TESTIMONY RE THE IMPACTS OF THE BNSF RAILROAD BRIDGE

TESTIMONY OF JERRY MUTTER
Gathered from page 934 / 935 Query: RAILROAD /10/ BRIDGE

Q Now, let's talk about the Burlington Northern Railroad. There has been some discussion already in the course of this case about how debris might collect under the Burlington Northern Railroad bridge and form an obstruction. First of all, you did leave the Burlington Northern Railroad bridge in your model, did you not?
A Yes.
Q And maybe in ten words or less, because we've been over this with the jury once, if there is obstruction on the Burlington Northern bridge, is there a way the river compensates for that?
A Yes. The basic mechanism is for the river to rearrange its boundary, its bed, by scouring it out and providing space, essentially, for the water to get passed. **Despite the apparent obstruction.** And this happened most recently in the 1995 flood in the Skagit River, where a pier actually failed, Burlington Northern Railway bridge being scoured, sank and tilted. So it's not an uncommon event.
Q **So that is the way the river compensates then for any debris or whatnot that might be snagged in the bridge?**
A It is.

Gathered from page 939 / 940 Query: RAILROAD /10/ BRIDGE

And Mr. Malone doesn't -- doesn't discuss that at all. Doesn't seem to acknowledge the fact that it's more troublesome for plaintiffs to have higher flood levels as a result of the levees. And I think it makes a very important difference to the plaintiffs whether the water is just in their front yard or whether it's up to their ankles or their chin.
Q Did you notice whether or not he focused any of his work on the Burlington Northern Railroad bridge?
A Well, yes. He attempted to -- first he made the claim that the bridge was partly responsible for the flood problems in the Nookachamps, and then attempted to do some modeling to support that argument.
Q And in fact, you leave the bridge in in your approach, isn't that correct?
A Yes.
Q So any effect that the bridge might have is in fact taken into account in your work; isn't that correct?
A Yes.
Are you still asking for my opinion?
Q Yeah. If there are some other differences between you and Mr. Malone.
A I can think of a couple of additional differences.

Mr. Malone has made the statement, I believe, that it's not possible, or at least he is not able, to isolate the effect of the levees on flood levels in the Nookachamps area, which is the focus of the case, as I understand it. And I disagree with that very strongly.

In fact, I've been able to do that. Our work has been focused purely on that, what is the effect of the levees. And I don't understand how he has not been able or willing to do that.

Gathered from page 13815-13817 Query: BRIDGE

Q Or the Burlington Northern for that matter; is that right?
A Yes.
Q And then there was a bunch of questions in the course of this case, and this one is particularly troubling because they have said on numerous occasions -- this is Exhibit 210, you have it in front of you, it's up on the board here -- well, some if it's better than others, so we got it shown in a couple place here.

What they've said and what their expert came in and said, look, nothing downstream of the Burlington Northern Bridge has much effect. We know that -- they claim the Burlington Northern Bridge has some effect and their expert measured that, but they claim nothing downstream of here could have much effect on the folks up in here in Clear Lake and Sterling and the Nookachamps area. Now, that seemed to me to be quite contrary to your testimony, and I was wondering if you'd explain to the jury why they're wrong in saying that nothing downstream of the Burlington Northern Bridge could have any effect on plaintiffs in this litigation.
A Well, the results tend to speak for themselves. You can see from that graphic plot the flood levels --
Q Why don't you come down here. Let's move it up so you can get the pointer out so you can make it quite clear to the jurors why what they say isn't so. And here's the pointer.
A You can see that flood levels -- the increase in flood levels downstream through -- downstream from the bridges is at its greatest, six, seven, eight feet, the rise is greatest, and in this kind of river, the effect of this ponding extends in the upstream direction. The control over water surface elevations here comes from the downstream direction. It's not the case in very steep rivers where the control comes from the upstream. This is called sub-critical flow.
Q Let's not use any fancy words.
A Very simply, it's ponded from the downstream end up, and you can see that it's ponded a great deal, so we would expect ponding back in the Nookachamps as a result.
Q Okay. And if you were to take out all the levees downstream from the Burlington Northern Bridge, what -- would that have any greater effect than taking out the

levees upstream from the Burlington Northern Bridge, that is Dike District 12's dike upstream from the Burlington Northern Bridge?

A That's essentially what we accomplished by removing the entire levee system. We could see a very strong effect by removing these levees, and water surface elevations were down slightly by removing this levee.

Gathered from page 13817 / 13818 Query: BRIDGE

Q Okay. And if you were to take out all the levees downstream from the Burlington Northern Bridge, what -- would that have any greater effect than taking out the levees upstream from the Burlington Northern Bridge, that is Dike District 12's dike upstream from the Burlington Northern Bridge?

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Q So if you removed the downstream levees, it would have a greater effect than the upstream levees?

A Absolutely.

Q That's what your model showed. One that took over a thousand hours to put together, something like that, Dr. Mutter?

A That's correct.

Gathered from page 13838 - 13840 Query: BRIDGE

Q You testified on direct, did you not, that in 1906, one of the reasons why you found the 37-foot elevation number to be inaccurate is because of your determination that at that time levees existed downstream from the Burlington Northern Bridge and they would have had an effect on water surface elevations, correct, Dr. Mutter?

A I feel the need to clarify. We modeled the 1990 flood event without levees. We estimated boundary condition, water surface elevation downstream, boundary condition for our model, and used all of the available USGS data and the most sophisticated techniques in order to estimate the starting elevation of 31 feet for the 1990 flood event.

Mr. Melone, I believe, had said that because of this 1906 event, this estimate, my starting elevation of 31 feet is incorrect, and I'm saying it is not. I don't believe the 1906 event is useful to make any judgment about my boundary condition.

Q I understand that.

A I did not model the 1906 condition or flood.

Q My question to you, sir, is on direct examination you testified, did you not, that one of the reasons why you

found the 37-foot number to be unreliable vis-a-vis what you did, because in 1906 there were downstream levees and they would have had an effect on the water surface elevation at the Burlington Northern Bridge and, therefore, you didn't take that into account and didn't think it was relevant. Isn't that your testimony?

A No, I said that -- first of all, Mr. Stewart made that observation, and that I was trying to model a situation in which levees were not present.

Gathered from page 13842 / 13843 Query: BRIDGE

Q Okay. Do you know what gradient the water surface elevation was in 1990 between, say, the Highway 9 bridge and the Burlington Northern Bridge?

A There isn't a simple straight line gradient. Our model predicted a surface which varied considerably between those two points, so we have the entire surface mapped as a result of our analysis.

Q What's the average gradient between Highway 9 and the Burlington Northern Railroad bridge during 1990?

A I don't know.

Q Would you expect it was the same for another flood event, such as 1975?

A Not necessarily.

Q And, though, in your computer model you used the 1990 conditions to replicate the 1975 flood.

A That's true.

TESTIMONY OF DR. MELONE

Gathered from page 9679 / 9680 Query: BRIDGE

April 7, 1997

MELONE - Direct (Smart)

the past by corps of engineers, U.S. Geological Survey, FEMA. In particular, I've looked at the flood analysis by the corps of engineers on the 1951 flood and the 1975 flood. I've also gone to the field and collected some of my own information. I have been in the field and identified high watermarks from the November 25th, 1990, flood and have had them surveyed. I have been to the field and have surveyed the crest elevations of Dike District 12's dikes on the north side of the river. I have surveyed the crest elevations of Dike District 17 on 17's levee that runs from Riverside dike up to the Burlington Northern Railroad and have surveyed the railroad embankments, Burlington Northern Railroad as it approaches the Burlington Northern Bridge and the railroad alignment that parallels State Route 20.

Gathered from page 9680 / 9681 Query: BRIDGE

I used the model in investigating the effect of debris

blockage on the Burlington Northern Bridge and what effect that has on the plaintiffs upstream.

Gathered from page 9683 / 9684 Query: BRIDGE

Number six, the hydraulic model that I developed shows that observed flood levels, flood levels that I surveyed in the November 25 flood, could not be achieved with an unobstructed Burlington Northern bridge opening. I had to simulate debris blockage, log debris blockages on the bridge in order to fully reproduce the flood levels that I surveyed for that flood. This does lead to an increase in flood levels on plaintiffs' properties.

Gathered from page 9684 / 9685 Query: BRIDGE

Number seven, again the hydraulic model that I developed, the different depths that were observed in the upper Nookachamps, some of the other levee depths as great as twelve feet. In the Nookachamps areas, the bigger depressional areas flood depth as great as 22 feet, but a portion of this, four or five inches, can be attributed to debris buildup on the Burlington Northern bridge.

Gathered from page 9735-9738
Gathered from page 9885 / 9886 Query: BRIDGE

Q Okay.
Then I wanted to ask you a question about another area. Yesterday you talked about you turned your computers on, help tell the jury about what the effect of the logjam might have been at the Burlington Northern bridge according to your computer analysis. But one thing you didn't tell the jurors that even you recognize, the concept of the scour, correct?
A Yes, I understand river scour.
Q And in fact, indeed, when you reduced the flow area, I think -- may be wrong here, I'm not a hydraulic engineer. You increased, as you described yesterday -- I thought you did a good job. You increased the velocity of the water going through a small area; isn't that right?
A That is correct.
Q And what happens is -- I have a chart around here somewhere -- Can you see this? Can you see this a little bit from where you're at, Dr. Mutter?
A Melone.
Q Oh. Dr. Melone. Of course.
A No, I can't see it very well.
Q You're so close to Dr. Mutter, I don't know why I would --
Taking a look at this diagram. You want to come down here?

A I would like to come down.
Q Help you out a little bit. I don't want you not to be able to see.

Mr. Regan got up and designed just a, you know, schematic, conceptually, of what happened in the river when we had scour. And this would be the normal riverbed here and then some obstructions. And he said you would get some scouring out effect here. This was a way he showed folks how you can measure. Put a chain in the ground when it's not scoured and when it scours out, you can see the distance of the scour where the chain sits in the bottom of the river.

A This is a river cross-section?
Q Yes.
A This is the water level?
Q Yes, sir.
A And this is the bed of the river?
Q Right.
A This is the bed of the river after the scour?
Q After the scour. That is conceptually how a scour would work, and how you might measure it?
A Yes, it is.
Q Okay.

And nobody really knows the depth of this scour, do they, Mr. Melone?

A The depth --

MR. SMART: Objection. Which scour? Talking hypothetical or talking about actual?

MR. HAGENS: Good point. Good point.

Q (By Mr. Hagens) Did a bad job with that question.

Nobody knows in 1990 what the depth of the scour was at the Burlington Northern bridge?

A I have not seen any numbers on the depth of the scour.
Q What you do know, like a doctor knows when a leg is broken or not, he knows that it occurs?
A I would believe a scour would occur.
Q Right. And one of the graphic evidences we have of that is 1995 when one of the piers on that bridge collapsed because, as your counsel has pointed out many times, there was a big logjam, almost like this. I don't know if this is '95 event. I think it maybe might have been. And this increases this scour effect up here, isn't that right?
A Contributes to the scour effect, yes.
Q Right.

So, and that is the way the river has of compensating for the fact that there is obstructions in the river floodway, is it scours, as portrayed on exhibit --

A As the area is obstructed and the water needs to pass through that, it will pass under the debris and scour.
Q And that failing pier in 1995 is good graphic evidence of what it can do; isn't that right?

1 A I would believe that that was a scour with the pier.

Gathered from page 9916 / 9917 Query: BRIDGE

14 Q Now, Mr. Hagens has talked to you about the concept of the
15 scour. Turn to the diagram. I don't think I need it for the
16 purpose of my question. Did you take into account the
17 concept of the scour when you made your determination that
18 the logjam on the Burlington Northern bridge actually
19 increased the water surface elevation in the Nookachamps
20 during the 1990 flood?
21 A Yes, I did. Scour -- we talked yesterday about the energy
22 that is required to go through a major blockage like a debris
23 -- a log debris map like that, and through the narrow
24 bridges or the narrow openings through the bridge. That the
25 more it's blocked, the more energy it takes to get through.

1 As we talked about this morning, part of that energy goes
2 into scouring the river. Even with that occurring, that does
3 not change the fact that upstream from that log boom you have
4 an increased water level. You have an increased water level,
5 that is how we got our energy, we got an increased water
6 level to go through this log debris to cause some of the
7 scour. And what we see, that increase in energy level is a
8 higher flood level upstream. So the scour is totally
9 consistent with a higher flood level upstream of the log
10 debris.

of Apr07b on 16-Dec-01 Query: BRIDGE

18 Q And do you have an opinion with respect to whether or
19 not that impediment raised water surface elevations
20 during the 1990 flood upstream from the Burlington
21 Northern Bridge?
22 A Yes. As the Burlington Northern Bridge is a bottle neck
23 in the river system by itself, it's a narrow opening for
24 the river to pass through. It has 12 big concrete piers
25 holding that bridge up. And, in addition, commonly for

1 major flood events, a lot of log debris comes and jams
2 up on that bridge, and as it jams up on the bridge, what
3 the water has to do -- if you think of it in terms of a

-- it takes the water more energy to get through this log jam and the pier, more energy than it would if the log jam wasn't there. So then how does the river get that energy? It gets that energy upstream from the bridge by backing up, backing up and getting higher. That's how it gets more energy, so that it can overcome the energy losses, the amount of energy it takes to get through the log jam and the bridge.

Q Okay. And have you calculated the amount of increased water surface elevation upstream from the Burlington Northern Bridge as a result of the log jams that occurred during the 1990 flood?

A My calculations showed --

MR. HAGENS: Wait, wait, wait, wait. I'm going to be object here. He needs some foundation. If he's talking about a log jam, I'd like on to know what the dimensions of the log jam are, how deep it is, how wide it is.

THE COURT: Sustained.

Q How did you calculate it, sir?

A We have a modeling effort. I mentioned that we created a two dimensional FESWMS, F-E-S-W-M-S. It is an acronym

for a model called the Finite Element Surface Water Modeling System. In creating this model, what a modeler must do is what we call calibration. Calibration means go out -- remember I said we surveyed 1990 flood elevations? A model, thus, to be calibrated, it must reproduce the 1990 flood elevations, and if it cannot do that, then you say I do not have a calibrated model.

We did the same with 1975 using information from the Corps of Engineers. We found, when we tried to calibrate our 1990 model in the vicinity of the bridge, upstream from the bridge we could not reproduce the observed flood levels that I surveyed with the bridge with just the 12 bridge piers, so what I did is made the area less. I lessened the area to account for more obstruction of the log debris, and I did that process. You put some -- you decrease the area to see if you reproduced your 1990 number. If I haven't, then that means I haven't blocked enough, so you block that area and make it smaller 'til you've reproduced the 1990 observed flood level.

Q Okay. And is that the standard practice in using the FESWMS computer model system for reproducing phenomena that affect certain flood levels?

A It's a standard procedure for all hydraulic models.

Q And what did you determine with respect to your efforts

in that regard concerning the water surface elevation caused by the log jam during the 1990 flood?

A I found that there was an increase in flood levels upstream from the Burlington Northern Bridge. **It varied with distance from the bridge, but in the immediate vicinity, about seven inches in my opinion was attributable to the log jam itself. As we went further upstream it lessened to perhaps four or five inches throughout the lower Nookachamps valley**.

TESTIMONY OF LAURENCE BOTCHER

Gathered from page 9582 / 9583 Query: BRIDGE

Q You're right. This is a photo that has been introduced into evidence, Exhibit 1123, of the log jam in 1995.

A Yes.