A Yes.

Q In your opinion, sir, is one or more of these mechanisms a probable source of the contamination that was found in May of 1979 in Wells G and H?

A Yes, it is.

MR. KEATING: Thank you, Dr. Guswa.

I have no further questions, your Honor.

THE COURT: Questions?

MR. FACHER: I have some questions, your Honor.

CROSS-EXAMINATION, By Mr. Facher

Q Doctor, do you mind standing up again. Most of my questions relate to some of these exhibits.

Why don't we start with the last one you had.

MR. KEATING: It's right over here.

MR. FACHER: And we'll need three stands.

Q Doctor, just to orient ourselves, we're looking at a diagramatic sketch of the property, we're looking at the end of the pumping test chalk that you prepared, and we're looking at the aerial photograph, all of which I hope show the same property.

Now, just to orient ourselves, will you point out Hemingway on all three of these diagrams?

A Yes. The main Hemingway building is here (indicating), the parking lot area covers about here (indicating), and then a piece of property that ends down this direction -- here (indicating), it is approximately like this. On here it is approximately this (indicating). And over here it goes down, approximately in this area here (indicating).

Q So that the main building on the photograph is that square building with these objects around it. There it is on the diagram (indicating), and there it is on the chalk by the pumping test?

A Yes.

Q And this middle diagram does not -- that is the PAL -- does not complete the river as it actually is. Is that correct?

A That's correct.

MR. FACHER: Would you---

A Meaning it doesn't go north.

MR. FACHER: Would you object, Mr. Schlichtmann, if the witness put the rest of the river on this diagram?

MR. SCHLICHTMANN: Yes.

MR. FACHER: You would object?

MR. SCHLICHTMANN: Yes. Do you want to put an overlay on it?

MR. FACHER: I don't have an overlay.

Q We will trace for the jury then, since Mr. Schlichtmann

objects, the course of the river above Olympia Avenue, as you have shown it on this one.

A Okay. This is Olympia Avenue, which is right here (indicating). The river heads slightly northwest and then back to the northeast around these two buildings (indicating), then under Route 128, and under Mishawum Road and into this sort of drainage area.

Q Could you show it on the photograph also?

A Yes. This photograph actually has its position in 1973, but the course hasn't changed that much.

Q Except for the lake?

A Except for the lake. So we have it going north from Olympia Avenue, slightly northwest and back to the northeast around the building, up under Route 128, under Mishawum Road and into what at that time was Mishawum Lake but now is a drainage canal.

Q Now, just to orient ourselves with respect to the flow arrows that you have on the diagram that's called the end of the pumping test, this top flow area shows the north-south parallel to the river, as you described it?

A Yes.

Q And that is around 82. Where is 82 on this -- I'm reading from the---

A That's B-2. That's right here.

Q That's right there by Hemingway. All right.

Now this arrow here going across the 45-foot line is just below S-76. Will you point out where that is?

A Yes. S-76 is here (indicating).

Q And where would that be on the photograph?

A It would be approximately---

Q I think you're blocking some of the jurors.

A I'm sorry. S-76 is approximately here.

Q And this arrow on the bottom that is pointing in the direction of the Riley pumping wells, that's approximately where on the diagram?

A This is Well BW-4, which is shown here (indicating), so the arrow is basically this direction. It's actually going to Well S-46, which is the pumping well.

Q And there are two pumping wells in that area?

A That's correct.

Q Now, I'm sure everyone, including Mr. Schlichtmann, would like to know why there are no arrows pointing directly at the heart of the Beatrice site.

I'll do some of your work for you.

Can you explain that, sir?

A Yes. The fundamental reason for that is that the data are not sufficient to draw conclusively what the groundwater flow direction is in this location. I had talked earlier about a groundwater divide on the Cryovac plant. That is a natural divide that courses with the topographic

high. We look at Wells G and H themselves. We see a large cone of depression, this large oval (indicating), which encompasses both Wells G and H. In the middle of that large oval, we see a small oval, two small ovals, one around G and one around H. And in between there, we have a slight mound. That is also a groundwater divide, meaning that water located in this position -- an imaginary line, if you will, where water to the north of that line flows toward Well H, and to the south of the line flows toward Well G, and the direction of flow is dependent on where that line is. That represents sort of a local mound in the water table. And I believe in some of the other transcripts I've read that there was reference to a drum or a rubber elastic. If you pull it down in two locations, that represented the cone of depression.

You can also -- And maybe that was mentioned. If not, I'll explain it. There was also a rise in between those two places that you're pulling down. That is a high on the water table, and it affects the groundwater flow direction. That groundwater divide, however, is not the same as this groundwater divide because it exists only because the two wells are pumping, because each of the wells is pulling the water level down in close proximity to itself.

And for instance if Well H were to stop pumping, there would be no cone of depression around here,

and then all flow would be -- from the vicinity of H would be south toward Well G.

Simiarly, because of the pumping of Wells S-46 and S-47, which are the Riley wells, there exists intermediate between these two 40-foot ones a groundwater divide, a temporary groundwater divide that exists only from the fact that all four of these wells are pumping. Ideally you would like to be able to draw the position of that temporary groundwater divide. Usually, the gradients within this area are very shallow, and the measurements are not precise enough to make that determination. There is a divide somewhere between these two locations. I don't know exactly where it is. It is west of the river, but its actual position is not known.

I mentioned the precision of the measurments. Earlier I talked about how one makes water level measurements, and that includes a land survey to establish the elevation of the measuring point of the well. And that is a fundamental parameter that goes into our water level measurements because that is the elevation control from which we subtract the depth to water to get the water elevation.

I also mentioned that there were, I think, four land survey elevations for all of these wells. Geoenvironmental Consultants contracted with someone -- that's Steve Maslansky's firm -- contracted with someone to survey in these

wells. The EPA had their contractor who did most of these wells. And both Woodward-Clyde and Weston Geophysical had land surveyors survey in the elevations of the wells on the Beatrice property.

And we have that information and there are discrepancies in the elevation of the measuring point. For several of the wells, those discrepancies are as much as two tenths of a foot. One land surveyor will say the elevation of the measuring point is 40 feet, and the other says it is 40.2 feet. So we know there is a difference between those two elevations. We don't know which one is correct.

We've used the measurements provided by Weston Geophysical simply because we received them first.

In addition to the imprecision resulting from the discrepancy in the land survey elevation, it appears, as we look at the water level measurements that were made, that they were made with an electric tape. Because as we see the water level measurements made at the end of the test, there are fluctuations in the measured water level that indicate a plus or minus depth of a foot rise in the water level. That reflects the precision of the measurement technique.

We now have three tenths of a variation or uncertainty in any one of these measurements. It is for that fundamental reason that it is not possible to draw the direction of the arrow because if I look at any one particular well, for instance, let's look at Well S-78, I see a gradient toward Well W-14, but I also see a gradient toward W-14. I know somewhere between these two 40 foot contours there is a groundwater divide which would really determine which way

groundwater is moving. It is for that reason that I can't draw an arrow through that portion of the map.

Q What is the gradient? Why are precision measurements essential when you have a gradient or a flat surface as you have at the Riley property?

A Well, it's for exactly that reason, a two tenths of a foot or three tenths of a foot measurement descrepancy for evaluating the Cryovac to Well G and H direction where the total variation is 45 feet. There is not a major discrepancy.

In areas of very shallow gradients, such as were shown on the other map, such as non-pumping conditions where we may have several hundreds of feet with only a one foot water level gradient, an error of three tenths of a foot or discrepancy of three tenths of a foot is a very significant part of that water level measurement.

Q Now, you referred to in one of the chalks to a mound. It may have been in the pre-pumping one.

A That would be in the pre-pumping one, yes.

MR. FACHER: May I have that?

Q Incidentally, while we're getting that, the red line in the photograph is the sewer connections?

Did I do that?

A No.

Yes, it is the sewer. There are actually two sewers that run through here. They don't follow exactly the

same path, but they're close enough.

Q Now, the pre-pumping conditions, that is, on December 4th, we show the northern arrow, that is again the flow of the groundwater before any effect of pumping, you say, parallel the river?

A That's correct.

Q Then there is sort of a northwest to southeast component that flows toward the river?

A That's correct.

Q And, again, the arrow down around BW-4, which is in the southern part of the property.

Now, you referred to a mound. What did you mean by that, looking at G-950, sir?

A The normal progression of water levels is to be at higher elevations at the edges of the valley as well as to the north and to decrease in elevation as you move south.

There is a lowering of the water level surface in the vicinity of Well S-46, which is lowering. That lowering is due to the pumping. There is, which I can only describe as an anomalous condition, that is an apparent rise in the water level surface based on measurements made at Wells BW-1 and BW-2. So I guess it is really BW-1 and BW-2. The two water level measurements, one has an elevation of 43.1 feet, the other, 43.9 feet, that sort of represents this little bubble, if you will, or rise on the water table surface.

I don't know the reason for it other than that's what the water level measurements say.

Q Is this chalk drawn, if you know, Doctor, with the wells, Riley wells 1 and 2 pumping or not pumping?

A I'm not exactly sure whether they were pumping at that time or not. The cone of depression indicates to me that either they had been pumping or had pumped recently, and I don't know whether it was S-46, or S-47. This line represents the uncertainty.

Q Just to prevent further confusion, S-47 is another number for Riley Well 1, and S-46 was another number of Riley Well 2, is that correct, sir?

A That's correct.

Q And those wells, do you have any data on the effect of those wells pumping together?

A No.

Q And do you have any data on the cone of depression created by one well pumping while one or the other of G and H is pumping?

A No.

Q Now, is it possible to tell without further detailed studies what the effect of those wells operating alone or operating together or in conjunction with G or in conjunction with G and H is?

A No.

Q Now, sir, I just want to point out the location of the point where you described to Mr. Keating, I think, that some samples were taken at Salem Street. You were talking about samples showing TCE in the river, is that right?

A Yes. They were taken at the north end of Salem Street, just off the bridge.

Q There is a bridge at this intersection there? (Indicating).

A Yes, the road goes across the river and the bridge over the river.

Q And that is down (Indicating) on the photograph you are pointing that out?

A Yes. (Indicating).

Q And over here on the chalk?

A That location would be here. (Indicating).

Q Now, you talked about a groundwater divide, I think that's the term you used. Did you say there was one on the Grace property?

A Yes, there is.

Q Would you explain what a groundwater divide is and what it does, if it does anything?

A Well, a groundwater divide is the term that we use to indicate an area, a line. It is really a zone because none of these things are permanently fixed in space, but it is a line which represents different directions or boundary

between different directions of groundwater flow. We have a high on the water level, the water level surface of the water table here on the Cryovac plant. To the east of this line water flows to the east, as we move from higher water levels 95.4 to lower water levels, 91.3.

That divide is a reflection of the topography on the fact that we are up on the edges of the valley, the water would be flowing down this way, and if we had another valley there would be water flowing into that valley and a divide on this station and another zone like this, we would have all our river valleys sort of flowing together.

Q The question was, what does the divide divide?

A In this case the divide identifies two different directions of groundwater flow.

Q Is that a phenomenon that hydrologists come in contact with, groundwater divide?

A Yes.

Q So that water is flowing in different directions on each side of the divide, would that be a way of putting it?

A That's correct.

Q Now, you had a chalk on drops, the contours showing the drops.

A Yes.

Q I don't know if I described it correctly.

A I think it was called "Water Level Change Map."

Q Water level change. All right.

You have a water level change map, and you show the difference in water level or the changes in water level between the two dates, is that correct?

A That's correct.

Q And the purpose, as I understand it, of your doing that was to locate the outlines of the aquifer, is that what you said on direct, or am I incorrect?

A That is what I was intending to say, that's correct. The area that is affected by the pumping is the aquifer.

Q And does this -- these lines indicating areas where the same wells drop the same amount, does that indicate in any way movement, that is, does the drop in the water level demonstrate any movement of the water?

A No, it does not.

Q Now, precipitation you talked about at some length. Precipitation, meaning rain, I guess, that would affect water levels, would it not?

A That's correct.

Q So if there is heavy rain, will that cause generally all the water levels to rise in an aquifer?

A That's right.

Q And if it is a dry month or dry period, will that cause water levels generally to drop in an aquifer, regardless of what else is going on?

A That's correct.

Q And you had a rain chart, at least I called it a rain chart. Is that correct, on the rainfall?

A On precipitation on Well S-94D, I believe. It is about this wide. (Indicating).

MR. KEATING: I think this is the one you are talking about.

Q This is the rain chart, again, on S-94D, and it shows the relation between what happens when it rains and what happens to the water level on that particular day, right?

A That's correct.

Q And it works the other way around, too, if you keep gettin no rain, the water level goes down?

A Water levels would decline if there is no rain, that is right.

Q Do you have a memory, sir, or a data on whether December was an unusually dry, if I can use that word, for December, dry month in 1985?

A I have my meteorological data here if I can go find it.

Q Maybe we'll just use the numbers.

What do you have, if you have it, sir?

A I'm sorry. These are data sheets from the National Oceanographic & Atmospheric Administration that summarize the daily precipitation for the months of November, December, 1985.

Q What do you have for December?

A Okay. I have a monthly summary for December also, as well as a daily summary. For the month of December, 1.21 precipitation and a departure of minus 3.27 on the drop.

Q In other words, there were three and a quarter inches less rainfall than was usual?

A That's correct.

Q And there had also been a heavy rainfall at the end of November?

A That's correct.

Q Now, you talked about the stream or the river being both recharged by the groundwater and under certain conditions discharging water into the groundwater?

A That's correct.

Q And I want to show you a diagram just to see if this helps illustrate the testimony. This is supposedly showing water table contours and groundwater flow directions in relation to stream stages for a losing stream, which I gather means water coming out of the stream. Is that something that you can recognize as a correct diagramatic representation?

A I would say that is a standard textbook representation of that process.

Q I got it from a textbook, that's right.

And would you -- sorry I didn't make a giant

one -- can you point out on this diagram where the water table is and write in the words "water table" and also where the ground is. On the losing stream is what I'm interested in.

A (Witness complies.)

Q And the bottom picture diagram is as if we were in an airplane looking down with X-ray vision seeing through the river?

A That's correct.

Q This little triangle that you put on the river surface, you put that on some of your other diagrams, I believe. That indicates the top of the water table?

A In this case it indicates the top of the stream. We also use that symbol to indicate the top of the water table.

Q And the arrows indicate water flow direction?

A That is what they are intended to indicate, yes.

MR. FACHER: I'd like to offer this as B-901, your Honor.

MR. SCHLICHTMANN: No objection, your Honor.

THE COURT: Want to show it to Mr. Keating.

MR. FACHER: Oh, I'm sorry.

MR. KEATING: I have no objection, your Honor.

THE COURT: And the number of that again?

MR. FACHER: B-901, water table contours, groundwater flow directions, losing stream.

THE COURT: That is admitted.

(Diagram entitled, "Water Table Contours, Groundwater Flow Directions, Losing Stream", Exhibit B-901, was received into evidence.)

Q One question that I forgot to ask about these contour lines on the drop. Are you able to distinguish, sir, in making this contour map showing drops at different wells the effect of G and H pumping, Riley 1 and 2 pumping, lack of precipitation or some combination or permutation of those. Can you distinguish between them in trying to figure out what caused the water drop?

A No. As I said, what that map represents is an arithmetic difference between the two water level measurements.

Q It is just what you found according to the numbers?

A Right.

MR. FACHER: Now, could I have one more, the nice sunshine one, the bright colors, orange and yellow, the three-dimensional---

THE COURT: Well, there were a couple of those. What layer do you want?

MR. FACHER: Not the long one. We might go to the well once too often, if you pardon the bad pun.

Q This is only going to be up there a little bit. Just

so I understand it, you sort of have to look at this in three D. We're standing at Salem Street or we're standing right in front of -- And we're looking at the river and it's coming toward us. So these arrows are actually coming right at us, except this one is going, the one on the top is going up a little bit?

A Right. It is coming at us but going up into the river.

Q Now, I just want to ask a question, see if I understand what you testified to talking about pumping conditions. I think you testified that these numbers really represent energy or a loss thereof, but for convenience we talk about them as water levels. Did I understand that correctly?

A Yes.

Q And on this S-92 -- which really is in the river, is it not?

A Yes.

Q For all practical purposes?

A On the banks of the channel it shows on the map, but it is in the river.

Q And based on your conception of this whole area, it would be a river well, I guess?

A Yes.

Q That has a 42.82 reading at that point. Ther's that little triangle. Is that right?

A This 42.82 is the actual elevation of the Aberjona River

surface water body itself. And they set up the measuring station to measure the relation of the river.

Q And am I correct that this is the first well, this 42.48, -- I don't mean first, but this is the first reading on the shallow well.

Would it be correct, using your information about which you told us that there would be an arrow, a small arrow going toward -- from 42.82, toward 42.48, would a purist put an arrow in there?

A Yes. On the basis of this information, there is a component or a decrease in the water level from the river to that shallow well.

Q So that would be an arrow going westerly, at least in some direction?

A That's right.

Q One last question, Doctor. To your knowledge, is there any well testing data, chemical analysis from a well, showing any of the complaint chemicals prior to May, 1979?

A You mean of Wells G and H?

Q Of any well that you're aware of, have there been any chemical analyses or tests of a production well or a monitoring well prior to May of '79 that you're aware of?

A No, there are not.

MR. FACHER: Nothing further.

CROSS-EXAMINATION BY MR. SCHLICHTMANN

Q Dr. Guswa, you were retained in June of 1985, is that right?

A That's correct.

Q And you were retained by W. R. Grace?

A Well, by Foley, Hoag & Eliot on behalf of W. R. Grace.

Q On behalf of them.

And, Dr. Guswa, you went on in great detail with the jury about the steps that you took in formulating a mathematical model of the aquifer, do you recall that?

A Yes.

Q That work also took place after I deposed you on January 22nd of this year?

A A lot of that work took place after that.

Q Is it not true that you said you were going to wait until you received all the data from the EPA before you would put together a mathematical model, isn't that what you told me?

A I was waiting for the result of the pump tests and well logs, but I started to review the glacial information and the hydraulic atlas.

Q But you had not done your model at the time I deposed you?

A That is correct.

Q You did that all from January 22nd to today?

A That's correct.

Q Dr. Guswa, there are lots of ways to analyze an aquifer, isn't that right?

A That's correct.

Q There are lots of different tools that you use as a hydrogeologist?

A That's correct.

Q And a mathematical model or computer model is one way of analyzing how an aquifer -- how the various principles of an aquifer are working together, is that right?

A Yes.

Q Another way is to analyze the actual data from the field?

A That's correct.

Q And there are different ways of analyzing that data which don't make use of a model?

A That's correct.

Q And there are ways in which you can analyze an aquifer by looking at the data, looking at the model, then looking at how the data from the field compares to your computer simulation?

A That's correct.

Q So there are many different ways, many different tools that you as a hydrogeologist can use to determine what is happening in any particular area of an aquifer?

A That's right.

Q Now, you, of course, your firm has collected all the water level data, that was very important to you, is that right?

A Yes.

Q And you collected it -- Your firm, Geotrans, didn't collect all of it, so you got some of it from the EPA?

A That is correct.

Q You got some of it from Woodward & Clyde?

A Yes.

Q And you got some of it from Weston Geophysical?

A Yes.

Q Based on that data, you used that data in forming opinions, is that right?

A That's right.

Q Now, when you wanted to form your opinion -- Excuse me, when you made a determination about the water level data in Well 14, Well 14D, what figure did you use?

A Do you mean the W. R. Grace Well 14 or the --

Q No.

A The Beatrice Well 14?

Q The Beatrice Well 14.

A Do you have a particular time period?

Q At the end of the pump test.

A The end of the pump test, yes.

The number for the water elevation that we

used was 41.24 feet, and that -- 41.24 feet.

Q Yes.

And what value did you use for CW-14?

A CW-14 is 41.21 feet.

Q And SW-14?

A 41.19.

Q And OW-14?

A 41.36.

Q Now, to calculate those numbers, you made use of the water level monitoring data, is that right?

A That's correct.

Q Now, I'm going to show you an exhibit. If you would come up here to the jury.

A Should I bring my water level?

Q Please.

A (Witness complies.)

Q Let me show you a diagram, and do you have the end of the pump test diagram?

MR. KEATING: Yes.

Q Now, in formulating your end of the pump test results, you used values for different water levels at different wells, is that right?

A That's correct.

Q And you used them to show the effect on the aquifer at the end of the pump test, the 38 pump test?

A That's correct.

Q 41.21 for W-14?

A That's correct.

Q That was taken from the deepest well from that Well 14 cluster?

A I believe so. I'll let you know. It was taken from the CW-14.

Q CW-14?

A Yes.

Q Now, in figuring that out, you got to the -- you take the monitoring data, the well monitoring data for that well and you look at the level recorded on that morning just prior to the pumps being turned off, is that right?

A That's correct.

Q That would be a document like this?

A That's right.

Q In fact, that is the one for CW-14, is it not?

A Just wait one minute and I'll let you know.

Q All right.

A I have a series of sheets that represent measurements in CW-14.

Q This is CW-14 in January at the end of the pump test. There it is right there. Do we agree?

A Yes.

Q The same one.

Now, that value on January 3rd, 1986, at 10:25 p.m. was -- they said what was the water level?

A Excuse me. You said 10:25 p.m.?

Q No -- Yes.

A Okay. January 3rd?

Q Yes. 1986. That was the sheet you just had.

A It was probably an a.m. measurement.

Q What did I say? I said p.m. Excuse me. A.m. in the morning.

10;25, that is just before they turned the wells off, right?

A That's correct.

Q Now, they checked the water level from the reference point and it showed a 5.86 drop, isn't that right? Isn't that what that document showed?

A That's right.

Q What you do to figure out what the water level was just prior to the pumps being turned off, you went to the reference point that was measured in?

A That's right.

Q And the reference point that you went to for CW-14 was you look at the measuring point and you go to 47.07?

A That's correct.

Q That is the measuring point?

A That's what I have, right.

Q When you take 47.07, which is the measuring point on the well, and subtract 5.86, you come to a value, is that right?

A That's correct.

Q The value you come to is 41.21?

A That's correct.

Q Now, would you please write on this diagram here at Well Cluster 14 where it says CW-14, would you put down the water level for that point?

A You want it right on the side, or over the well, it doesn't make any difference?

Q Right to the side.

A (Witness complies.)

Q Do you agree with that water level, you used that in forming your opinions?

A That's correct.

Q Now, when you go to the next well above it, that would be SW-14?

A Yes.

Q And you go to another sheet taken on that day, January 3rd, in the morning, approximately the same time, 10:24-10:30?

A Yes.

Q And the value that you get when you do the subtraction and everything is 41.19, is that correct?

A That's correct.

Q You write that down, 41.19?

A (Witness complies.)

Q You agree with that figure, you used that in forming your opinion?

A Yes.

Q And the measuring point you used for the 41.19, for SW-14, was 47.30?

A That's correct.

Q You used that in forming your opinion?

A Yes.

Q And then you go to 0W-14?

A Yes.

Q And do you have the sheet of paper on that?

A Yes.

Q For January 3rd at 10:30?

A Yes.

Q And that value is 6.19, is that right?

A I have 6.18.

Q Well, doesn't this document say January 3rd, 10:30, 6.19?

A We may have used the 9:57. I don't know why we would have. A hundredth of a foot.

Q 10:30 would be more accurate, wouldn't it?

A Yes, it would be the same time as the other ones.

Q You agree we should use that one to be the most accurate?

A You could use that one, yes.

THE COURT: We're talking about one hundredth of a foot here?

MR. SCHLICHTMANN: Oh, yes.

THE COURT: Press on.

MR. SCHLICHTMANN: It won't make much difference, but we will use 6.19.

Q The measuring point you used for that is 47.52?

A I have 47.54.

Q Well, isn't the surveyor who gave you the results for the other ones, didn't he say 47.52?

A I'll let you know. He may have said 52 and I may have put in 54.

Q It's understandable.

A Well, I can't find the elevation.

Q Isn't this the one right here? Do you recognize that?

A Yes.

Q Is that 47.52?

A That's correct.

Q The correct measuring point would be 47.52?

A Okay.

Q If we do 47.52 and subtract 6.19, we come to what value?

A 41.33.

Q Exactly. Why don't we put down 41.33 right there.

A (Witness complied.)

Q Now, those are values which you used and relied upon in forming your opinions?

A Yes.

Q Now, let's go to 13 and why don't you put down the values that you used for Well 13. You have those right with you, don't you?

A Yes.

Q For OW-13 you got 41.40?

A That's correct.

Q All right. Put that down.

And for SW-12, you got 41.20?

A That's correct.

Q And for CW-13, the deepest one, you got 41.24, am I correct?

A That's correct.

Q Now, we go over to S-92, those are values that you used in forming you opinions, you relied upon?

A Yes.

Q We go over to S-92. You used for the shallow well, top well, is 42.48, am I right?

A That's correct.

Q Put that down.

And for the medium well you used 40.98. Is that right?

A Yes.

Q And for the intermediate you used 41.01?

A Yes.

Q And the 92 deep, the measuring point that you used was 45.69,

A Sixty eight.

Q Well, doesn't the EPA for that well say that it was 45.69?

A I'll take your word for it right now.

Q Well, let me show it to you. S-92 deep, 45.69.

A That sheet says 45.69. We may have made a mistake here, but I know we've gone through several revisions, so -- I'm not yielding on it yet, but it is a hundred to a foot---

Q You recognize that as an EPA sheet?

A Yes, I do.

Q And 45.69?

A Yes.

Q All right, you have 45.69. Now you want to subtract from that the water level just before they turn the pumps off. And what was the value used there?

A 40.90.

Q Yes. I'm sorry. The actual water level measurement.

A 4.78. Is that right. That is 92-D.

Q Really shouldn't it be 4.77. Isn't that what that -- rounding it off from---

MR. FACHER: I object, your Honor. "Really shouldn't it be."

Q Well, I'm asking do you recognize this as the -- Do you have the original shett there?

A I have our water level sheets.

(Pause.)

Q It is a little blurred here so it might be a difference

of opinion, but I think the last number before that was 4.769, if I'm not mistaken.

MR. KEATING: I can't hear you.

Q I think it says -- that is the computer printout -- it says 4.769. So I think they would probably round it off to 4.77.

A This is S-92?

Q S-92, the last day of the pump test, right before they turned the pumps off.

A Which, the deep well?

Q That's right. Ninety-two deep.

A The last day of the test, we're talking about depth of water, is that right?

Q Yes.

A I have 4.79 is what we used.

Q Well, we'll use your figure then. I think we have a difference of opinion. Do you have the actual computer sheet?

A I have our summary of that.

Q You don't have the original one? It was a transducer.

A Right. That is why I might not have it here.

Q All right.

A Wait a minute.

Q I don't think it is going to amount to any difference, so why don't we use your figure.

A All right.

Q 40.90. Put that down.

Now, the values for S-93, the water level values, are less than they are at 92, is that right?

A That's correct.

Q Do you have those with you. Can you just plug those right in there, S-92.

THE COURT: This is again for the same time?

MR. SCHLICHTMANN: Yes. January 3rd in the morning at 10:30.

Q Is that 40?

A 40.1, yes.

Q So the top well for 93, the shallow one is 40.1?

A That's correct.

Q And for the medium, it is 39.88. And for the deep one it is 39.48?

A Yes.

Q And for G, what was that on the morning just before they turned the pump off?

A 21.47.

Q Now, you did a cross section. That is shown in this exhibit. And what you did is that you did a cross section from Well G to 93 over to S-92?

A That's correct.

Q Now, in this, your exhibit here goes right to here; is that right?

A That's correct.

Q Your exhibit stops here?

A That's correct.

Q Your exhibit didn't go to the next two wells, 14 and 13; is that right?

A It doesn't have 14 and 13 on it, yes.

Q It stops right here at 92?

A That's correct.

Q So this is a cross section done which includes also not only the wells on this side of 92 but also on this side of 92?

A This section here, yes.

Q This one right here?

A And Well 14, that is on the Beatrice property, yes. Could I just look at a map, though, just to make sure we're looking at the same line of section. I just want to make sure where 13 and 14 are.

Q All right. Let me get you this one over here. It seems to be gotten a lot of use out of in the trial.

Now, there's G-93, 92, 14, 13?

A Yes.

Q Is that right. That's along the cross section?

A That's on this section, yes.

Q And 14 is on the Beatrice property?

A Yes.

Q And 13 is on the Beatrice Property?

A Yes.

Q There's no question in your mind about that?

A No.

Q Now, Dr. Guswa, in drawing your arrows here, you applied basic hydrologic principles known to your science?

A That's correct.

Q And the basic hydrological principle known to your science is a really fundamental one in hydrology, which says that if you have a place of high hydrostatic head and you've got a place of low hydrostatic head, that the groundwater is going to move from the high hydrostatic head to the low hydrostatic head. Is that a fundamental principle in your science?

A Yes.

Q And you applied it doing this diagram. Right. You looked up here and you saw high hydrostratic head. Right. It applies both horizontally and vertically?

A My point means hydrostatic means no flow at all.

Q Fine. We'll use high head. So if you go -- Here's high head?

A Yes.

Q And here it is a little lower. So you know vertically now it is going to go from high head to low head, vertically?

A That's correct.

Q And when you want to find out how it is going to go horizontally you look over here and you see what it is here and then you look over here and you see what it is here, and you note that here it is high and here it is low?

A Yes.

Q So you know it is going to go -- It is going to tend to go from here over to here?

A Yes.

Q And when you look down all of the wells you notice that all of them are higher than the other ones here. So you know you're going to have flow from here over to here?

A We have a gradient, a flow component in that direction.

Q The gradient is moving from here to here. And of course this is higher than it is here?

A That's correct.

Q And now that basic principle of hydrology applies on this side of Well 92 and it also applies on this side of 92 as well, doesn't it?

A That's correct.

Q And it applies to the Beatrice property no less than it applies to anywhere else in the aquifer; is that right?

A That's correct.

Q Beatrice has no dispensation from the rules of hydrologic practice?

A Not that I know of.

Q Let's go over to the Beatrice side of the property and let's look at Cluster 14. Now, when I look at the hydrostatic head and in the medium I compare it to the medium well at 92. And I see that the head is higher than it is for 92-M; am I right?

A That's correct.

Q And when I look at deep, I see that the head is higher than it is down here?

A That's correct.

Q And you'll agree with me that that's an indication that in the medium to deep layers of the aquifer, that the water is going to tend to move from high head to low?

A That's correct.

Q Now, when I go over to Cluster 13 and I make a comparison, I notice that the head at 13 is also higher than the head at 14. Am I correct?

A Yes.

Q And so I know, applying the basic principle of my science, that it is going to tend to move from 13 to 14. Am I right?

A Well, it will move -- It won't move directly to there but actually move in that direction.

Q In that direction, around the area of 14.

Now, another principle known to your science is that when you draw contours -- You draw contours to determine flow, is that right?

A That's right.

Q And when you draw contours, another principle to your science is that when you draw a flow line, an arrow to determine flow, it is always at right angles to the contour line. Am I right about that?

A Yes.

Q It is a basic principle?

A That's right.

Q Now, we have some contours on here. We have heads, the head values. But between here, which is a 41 line -- Do you see that, the 41 line that goes down here? That 41 line is perpendicular to S-82. We don't have any contour lines between here and over here. Do you see that?

A That's correct.

Q Now, if I wanted to put in a contour line between 41 and 41.5, if I wanted to run a line like this between these two values, seeing the values that I have over here, am I not correct -- please correct me if I'm wrong -- that if you drew the contour line between these two points I'd have to terminate somewhere around here?

A Which contour Line. 41---

Q Between 41 -- call it 41.1.

A 41.1?

Q Yes.

A Yes.

Q Would you draw that for the jury?

A (Witness complied.)

Q Now, Dr. Guswa, if I gave you the task of plotting the flow lines on this diagram, knowing what you know about the water level measurements and having the contours in front of you, and with the basic principle that an arrow flow should be right angles to the contour, would you be able to put those arrows on this diagram?

A I think so.

Q You could. All right. Could you draw the arrow between the top of the surface and this contour line?

Now, let me give you another pen. We have a red one. There you go.

A From the land surface to here? (Indicating).

Q Yes.

A (Witness complied.)

Q And if you want to draw an arrow of the flow between here and here, (Indicating), how would you draw it?

A (Witness drawing.)

Q And if you wanted to draw it from here to here, (Indicating), how would you draw it?

A This one -- Well, these numbers are very small differences --

Q Yes.

A -- but using these two numbers --

Q Yes.

A -- you have one going that way. (Witness drawing).

Q And how would you draw it here? (Indicating).

A (Witness drawing).

Q And how would you draw it over here? (Indicating).

A (Witness drawing).

Q And how would you draw it here? (Indicating).

A (Witness drawing).

Q And how would you draw it over here? (Indicating).

A (Witness drawing).

Q Now, Professor, I want to show you another diagram and ask that you examine it. Have you ever seen that before?

A This diagram?

Q Yeah, that one.

A No, I have never seen it.

Q Have you seen anything like it, bigger, more colorful?

A You mean a cross section?

Q Yes, something similar.

A The one behind it.

Q Did Mr. Facher or anybody from Beatrice Foods show you a diagram that any of their experts did?

A No, never did.

Q Never did. Let me ask you to help me, please. Could you hold that for me, please?

A (Witness complied).

Q Could you unclip that?

A (Witness complied).

Q Just line up the dots.

A Put the clip on, too?

Q Yes.

Now, Dr. Guswa, do you agree with me, if you could step to the side just so the jury could take a look, would you agree with me if I told you that, in fact, the diagram below was done by Mr. Koch for Beatrice Foods?

A Okay.

Q And this overlay right here was done by yourself?

MR. KEATING: I just didn't hear what you said. This overlay was done by whom?

MR. SCHLICHTMANN: Him.

MR. KEATING: Okay.

Q You and Mr. Koch seem to have a difference of opinion as to how the well flows from 13 to 14 from Well 92 to G, am I correct?

A Yes.

Q Take your time.

A Well, there are different directions on the arrows.

Q Yes, quite different, aren't they? Aren't they about as different as you can get? I mean, there is no mistake about it, your arrows are going straight over to C, and Mr. Koch's arrows are going straight away, am I right?

A That's right.

Q Well, who do you think is right, you or Mr. Koch?

MR. KEATING: I object to that, your Honor.

THE COURT: Overruled.

A Well, I contoured these water level data. I don't know what water level data Mr. Koch contoured.

MR. SCHLICHTMANN: Neither do I.

MR. FACHER: May that go out, your Honor?

THE COURT: Yes, that will go out. Just questions, Mr. Schlichtmann.

Q Mr. Guswa, just one thing. We have an overlay here -- Bill, could I have an overlay here?

Now, Dr. Guswa, if we go back to your diagram at the end of the pump test, we have just gone through this exercise with these flows from 13 over to 92. When you go to your diagram back here, based on the work we just accomplished over there, tell the jury how the groundwater flows from the Beatrice site at the end of the pump test based on the work that we did just a few minutes ago; would you be able to do that on this diagram?

A I would be able to show what this section shows, but

this section doesn't tell us what the groundwater flow is doing on the Beatrice site at that time. This is a cross section based on these six wells which happens to run this way.

Q Exactly.

A It doesn't consider any downgradient of wells, either. I will draw it if you like.

Q Yes. Show us where 13 and 14 are, for the jury.

A Do you want me to mark them?

Q Yes.

A This is 13 and this is 14. (Indicating).

Q Based on the work that we did on the cross section, would you show the jury the direction of flow, based on the water level data? Indicate it with an arrow based on the work you did with these wells.

A If you are asking me to do groundwater flow direction from 13 --

MR. FACHER: Objection, your Honor.

A -- I cannot say that it goes to 14. If you are asking me to translate this information to this sheet, with that restriction, I'll draw it.

Q Yes, thank you.

A That is what you are asking me to do?

Q That is exactly what I'm asking you to do.

MR. FACHER: I object. That is not what he asked.

THE COURT: Sustained.

Q Dr. Guswa, when we were over here, I asked you to make a determination of how the groundwater flowed based on this data from 13 over to 92, do you remember that?

A I did that.

Q That is what the data shows, is that right?

A That's correct.

Q Do you have any reason to doubt that these water levels are incorrect?

A No.

Q You used them in forming your opinions, didn't you?

A No reason to doubt that they are incorrect other than dealing with the relative uncertainty I talked about earlier.

Q Yes, but you used those values, didn't you, informing your opinions?

A That's correct.

Q You didn't come into the courtroom when you did this map and say, "Don't pay any attention to some of these values, these are the ones I used in forming my opinion"?

THE COURT: Enough. Enough. Just questions and no argument. Come on.

MR. SCHLICHTMANN: I won't argue.

Q Now, Dr. Guswa, you have the groundwater flow direction arrow here, is that right?

A That's correct.

Q And you have a groundwater flow direction here, is that right?

A That's right.

Q Now, based on our work over here, and based on the fine work you did on the aquifer here, do you think it is probable that if we had to draw an arrow about where the groundwater flowed in this area, right here in the middle, don't you think that the probabilities are -- Let me ask you this. If you had a choice between drawing a groundwater flow arrow to the east --

A Yes.

Q -- and drawing a groundwater flow arrow to the west --

A Yes.

Q -- would you be able to make a choice between those two?

A Between those two, yes.

Q Would you draw the arrow to the east rather than to the west?

A That's correct.

Q That would be based on the work you did over here as well as your understanding of the aquifer?

A That's correct.

Q Would you please draw an arrow which is the probable direction of the groundwater flow in this area in your opinion?

MR. FACHER: Objection.

THE COURT: Wait a minute. No, I'll let him answer, if he can.

A If you ask me to draw probable groundwater flow --

Q Yes,

A -- I would connect W-13 with W-10. I would not connect W-13 with W-14. There is only three hundredths of a foot difference which is over a hundred feet apart, and two tenths of a difference between these two wells, which are the same distance apart. So there is a lateral component of flow to the east toward the river, but there is an even stronger -- these are minor gradients, but there is a stronger gradient to the south. So if I were to draw --

Q Yes, please.

A -- a groundwater flow direction here, I would draw an arrow that looks like that. (Witness drawing).

Q You would not go to the west?

A I would not go to the west.

Q If you were up at W-11, what is the value at W-11?

A 41.43.

Q 41.43?

A Yes.

Q That is what you have down there, 41.43?

A Yes.

Q How would you draw the arrow from W-11; how would the groundwater flow from W-11?

A (Witness drawing). A lousy arrow.

Q How would it go at BW-7, that is, 41.77?

A 41.77.

Q How would that go?

A It is getting a little more difficult to interpret because the differences are further apart. There is an eight tenths of a foot difference between 7.92.

Q Right.

A Three tenths of a point difference between these two.

Q Yes.

A I'll try and split the difference here and make an interpretation like that. (Witness drawing).

Q Please.

Well, Dr. Guswa, do you tend to get the impression, based on your drawing of these arrows, that, in fact, you have come to an opinion that the probabilities are that during the pump test the groundwater at the Beatrice site flowed in a westerly, southwesterly direction, is that right?

A Southwesterly --

MR. FACHER: Objection.

Q Am I right about that?

MR. FACHER: Wait a minute, sir.

Objection, your Honor.

THE COURT: Overruled.

Q Am I right?

A From these three points, that's correct.

Q Well, you did that?

A That's right.

Q You have no reason to doubt what you did --

THE COURT: Are those three points adequate for you to form an opinion, Doctor?

THE WITNESS: No, they are not.

Q You want more points?

A It is not a question of points.

Q How about 79?

A Here is the dilemma. S-80 is two tenths of a point higher than S-79. S-79 is 400ths of a foot higher than BW-7. If I were to interpolate those, I would have to draw, just using those three, I would have to draw a flow to the north.

This is the problem I was talking about earlier. There are uncertainties in these measurements that mask the natural gradient.

Q How about S-76, 42.52?

A (Witness drawing).

Q And how about S-88, 41.37?

A (Witness drawing).

Q Let's see if we have any more wells left.

Q Now, how about if you had to make a choice here? If you did a triangle between S-92, W-14 and S-95, how would you draw the direction of the arrow?

A This one is highest, this one is lowest, this one is higher, this one is higher, this one the lowest. 40.9 would fall --

Q It would go from the apex?

A I'm trying to scale off -- If I took a linear scaling, the difference between these -- this is sort of how this triangle stuff works. Take a 41.2 and 41.5 and 40.9 is approximately here. We draw a line that connects these points and draw an arrow right next to that.

Q And did we do S-79? If you did S-79 and S-78 and S-92, how would you draw the arrow?

A 79, 78, S-92?

Q Right.

(Pause.)

Q Can you draw a little bigger than that?

(Pause.)

Q Well, now, have we drawn enough arrows for you to form and opinion yet?

A No.

Q Not enough arrows?

A No.

THE COURT: Well, that's about enough arrows

for today. It's five minutes past one. We'll start tomorrow morning.

9:00 o'clock tomorrow morning, ladies and gentlemen.

(Whereupon the jury left the courtroom.)

MR. KEATING: Your Honor, may we have a moment before you leave just to raise one question concerning scheduling matters?

MR. SCHLICHTMANN: Your Honor, can we have these marked for the record? The first overlay is P-901, and the second overlay is P-902. And P-901 goes on -- well, it's all part of the same exhibit. P-902 is on Exhibit G-952.

THE COURT: Straighten that out any way you want.

CONFERENCE AT THE SIDE BAR AS FOLLOWS:

MR. KEATING: Your Honor, just two matters, one scheduling and one related.

I think we're still shooting to wind up our case before the break, before the 4th. I think that's quite likely.

Now the reason I wanted to bring that to your attention was that I have listed on my witness list, and I think I listed it for at least a month now, an additional witness that I retained as a result of the epiphany of Dr. Pinder, one of his epiphanies. I think it might have been

second shower epiphany, where he finally began to discuss the role of the river and the role of the aquifer and all of a sudden it's first the molecules get the signals one way and then it's the peat. Whatever it is. And you recall that when I moved to strike his testimony, you had denied my motion, and I had said to you at the time that since this was not an opinion that he had given at the time of the deposition and therefore was not something that I was on notice of, that I wanted to have the opportunity to introduce -- look over my witness list and if necessary introduce an expert to testify on that particular issue.

THE COURT: Yes.

MR. KEATING: I have retained an expert. It is David Todd, the man who does all these charts. He's available to testify. I don't know if I'm going to use him. I may or I may not use him. I don't think I would use him until next week. But I have listed him on my witness list. No one said anything about it. I recognize that if he's going to estify, Mr. Schlichtmann and/or Mr. Facher would like an opportunity to have him deposed ahead of time. I have no problem with that.

But before -- I just thought -- I didn't want to all of a sudden waltz him into the courtroom, even though I had listed him, and run the risk that it be objected to.

THE COURT: Do you want to depose him?

MR. SCHLICHTMANN: I object to having him brought in as a witness. Two grounds. One, Mr. Keating makes the statement that they didn't know Dr. Pinder's attitude about the river when in fact he was asked specifically at the deposition and he gave the opinion at the deposition about his opinion as to how long it takes for the river water to get to the wells. It was explored and dropped by counsel at the deposition. They could have explored it in greater detail. They chose not to.

There was no surprise about his feelings about the river. That's one.

And I can show the page reference in the deposition.

Two, Dr. Guswa, a very fine hydrogeologist, who has completely examined this whole area, has given an extensive opinion about his feelings about the river. He was identified to me. I deposed him. Everybody was on fair notice about the fact that Dr. Guswa was going to give opinions as well as Mr. Maslansky.

This is another witness. It is cumulative. It's another hydrogeologist. There's nothing to be gained except bringing in another hydrogeologist to outnumber the hydrogeologists that came in for the plaintiff.

THE COURT: I thought he was a fellow who made diagrams.

MR. KEATING: He does everything. Mr. Schlichtmann is correct. He's a hydrogeologist. He writes textbooks. He's a Professor at the University --

THE COURT: I don't suppose that they're limited to numbers.

MR. SCHLICHTMANN: Well, only in the sense, your Honor, that both sides were fully aware that they were to obtain their experts, have them prepared and provide them for both sides so they could be deposed.

Now, I think what is happening here is that a very bad precedent is being established where plaintiffs are stuck with all of their experts, as they should be, and who are adequately and completely deposed about all their opinions, and the defendants keep changing the players. Their experts came in with no opinions when I deposed them. But that's not good enough. They don't like the few things they did give at the deposition so now they change it with a new witness and ask me now to stop and to do --

THE COURT: Yes. Yours did that, too.

MR. SCHLICHTMANN: No, they did not, your Honor. Not during the trial. That's just not true.

THE COURT: We had several depositions during the trial.

MR. SCHLICHTMANN: They were because you were trying to do some fundamental fairness to the plaintiffs.

And the plaintiffs were only asking -- he just wants to bring in another hydrogeologist. Dr. Guswa has shown no incapability of showing how the river works. What's to be gained?

THE COURT: Well, it seems to me there was some notion of Dr. Pinder that he had a new thought.

MR. KEATING: His epiphany, he called it.

MR. SCHLICHTMANN: Mr. Handon was a geologist. He was on the list. I deposed him.

THE COURT: That is totally irrelevant.

MR. SCHLICHTMANN: You're giving them a blank check to bring in new experts, and you're asking me in the midst of trial to depose them.

THE COURT: You had an expert who had new thoughts.

MR. SCHLICHTMANN: That is not true.

THE COURT: I remember that.

MR. SCHLICHTMANN: Every expert that has appeared for the defense has changed their opinion from the little that they gave me from the depositions. Dr. Pinder and Mr. Drobinski testified in this courtroom exactly as they testified. The opinions they gave were the same opinions that they gave in the deposition. They were fully aware of it. Now this game that they're playing about new opinions is just not true.

THE COURT: There was enough cross-examination

to set aside that notion.

MR. SCHLICHTMANN: Well, that is just not true, your Honor.

THE COURT: There was plenty of contradictory statements. He claimed they weren't contraditory because he was trying to answer in the spirit of something or other.

MR. SCHLICHTMANN: Every witness has that opportunity. Dr. Guswa is going to wiffle and waffle as all experts do.

THE COURT: He hasn't yet.

MR. SCHLICHTMANN: He's just started. Maybe he won't. The point is why should the defendants have a blank check to bring in any expert they want, to have me at a disadvantage and hope in the turmoil of the trial I won't have the chance to do the preparation?

THE COURT: What is Mr. Todd going to testify to?

MR. KEATING: The impact of the river, the impact of the river on the aquifer, to the role of the sources of water within the watershed of the area as to --

THE COURT: Anything different than what Guswa said?

MR. KEATING: I think he would deal particularly with the issue of dilution, your Honor, which I don't think Dr. Guswa dealt with in any particular detail.

THE COURT: Yes, he did. He talked about it.

MR. KEATING: Two points. First of all, it isn't a question of my holding back. I specifically mentioned this when you denied the motion with regard to Pinder. That's number one.

THE COURT: I remember that.

MR. KEATING: And I put it in the record.

Secondly, I have put his name down on witness lists that I furnished to Mr. Schlichtmann as late as a month ago and I continued to list him, and nobody has ever said anything about it. So I thought I better bring that to his attention explicitly or to all of our attention.

Thirdly, I'm not absolutely sure I'm going to use him. I have him, I've retained him, he's prepared to testify on the subjects I've used. And I just want to make sure they have an opportunity to examine him.

MR. SCHLICHTMANN: Dr. Todd, by the way, was in the courtroom during Dr. Pinder's testimony.

MS. LYNCH: He was not.

MR. KEATING: That's false. He's never been in this building. He's never been in the courthouse here at all.

MR. SCHLICHTMANN: I'm sorry. I take it back.

MR. KEATING: No, I would never run the risk of bringing him in if I was going to use him as a witness.

MR. SCHLICHTMANN: Talk about dilution, the more hydrogeologists, you are going to dilute it. Their opinions are going to be diluted.

MR. KEATING: That is my risk.

THE COURT: I can't say just because you decide on one hydrologist, they are limited to one. I don't suppose I need to rule on whether they can bring him in until they decide to bring him in. The question is, do you want to depose him?

MR. SCHLICHTMANN: If he is to testify, yes, I want to depose him.

MR. KEATING: I'll work out a schedule with Mr. Schlichtmann on that.

MR. SCHLICHTMANN: It is prejudicial for me to depose their other expert.

THE COURT: That is what they said about your expert.

MR. SCHLICHTMANN: They never had to depose any of my experts because they gave an opinion which they were not fully apprised of or not fully able to explore during the trial; that is absolutely true for every single expert.

THE COURT: Fine. I'm going to go to lunch. See you later.

(Whereupon the 68th day of trial was concluded.)

I N D E X

EXX H I B I T S