

No. 126, Original

In The
Supreme Court of the United States

DEPOSITION OF NORMAN L. KLOCKE, PH.D., P.E.

STATE OF KANSAS,

Plaintiff,

v.

STATE OF NEBRASKA

and

STATE OF COLORADO,

Defendants.

Tuesday, February 14, 2012

8:20 A.M.

PURSUANT TO NOTICE and the Federal Rules of Civil Procedure, the above-entitled deposition was taken on behalf of Defendant State of Nebraska at 1525 Sherman Street, 7th Floor, Denver, Colorado, before K. Michelle Dittmer, Registered Merit Reporter and Notary Public within Colorado.

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6 Also Present via telephone: Joel Hamilton
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1 P R O C E E D I N G S

2 NORMAN L. KLOCKE, PH.D., P.E.,
3 having been first duly sworn, was examined and
4 testified as follows:

5 (Messrs. Larson and Hamilton were not
6 present at the commencement of the proceedings.)

7 EXAMINATION

8 BY MR. WILMOTH:

9 Q Good morning, Dr. Klocke.

10 A Good morning.

11 Q How are you today?

12 A Fine.

13 Q Thank you for coming. As you know, my name
14 is Tom Wilmoth. I'm counsel for the State of Nebraska
15 in this matter.

16 Could you please state and spell your full
17 name for the record.

18 A Norman, N-O-R-M-A-N, Lee, L-E-E, Klocke,
19 K-L-O-C-K-E.

20 Q Very good. And have you been deposed
21 before in any matters?

22 A Yes.

23 Q Could you tell me how many times?

24 A Three times.

25 Q And could you tell me the matters in which

1 you were deposed?

2 A The first one was a litigation between a
3 farmer and a pipeline company, and the pipeline company
4 had installed an underground pipeline across the
5 farmer's field. And the field was furrow irrigated, and
6 the farmer claimed that the water, as the water was
7 going down the furrows, did not get by, across the --
8 where they put the line in, and so it was halted at that
9 point so the rest of his field was not irrigated.

10 Q Okay. And how about the second one?

11 A The second one was involved with a personal
12 injury suit where irrigation -- a local dealer employee
13 was going out to fix an irrigation system, and he fell
14 off the system, so -- and it was whether the -- the --
15 there's an additional part added to the system as an
16 overhang that was constructed locally by the -- this
17 same firm, not by the manufacturers. That failed and he
18 fell and was hurt severely.

19 Q And the third time?

20 A It was a litigation in Nebraska where
21 the -- a livestock owner claimed that the creek where
22 his water supply for his cattle was had dried up
23 because -- allegedly because of the sprinkler irrigation
24 above him had drawn out enough water to -- the water
25 didn't flow in the stream anymore.

1 Q And in any of those instances, did you
2 perform any analyses comparable to those you have
3 performed in your expert report which was filed in this
4 case?

5 A In the last -- in the last one.

6 Q So that case involved crop production
7 functions and --

8 A Yes, crop production functions.

9 Q -- yield? Okay.

10 A And then, of course, an economic analysis
11 that was beyond what I did.

12 Q And what did you utilize to develop your
13 crop production functions in that case?

14 A In that case, I used the Nebraska Water
15 Optimizer, which has the same production function -- or
16 the source of the production functions is similar to
17 what we are dealing with today, and the parameters for
18 the -- that location were available through the Water
19 Optimizer. So I developed the crop production function
20 in that manner.

21 Q Perhaps you said and I did not hear, but
22 could you tell me where in Nebraska that work was
23 located?

24 A Yeah. It was predominantly -- the
25 watershed predominantly in Banner County is the Pumpkin

1 Creek watershed. I don't remember the other county that
2 was involved.

3 Q Thank you.

4 MR. WILMOTH: Let's go off the record for a
5 moment.

6 (Discussion off the record.)

7 Q (BY MR. WILMOTH) Dr. Klocke, before we
8 continue any further, could you just tell me if you are
9 currently on any medication or suffering any ailment
10 that would preclude you from testifying truthfully and
11 accurately today?

12 A No.

13 Q Thank you.

14 The State provided you with a Notice of
15 Deposition. I'd like to provide you a copy of that now.

16 MR. DRAPER: Here as an extra.

17 MR. WILMOTH: We'll mark this as Exhibit 1.

18 Q (BY MR. WILMOTH) Have you seen this
19 document before, sir?

20 A Yes.

21 Q And on the second page, it requests that
22 you bring with you any additional materials supplemental
23 to your expert report. Did you bring any such materials
24 today?

25 (Documents were tendered to Mr. Wilmoth.)

1 Q (BY MR. WILMOTH) Thank you.

2 A Another copy?

3 Q Would you be so kind as to describe the
4 nature of these materials?

5 A The one I'm looking at is an email from
6 Dr. Scott Staggenborg, agronomist with KSU at Manhattan.
7 And he is responding to something I requested as far as
8 the yields from alfalfa and sorghum. And as background,
9 I'm preparing my parameters that I used for those crops
10 in the crop production function.

11 So he was reporting to me what the mass
12 yields for irrigated and nonirrigated sorghum were and
13 also what -- the yields that he had experienced in
14 working with the field -- the KSU research field site in
15 Scandia --

16 MR. DRAPER: I think we should hold up for
17 just a second. We're getting some interference from the
18 phone.

19 MR. WILMOTH: We'll go off the record then.

20 (Discussion off the record.)

21 (Deposition Exhibits 1 through 5 were
22 marked.)

23 (At this time, Mr. Joel Hamilton joined the
24 deposition by speakerphone.)

25 Q (BY MR. WILMOTH) So for the record, we have

1 received four documents provided by Dr. Klocke. They
2 have been marked Exhibits 2 through 5, and I'd like you
3 to work through them in that order, if you would,
4 Doctor, in identifying each.

5 A Okay.

6 Q Perhaps pick up where you left off with
7 regard to Exhibit 2.

8 A Exhibit 2, which is the email dated Friday,
9 June 24?

10 Q Yes, sir.

11 A Okay. So I was in discussion with
12 Dr. Staggenborg on the appropriate irrigated and
13 nonirrigated yields for sorghum and also the -- in the
14 same fashion for alfalfa. And since he had been
15 involved with the Scandia -- or the work near the
16 Scandia research field, I was consulting with him on
17 those data.

18 Q And what does this email tell you?

19 A This email tells me that there's a range of
20 yield from your nonirrigated yield to your fully
21 irrigated yield and also that the magnitudes of those
22 yields were different in the case of sorghum from those
23 two sources of data.

24 One -- in the case of the NASS data, for
25 sorghum, does include, on the dryland side, yields that

1 would not -- would not necessarily be from a crop that
2 was preceded by another summer crop. For instance, it
3 might be wheat.

4 And the crop performance testing yields,
5 they were higher. The University was running those
6 plots so there was -- with excellent management. The
7 NASS yields covers the spectrum of management that would
8 be producing those yields from the farmers.

9 So this was the basis of my work to try to
10 find what those appropriate yields were for the inputs
11 of the production function equation.

12 Q And to which years do these refer?

13 A That, I don't know. I don't remember.

14 Q Do you recall if that was a relevant
15 consideration?

16 A Well, in the case of the production
17 function that we're using, I was trying to find an
18 average value for -- to put into that production
19 function. So --

20 Q Over some number of years?

21 A Right. So I was trying to understand
22 the -- more the broader aspect of it.

23 Q And if you don't recall the actual dates or
24 the years in question, do you recall generally how broad
25 a range you were looking at, how many years?

1 A Okay. In the case of the performance
2 data -- I'd rather -- I don't think I can put a number
3 on that. I just don't recall what that is.

4 Q So it could be an average of two years or
5 five years or fifty years?

6 A I would say it's more in the average of
7 five, five to ten on the performance data.

8 Q Okay.

9 A I don't know what year this NASS data were
10 pulled out.

11 Q Would that be something that Professor
12 Staggenborg would know the answer to?

13 A Yes.

14 Q Are you prepared to move on to Exhibit 3 --

15 A Okay.

16 Q -- the second email. If you would, please,
17 describe that exhibit.

18 A Again, I was working with Dr. Staggenborg,
19 and he also works with the weather data and the weather
20 data system that we have in Kansas on collecting data.
21 So he reported to me the average annual precipitation,
22 as he noted here, 1985 to 2010, and then the average
23 annual precipitation in 2000 [sic], 2006.

24 And I was looking at the aspect of whether
25 the fact that the average annual precipitation, '05 and

1 '06, was above average -- let me see. The average data
2 out of 2005 and 2006, those annual precipitations were
3 more than what the average, long-term average would be,
4 as noted in here.

5 So I was investigating what impact that
6 more rainfall above average was on the production
7 function equation, considering the production function
8 equation was used for average, long-term average
9 precipitation.

10 Q And what was your conclusion?

11 A My conclusion was, it made minimal
12 difference.

13 Q And why was that?

14 A I can just -- there's -- I can show it in
15 another exhibit.

16 Q Very well. Which exhibit are you referring
17 to?

18 A It's this table.

19 Q That would be Exhibit 5?

20 A Yes. Here I was looking at adjusting the
21 net irrigation requirement by 2 inches for corn and
22 soybean grown with a center pivot and using the
23 parameters from the production function equation. I was
24 trying to characterize that difference when you change
25 2 inches from the 10.1 to 8 and -- in the case of the

1 corn, and for soybean, from 8.6 to 6.6. And that's in
2 Table 1.

3 In Table 2, I just repeated -- the first
4 line of data in Table 2, I repeated from the
5 calculations that were done with the average net
6 return -- or net irrigation requirement. That's the
7 first line.

8 The second line was with an adjustment of
9 the -- down to 8 inches net irrigation requirement. And
10 those play out from 0 irrigation up to 18 inches of
11 irrigation.

12 And the third line there, the yield
13 difference between those first two lines of data,
14 indicate what the effect of that change in that
15 irrigation requirement was. So there is a minimal
16 change, and it was in the midrange of the irrigation
17 amounts that I put forward there.

18 And similarly, we performed that analysis
19 with soybean, going to 6.6 inches of net irrigation
20 requirement.

21 Q And are the graphics on the second page of
22 this Exhibit 5 simply a manifestation of these tables?

23 A That's correct. They're --

24 Q The top one reflects Table 1 and the --

25 A Yes, and the bottom reflects Table 2. Yes.

1 Q Can you explain to me how you went about
2 adjusting the NIR from 10.1 to 8?

3 A Okay. The first -- first looked at trying
4 to find out, well, what was the effective rain that
5 contributed to ET the -- in the crop,
6 evapotranspiration, what contributed to the crop when
7 they had maximum yield.

8 So I assumed a value for evapotranspiration
9 and then subtracted off the net irrigation to produce
10 what a -- effective precipitation that went into that ET
11 in a normal year.

12 Q Okay.

13 A So then I -- let's see. Then I looked at
14 the difference between the precipitation in 2005 and
15 2006 and the average precipitation, which was
16 approximately 4 inches.

17 And from the calculation of the
18 precipitation in that -- where I assumed the ET, and I
19 took the ratio of that precipitation into the average
20 annual precipitation. So I had a percentage of the
21 annual precipitation, the average precipitation that
22 was -- effectively went into the ET, assuming that ET
23 value. So I had a percentage to work with.

24 And I applied that percentage to the 4-inch
25 difference between the precipitation '05 and '06 and the

1 precipitation and -- on an average -- or annual basis.
2 So then I could find out or infer what the added
3 effective precipitation was for the -- in those two
4 years as an inference.

5 So that's -- that's how I arrived at the
6 2 inches, an adjustment in net irrigation return -- or
7 requirement.

8 Q And how did you select the ET value you
9 assumed?

10 A It was on my judgment, what it might have
11 been.

12 Q I notice that although the NIR figures
13 change due to your adjustment, the $Y_{sub\ ni}$ over $Y_{sub\ max}$
14 ratio does not change. Why is that? Wouldn't those
15 be expected to change?

16 A I just -- I just don't -- I don't recall
17 what I was -- my thinking at that point.

18 Q What about the data --

19 A Just -- just a little -- could I get some
20 more time?

21 Q Certainly.

22 A As I analyze this, I used the nonirrigated
23 yield, which would -- that come from the average
24 conditions, from the parameterization for the average
25 conditions, and I used the Y_{max} for that -- the same --

1 same yield that I had been working with before on the
2 yield max.

3 So that's the approach I took. So I used
4 the same values that were parameterized for the average
5 conditions.

6 Q So you wouldn't expect them to change then?

7 A Not the way I analyzed the data.

8 Q Okay. Is there an alternative way that it
9 could be analyzed that would result in a change?

10 A I'd have to give that a lot of study.

11 Q That wouldn't be reflected in your work?

12 A That's right, it was not.

13 Q All right. Thank you.

14 I notice in Table 2 that the yields with
15 the adjusted NIR appear to exceed those with your
16 original NIR; is that correct?

17 A In the cases of -- minimally, in the cases
18 in the midrange of the applied irrigation. If you go
19 from zero irrigation up to 18 inches, the difference,
20 the largest difference is in the range of 6 inches of
21 irrigation to 10 inches of irrigation.

22 Q And there doesn't appear to be any
23 difference once you reach 12 inches, right?

24 A That's right. That's what it's indicating.

25 Q For a layperson like me, does this mean

1 that essentially a higher yield would have been achieved
2 with the adjusted NIR?

3 A Not the way I did -- not the way I did
4 this. I held the -- as I said before, the nonirrigated
5 yield of Y_{ni} and the Y_{max} constant.

6 Q So, for example, at 8 inches, when there is
7 a 168-bushel yield in the original NIR and a 174-bushel
8 yield in the adjusted NIR, what's the cause of that
9 increase in yield with regard to the adjustment?

10 A Well, you've added -- you've added water to
11 the net -- or you decreased the net irrigation
12 requirement because you've -- you've added some
13 effective precipitation into that.

14 Q I see. So the crop doesn't really care if
15 the water that's applied to it is precipitation or
16 irrigation water; it just uses what's there. And if I
17 understand it in this case, with regard to the
18 adjustment, the additional precipitation --

19 A Has minimal impact on --

20 Q Well, at least with regard to those 8 --
21 pardon me, six bushels at 8 inches --

22 A Right.

23 Q -- the precipitation essentially displaced
24 the need for the additional irrigation water; is that
25 correct?

1 A Correct.

2 Q Now, you've also got an Exhibit 4. If
3 you're done with Exhibit 5, would you be so kind as to
4 explain Exhibit 6 -- I'm sorry, 4.

5 A 4. Is it 4? Okay.

6 Q I apologize for jumping around.

7 A Now, this is out of -- an excerpt from a
8 handbook that -- Irrigation Guide that USDA NRCS uses
9 for Kansas, and I went to this information.

10 On page 2, it indicates Chapter 4, Water
11 Requirements. It's part of the Irrigation Guide, if
12 you'll notice along the top. And I was particularly
13 zeroed in on sorghum and alfalfa, as those two crops
14 were not parameterized by the efforts with -- the
15 collaboration with University of Nebraska.

16 So I was looking at the net -- and this is
17 at 50 percent range of all chance, so looking at average
18 conditions. So I was pulling out the net irrigation
19 requirement for Republic County for alfalfa and sorghum,
20 which go back to -- well, they go back to my report,
21 expert report, on how those utilized.

22 Q Is that everything you would like to
23 discuss on these exhibits?

24 A Yes.

25 Q Okay. Doctor, returning back to Exhibit 4,

1 if you would look at page 2. I notice there's no
2 information there listed for Jewell County. Why is that
3 and how did you address that?

4 A The preponderance of irrigation --
5 irrigated acres was in Republic County, so I keyed in on
6 one county for -- Republic County for developing the
7 production function.

8 Q Is the Jewell County information available?

9 A Oh, yes. It would be on a different page.

10 Q Okay. Within the same publication?

11 A Within the same publication, yes.

12 Q Do you know how it would have differed, if
13 at all?

14 A I don't remember.

15 Q Thank you.

16 I'd like to hand you a copy of your CV,
17 which we will mark as Exhibit 6.

18 (Deposition Exhibit 6 was marked.)

19 Q (BY MR. WILMOTH) Do you recognize this
20 document, Doctor?

21 A Yes, I do.

22 Q And could you just identify it for the
23 record.

24 A It's my curriculum vitae.

25 Q For yourself?

1 A For myself, yes.

2 Q Thank you.

3 And does this document contain your
4 complete educational background?

5 A Yes, it does.

6 Q Is there anything you wish to elaborate on
7 as it might be relevant to the instant proceedings?

8 A I don't think so.

9 Q And does it contain a complete discussion
10 of your professional background?

11 A As far as my experience from student days
12 through the present, it does.

13 Q I'd like to talk to you a little bit about
14 some of the things that are contained in the CV,
15 starting with your title as professor and research
16 irrigation engineer at the Southwest Research-Extension
17 Center at KSU.

18 Could you tell me just generally what the
19 nature of your work involves in that regard?

20 A Well, I'm responsible for irrigation
21 project -- research project relevant to the area of
22 southwest Kansas in trying to develop projects that will
23 address water issues.

24 My primary work -- there's two or three
25 phases to it, but my primary work has been with actually

1 measuring the amount of water -- or amount of yield that
2 we can obtain for different levels of -- amounts of
3 water.

4 So we have a -- what we consider full
5 irrigation down to very minor irrigation and want to see
6 how much yield we can produce over a number of years.
7 So we work with corn, wheat, sorghum, sunflower,
8 alfalfa -- as I said, sorghum and for a couple of years,
9 we worked with soybeans.

10 And the -- and gather that information is
11 really irrigation -- folks like me have gathered that
12 information for years and years and years because it's
13 an important piece of information, the irrigation,
14 needing to know for management, and economists need to
15 know for going on with other economic analyses.

16 Q So is the ultimate objective of that work
17 to try and help producers optimize their yield under any
18 given condition?

19 A Well, it's a foundation for that because
20 anytime you make some -- you're converting that
21 information through the economists in developing what
22 the economic impact of the different levels of
23 information are to the producer.

24 Q And how does the producer utilize that
25 information in a day-to-day operation?

1 A In a day-to-day operation, probably not --
2 minimal. On a planning -- when you're planning your
3 strategy for the year, they come more into play there.

4 Q And what's the typical planning horizon?

5 A It could be for this next season. It could
6 be for several seasons and planning what crops you're
7 going to plant, in that type of decision.

8 Now, there are other -- other tools that
9 would go into more day-to-day operation, but this is the
10 responsive yield, the total irrigation. So you're
11 taking that -- a bird's-eye view or strategic view of
12 what you might do for the next year or several years
13 down the road.

14 Q So do you engage with these producers
15 directly?

16 A Yes, I do.

17 Q When do you typically do that?

18 A It's not a part of my official research
19 work, but in working with producer -- I mean, having
20 this information, we want to transfer that information
21 to producers in a way that they can utilize it in their
22 programs.

23 These response curves that I give them are
24 illustrations for them for what goes on, but they're
25 historical information. Then the economist -- a lot of

1 the economists, and I have to turn that historical
2 information into what -- what might happen.

3 Q I see. So it's used to project certain
4 yields --

5 A Yes.

6 Q -- given certain inputs, if you will?

7 A Given certain input, right.

8 Q And what model do you typically employ for
9 that purpose in the KSU setting?

10 A In my setting, it's -- the Kansas Water
11 Budget is the -- is the -- really the foundation for
12 projecting the yields.

13 But on top of that, of course, there's an
14 economic component that has to be brought in to apply
15 what costs are going to be associated for that
16 production at that yield level; and then what -- of
17 course what returns they would have, gross returns they
18 would have from the commodity price times the yield.

19 And that works together then to say, Well,
20 what am I going to get out of this crop -- out of this
21 crop economically.

22 Q And in your experience, when are these
23 folks -- what time of year are those folks generally
24 doing their planning?

25 A I've seen them try to want to start

1 planning as early as post harvest, thinking about
2 November, December, because they're thinking about,
3 well, I'm going to have to buy certain inputs to --
4 to -- to plan for the next year.

5 Now, it may go as late as closer to
6 planting in the spring, depending on what questions
7 they're asking.

8 Q What factors typically affect that time
9 horizon?

10 A I think it's more the personality and
11 the -- just how people plan. You know, people plan as
12 careful, methodical planners and then there's
13 spur-of-the-moment planners.

14 Q How does that Kansas Water Budget differ
15 from the model you've employed in the instant case?

16 A Okay. The -- I think the similarity is
17 there's an approach to say we have a volume of soil that
18 the crop draws water from and knowing what goes in and
19 out of that volume of soil, we can come up with how much
20 more that crop is using.

21 So it's a balance of the input/output. So
22 it's -- conceptually, it works with an input/output, as
23 far as I understand the Nebraska CROPSIM model.

24 Q Are there any differences?

25 A Yes. There are differences in how some of

1 the parameters are calculated and which parameters are
2 utilized in the models.

3 Q Do you have a preference for one over the
4 other? Obviously, you employ this one, but does that
5 mean you have a preference or you believe it's more
6 reliable?

7 A Well, I've tested both models with my
8 field -- the field data I started with. And I tested
9 both models, and the results I get with the years that I
10 have data for, there's close agreement.

11 Q So there may be some differences in the
12 parameters, but at the end of the day, the results are
13 comparable?

14 A I look at, you know, the results clear back
15 to what I showed in my -- my field data.

16 Q Now, you mention that you do the majority
17 of your work, it sounds like, in southwest Kansas. What
18 are the water issues that you're addressing down there?

19 A Well, in doing this planning and
20 strategically looking at crops, potential crops to plant
21 in relationship to the water supply, it's really -- from
22 the irrigator's issue, is that the capacity of the
23 aquifer-produced water to a well is diminishing as the
24 groundwater diminishes.

25 So there's -- in the case of Kansas,

1 there's a lot of -- the constraint comes from how much
2 water that well will produce. So that's -- from a
3 farmer's perspective, that is key in his mind: What is
4 going to be my supply?

5 From the -- then taking our information
6 then and others taking our information in, like I said,
7 economic models to try to say -- go to other larger
8 questions affecting the community or the general economy
9 of the area.

10 So we give some base- -- some baseline
11 information for them to work with as they look at their
12 alternative strategies.

13 Q And why is that groundwater level
14 declining?

15 A Well, we're pumping irrigation water.

16 Q The work you do in southwest Kansas and the
17 use of this Kansas Water Budget, is that applicable to
18 areas outside of southwest Kansas?

19 A With different -- different -- how would I
20 say this? The parameters that -- well, for instance,
21 the runoff parameter would change because of the --
22 again, the less efficiency of utilizing that water and
23 having more water precipitation and running off the
24 surface and --

25 Q Is this in, I'm sorry, eastern Kansas or

1 southwest Kansas?

2 A East central or later -- yeah, central
3 Kansas as you work east.

4 Q So efficiencies are less --

5 A Less on --

6 Q -- the further east you go?

7 A -- on precipitation. In working that
8 aspect of it in, the drainage, the amount of drainage
9 increases, again, because of the -- those impacts to the
10 water, when they come. And the calculations that we use
11 to calculate drainage are the same, but the inputs, the
12 influence drainage change. So that's another aspect of
13 it.

14 Q Okay. Does anything else influence the
15 nature of that drainage; soil type, for example?

16 A Of course. There -- there's specific
17 equations for the -- we use the main soil types that
18 we've been looking -- we have looked at will be -- maybe
19 four. There will be a silt loam, loamy sand, and fine
20 sand.

21 Q And what's the predominant soil type in
22 southwest Kansas?

23 A Southwest Kansas is silt loam soils.

24 Q And what about eastern Kansas?

25 A I'm not specifically sure how much clay

1 loam or more of a clay fraction come in there. I -- I
2 don't know those numbers.

3 Q Do you have any idea what the predominant
4 soil type is in the Kansas Bostwick Irrigation District,
5 for example?

6 A I can't remember that I've seen all the
7 soil maps.

8 Q I'm sorry, can you repeat that?

9 A I'm not sure, I was trying to recall in my
10 head what the soil maps and my -- well, I can't
11 specifically say percentages or what they are. My
12 understanding of them are -- would be there would be
13 silt loam soils.

14 Q So why not apply the Kansas Water Budget in
15 your present analysis?

16 A I made a recommendation to the Kansas team,
17 that I've been collaborating with Dr. Martin and
18 Dr. Supalla in Nebraska. And the parameters for the
19 model or the Cobb-Douglas Function that I used was how
20 the -- what was used in that -- those analyses.

21 And Dr. Martin had gathered or prepared or
22 calculated the -- all the parameters going into the
23 function I used in this matter, across all of Nebraska,
24 eastern Colorado and central -- from central to the
25 western part of Kansas.

1 So having a model that we had both worked
2 on and been presented through our work collaboratively
3 to the Risk Management Agency as a tool, and with a
4 possibility of needing to really evaluate what was going
5 on with the Kansas side of this work and the Nebraska,
6 if we needed to do that type of work, we would use the
7 same -- same model, the same procedures in both cases.

8 Q And you mentioned that this was -- this
9 tool was presented to the RMA?

10 A Yes.

11 Q What was the purpose of that use by the
12 RMA?

13 A They needed some foundation rate, a way to
14 calculate or project yields, rain yields, if there was a
15 change in the amount of water supply available,
16 especially when you went -- a sudden change.

17 This year I had less water -- or more
18 water, and all of a sudden the next year I would have
19 very little water. And there's no history of yields in
20 that situation for that particular farmer. There had
21 been historical average that the RMA had been working
22 with to calculate their appropriate proven -- a proven
23 yield. And when you --

24 Q I'm sorry, appropriate proven?

25 A Proven yield.

1 Q Yield?

2 A Proven.

3 Q Okay.

4 A Making this jump. If your water is
5 supplied in gradually, decreasing or increasing, then
6 that's reflected in that ten-year average that they use
7 for the proven yield. But this is in a case where
8 there's a change in that water supply with unknown
9 result, potential results.

10 Q So is it fair to say that was a tool to --
11 it was a forecasting tool?

12 A Yes, it is, based on a simulat- -- a
13 long-term simulation, going into the parameterization of
14 the function, production function.

15 Q Are there limitations to that tool when
16 it's used to backcast, if you will, certain effects?

17 A Okay, backcast?

18 Q Use it to determine what happened seven,
19 eight years ago.

20 A Well, I guess the only way I can
21 characterize that is the activity that I reported in my
22 official report, where I did go back and use that and go
23 back into prior data to make that comparison. That's
24 what I was involved with.

25 Q But that wasn't why the tool was developed?

1 A I'm not sure that I can answer that on all
2 the whys of -- maybe Dr. Martin and Dr. Supalla could
3 see it as far as other applications. So I -- I don't
4 think I can answer that question.

5 Q But when you were participating in
6 developing it, did you foresee its use in that way?

7 A I really hadn't thought about that, but I
8 looked at that -- looking back with my data, but I
9 hadn't given thought to that.

10 Q But you don't see any limitations inherent
11 in that tool when applied to a retrospective --

12 A You would have to -- you would have to take
13 the inputs of those years, if they were available, if
14 they're the appropriate inputs, to make the -- run it
15 through the model and make those estimations.

16 Q Could you identify some of those inputs for
17 me?

18 A Well, as you -- if you're doing this
19 specifically for a specific, you have to go back into
20 knowing the weather inputs we have, the precipitation,
21 really what was going on at that time that would
22 influence that water balance, inputs and outputs going
23 to what -- what the crop is using and yield -- that
24 yield it would potentially produce.

25 Q All right. Let me ask you about your role

1 as president and chief engineer of NLK Engineering. Can
2 you tell me what NLK Engineering is?

3 A Okay. That's just an acronym for Norman
4 Lee Klocke. I started -- started with this during 1997,
5 when I was -- between the times I was working for the
6 University of Nebraska and Kansas State University and I
7 was testing the water for me to see about private
8 consulting.

9 Q We've all been there.

10 A Yeah, testing that water. And, you know,
11 it has its ups and downs and -- as far as clients and --

12 Q We've all been there, too.

13 A And when the clients are there, we do an
14 admirable job, I think. I mean, we do the best -- the
15 best we can with those clients. But I really needed a
16 top-notch marketing person with me, so that was my
17 limitation. That -- I always wanted to try it.

18 Since going back to Kansas State, it's just
19 a sporadic thing as far as someone coming to me. I
20 don't seek out jobs. It's more what comes to me, do I
21 think I can handle, do I have the expertise to jump into
22 that situation.

23 But it has been -- in comparison to a
24 full-blown company or a person in a full-blown company,
25 it has been very minimal.

1 Q Is the current work you're performing on
2 behalf of the State of Kansas under that NLK moniker?

3 A Yes, it is.

4 Q Okay. And could you tell me who your
5 client base is at NLK, aside from the State?

6 A None right at the present.

7 Q Okay. I notice that your CV also lists
8 your experience as an agricultural engineer for the
9 Environmental Protection Agency. Could you tell me what
10 you did for EPA?

11 A Okay. I entered the agency in June of
12 1971. The agency was created in December 1969, so it
13 was a new agency kind of feeling its way.

14 But my primary work was in the area of
15 large cattle feedlots, and that was in the early days of
16 trying to do something with the runoff and the
17 contaminated runoff leaving the pens and coming up with
18 strategies and methods to control that water, keep it
19 out of the streams and deal with that.

20 So it was -- Kansas had been involved with
21 that, and I worked a lot with Nebraska on their cattle
22 feedlots, some in Iowa. But we were just trying to get
23 those engineering structures out, the ponds and --
24 catchment ponds and ways to fill -- reduce the amount of
25 solid materials going into these ponds and then methods

1 to get it out, to spread the effluent on the fields, so
2 the field application.

3 Q And for what did you receive the
4 Commissioner's Conservation Award from the Bureau of
5 Reclamation?

6 A That was from a -- if I recall this one
7 right, that was from a demonstration project that we
8 started, and it was continued on beyond my tenure at
9 University of Nebraska. But we had an extensive
10 demonstration project, when we actually went out on a
11 producer's field and tried to demonstrate different
12 strategies with irrigation and actually reducing the
13 water below the level of -- that the crop really wanted
14 or -- or to produce full yields and demonstrating to
15 find out what -- what's the -- how much water -- yield
16 you're going to lose in a -- producer scale fields.

17 The producer always -- when you're on small
18 plots, that's -- apply to us and they fit -- they --
19 unlike us, they experience the constraint of, I've got
20 to go clear around this field with my center pivot
21 system. It's going to take some time for me to get
22 there.

23 Where over in the research plot, you have a
24 protocol for when and how much water you put on, which
25 we have a system there we can respond exactly to that

1 protocol and -- in the smaller plot areas.

2 There's reasons for smaller plot areas to
3 start your ideas, but the producer sure likes to see how
4 it plays out for me.

5 Q So this is kind of like the difference
6 between test -- field tests and large-scale application
7 of your --

8 A Right.

9 Q -- concepts?

10 A Controlled. The environment stays where we
11 could do the statistics and the things that we need to
12 evaluate to see, well, are there differences in what you
13 did, where out on the producer's field it's a very
14 coarser measurement or coarser conditions.

15 Q Sure.

16 A But see how it plays out.

17 Q In your experience in that regard, how
18 representative are the field studies that you conduct
19 and how do they relate to the actual producer
20 activities?

21 A How do I characterize that? I guess --
22 maybe I'm not answering your question quite correctly,
23 but producers were paying attention to what we were
24 doing, and they started -- we had the producers as a
25 check over here, how we -- what we were doing. Then

1 staying on their farms for additional years gravitated
2 to what they saw the best of what we were doing.

3 So in that -- as they gravitated, we could
4 see, well, the change they're making, how they're
5 adjusting, and I think that was the most -- information
6 from both of us to say, well, can we see latitude for
7 the producers to move to a better position in their
8 management.

9 Q So it sounds like when you started the
10 field studies, maybe they're not terribly representative
11 of what's going on on the producers' side, but the
12 producers tend to gravitate toward that?

13 A It -- again, it depends on the producer.
14 We had some very good producers that were close -- in
15 close to what we were doing. We had some where they
16 weren't paying as much attention, and this -- this is a
17 very small sample of producers, but we went from
18 southwest Nebraska over to more what we call south
19 central on the western edge there, and they had more
20 precipitation to work with.

21 I am zoning in on one producer, but because
22 of not as much care taken for the interaction
23 precipitation with irrigation, they were overirrigating.

24 Q I see.

25 A And they're -- we inferred from that

1 overirrigation, they were also losing fertilizer,
2 nitrates in particular, through drainage.

3 Well, they -- because in their gravitation
4 to what we did, they cut their irrigation amounts
5 significantly.

6 Q Let me ask you about a couple of the
7 publications referenced in your CV. Turn your attention
8 to KS 463, if you look at the bottom right-hand corner.
9 Do you see that page?

10 A Yes. 463?

11 Q Yes, sir.

12 The second one down there is entitled,
13 "Development of deficit irrigation strategies for corn
14 using a yield ratio model."

15 Do you see that?

16 A Yes.

17 Q Could you tell me a little bit about the
18 development of deficit irrigation strategies? What are
19 those strategies and how are they developed?

20 A This work was conducted at South Dakota
21 State University by a graduate student there, and I
22 didn't get into the details of the strategy development.
23 My role was to furnish field data again, to do
24 confirmation of how their strategy and what they were
25 coming up with fit in their predictive sense.

1 Q I see.

2 A So I didn't get into the development side
3 of that.

4 Q In your experience, do producers attempt to
5 develop such strategies?

6 A Certainly they -- again, the -- well, it's
7 several different levels. They are trying to respond to
8 what they think will happen next year and adjusting
9 their cropping and management approaches.

10 During the growing season, then they're
11 looking at strategies of what -- when is my water most
12 effective? Do I have enough water in the soil to maybe
13 not irrigate as much, to hold off, and then pick it back
14 up?

15 And this is -- the point of -- or the --
16 where you are in the season makes a huge impact on that,
17 too, because the crop is using more water during the mid
18 part of the season than on the ends.

19 Q I see.

20 A So that factors in also. But there -- the
21 strategy then is to match their irrigation and
22 precipitation inputs to supply the proper irrigation.

23 Q Okay. In deficit irrigation, is that same
24 thing true, that you seek to apply most of the water
25 during the middle of the season, or is there some

1 benefit to holding back and applying in the latter part
2 of the season?

3 A Well, there's -- from the crop point of
4 view, yes, the crop can bear the stress generally and
5 the vegetative growth early in the growing season when
6 it's growing the plant.

7 Now, people get nervous when they see the
8 crop under stress out there, when, you know, well, my
9 crop, I've got to produce the product. Okay.

10 But overlap -- over the top of that, it's
11 the capability of that with respect to that well and
12 that irrigation system to apply the water.

13 So that -- those factors run together, so
14 if I don't think I can -- if I can hold back, it puts me
15 in disadvantage for the mid part of the season, when the
16 water's important for pollination and all that in the
17 mid part of the season. Then you might be shortchanging
18 yourself as far as potential yield.

19 Q So it sounds like there are a lot of
20 realtime decisions that need to be made during the
21 course of an irrigation season?

22 A It's -- and it's -- it's a management
23 strategy where, if you have weedy field, you have weeds,
24 you put something on it. If you have insects in your
25 field, you apply something visual.

1 In our -- our realm, what water is in the
2 soil is not visual, and that's the toughest thing to get
3 through is saying, well, yes, I have water down there
4 or, no, I don't and responding to the -- to those
5 situations.

6 Q I see. The next article down talks about
7 "Equations for drainage component of the field water
8 balance."

9 Do you see that?

10 A Yes. The one by -- with Stone as the
11 primary author or lead author.

12 Q Could you tell me a little bit about, first
13 of all, the field water balance and what the drainage
14 component of that balance is?

15 A Okay. The drainage component comes from --
16 it's the water that drains through the root zone, but
17 because the soil water is wet enough at the base of the
18 root zone, that water passes on out.

19 And in our region of the country, it won't
20 come back. There we have very deep soil. So it's on
21 the way to the groundwater.

22 Q Let me interrupt you. When you say your
23 region of the country, are you referring to southwest
24 Kansas?

25 A Southwest Kansas, southeast central Kansas

1 and Colorado.

2 Q So this is also true in east central Kansas
3 where, for example, KBID is located?

4 A Right.

5 Q Okay.

6 A If you have a -- the type of soil is the
7 important thing, is a well-drained soil, and the soils
8 we have are draining, we call well-draining. So they
9 have that potential for going on.

10 And the -- Dr. Stone has an equation or a
11 form of equation that he uses, based on some prior
12 research going quite a ways back, on matching up what --
13 if you have a certain soil water content in that bottom
14 of your root zone or in your profile, we would expect
15 this much drainage based on a function, again a
16 mathematical function.

17 And he goes out in the field with
18 instruments and gets the parameters for that function
19 based on the different soil types.

20 Q In a poorly drained field or a field in
21 which applied water doesn't leave the root zone as
22 quickly, does that water ever contribute to the water
23 requirements for the crop?

24 A Yes. It -- if it's -- is what we call
25 purged water or very slowly drawing water, it can

1 contribute as long as it doesn't get to the water
2 content that the roots can't live in, that go in there
3 and they need oxygen.

4 And so it kind of starves that -- that root
5 for oxygen. Then it's not productive at that level and
6 it's just depending on what's up there (indicating).

7 More typically, you would have that in
8 slower drainage if you have a clay soil, but there's
9 still slow drainage through a clay soil. But it's more
10 likely that more water will be held where the roots can
11 get it.

12 Q I'm confused by something I learned about
13 KBID recently, and I would like to understand your view
14 of it.

15 I understand that you're likening the
16 drainage in southwest Kansas to the drainage in KBID?

17 A Not -- well, again, going back to my
18 recollection of soils, I just -- I can't remember how
19 much the soils that you're describing might be there.
20 So --

21 Q Might be in KBID?

22 A In KBID. So I don't have that information.

23 Q Okay.

24 A There may be more soils like that where
25 water would be purged, but I don't have the knowledge on

1 that.

2 Q Have you been told anything about the
3 artificial drainage structures within KBID?

4 A No.

5 Q Let me ask you about an article two down:
6 "Planning for deficit irrigation."

7 Could you tell me a little bit about your
8 role in that regard?

9 A Okay. The planning for irrigation deficit.
10 It really goes back to -- let's see -- I've got to make
11 sure that I remember which one is which.

12 Q Was this different in fundamental concept
13 from the first one we talked about?

14 A Yes, yeah. It went back to, again,
15 utilizing my field data and that -- I was trying to find
16 out from my field data -- and in this case it was over
17 five years -- what was the trend, or when you applied
18 the statistics to it, what was the functional trend that
19 described that data. They're scattered around that
20 data, but coming up with that.

21 And then furthermore, taking the Kansas
22 Water Budget and running that model with the actual
23 conditions we had during those five years as far as
24 inputs. And then going -- in the case of our location,
25 gathering that -- the field component data and the model

1 runs based on our input data to see how close they came.

2 Q What was your conclusion from that
3 exercise?

4 A My conclusion was that they're very close.
5 The -- my inference on the difference was when the -- we
6 had less water applied, that there were some deviation
7 there at the lower ends of the yield in the water
8 applied.

9 And I attributed that to -- some to the
10 facts that we were using soil -- residue management and
11 had surface cover on the -- on the -- cover on the
12 surface and potentially more use of that water that
13 didn't evaporate into the crop.

14 Q At the very bottom of this page, there's an
15 article concerning: "Long-term responsive corn to
16 limited irrigation."

17 Can you tell me generally what the
18 differences are in the response over the short and long
19 term?

20 A The differences of what?

21 Q The differences in the response of --

22 A Oh, of corn.

23 Q -- of corn.

24 A Of corn. Let's see, I'm trying to zero in
25 on which experiment that was.

1 I guess the word "long-term" I was using
2 there was the fact that we performed the experiment over
3 a long time period.

4 Q So you deficit-irritated corn for a very
5 long time?

6 A For -- over a long time period. So that
7 then we were compiling the data from those years into a
8 database for analysis.

9 So the change in response from year 1 to
10 year 15, I didn't -- that wasn't the point of the
11 analysis. It was -- it was utilizing a large -- a long
12 data set to characterize the response over a long-term
13 period.

14 Q But you never drew any conclusions from
15 that?

16 A From -- differences from year 1 to year 15?

17 Q 15.

18 Do you recall that there was a difference
19 in the response?

20 A I don't recall that we did that analysis,
21 that it -- the one thing -- there was a portion of it --
22 I'm just trying to bring back -- they were trying to
23 turn that into a probability function, I think, so --
24 but it wasn't separating out one year versus -- first
25 versus last. I think there was a -- something in there,

1 that I'm recalling the right paper.

2 Q I'd like to turn the page and look at a
3 couple more articles here.

4 THE DEPONENT: Could we --

5 MR. WILMOTH: Oh, you need a break?

6 THE DEPONENT: Could we break?

7 MR. WILMOTH: Sure. We're pretty short on
8 time, we got a late start. Could we keep it to five
9 minutes?

10 THE DEPONENT: Sure.

11 (Recess taken from 9:29 a.m. until
12 9:36 a.m.)

13 Q (BY MR. WILMOTH) Doctor, I want to direct
14 your attention to the fourth article down on this page.

15 A Which page?

16 Q 464.

17 A 464.

18 Q Do you see that "Comparison of irrigation
19 strategies" article?

20 A Yes.

21 Q Could you tell me what strategies you were
22 comparing?

23 A This goes quite a ways back.

24 MR. DRAPER: I'm sorry, could you point out
25 where on page 464 you are?

1 MR. WILMOTH: The fourth article down.

2 MR. DRAPER: Thank you.

3 A I know we put on different -- we put on
4 different irrigation events from zero -- I don't recall
5 on the top end how many irrigation events we did on
6 the -- to the most irrigation events. I believe there
7 were three different levels of irrigation, if I recall
8 that correctly.

9 Q (BY MR. WILMOTH) Does that mean you just
10 applied different amounts of irrigation water, or was
11 there a timing component or --

12 A It was a timing component. Boy, that --
13 that one reaches back as far as whether there was an
14 amount component for each irrigation.

15 Q Do you have any recollection of your
16 general conclusions in that study?

17 A Well, we -- let's see. I know we had
18 difference in yields, of course, and I think we
19 evaluated also how far the -- or we -- we took soil
20 water measurements and found that the -- at the head in
21 the field or the field -- the head -- the field -- part
22 of the field nearest the irrigation supply -- this is a
23 gated pipe -- of course it had more soil water in it and
24 less as we went down the row. We --

25 Q Does that -- let me stop you there. Does

1 that mean that your efficiencies differ throughout the
2 field?

3 A Well, your time involved in how much time
4 is available to infiltrate water is more at the upper
5 end of the field than the lower end of the field. So
6 the crop is utilizing more of the -- or more of the
7 applied water for yield as you go down the field on a
8 percentage basis.

9 In this case, we were not trying to stop
10 irrigations when the water reached the end of the field.
11 There was some runoff, I think, in the highest
12 irrigation treatments, but we were attempting to keep
13 the water on -- it was a -- fairly short plots.

14 Q Did you see any difference in yield
15 throughout the field?

16 A Yes, from the top end of the field to the
17 bottom end of the field, there's more yield at the top
18 end of the field than the bottom.

19 Q And does the top mean --

20 A A one-point use --

21 Q -- the point at which the irrigation water
22 is delivered?

23 A Yes.

24 Q I see. And is that true -- strike that.

25 Let me ask you about the seventh article

1 down, the "Crop Water Allocator"?

2 A Yes.

3 Q Did you participate in developing that?

4 A Yes, I did.

5 Q And could you just explain what that is
6 exactly?

7 A Well, this goes back to an assessment of a
8 question of, given a water supply for my -- that I
9 expect from my field, what does the optimum mix of crops
10 or optimum crop to choose. First you have to choose --
11 decide, well, am I going to plant all my crop in one --
12 on the one field, given if I have a common water supply,
13 can I designate water going more to one crop or another
14 crop?

15 And the economists bring in their -- their
16 end analysis, what the input costs, money, prices would
17 be.

18 So if you have a given amount of water,
19 plus precipitation, that you expect a certain yield
20 level based on production function in the -- in the
21 tool.

22 So then it goes and looks at all the
23 different combinations of crops that you may want to
24 look at as far as selection of crops and find out, well,
25 will one crop alone be best or would I consider

1 splitting the field and putting -- with the same water
2 supply, putting more on one crop than the other crop?

3 So it goes through all those possibilities
4 and then stacks the results, each option, by the most
5 net return or the -- what I -- we call net return is the
6 gross return, which would be the price versus -- times
7 the yield, subtract off the input cost, and it's --
8 there's no fixed cost in the evaluation.

9 Q And so is the objective of that to allow
10 the producer to determine the best crop mix,
11 essentially?

12 A Right.

13 Q Okay. Could that Crop Water Allocator have
14 been used to conduct the analysis you conducted in this
15 case?

16 A No. I didn't -- I didn't examine that --
17 that issue. You're saying, in this case --

18 Q Could you have used Crop Water Allocator to
19 determine the values you determined in your report?

20 A Well, I limited my work to the production
21 function development, and that was passed on through the
22 economic part of the study. And so I didn't have any
23 part in choosing the analysis or how the analysis was
24 done beyond furnishing the crop production function.

25 Q So could it have employed the Crop Water

1 Allocator?

2 A I was trying to remember if -- if -- in
3 visiting with the economist, whether that came up. I
4 don't recall. They chose their analysis.

5 Q Do you know if the Bureau of Reclamation
6 uses the Crop Water Allocator for any of its projects?

7 A I'm not aware of that.

8 Q Do you know if KBID utilizes it in any
9 regard?

10 A I'm not aware of that.

11 Q Does the Crop Water Allocator apply to a
12 certain precipitation zone or is it -- does it apply
13 equally across Kansas from west to east?

14 A It would -- some of the parameters would
15 change -- okay, wait a minute. I think -- I'm trying to
16 get myself with the Crop Water Allocator.

17 It would change -- the production function
18 would change as more precipitation is added. So it
19 would apply -- we have put -- the Crop Water Allocator
20 precipitation band's region right now is 21 inches of
21 annual precipitation and we're increasing that to
22 possibly 24 inches.

23 So that would be the primary change. And
24 then generating the appropriate crop production function
25 at the precipitation level.

1 Q How would the crop production function
2 change, say, if you were in a 26-inch level?

3 A Okay. It would be what I call more -- more
4 curvilinear. It would start with a higher nonirrigated
5 yield at the start, when you have zero irrigation, so
6 that would be more yield with -- with that precipitation
7 level. And it would be more curvature, like say
8 this (indicating) versus this, curvature in my hand
9 versus straight hand, when you -- until you would get to
10 the maximum yield, potential yield from that field and
11 then they come back together.

12 Q Could I ask you just to draw that for me --

13 A Sure.

14 Q -- if you don't mind. Do you have a pen?

15 A If I could borrow.

16 Q I'll give you mine.

17 A (The deponent complied.)

18 Q Thank you.

19 MR. WILMOTH: Let's mark that as Exhibit 7,
20 please.

21 (Deposition Exhibit 7 was marked.)

22 Q (BY MR. WILMOTH) Let me ask you about an
23 article two up from the bottom.

24 A Page 464?

25 Q Yes, sir. "Cropping systems for stretching

1 limited water applies in the central Great Plains."

2 Do you recall the general nature of that
3 article? Now we're really going back.

4 A Well, this was a long-term experiment. I
5 need to recall the . . .

6 We had corn, wheat and soybeans, and we had
7 continuous corn, corn after corn, and we had set up
8 three different irrigation levels, regimes. And we had
9 dryland and when -- we had generally put on 6 inches of
10 water.

11 And then we put on the irrigation -- by
12 scheduling irrigations, accounting for soil water and
13 accounting for precipitation, we put on that much water
14 under the best management practices for that top level
15 of irrigation, the best management we would recommend
16 and follow.

17 So we had continuous corn. We had a corn/
18 soybean rotation, so there was corn one year, soybeans
19 another year. We had a rotation of wheat, followed
20 by -- man -- well, we had a two-year rotation of wheat/
21 soybean. So one year we had wheat, one year we had
22 soybean, and we planted the wheat right after the
23 harvest of the soybean, back around to those two crops.

24 And there was a sequence of three crops
25 there, and I -- there were three crops of wheat, corn

1 and soybean, and I believe the -- it was wheat going to
2 corn and going to soybean and planting the wheat back in
3 the -- right after the soybean harvest.

4 And we were taking yield results for all of
5 these different combinations in all our replicated plots
6 for these three different water amounts.

7 Q So in terms of stretching supplies, you're
8 really referring to different crop rotations?

9 A That, and the difference in the amount of
10 the water we were putting on, the combination of both of
11 those effects.

12 Q In your experience, are there any other
13 ways in which producers stretch limited supplies, for
14 example, spreading water or stacking water to achieve an
15 optimal yield?

16 A In this case, we had a -- pretty much a
17 prescription for how much -- how they distributed the
18 6 inches over the plots, and that was based on stage of
19 growth.

20 Q Sure. I'm just asking, as a practical
21 matter, regardless of this study.

22 A Okay. Can you repeat the question again?

23 Q Sure.

24 In your experience, notwithstanding this
25 particular study, are there other ways in which

1 producers stretch water, such as spreading it over a
2 larger area or stacking it on certain crops to optimize
3 yield?

4 A I think they make those -- make those
5 adjustments based on water supply.

6 Q And when you say "water supply," are you
7 referring to irrigation water --

8 A Irrigation water, irrigation.

9 Q -- or --

10 A Irrigation water.

11 Q Irrigation water alone?

12 A And potential precipitation.

13 Q Okay.

14 A We have -- well, I can speak to western
15 Kansas better -- that we have producers that are -- the
16 same well, are planting part of their field with corn
17 and part of their field for another crop, predominantly
18 wheat, but sometimes sorghum, as you say, putting more
19 water on the corn side to produce more yield over here,
20 but the other crop is more of a dryland crop that can
21 take less water.

22 Q I see. And in that way, they optimize the
23 corn yield, maybe at the expense of the wheat yield
24 or --

25 A Possibly, but -- now that -- the strategy

1 is do better -- as well as you can on both, but by prior
2 experience, research, that you're going to be more
3 return and yield from water on the corn side.

4 Q Okay. Let me turn the page to 465 at the
5 very top. You've got an article there entitled,
6 "Irrigators response to system type, in-season
7 precipitation and geography."

8 Could you reflect on that for a moment and
9 tell me your recollections of how producers respond,
10 particularly to in-season precipitation?

11 A Now, I can't recall that in reference to
12 this exact article and that's -- but in-season
13 precipitation is more of a scheduling of the water, what
14 you receive in relationship to what the crop is
15 utilizing. So you're trying to balance your irrigation
16 amount and your precipitation you receive to this
17 requirement of the water during the growing season.

18 Q About halfway down the page, you've got a
19 couple of articles that talk about different activities
20 on sandy -- irrigated sandy soils. Do you see that?
21 "Intercropping corn in perennial cool-season grass on
22 irrigated sandy soil," and then two down: "Surface
23 cover from corn residue on sandy soils"?

24 A Yes.

25 Q Can you tell me a little bit about how

1 sandy soils respond relative to other types of soils?

2 A Respond how?

3 Q How do crops grown in sandy soils respond
4 to the application of irrigation water, for example?

5 A Respond in yield?

6 Q Yes, sir.

7 A Okay. With proper management -- again,
8 going back to this applying the proper inputs to get the
9 optimum -- for maximum outputs, they don't differ. I
10 mean, but --

11 Q They don't differ from what?

12 A Well, in, say, a silt loam management or
13 sandy loam soils, you can still get the equivalent
14 yields with proper management in the two media --

15 Q Okay.

16 A -- in the two media. Their limitations are
17 a difference in management because the sandy soil holds
18 about half the available water. I mean, it doesn't hold
19 as much water in the same depth as a silt loam soil over
20 here (indicating).

21 So you adapt your management so that you're
22 putting on potentially less water each time so that
23 you're not exceeding that holding capacity.

24 Q In the silt --

25 A In the sand -- in the sand.

1 Q Okay.

2 A You're matching your irrigation management
3 with that available water-holding capacity.

4 Q Okay.

5 A You have some more latitude over the silt
6 loam soil because it has more of that holding capacity,
7 but you're still trying to -- with good management,
8 trying to still make that match.

9 Q But in the silt loam soils, like in KBID,
10 for example, if you apply additional water, it's just
11 going to run off, right?

12 A It's -- I'm talking about -- when I -- my
13 mind was going with center pivots, so --

14 Q Okay.

15 A -- in -- that's where I was coming from
16 when I was talking about these differences.

17 Now, in furrow irrigation, the
18 water-holding capacity and the drainage are -- come into
19 the runoff question more predominantly when you have
20 silt loam comparison with sandy loam soils, because then
21 the water-holding capacity limitation of sand and the
22 higher infiltration rate of the sand allows more
23 drainage when you're going from one side of the field in
24 your application rather than your center pivot.

25 Q So just so I'm clear then, are you

1 suggesting that on the silt loam with furrow irrigation,
2 there will be less infiltration?

3 A The infiltration rate would be less.

4 Q Okay. What does that mean for the --

5 A Well --

6 Q -- crop irrigation requirement?

7 A Well, the irrigation rate is less. It goes
8 back to how much time that water has to soak in and how
9 much time you run the water down the furrows.

10 Now, if you really had a stretched-out
11 time, the silt loam would also drain below --

12 Q Okay.

13 A -- at the top end of the field more
14 predominantly.

15 Q But if you're on, say, a 60-day irrigation
16 schedule, what would happen?

17 A Now, what do you mean by 60-day irrigation
18 schedule?

19 Q Well, if you were delivering water in a
20 60-day period instead of, say, a 120-day period.

21 A Well, if you're -- you're irrigating,
22 you're not going to generally apply water during that
23 entire 120-day period.

24 Q Why is that?

25 A Because the growing season for the corn

1 would be approaching that 120-day period, and if you
2 were in a place or a season where there was some
3 precipitation contribution or precipitation held in
4 storage, then the crop can utilize that early water.

5 And again, it can go under stress and can
6 be the time you can limit water, so you would start your
7 irrigation later in the season.

8 Q I see. So you wouldn't distribute the
9 irrigation uniformly over the irrigation season then?

10 A Oh, the time season? No.

11 Q Okay. On the same page, under the heading
12 "Symposium or Workshop Proceedings" --

13 A Yes.

14 Q -- the very first one speaks about deficit
15 irrigation in no-till soils. And I realize this is
16 looking at carbon concentrations, but I've seen through
17 your CV a number of references to no-till practices.

18 Do those practices have an impact on yield?

19 A In a sprinkler -- more in a sprinkler
20 irrigated situation. No-till practices come into play
21 because when we -- we can plant our -- our plant --
22 present planting equipment, we can plant through
23 residues and have that layer of residue there to really
24 reduce the rate and energy to the soil surface. You
25 have an insulating layer.

1 Q Okay.

2 A And you're reducing the energy so you don't
3 evaporate as much water when you -- every time you wet
4 the soil surface.

5 Q I see. So the extent to which no-till is
6 practiced could affect yield in any given area?

7 A It would be in the -- in the -- in center
8 pivot arena. In the furrow irrigation arena, the
9 no-till or leaving the residue where you're creating a
10 furrow to run the water down, it becomes problematic
11 because it actually slows the advance -- can slow the
12 advance of the water down the field if that residue is
13 still remaining there.

14 Q At the bottom of page 466, you've got an
15 article there referenced: "Trends in income from
16 limited irrigation using the Crop Water Allocator."

17 Could you explain to me what you were
18 attempting to evaluate there?

19 A I don't recall what -- what trend -- what
20 characteristics were of the trends. I just don't -- I
21 know it's trends in income, but I don't know what --
22 remember what inputs we changed to see those trends. I
23 don't recall that at all --

24 Q Okay. All right.

25 A -- but we changed something that affected

1 the crop.

2 Q Let me turn your attention to 467, the
3 third article from the bottom: "Irrigation management
4 strategies for corn to conserve water."

5 Do you recall participating in that paper?

6 A I was a -- well, of course, in here I was a
7 third author. That work was a continuation of that --
8 of a U.S. Bureau of Reclamation project.

9 But the scope of the work and the
10 methodology and the approach was changed after I left,
11 and I think -- I believe this was based on that
12 subsequent work, so -- I was coauthor because I was
13 involved in the overall project in the early part, but I
14 really didn't get into the management or execution of
15 what followed, and Mr. Melvin was in charge of that.

16 Q Let me turn your attention to page 469,
17 middle of the page. There's an article called:
18 "Storage efficiency of off-season irrigation" water --
19 excuse me -- "Storage efficiency of off-season
20 irrigation."

21 Do you see that?

22 A Yes.

23 Q What was the nature of that work?

24 A Again, I wasn't the lead on this, and the
25 particular conference this was reported at, it would

1 have been a brief or abstract type of report, and I
2 really don't know what went into that abstract.

3 The -- Dr. Stone, I know, was trying to
4 ultimately find out if preseason irrigation was -- was
5 when was preseason irrigation worthwhile, when wasn't
6 it.

7 Q Do you recall any conclusions from that
8 work?

9 A I can picture some of the graphs, but -- I
10 know that, again, your -- your starting point was soil
11 water.

12 Q Soil water?

13 A Soil water, soil water. Then plays in
14 directly on how valuable that -- that irrigation is
15 after you plant the crops.

16 So your initial conditions, say, in
17 essentially after harvest or early in the spring, those
18 initial conditions really impact whether you really have
19 enough water there to carry into the season and impact
20 the growth and yield of the crop.

21 Q We talked a little bit about the Water
22 Allocator, and we talked a little bit about the Kansas
23 Water Budget; do you recall?

24 Could the Kansas Water Budget have been
25 used to perform the analysis you performed in this case?

1 A Well, I made the choice, as I said before,
2 that -- of -- what really influenced my choice was that
3 I collaborated with the Nebraska folks on a common
4 modeling approach and the parameterization was there.

5 I did not do anything with the Kansas Water
6 Budget to see if it would apply. I've never been
7 involved in any of that work.

8 Q Do you know if any of your colleagues have
9 conducted an analysis using the Kansas Water Budget to
10 determine yields in the KBID area?

11 A I'm not familiar with that work.

12 Q Does that mean you don't know if it exists
13 or you -- it exists and you're just not familiar with
14 it?

15 A Well, it -- I did see a reference in the
16 Bill Golden report that referred to a specific
17 manuscript that was used in their report.

18 Now, I don't know what preceded the --
19 where the analysis was done. I know that that reference
20 came back to a manuscript where the Kansas Water Budget
21 was used in that manuscript. I don't know how it was --
22 how the Kansas Water Budget played into Golden's work,
23 but there was a reference there in that.

24 So that's the only indication I had of --
25 that it referred back to the paper where there were crop

1 production functions developed.

2 Q And for the record, Mr. Golden's work
3 you're referring to is the work that was provided to you
4 and filed in the arbitration preceding this action; is
5 that correct?

6 A I think that -- that's my understanding,
7 that went in -- that was in the arbitration, yes.

8 Q Okay. Thank you.

9 We also spoke about your work with
10 Dr. Martin, and for the record, is Dr. Martin in the
11 room today?

12 A Do I answer? Yes, he is.

13 Q Okay. Thank you. And -- very good. Same
14 Dr. Martin.

15 Could you describe the nature of the work
16 that you conducted with Dr. Martin and what its purpose
17 was?

18 A Concerning -- concerning what?

19 Q Well, really concerning any of the work
20 that you performed, but primarily on crop yield, crop
21 production functions and crop yields?

22 A Well, that goes quite a ways back as far as
23 in one of these references, I think it's Schneekloth,
24 let's see, I'm looking -- okay, on page 464.

25 Q Uh-huh.

1 A Third from the top, that's it -- no. Where
2 is it? That's not it.

3 Well, there's -- okay. Page 465, second
4 from the top. This is the study that we were visiting
5 before about, about different crop rotations and three
6 different water levels applied to those.

7 Mr. Schneekloth was a graduate student on
8 that project, along with colleagues -- a colleague at
9 the North Platte side, Dr. Martin, and Dr. Clark was an
10 economist on the project.

11 And Dr. Martin was the Lincoln -- he was
12 at -- on campus at Lincoln so he mentored the graduate
13 student, Mr. Schneekloth, in this project. So he had a
14 direct linkage to that project and development of that
15 student and that -- there's a thesis that resulted from,
16 of course, the master's thesis work and then furthermore
17 into this -- this manuscript that was published in a
18 journal.

19 Q And there's certain work of Dr. Martin's
20 that's referenced in your expert report, correct?

21 A Correct.

22 Q And did you participate in that work?

23 A I partic- -- my participation was in using
24 my field data to compare with the resulting -- the crop
25 production functions that were developed for my location

1 and seeing how they compared.

2 Q But you didn't work with Dr. Martin to
3 develop that model?

4 A No, I did not. I didn't work with him on
5 the development of the crop production function itself.

6 Q Do you consider yourself to possess a
7 thorough understanding of that crop production function,
8 or are there any things about it that you don't feel
9 comfortable in your understanding of it?

10 A Well, I understand the mathematical
11 equation and using their -- the developed parameters
12 that go into that equation. I was not involved with
13 developing the parameterization, as we call it, the
14 parameters that went into the equation. I was not
15 involved in that process.

16 Q Do you know how those were developed?

17 A My -- what I understand is that Dr. Martin
18 used his CROPSIM model for looking at long-term record,
19 his inputs into that model, county by county, in the
20 coverage area of Nebraska, eastern Colorado and central
21 and west central -- or central and western Kansas.

22 Q So does your -- is it your understanding
23 that Dr. Martin relied on averages to generate those
24 parameters?

25 A My understanding is that, no, he used each

1 year -- my understanding is he used each year to execute
2 the crops in the model and to find -- find out the
3 outputs from those years of executions.

4 Q And you mentioned that that application was
5 based on areas other than eastern central Kansas,
6 correct?

7 A That was my understanding, yeah.

8 Q Does it give you any pause or create any
9 reservation in your mind to apply that to an area to
10 which it wasn't calibrated, for lack of a better word?

11 A I can only speak to how it -- it compared
12 with my data in -- at my location, so I --

13 Q In southwest Kansas?

14 A In southwest Kansas. I don't think I can
15 speak to that more general question.

16 Q How it would apply in eastern Kansas, you
17 mean?

18 A That's right.

19 Q Okay. What did you use to estimate yield?

20 A In what -- in what effort?

21 Q In the work that you performed.

22 A My field -- my field project, we went out
23 and physically took yield samples --

24 Q Okay.

25 A -- in the plots.

1 Q And how did you -- how did you estimate
2 yield when you compared that to Dr. Martin's work?

3 A Well, I -- it was actual measured data, so
4 I used the data that we measured in the field for yield.

5 Q Okay. Let's turn to your expert report.
6 I'll hand you copies for your convenience, just ask you
7 to review this and validate that it's complete. We'll
8 mark this as Exhibit 8.

9 (Deposition Exhibit 8 was marked.)

10 Q (BY MR. WILMOTH) Could you just confirm
11 that that's a copy of your expert report?

12 A Yes.

13 Q Obviously, the purpose of the report is to
14 deal with this crop production function. Could you
15 explain to a layperson what crop production function
16 generally is?

17 A I've heard it referred to as -- well, it's
18 the amount of yield you get from a certain amount of
19 irrigation. So in the functional way, it's trying -- it
20 would be a trend from data or simulation somehow to show
21 that from zero irrigation to irrigation where you get
22 full yield, what that trend looks like.

23 Q Is that comparable to what you've drawn as
24 Exhibit 7?

25 A That's, yes, for the -- comparably, it's

1 for -- those are for different precipitation amounts.

2 Q All right. Thank you.

3 And what's the typical use of a crop
4 production function?

5 A Well, it's the basis for us to, first of
6 all, let irrigators know about how the crops respond to
7 irrigation, and there's -- the time -- the thing we're
8 trying to impress on the irrigators is that it's -- they
9 have more yield produced from the same -- from lower
10 amounts of irrigation than you have with added and added
11 irrigation.

12 So there's more inefficiency, causing what
13 the economists call diminishing returns. It's the same
14 phenomenon for applying fertilizer.

15 Q So is it really a planning tool to help
16 people understand how much water to apply, how much
17 fertilizer to buy, that kind of thing?

18 A In a -- in an understanding way, but then
19 that is used in economic models to say, again, how
20 much --

21 Q Sure.

22 A -- yield I get from so much water. In a
23 planning sense, we would go back to what we talked about
24 with the Crop Water Allocator: You find your yield from
25 the amount of water, say, you're going to have available

1 to you.

2 But that is a planning mode. Did you ask
3 about what crop -- what producers are doing during the
4 growing season?

5 Q You've answered my question.

6 A Okay.

7 Q Is it a predictive tool? Does it
8 essentially tell you what's going to happen if you do
9 these things in a certain proportion to one another
10 or --

11 A The Crop Water Allocator -- well, it's
12 predicting within the constraints of the inputs you
13 have, as far as the Crop Water Allocator. You have
14 to . . .

15 Q So the output is only as good as the
16 constraints --

17 A Right.

18 Q -- is that what you're suggesting?

19 A Right.

20 Q All right.

21 A In all -- you know, in models.

22 Q Do you normally, in your work, use a crop
23 production function to determine what might have
24 happened in prior years? Is that a common use in your
25 world?

1 A Well, from what I do, I'm trying to develop
2 the crop production functions from actual field data.
3 That's my world use of it.

4 But then it goes into these other
5 applications for more planning tools. And I'm involved
6 in the development of the Crop Water Allocator, but
7 that's the -- the key ingredient to get from irrigation
8 to yield.

9 Q But you refer to these planning tools.
10 Again, to me that means a forward-looking tool.

11 A Uh-huh.

12 Q Is it a generally accepted practice to use
13 crop production functions to ascertain what might have
14 happened in prior years?

15 A In prior years? Well, I -- again, I use my
16 historical data when I have the data.

17 Q But you use it to input into your model to
18 get a crop production function to plan with into the
19 future?

20 A Uh-huh.

21 Q So is the answer to my question no?

22 A I guess I'm not -- still not understanding
23 where -- what you're --

24 Q Do you typically use a crop production
25 function to ascertain what would have happened a decade

1 ago? Do you conduct those analyses normally?

2 A Well, in the case that we're talking about
3 today, we did use a crop production function to
4 ascertain what would happen on an average year.

5 Q Have you done that before?

6 A Have I done that before? I'm trying to
7 think through several -- a number of years.

8 I guess the area that I've been involved
9 with in doing that is more with the crop yield
10 predictors, another -- another tool that we developed.
11 So given the inputs, especially when you start the
12 growing season -- that's a critical one. Given the
13 inputs -- well, I guess that -- I did that exactly in
14 the one manuscript I was talking about, where we did the
15 comparison with the Kansas Water Budget.

16 So I'd say that I was using what happened,
17 I mean the inputs, the soil water inputs, the weather
18 inputs, everything that went into that model, and
19 compared it back with what happened before.

20 I'm not sure if I'm making -- where you
21 want to go.

22 Q I think that's sufficient.

23 You refer to this term, I think I've heard
24 it a couple of times, using crop predictors, yield
25 predictors. What is a yield predictor or yield

1 prediction?

2 A Well, it's -- it's like -- it's more
3 simulation of what conditions you want to put into it,
4 what parameters you want to put into it.

5 Q Okay.

6 A And then having some sort of an algorithm
7 or method to turn that into a yield prediction.

8 Q Okay.

9 A So it's simulating, based on how much --
10 what you know, that you create -- the conditions you
11 want to create and then spin that out into a yield.

12 Q So again, that's a forward-looking --

13 A Well, it could be backward-looking because
14 you -- as I did, I -- my field data was back
15 here (indicating), and so I was looking back at -- if
16 applied a simulation to those conditions back here, how
17 did I -- how did it compare results from the simulation
18 versus actual field measurements.

19 Q Isn't that really, though, just calibrating
20 your predictor --

21 A No.

22 Q -- to actual conditions?

23 A No, it wasn't. The predictor was
24 calibrated, and you had -- you had the -- all I was
25 doing was putting in the appropriate drivers to the

1 model.

2 There's two steps you can go through. I
3 was doing the verification or validation part of it.
4 You take another set of data and set the parameters.

5 Q Why would you engage in the process of
6 looking at that historical information? I believe you
7 said soil type, precipitation and some other things?

8 A Right.

9 Q What's the value of doing that?

10 A The first -- the first value is, is to
11 validate that the model produces similar results, so
12 it's building your confidence, is what you're doing with
13 the model, it matches real world.

14 Q Why is that important?

15 A Well, the -- are the procedures utilized to
16 come up with the parameters appropriate? Can you
17 isolate one or some of those parameters that might be
18 more important to the model than others?

19 So you're just -- it's a -- you're
20 checking, you're checking that model. We have to
21 develop trust that they work.

22 Q What do you typically do if you find that
23 the model doesn't predict what actually happened?

24 A Then I -- for me, as a non-model developer,
25 I go back to the developer and say, This is the evidence

1 I have. Should something be considered that -- in the
2 model that we identified in the field was important.

3 Q So you're trying to match up the model's
4 output and the real world --

5 A As a validation. Then if you're satisfied
6 with the validation, then applying it to future --
7 future events becomes -- you're telling your peers and
8 the users that these are appropriate.

9 Q I think I understand.

10 Now, in the summary section on page 3 of
11 your report, you note that: Often in economic analyses,
12 yield needs to be calculated from the amount of applied
13 irrigation.

14 What does that calculation tell you?

15 A Well, again, in the case of the -- we
16 talked about the Crop Water Allocator, it's -- you're
17 starting with the water you have and you want to find
18 out what yield you might be able to generate.

19 And that's key input to saying, Well, what
20 is the economics? How does the economic reality spin
21 out from there? Just getting to the point of yield in
22 relationship to the water applied.

23 Q Okay.

24 A So then the yield information, then that
25 goes on into the -- usually -- or one of the things can

1 do is into a more detailed economic analysis.

2 Q And can yield be calculated for
3 nonirrigated lands?

4 A Sure.

5 Q How would you go about doing that?

6 A Again, go back to, is there an
7 established -- let's see. I guess that the production
8 function at its extreme would be where you would have a
9 calculated yield. You know, is that kind -- as your
10 production function is coming down, you go -- it's at
11 zero irrigation. So that's the starting point of the
12 production function, as I've drawn it on that -- that
13 figure.

14 Q Is that the same thing as yield for
15 nonirrigated lands, or that's just the starting point of
16 your production function?

17 A Well, in the context of what I worked on or
18 looked at that -- that description and what is in the
19 mathematical function, that's -- that's the -- where you
20 have zero irrigation, that's nonirrigated.

21 Q But as a real-world matter, yields aren't
22 zero on nonirrigated land, are they?

23 A That's correct. And that's -- that's -- in
24 the regions that have enough precipitation to get to --
25 you know, to produce yield, I've had experiments where

1 even some irrigation produces a zero yield.

2 Q Okay.

3 A But --

4 Q So in eastern Kansas, is that one of those
5 regions where precipitation can produce yield?

6 A Sure.

7 Q Okay. In KBID, for example?

8 A I don't know especially about KBID. I
9 don't have any data on that.

10 Q Okay.

11 A But in general, yes.

12 Q Would you look at NASS data, for example,
13 to figure out the yield on nonirrigated crops?

14 A Nonirrigated crops? That could be a point
15 of reference for start of that determination. But there
16 are nonirrigated situations and there are dryland
17 situations --

18 Q Sure.

19 A -- depending on your -- on your definition.
20 If you expect that nonirrigated crop to be preceded by a
21 nonirrigated row crop, that would produce one yield; but
22 if it was preceded by a dryland crop or a crop from a
23 rotation, that NASS yield may not be -- that
24 nonirrigated yield -- and also you have a mixture of
25 management in these situations with the prior

1 conditions.

2 So my understanding and what the work that
3 Dr. Martin did was that the nonirrigated yield assumes
4 an irrigation -- irrigated -- somehow irrigated before
5 and a not -- excuse me -- not a dryland crop before
6 coming to that.

7 So upon his recommendations and what I
8 understand about the definitions, I would agree that
9 that's appropriate to do some adjustments.

10 Q Did you take any of that into account in
11 your report?

12 A Well, I -- I used -- as far as the
13 parameters from Dr. Martin, yes, the -- you have the --
14 I guess the -- I'm trying to get to the right table.

15 We have -- as far as the parameters that
16 were developed by Dr. Martin, in Table 1, we have Y full
17 and the ratio of Y nonirrigated, what I call Y n,
18 divided by that fully irrigated yield.

19 Q This is on page 4?

20 A Excuse me. Page 475.

21 Q 75?

22 A Excuse me.

23 Q So if irrigation land was not irrigated,
24 how would you predict the yield for that land?

25 THE DEPONENT: I'm going to have to take a

1 break. I'm sorry.

2 MR. WILMOTH: That's okay.

3 THE DEPONENT: I need to just --

4 MR. WILMOTH: Take five. No problem.

5 (Recess taken from 10:32 a.m. until
6 10:42 a.m.)

7 Q (BY MR. WILMOTH) I was asking you a
8 question earlier and we broke, but I want to revisit
9 this.

10 Essentially, when you're trying to
11 determine the yield on KBID lands, if you assume that
12 there was irrigation and then it was not irrigated
13 because it lacked sufficient supply, how would you
14 predict the yield on that land?

15 A Well, I think -- well, how I used this
16 production function was based on average -- average
17 conditions. The simulation model would be where you
18 were simulating those conditions, the CROPSIM model.

19 Q So the crop production function that you
20 created doesn't represent those lands, or does it?

21 A It represent -- well --

22 Q Does it represent the conditions on those
23 lands?

24 A What this parameterization -- parameters
25 that went into the crop production function came from a

1 simulation, that Crop Simulation Model that was done by
2 county in Kansas, Nebraska and Colorado.

3 So those parameters were developed from
4 that long-term simulation and were put into the crop
5 production function.

6 Q And did you do any work to kind of compare
7 how those related to yields observed in '05 and '06 in
8 KBID?

9 A No.

10 Q Now, you note that the crop production
11 functions can be derived from field studies, and I think
12 we talked a little bit about that, as a method of
13 understanding this issue. Can you explain how those
14 studies are conducted?

15 A Okay. First of all, you have to have
16 enough irrigation treatments, different amounts of
17 irrigation, to describe that curvilinear phenomenon. So
18 the first criteria is the number of irrigation
19 treatments.

20 And the study I conducted in Garden City,
21 we had six treatments, which is a little bit unusual for
22 what is reported in the literature. It might be three,
23 at the most four.

24 What I was trying to describe, more points
25 that potentially come up with a better regression for

1 that crop production function.

2 Okay. From there, the way I -- of course
3 we plant our crops in plots and are randomized, the
4 irrigation treatments are randomized within a block, so
5 that through the statistical analysis, you can say,
6 Well, was the effect -- what's the yield effect?

7 And trying to take out the difference by
8 where that plot is if there's somewhat different
9 conditions in that particular plot. I mean, soils
10 aren't perfectly uniform. You don't have perfectly
11 uniform conditions in this plot that you're trying to
12 understand.

13 We come up with a protocol for how we put
14 the water on these six different treatments. And what I
15 used -- my protocol was to try to match the management
16 that our -- the constraints that our irrigators are
17 facing in the face of the yields from the aquifer
18 dropping and their capacity of the well that live right
19 off the water is dropping.

20 So my approach was to put the same amount
21 of water on at each irrigation event, but as
22 the point -- overall less and less water, we stretched
23 the frequency between each irrigation event. So that's
24 what our water variable was.

25 In most of the studies of similar studies

1 out in the literature, they have applied water at each
2 event, all six treatments would have been applied at
3 each event, and it would just be a different amount, the
4 decreasing amount as you cross.

5 But I was trying to simulate the -- what
6 our area farmers are seeing. And over the years, the
7 crop production functions have evolved.

8 So then we -- in my case, we uniform -- we
9 had residue management, so each plot had the residue
10 from the previous crop still on the surface. Now, that
11 residue may not -- wasn't the same because you had a --
12 every plot, the dry plots followed the dry plots through
13 this five years. So you would have what the crop could
14 produce based on the water, previous water, what the
15 previous is carrying into the next one. So there was --
16 there was effect there.

17 But again, real-world situation. If you
18 have -- this year, I have this kind of capacity in my
19 well, then that's going to probably in our case
20 gradually decrease, but what's appropriate.

21 Then --

22 Q How many years did you conduct that study?

23 A It's -- well, we started it in 2003. The
24 first year was a cropping year in 2004. And we got
25 into -- what we call got into rotations.

1 So the proper sequence of crop was set up
2 and we also had a carryover effect of treatments,
3 irrigation treatments, already on -- in 2004, so we
4 could develop that -- that differences in soil water
5 carrying forward.

6 Q Then do you average those results over the
7 period, or do you take them on an annualized basis?

8 A The yield results?

9 Q Yes.

10 A It was -- it was -- the grain yield results
11 were on an annual basis. The only -- the one
12 intermediate measurement we took was what we called leaf
13 area index.

14 Q Sorry?

15 A Leaf area index.

16 Q Leaf area index, okay.

17 A So it's the area of the leaves total for
18 that plant in relation to the ground surface. So
19 indicating the stature of that crop across the
20 irrigation treatment. So it was an intermediate
21 measurement without destroying the crop.

22 Q How do those studies take into account
23 precipitation?

24 A We have rain gages out there at all times.

25 Q Okay. And the precipitation volume is

1 factored into your yield analysis somehow?

2 A It's -- it's factored into the
3 evapotranspiration, so then we can get at the -- the --
4 also -- not only the irrigation driver to yield, but
5 also the evaporation driver to the yield.

6 Q So that kind of helps you figure out the
7 total crop budget, is that right, the crop water budget?

8 A Yes. We also measure soil water, so we can
9 see, well, what's -- during this two-week time period,
10 what soil water either accumulated or is taken out by
11 the plant. And we also estimate drainage going beneath
12 the root zone.

13 So I just point out as the water budget of
14 what we call a water balance: What goes in, what goes
15 out, different pathways. And then the residual
16 calculation from all that is what was
17 evapotranspiration. So that's -- that's where we're
18 going at.

19 Q Okay.

20 A At the end of the season, we do take also
21 dry matter; in other words, we get the total weight of
22 the stalk and everything to -- and again reflect the
23 stature of the stalk in relationship to the grain it
24 produces.

25 Q When you talk about the use of mathematical

1 models, what's generally the relationship between the
2 mathematical equations and the field studies? Is it a
3 pretty strong relationship commonly or do you see
4 differences?

5 A I generally see strong relationships.
6 There is -- when I -- when I -- it's a multiple-year
7 crop -- or study like we're doing, you have the multiple
8 effects of precipitation.

9 So if you graph yield versus irrigation, as
10 a trend of this data, then you do have scatter about
11 that line. And the scatter does increase as you put on
12 less water.

13 So, in other words, there's more
14 variability year -- yield from year to year as you put
15 on less water.

16 Q What typically affects that variability,
17 what leads to it?

18 A It's precipitation primarily.

19 Q Okay.

20 A Now, there -- I've had -- some of my data
21 that I have a certain trend in yield irrigation, but if
22 you went to a different location with different
23 precipitation patterns and also just the energy that's
24 there in radiant energy and the wind and all that
25 affects the water -- or the crop differently as far as

1 the yield irrigation goes.

2 Q Okay. And you typically calibrate these
3 mathematical equations to the field studies? I think we
4 talked a little bit about that in the past.

5 A It's -- and that's -- yes, you do, and
6 that's the reason for taking other information about the
7 crop. And what I did was take more information about
8 the growth of the crop and the final product.

9 But we also -- along the way, we record all
10 the weather information or temperature, relative
11 humidity, wind, those components, that can be taken and
12 put into the models for actually calculating
13 evapotranspiration from these weather factors that --
14 from other research.

15 So this helps by not only doing the yield
16 irrigation and doing this water balance calculation of
17 ET, it helps to test those -- those other approaches
18 through measuring evapotranspiration.

19 Q Okay. And when you do these calibrations,
20 are you typically calibrating to some average condition,
21 or are you looking at actual specific years?

22 A Well, I have -- say as far as me
23 personally.

24 Okay. The -- let's go back and make sure I
25 understand the question you're asking about. Whether

1 the calibration comes from individual years or --

2 Q Or an average.

3 A -- or averages? I'd say it's done both
4 ways.

5 Q Do you think one is more or less reliable
6 than the other? Do you have a preference?

7 A Well, I guess it -- it's -- how am I going
8 to impact the information or what -- what am I trying to
9 impact?

10 And when I'm working with the economist on,
11 say, a year-to-year yield risk or how much variability
12 do I have along those years, I want those individual --
13 actually, each irrigation treatment effect from each
14 year, so we can see -- the scatter is important in some
15 application.

16 And then in other applications, for
17 example, when we go into the Crop Water Allocator, that
18 comes from long-term simulation, and you want to --
19 we're using averages there to make a different decision.
20 It's a more coarse decision.

21 Q So you wouldn't use the Crop Water
22 Allocator to determine what happened in 2005 and 2006 in
23 KBID necessarily because of these averages?

24 A All I could do was to say as a -- one
25 precipitation input versus another precipitation input,

1 but still would come from these average curves.

2 Q Okay. At the bottom of page 3, you speak
3 of this concept of diminishing returns and the
4 diminishing return characteristic of yield resulting
5 from more and more irrigation water.

6 Q Could you just generally elaborate on the
7 nature of that relationship?

8 A Well, I guess -- I guess Figure 1 would at
9 least visually describe it.

10 Q Figure 1 on page 5?

11 A On page --

12 Q Or 475?

13 A -- 47 -- 476.

14 Q Yes. And what does that figure tell you?

15 A The figure, when we start at the
16 zero-irrigation level, we see it's -- you know, the --
17 took the -- drew a line between each one of those
18 points, and what we call the slope would be decreasing
19 as you proceeded up the curve, especially for corn, the
20 top curve; that you get over to a certain maximum yield
21 and it levels out. So in the intermediary process, it's
22 exhibiting that return.

23 Q Now, sorghum, the next one down, you reach
24 the maximum point of yield at less irrigation.

25 Q I see. And what factors affect the point

1 at which you reach diminishing returns?

2 A Reach -- okay. Yield maximum or the --

3 Q Yield maximum.

4 A Okay. Yield maximum?

5 Q What factors influence, I guess, the break
6 point of that linearity?

7 A Okay. The maximum yield, of course, there
8 are a number of drivers there. The main one would be
9 water, or one of the main ones would be water. It would
10 be nitrogen. On a yearly base, it would be other
11 environmental effects, but --

12 Q Like precipitation?

13 A Precipitation.

14 Q How about soil type?

15 A Not -- not so much soil type unless there
16 was an interaction between precipitation and how the
17 precipitation came in relation to the irrigation events.
18 You know, how they interact.

19 Q For example, if --

20 A We have -- if you had irrigation followed
21 by a big rain --

22 Q I see.

23 A -- and then that would -- more of that
24 water would get away from you.

25 Q Does that mean you have a diminishing

1 return from that irrigation water?

2 A Yes.

3 Q Okay.

4 A It's less if -- from the point of view of
5 the crop, it's getting the water to be less efficient.

6 Q And obviously crop type matters, that's why
7 you have three --

8 A Yes.

9 Q -- on Figure 1?

10 A That's exactly right.

11 Q Does the timing of the delivery of the
12 irrigation water matter? In other words, whether you
13 delivered early in the season or late in the season?

14 A Well, it matters more if you're -- if
15 you're meeting the crop needs at that particular point.
16 If the precipitation is sufficient to supply that crop,
17 you would irrigate it a different time.

18 Q Okay. Does irrigation efficiency have any
19 effect on the point at which the yield curve starts to
20 flatten out?

21 A The irrigation efficiency, if we're talking
22 the same term that -- used in here would be the -- how
23 efficiently the irrigation system itself delivers water.

24 So how it would impact, it would be the net
25 irrigation year or the irrigation amount you would be

1 able to put into the soil versus how much you're
2 actually putting -- putting out through the pump.

3 Q So if all of these factors are relevant to
4 this point at which diminishing returns are reached, how
5 did you evaluate these or factor these into your expert
6 report?

7 A Okay. Those were factored in through
8 the -- the parameters in Table 1 of the report that came
9 primarily from Dr. Martin's simulations.

10 Q I see. So all of those factors, in your
11 understanding, are built into those parameters?

12 A Right. Those parameters are -- as I
13 understand it, will be driving the simulation model --

14 Q But --

15 A -- but -- related to water.

16 Q But I think we talked earlier in -- if I
17 understood you to say, you have not evaluated how these
18 apply in the KBID area directly?

19 A That's correct.

20 Q Okay. Thank you.

21 You mention, a little further on in your
22 report, that it was necessary to calculate the crop
23 yields that would have been produced in '05 and '06 had
24 the additional water been available.

25 I'm curious, just very fundamentally, why

1 it was necessary to calculate those yields if you could
2 have gone back and just looked at the yields? Why
3 wouldn't you do that?

4 A Well, you would have to have the yield --
5 the yields available to -- well, let's see. You have to
6 have the parameters -- let's rephrase the question and
7 see if I can get -- track with you better.

8 Q Why calculate yields based on some
9 theoretical value or model if you could just look at the
10 actual yields in a given year?

11 A If you had a detailed yield record that was
12 measured out in the field, if you had -- had the data
13 set, measured yields in the fields, have those measured
14 and the actual yields coming out there, then relating
15 them back with the amount of water that was supplied, I
16 mean, you have to have that linkage.

17 And also, when you talk about that
18 application efficiency, knowing what type of irrigation
19 system is -- was used.

20 Now, the application efficiency can vary
21 quite dramatically in the case of furrow irrigation, but
22 you have to have the data set.

23 Q Did you make any effort to obtain that data
24 set from KBID?

25 A No.

1 Q Why not?

2 A Well, it -- I would have needed -- well, I
3 didn't -- from what our -- what I was told, I didn't
4 think the data set was sufficient.

5 Q Who told you that?

6 A I think that was in conversations with
7 Dr. Scott Staggenborg, who was mentioned in here, my
8 agronomist colleague from Manhattan.

9 Q If you had that information available to
10 you, would you have preferred to utilize it to calculate
11 the actual yields, or would you have used a model?

12 I mean, isn't this the difference --

13 A Again, I would have to -- again, I would
14 have to have the yield and the irrigation information to
15 go into economic -- the economic approach.

16 Q Sure. And I'm asking you to assume, for my
17 question, that you --

18 A If I had all of that --

19 Q -- that you had --

20 A -- all of that, then I would use it for
21 going into the -- the model.

22 Q Okay. We've touched a little bit on this,
23 but why did you elect to use the model that was
24 developed at the University of Nebraska?

25 A Again --

1 Q Was that generally just to minimize
2 controversy in the matter --

3 A No, I --

4 Q -- or do you believe it's the best choice?

5 A For what -- the best choice was because the
6 parameters had been developed and I had tested those
7 with my field -- field results.

8 Q In Garden City?

9 A In Garden City. So when the inputs
10 needed -- from the simulation model and getting into
11 these parameters was in place.

12 Q Okay. Can I assume that you considered
13 those people that developed the model qualified to apply
14 it?

15 A Yes.

16 Q Did you ever consider using any other model
17 for purposes of your analysis?

18 A No.

19 Q Can you tell me, in as simple of terms as I
20 could comprehend, how you took that model and applied it
21 to north central and eastern Kansas?

22 A Using the parameters that are used in the
23 calculation of yield, by substituting the parameters
24 appropriately into the mathematical equation, calculated
25 yield.

1 Q So if I understand -- and I don't want to
2 oversimplify this, but I'm -- will probably do so in
3 this effort: Is it fair to say that you took the model
4 parameters off the shelf and plugged it into your model?

5 A Into -- into the UNL equation, took
6 off-the-shelf parameters --

7 Q Okay.

8 A -- for that area.

9 Q Okay. So you made no adjustments to those
10 individual parameters?

11 A No, I did not.

12 Q All right. Now, kind of fundamentally, as
13 I understand it -- this is on the middle of page 473 --
14 you note that the differences between yields that would
15 have been produced in 2005 and 2006 with irrigation and
16 yields expected when no irrigation was available were
17 the basis for the analysis.

18 My question is, wasn't there some
19 irrigation that took place in KBID in '05 and '06? Why
20 would you assume that the difference, the material
21 figure, if you will, is the difference between total and
22 no irrigation?

23 A Well, I -- we -- each point on the graph
24 was driven by the applied irrigation, so I didn't --
25 let's see. I'm trying to go back to the question.

1 We're on 473. Okay. We had the graph or
2 the --

3 Q Figure 1.

4 A Yeah, Figure 1. Okay. Then the irrigation
5 amounts -- and this is -- it's my understanding from
6 Dr. Hamilton, the irrigation amounts that were applied
7 were put to that function and the yield -- yield was
8 calculated.

9 Q So what role did Dr. Hamilton play in that?

10 A He would take the yields, calculated yields
11 into the economic model.

12 Q He took the calculated yields that you
13 calculated and put it into his economic model?

14 A He -- well, no. Let's back up. He
15 determined what irrigation went on, how much irrigation
16 went on. I did not -- did not get involved in how much
17 actual irrigation was applied.

18 But he took the applied irrigation that he
19 found and applied this -- this function to find the
20 yield.

21 Q Okay. I'm not sure that's consistent with
22 my understanding, but let's move on from there. We may
23 circle back on that.

24 What factors did you consider to determine
25 whether irrigation water would actually have been

1 available -- actually had been applied had it been
2 available in KBID?

3 A I did not make that determination.

4 Q Okay. Is that something Dr. Hamilton did,
5 is that what we were just --

6 A I -- I'm not sure where those numbers came
7 from. You know, he had his sources of information, but
8 I don't know the chain of events on how he arrived at
9 that.

10 Q Okay. But you didn't have any involvement
11 in that?

12 A That's correct.

13 Q All right. How does one recognize when
14 maximum yield has been achieved?

15 A Recognize in the field?

16 Q Either in the field, in your field studies,
17 or in a mathematical sense.

18 A Well, I can't find out what the maximum
19 yield in the field is until I measure it, so I --
20 identifying it only becomes what you've seen as far as
21 the health and wealth of the crop. But you don't know
22 until you measure that.

23 Q How about in the mathematical sense?

24 A In the mathematical sense, it would need to
25 be through a simulation model, like the CROPSIM model

1 that went to getting these parameters.

2 Q And what do you see in that model output
3 that tells you what the maximum yield is --

4 A Well, it would --

5 Q -- and whether it's achieved?

6 A It would be the -- more the
7 evapotranspiration that went on in that crop.

8 Q So it doesn't have anything to do with the
9 shape of the curve in Figure 1, for example?

10 A It becomes a limiting factor to that -- the
11 shape of the curve. It comes to an end point.

12 Q And when you reach that maximum yield,
13 what's the effect of applying additional irrigation
14 water?

15 A You don't get -- you don't get any more
16 yield.

17 Q Okay.

18 A Because this is --

19 Q What physically happens to that water?

20 A Well, it's satisfied the water needs of the
21 crop to achieve that maximal yield. So the crop has
22 been satisfied, and it's taken the water that can -- it
23 can take through to the -- and evaporated to the
24 atmosphere and gets that maximum.

25 Q And what happens to the water physically

1 that's applied after that maximum yield has been
2 reached?

3 A Well, it -- physically, if you have
4 conditions where the water can run off and doesn't get
5 in the soil, that's one condition.

6 Another condition, you get into the soil
7 and the crop's not taking any more and you get it so wet
8 that it can drain on down past the root zone. It can --
9 underground it's -- it couldn't make some movement --
10 maybe slowly, but -- one way or another.

11 Q Can you explain, again to a layman, what a
12 net irrigation requirement is?

13 A Okay. Usually we look at average
14 precipitation or 50 percent probability of
15 precipitation. Then we -- a couple of -- let me just
16 think a minute.

17 MR. DRAPER: Tom, are you looking for a
18 different explanation than the one that he has on
19 page 474?

20 MR. WILMOTH: I'm looking for one I can
21 understand.

22 Q (BY MR. WILMOTH) I'm just asking if there's
23 a simpler layperson's explanation.

24 A Okay. Go back to the evapotranspiration
25 side. We're saying water that is necessary to produce

1 maximum yield.

2 Q Okay.

3 A So you've looking at the contribution of
4 the precipitation to that, the inefficiency -- looking
5 at effective precipitation. You would expect that
6 effective precipitation used by that crop to get your
7 maximum yield. You fill in the rest with --

8 Q I see.

9 A -- the irrigation that actually gets into
10 the soil.

11 Q I see. So this is basically the difference
12 between the amount of the crop water requirement that's
13 supplied by precipitation and what's supplied by
14 irrigation?

15 A Well, it's the difference -- what
16 irrigation water needs to make up for in addition to the
17 precipitation to get your maximum yield.

18 Q I understand. All right. Thank you.

19 And that varies with rainfall
20 probabilities?

21 A Well, it -- yes, it -- right. It would --
22 yeah.

23 Q So location is a relevant factor?

24 A Yes. Oh, yes.

25 Q Because rainfall probabilities change,

1 depending on where you are in the world, I guess?

2 A The amount of rainfall for a certain
3 probability changes.

4 Q Okay. What's the difference in the net
5 irrigation requirement and a ET sub inc in Table 1?

6 A Okay. The ET inc -- excuse me -- there's a
7 threshold of -- there's a threshold of the amount of
8 water that it takes to get to the point when you start
9 being able to produce the rain. There's a threshold
10 amount of water.

11 From that point to the maximum ET
12 requirement is the -- is the difference in -- of ET
13 creating that yield. The difference between that
14 threshold ET and where you have full irrigation, that's
15 the water that contributes to the rain side of the
16 yield.

17 Q So is it 2.6 inches in this case, for
18 example, for center pivot corn?

19 A 2.6 meaning the difference between --

20 Q Yes.

21 A -- NIR? No, because you have the
22 inefficiencies of -- is it -- the curvilinear nature
23 versus a straight-line relationship for ET.

24 Q Okay. So is the actual NIR for any given
25 crop at any given location in any given year variable?

1 A Crop by year by location? And the
2 precipitation?

3 Q True.

4 A Yeah. Well, let's see.

5 (A pause occurred in the proceedings.)

6 Q (BY MR. WILMOTH) Maybe another way to ask
7 it is, in order to know the actual NIR, wouldn't you
8 need to know the crop type and the location and the soil
9 type and the precipitation that actually occurred?

10 A Yes.

11 Q And if you knew those things, you could
12 determine the actual NIR, could you not?

13 A The actual for those conditions.

14 Q For those conditions.

15 Do you have an opinion as to what the
16 actual NIR was in KBID in '05 and '06?

17 A No.

18 Q Okay. Let's look at Table 1 briefly. Can
19 you explain how you rely on this concept of beta in this
20 table and what that beta represents?

21 A Again, it's one of the parameters developed
22 from the Crop Simulation Model and --

23 Q So you just took that off the shelf?

24 A I took that from the parameters that UNL
25 produced.

1 Q Okay. And that generated a result, I
2 guess, that's shown in Figure 1; is that correct?

3 A That's -- yeah, Table 2, spinning into
4 Figure 1.

5 Q True.

6 So just for the sake of our discussion, if
7 you had a lower beta, how would it affect the way
8 Figure 1 looks?

9 A Okay. Lower than what?

10 Q Than what you utilized.

11 A Okay.

12 Q Would it change the shape of the curve?

13 A Yes, it would.

14 Q Could you actually draw on Exhibit 8,
15 Figure 1, how it would change the shape of the curve?

16 MR. DRAPER: Is this for a certain amount
17 of reduction in the value of beta?

18 Q (BY MR. WILMOTH) Let's just assume a value
19 of .5.

20 A Well, this -- I couldn't give you a
21 numerical actual.

22 Q Sure.

23 A But I can just generally --

24 Q Just a flavor of the --

25 A Yeah.

1 Q -- nature of the shape change is what I'm
2 after.

3 A This would be on the corn, for example.

4 Q Thank you.

5 So let me look at Table 2, which is at page
6 476.

7 A Yes.

8 Q With regard to center pivot corn and the
9 yield response to irrigation, it looks like something
10 happens around 10 or 11 inches. Is that essentially
11 when maximum yield is attained?

12 A You're approaching it and you get it to 12
13 and you -- 12 inches, you're in the range of maximum
14 yield, yes.

15 Q About 12 inches?

16 A Yeah, between 11 and 12.

17 Q So assume for this next question that KBID
18 is your client at NLK and they come to you and they tell
19 you that they have a 15-inch standard allocation.

20 What would you tell them about that
21 additional 3 inches over the 12-inch figure in your
22 Table 2?

23 A This is -- this is applied irrigation.
24 What I'd say to them is that you're approaching the
25 maximum yield, but there's still, in the field,

1 variation about that.

2 This is -- this is -- based on the
3 assumptions and how the model was -- the simulations to
4 get to the parameters, to get the calculations, there --
5 I wouldn't expect them to be right on that 182.

6 Q I'm sorry, I didn't hear what you said.

7 A What I'd say is, they can expect some
8 variation about that 182, and when you're going to reach
9 that, in actual practice for that year.

10 Q I see. So -- and could that variation be
11 up or down?

12 A Sure.

13 Q In your discussion of your field results on
14 page 7 -- excuse me, 477, you have a self-reference
15 there, "Klocke et al., 2011." Do you see that at the
16 bottom of the page?

17 A Yes, I do.

18 Q Is there variation between years in that
19 period that you reference?

20 A Yes.

21 Q So why use an average?

22 A It goes to what purpose you have for it.

23 Q What was your purpose?

24 A In this?

25 Q Yes.

1 A In this? I was just describing on a
2 statistical analysis, I just -- a regression. I was
3 describing that trend from those data.

4 Q Would it be more accurate to rely on actual
5 data for the years in question?

6 A That was actual data in the --

7 Q I mean, annual data each year?

8 A I did, yeah.

9 Q Okay. So in developing this corn yield
10 data, did you utilize the actual water delivered in '05
11 and '06?

12 A In this development?

13 Q Yes.

14 A No.

15 Q Did you utilize actual precipitation in '05
16 and '06?

17 A At where?

18 Q At KBID.

19 A No.

20 Q Do you know, if you had utilized that data,
21 what the beta would have been in Table 1?

22 A No, I don't.

23 Q Have you had an opportunity to look at the
24 NASS data for Republic and Jewell counties in '05 and
25 '06 to determine whether they show any change in yields

1 relative to past years?

2 A No.

3 Q All right.

4 MR. WILMOTH: Let's just take five minutes.
5 Actually, why don't we take ten minutes.

6 MR. DRAPER: Okay.

7 (Recess taken from 11:27 a.m. until
8 11:37 a.m.)

9 Q (BY MR. WILMOTH) Dr. Klocke, when you have
10 a water-short condition, in your experience, in a
11 scenario where the irrigated fields are drained with
12 drain tiles, do you ever experience a scenario where
13 there's an upward flow of water?

14 A I really haven't studied or taken data or
15 been in an irrigated region or -- where that's been a
16 factor.

17 Q Aren't there a number of drained,
18 tile-drained lands in Illinois?

19 A Yes.

20 Q Did you not study in Illinois?

21 A It wasn't with irrigation.

22 Q That issue -- oh, I see.

23 A When -- there's no irrigation involved.

24 Q So you don't have an opinion on that --

25 A That's right.

1 Q -- question?

2 All right. And again, in times of
3 shortages, in your personal experience, how do farmers
4 react to a limited water supply in the real world,
5 not -- not in any study, but in your experience?

6 A Well, they start examining, going back
7 to -- let's go back to Figure 1 in my report. They
8 start examining crops and their water needs.

9 Q With an eye toward changing the crops
10 they're growing or --

11 A Possibly. They're also, I think, trying to
12 think about, Well, when did I have a similar condition
13 when I didn't have the precipitation I wanted? How did
14 my -- how did my crop react and how did my management
15 suit the situation where I didn't have the precipitation
16 that I wanted? And make judgments based on their
17 experience.

18 And going at something like this, they
19 understand the differences among crops and how much
20 water they need, if they have been involved with it or
21 with their neighbors or had some connection with us
22 extension people.

23 So yes, they'll look at that. And then if
24 they have enough experience with irrigating different
25 crops and their response to crops and that -- the water,

1 they very well could put -- if they have a common water
2 supply. If they have the latitude of moving or putting
3 water preferentially on one crop versus another, what
4 crop, they may do that.

5 They may also look at the timing of the
6 irrigation to get the best benefit of the water for that
7 particular crop.

8 So if we're talking about wheat, which is a
9 winter annual crop and corn or other summer annual
10 crops, the -- when you apply the water most judiciously
11 and most response, the water to that particular crop at
12 that time, you may be able to separate out -- or apply
13 to those optimum times.

14 Now, then they have to take into
15 consideration, while stretching out actually the time
16 period they're applying water, whether they have some
17 other limitation of the supply, pumping capacity or the
18 regulatory imposition on that.

19 Q Do you ever observe them making efforts to
20 improve their efficiency in terms of the water delivery?

21 A Oh, yes. There's been quite a
22 transformation going from furrow irrigated -- in my
23 region, furrow irrigated to sprinklers. Not necessarily
24 using less water, but applying it in a fashion that the
25 crop can benefit, you know, over -- over the area can

1 benefit from that water and maybe doing a better job of
2 getting the water to the field, whole field, so
3 they're -- they're producing more crop from maybe --
4 maybe the same source of water, just by meeting the
5 crops' needs better.

6 Q So if I understand, they're spreading that
7 water over all the ground that they might be farming?
8 Rather than focusing it on a particular piece of ground
9 they think is highly productive, they just try to spread
10 it --

11 A Well, in the case of the furrow irrigation
12 to center pivots, more to the fact we talked about near
13 this water source, the pipeline at the head of the
14 field, for running the water down the furrows. There's
15 a more uneven pattern of how much infiltrates, just
16 because of the time for infiltration.

17 So that improvement is -- really, going
18 with a center pivot where you have uniform application
19 of what you're striving for is uniform amount of water
20 going in every part of the field.

21 So it's making better use of that water
22 because it's utilizing more than what might have been --
23 would have been lost in the furrow irrigation scenario.

24 Q So you don't necessarily see these folks
25 trying to pick out their most productive grounds and

1 stacking that water on that ground first?

2 A Well, they're really trying every --
3 everything they can now with new technology --

4 Q True.

5 A -- to, yes, set up center pivots, to take
6 advantage of better areas of their field.

7 Q So you see them selecting the best ground
8 and trying to irrigate that first?

9 A Right, irrigating as they go. That's --
10 that's really new technology. But if you had the
11 choice -- or, again, back to the water supply you have
12 in your latitude to move it this way or this way within
13 that field, over the irrigated field you can, there's a
14 possibility they would do that.

15 Q Okay. And if you were -- if they did that,
16 then there are some residual lands that are not as good
17 that they're still irrigating; is that right?

18 A That goes back to whether they have the
19 capability -- the capability in their irrigation system
20 to bypass that. It would take more technology on the
21 system itself, bypass it and that's -- for instance,
22 it's in -- with the center-pivot situation, there is an
23 ability to speed up and slow down, the pivot has passed.
24 So if you're at a pie that you're concerted on --
25 concerned about one way or the other, you can do some

1 adjustments there.

2 Q Sure.

3 But it sounds like it's not always the case
4 that the best, most productive land is next to the
5 irrigation infrastructure?

6 A Well, when you set up the infrastructure at
7 the very beginning --

8 Q You try to do that.

9 A -- you're going to -- your return to your
10 investment drives you, too.

11 Q Sure.

12 So I think you may be aware that
13 Dr. Hamilton assumed that in times of shortage,
14 producers will irrigate their most productive ground
15 first. Are you familiar with that assumption?

16 A Yes, I am, but I didn't delve into, at all,
17 with how -- what factors he used to get to that, so --

18 Q Okay. So assuming he did that and assuming
19 that you're using the crop production function to figure
20 out what the yield would have been on those acres, is
21 that same crop production function applicable to the
22 lesser ground that was being irrigated on a secondary
23 priority?

24 I mean, it seems you're trying to create an
25 average here, and I'm not sure where that --

1 A I'm not sure I can answer that question,
2 either, on the application in this case to how he did
3 it.

4 Q Okay. One final cleanup question:
5 I notice that you're a Professional
6 Engineer, Doctor; is that correct?

7 A Yes.

8 Q Why doesn't your report bear an engineering
9 seal?

10 A I didn't think it required it. I didn't
11 understand that it required it. Most -- I don't use the
12 engineer's seal; only in -- well, I don't use it much at
13 all, maybe once in my career, where there's a
14 requirement somehow to certify a plan or a design or
15 something like that. So --

16 Q I see.

17 A -- it's not meant for what I do, and I
18 didn't feel it was needed, that kind of stamp.

19 Q Would you have any reservation in affixing
20 the seal?

21 A Well, I -- no, I don't think I would
22 because -- if that was a requirement. Now, our
23 profession, you know, we've got to have a reason for
24 doing it.

25 Q Sure.

1 MR. WILMOTH: All right. Thank you. I
2 think we're done.

3 MR. DRAPER: Okay. We'll just take a
4 minute, be back.

5 (Recess taken from 11:47 a.m. until
6 11:50 a.m.)

7 MR. DRAPER: Let's see. I guess the next
8 question is, Pete, do you have any questions?

9 MR. AMPE: I don't have any questions.

10 MR. DRAPER: Well, in that case, I don't.
11 Thank you very much.

12 MR. WILMOTH: Thank you very much, Doctor.
13 Appreciate your time. Thank you.

14 (Whereupon, the deposition concluded at
15 11:51 a.m.)

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25

1 I, NORMAN L. KLOCKE, Ph.D., P.E., do hereby
2 certify that I have read the foregoing transcript and
3 that the same transcript and accompanying correction
4 sheets, if any, constitute a true and complete record of
5 my testimony.

6
7 _____
8 Deponent

9
10 No Changes Amendments attached

11
12 Subscribed and sworn to before me this
13 _____ day of _____ 2012.

14 My commission expires: _____

15 _____
16 Notary Public

17 sd

18 State of Kansas v. State of Nebraska, et al.
19
20
21
22
23
24
25

1 STATE OF COLORADO)
2)SS. REPORTER'S CERTIFICATE
3 COUNTY OF ARAPAHOE)

4 I, K. MICHELLE DITTMER, do hereby certify
5 that I am a Registered Merit Reporter and Notary Public
6 within the state of Colorado; that previous to the
7 commencement of the examination, the deponent was duly
8 sworn by me to testify to the truth.

9 I further certify that this deposition was
10 taken in shorthand by me at the time and place herein
11 set forth and was thereafter reduced to typewritten
12 form, and that the foregoing constitutes a true and
13 correct transcript.

14 I further certify that I am not related to,
15 employed by, nor counsel of any of the parties or
16 attorneys herein, nor otherwise interested in the
17 result of the within action.

18 I further certify reading and signing not
19 requested pursuant to CRCP Rule 30(e).

20 In witness whereof, I have affixed my
21 signature this 24th day of February, 2012.

22
23
24
25

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Registered Merit Reporter

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Denver, Colorado 80231

3

February 27, 2012

4

5 JOHN B. DRAPER, ESQ.
Montgomery & Andrews, PA
6 325 Paseo de Peralta
Santa Fe, New Mexico 87501

7

8 Case Name: State of Kansas v. State of Nebraska, et al.
Case No.: No. 126, Original
9 Deposition of: NORMAN L. KLOCKE, Ph.D., P.E.

10 The deposition in the above-entitled matter is ready for
reading and signing. Please attend to this matter by
11 complying with ALL blanks checked below.

12 XX arranging with us at (303) 696-7680 to read.
and sign the deposition in our office.

13

OR (if applicable),

14

XX have deponent read your copy; signing attached
15 original signature page and any amendments
sheets.

16

_____ read enclosed deposition, sign attached
17 signature page and any amendment sheets.

18 XX within 30 days of the date of this letter.

19 Please be sure that the signature page and accompanying
amendment sheets, if any, are signed before a notary
20 public and returned to our office at the above address.

21 If this matter has not been taken care of within said
period of time, the deposition will be filed unsigned
22 pursuant to the Rules of Civil Procedure.

23 Thank you.
Enclosures:

24 cc: Tom Wilmoth, Esq; Peter J. Ampe, Esq.

25

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2 2170 South Parker Road, Suite 263
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February 27, 2012

3
4 TOM WILMOTH, ESQ.
Blankenau Wilmoth LLP
5 206 South 13th Street, Suite 1425
Lincoln, Nebraska 68508

6
7 Re: State of Kansas v. State of Nebraska, et al.
Deposition of: NORMAN L. KLOCKE, Ph.D., P.E.

8 Dear Mr. Wilmoth:

9 ___ Previously filed. Forwarding signature page and
amendment sheet(s).

10 ___ Signed, no changes.

11 ___ Signed, with changes, copy of which is enclosed.

12 ___ No signature required.

13
14 ___XX Reading and signing not requested pursuant to CRCP
Rule 30(e)

15 ___ Signature waived.

16 ___XX Forwarding original transcript unsigned; signature
17 page and/or amendments will be forwarded if
received.

18 ___ Original exhibits included in ongoing notebook
19 and will be filed with counsel at conclusion of
discovery.

20 Enclosures: (As above noted)

21 cc: John B. Draper, Esq.; Peter J. Ampe, Esq.

22
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24
25

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