --
13 may be what is responsible for the depletion in
14 storage and simply splitting the residual between the
15 States doesn't capture the difference physically
16 between where the pumping occurs.

17 THE WITNESS: Yes. Well, of course, the
18 location is captured in the model.

19 ARBITRATOR DREHER: I agree the location
20 is captured in the model, but you are distributing
21 the residual based upon algebraic coefficients. You
22 are splitting it equal, and I don't see where there
23 is any reflection in that split of physically where
24 the pumping occurs.

25 THE WITNESS: I will add that to my

1 homework list.

2 ARBITRATOR DREHER: Okay.

3 Now, given that, I don't know how you
4 want to proceed.

5 MR. DRAPER: I would be happy to let one
6 of the other parties start cross if that is what they
7 desire or it looks to me like we are not going to get
8 done with Dr. Ahlfeld today. We can break and start
9 fresh tomorrow.

10 ARBITRATOR DREHER: I mean, I know you
11 are trying to finish up and I'm sensitive to that,
12 but I want make sure we have a thorough examination
13 of this.

14 MR. BLANKENAU: We are prepared to keep
15 going on cross.

16 MR. DRAPER: You are prepared to keep
17 going on cross?

18 MR. BLANKENAU: I mean I'm prepared to
19 have you keep going on cross.

20 MR. WILMOTH: I'm going to handle the
21 cross, John. I have just a couple of questions.

22 MR. DRAPER: Very kind of you.

23 ARBITRATOR DREHER: There are a couple
24 of different ways we could proceed at this point.

25 I mean, we could recess for the day.

1 I'm not suggesting that is necessarily the best use
2 of time.

3 If Colorado and Kansas, or Kansas or
4 both, are prepared to proceed with cross-examination,
5 we could do that and either give Mr. Ahlfeld a
6 subsequent opportunity tomorrow to respond to the
7 questions, or we could -- we could suspend the cross
8 of Mr. Ahlfeld and you could proceed with another
9 rebuttal witness and then we will bring him back.

10 MR. BLANKENAU: I'm not sure that that
11 would be most useful to us at this time.

12 MR. DRAPER: Does Nebraska have other
13 rebuttal witnesses?

14 MR. BLANKENAU: Seven. No, I'm kidding.
15 Just one. Perhaps two more.

16 MR. DRAPER: Who is that going to be?

17 MR. BLANKENAU: Dr. Schneider, for sure,
18 and I don't know the other yet.

19 (Pause in the proceedings.)

20 MR. DRAPER: Your Honor, maybe the best
21 way to use our time, it's just about 4:30 here, is
22 maybe rather than us cross-examining before we have
23 heard the direct testimony completely and maybe
24 having to come back and do further cross-examination,
25 based on what the further direct testimony is, it

1 might be the best use of our time -- and I think we
2 are all interested in concluding as soon as possible;
3 but, secondly, being sure that we are covered the
4 issues fully -- that we maybe start at 8:30 tomorrow
5 morning and break now and we would begin with
6 Dr. Ahlfeld's responses to your questions and any
7 further questions that you may have and then begin
8 with the State's cross-examination.

9 MR. AMPE: Concur.

10 ARBITRATOR DREHER: You concur? What
11 about Nebraska?

12 MR. BLANKENAU: That would be fine with
13 us.

14 ARBITRATOR DREHER: All right. Well I
15 didn't think we would quit early today, but I guess
16 we will, and we will see you all at 8:30 in the
17 morning.

18 (WHEREUPON, the hearing recessed at 4:22
19 p.m. to be continued March 19, 2009 at 8:30 a.m.)

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CERTIFICATE

I, Carol Patterson, Registered Merit Reporter, do hereby certify that the above-named proceedings were reported by me in stenotype; that the within transcript is true and correct, to the best of my knowledge and belief.

Patterson Reporting & Video
Carol Patterson
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