

ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF: )  
WATER QUALITY STANDARDS AND ) R08-09  
EFFLUENT LIMITATIONS FOR THE ) (Rulemaking-  
CHICAGO AREA WATERWAY SYSTEM ) Water  
AND THE LOWER DES PLAINES )  
RIVER: PROPOSED AMENDMENTS )  
TO 35 Ill. Adm. Code Parts 301, )  
302, 303 and 304 )

REPORT OF THE PROCEEDINGS held in the  
above entitled cause before Hearing Officer Marie  
Tipsord, called by the Illinois Pollution Control  
Board, taken by Steven Brickey, CSR, for the State  
of Illinois, 100 West Randolph Street, Chicago,  
Illinois, on the 10th day of March, 2011,  
commencing at the hour of 9:00 a.m.

A P P E A R A N C E S

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4 MR. ANAND RAO, Senior Environmental Scientist  
5 MR. TANNER GIRARD, Acting Chairman  
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MR. SCOTT BELL

REPORTED BY:

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I N D E X

THE WITNESS: SCOTT BELL

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1 MS. TIPSORD: Good morning,  
2 everyone. My name is Marie Tipsord and I've been  
3 appointed by the Board to serve as Hearing Officer  
4 in this proceeding entitled Water Quality  
5 Standards and Effluent Limitations for the Chicago  
6 Area Waterway System and Lower Des Plaines River,  
7 Proposed Amendments to Ill. Adm. Code 302, 303 and  
8 304. This is docket R08-09 Subdocket C.

9 With me today to my immediate  
10 left is acting Chairman, G. Tanner Girard, to his  
11 left is Board Member, Carrie Zalewski, and to her  
12 left is Board Member, Gary Blankenship. To my far  
13 right is Board Member, Thomas Johnson. To my  
14 immediate right is Anand Rao and to his right  
15 Alisa Liu from our technical staff.

16 Today's hearing is the fourth  
17 day of the hearing in Subdocket C, our 48th.  
18 We're fast approaching that 50th mark. A  
19 prehearing conference was held March 7th and a  
20 schedule decided upon. I did not do a hearing  
21 officer order, but the schedule is as follows.  
22 Mr. Scott Bell on behalf of the Metropolitan Water  
23 Reclamation District will testify today. He will  
24 be questioned first by the IEPA, then Prairie

1 Rivers and Sierra Club and finally by Midwest  
2 Generation.

3 If we finish with Mr. Bell,  
4 which is highly unlikely today, we will go to  
5 Mr. Scudder Mackey also with the District and he  
6 will be questioned first by the IEPA, then Prairie  
7 Rivers and Sierra Club, then Open Lands, Midwest  
8 Generation and finally by Citgo.

9 As I said, we don't anticipate  
10 completing Mr. Bell's testimony so additional  
11 hearings will be scheduled. The Board will need  
12 to take a brief break of about 20 minutes at 10:00  
13 to enter into a closed deliberative session which  
14 will be brief because they will recess it and then  
15 go back at our lunch break and do a deliberative  
16 session. That means we'll take a little longer  
17 lunch break, but I would anticipate after we come  
18 back at 10:00 we will go until about 12:30 or so  
19 before we take our lunch break.

20 Also, I will have the attorneys  
21 come back a little bit early from our lunch break  
22 to do the scheduling of additional days of  
23 hearings. Frankly, I'm still waiting to hear. We  
24 have a Section 20.5 rulemaking which under the Act

1 requires us to hold hearings within 55 days of  
2 receipt and those 55 days run right up against  
3 where I was looking at the schedule in our  
4 hearing. So I need to find out if we're going to  
5 have days available that week.

6 The testimony will be marked as  
7 an exhibit and entered if read. Anyone may ask a  
8 follow-up question. You need not wait until your  
9 turn to ask questions. I do ask that you raise  
10 your hand and wait for me to acknowledge you.  
11 After I've acknowledged you, please state your  
12 name and whom you represent before you begin your  
13 questions. Please speak one at a time. If you're  
14 speaking over each other, the court reporter will  
15 not be able to get your questions on the record.

16 Please note that any questions  
17 asked by a Board member or staff are intended to  
18 help build a complete record for the Board's  
19 decision and not to express any preconceived  
20 notion or bias. I do remind you all the acoustics  
21 in this room are horrific. It's very hard to hear  
22 in the back of the room. If you have any problems  
23 hearing, let me know or please move up.

24 Dr. Girard?

1 MR. GIRARD: Good morning. Welcome  
2 to hearing day 48. I haven't totally lost hope we  
3 can finish with Dr. Bell this morning, but the  
4 best way to do it is get on with it. So, Marie,  
5 let's get moving. Thanks.

6 MS. TIPSORD: Before we do start  
7 with Mr. Bell, however, I was approached before  
8 the hearing. Mr. Harley, you have some items  
9 you'd like to enter into the record?

10 MR. HARLEY: For the record, Keith  
11 Harley, Southeast Environmental Task Force.

12 MS. TIPSORD: We can't hear you.

13 MR. HARLEY: Good morning.

14 MS. TIPSORD: Good morning.

15 MR. HARLEY: Madam Hearing Officer,  
16 Keith Harley for the Southeast Environmental Task  
17 Force. Madam Hearing Officer, as you know, we do  
18 not intend to present any witnesses, but we do  
19 have two exhibits that we'd like to have entered  
20 into the record still.

21 MS. TIPSORD: I've been handed  
22 Calumet Monitoring Locations Dissolved Oxygen  
23 Levels mg/L January 2007 through December 2008 and  
24 the source is the Metropolitan Water Reclamation

1 District of Greater Chicago website.

2 If there's no objection, we will  
3 mark that as Exhibit 445. Seeing none, it is  
4 Exhibit 445.

5 (Document marked as IEPA Exhibit  
6 No. 445 for identification.)

7 MR. ETTINGER: May I ask who  
8 compiled this?

9 MS. TIPSORD: Yes.

10 MR. HARLEY: Madam Hearing Officer,  
11 it is compiled from asiancarp.org and it's  
12 compiled based on fish inventory data that they  
13 compiled over a period of several months in 2010  
14 as indicated by the caption.

15 MS. TIPSORD: And the second is  
16 Little Calumet River Fish Inventory Sampling  
17 Summary May 2010 through October 2010. Source  
18 asiancarp.org. If there is no objection, we will  
19 mark that as Exhibit 446. Seeing none, it's  
20 Exhibit 446.

21 (Document marked as IEPA Exhibit  
22 No. 446 for identification.)

23 MR. HARLEY: Madame Hearing Officer,  
24 is there a place I can place extra copies?



1 MS. TIPSORD: How about this table  
2 right over here?

3 MR. HARLEY: Thank you, Madame  
4 Hearing Officer.

5 MS. TIPSORD: Thank you very much.  
6 With that, I think we're ready to begin with the  
7 witness. Can we have Mr. Bell sworn in please?

8 WHEREUPON:

9 SCOTT BELL  
10 called as a witness herein, having been first duly  
11 sworn, deposeth and saith as follows:

12 MS. TIPSORD: Do we have a copy of  
13 his testimony?

14 MR. ANDES: Yes. Three copies.

15 MS. TIPSORD: Actually, I just need  
16 one. Is there anyone out there that would like a  
17 copy of the testimony? Just go ahead and set it  
18 over there if somebody wants it later. If there  
19 is no objection, we will mark the pre-filed  
20 testimony of Mr. Scott Bell as Exhibit 447.  
21 Seeing none, it's Exhibit 447.

22 (Document marked as IEPA Exhibit  
23 No. 447 for identification.)

24 MS. TIPSORD: And as indicated, we

1 will begin questions with the IEPA.

2 EXAMINATION

3 BY MS. WILLIAMS:

4 Q. Good morning, Mr. Bell. My name is  
5 Deborah Williams and I'll be doing the questions  
6 on behalf of Illinois EPA this morning. We'll  
7 start with pre-filed question number one.

8 Page 3 of your testimony states  
9 that, quote, physical habitat, not water quality,  
10 is the most limiting factor for fish in the CAWS  
11 today. At Page 11 of your pre-filed testimony  
12 also states that, quote, physical habitat is  
13 relatively more important (i.e., more limiting) to  
14 fish in the CAWS than DO.

15 Question A, what do you mean by  
16 more limiting?

17 A. In the context of my testimony and  
18 our study, the terms "more limiting", "most  
19 limiting" and "relatively more important"  
20 generally all mean the same thing and that is of  
21 the factors that we considered in our study we  
22 found that physical habitat was the most limiting  
23 factor to fish condition in the CAWS today.

24 Q. Why don't we just maybe more

1 generally step back and talk about limiting, what  
2 do you mean by limiting? Limiting what?

3 A. Okay. The concept of a limiting  
4 factor has to do with in considering all the  
5 various things that can affect condition of fish  
6 in a system. There are a great number of them and  
7 at any given time depending on how these different  
8 conditions present themselves some can be limiting  
9 and some can be not limiting. It doesn't mean  
10 that the fish don't necessarily need the  
11 nonlimiting factors. It just means for them to be  
12 more successful than they are right now for them  
13 to have greater abundance or condition, it means  
14 that there are certain factors that are holding  
15 them back and in our work we concluded that today  
16 in the CAWS the physical habitat conditions are  
17 the factors that are limiting the fish, not  
18 dissolved oxygen.

19 Q. What about the fish are being  
20 limited by the physical habitat?

21 A. There were ten metrics that we used  
22 to assess fish condition and they're listed in our  
23 Habitat Evaluation Report. I don't, today, have  
24 them committed to memory, but if you can give me a

1 moment I can tell you.

2 MS. TIPSORD: For the record, that's  
3 Public Comment 284.

4 BY THE WITNESS:

5 A. So referring to Appendix A of our  
6 Habitat Evaluation Report which is entitled Review  
7 and Selection of Fish Metrics and in this we list  
8 a process by which we evaluated a great number  
9 of -- a few dozen anyway -- fish metrics for  
10 potential inclusion in our study and at the end of  
11 a process of whittling that list down we came up  
12 with ten that we used as indicators. The ten that  
13 we used represent four ecological function  
14 categories, which is a description of the type of  
15 metric. Those function categories represent a  
16 reproduction function, trophic function, that is  
17 where they are in the food chain, species richness  
18 and composition and then indicator species metrics  
19 which are metrics that are used to identify  
20 particular species of interest.

21 The specific metrics that we  
22 used were percent with lithophilic spawners by  
23 count, percent insectivores by count, percent top  
24 carnivores by weight, proportion of Illinois

1 tolerant species, Illinois ratio of nontolerant  
2 coarse mineral substrate spawners, number of  
3 Illinois native minnow species, number of Illinois  
4 native sun fish species, Illinois ratio of  
5 generalist feeders, percent intolerant species by  
6 count and percent moderately intolerant species by  
7 weight.

8                     These metrics are all listed in  
9 Table 5.1 of that appendix and they're also listed  
10 elsewhere. I just couldn't put my finger on the  
11 table on the main body of the report.

12                     MS. TIPSORD: Table 5.1 of which  
13 appendix?

14                     THE WITNESS: Appendix A.

15 BY MS. WILLIAMS:

16                     Q. So, Mr. Bell, I think we'll get into  
17 more detail later in the questions about the  
18 specifics of all of those, but are you telling us  
19 today that each of those elements are limited by  
20 physical -- each of those metrics are impacted by  
21 physical habitat?

22                     A. No. My testimony is not each of  
23 those are limited by physical habitat. What I'm  
24 saying in my testimony and in our report is that

1 when those metrics are used to assess fish  
2 condition in the CAWS and assembled into a single  
3 variable representing all of them that that  
4 measure of fish condition indicates that fish are  
5 being limited by physical habitat more than  
6 dissolved oxygen.

7 Q. Do you agree that it's necessary to  
8 perform controlled experiments that manipulate the  
9 relative amount of each potentially limiting  
10 factor while holding constant all other factors to  
11 establish the most limiting factor to a population  
12 of organisms? This is E.

13 A. No, I don't agree with that  
14 statement.

15 Q. Can you explain?

16 A. Yes. I think as a scientist it  
17 would be wonderful if we could do that because  
18 then we would be able to eliminate all  
19 uncertainty, but the fact of the matter is in the  
20 real world we can't and that's why the most common  
21 approach used in studies like this is to actually  
22 go out and measure what we're studying in nature,  
23 in the environment, and to try to discern  
24 patterns, empirical patterns between the data that

1 we collect. It's simply impossible to create  
2 controlled experiments of the type described in  
3 the question for all the things that we want to  
4 understand about what is going on.

5 Q. I think I understand and kind of  
6 agree with what you're saying, but I guess my  
7 question for you is, do you believe that in the  
8 real world through field experiments a true -- one  
9 true limiting factor can never be discovered  
10 through studies like what you've done or is it?

11 A. Can you repeat that question,  
12 please?

13 MS. WILLIAMS: Do you think you  
14 could or I can try?

15 (Whereupon, the record was read  
16 as requested.)

17 BY THE WITNESS:

18 A. I do believe that it is possible  
19 through field studies to discern the relative  
20 importance of various factors that are affecting  
21 organisms. It's often difficult because of the  
22 variety of things that can affect animals, but  
23 given enough data and the proper analytical  
24 methods, I do believe that it's possible to

1 evaluate the data and conclude which factors are  
2 most limiting to organisms.

3 BY MS. WILLIAMS:

4 Q. Thank you. Let's move onto question  
5 two. Do you equate the statistical concept of  
6 relative importance in regression with practical  
7 importance?

8 A. Could you please explain what you  
9 mean by practical importance?

10 Q. I think I'm meaning it as a  
11 layperson would understand of importance to a  
12 decisionmaker such as the Board.

13 A. Okay. Well, if you're asking if --  
14 if you're asking if through statistical analysis  
15 of data when we find a relationship that's  
16 statistically defensible, if it actually always  
17 means that there is a functional relationship  
18 between the variables, that may not be true. I  
19 don't know if that is exactly what you're getting  
20 at.

21 Q. Can you repeat your answer?

22 A. I think. Okay.

23 (Whereupon, the record was read  
24 as requested.)



1 BY MS. WILLIAMS:

2 Q. Is it possible for a relationship  
3 between or among variables to lack statistical  
4 significance and yet still be of practical  
5 importance? It's B.

6 A. It is possible, but I think I would  
7 add if you're using variables that you've  
8 determined ahead of time to be logically related  
9 to each other like habitat and fish to see a  
10 statistically valid relationship -- if you have  
11 enough data, you would expect to see a  
12 relationship there.

13 Q. Question three. On Page 2 of your  
14 pre-filed testimony, you state in the first  
15 paragraph that, quote, these data were evaluated  
16 using analytical methods appropriate for this type  
17 of ecological evaluation, end quote.

18 A, please explain why you feel  
19 these methods are appropriate.

20 A. That portion of my testimony refers  
21 to some of the methods we used to analyze the data  
22 that we collected and that the District collected  
23 and I'm specifically referring to multiple linear  
24 regression, principal components analysis, cluster

1 analysis and CART analysis and I feel that they  
2 are appropriate for several reasons.

3 First, because they're, in fact,  
4 recommended by authoritative references in the  
5 field, standard references. For example, the  
6 American Fisheries Society has a reference called  
7 Analysis and Interpretation of Fisheries Data and  
8 these methods are all discussed in there.

9 Secondly, these methods are the  
10 same methods that are used in the scientific  
11 literature for similar studies and I can provide  
12 examples if you'd like and third --

13 MR. ANDES: We'll come back to that.  
14 We have copies of those references.

15 BY THE WITNESS:

16 A. And, third, our study was reviewed  
17 by national experts and we spent a great deal of  
18 time discussing our methods and our data with them  
19 and those experts had no criticisms of what we had  
20 done.

21 BY MS. WILLIAMS:

22 Q. So let's talk about that. What do  
23 you mean? I don't know if I found reference to  
24 that in your documents, specifically the national

1 experts had reviewed this study?

2 A. When we completed the drafting of  
3 our Habitat Evaluation Report, we engaged the  
4 service of three gentlemen who are national  
5 experts. I don't know if they've been presented  
6 to you before. I can give you their names if  
7 you'd like.

8 Q. That would be great.

9 A. They were Dr. Charles Hawkins of the  
10 University of Utah, Dr. Edwin Herricks of the  
11 University of Illinois and Dr. Charles Rabeni of  
12 the University of Missouri. As you see, they're  
13 all college professors with expertise in fisheries  
14 and habitat and --

15 Q. So you're telling me that none of  
16 those professors found any problems with your  
17 study?

18 A. No, they had several questions.

19 Q. Okay.

20 A. We went -- in fact, we spent a day  
21 with them discussing their questions and answering  
22 them. They made some suggestions and --

23 Q. At what point in the process did you  
24 meet with them?

1           A.       As I said, upon completing our draft  
2 report, we submitted the draft report -- the  
3 Habitat Evaluation Report to them for their review  
4 and comment. We convened with them and we  
5 received their comments at that time and discussed  
6 their questions.

7           Q.       Do you want to talk about what kind  
8 of questions and comments they had?

9           A.       I don't recall everything  
10 specifically, but one of the major items that came  
11 out of that discussion was the suggestion that as  
12 a way of possibly corroborating or testing our  
13 linear regression analysis we conduct what's known  
14 as a CART analysis, which is Classification And  
15 Regression Tree Analysis. It's an alternative  
16 discerning limiting factors in ecological studies  
17 and they said, you know, the thing with multiple  
18 linear regression is that you can have several  
19 variables that are competing, but you have to boil  
20 them all down to a few variables in order to test  
21 them with regression. The advantage of CART is  
22 that you don't have to do that. You can leave a  
23 bunch of variables in there. You don't have to  
24 worry about if they're correlated with each other.

1 We said "Great. Let's do that." We did that and  
2 I think there are questions elsewhere that refer  
3 to this.

4 Q. Yes.

5 A. In fact, we wrote a memo about that  
6 analysis and I attached it to my testimony. The  
7 reason it wasn't included in the body of the main  
8 report was the body of the main report had been  
9 completed at that time.

10 Q. At that point, did any of them say  
11 to you "Why didn't you just do it this way from  
12 the beginning with the CART analysis"?

13 A. Not that I recall.

14 Q. Have you ever developed a system  
15 specific habitat index before? That is question  
16 B.

17 A. No, I have not, but examples exist.

18 Q. Have you ever developed a combined  
19 fish metric before?

20 A. No, I've never had the need to, but  
21 the methods we used were appropriate.

22 MR. ETTINGER: Albert Ettinger,  
23 Prairie Rivers Network and Sierra Club. You said  
24 it had been done before, the developing of

1 specific metric index in response to Ms. Williams  
2 3 (b) ?

3 THE WITNESS: Yes.

4 MR. ETTINGER: Where else has it  
5 been done before?

6 THE WITNESS: One example that comes  
7 to mind is an index that was recently developed  
8 specifically for the Ohio River system. Notably  
9 in spite of the fact that an index already existed  
10 from the State of Ohio for rivers, the researchers  
11 on the Ohio River determined the need for specific  
12 index for that system because of its unique  
13 characteristics. We have a reference on that if  
14 you'd like.

15 MR. ETTINGER: Delightful. Are you  
16 familiar with any others?

17 THE WITNESS: I would be going by  
18 memory, but if I'm not mistaken specific habitat  
19 indices have been developed for San Francisco Bay  
20 and if I try to remember more I may misspeak, but  
21 I do know that there are others that we have seen.

22 MR. ETTINGER: Thank you.

23 MR. ANDES: The document that we're  
24 introducing is entitled Development of a

1 Multimetric Index for Assessing the Biological  
2 Conditions of the Ohio River.

3 MS. TIPSORD: Fred, we're going to  
4 have a couple of extra copies up here.

5 MR. ANDES: Okay.

6 MS. TIPSORD: If there's no  
7 objection, we'll mark the Development of a  
8 Multimetric Index for Assessing the Biological  
9 Conditions of the Ohio River, copyright by the  
10 American Fisheries Society 2003 as Exhibit 448.  
11 Seeing none, it's Exhibit 448.

12 (Document marked as IEPA Exhibit  
13 No. 448 for identification.)

14 BY MS. WILLIAMS:

15 Q. Mr. Bell, do you know if this is the  
16 most up-to-date version of this index that you're  
17 entering into the record?

18 A. I do not.

19 Q. Question D asks whether your index  
20 was published?

21 A. It has not been published. We have  
22 a manuscript in preparation. Actually, two  
23 manuscripts in preparation related to the study.  
24 We have presented portions of the study at several

1 conferences. I can give you a list if you'd like.

2 Q. I don't know if I need a list of all  
3 the conferences, but I am curious about which  
4 portions of the study you have taken. The whole  
5 thing or are there certain aspects of it that you  
6 have taken to conferences?

7 A. Aspects. It would have been  
8 difficult to present the whole thing in a context  
9 study because it's a rather large study, but, for  
10 example, at the 2009 national conference on  
11 ecosystem restoration in Los Angeles I presented a  
12 poster on the development of the habitat index and  
13 other portions of the study have been presented,  
14 for example, at the annual conference of the  
15 Michigan Chapter of the American Fisheries Society  
16 and at the 2010 Water Environment Federation Urban  
17 Rivers Restoration Conference.

18 Q. Subpart E. Have you sampled and  
19 studied fish populations in the CAWS?

20 A. Yes. We sampled and studied fish as  
21 part of this study.

22 Q. And by we I mean this question  
23 specifically is getting into your personal  
24 experience?



1 A. Me personally?

2 Q. Yes. I'm sorry.

3 A. I have not gone out on a boat and  
4 sampled fish.

5 Q. That was the question. Thank you.

6 MR. ANDES: Other Limno Tech  
7 personnel have?

8 THE WITNESS: Absolutely. People  
9 from our company have.

10 MR. ANDES: Thank you.

11 BY MS. WILLIAMS:

12 Q. Question four, how do you compare a  
13 system specific index to the Clean Water Act  
14 aquatic life use goal?

15 A. I'm not sure I understand the  
16 question. Can you clarify it, please?

17 Q. I think so. Maybe you should  
18 clarify what part you don't understand.

19 A. Your question was how you compare a  
20 specific system index to the Clean Water Act  
21 aquatic life goal.

22 Q. And I'm referring to the habitat  
23 index if that helps.

24 A. That part I understand.

1 Q. Okay. So in this proceeding what I  
2 think we've been doing is looking at measures of  
3 habitat and using that information with other  
4 information to evaluate what aquatic life uses are  
5 attainable in these waters and I'd like to  
6 understand how if the index is system specific  
7 just to the CAWS how we can compare the CAWS to  
8 the goals that are set for waters of the US?

9 A. Okay. My testimony doesn't have  
10 anything to do specifically with Clean Water Act  
11 goals. I am not testifying with respect to that.

12 Q. Okay.

13 A. I am testifying with respect to the  
14 fact that our study identified physical habitat as  
15 the most limiting factor to fish and what we used  
16 was an index of habitat that allows you to compare  
17 various reaches to each other for relative levels  
18 of habitat quality and fish quality.

19 Q. So the goal was not to compare to  
20 the Clean Water Act?

21 A. That is correct. Our goal was not.

22 Q. Thank you. That's what I was going  
23 for. Question five, is it your opinion that,  
24 quote, severe physical habitat limitations you

1 referred to on Page 2 of your pre-filed testimony  
2 historically have always outweighed influence of  
3 water quality in the CAWS?

4 A. Our study didn't involve a study of  
5 the historical conditions in the CAWS -- water  
6 quality conditions so I do not have an opinion on  
7 that.

8 Q. Question six, Page 2 of your  
9 pre-filed testimony states that in a multiple  
10 linear regression analysis six habitat variables  
11 accounted for 48 percent of the variability in  
12 fish data.

13 A, do you agree that 48 percent  
14 is statistically biased high?

15 A. Could you please tell me what you  
16 mean by "biased high"?

17 Q. Well, if I said statistically  
18 overfitting model, would that clarify for you?

19 A. Could you rephrase the question with  
20 that term in it just so I'm sure I understand?

21 Q. I think if we move onto B we'll  
22 clarify this concept a lot better.

23 A. Okay.

24 Q. Because this is really what I'm

1 getting at. Please define the, quote, adjusted r  
2 squared mentioned on Page 11 of the CAWS Habitat  
3 Evaluation Report? Did I say Page 11, sir?

4 A. Eleven.

5 Q. Sorry. Page 111.

6 MS. TIPSORD: Public Comment 284.

7 BY THE WITNESS:

8 A. Okay. Adjusted r squared is a  
9 calculated quantity. It's a number that is  
10 calculated during regression and it's intended to  
11 account for the inclusion of additional variables  
12 in the regression. When you do a regression, you  
13 can often get a better r squared -- absolute r  
14 squared by simply adding more variables to the  
15 regression, but as you do so you also increase the  
16 uncertainty with the model. So you don't want to  
17 just keep putting variables in until you get the  
18 highest possible r squared value. What you want  
19 to do is consider other calculated quantities as  
20 measures of how good the model is describing your  
21 data and whether or not you've got too many  
22 variables.

23 So that's what the adjusted r  
24 squared does and that's why we looked at it and

1 that's why we presented it in our reports so  
2 people reading it could see that we looked at it.

3 BY MS. WILLIAMS:

4 Q. And what was the adjusted r squared  
5 that correlates to this 48 percent of the fish  
6 habitat?

7 THE WITNESS: Can I see the report?

8 MR. ANDES: Sure.

9 BY THE WITNESS:

10 A. Let me just check so I don't  
11 misspeak. Right. So I'm referring to Table 6.4  
12 in our Habitat Evaluation Report. I don't recall  
13 the exhibit number. I'm sorry. But it's on Page  
14 114 and this table represents a number of  
15 different regression models that were tested and  
16 the third column in this table lists the adjusted  
17 r squared values and the adjusted r squared value  
18 for the regression model that we selected was  
19 0.44.

20 BY MS. WILLIAMS:

21 Q. Does that correlate to 44 percent  
22 rather than 48 percent?

23 A. No.

24 Q. Okay.

1 MR. ANDES: Could you explain why  
2 that is?

3 THE WITNESS: Yes, I think.

4 MR. ANDES: What is the difference?  
5 Why would you use an r squared instead of an  
6 adjusted r squared in explaining variability in a  
7 dataset?

8 THE WITNESS: First of all, it's  
9 standard practice to use the r squared to explain  
10 the percent of variability explained. It gives  
11 you a common way of comparing regressions. The  
12 adjusted r squared is only calculated for multiple  
13 regressions. So that's why when one wants to  
14 compare a multiple regression to a single  
15 regression, a bivariable regression, you used the  
16 r squared. It's why in the literature you don't  
17 see people citing adjusted r squared values.  
18 That's why, for example, when the Ohio QHEI was  
19 published, the author used r squared value and not  
20 the adjusted r squared value. It's simply the  
21 more appropriate way of stating the degree of  
22 variability and the dependant variable that's  
23 explained by the regression.

24 Q. Let's ask question E. I'm sorry. I

1 shouldn't have skipped D. Question D, do you  
2 believe the amount of explained variance from the  
3 fish versus habitat regression analysis indicate  
4 that improvements to water quality in the CAWS  
5 will not likely improve fish conditions?

6 A. I don't think the wording of the  
7 question accurately reflects our findings. We  
8 concluded that improvements in DO in general are  
9 poor predictor of fish health.

10 MR. ETTINGER: Can I just clarify?  
11 That water quality is a big concept, right, it  
12 includes more things than dissolved oxygen? You  
13 have to vocalize your --

14 THE WITNESS: Was that a question?

15 MR. ETTINGER: It is a question.  
16 Water quality involves more than dissolved oxygen,  
17 is that correct?

18 THE WITNESS: Yes.

19 MR. ETTINGER: So the question --  
20 your study didn't look at elements of water  
21 quality other than dissolved oxygen, did it?

22 THE WITNESS: Actually, we looked at  
23 temperature.

24 MR. ETTINGER: Temperature and

1 dissolved oxygen. Did you look at any other  
2 elements like zinc content or the amount of  
3 cyanide in the water?

4 THE WITNESS: No, we did not.

5 MR. ETTINGER: Or turbidity.

6 THE WITNESS: Turbidity we did  
7 consider because we utilized the measure of  
8 turbidity Secchi disk in our analysis. We  
9 included it as a habitat variable because it's a  
10 physical attribute. It's one of those things that  
11 can be considered either a water quality parameter  
12 or a physical parameter. We happened to conclude  
13 it as a physical parameter in our study, but we  
14 did consider it.

15 BY MS. WILLIAMS:

16 Q. Let's go back to the answer. I want  
17 to make sure I got the answer correctly from the  
18 answer before Albert started his follow up. You  
19 said your study concluded that water quality is a  
20 poor predictor of fish habitat?

21 A. Yes.

22 Q. Did I hear you right?

23 MR. ANDES: Not water quality.

24 BY THE WITNESS:



1           A.       I'm sorry. Dissolved oxygen.

2       BY MS. WILLIAMS:

3           Q.       Did I hear you say dissolved oxygen  
4       is correlated to improvements of fish health or is  
5       poor?

6           A.       No.

7           Q.       Would you just repeat? I want to  
8       make sure.

9           A.       What I said was, in general,  
10       dissolved oxygen is a poor predictor of fish  
11       health in the CAWS today.

12          Q.       And you're just talking about in the  
13       CAWS today? You wouldn't say that's true over  
14       time, you're just talking about today?

15          A.       Our study focused on a relatively  
16       current period of time. It didn't focus on  
17       historical conditions.

18          Q.       But you're also looking to the  
19       future when you say in the future you're  
20       predicting that it would be poorly correlated to  
21       fish health?

22          A.       Yes. I think what we mean by that  
23       is if you went out and measured fish somewhere  
24       else in the system where they haven't been

1 measured you might not be able to or probably  
2 wouldn't be able to predict what the condition of  
3 those fish at that location would be simply by  
4 looking at dissolved oxygen. So many things can  
5 change in the future that I would hesitate to make  
6 predictions about.

7 Q. Did you consider looking at  
8 historical data in doing your analysis?

9 A. Our study was focused on conditions  
10 today. In the course of reviewing variable  
11 information on the system, I think we encountered  
12 some terms that talked about it, talked about  
13 historical water quality conditions for example,  
14 but they were never really the central focus of  
15 our study.

16 Q. Question E, isn't it correct that  
17 when the six selected habitat variables were  
18 regressed against the combined fish metric for the  
19 year 2008 fish samples, the amount of explained  
20 variability dropped 29 percent?

21 A. The important thing I think we need  
22 to remember is that our --

23 Q. It's a yes or no. Can you just  
24 answer the question part of that?

1           A.       I am. It is true that the  
2 regression for single year of data 2008 yielded an  
3 r squared of 0.29 or 29 percent explanation, but a  
4 single year of data is a much smaller dataset and  
5 one would expect the regression to have a lower r  
6 squared.

7           Q.       But wasn't the point of doing that a  
8 cross validation of your study?

9           A.       Validation. I don't know if I would  
10 say cross validation, but the reason was we wanted  
11 to test what we had done with an independent set  
12 of data.

13          Q.       Was it an independent set of data?

14          A.       The fisheries were. The fisheries  
15 were newly collected.

16          Q.       So the 2008 data was not included in  
17 your original analysis?

18          A.       That's correct.

19          Q.       Okay. Question seven, Page 9 of the  
20 pre-filed testimony states, quote, when the DO  
21 variable was added to the regression equation with  
22 the six key physical habitat variables, the r  
23 squared of the resulting regression equation was  
24 only increased by four percent.

1                   A, isn't the influence of adding  
2 the single dissolved oxygen variable greater than  
3 the influence of at least two of the six habitat  
4 variables that were selected?

5           A.       I think it would be inappropriate to  
6 consider the influence of a single habitat  
7 variable because habitat is not evaluated on the  
8 basis of single variables. So comparing the  
9 influence of a single water quality variable which  
10 is commonly evaluated on its own merit through a  
11 single habitat variable, I believe, is  
12 appropriate.

13          Q.       So what do you mean it's common to  
14 evaluate water quality? I mean, in this context  
15 in the field --

16          A.       I said habitat. It's common to  
17 evaluate habitat using multiple variables.

18          Q.       Right. But you're saying it's okay  
19 to look at just a single water quality variable,  
20 but it wouldn't be appropriate to look at habitat  
21 variables individually, right, is that what you're  
22 saying or that it's common?

23          A.       What I'm saying is it's common to  
24 evaluate habitat using multiple variables. In

1 fact, I'm unaware of any protocol or index for  
2 habitat that requires on a single measure.

3 Q. Are you aware of any fish index or  
4 any other water quality type index that would only  
5 look at one water quality parameter?

6 A. I am not making any conclusions  
7 about water quality indices. I'm looking at the  
8 question of dissolved oxygen and we know that  
9 dissolved oxygen is commonly evaluated on its own.

10 Q. That's what I'm asking. What do you  
11 mean? We know that how?

12 A. For example, water quality standards  
13 are written for single water quality parameters  
14 like dissolved oxygen.

15 Q. I would agree with that, but I'm  
16 trying to understand where in the field someone  
17 would just be looking at one water quality  
18 variable?

19 A. Right. Are you asking me to cite  
20 specific studies?

21 Q. You said it was common. I guess I'm  
22 asking you to say what it's based on that it's  
23 common. So it's based on water quality study --

24 A. Well, that's just one example. Also

1 we know that -- well, from my own experience, I've  
2 been involved in a number of studies that have  
3 focused on single water quality parameters  
4 because --

5 Q. Is this one of them?

6 A. No. We focused on dissolved oxygen  
7 and temperature.

8 Q. Why?

9 A. That's another question.

10 Q. That's true. Okay. We can move  
11 ahead. We can save that.

12 A. I think I want to just add that what  
13 it really gets to is how aquatic life is affected  
14 by the things around them. Different water  
15 quality variables or parameters such as dissolved  
16 oxygen affect fish in a distinct way. So, for  
17 example, they're affected by dissolved oxygen in a  
18 way that is different than how they're affected by  
19 cyanide. Whereas with habitat, it's the interplay  
20 of a number of physical factors that are important  
21 to the fish and that's why we have to evaluate  
22 them together.

23 Q. I'll accept that for now. I mean,  
24 you would agree, though, that there are water

1 quality indices out there that include a variety  
2 of water quality parameters including dissolved  
3 oxygen not just --

4 A. Yes.

5 Q. Do you agree that Table 6-4 on Page  
6 114 of the CAWS Habitat Evaluation Report shows  
7 that adding the Percent Macrophyte Cover variable  
8 to the regression model only increased the  
9 adjusted r squared value by two percent?

10 A. I don't see in the table where that  
11 is shown.

12 Q. Does that mean you disagree or you  
13 don't know?

14 A. No, I just don't see it. If you  
15 could point to where you're referring, I could  
16 tell you whether I agree or not.

17 Q. I'm going to have to count. So as  
18 you go down the rows there's numbers on the first  
19 column, right?

20 A. Yes.

21 Q. So you go to the third five column  
22 and you compare that to the second six column.  
23 And it's a 42 to a 44 adjusted r squared. That's  
24 what we're seeing in the table.

1           A.       Did you say the second number five  
2 row?

3           Q.       Third.

4                   MR. ANDES: We're comparing the  
5 third five to the second six, is that correct?

6                   MS. WILLIAMS: I hope so.

7 BY THE WITNESS:

8           A.       I think I see what you're getting  
9 at. Thank you for clarifying.

10 BY MS. WILLIAMS:

11           Q.       Howard is now telling me that the  
12 last four maybe should be a five. So if we're  
13 not -- based on what's in the table in the report  
14 maybe the second five should actually be a four,  
15 but that is --

16           A.       I think I see what you mean, though.  
17 Let me just refresh myself on the question. I  
18 would agree that in comparing the two regression  
19 models that you're referring to in the table that  
20 the r squared is increased by 0.02 or two percent  
21 by the addition of that variable.

22           Q.       What about question C, does adding  
23 this habitat variable Percent of Vertical Walls to  
24 the regression model only increase the adjusted r



1 squared value by one percent?

2 A. And if you could again just tell me  
3 which two you want me to compare I'd be happy to  
4 do that.

5 Q. The first five -- which -- wait a  
6 minute. Right. The first five compared to the  
7 second line down that's labeled six.

8 A. The first five to the second six, is  
9 that right?

10 Q. Yes.

11 A. If I'm comparing the correct rows  
12 you told me, I would disagree with that.

13 Q. Okay. I think you are correct. I  
14 disagree with that also.

15 A. Okay.

16 Q. Do you know what that would be?

17 A. I'm sorry?

18 Q. Do you know the right answer or is  
19 the answer you're not sure on this table?

20 A. I don't.

21 Q. The percent, the correct percent  
22 value?

23 A. Well, to answer that, I would have  
24 to know specifically which two models you're

1 referring to.

2 Q. Let's -- let me ask just a very  
3 clarifying point on this table while we have it  
4 out. When you look at the second row of fives  
5 there, would you agree with me that should be a  
6 four there?

7 A. That -- yes. So I think what you're  
8 referring to is the fact that only four boxes are  
9 checked on that table. So obviously there's a  
10 discrepancy there and I can't say whether there's  
11 a checked box missing or the five should actually  
12 be a four. I would have to go back and look at  
13 the output of the analysis.

14 Q. What about the last row of fours?

15 A. So there, too, we have five checked  
16 and four in the first column. So, again, I can't  
17 say whether the four should be a five or one of  
18 the boxes should be unchecked.

19 Q. And the first row of fours?

20 A. The same thing.

21 Q. Thank you.

22 A. We'd be happy to go back and check  
23 these and provide a corrected table.

24 Q. Can you tell us from this table or

1 elsewhere in your report whether any of the six  
2 habitat variables alone explain as much variance  
3 as dissolved oxygen alone?

4 A. No. None of the single habitat  
5 variables that we evaluated on their own explain  
6 as much variance in the fish data as dissolved  
7 oxygen.

8 Q. Thank you.

9 A. Again, I would add, though, I think  
10 it's inappropriate to evaluate single habitat  
11 variable in this selection.

12 MR. ETTINGER: Can I just ask about  
13 that a little bit?

14 THE WITNESS: Sure.

15 MR. ETTINGER: Why do you think  
16 it's inappropriate?

17 MS. TIPSORD: I'm sorry, Albert. I  
18 didn't hear that.

19 MR. ETTINGER: Why do you think it's  
20 inappropriate?

21 THE WITNESS: I think I alluded to  
22 this a moment ago where when I was saying that the  
23 affected habitat on fish is a cumulative affect  
24 resulting from several physical factors in their

1 environment. This is reflected in the fact that  
2 all major protocols and indices used to evaluate  
3 habitat rely on multiple measures of physical  
4 habitat, not a single measure. That's distinctly  
5 different from water quality. While there are  
6 many various water quality parameters that one  
7 should consider, their affect on fish is usually  
8 determinable on their own. So the affect of  
9 dissolved oxygen on fish can be studied on its  
10 own. It can be separated from suspended solids or  
11 temperature although the response of DO to things  
12 other than itself is present in the environment.  
13 So dissolved oxygen is a function of temperature  
14 in some cases. You can look at just DO and fish  
15 and understand the relationship.

16 MR. ETTINGER: Certainly you're  
17 aware of studies, though, in which they say a fish  
18 is under pressure because of one water quality  
19 factor, for example, very low DO might be more  
20 sensitive to another water quality factor such as  
21 toxic level, is that correct?

22 THE WITNESS: That's possible.

23 MR. ETTINGER: And does the  
24 temperature in the water affect the toxicity of

1 various water quality factors?

2 THE WITNESS: It could.

3 MR. ETTINGER: It could. And if you  
4 have multiple water quality stressors, couldn't  
5 they affect the quality of the fish -- sorry. The  
6 quality of the fishery whereas one factor might  
7 not? Couldn't the factors be synergistic?

8 THE WITNESS: It's possible.

9 MR. ETTINGER: It's possible. In  
10 fact, if I was doing a study and I wasn't  
11 concerned about dissolved oxygen, but I was  
12 worried about cutting down the trees along the  
13 water bank and I hired you to do a study like that  
14 wouldn't you come up with a study which looked at  
15 the individual affect of cutting down the trees  
16 and come up with -- couldn't you come up with a  
17 factor about that?

18 THE WITNESS: No, I wouldn't do  
19 that.

20 MR. ETTINGER: You wouldn't do that.  
21 Why is that? We can't break down habitat factors,  
22 but we can break down pollution --

23 THE WITNESS: Oh, I see what you're  
24 saying. We could try to design a study that

1 compared -- tried to hold other factors constant.  
2 I don't know if we could do it, but we could try  
3 to design a study that held other habitat factors  
4 constant. Not remove them from the equation and  
5 look at the one that you're interested in.  
6 Theoretically, one could do that. But it wouldn't  
7 be appropriate to ignore all other habitat factors  
8 and isolate them.

9 MR. ETTINGER: I'm not asking you to  
10 ignore anything. I'm just saying isn't, you know,  
11 what factors you look at dictated ultimately by  
12 what policy issue you're interested in?

13 THE WITNESS: They're dictated -- a  
14 study design is dictated by the questions it's  
15 designed to answer. So our study wasn't designed  
16 to determine all of the factors that are affecting  
17 fish in the CAWS.

18 MR. ETTINGER: It was designed to  
19 look at the dissolved oxygen?

20 THE WITNESS: Primarily.

21 MR. ETTINGER: Right.

22 MR. ANDES: And habitat.

23 THE WITNESS: Yes. It was designed  
24 to evaluate the relative importance in habitat and

1 dissolved oxygen in fish.

2 MR. ETTINGER: It was designed to  
3 compare the relative importance of dissolved  
4 oxygen and all of these habitat factors. All I'm  
5 asking is if I were your customer and I was  
6 interested in whether or not it would be a bad  
7 thing to cut down trees I could have hired you to  
8 look at the relative importance of tree cover  
9 versus other factors, correct?

10 THE WITNESS: I suppose you could  
11 have.

12 MR. ETTINGER: Thank you.

13 MS. TIPSORD: All right. With that,  
14 we need to take about a 20 minute break. We'll be  
15 back.

16 (Whereupon, a break was taken  
17 after which the following  
18 proceedings were had.)

19 MS. TIPSORD: Let's go back on the  
20 record. All right. Ariel Teshler on behalf of  
21 Citgo has some documents they told us they would  
22 get to us and he has them today.

23 MR. TESHER: Good morning, Madam  
24 Hearing Officer. I have Temperature Dependant

1 Effects of Road Deicing Salt on Chironomid Larvae.  
2 This is the study that Jim Huff referred to  
3 yesterday and I brought copies for the Board and  
4 for the record.

5 MS. TIPSORD: If there's no  
6 objection, we'll mark the Temperature Dependant  
7 Effects of Road Deicing Salt on Chironomid Larvae.  
8 Our authors are Silver, Rupprecht and Stauffer and  
9 it's Volume 29 Number 3 September 29 of Wetlands.

10 We'll mark that as Exhibit 449  
11 if there's no objection. Seeing none, it's  
12 Exhibit 449.

13 (Document marked as IEPA Exhibit  
14 No. 449 for identification.)

15 MS. TIPSORD: With that,  
16 Ms. Williams.

17 BY MS. WILLIAMS:

18 Q. I'm going to pick up with question  
19 nine. I think you already answered eight. The  
20 regression analysis relied on 81 fish samples from  
21 23 sites. However, 49 of the 81 fish samples were  
22 from only seven sites and I reference Table 3-1 on  
23 Page 52 of the habitat report.

24 Question A, isn't it correct



1 that 27 of the observations came from only a  
2 single waterbody, the Chicago Sanitary and Ship  
3 Canal?

4 A. It is correct that 27 of the 81  
5 samples came from the Chicago Sanitary and Ship  
6 Canal.

7 Q. Do you believe that one should be  
8 cautious about generalizing to all of the CAWS  
9 from a regression for which one-third of the  
10 observations are from a single waterbody, the  
11 Chicago Sanitary and Ship Canal, and for which  
12 more than half the observations are from only  
13 seven sites?

14 A. I believe that one-third of the  
15 paired habitat fish samples used in our evaluation  
16 coming from the Chicago Sanitary and Ship Canal is  
17 appropriate given that the Chicago Sanitary and  
18 Ship Canal represents 40 percent by length of our  
19 study area.

20 Q. Can you define your study area for  
21 your purposes? I'm not sure it's necessarily the  
22 same as the study area as I would use it for the  
23 Agency's purpose in this rulemaking.

24 A. Okay. We have a map in our report,

1 the Habitat Evaluation Report. Let me refer to  
2 that. It's Figure 1.1.

3 MR. RAO: What page, please?

4 THE WITNESS: On Page 3.

5 BY THE WITNESS:

6 A. And each of the reaches of the CAWS  
7 that we included in our study area is further  
8 described in Section 1 of our report. Those  
9 areas/reaches include the North Shore Channel, the  
10 North Branch of the Chicago River, the North  
11 Branch Canal, the Chicago River, the South Branch  
12 of the Chicago River, Bubbly Creek, the Chicago  
13 Sanitary and Ship Canal, the Cal-Sag Channel and  
14 the Little Calumet River to the O'Brien Locks.

15 BY MS. WILLIAMS:

16 Q. And the southern most point is?

17 A. The Lockport controlling waters.

18 MR. ANDES: Mr. Bell, can you  
19 address the second part of that question in terms  
20 of the fact that more than half the observations  
21 came from seven sites?

22 MS. TIPSORD: Excuse me, Mr. Andes.

23 Before he answers that just for point of  
24 clarification and to try to bring this all

1 together. Are you familiar with what is defined  
2 as the CAWS and the UAA CAWS study portions and  
3 what segments of the river that it covers?

4 THE WITNESS: Yes.

5 MS. TIPSORD: Was your study area  
6 consistent with that?

7 THE WITNESS: It's slightly  
8 different and I'm afraid I would have to refer to  
9 both, side by side, to tell you how they're  
10 different. I don't recall the specific  
11 differences.

12 BY MS. WILLIAMS:

13 Q. Does it make sense to clarify that  
14 in particular this rulemaking extends down to  
15 the I-55 bridge on the Des Plaines River, but you  
16 didn't study that far south, correct?

17 A. I believe that's correct.

18 MS. TIPSORD: But I was talking  
19 specifically about the CAWS UAA which is  
20 different -- I mean, there's a lower Des Plaines  
21 UAA and then there's the CAWS UAA which is defined  
22 as CAWS and I just wanted to know the differences  
23 between what we've generally called the CAWS based  
24 on that UAA and the description of the CAWS and

1 what your study was.

2 MR. ANDES: Is it fair to say that  
3 all the significant reaches that are encompassed  
4 within the CAWS were included in your study in  
5 terms of the list that you just provided?

6 THE WITNESS: Yes.

7 MS. TIPSORD: Thank you, Mr. Andes.  
8 Sorry about that.

9 MR. ANDES: Thank you. The question  
10 I had asked you was to address the second part of  
11 the question about more than half the observations  
12 coming from seven sites in B.

13 THE WITNESS: I'm just getting my  
14 bearings here. Half of the observations from  
15 seven sites. Right. The fact that half of the  
16 paired samples are from seven sites there in the  
17 Sanitary and Ship Canal doesn't concern me since  
18 those seven sites were distributed throughout the  
19 entire length of Chicago Sanitary and Ship Canal.

20 BY MS. WILLIAMS:

21 Q. Part E, how likely is it that if  
22 this study was repeated in the CAWS the same  
23 habitat and fish variables would be picked and the  
24 same amounts of explained variance would be found

1 between them?

2 A. Repeated by whom?

3 Q. By someone other than yourself.

4 A. Thank you. I can't speculate as to  
5 what other researchers would do if they attempted  
6 our study, but I can say that it's safe to say  
7 that if other researchers used the same data and  
8 analytical methods that we used, I'm confident  
9 that they would reach the same conclusions that we  
10 did.

11 Q. Are you confident that they would  
12 choose the same six habitat variables, for  
13 example, or the same fish variables that you used?

14 A. No. There is subjective judgment  
15 involved in selecting those at some phases of the  
16 study.

17 MR. ANDES: But you believe that the  
18 judgments you applied were appropriate?

19 THE WITNESS: Absolutely. I believe  
20 if other researchers attempted to do what we did,  
21 that they would have to make the same sorts of  
22 subjected judgments. It's simply necessary to do  
23 that to arrive at the conclusions that we arrived  
24 at.

1 BY MS. WILLIAMS:

2 Q. Question ten, in the first bullet on  
3 Page 3 of your testimony, you state, quote, of the  
4 half of fish data variability not explained by the  
5 key habitat variables, most is explained by  
6 natural variation in the fish data from one  
7 sampling event to another at one location.

8 A, what do you mean by most?

9 A. I think the statement referenced  
10 reflects the fact that we found that 70 percent of  
11 the variability in fish data over time at a  
12 station is explained by -- I'm sorry. Seventy  
13 percent of the variability of the fish data is  
14 explained by changes over time at any given  
15 station.

16 MR. ANDES: If I can clarify for  
17 just a moment. That's 70 percent of the  
18 variability that's not explained by the habitat  
19 variables?

20 THE WITNESS: That's correct.  
21 Seventy percent -- if we take a look at what  
22 portion of that fish data variability that isn't  
23 explained by physical habitat in our study, of  
24 that 70 percent. So I think that works out to 30

1 percent overall or something like that.

2 MR. ETTINGER: I'm a little confused  
3 by that. When you say variability, that's  
4 variability over time in the same site?

5 THE WITNESS: Yes, that's correct.

6 MR. ETTINGER: So you're saying at  
7 site one we have a substantially different set of  
8 fish at time A from time B and that's what you're  
9 pointing to as the variability -- variability over  
10 time at the same site.

11 THE WITNESS: Yes. Variability over  
12 time at the same site. That's correct. That's  
13 what I'm talking about.

14 BY MS. WILLIAMS:

15 Q. And that's what you're calling  
16 natural variability, correct?

17 A. That's right.

18 Q. Question D, do you believe this  
19 natural variability is explained simply by fish  
20 moving to different locations in the system?

21 A. There are many possible reasons for  
22 variability and fish movement may be part of it.

23 Q. I guess I skipped C. Maybe I  
24 shouldn't have. Even though the fish data varied

1 considerably at each site though the seven years  
2 this variability was not accounted for by the six  
3 habitat variables in the fish versus habitat  
4 regression analysis or by the single dissolved  
5 oxygen variable in the fish versus dissolved  
6 oxygen correlation, correct?

7 A. No -- yes, that's correct. You  
8 wouldn't expect all the variability in the fish  
9 data to be explained by physical habitat and  
10 dissolved oxygen.

11 Q. Could the variability also be due to  
12 sampling efficiency and precision?

13 A. It's possible that sampling  
14 efficiency plays a role, but we didn't see any  
15 specific reason to suspect that fact.

16 MR. ANDES: If I can follow up. Why  
17 would you expect that not all variability would be  
18 explained by habitat and DO? Look at all the  
19 variability in the fish data --

20 THE WITNESS: That's a difficult  
21 question. We know first of all that when you go  
22 out to try to measure fish that there's a lot of  
23 things that can affect what you see. Some things  
24 you can measure and try to control for. Other



1 things you can't. Physical habitat and water  
2 quality are two of the most obvious factors that  
3 you can measure and try to account for, but there  
4 are other things that may have affect on that  
5 given day such as the weather and whether it's a  
6 sunny day or cloudy day may affect how you're  
7 doing -- the sampling efficiency may be affected  
8 by conditions. There may have been a lot of barge  
9 traffic the day before you went out that you  
10 didn't account for. That could affect what you're  
11 seeing. There's just a variety of factors.

12 So I think that's why when you  
13 look at studies that where researchers have tried  
14 to use the methods that we've used to compare  
15 physical habitat to fish, generally speaking, you  
16 can't explain it all. You can only explain about  
17 half of the variability give or take by just  
18 looking at habitat. So our findings were  
19 consistent with that. This other half I'm not  
20 aware of any studies that have really been  
21 successful in explaining all of that variability  
22 in fish. There's just too many multiple factors  
23 to account for.

24

1 BY MS. WILLIAMS:

2 Q. Are you aware of any studies that  
3 have looked at sampling efficiency in that context  
4 that you're referring to in explaining  
5 variability?

6 A. I know there are studies of sampling  
7 efficiency, but I have not recently reviewed them.

8 Q. So what caused you to conclude that  
9 you didn't see any evidence that sampling  
10 efficiency was a factor?

11 A. We didn't conduct a controlled  
12 investigation of sampling efficiency. I'll say  
13 that. But we did look at -- for example, we  
14 looked at the variability -- one of the factors  
15 that affects -- that can affect a sampling  
16 efficiency and this is raised elsewhere in your  
17 questions is the depth of water. There are a  
18 couple of reasons for that. One is that the  
19 sampling that was done in this study was  
20 electrofishing. You induce an electric current  
21 into the water and this causes fish to be  
22 immobilized and you collect them with a net. So  
23 the propagation of the electric current in the  
24 water can be affected by a number of things and

1 I'm not an expert on electrofishing, but it can be  
2 attenuated with distance from the source just like  
3 any electric current can.

4           So if you're shocking in the  
5 upper part of the water column, let's say the  
6 upper five feet, and your water is 20 feet deep,  
7 the effect of the electric current is going to  
8 have a slighter effect at deeper depths. So  
9 that's one factor that can affect it and the other  
10 is the ability of the sampler to see the fish and  
11 net them and actually bring them into the boat can  
12 be affected by conditions.

13           So those are a couple of things  
14 that can affect efficiency and given the  
15 conditions in the CAWS where we have relatively  
16 deep water and turbid water, those could possibly  
17 be an effect, but what we did was we did compare  
18 the standard deviation of the fish samples over  
19 time, a measure of variability at each station  
20 over time to depth at the stations and we found  
21 that to not be a correlation between those two  
22 factors or rather I should say an extremely small  
23 correlation. I can give you the number if you can  
24 give me a moment.

1 Q. Where is that in the report?

2 A. Actually, we did that in response to  
3 a line of questions that you submitted. As I  
4 said, it wasn't part of our study to investigate  
5 the efficiency of electrofishing, but the question  
6 was raised. So we thought we should have a good  
7 answer for it.

8 MR. ETTINGER: So we're going to get  
9 there?

10 THE WITNESS: If the questions are  
11 asked, yes.

12 BY MS. WILLIAMS:

13 Q. Which question were you referring  
14 to, do you know?

15 A. Not off the top of my head. If you  
16 give me a few minutes, I can find it.

17 MR. ETTINGER: Could I follow up on  
18 something else that you mentioned? You referred  
19 to other studies that looked at habitat as a  
20 percentage factor?

21 THE WITNESS: Yes.

22 MR. ETTINGER: What other studies  
23 are those?

24 THE WITNESS: The easiest

1 comparisons are the studies that used multiple  
2 linear regression to explain variability in fish  
3 to develop a habitat index like we did. So, for  
4 example, the QHEI did that, the Michigan  
5 Non-Waivable Index did that.

6 MR. ETTINGER: So all of these  
7 different indices?

8 THE WITNESS: Not all of them use  
9 that measure. There are different ways to develop  
10 the indices, but those are some examples.

11 MR. ETTINGER: You were talking  
12 about sort of all habitat studies in general not  
13 just ones like yours?

14 MR. ANDES: In what understanding?

15 MR. ETTINGER: I'm not sure either  
16 because you referred to studies and other  
17 experience. So I can't really say what you were  
18 thinking.

19 THE WITNESS: Let me clarify. What  
20 I think I was -- if I follow you. What I was  
21 saying was that when studies are conducted and  
22 habitat is compared to fish data, it's common that  
23 the ability of habitat to explain variability in  
24 fish data is around half, 50 percent give or take,

1 maybe 60 percent, maybe 40 percent, but in that  
2 range.

3 So there's always a portion that  
4 is not explainable. I think that's what I was  
5 trying to get at.

6 MR. ETTINGER: Okay. You would  
7 expect if water quality were perfect that the only  
8 thing that would affect the results would be  
9 habitat variability, right?

10 MR. ANDES: Do you want to define  
11 what you mean by perfect?

12 THE WITNESS: No, I don't think I  
13 would say, but by all means if you can explain  
14 what you mean by perfect?

15 MR. ETTINGER: There were no  
16 pollutants in the water that were affecting the  
17 fish, then the only thing we would expect to be  
18 affecting the fish are habitat and variability  
19 where fish swim?

20 THE WITNESS: I'd have to think  
21 about that. I think it may be an  
22 oversimplification to say the least.

23 MR. ETTINGER: That's good. I'm  
24 often guilty of oversimplification.

1 BY MS. WILLIAMS:

2 Q. I think it would make sense to jump  
3 ahead to question 42. I think maybe that's  
4 getting to what you were talking about. The later  
5 questions have not. We can jump back. Question  
6 42, the first row in Table 6-4 on Page 114 of the  
7 CAWS Habitat Report indicates that the habitat  
8 variable called maximum depth is the one habitat  
9 variable relative to the 12 variables examined  
10 that explains the most of the variability in the  
11 combined fish metric, end quote.

12 Question eight, does this mean  
13 that as maximum depth increases the combined fish  
14 metric decreases?

15 A. Excuse me while I check that. Yes,  
16 but it's a relatively weak correlation and as I  
17 said before I believe it's inappropriate to rely  
18 on single measures of habitat.

19 Q. So you're saying, yes, as maximum  
20 depth increases, the combined fish metric  
21 decreases?

22 A. Yes.

23 Q. Isn't it possible that this  
24 relationship simply reflects that it is harder to

1 capture fish by electrofishing in deeper water  
2 than shallower water?

3 A. It's possible there's a relationship  
4 between sampling efficiency and maximum depth, but  
5 it doesn't seem to be a major factor here for a  
6 few reasons. First, all of the stations in the  
7 CAWS are relatively deep, greater than ten feet at  
8 maximum depth. Secondly, species that we know are  
9 bottom dwelling species are among the most common  
10 such as -- common carp are among the most common  
11 in terms of number caught and in addition I do  
12 know that the District in their sampling biases  
13 their sampling efforts at any given location  
14 towards shallower water to maximize efficiency.

15 MR. ETTINGER: What do you mean by  
16 that?

17 THE WITNESS: By what?

18 MR. ETTINGER: The bias there -- can  
19 you read back what he just said?

20 (Whereupon, the record was read  
21 as requested.)

22 THE WITNESS: I know what part.

23 MR. ETTINGER: You said something  
24 about the District does something with its



1 sampling for shallow water.

2 THE WITNESS: Do you want him to  
3 read it?

4 MR. ETTINGER: I just --

5 THE WITNESS: I wanted to make sure  
6 I was addressing what you're interested in  
7 addressing. I don't think he needs to search.  
8 What I said was if I'm recalling correctly that  
9 the District when they sample fish they bias their  
10 effort towards shallower parts of the sampling  
11 reach. So the variable in question is the maximum  
12 depth in the reach, but there may be portions of  
13 the reach such as near the banks where the water  
14 is shallower and the District, to my  
15 understanding, when they go out and sample they  
16 electrofish to the extent they can in those  
17 shallower places to maximize the catch. That's  
18 all I meant. So they take measures to counter the  
19 deepness.

20 BY MS. WILLIAMS:

21 Q. Do you know if the Sanitary and Ship  
22 Canal is deeper than other parts of the system?

23 A. Let me consult something. The  
24 highest values of maximum depth that we used in

1 our study as a variable do include the Chicago  
2 Sanitary and Ship Canal.

3 Q. I'm sorry. They do?

4 A. They do, yes.

5 Q. Let's look back at -- I think I left  
6 off at 10(g). Ten G it says if fish in the CAWS  
7 are more related to habitat than water quality why  
8 are there such large year-to-year differences in  
9 fish data for several sites?

10 A. As I said, we didn't conduct a  
11 focused investigation of why the variability at  
12 sites from year to year occurs. We do know that  
13 habitat appears to explain about half of the  
14 variability that we observed, but there are  
15 probably many factors such as I mentioned before,  
16 weather or navigation.

17 Q. Let's just take one of the sites  
18 just for an example. Chicago Sanitary and Ship  
19 Canal at Harlem Avenue, Site IB41 on your Table  
20 5-1 on Page 96. It's the sixth row down. It's  
21 listed as site number 41.

22 A. Okay.

23 Q. With that, can you tell me from what  
24 the highest number of individuals that were found

1 in any of the years at the same site?

2 A. The highest number of individuals  
3 would be 388 in 2006.

4 Q. What about 2005?

5 A. I'm sorry. 758. You're right. The  
6 highest number of individuals would have been 758  
7 in 2005.

8 Q. What is the lowest?

9 A. It looks like it would be 2001 where  
10 there were 88 individuals.

11 Q. Do you have any idea what can  
12 explain that significant of a variability, 88  
13 individuals to 758 at a single site?

14 A. No. As I said, we didn't conduct a  
15 specific investigation of what caused variability.

16 Q. Question 11, in the second bullet on  
17 Page 3 of your testimony you conclude, quote,  
18 various measures of dissolved oxygen were tested  
19 including compliance with existing and proposed  
20 water quality standards, average and minimum DO,  
21 and percent of time below various DO concentration  
22 thresholds and the next series of questions get at  
23 trying to understand what you get at here.

24 A, how was compliance with

1 proposing current standards determined?

2 A. So, much of the explanation is in  
3 Appendix A, but to determine the compliance with  
4 proposed --

5 MR. ANDES: Appendix C.

6 BY THE WITNESS:

7 A. I'm sorry. Appendix C. So to  
8 determine the compliance standards we used the  
9 District's continuous dissolved oxygen monitoring  
10 data. These data are hourly measurements at a  
11 number of stations throughout the system. The  
12 data we used for this analysis was collected from  
13 2001 to 2007. So we had hourly -- for the most  
14 part, continuous hourly data on dissolved oxygen  
15 at several stations. What we then did was we  
16 paired -- we paired individual CDOM stations or  
17 continuous dissolved oxygen monitoring stations  
18 with fish sampling stations by proximity.

19 So we looked at which CDOM  
20 stations were closest to the fish sampling  
21 stations and paired them up that way. Then we  
22 used the data from the CDOM's to calculate  
23 representative quantities.

24 So, for example, for the seven

1 day average of daily minimum criteria we  
2 calculated the average of the seven daily minimum  
3 values recorded in each of the seven calendar days  
4 leading up to a given date such as a fish sampling  
5 event and then we did this for every day of the  
6 calendar period that we were interested. So we  
7 kind of took the hourly data and said how would we  
8 use this to determine attainment and we looked at  
9 daily minimum if the standard was written as a  
10 daily minimum.

11 So we calculated these values  
12 for an appropriate calendar period so if the  
13 standard was applicable to the entire year we used  
14 an entire year's worth of data. If the standard  
15 was applicable to a certain portion of the year  
16 such as several months, we only used the several  
17 months of data. So we kind of parsed it out  
18 depending on what the standard was talking about.

19 BY MS. WILLIAMS:

20 Q. I thought -- I must have  
21 misunderstand when I was reviewing your testimony.  
22 So the continuous stations are not coterminous  
23 with the fish sampling sites?

24 A. Not in all cases.

1 Q. Some are and some are not, is that  
2 true or none are?

3 A. I would have to consult a map.

4 Q. I think what I'm most interested in  
5 is what would be the maximum distance between the  
6 site where the fish were collected and the site  
7 where the DO sample was taken that was correlated  
8 with it?

9 A. I don't know off the top of my head.  
10 I would have to consult a map and make  
11 measurements to do that, but I believe we have a  
12 map showing the relative pairings. We have a  
13 table in Appendix C that shows the pairings and  
14 then we have a map that shows all the locations  
15 and there are many. So it is true that some  
16 weren't exactly coterminous.

17 In some cases we found, in fact,  
18 that there were no CDOM stations that were close  
19 enough to the fish sampling stations that we felt  
20 confident in using the data and we tried to  
21 determine whether we could extrapolate and we felt  
22 that in some cases that was not a reliable way of  
23 doing it so we excluded those and that's the  
24 reason why there were fewer data pairs for

1 comparison of fish and DO than there were for  
2 habitat and DO. So we made some effort to make  
3 sure that our pairings were as appropriate and  
4 reliable as we could.

5 Q. So you wouldn't have thrown out the  
6 entire site of habitat data, you just wouldn't  
7 have included that site in your analysis with the  
8 DO or did you just --

9 A. Just to be clear, habitat was  
10 measured at the same location as fish in all  
11 cases.

12 Q. Right.

13 A. But the DO is a different monitoring  
14 program, if you will. So they're not always in  
15 the same place. The deployment of these monitors  
16 is usually governed by the variability of  
17 structures that you can mount them to. So it's  
18 not the same locations.

19 Q. Then I think my next question asks  
20 about when you looked at compliance with existing  
21 standards. Did you separate out segments that had  
22 the secondary contact standard applicable today  
23 versus the general use standard applicable today?  
24 Was that part of your analysis? This is question

1 E.

2 A. Got it. When we did the analysis,  
3 the individuals that conducted the analysis  
4 consulted the applicable standards.

5 Q. Do you know if they looked at  
6 general use standards in the Chicago River Main  
7 Stem, for example?

8 A. I am fairly certain they did. If  
9 they're part of the current or proposed water  
10 quality standards, then yes.

11 Q. Question C, was anything less than a  
12 hundred percent compliance considered  
13 noncompliance?

14 A. Yes. Anything less than one hundred  
15 percent compliance was deemed noncompliant.

16 Q. I'm not sure if you answered D.  
17 What was the period of data used, for example, one  
18 week prior to fish collection?

19 A. Right. So I mentioned it before,  
20 but I'll restate it just for clarity. For  
21 comparing the fish data to attainment of  
22 standards, we looked at all the data within an  
23 applicable period such as a calendar year or  
24 period of months within a year. We approached it



1 as one might if you were taking the most stringent  
2 interpretation of water quality standards that we  
3 could. We didn't look at solely attainment  
4 immediately prior to fish sampling. We did do  
5 that when we were looking at other measures of  
6 dissolved oxygen and temperature. We looked at  
7 just conditions immediately preceding fish  
8 sampling, but not for the attainment analysis.

9 Q. Question 12. On Page 3, second  
10 bullet point of your pre-filed testimony, you  
11 state, quote, the strongest relationship  
12 identified between any of these metrics and the  
13 combined fish metric had an r squared value of  
14 0.27, which is about half as good as the key  
15 variables identified in the study.

16 A, is it appropriate to compare  
17 a multiple linear regression with singular  
18 regression?

19 A. There's nothing wrong with comparing  
20 the multiple regression of habitat variables of  
21 fish to the regression of single DO variable to  
22 fish.

23 Q. Were linear regressions done for  
24 each habitat variable so that the r squared values

1 could be compared with results for dissolved  
2 oxygen?

3 A. Regressions between single habitat  
4 variables and the combined fish metric were --

5 MR. ANDES: Slow down.

6 BY THE WITNESS:

7 A. I'm sorry. Regressions between  
8 single habitat variables and the combined fish  
9 metric were calculated as the part of multiple  
10 linear regression analysis. They're on sort of an  
11 automatic output of the analysis as reported in  
12 Table 6-4. The best single variable regression  
13 had an r squared of 0.25 as you saw in the table,  
14 but we didn't focus on single variable regressions  
15 with fish data because as I mentioned before I  
16 believe it's inappropriate to do so.

17 BY MS. WILLIAMS:

18 Q. Are all of those regressions in your  
19 report?

20 A. No, they're not.

21 Q. Okay.

22 A. No.

23 Q. Why not?

24 A. What we did was the analysis we did

1 we extracted the top three for each number of  
2 variables considered. So that's why the table has  
3 three one variable regressions and three two  
4 variable regressions. There are actually -- I  
5 don't know how many, but many dozen more  
6 regressions that were calculated, but we knew that  
7 they would not be as good as the top three. So we  
8 only extracted the top three for each of the  
9 variable quantities.

10 MR. ETTINGER: Did you ever look at  
11 the degree of variation in dissolved oxygen levels  
12 over the course of the day?

13 THE WITNESS: No. For this study,  
14 we did not specifically investigate that.

15 MS. TIPSORD: Mr. Harley had a  
16 follow up as well.

17 MR. HARLEY: Dr. Bell, my name is  
18 Keith Harley. I'm an attorney for the Southeast  
19 Environmental Task Force in these proceedings and  
20 I actually had a follow question and it relates to  
21 the technical memorandum that you attached to your  
22 pre-filed testimony. It's a technical memorandum  
23 which is dated November 18th, 2009. It's entitled  
24 Classification and Regression Tree Analysis for

1 Chicago Area Waterway System Habitat Evaluation  
2 and Improvement Study.

3 THE WITNESS: Yes.

4 MR. HARLEY: And in that technical  
5 memorandum, there's a conclusion that I wanted to  
6 ask you about. The conclusion -- what are the  
7 conclusions contained on Page 8 of this technical  
8 memorandum is the most important dissolved oxygen  
9 metric tested is the percent of time between June  
10 and September that DO is less than five mg's/L  
11 which is the same DO metric identified as being  
12 most important in the Habitat Evaluation Report,  
13 do you recall that conclusion?

14 THE WITNESS: I don't have the memo  
15 in front of me, but it sounds accurate.

16 MR. HARLEY: I wanted to ask you  
17 about this most important dissolved oxygen metric.  
18 Why is the period between June and September so  
19 important in terms of its relative importance?

20 THE WITNESS: The period of June  
21 through September was selected by us as a period  
22 in which we would expect dissolved oxygen to be  
23 found at its lowest. So we thought that if we  
24 wanted to really see if it was stressing fish

1 that's the time period we ought to look at so  
2 that's why we selected that time period.

3 MR. HARLEY: And why did you choose  
4 five mg's/L for that period of time?

5 THE WITNESS: It's a level that is  
6 in the standards and it's one that is commonly  
7 used. We used other numbers as well, I believe,  
8 if you look at our report. You'll see we did look  
9 at other levels, but five was the one that we  
10 found to have the most statistically significant  
11 relationship with the fish metrics.

12 MR. HARLEY: And why is this the  
13 most important dissolved oxygen metric that you  
14 looked at?

15 THE WITNESS: Again, because that  
16 metric was found to have the strongest  
17 relationship to fish.

18 MR. HARLEY: To fish in what  
19 seasons?

20 THE WITNESS: To the combined fish  
21 metric that we used in our study.

22 MR. HARLEY: And the DO metric  
23 identified as being the most important in the  
24 Habitat Evaluation Report, why was this identified

1 as being the most important in the Habitat  
2 Evaluation Report? Is it the same answer as  
3 you've already given?

4 THE WITNESS: Yes.

5 MR. HARLEY: Is there a reason to be  
6 concerned about DO levels which would be  
7 significantly less than five mg's/L during this  
8 period between June and September?

9 THE WITNESS: Our study didn't  
10 specifically investigate that.

11 MR. HARLEY: Thank you.

12 MR. ETTINGER: Sorry. I guess  
13 following up on Keith's questions. Did you look  
14 at the spring period as a specific period?

15 THE WITNESS: There was -- going by  
16 memory a bit, but one of the standards refers to a  
17 spring period, I believe, and if that's accurate  
18 then we did look at it, but in the context of  
19 getting away from the standards and just looking  
20 at actual data around the time of sampling, no, we  
21 did not.

22 MS. TIPSORD: Ms. Williams?

23 BY MS. WILLIAMS:

24 Q. Question 14, Appendix D of the CAWS

1 Habitat Evaluation Report describes a process that  
2 eliminated habitat variables from further  
3 consideration in the search for the few habitat  
4 variables that are the most important to fish in  
5 the CAWS.

6 A, isn't it true that before --  
7 isn't it true that before performing the analyses  
8 that examined how habitat was related to fish in  
9 the CAWS this stage of the process eliminated from  
10 further consideration 225 of the original set of  
11 241 habitat variables?

12 A. It's true that we started a list of  
13 241 possible habitat variables and reduced it to  
14 16 for use in the multiple regression analysis  
15 with fish data, yes.

16 Q. Isn't it correct that the principal  
17 components analysis or PCA, which was a primary  
18 approach used to selectively eliminate habitat  
19 variables is not based on how the habitat  
20 variables related to fish?

21 A. Yes, it's correct that the principal  
22 components analysis we conducted was not based on  
23 how the habitat variables related to fish, but  
24 that wasn't the purpose of using PCA in this part

1 of the analysis. Our purpose was to identify the  
2 habitat variables that were -- that varied most  
3 across the system. We wanted to create a strong  
4 gradient for comparison of fish.

5 Q. Isn't it likely that some habitat  
6 variables that are important to CAWS fish were  
7 left out?

8 A. Could you tell me what you mean by  
9 important?

10 Q. By important I would mean would  
11 explain some of the variations between fish?

12 A. Yeah. Actually, along the way and I  
13 think we discussed in our report we found some  
14 variables were strongly correlated with each other  
15 and we had to make choices between them. If you  
16 carry forward variables that are strongly related  
17 or correlated to each other in a multiple  
18 regression, it causes you problems and it  
19 decreases the ability of the usefulness, if I may,  
20 of the regression.

21 So, yeah, we did eliminate some,  
22 but I would add that if we inadvertently  
23 eliminated some habitat variables that were more  
24 strongly related to fish than the ones we



1 retained, then I would think that our ultimate  
2 findings would be even stronger than they were  
3 reported to be.

4 MR. ANDES: So, in other words, if  
5 you inadvertently excluded some habitat variable  
6 that is really important to fish and reported  
7 habitat having a certain impact, if you then  
8 included that additional factor of habitat it  
9 would even have more of an impact, is that  
10 correct?

11 THE WITNESS: Yes, that is correct.  
12 Although it wouldn't be possible to put it into  
13 the regression.

14 MR. ANDES: Can you explain a little  
15 further how you in a summary fashion because I  
16 know it's a detailed analysis how you took 241  
17 habitat variables and took them down to 16 and why  
18 you think those were the correct, most appropriate  
19 ones to use?

20 THE WITNESS: Sure. In general, we  
21 went through several steps to do this. We knew  
22 that ultimately we needed to reduce habitat  
23 variables to a much smaller set of variables than  
24 we started with because of the fact that we were

1 going to use multiple regression analysis to  
2 compare habitat to fish. So we first compiled a  
3 list of what I unofficially would refer to as the  
4 universe of habitat variables and if you look at  
5 the original list I think it's in Appendix D or E  
6 of our report, it's all over the place. It's got  
7 quite a lot of different ways of evaluating  
8 habitat, lots of different variables. And when we  
9 looked at that we said, okay, here's what we can  
10 start with. We didn't want to leave anything out.  
11 We put it all on the table and then we said, gee,  
12 some of these just don't apply.

13 So there was a step where we  
14 qualitatively eliminated some because either they  
15 were not applicable to the CAWS or they were  
16 obviously variables that didn't vary in the CAWS  
17 if you went out and measured them you get the same  
18 value everywhere and we knew that wouldn't help us  
19 in our analysis because we needed things that  
20 could be measured on a gradient, if you will,  
21 things that varied, changed, throughout the CAWS.

22 So having done that and  
23 eliminating variables that we didn't think were  
24 applicable, we then said a lot of these things are

1 measuring the same things. So we looked for  
2 variables that were redundant with each other and  
3 we eliminated those and then we said, well, some  
4 of these things functionally mean the same thing  
5 even if they're measuring different things. So,  
6 for example, we had separate variables for sheet  
7 piling versus concrete walls versus wooden  
8 vertical walls and we said to a fish that may be  
9 pretty much the same thing so let's combine those.

10 So we slowly whittled this set  
11 of 241 down to a point where we could get more  
12 analytical with the data. Then we took the data  
13 for all of those remaining variables and I can't  
14 recall off the top of my head how many there were.  
15 I think there were something like 66 variables at  
16 that point and we said what tools can we use for  
17 these variables that we can measure to assess how  
18 variable they are in the CAWS and we assigned  
19 values based on the measurement that we had and we  
20 used principal components analysis and correlation  
21 analysis to evaluate those remaining variables.

22 The principal components  
23 analysis is a way of looking at four different  
24 groupings of data and we had five different major

1 groupings of data such as sediment and substrate,  
2 anthropogenic factors, things like that. We said  
3 within each of those groups which variables are  
4 explaining most of the variability and we wanted  
5 to pull those out.

6                   Keep in mind, these are the  
7 variables that we believed weren't spurious. They  
8 were variables that you could rationally look at  
9 and say, yeah, I can understand how that might  
10 affect fish, but we didn't measure the effect on  
11 fish at this stage.

12                   So then we used PCA's to reduce  
13 the variables. We also looked at cross  
14 correlation between the variables at that point  
15 and we said we know we can't have two variables  
16 that are strongly correlated with each other in  
17 the index so we tried to eliminate those because  
18 they cause problems in the regression. They make  
19 it unstable and they reduce the certainty of the  
20 outcome.

21                   So by the time we got through  
22 with all that we ended up with these 16 variables  
23 so I believe it was a reasonable and stepwise  
24 process that we had to go through and I think each

1 of the steps is defensible.

2 I would also mention that the  
3 CART analysis we did took a step back. It  
4 actually looked at a larger set of habitat  
5 variables because in CART analysis you don't have  
6 to worry about the cross correlation between  
7 variables. You can let those go. So I think we  
8 had 40 habitat variables in that analysis. So it  
9 is possible that along the way some variables were  
10 omitted that may, in fact, be important to fish.

11 Q. Would a different group of  
12 researchers applying the same steps of the  
13 elimination process you used be likely to end up  
14 with the same final set of 16 habitat variables  
15 for analysis? This is E.

16 A. As I said, along the way some  
17 decisions had to have been made where we had  
18 variables that were correlated with each other.  
19 For example, we knew we had to pick one over the  
20 other. So it's entirely possible that another  
21 group of researchers would have made a different  
22 choice, but in the end because of the strong  
23 correlation between those variables that you make  
24 decisions about even though they may have ended up

1 with a regression that included different  
2 variables or a different variable I believe the  
3 outcome would have been the same, that the degree  
4 of fish data variability explained by the  
5 regression would have been similar if not exactly  
6 the same as our analysis showed.

7 Q. Was one of the reasons -- was one of  
8 the factors that you used to eliminate habitat  
9 variables also the lack of data -- sufficient data  
10 on that variable? Can you explain that aspect of  
11 it?

12 A. Yes. In the initial screening,  
13 there were variables that simply couldn't be  
14 measured in the CAWS. So, for example, there were  
15 measures of presence of riffles in pools and that  
16 sort of attribute of a natural stream is just  
17 absent in the CAWS. So, in those cases, there was  
18 a lack of data -- I mean, aside from the obvious  
19 inapplicability of a measure like that there just  
20 was no data for it.

21 MR. ETTINGER: Can you give us  
22 examples of other things that were just tossed out  
23 as not applicable to the CAWS?

24 THE WITNESS: Off the top of my head

1 I can't. I could dig through the appendixes.

2 MR. ETTINGER: For example, did you  
3 look at things like connected to back waters, is  
4 that something you looked at or didn't look at?

5 THE WITNESS: I don't recall that  
6 specifically.

7 MR. ETTINGER: The connection.

8 THE WITNESS: But we did have a  
9 variable that we called off channel days, which  
10 referred to areas that were physically separate --  
11 partially physically separated from the main  
12 channel that would provide the same sort of refuge  
13 that I think what you're referring to and we did  
14 include that.

15 MR. ETTINGER: And that was one of  
16 the factors?

17 THE WITNESS: It was a factor that  
18 ended up being important.

19 BY MS. WILLIAMS:

20 Q. This is my question F. Why wasn't  
21 the collection -- I understand for the analysis  
22 you chose you had to come up with a smaller set of  
23 habitat variables. Why wasn't the selection  
24 primarily based from the start of how they related

1 to fish? Wouldn't that have been simpler?

2 A. Well, I think that our process of  
3 elimination was driven by specific objectives not  
4 just from the outset determining which -- I mean,  
5 obviously we wanted to get variables that were  
6 related to fish, but we didn't necessarily want to  
7 prejudice the outcome by preselecting variables  
8 that were important to fish. We wanted to get  
9 variables that intuitively should be relevant to  
10 fish and that varied across the system.

11 So the other factor that we may  
12 have missed is if we had done that is by just  
13 looking at those simple regressions between  
14 habitat and fish we might have missed variables  
15 that by themselves don't have a strong  
16 correlation, but in connection with other  
17 variables would have a correlation and that's  
18 really what gets drawn out by the multiple  
19 regression is that the habitat it's not just the  
20 quantity of an individual variable that matters,  
21 it's the presence of that variable along with  
22 other factors. There's interactions between  
23 elements of the physical habitat that fish care  
24 about.



1                   At different life stages, they  
2 need different things. They need different types  
3 of physical habitat for different reasons. Some  
4 types of habitat they need for shelter from  
5 predators, some they need to forage for food, some  
6 they need for reproduction. So looking at a  
7 single variable is just not adequate to get to  
8 what fish need. So looking at those I think would  
9 have been inappropriate. I should also add it is  
10 likely, as I said before, there might have been  
11 habitat variables that were strongly related to  
12 fish that we omitted, but in the end those  
13 probably would have only made our conclusions  
14 stronger.

15           Q.       So you're saying -- when you say it  
16 would have been inappropriate to look at the  
17 correlation before you narrowed them down --

18           A.       Of a single habitat variable with  
19 fish.

20                   MR. ETTINGER: Just to make that  
21 clear. We left out a habitat factor. You're  
22 saying that the results would have been that  
23 habitats influence would have been underestimated.

24                   THE WITNESS: I think the line of

1 questioning as I understood it was trying to pose  
2 the question could there have been a habitat  
3 variable that strongly related to fish that you  
4 didn't look at and my response was that if there  
5 was a habitat variable that we didn't include in  
6 our final regression that was stronger in  
7 relationship to fish than the ones that we did  
8 look at I think our regression would have been  
9 stronger if that had been included. I don't think  
10 it would have weakened our end result.

11 MR. ETTINGER: And the sort of  
12 habitat variables that you tossed out were ones  
13 that you felt were not applicable to this system  
14 now.

15 THE WITNESS: I'm sorry?

16 MR. ETTINGER: Some of the habitat  
17 variables you tossed out were ones that were just  
18 not applicable?

19 THE WITNESS: In my opinion, yes.

20 MR. ETTINGER: One was the riffle  
21 habitat?

22 THE WITNESS: That's an example.

23 MR. ETTINGER: Were there any other  
24 ones?

1 THE WITNESS: There were other ones  
2 and, again, I hesitate to give you a complete list  
3 by memory.

4 MR. ANDES: Let me follow up on that  
5 for a second.

6 MR. ETTINGER: I'd be pleased to  
7 have you expand if you can point out something the  
8 witness did.

9 MR. ANDES: Is it correct one of  
10 them was sinuosity?

11 THE WITNESS: That's a good example.

12 MR. ANDES: For these factors like  
13 sinuosity or ripples in pools, can you explain is  
14 that a habitat relevant factor that's not present  
15 in the CAWS so the CAWS is really poor in terms of  
16 sinuosity, right, in --

17 MS. WILLIAMS: Fred, are you  
18 testifying now?

19 MR. ANDES: I was about to ask.

20 MR. ETTINGER: He is asking a  
21 question.

22 MR. ANDES: Is it right that the  
23 CAWS throughout the system is relatively poor in  
24 terms of sinuosity?

1 THE WITNESS: Yes, it is.

2 MR. ANDES: What is that -- why  
3 wouldn't you consider that in this study?

4 THE WITNESS: We wouldn't consider  
5 that because it's uniformly poor across the  
6 system. So if we had included a variable like  
7 that and we went out and measured it, it would be  
8 assigned the same value everywhere. That doesn't  
9 help us when we perform a statistical comparison  
10 between habitat and fish because we'll have  
11 varying fish data and a habitat variable that  
12 doesn't change. So we need variables that exhibit  
13 a gradient.

14 MR. ETTINGER: Do you have a list  
15 somewhere in your report of all the variables that  
16 you considered and rejected?

17 THE WITNESS: Absolutely. Let me  
18 tell you if you just give me a moment.

19 MR. ETTINGER: Yes.

20 THE WITNESS: What we tried to do in  
21 our report -- first of all, Appendix E is the  
22 answer and I want to point out that what we tried  
23 to do with what we included in Appendix E was to  
24 allow a reviewer of our study to kind of walk with

1 us through the process of reducing this variable.  
2 We present a table of the original 241 and then we  
3 present a sequence of tables that show the  
4 different steps of reducing those variables. We  
5 didn't want to hide anything certainly.

6 MS. TIPSORD: I actually have a  
7 question about sinuosity since you brought it up.  
8 In your testimony on Page 5, you note that  
9 anything less than 1.2 is considered low, anything  
10 greater than 1.35 is considered high. Most of the  
11 reaches of the CAWS have a sinuosity between 1.0  
12 and 1.1. Is there any area of the CAWS that would  
13 be above 1.2, do you know? If you have to refer  
14 to something, you can just tell me where to look  
15 and I can look it up later.

16 THE WITNESS: I do think we  
17 included -- I could be wrong, but I recall we  
18 included a table in our report of those values. I  
19 know that we calculated them. So if it's not in  
20 the report, I can provide it.

21 MS. TIPSORD: Okay. Thank you.

22 THE WITNESS: And I believe it would  
23 be in section four.

24

1 BY MS. WILLIAMS:

2 Q. I'm trying to understand or make  
3 consistent in my mind your explanation of your  
4 answer to question F that why you decided it was  
5 inappropriate to look at the beginning as the  
6 correlation with fish, correct? That was your  
7 answer that it was inappropriate to just start  
8 with that, correct?

9 A. Mm-hmm. Yes.

10 Q. Could you explain why you were  
11 comfortable, however, using correlation with the  
12 fish metrics to separate out and eliminate habitat  
13 variables that were similar? Do you understand  
14 what I'm asking?

15 A. No, I don't follow you.

16 Q. Why don't I refer you to a page in  
17 your report. I think it would be easier.

18 A. Okay.

19 Q. It's going to be Appendix D, Page  
20 D-2 I guess. D-2, the very first sentence that  
21 begins on that page.

22 A. If you can wait a moment, I don't  
23 have a copy of the appendix. I'd like to follow  
24 along, please.

1 Q. Would you like me to read the  
2 sentence or would you rather follow along?

3 A. I would like to follow along as I  
4 read it, if I may. We have it. I just didn't  
5 have it in front of me.

6 MS. TIPSORD: What is that appendix,  
7 Deb?

8 MS. WILLIAMS: It's Appendix D, Page  
9 D-2. The top of the page.

10 BY THE WITNESS:

11 A. Okay. Thank you.

12 BY MS. WILLIAMS:

13 Q. Are you ready?

14 A. Yes.

15 Q. In selecting between two correlated  
16 habitat variables correlation of the habitat  
17 variables with fish metrics, coefficients of  
18 variation of habitat variables and potential to be  
19 improved in the CAWS were also considered. So can  
20 you explain why it was appropriate to consider  
21 correlation of the fish metrics at this stage?

22 A. At this stage, we had an objective.  
23 For the multiple regression, we knew the number of  
24 variables for habitat that we wanted to get down

1 to and that's discussed in here, I think.

2 Q. You knew you wanted to get to what  
3 number?

4 A. I am going to say 16, but I would  
5 have to double check.

6 Q. That's fine.

7 A. But we were running out of tools.  
8 We were whittling this down. So one of the things  
9 we did was we looked at not the relationship  
10 between single fish metrics and habitat. What we  
11 had was we had these groupings of metrics, the  
12 ecological function, the trophic function of the  
13 ten metrics that we used in our combined fish  
14 metric and we looked at how those varied with the  
15 remaining habitat variables and we said at this  
16 stage we have tried everything that we can think  
17 of to make sure we're getting the reduction we  
18 need and we're not quite where we need to be so at  
19 that stage we did look at that. I can't tell you  
20 specifically which variables were eliminated  
21 specifically because of that, but I believe it's  
22 in the report.

23 Q. Wasn't this stage before the PCA  
24 analysis?



1           A.       It may have been concurrent.  I  
2 believe it was concurrent with the PCA analysis.

3           MR. ANDES:  Again, am I correct that  
4 the intent again was to try to get down to a  
5 manageable number of variables that you could do  
6 the analysis with?

7           THE WITNESS:  Absolutely.  I mean,  
8 there are rules that you have to apply to make  
9 sure you have an appropriate number of variables  
10 and that's what we were trying to get to and so if  
11 we had missed one of the variables that is more  
12 strongly related to fish than others as I said  
13 it's possible, but I don't think it would have  
14 altered the outcome.

15 BY MS. WILLIAMS:

16           Q.       Can you tell us what rule you're  
17 referring to that said you have to get down to 16  
18 variables?

19           A.       Again, I have to -- this could take  
20 a moment.  So what I was talking about is  
21 discussed on Page 103 of the Habitat Evaluation  
22 Report and it has to do with the ratio of data to  
23 variables used in the multiple regression and we  
24 cite a reference here Smoger and Engelmeyer 1999

1 and this is just one I think, but it suggests the  
2 variable to data ratio in a multiple regression be  
3 0.1, but as high as 0.5. So we had 81 data pairs  
4 and that suggested that we needed to get down to  
5 somewhere between 8 and 40. The lower we could  
6 go, the better.

7 Q. Let me just get this clear for the  
8 record. The rule that you're referring to is the  
9 Smoger Rule, can we call it that?

10 A. No, I wouldn't call it that because  
11 I don't think he is the originator of that.

12 MR. ANDES: But Mr. Smoger can  
13 certainly call it that.

14 BY MS. WILLIAMS:

15 Q. So basically you're saying you only  
16 have -- are you saying you had a limit to the  
17 number of fish metrics you were going to compare  
18 the habitat to and that's why you had to limit  
19 that?

20 A. The number of habitat variables so  
21 the rule has to do with the number of independent  
22 variables.

23 Q. Okay.

24 A. Which in this case is habitat. Fish

1 being the dependant variable.

2 Q. Okay. Why don't we move onto  
3 question 15. On Page D6, Figure D-1 in Appendix D  
4 of the CAWS Habitat Evaluation Report 38 variables  
5 are represented in the Scree plots; principal  
6 components analysis based on a correlation matrix  
7 results in one PCA axis for each variable used in  
8 the analysis. However, Table D-2 represents 37,  
9 not 38, variables. What is the reason for the  
10 discrepancy between variables D-1 and Table D-2?

11 A. It's a transcription mistake. When  
12 we were preparing the report, one of the variables  
13 was inadvertently omitted from the table, from  
14 Table D-2. That variable is what we call CAWS  
15 channel ratio which is the geomorphology and  
16 hydrology variable.

17 Q. Which matrix was used in the PCA?

18 A. The correlation matrix.

19 MR. ANDES: Is that appropriate?

20 THE WITNESS: Which is appropriate,  
21 yes.

22 MR. ANDES: Did the discrepancy  
23 change anything in terms of the results?

24 THE WITNESS: No. Absolutely not.

1 As I said, it's just a transcription omission. It  
2 has nothing to do with the outcome of the  
3 analysis.

4 BY MS. WILLIAMS:

5 Q. Tell me why the correlation matrix  
6 versus the covariance matrix is appropriate?

7 A. I'm not an expert on principal  
8 components analysis and I relied on the expertise  
9 of people on my team. So I can't explain to you  
10 why that was appropriate to use the covariance  
11 matrix.

12 Q. Question 16. On Page D-6 in  
13 Appendix D of the CAWS Habitat Evaluation Report  
14 the description of two vertical axes in each plot  
15 of Figure D-1 are -- eligible is my word. I guess  
16 I might say hard to read if I were to resay it.  
17 What does each vertical axis represent?

18 A. The left ordinate on each graph says  
19 igan value and the right says cumulative  
20 proportion of variance and if you turn your head  
21 sideways and squint --

22 Q. Hard to read is probably better.  
23 Page D-5 of the CAWS Habitat Evaluation Report  
24 states that, quote, inclusion of a fifth access

1 did not significantly improve the variance  
2 explained. How much of the variance in the nine  
3 geomorphology and hydrology variables did the  
4 fifth principal component explain?

5 A. The fifth principal component in the  
6 geomorphology and hydrology explained  
7 approximately ten percent of the variance and in  
8 anticipation of your subsequent questions we  
9 prepared a table of the results which we didn't  
10 include in the report, but we have copies today.  
11 So I can answer those specific questions by  
12 referencing this.

13 Q. So that would answer A through D is  
14 what you're saying?

15 A. It would answer A and B --

16 Q. A and B.

17 A. -- at least.

18 MR. ANDES: And we have an exhibit  
19 that is entitled CAWS Habitat Principal Components  
20 Analysis Results.

21 MS. TIPSORD: If there's no  
22 objection, we will mark CAWS Habitat Principal  
23 Components Analysis Results as Exhibit 450.

24

1 BY MS. WILLIAMS:

2 Q. Mr. Bell, did you prepare this?

3 A. No. One of my staff prepared this.

4 Q. Can you tell us who?

5 A. His name is Tim Towey, T-O-W-E-Y.

6 MS. WILLIAMS: I have no objection.

7 MS. TIPSORD: Seeing no objection,  
8 it's marked as Exhibit 450.

9 (Document marked as IEPA Exhibit  
10 No. 450 for identification.)

11 BY MS. WILLIAMS:

12 Q. So for question A the answer is  
13 explained -- well, let me read the question for  
14 the record. For each of the five PCA's that were  
15 run, how much variance and what proportion of  
16 total variance did each of the principal  
17 components explain? Where do we find that?

18 A. The way this table is organized  
19 there are five major headings which represent the  
20 five types of habitat variables that we grouped  
21 things into. The first being banks and riparian  
22 area variables and so forth. You can see those in  
23 bold, all caps. If you look at that, you see a  
24 row of numbers that say PC 1, PC 2 and so forth

1 across the top. Those are what we call the  
2 principal components. This second row of the  
3 upper table in each section says on the left  
4 proportion. That row following across from left  
5 to right represents the proportion of total  
6 variance for that grouping of habitat variables  
7 explained by each of the principal components.  
8 So, for example, under banks and riparian area  
9 variables, principal component PC 1 explains 0.365  
10 or 36.5 percent of the total variance of that set  
11 of variables and the variables included in that  
12 analysis for that type of category are listed in  
13 the second table in that section where it says  
14 BNK\_ANGL. That would be bank angle and these  
15 abbreviations refer to the abbreviations we  
16 assigned them in our database. We tried to be as  
17 intuitive as possible in those.

18 MR. ETTINGER: So what is the PC 1  
19 in this case?

20 THE WITNESS: PC 1 is the first  
21 principal component axis derived during the  
22 principal components analysis.

23 MR. ETTINGER: Can you give me an  
24 example of one such -- is this a thing or --

1                   THE WITNESS: This is probably the  
2 most difficult to explain and the reason is the  
3 principal components analysis is a method of -- as  
4 I said, it's difficult to explain. It's a way of  
5 transforming your data into a different spatial  
6 coordinate system other than cartesian. So the  
7 principal components -- typically, if we want to  
8 look at three variables, we could create an XYZ  
9 graph and look at how that variable might change  
10 in those coordinates of space, but what principal  
11 components does is it throws those coordinates out  
12 and it creates new coordinates based on the data.  
13 So you can have more than three coordinate actions  
14 and they don't have anything to do with space.  
15 They just have to do with how the data varies with  
16 respect to other data in the set. So it's a very  
17 abstract concept and that's why I'm struggling a  
18 bit with the explanation.

19                   MR. ETTINGER: I was trying to find  
20 out which here is math and which here is data and  
21 this is part of the math part.

22                   THE WITNESS: It's part of the math.  
23 It's driven by the data, but it is a mathematical  
24 analysis.



1 BY MS. WILLIAMS:

2 Q. There is a lot of math in this  
3 analysis, wouldn't you agree?

4 A. Yes, there's a lot of math.

5 MR. ANDES: That's why we all went  
6 to law school.

7 BY THE WITNESS:

8 A. I think you're asking about A?

9 BY MS. WILLIAMS:

10 Q. I think.

11 A. Did I --

12 Q. I think you answered that. I would  
13 like to ask this part of C.

14 A. Okay.

15 Q. What loading level was used to  
16 distinguish a low load from a high load or higher  
17 one?

18 A. We didn't set a specific numerical  
19 target for that. We used -- because we were  
20 applying the PCA as a variable reduction step we  
21 were just looking at the relative contribution  
22 within a set and saying -- speaking that the  
23 judgment on a case by case basis let's say whether  
24 or not we would be losing any explanatory power by

1 eliminating a PC axis.

2 So when we say relatively low  
3 load, we mean a lower load than what is  
4 contributed by one of the retained axes.

5 MR. ETTINGER: Can I just go back to  
6 450 for a second? What is the meaning of the  
7 positive versus the negative numbers here? Under  
8 coefficients, I have P rip vague.

9 THE WITNESS: Right.

10 MR. ETTINGER: That's a negative  
11 0.494?

12 THE WITNESS: Yes.

13 MR. ETTINGER: What is the  
14 significance of the negative there versus the dom  
15 lee which is a 0.344?

16 THE WITNESS: Right. That only has  
17 significance in the context of principal  
18 components analysis. It doesn't really -- it  
19 describes the relative position to the principal  
20 component whether it's above or below it, but it  
21 doesn't really have any meaning -- the negative or  
22 positive has no real meaning in the real word.

23 MR. ANDES: That's not showing a  
24 positive correlation versus a negative correlation

1 or anything like that?

2 THE WITNESS: No.

3 MR. ETTINGER: That's what I was  
4 trying to figure out.

5 BY MS. WILLIAMS:

6 Q. Question 18, Page 105 of the CAWS  
7 Habitat Evaluation Report states that the 16  
8 habitat variables picked from the original set of  
9 241 habitat variables explain, quote, most of the  
10 variance in the habitat dataset, unquote.

11 A, how much variance was there  
12 in the original set of 241 habitat variables?

13 A. We didn't calculate an overall  
14 variance for the complete set of habitat  
15 variables. It wasn't necessary to do that.

16 Q. Page D-7 in Appendix D of the CAWS  
17 Habitat Report shows that five different subsets  
18 each having a different number of variables were  
19 created from the -- now we -- this shouldn't be  
20 39. It should be 38 remaining habitat variables  
21 that were used in the PCA. What proportion of the  
22 total variance in the 38 habitat variables is  
23 represented by each of the five subsets of  
24 variables?

1           A.       Okay.  So if I can -- let's see.  I  
2       think I can answer that from this table.

3                   MS. TIPSORD:  Exhibit 450?

4                   THE WITNESS:  The variables retained  
5       after PCA explain between in each group or across  
6       the groups explain between 73 percent and 82  
7       percent of the variance in their representative  
8       groupings.

9       BY MS. WILLIAMS:

10           Q.       So the question I think was looking  
11       at the variance in the total of the 38 variables  
12       that you started with, is that the question you  
13       were answering?

14           A.       I may have misunderstood your  
15       question.  I'm just reading it again to make sure  
16       I'm clear.

17           Q.       What proportion of the total  
18       variance in the 38 habitat variables is  
19       represented by each of the five subsets?

20           A.       Again, we didn't calculate total  
21       variance for the entire set of variables.  We  
22       calculated contributing variance in each of the  
23       five groups and the reason we did that was that  
24       the five groups that we used all represent major

1 categories of habitat variables and we wanted to  
2 make sure we had representation of each of those  
3 in our ultimate analysis.

4                   So if we had not done that, we  
5 may have ended up eliminating all substrate and  
6 sediment variables for example and we wanted to  
7 try to avoid that even though those variables in  
8 the overall context might have contributed less  
9 variance than anything else and I don't know that  
10 they did. I didn't examine it. But we wanted to  
11 make sure we had some representation of those.

12           Q.       But if you can't quantify the total  
13 variance in the 39 variables that remain -- 38.  
14 38 variables that remain immediately prior to the  
15 PCA, how can we know whether or not the 16  
16 variables that you ended up with truly represents  
17 most of the variance even from the remaining 38?

18           A.       Again, the variables that we ended  
19 up with represent the most varying measures within  
20 each of the habitat categories and we had a very  
21 good reason for not lumping them all together. So  
22 I don't know that it's --

23           Q.       You weren't trying to do that?

24           A.       We weren't trying to necessarily at

1 that stage capture the greatest percentage of  
2 total variability. At this stage, we're applying  
3 a rule that said we don't want to lose information  
4 about different categories or certain categories.

5 Q. Question 19, in bullet two on Page 3  
6 of your pre-filed testimony, you state that quote,  
7 the other four DO measures had an r squared values  
8 ranging from 0.2 to 0.8. This indicates that  
9 physical habitat, not water quality, is a limiting  
10 factor for fish in the CAWS today.

11 A, was a multiple regression  
12 done with a dissolved oxygen and other water  
13 quality parameters such as temperature, turbidity,  
14 pH, nutrients, chloride, sulfate and metals?

15 A. No, we did not perform a multiple  
16 regression with those variables.

17 Q. Would you agree that several water  
18 quality variables were eliminated from the start  
19 without any consideration for how much they  
20 related to the fish data?

21 A. In screening the water quality  
22 parameters that we did evaluate, our intention was  
23 to identify those that apparently were most  
24 important to fish and the way we did that was we

1 eliminated some that weren't related to fish such  
2 as bacteria. Some there were no water quality  
3 standards so we had no measure against which to  
4 say whether they were important to fish and others  
5 were apparently in good attainment with what's  
6 considered to be good conditions. We focused on  
7 DO and temperature because they seem to be the  
8 variables that first of all had the most robust  
9 data and by all the information available to us at  
10 the time were most important to fish.

11 Q. Why didn't you use things like  
12 conductivity and pH?

13 A. We, again, had no reason to think  
14 that they would drive a fish response in this  
15 system.

16 Q. Okay. What temperature variables  
17 were considered? This is D?

18 A. The temperature variables we used  
19 were attainment of existing and proposed  
20 standards, 24 hour antecedent average temperature,  
21 48 hour antecedent average temperature. I think  
22 that's all of them.

23 Q. So did you do an analysis of the  
24 period average temperature proposal or just the

1 maximum?

2 A. Only the proposed daily maximum was  
3 evaluated.

4 Q. Why?

5 A. I don't recall.

6 Q. Why didn't you compare the dissolved  
7 oxygen and temperature variables to the habitat  
8 variables? This is E.

9 A. At this point in our study, our goal  
10 was to try to identify the most important one that  
11 apparently had the most relationship with the fish  
12 metric we were using and that happened to be  
13 dissolved oxygen.

14 Q. Do you agree that dissolved oxygen  
15 and temperature work together in their affect on  
16 fish?

17 A. I believe that the dissolved oxygen  
18 can be a function of temperature in water.

19 MR. ETTINGER: They're actually  
20 interrelated variables, aren't they?

21 THE WITNESS: I would like to  
22 mention at this point that in reviewing your  
23 questions and preparing for today we did go back  
24 and in order to provide additional information



1 we -- if you recall, we did a CART analysis where  
2 we used habitat and dissolved oxygen together and  
3 I think it's relevant to mention at this stage  
4 that when we read these questions we said, well,  
5 maybe we should have thrown temperature in there,  
6 maybe we ruled it out too quickly. So what we did  
7 was in preparing for today is we ran our CART  
8 analysis because it just happened to be more  
9 expedient to do that than the regression analysis  
10 and we included dissolved oxygen and temperature  
11 variables. We put all of those temperature  
12 variables in along with the dissolved oxygen and  
13 the habitat variables that are described in the  
14 memo that is an attachment to my testimony and I  
15 wanted to mention in doing that our finding was it  
16 didn't change the outcome of that analysis. We  
17 got exactly the same results. So when we, in  
18 other words, look at temperature, dissolved oxygen  
19 and habitat together habitat still comes out as  
20 the most limiting factor for fish.

21 Q. What do you mean by it didn't change  
22 the results?

23 A. The outcome of the CART analysis was  
24 identical.

1 MS. TIPSORD: Mr. Harley?

2 MR. HARLEY: On the CART analysis  
3 that you completed, this is what you're describing  
4 in your pre-filed testimony on Page 10 and then  
5 into Page 11 where you talk about 40 physical  
6 habitat variables and six DO variables in ranking  
7 those.

8 THE WITNESS: Yes.

9 MR. HARLEY: And the conclusion of  
10 that CART analysis was that there were two habitat  
11 variables that were most important, is that  
12 correct?

13 THE WITNESS: Yes.

14 MR. HARLEY: They were maximum  
15 channel depth and percent overhanging vegetation?

16 THE WITNESS: Yes.

17 MR. HARLEY: What was the third most  
18 important variable, do you recall?

19 THE WITNESS: The third variable  
20 appeared on the third line of the analysis was  
21 dissolved oxygen variable and I'd have to refer to  
22 get it right, but it was a dissolved oxygen  
23 variable.

24 MR. HARLEY: And that was the

1 percent of time from June to September that DO was  
2 less than five mg's/L?

3 THE WITNESS: That sounds right.

4 MR. HARLEY: Out of 46 variables  
5 that you evaluated, that was the third most  
6 important?

7 THE WITNESS: It was the third most  
8 limiting and I would point out just so the results  
9 of that analysis are fully understood the CART  
10 analysis deconstructs the data in a stepwise  
11 fashion. So when you look at the entire dataset  
12 only the first variable applies to all the data.  
13 So you can only truly say that the first variable  
14 in that analysis, which is maximum channel depth,  
15 is the most important habitat or the most  
16 important variable across the entire system.

17 You then go down branches of the  
18 analysis and it's depicted graphically in the memo  
19 and at the second level we bring in a second  
20 variable and that's the second most important  
21 variable for a subset of the system and so forth  
22 until you get to the third level where the  
23 dissolved oxygen variable that you're talking  
24 about appears and the way to interpret that is for

1 that subset of the system it is -- that variable  
2 of dissolved oxygen it is third most limiting.

3 So it's important that that  
4 conclusion not be extended to the entire system.  
5 I just wanted to make sure that's clear and it's  
6 an important distinction, I think.

7 MR. HARLEY: So how would that DO  
8 variable compare to the other 46 variables that  
9 you considered in terms of its relative  
10 importance?

11 THE WITNESS: I can't quantify it,  
12 but the results indicate that the three variables  
13 that are called out are the three that are  
14 statistically the most important to fish.

15 MR. ANDES: Is that -- if I can  
16 follow up and you can explain, does that mean the  
17 third one is close to the second one, far from the  
18 second one?

19 THE WITNESS: The CART analysis  
20 doesn't tell us anything about the relative -- it  
21 doesn't tell us anything about whether the second  
22 variable is very close or very far from the first  
23 or whether the third is very close or very far  
24 from the second. So it just puts them in order.

1 MR. HARLEY: It does put them into  
2 an order from 1 to 46?

3 THE WITNESS: It puts them in an  
4 order from 1 to 3.

5 MR. ETTINGER: You referred to a  
6 subset of the system, what do you mean by that?

7 THE WITNESS: So the way a CART  
8 analysis works is that you start out with all your  
9 data which represents in our case all the data  
10 that we had for the system and then it looks at  
11 the data and says what variable best describes  
12 fish. What single variable best describes fish  
13 for the entire system. It determines that and  
14 then it looks at that it and basically splits all  
15 the data into two pieces. It breaks the data into  
16 two branches, if you will. This is where the term  
17 tree and calcification and regression tree comes  
18 from and it looks at those branches and it says is  
19 there enough information here to determine what  
20 each of those branches is affected by?

21 So, in our case, it broke the  
22 data into two branches. I don't remember the  
23 numbers that were split. I can check. I  
24 believe -- let me just look really quick. So it

1 looked at all the data and it said we have these  
2 101 data pairs for this because we used the 2001  
3 to 2008 data for the CART analysis and we said the  
4 analysis said that maximum depth is the best  
5 indicator, best predictor of fish quality based on  
6 the overall dataset.

7 MR. ETTINGER: Overall dataset  
8 meaning all the data points for the entire --

9 THE WITNESS: Everywhere. The  
10 entire system.

11 MR. ETTINGER: We're talking about  
12 geographical numbered points?

13 THE WITNESS: Yes. And temporal.

14 MR. ETTINGER: Okay.

15 THE WITNESS: All the data we had,  
16 all the pairs and it said the best variable to  
17 describe these in terms of fish response is  
18 maximum depth and then it figured out where those  
19 data can be broken and it branches the data into  
20 two pieces. Ten datasets or 10 data pairs in one  
21 branch and 91 in the other, then it looks at each  
22 of those subsets and it says are there enough data  
23 here to determine what is the second best  
24 indicator of fish at this level for this dataset.

1                   In our case, the one branch that  
2 only had ten data pairs in it, there was  
3 insufficient data so the analysis stopped there.  
4 For those ten, we can only say that maximum depth  
5 is the most important. For the remainder, the  
6 analysis said you can look at this data and say at  
7 this stage eliminating maximum depth is a  
8 variable, the percent of overhanging cover is the  
9 most important variable, another habitat variable.

10                   It, again, breaks the data into  
11 how that variable describes fish into two sets and  
12 in this case it broke it into 64 variables on one  
13 side and 27 on the other and it looks at each of  
14 those branches and says again is there enough data  
15 on this branch to make a determination as to what  
16 the next most important factor is and in our  
17 analysis the right-hand branch could not go any  
18 further, but in the left-hand branch there was  
19 enough data make a third determination and it was  
20 at that point that subset of data that the  
21 analysis determined that dissolved oxygen was the  
22 best way to determine it.

23                   MR. ETTINGER: When you say subset  
24 of data, is that a particular geographic locations

1 or particular time geographic locations?

2 THE WITNESS: It could be a  
3 combination and I can't tell you from memory or  
4 from what we wrote what that is. It's  
5 determinable from the analysis.

6 MR. ETTINGER: Let's say I was like  
7 Johnny Appleseed and I wanted to determine what  
8 the best place to plant trees was to maximize  
9 fish, could I use your analysis in some way to do  
10 that?

11 MR. ANDES: The CART analysis  
12 specifically?

13 THE WITNESS: The CART analysis  
14 specifically?

15 MR. ETTINGER: Right.

16 THE WITNESS: I believe it would be  
17 informative. I don't know it would be the sole  
18 thing you looked at, but, yeah, I think it  
19 contains useful information.

20 MR. ETTINGER: Thank you.

21 MR. HARLEY: Would it also be  
22 informative in terms of where you would want to  
23 have increased dissolved oxygen in the system?

24 THE WITNESS: You could use it that



1 way.

2 MR. HARLEY: And that would be one  
3 of the three most important things for variables  
4 in terms of removing limits on fish populations?

5 THE WITNESS: It would be the,  
6 according to this analysis, third most limiting  
7 factor for a portion of the data we examined, but,  
8 again, I would stress that it tells you nothing  
9 about whether it's a close third or a distant  
10 third. So probably some other ways of  
11 investigating that would be appropriate.

12 MR. HARLEY: So you don't have a  
13 conclusion whether or not it's a close third or a  
14 far away third, but it is third?

15 THE WITNESS: That's correct.

16 MR. HARLEY: Thank you.

17 BY MS. WILLIAMS:

18 Q. Mr. Bell, to follow up on that  
19 piece, when you said earlier that you redid the  
20 CART analysis with DO and temperature and you came  
21 up with the exact same result, what you mean is  
22 you know that DO plus temperature is still third,  
23 but you're not sure how if it's a closer third or  
24 the same third, same amount away from the second,

1 correct?

2 A. What I mean is when we redid the  
3 analysis with the inclusion of the temperature  
4 variables, the outcome of the analysis that was  
5 presented in our memo is exactly the same. We  
6 wouldn't change anything in this presentation and  
7 the conclusions we draw would not change. I can't  
8 say anything about where temperature fits in  
9 except that it doesn't change the outcome of the  
10 analysis.

11 Q. So it wasn't combined with DO, it  
12 just wasn't -- it didn't factor into one of the  
13 top three factors, temperature didn't?

14 A. Yeah. No. We didn't combine it in  
15 any way. The temperature variables were  
16 maintained as their own variables just like  
17 dissolved oxygen variables were maintained.

18 Q. Then I think I misunderstood what  
19 you were saying.

20 MR. ETTINGER: Can I say that on  
21 temperature because I'm confused? The area you  
22 studied was above Lockport?

23 THE WITNESS: Yes.

24 MR. ETTINGER: Now, unless I'm

1 missing something, the only real temperature  
2 inputs to that system of high temperatures at  
3 least are the Fisk and Crawford power plants, is  
4 that your understanding?

5 THE WITNESS: I didn't study inputs  
6 of temperature loads.

7 MR. ETTINGER: Did you see high  
8 temperatures in your data? I mean, ones over 90,  
9 over 100?

10 THE WITNESS: I don't recall.

11 MR. ETTINGER: So you don't know  
12 whether you got any data of assorted temperatures  
13 that might be expected to affect fish populations?

14 THE WITNESS: I don't recall what  
15 the temperatures were. We used the available  
16 temperature. If they were measured, we used them.

17 MR. ETTINGER: That's all I'm trying  
18 to find out. So temperature as a factor, for all  
19 we know, we're looking at temperatures that are  
20 all below 80 in our data?

21 THE WITNESS: I can't say.

22 MS. FRANZETTI: If I can just follow  
23 up.

24 THE COURT REPORTER: Name, please.

1 MS. TIPSORD: Susan, we need your  
2 name for the record.

3 MS. FRANZETTI: I'm sorry. Susan  
4 Franzetti, counsel for Midwest Generation.

5 Mr. Bell, do you recall what the  
6 time period was of the temperature database that  
7 you used in your study?

8 THE WITNESS: In the original  
9 analysis, we used the continuous monitoring  
10 temperature data from the District from 2001 --  
11 I'm turning away from you.

12 MS. FRANZETTI: You don't have to  
13 face me.

14 THE WITNESS: Originally, in the  
15 regression and pre-regression analyses for the  
16 main study, we used 2001 to 2007 data. When we  
17 redid the recent CART analysis, we used 2001 to  
18 2008 to be consistent with what we had done  
19 previously.

20 MS. FRANZETTI: Mr. Bell, that data  
21 includes both some continuous temperature  
22 monitoring data and some that is, you know, less  
23 frequent temperature monitoring data, correct?

24 THE WITNESS: Our analysis used only

1 the continuous monitoring data.

2 MS. FRANZETTI: Okay. So you have  
3 continuous temperature monitoring data for all  
4 those years included in the database not excluding  
5 any months of the year like July and August,  
6 correct?

7 THE WITNESS: I can't say from  
8 memory whether there are any gaps in the  
9 continuous monitoring record.

10 MS. FRANZETTI: But in those years  
11 you didn't exclude?

12 THE WITNESS: No.

13 MS. FRANZETTI: That's my point.  
14 You didn't say we're taking out the hotter months  
15 of July and August from this database, for  
16 example?

17 THE WITNESS: No. We used all the  
18 data that we had.

19 MS. FRANZETTI: And the District --  
20 do you recall that the District has monitoring  
21 locations within the Ship Canal that are within  
22 the vicinity of the Fisk and Crawford stations?

23 THE WITNESS: I don't recall the  
24 specific locations of the temperature monitoring

1 stations.

2 MS. FRANZETTI: But those are  
3 identified in your report, correct?

4 THE WITNESS: Yes.

5 MS. FRANZETTI: Thank you.

6 MR. ETTINGER: Is all of that  
7 temperature data available somewhere that we can  
8 see?

9 THE WITNESS: I believe it's  
10 available. I would have to defer to the District.  
11 I wouldn't give it to you because it's not my  
12 data.

13 MR. ETTINGER: I'm not asking you to  
14 give it to me. I'm just saying do you know the  
15 District gave you all of that data and it's in  
16 some data source?

17 THE WITNESS: I believe it is.

18 MR. ETTINGER: That's the Water  
19 Reclamation District data, not IEPA data?

20 THE WITNESS: Yes, that's correct.

21 BY MS. WILLIAMS:

22 Q. I think we left off at 19(h). Let's  
23 start there. Since an objective of the study was  
24 to examine how fish relate to both habitat and

1 water quality in the CAWS, wouldn't it have been  
2 more consistent to pick a subset of water quality  
3 variables via process similar to how the physical  
4 habitat variables were picked?

5 A. No. Based on our review of the data  
6 we couldn't discern any other variables that were  
7 potentially limiting to fish and we made the  
8 judgment that DO and temperature were the most  
9 limiting.

10 Q. Some of the variables you looked at  
11 didn't have standards to compare against, right?

12 A. That's right.

13 Q. So how did you determine that those  
14 variables without standards didn't have  
15 correlation to the fish?

16 A. We didn't determine anything about  
17 correlation or not, but we made the judgment that  
18 if a standard didn't exist, that it probably isn't  
19 a concern.

20 Q. That gives a lot of faith in us.  
21 Thank you. I, wouldn't it be reasonable to begin  
22 by examining all available water quality variables  
23 for how they relate to fish variables and proceed  
24 with the selection from that point forward? This

1 is I.

2 MR. ANDES: Didn't we answer that  
3 one already?

4 MS. WILLIAMS: You answered for  
5 habitat, not for H and then I is about water  
6 quality variables to fish variables not water  
7 quality to habitat.

8

9 BY THE WITNESS:

10 A. Again, based on our review of the  
11 parameters for the data given, we didn't think  
12 there was any other parameters that would be more  
13 limiting than DO and temperature.

14 BY MS. WILLIAMS:

15 Q. Does that include contaminated  
16 sediment?

17 A. Contaminated sediments aren't a  
18 water quality parameter.

19 Q. All right.

20 MR. ANDES: You did look at sediment  
21 contamination in another context, am I right?

22 THE WITNESS: Yes, we did. We  
23 recognized sediment contamination in the CAWS and  
24 we tried to address that in another aspect of our



1 study which I can elaborate on if you'd like.

2 MS. WILLIAMS: I don't think this is  
3 the best time to do that.

4 THE WITNESS: Okay. I think you get  
5 to that later.

6 BY MS. WILLIAMS:

7 Q. Given that the selective elimination  
8 process for habitat variables differ substantially  
9 from the process used to pick water quality  
10 variables, isn't it reasonable to interpret the  
11 subsequent comparisons of the relative ability and  
12 habitat or water quality to explain fish data are  
13 invalid apples versus oranges type comparisons?

14 A. No. I don't think it's reasonable  
15 to interpret that. It's common practice and  
16 entirely appropriate when evaluating habitat to  
17 use multiple variables to represent habitat  
18 conditions whereas it's equally common and  
19 appropriate to use a single parameter to represent  
20 water quality.

21 Q. It's equally what?

22 A. Appropriate and common to use a  
23 single water quality parameter when evaluating  
24 water quality.

1 Q. So you're saying DO is  
2 representative of all the water quality?

3 A. No. I'm saying DO is representative  
4 of DO.

5 Q. Could water quality variables left  
6 out of the regression analysis explain some or all  
7 of the fish data variability not explained by  
8 habitat?

9 A. It's possible that some other water  
10 quality parameters may explain some variability in  
11 the fish data. I can't say one way or the other.  
12 But it's unlikely that they explain most or all of  
13 them.

14 MS. TIPSORD: Mr. Harley has a  
15 follow up.

16 MR. HARLEY: Within DO itself in  
17 terms of the variability of DO, you used the  
18 standard of below five mg's/L. Did you capture  
19 the degree to which DO levels were below five  
20 mg's/L? So, for example, did you capture periods  
21 of time that were below four in your analysis?

22 THE WITNESS: The analysis you're  
23 referring to just looked at whether the data were  
24 above or below the threshold name. We didn't look

1 at the magnitude to which the data were above or  
2 below.

3 MR. HARLEY: Is it possible that if  
4 the DO level was significantly lower than five  
5 that its relative importance in terms of limiting  
6 fish could be greater?

7 THE WITNESS: I'm sorry. Can you  
8 say that again?

9 MR. HARLEY: Could you repeat that  
10 question?

11 (Whereupon, the record was read  
12 as requested.)

13 BY THE WITNESS:

14 A. I would say it's possible, but I  
15 couldn't offer a conclusive opinion one way or the  
16 other.

17 MR. HARLEY: And you didn't analyze  
18 that, it was just five above and five below?

19 THE WITNESS: Yeah.

20 MR. HARLEY: What about the duration  
21 of time during which DO was below five, does your  
22 model capture, for example, whether or not it was  
23 below five, for example, six of seven days or --

24 THE WITNESS: No. We just looked at

1 the threshold, compared the data with the  
2 threshold.

3 MR. HARLEY: So you have no  
4 information related to we're talking about  
5 different indicators of water quality even within  
6 DO which is the indicator that you chose we don't  
7 know the magnitude to which the DO levels are  
8 below five and the influence that would have?

9 THE WITNESS: In the variable that  
10 you're referring to, no, but I would say we did  
11 have other variables that approach what you're  
12 describing. We looked at antecedent conditions  
13 for example where we looked at the minimum DO that  
14 occurred 24 hours preceding -- within the 24 hours  
15 preceding a fish sample or within the 48 hours  
16 proceeding. So we did a little bit of that.

17 MR. HARLEY: A little bit.

18 THE WITNESS: But they didn't end up  
19 being as descriptive of the fish data as the  
20 standard -- I'm sorry -- the parameter you  
21 referenced.

22 MR. HARLEY: And you didn't  
23 incorporate information about the duration of the  
24 period of time during which the level was below

1 five and the influence that would have?

2 THE WITNESS: No, we didn't.

3 MR. HARLEY: Thank you.

4 MR. ETTINGER: Do you know if you  
5 had any dissolved oxygen data that was taken  
6 directly at the SEPA stations?

7 THE WITNESS: I don't recall.

8 MR. ETTINGER: Do you know if they  
9 were trying to avoid that or promote that? Do you  
10 know what the SEPA stations are?

11 THE WITNESS: I know.

12 MR. ETTINGER: And you don't know.

13 THE WITNESS: I don't recall.

14 MR. ETTINGER: But I would say our  
15 report has maps that shows all the stations we  
16 used and although they might not point out the  
17 SEPA stations they should be easy to identify  
18 where the data came from.

19 MR. ANDES: In terms of looking at  
20 DO, am I correct that you looked at a number of  
21 different parameters, variables that related to  
22 DO?

23 THE WITNESS: Yes.

24 MR. ANDES: Is it true that the one

1 that was most correlated to fish variability was  
2 whether the level was above or below five?

3 THE WITNESS: Between June and  
4 September, yes.

5 MR. ANDES: Okay. So the other DO  
6 related variables you looked at had less  
7 significance?

8 THE WITNESS: They were -- they did  
9 a poorer job of explaining the fish variability.

10 MR. ANDES: Thank you.

11 BY MS. WILLIAMS:

12 Q. Question L, in Table 4-2 on Page 65  
13 of the Habitat Evaluation Report it states that,  
14 quote, the CAWS is dominated by suspended  
15 sediments. If so, why was this variable -- do you  
16 agree with that statement? I'm sorry. I skipped  
17 a sentence. Do you agree?

18 A. If I can read the full statement,  
19 I'd like to?

20 Q. Sure.

21 A. What you're referring to is the  
22 statement in Table 4-2 that says the CAWS is  
23 dominated by suspended sediments that result from  
24 a combination of urban surface runoff discharges,

1 CSO's, treated discharges and navigation  
2 resuspension and the statement was a general  
3 statement based on visual observations made during  
4 a field investigation and it appears in that part  
5 of the report and I agree with it.

6 Q. Okay. Why was this variable not  
7 picked for the inclusion in the water quality or  
8 physical habitat variable that were related to the  
9 fish data?

10 A. Our final set of habitat variables  
11 that we used incorporated a variable called Secchi  
12 depth which is a measure of visibility in the  
13 water column and it's a quantitative indicator of  
14 suspended sediments.

15 Q. And that variable is from just 2008  
16 sampling data, correct?

17 A. Yes.

18 Q. Do you agree that there is data that  
19 measures suspended sediments through the 2001/2007  
20 period from MWRD that was not used?

21 A. That's right.

22 MR. ETTINGER: I'm sorry. I  
23 thought -- maybe I'm reading the wrong part of the  
24 report. I thought in the report as a whole you

1 decided to use something else as a proxy for  
2 Secchi depth?

3 THE WITNESS: Let me refresh my  
4 memory so I don't misspeak.

5 MR. ETTINGER: I believe you --

6 THE WITNESS: We may have used  
7 turbidity.

8 MR. ETTINGER: I think you used  
9 vegetative measure macrophytes or something as a  
10 approximate --

11 THE WITNESS: No.

12 MR. ETTINGER: And then correct me  
13 if I'm wrong. My understanding is you used a  
14 different measure that I believe had to do with  
15 vegetative growth in the pool and then you charted  
16 that versus Secchi depth and decided it was okay  
17 to use that in earlier years?

18 THE WITNESS: Again, let me make  
19 sure I don't misspeak. I know the part of the  
20 report you're referring to, I believe. I've  
21 refreshed my memory and what we did was we looked  
22 at turbidity, historical turbidity data, and using  
23 our 2008 data for both Secchi and turbidity we  
24 compared them to evaluate whether we could --



1 whether there was a relationship between the two  
2 and we determined that there was a statistically  
3 significant relationship, but the degree to which  
4 the two varied with respect to each other was  
5 still too large for our purposes so in the end we  
6 eliminated it from the final habitat analysis.

7 BY MS. WILLIAMS:

8 Q. Why didn't you just use turbidity  
9 instead? Is turbidity a different measure than  
10 total suspended solids in this case that you're  
11 referring to, two separate ones?

12 A. In the context of habitat, one of  
13 the things that we determined was turbidity was  
14 functioning as a cover, if you will. We treated  
15 it as a habitat parameter and in limiting light  
16 penetration so we concluded that we weren't losing  
17 any information by not considering it. We had a  
18 variable for macrophyte cover that was correlated  
19 with it and we substituted that.

20 MR. ETTINGER: That's what I was  
21 thinking. On Page 109 of your report you say  
22 Secchi is typically used in habitat studies as an  
23 indicator of light penetration related to the  
24 growth of aquatic macrophytes that create fish

1 habitat and provide food. So I believe based on  
2 that and your correlation between -- I guess you  
3 have correlated Secchi and turbidity and then you  
4 decided you were okay because you had macrophytes  
5 in your habitat study?

6 THE WITNESS: Right. As it goes  
7 onto say "In this study, a metric reflecting  
8 macrophyte growth was already included." So  
9 Secchi was in a sense redundant, which is the  
10 reason it was eliminated from the analysis.

11 MS. TIPSORD: And for the court  
12 reporter, Secchi is S-E-C-C-H-I.

13 MR. ETTINGER: That was on page --

14 THE WITNESS: What I just read is on  
15 Page 109.

16 MS. TIPSORD: Of PC 284.

17 MR. ETTINGER: Then you considered  
18 macrophyte as part of your habitat --

19 THE WITNESS: It was retained for  
20 the regression analysis.

21 MR. ETTINGER: Thank you.

22 BY MS. WILLIAMS:

23 Q. So just to finish that line in my  
24 mind. Total suspended solids as a water quality

1 parameter why did you eliminate that as a  
2 potential water quality parameter? You've given  
3 several reasons that different water quality  
4 parameters were thrown out. Which one of those  
5 applies to total suspended solids?

6 A. To be honest, I don't recall  
7 specifically why.

8 Q. Okay. Thank you. Question 20,  
9 according to Table 6-4 on Page 114 of the Habitat  
10 Evaluation Report the highest r squared value of  
11 0.25 for a single habitat variable was for maximum  
12 depth. Other listed single habitat variables,  
13 organic sludge and macrophytes had r squared  
14 values of 0.15. I think we discussed A already.  
15 Are all of these individual values less than the  
16 0.27 r squared value for DO?

17 A. Yes, they are.

18 Q. What are the individual r squared  
19 values of each of the other nine variables  
20 included in this table all less than 0.15?

21 A. 0.15 or less?

22 Q. Yes. Sorry. What were these  
23 values?

24 A. I don't have the other numbers. We

1 didn't save them. If necessary, we could  
2 regenerate them for the analysis. We extracted  
3 the top three, but I would also add that we didn't  
4 consider them to be relevant because we weren't  
5 concentrating on single habitat variables as I  
6 mentioned.

7 Q. You said because you weren't  
8 focusing on single habitat variables, is what you  
9 said?

10 A. That's right.

11 Q. Question 21. Page 7 of your  
12 pre-filed testimony states that, quote, the CAWS  
13 habitat study found that channel depth, lack of  
14 off channel areas and bank refuge for fish,  
15 vertical walled or riprapped banks and manmade  
16 structures in the channel were all strongly  
17 negatively correlated with fish condition. Where  
18 in that CAWS Habitat Evaluation Report does it  
19 show that each of these four variables is  
20 individually as strongly, negatively correlated  
21 with fish condition?

22 A. My statement was all of these  
23 variables together are strongly, negatively  
24 correlated with fish condition, not that each one

1 is individually strongly, negatively correlated  
2 with fish correlation. Just to clarify.

3 Q. Thank you. I'll skip onto 23. You  
4 testify on Page 4 that many miles of channel banks  
5 were dug into bedrock where the channels were dug  
6 in the soil banks -- let me start over. Quote,  
7 many miles of the channel banks were dug into  
8 bedrock where the channels were dug in soil the  
9 banks were armored with stone and other materials  
10 to prevent erosion. I don't know if I left out a  
11 comma here or not. End quote. Is erosion  
12 considered a negative habitat input in most  
13 streams?

14 A. Erosion is a natural process in  
15 streams and excessive erosion is generally  
16 considered to be a negative habitat attribute in  
17 natural streams.

18 Q. So could preventing erosion with  
19 these armored banks result in less total suspended  
20 solids and sedimentation in the CAWS compared to  
21 other waters?

22 A. The purpose of bank armoring in the  
23 CAWS is to prevent erosion of the banks and I  
24 haven't investigated its effectiveness in the

1 CAWS.

2 Q. Have you compared the CAWS to other  
3 waters for total suspended water levels?

4 A. No.

5 Q. Question 24. You testify on Page 5  
6 that 61 percent of the CAWS was vertical walls or  
7 covered with rip rap. What percentage was  
8 vertical walled and what percentage was rip rap?

9 A. About 19.3 percent of the banks in  
10 the CAWS are covered by rip rap and approximately  
11 41.5 percent are vertical walled.

12 Q. Is there a difference between  
13 vertical walls and rip rap from the point of view  
14 of habitat for fish?

15 A. We didn't focus on a comparative  
16 evaluation of those two specifically, but in a  
17 general sense they represent different aspects of  
18 bank condition. So there may be -- they may  
19 affect fish differently.

20 Q. Can you explain why they were thrown  
21 together in this case? On Page 5, why you  
22 combined them?

23 A. I think my intention was just to  
24 point out an aspect of the modification of the

1 system and its deviation from a natural condition.  
2 My referring to them in the same statement doesn't  
3 really have anything to do with the conclusions of  
4 our study, though.

5 Q. Okay. I would like to look at some  
6 of the comparisons between percent wall --  
7 vertical wall and percent rip rap in your study.  
8 If you can turn to Table 7-5 on Page 136. Have  
9 you found the table?

10 A. Yes, I have.

11 Q. What segment has the highest  
12 percentage of vertical walls?

13 A. That would be the Chicago River.

14 Q. And the lowest?

15 A. Upper North Shore Channel north of  
16 the North Side Water Reclamation Plant and the  
17 Lower North Shore Channel.

18 Q. And they both have zero, right?

19 A. Yes.

20 Q. What segments have the highest  
21 percentage of rip rap?

22 A. Cal-Sag Channel and the Upper North  
23 Branch of the Chicago River north of Addison.

24 Q. And I'd like to draw your attention

1 to comparing the Chicago Sanitary and Ship Canal  
2 in this table to the Cal-Sag Channel for a moment.

3 A. Okay.

4 Q. Would you agree that if you combined  
5 the percent vertical walls and percent rip rap  
6 into a single figure that these numbers are  
7 similar yet when you separate them they're very  
8 different? It's a compound question, but does  
9 that make sense what I'm saying?

10 A. No.

11 Q. In your testimony, you combine those  
12 two metrics together and I'm asking is it true if  
13 you combine those two together for those two  
14 segments for the Sanitary and Ship Canal you'd  
15 have 59 plus 5, correct, so 64, is that correct?

16 A. Yes.

17 Q. And if you combined them for Cal-Sag  
18 Channel you'd have 19 plus 53, which is higher,  
19 but it would be -- man, my adding is bad.  
20 Seventy-two, correct?

21 A. Yes.

22 Q. It is correct that the Cal-Sag  
23 Channel has 53 percent rip rap banks, correct?

24 A. Yes.



1 Q. While the Chicago Sanitary and Ship  
2 Canal has 59 percent vertical walls, correct?

3 A. Yes.

4 Q. Thank you.

5 A. I should clarify my mentioning of  
6 them together doesn't mean that I combined them in  
7 some way. I think that's the word you used.

8 MR. ANDES: Did you add them  
9 together in your analysis?

10 THE WITNESS: No.

11 MR. ANDES: Would you ever do that?

12 THE WITNESS: No. Because they  
13 represent different attributes.

14 MR. ANDES: Thank you.

15 BY MS. WILLIAMS:

16 Q. So you would agree there's a  
17 difference between these two segments with regard  
18 to the banks, correct?

19 A. Yes.

20 Q. Question 26. You state on Page 5-6  
21 of your pre-filed testimony that, quote, many of  
22 the channels were made to be roughly rectangular  
23 or trapezoidal in cross section with very little  
24 of the shallow, near shore areas called littoral

1 zones. Are there areas in the CAWS where the bank  
2 walls are crumbling leaving borders and large  
3 cobble as littoral substrate?

4 A. I believe the word is boulders.

5 Q. Did I say borders?

6 A. I knew what you meant.

7 Q. Thank you.

8 A. Yes. It does appear that there are  
9 areas in the CAWS where debris from crumbling bank  
10 walls is contributing to littoral substrates. I  
11 should add that I don't necessarily want to  
12 promote intentionally crumbling bank walls to  
13 create substrates.

14 Q. Do you agree over time this is going  
15 to continue to occur?

16 A. Well, I can't really say. I would  
17 hope there's maintenance procedures in place, but  
18 we haven't evaluated whether that is likely to  
19 continue or not.

20 Q. Have you evaluated whether it's an  
21 inexpensive habitat improvement project to allow  
22 them to continue to occur?

23 MR. ANDES: Is the Agency suggesting  
24 we should let bank walls crumble in navigation

1 channels?

2 MS. WILLIAMS: Are you asking me a  
3 question, Fred?

4 BY MS. WILLIAMS:

5 Q. You did a report on habitat  
6 improvements. I want to know is that a habitat  
7 improvement that you evaluated?

8 A. Can you repeat that? I'm sorry.

9 Q. Did you evaluate whether crumbling  
10 walls is a low cost habitat improvement mechanism  
11 in the CAWS in your habitat improvement report?

12 A. Bear with me. The habitat  
13 improvement that you're asking is it crumbling the  
14 walls or preventing the crumbling of the walls?

15 Q. Crumbling them.

16 A. No, we didn't evaluate that.

17 MR. ETTINGER: Can I ask kind of a  
18 follow-up question? When you analyze something as  
19 vertical walls or not, did you make any sort of  
20 judgment as to how good a shape the wall was in.

21 THE WITNESS: Not with the vertical  
22 wall parameter or variable in and of itself, but  
23 we did have other variables that describe the  
24 condition of things such as bank pocket area where

1 we were trying to look for places where holes had  
2 eroded into the walls or where there were gaps  
3 that had developed that could provide small refuge  
4 area for the fish.

5 MR. ETTINGER: So as to the vertical  
6 wall component, it either had a vertical wall or  
7 not?

8 THE WITNESS: That's right.

9 MR. ETTINGER: But then there were  
10 other factors that you analyzed that might have  
11 caught some of the erosion of the vertical wall or  
12 something like that?

13 THE WITNESS: The condition in any  
14 case, yeah, we tried to get it as it would be  
15 relevant to fish I guess is the best way to say  
16 it.

17 MS. TIPSORD: If we're done with  
18 that question, let's go ahead and take a lunch  
19 break.

20 (Whereupon, a break was taken  
21 after which the following  
22 proceedings were had.)

23 MS. TIPSORD: We're ready to go back  
24 on the record.

1 BY MS. WILLIAMS:

2 Q. I'm going to pick up -- in general,  
3 if I skip something, I'm done. I would like to  
4 flag 28 maybe to come back to later, but let's  
5 pick up on question 29.

6 Page 65 in the CAWS Habitat  
7 Evaluation Report states, quote, where large  
8 substrate (gravel, cobbles, boulders) are present  
9 in the CAWS they appear to be important to fish,  
10 end quote. Do you know what minimum amount of  
11 available habitat space needs to be covered by  
12 these important substrates in order for fish  
13 populations to be maintained?

14 A. I presume you're referring to in the  
15 CAWS, a portion in the CAWS?

16 Q. I guess so. It could be read more  
17 generally, but let's stick with the CAWS.

18 A. We didn't study specifically the  
19 relationship between large substrate and fish in  
20 the CAWS. We did point out -- I'd like to point  
21 out on Page 65 we do say that future work should  
22 include collection of more data in that regard.  
23 So it's something that is an interesting question  
24 to us.

1 Q. What kind of data do you have in  
2 mind?

3 A. I am making the general comment that  
4 there's insufficient data to fully understand the  
5 relationship between large substrate and fish and  
6 more data has to be collected. I have to take  
7 some more time to think about it to offer a  
8 suggestion as to what kind of data that would be,  
9 but I wanted to add that in the CAWS, particularly  
10 in portions where navigation occurs, that  
11 placement of large substrate could be in conflict  
12 with navigational use and even in other places it  
13 should be carefully considered because these large  
14 substrates can affect the hydraulic conveyance of  
15 these channels. So it's nothing to be taken  
16 lightly.

17 Q. Did you look at any sonar mapping by  
18 Dr. Mackey?

19 A. Yes, we did.

20 Q. Is that the data you're talking  
21 about or --

22 A. It could be part of the  
23 investigation.

24 Q. Question 30. On Page 6 you indicate

1 that, quote, analysis conducted as part of the  
2 CAWS habitat study showed that there are  
3 statistically significant relationships between  
4 the concentrations of many of these chemicals and  
5 the health of benthic invertebrates. Can you just  
6 explain how -- A, how was health measured?

7 A. So for everybody's -- so we're all  
8 on the same page. The reference quote has to do  
9 with the analysis of contaminated sediments and  
10 macroinvertebrates in our study and we wanted to  
11 be sure that we included some representation of  
12 the sediment contamination in the CAWS and our  
13 analysis of habitat because it could potentially  
14 be an affected or an important factor on fish. So  
15 we also recognize that it's difficult without  
16 special kinds of data to understand the  
17 relationship between fish and contaminated  
18 sediment. So what we did was we looked at the  
19 relationship between the contaminated sediment and  
20 macroinvertebrates to sort of discern which  
21 contaminants in the CAWS might be most affecting  
22 biota. We looked at that. We compared actual  
23 sediment -- measured sediment concentrations from  
24 a number of different locations in the CAWS with

1 macroinvertebrate data from the District and did  
2 correlation analysis between them. So the  
3 question of how is health measured, it was a  
4 correlation analysis of sediment contaminant  
5 concentrations and metrics including taxa  
6 richness, detrital enrichment, percent detrital and  
7 percent algal and I have to admit I'm not a  
8 macroinvertebrate specialist. So we relied on the  
9 expertise of members of our team to do this.

10 Q. What were the measurements of  
11 contaminated sediment that you relied on?

12 A. They were concentration  
13 measurements. A very long list of chemicals.

14 Q. Can we find a list somewhere in your  
15 report?

16 A. I think so. Let me check.

17 Q. It should be -- if it's in here, it  
18 should be in Appendix B and the complete list --  
19 so as part of Appendix B -- Appendix B consists of  
20 two memoranda that were conducted by Baetis  
21 Environmental Services specifically -- they were  
22 specifically contracted by us to look at the  
23 macroinvertebrate data and in there it's difficult  
24 to pinpoint because there's not a page number.



1 There are tables of statistical results that  
2 include lists of variables and I don't know how to  
3 reference the specific page. It's the first --  
4 for example, the first page of the appendix to the  
5 second memo in there.

6 MR. ANDES: Can you give the title  
7 on the top of the page?

8 THE WITNESS: And the title says  
9 Correlation Analysis of Percent Head Capsule  
10 Deformities and Sediment Contamination 2001 to  
11 2007 by Station ID and Year and it lists several  
12 chemical measures from sediment samples and they  
13 range from ammonia and phosphorous to metals such  
14 as mercury and cadmium, indirect measurements such  
15 as acid volatile sulfides, total PCB's. There are  
16 some pesticides on the list. Volatile organic  
17 compounds.

18 Some of these items I should  
19 mention also when we examined the data, for  
20 example, for PCB, PCB's can be present in a number  
21 of forms, we consolidated the data into a single  
22 number. So if someone measured a particular  
23 congener or PCB, we added them up into total  
24 PCB's. Similarly, we did that with volatile

1 organic compounds and semi-volatile organic  
2 compounds. There are individual chemicals in  
3 those lists. We just totalled them up.

4 Q. So those would be -- I think that's  
5 a pretty complete list right there.

6 MS. TIPSORD: That's Appendix B of  
7 Public Comment 284?

8 THE WITNESS: Yes, it is.

9 BY MS. WILLIAMS:

10 MR. ANDES: Is that PCB of the  
11 habitat evaluation?

12 MS. WILLIAMS: At this point, I  
13 don't think we have to do it now, but I think it  
14 might help the record if we enter these reports in  
15 as exhibits because there's two reports and they  
16 each have A, B. There's not just one Appendix A,  
17 one Appendix B. There's two reports in one public  
18 comment. I'm not worried about it right now, but  
19 to refer back later I don't know if you really  
20 want it all to be one public comment number. I  
21 guess it's up to you. I just want to point that  
22 out.

23 MS. TIPSORD: I would hate to enter  
24 another group of pages when we already have a

1 public comment.

2 MS. WILLIAMS: Just to be clear,  
3 it's Appendix B. That's why I refer to it as the  
4 Habitat Evaluation Report versus the Habitat  
5 Improvement Report. Okay.

6 BY MS. WILLIAMS:

7 Q. Can you tell us what percentage of  
8 samples had a significant relationship?

9 A. Percentage of samples?

10 Q. This is C, 30 C.

11 A. No, we didn't calculate the  
12 percentage of samples with significant  
13 relationships. We could go back and calculate  
14 that, but I don't have that number.

15 Q. I'm going to go onto 33. On Page 7  
16 of your pre-filed testimony, you state that,  
17 quote, the CAWS habitat study -- Habitat  
18 Evaluation Report found that sediment  
19 contamination was statistically correlated to poor  
20 invertebrate condition, end quote. Are you  
21 referring to Chironomidae or midge head capsule  
22 deformities?

23 A. Yes, that statement refers to midge  
24 head capsule deformities.

1 Q. What types of deformities?

2 A. What types of head capsule  
3 deformities or what types of other deformities?

4 Q. What types of head capsule  
5 deformities?

6 A. I don't specifically have that  
7 answer. I'd have to look it up.

8 Q. Do head capsule deformities relate  
9 directly to survival and reproduction?

10 A. We didn't examine the direct  
11 relationship between head capsule deformities and  
12 survival of reproduction. The purpose was simply  
13 to assess whether there was an impact of sediment  
14 contamination on macroinvertebrates.

15 Q. Are some -- are some midges more  
16 tolerant and still have fewer deformities?

17 A. We didn't study the susceptibility  
18 of different species to contamination.

19 Q. So you don't know?

20 A. I don't know.

21 Q. How meaningful are these results if  
22 the two regression methods indicate totally  
23 different significant parameters for the  
24 Hester-Dendy samples, i.e., nickel and lead for

1 the Pearson correlation and ammonia, iron and DDX  
2 for the Spearman correlation?

3 A. It's not unexpected that you would  
4 get different results for the Spearman and Pearson  
5 correlations. Pearson correlations can be heavily  
6 influenced by extreme values. The Pearson  
7 correlations presented in the Baetis reports that  
8 you see are presented just for the sake of  
9 completeness. We didn't rely on them. I think  
10 they're all -- kind of have an X through them.

11 Q. You relied on the Spearman?

12 A. Right. So we relied on the  
13 Spearman.

14 Q. Is it true that the Pearson is more  
15 powerful than the Spearman?

16 A. I don't know that to be true.

17 MR. ANDES: Did the results of those  
18 correlations affect your approach in terms of  
19 looking at habitat and fish?

20 THE WITNESS: No. And, ultimately,  
21 our purpose was to identify which settlement  
22 containments could reasonably be expected to have  
23 an impact on aquatic life, the most impact on  
24 aquatic life and so we selected three that we

1 thought were exhibiting the most impact. We  
2 didn't want to include all of them. It would have  
3 been cumbersome to do so.

4 Q. Question 34, you testify in the last  
5 sentence of Page 7 that, quote, navigation also  
6 has a significant negative impact on fish in the  
7 CAWS. CAWS reaches with high commercial  
8 navigation were found to have statistically  
9 significant poor fisheries conditions than other  
10 reaches without high commercial navigation.

11 A, is there a relationship  
12 between poor habitat and navigation?

13 A. We observed a statistically  
14 significant relationship between fisheries  
15 condition and high navigation in the CAWS and it  
16 was a negative relationship. So where we saw high  
17 commercial navigation we saw lower values for the  
18 combined fish metric.

19 Q. Okay. I think you've answered B and  
20 C, but I'm not sure if that's -- A, is there a  
21 relationship between poor habitat and navigation?

22 A. I'm sorry. We didn't examine the  
23 relationship between navigation and habitat except  
24 to observe that there were some habitat attributes

1 that were correlated with high navigation. So we  
2 didn't examine it. We didn't make a thorough  
3 examination. I'll say that. But we did observe  
4 that there were some habitat variables that are  
5 definitely correlated with high navigation.

6 MR. ANDES: Were those negatively  
7 correlated with fish?

8 THE WITNESS: Generally, ones that I  
9 recall were all negatively correlated with fish.

10 BY MS. WILLIAMS:

11 Q. B, was your conclusion that the  
12 negative impact of navigation to fish based on an  
13 experiment and I think you answered that no?

14 A. Right. We didn't do that one.

15 Q. It is based on a correlation, that's  
16 yes?

17 A. That's yes.

18 Q. Question B, do you believe the Clean  
19 Water Act Aquatic Life Use Goal is not attainable  
20 in waters with commercial navigation?

21 A. I'd have to say that I think that  
22 question needs to be answered on a case by case  
23 basis.

24 Q. Question 35. On Page 8 of your

1 pre-filed testimony, you state with regard to  
2 navigation that there are also -- that, quote,  
3 there are also direct negative impacts on fish  
4 including propeller impacts, end quote. How many  
5 fish samples show evidence of propeller impacts?

6 A. The statement that you referred to  
7 was a general statement made in light of the body  
8 of professional literature discusses negative  
9 impacts of navigation on fish. I don't believe  
10 that the District records propeller impacts  
11 explicitly although they do record injuries and  
12 lesions. We didn't record evidence of propeller  
13 impacts in our review of the fish either.

14 Q. Before I move on let me ask. When  
15 you make some conclusions about navigation in your  
16 report and areas of higher versus lower  
17 navigation, did you look at data? How did you  
18 define navigation and how did you define high  
19 navigation versus lower navigation areas?

20 A. We relied on data that had been  
21 processed as part of a study which I can cite for  
22 you. I don't have it at my fingertips, though. I  
23 believe it was the Great Lakes Fisheries  
24 Commission, but I need to verify that.



1 Q. I think it might be in the  
2 improvement report, is that where you're looking?

3 A. Actually, I'm looking in the  
4 evaluation report because that's where we  
5 introduced the data, but it may be in that as  
6 well. It was the Great Lakes Fisheries  
7 Commission. There was a project report regarding  
8 ecological separation. Brammeier, Polls and  
9 Mackey 2008. As part of that study, the  
10 investigators collected navigation -- commercial  
11 navigation data from the Corp of Engineers and  
12 processed it.

13 Q. Was it based on the tonnage carried  
14 by the boats or the number of passages by the  
15 boats?

16 A. They only record tonnage. They  
17 don't record number of passages.

18 Q. So you're equating high navigation  
19 based on high counts?

20 A. Tonnage, yes. Which was the only  
21 available measure we had.

22 Q. I think we had some questions that I  
23 don't know that makes sense to go through with you  
24 about some possible discrepancies between sample

1 numbers in the macroinvertebrate data. Would that  
2 be something that you would just -- you would just  
3 have reviewed, you wouldn't necessarily be able to  
4 answer?

5 A. Yeah. Regarding specific sample  
6 numbers, I don't have that knowledge at my  
7 fingertips.

8 MR. ETTINGER: Going back to the  
9 macroinvertebrate. How did you use the  
10 macroinvertebrate data in your overall  
11 conclusions?

12 THE WITNESS: The way we use the  
13 data was we looked at relationships between  
14 macroinvertebrates and sediment contamination to  
15 identify specific sediment contaminants that could  
16 be most damaging and that apparently were most  
17 damaging to macroinvertebrates and then we carried  
18 those into the habitat analysis as habitat  
19 variables.

20 MR. ETTINGER: Which of the habitat  
21 variables? Would that be registered in on your  
22 final five or whatever it was?

23 THE WITNESS: They aren't in the  
24 final five. They didn't make the cut. They

1 weren't significantly related.

2 MR. ETTINGER: So when you did your  
3 shaking and dancing with the numbers --

4 MR. ANDES: That's your technical  
5 term?

6 MR. ETTINGER: That's my technical  
7 term. The sediments didn't work into the final  
8 habitat factors that you thought affected the  
9 CAWS?

10 THE WITNESS: Right. They weren't  
11 the most effective at describing fish variables.

12 MS. WILLIAMS: So just to ask  
13 Mr. Andes when we have Ms. Wasik here, would we be  
14 able to direct specific questions on the  
15 macroinvertebrate data to her? Would that be  
16 appropriate because it's a MWRD study, correct?

17 MR. ANDES: Yes.

18 MS. WILLIAMS: We'll save that for  
19 her.

20 MR. ANDES: If those questions were  
21 not in the pre-filed questions for Ms. Wasik, but  
22 you plan to ask them, I mean you could provide  
23 them beforehand. That would be very helpful so we  
24 can have answers ready to go.

1 MS. WILLIAMS: I think if we have  
2 that may be possible if we have -- if we identify,  
3 we do see some specific discrepancies, we'll do  
4 that.

5 BY MS. WILLIAMS:

6 Q. Question 39. On Page 9 of your  
7 pre-filed testimony you state, quote, this  
8 analysis showed that a set of six key habitat  
9 variables (maximum channel depth) number of off  
10 channel bays, percent of vertical wall banks,  
11 percent of rip rap banks, manmade structures and  
12 macrophyte cover were the most strongly correlated  
13 with the combined fish metric.

14 A, is it true that the  
15 measurements of these six habitat variables were  
16 only done in 2008?

17 A. Yes.

18 Q. Were these same values applied to  
19 the data from 2001 through 2007?

20 A. Yes.

21 MR. ANDES: Can you explain how that  
22 was done?

23 THE WITNESS: Of those six variables  
24 that you mentioned, we -- as you pointed out, we

1 measured them in the field in 2008 and then we  
2 evaluated which of the variables -- we made a  
3 determination for several variables, not just  
4 these, regarding whether or not they had changed  
5 in the last several years.

6 We were using fish data from  
7 2001 to 2007. So, obviously, we couldn't go back  
8 and directly measure a lot of these things, but  
9 for many of the characteristics we were able to  
10 determine through talking to people that were  
11 familiar with the system at that time and through  
12 aerial photography, and actual inspection of the  
13 CAWS themselves, that those conditions had existed  
14 in the same way and the same places for some time  
15 such as rip rap and vertical walls, the structures  
16 that are in place and so forth.

17 So we couldn't go back and  
18 measure them, but we felt comfortable in going  
19 back and extrapolating 2008 measurements to the  
20 time period in which we have fish data because we  
21 felt they were representative of that time.

22 Macrophyte cover we couldn't exactly do it the  
23 same way, but what we did have was we had habitat  
24 assessment reports from that time period collected

1 by the District that noted presence and coverage  
2 of macrophytes. So we were able to make some  
3 qualitative judgments about how representative the  
4 2008 observations were to that time period 2001 to  
5 2007.

6 Q. You looked at it and decided, yeah,  
7 it was pretty much the same as what you found in  
8 2008?

9 A. Yes.

10 Q. What about -- do you agree that  
11 maximum depth can change from year to year?

12 MR. ANDES: You're on subsection A?

13 MS. WILLIAMS: D.

14 BY THE WITNESS:

15 A. Yes, maximum depth. The depth of  
16 the water will vary from year to year, from time  
17 to time, but we were pretty comfortable in using  
18 the values that we used. What we used were model  
19 values from Dr. Melchin's due flow model and we  
20 compared them to measurements we took in 2008.  
21 They were fairly comparable, but furthermore the  
22 maximum depth in the channels varies by only a few  
23 feet, four feet give or take and relative to the  
24 overall depth of the channel that's pretty small.

1                   Secondly, we know that maximum  
2                   change in water depth occurs when the water levels  
3                   are drawn down in the CAWS in anticipation of a  
4                   major storm event. The District avoids sampling  
5                   during that time. So we know that the fish data  
6                   that we were comparing to weren't collected at a  
7                   time when maximum drawdown was occurring. So we  
8                   felt pretty comfortable in using those maximum  
9                   depth variables.

10                   MR. ETTINGER: I just want to make  
11                   sure I understood. When did you say it is that  
12                   you know that the Water Reclamation District  
13                   doesn't sample?

14                   THE WITNESS: When the water levels  
15                   are drawn down in the CAWS in anticipation of a  
16                   major storm event. That's when the fluctuations  
17                   in level occur and the District avoids going out  
18                   in those times.

19                   MR. ETTINGER: Do they go out in  
20                   major storm events?

21                   THE WITNESS: I don't think they do.  
22                   You'd have to ask them that.

23                   BY MS. WILLIAMS:

24                   Q.           So did you say that you looked at

1 the actual maximum depth measurements that you  
2 took and compared them to the due flow model to  
3 conclude that they were responsible? Is that what  
4 I heard you testify?

5 A. We made observation when we were in  
6 the field and we said qualitatively are these what  
7 we're seeing what is reflected by what the model  
8 says and we concluded that the model maximum  
9 depths were valid.

10 Q. I see. So you relied on the model  
11 depths?

12 A. Yes.

13 Q. What did you do with the measured  
14 depths?

15 A. We didn't use them.

16 Q. Are they provided in your report?

17 A. No, I don't think so because we  
18 didn't use them.

19 Q. Thank you.

20 MR. ANDES: Am I correct that, in  
21 essence, you crosschecked those against the depths  
22 from the model?

23 MS. WILLIAMS: I object because he  
24 said it's not in his report. How can we compare?



1 MR. ANDES: I asked if that's what  
2 he did.

3 MS. WILLIAMS: Okay. You're asking  
4 him if that's what he personally did?

5 MR. ANDES: Yes.

6 THE WITNESS: I did not personally  
7 do that.

8 MR. ANDES: Did your staff do that?  
9 Did Limno Tech --

10 THE WITNESS: Honestly, I would have  
11 to go back and look at exactly what we did because  
12 I don't recall what the nature of the comparison  
13 was and I don't want to misspeak while I'm on the  
14 record.

15 BY MS. WILLIAMS:

16 Q. Thank you. We all appreciate that.  
17 Isn't it correct that when examined for their  
18 applicability, the six habitat variables explain  
19 only 29 percent or less of the CAWS fish  
20 information based on using the year 2008 fish  
21 data?

22 A. Yes, that's correct that the model  
23 explains 29 percent of the variability of the fish  
24 data collected in 2008, but I want --

1 Q. We did talk about this earlier?

2 A. Yes.

3 Q. G --

4 MR. ANDES: Wait. Let him finish  
5 his answer.

6 BY THE WITNESS:

7 A. I just want to say part of that  
8 question -- I want to make sure that I answered  
9 it. The question says when examined for their  
10 applicability the six habitat variables explain.  
11 To be clear, the comparison was done to evaluate  
12 the regression model as a whole which contained  
13 those six variables. It didn't shed any light on  
14 each individual variable. So I just want to be  
15 clear on that.

16 BY MS. WILLIAMS:

17 Q. Do you agree that if regression  
18 results are going to be used for valid predictions  
19 then prediction error in the regression relation  
20 must be accounted for? This is G.

21 A. What exactly do you mean by  
22 prediction error?

23 Q. You're not familiar with the term  
24 prediction error?

1           A.       There are other terms for error in  
2 regression analyses and I just want to be clear  
3 specifically what quantity you're asking about. I  
4 can tell you what we looked at.

5           Q.       Sure. That would be fine.

6           MR. ANDES: Can we get an answer in  
7 terms of what your engineer is intending to lean?

8           MS. WILLIAMS: Sure. Just a second.

9 BY MS. WILLIAMS:

10          Q.       So what I think I was trying to get  
11 at is if you're using your model to predict what  
12 the combined fish metric is going to be there's a  
13 plus or minus error inherent in the model,  
14 correct?

15          A.       Okay. It would be similar to the  
16 root mean square error?

17          Q.       What?

18          A.       The root mean square error.

19          Q.       That's fine. That will be fine.

20          A.       Okay. Which is inversely related to  
21 the R square. So if you know what the r squared  
22 is you can extract what that error is from that  
23 approximately.

24          Q.       We've already covered 40, 41, 42.

1 So I'm going to move onto 43. What is the  
2 significance of the following conclusion from Page  
3 11 of your pre-filed testimony, quote, when  
4 compared to fish data from the CAWS, the index  
5 developed using these 11 habitat variables had an  
6 R square of 0.48, end quote. Why is it  
7 significant if the r squared is the same for the 6  
8 and 11 variables?

9 A. The significance is that the  
10 addition of the five habitat variables that we  
11 included after the regression analysis -- the  
12 significance of the statement is we included those  
13 five habitat variables after the regression  
14 analysis and they weren't part of the regression  
15 analysis. They didn't end up in the final  
16 regression model, but they didn't change the  
17 effectiveness of the ability of the model with  
18 those five variables to predict fish data.

19 Q. So maybe you need to explain --  
20 maybe we need to step back and explain this point  
21 in the process where you added five variables to  
22 six?

23 A. Okay. At this point, we had done  
24 our statistical analysis of fish and habitat data

1 and the point of that was to try to understand the  
2 relative importance of habitat and what measures  
3 of habitat could be used to describe variability  
4 in fish. So we had this equation that said fish  
5 equals some function of these six habitat factors,  
6 variables. We then wanted to try to assemble  
7 those in a way that could be used to compare  
8 different reaches within the system, an index.

9           When we looked at doing that, we  
10 looked at the variables we had in our equation and  
11 we said "Are they sufficient today?" With the  
12 measured data, they're sufficient to compare  
13 locations in the CAWS, but what if someone wants  
14 to try to do a project down the road that would  
15 improve habitat or what if there is some aspect of  
16 habitat that's important at a particular location,  
17 it's not important across the whole system, but at  
18 a particular location of the CAWS. Is there  
19 something that we haven't accounted for?

20           So we said if we're going to do  
21 an index for this maybe we need to include some  
22 other variables and that's why we added these five  
23 because we felt they weren't -- potentially  
24 weren't -- although they were adequate to describe

1 the fish data today, they potentially weren't  
2 adequate to measure differences down the road if  
3 habitat were to be improved. So that's why we  
4 included some of those things.

5 Q. And how did you choose them?

6 A. The variables that we added were  
7 taken from a list of variables that we had already  
8 determined had fairly good variance across the  
9 system, but not as good as the variables we saw  
10 and that we felt intuitively most people that are  
11 associated with habitat and fish studies would  
12 want to understand, yeah, those are things that  
13 you ought to consider. Those are things you might  
14 want to improve. So it was very qualitative in  
15 adding those in.

16 MR. ANDES: Can you give examples of  
17 where those were?

18 THE WITNESS: Sure. Just a moment.  
19 So, for example -- if you look at Page 129,  
20 there's descriptions of some variables that didn't  
21 appear in the regression equation, but that we  
22 added for purposes of index development.

23 BY MS. WILLIAMS:

24 Q. When you say didn't appear, what do

1 you mean didn't appear?

2 A. The variables -- the regression  
3 equation had six habitat variables. We then used  
4 those and five others in developing our index. So  
5 the five that we added were in addition to the six  
6 in the regression. So when I say they didn't  
7 appear in the regression equation, they were  
8 different from what was in the regression  
9 equation.

10 Q. Explain what you mean by the six  
11 that were in the regression equation and the 16  
12 variables we were talking about earlier?

13 A. The six in the regression equation  
14 are a subset of the 16 that were evaluated, okay,  
15 for the regression.

16 Q. And of the five that were added back  
17 in, can you tell us how many were in the 16 and  
18 how many were not in the 16?

19 A. I'd have to look that up. I can't  
20 tell you off the top of my head and I don't know  
21 if I can do that quickly.

22 Q. That's okay. If you don't know,  
23 that's fine.

24 A. I don't know.

1 Q. I don't know is fine.

2 A. I think I can do it quickly. Three  
3 of them were --

4 MR. ANDES: What are those five  
5 additional variables?

6 THE WITNESS: The five additional  
7 variables were the percent of overhanging  
8 vegetation, the number of bank pocket areas, the  
9 percentage of large substrate in shallow part of  
10 the channel, the percentage of large substrate in  
11 deep part of the channel and the presence of  
12 organic sludge.

13 BY MS. WILLIAMS:

14 Q. Question 44, you state on Page 11  
15 that quote, for example, the Qualitative Habitat  
16 Evaluation Index, QHEI, developed in Ohio and  
17 widely used elsewhere had an r squared.45 of its  
18 original development dataset (Rankin 1989), end  
19 quote.

20 A, is this r squared value for  
21 all data statewide and all collection methods?

22 A. Yes, it is.

23 Q. Did boat sites have an r squared of  
24 0.59?



1           A.       Yes, the r squared reported by  
2 Rankin for boatable sites was 0.59.

3           Q.       What about boat sites within an eco  
4 region?

5           A.       The r squared values reported by  
6 Rankin by eco region varied from 0.0286 to 0.81  
7 and I don't know which of those were boatable  
8 sites and which weren't.

9           Q.       Who collected the habitat data that  
10 was used to calculate the QHEI scores on Pages 11  
11 to 12 of your pre-filed testimony?

12          A.       Our staff did during 2008.

13          Q.       Can you tell me -- specifically  
14 which staff members?

15          A.       The field activities for the project  
16 were all led by Doug Bradley and there were a few  
17 people that would have been out with him on  
18 various days and I can't tell you which days which  
19 data was collected, but Doug was the primary  
20 person on that.

21          Q.       And did he use Ohio EPA and Michigan  
22 DEQ procedures?

23          A.       No.

24          Q.       Why did you conclude not to use

1 well-designed existing habitat protocols such as I  
2 refer here to US EPA EMAP, USGS NAWQA and Ohio EPA  
3 QHEI approaches for the CAWS? These are all  
4 referenced in your testimony as well.

5 A. Yes. This is also discussed in  
6 Section 2.4 of our Habitat Evaluation Report and  
7 we reviewed available protocols. We recognized  
8 that going into this we needed a way to quantify  
9 habitat condition and it would have been much  
10 easier for us to use an existing protocol, but  
11 when we reviewed them in light of the CAWS we felt  
12 that none of them met the criteria we wanted to  
13 meet for this.

14 Those criteria included -- we  
15 wanted a protocol that was developed using biota  
16 as the dependant variable. So it had to be fish  
17 based. We wanted something that relied on  
18 quantitative measures as opposed to qualitative  
19 and we wanted to make sure it included habitat  
20 variables that reflected what was in the CAWS and  
21 the fact is of the protocols mentioned although  
22 they may have included modified streams or rivers,  
23 largely they were developed for natural systems  
24 and the variables they use in the protocols and

1 indices reflect that and we felt that we wouldn't  
2 be capturing the nature and variability of habitat  
3 in the CAWS if we used one of those other  
4 protocols.

5 Q. Do you believe that these published  
6 physical habitat approaches cannot distinguish  
7 between the best and the worst habitat conditions  
8 that occur in the CAWS?

9 A. Because they were developed for  
10 natural rivers and streams, I believe they're  
11 limited in their ability to distinguish habitat  
12 differences in the CAWS.

13 Q. Is it your testimony they can't  
14 distinguish between habitat differences among  
15 locations in the CAWS?

16 A. No, that is not my testimony.

17 Q. Did you apply the variable habitat  
18 approaches to the CAWS and find them to be unable  
19 to distinguish habitat differences?

20 A. We applied the QHEI and the  
21 Michigan Non-wadeable Habitat Index to the CAWS  
22 and found they did a poor job of explaining the  
23 fish data which was really what our objective was.

24 Q. Do you agree that the Ohio QHEI

1 development looked at impacted streams as well as  
2 natural streams?

3 A. I would have to go back and read the  
4 report on that, but my recollection is that they  
5 did include impacted streams.

6 Q. Question G, explain why the  
7 following variables were eliminated from  
8 regressions of fish data; flashiness, percent  
9 large substrate in deep water and percent plant  
10 debris on channel bottom?

11 A. Flashiness was eliminated from  
12 consideration and I should point out this is  
13 discussed on Page 112 of the Habitat Evaluation  
14 Report. Flashiness was eliminated from  
15 consideration because it was observed to be  
16 positively correlated with fish data, which didn't  
17 make sense to us. So we concluded that the data  
18 were unreliable in this regard. Similarly,  
19 percent large substrate in deep water was observed  
20 to be both positively and negatively correlated  
21 with fish in the multiple regression depending on  
22 what other variables it was paired with and we  
23 call this an unstable variable. So we didn't  
24 carry that forward and the same reason was the

1 reason for eliminating the plant debris was that  
2 it kind of waffled between the positive and the  
3 negative attribute.

4 Q. I'm going to move onto 46. Page 8  
5 of your pre-filed testimony states, quote, a  
6 combined fish metric was developed as part of the  
7 CAWS habitat study which served as a CAWS specific  
8 index of biological integrity for fish.

9 A, isn't it correct that Page 1  
10 of Appendix A of the CAWS Habitat Evaluation  
11 Report states, quote, it was not the objective of  
12 the study to develop a CAWS specific index of  
13 biotic integrity?

14 A. It's true that we didn't set out to  
15 create a CAWS specific index of biotic integrity.  
16 When I said that the combined fish metric served  
17 as a CAWS specific index of biological integrity  
18 for fish in our study what I meant was it served  
19 the role of an IBI by providing a single dependant  
20 variable for fish for use in the multiple  
21 regression of habitat.

22 Q. It served the role of an IBI for the  
23 multiple regression purposes?

24 A. Yes.

1 Q. Was the goal of the site to pick a  
2 subset of fish variables for use in comparing the  
3 habitat setup? Did you just say yes to that?

4 A. No.

5 Q. Okay.

6 A. I didn't say anything to that one.

7 Q. Okay.

8 A. It wasn't an original goal of the  
9 study to pick a subset of fish variables for use  
10 in comparing the habitat data, but when we started  
11 designing our study approach we determined the  
12 need for a single dependant variable to represent  
13 fish in the multiple regression and that's what it  
14 came from, the need to have a single variable.

15 Q. Why did you need just one?

16 A. Because when you do a multiple  
17 regression, you have multiple independent  
18 variables which in our study were habitat  
19 variables and you have a single dependant variable  
20 which is fish.

21 Q. So there weren't other techniques  
22 visible that you could have compared multiple  
23 metrics on both?

24 A. There were, but we had chosen the

1 multiple regression approach that we ultimately  
2 used.

3 Q. How many fish metrics were included  
4 in the combined fish metric?

5 A. The combined fish metric included  
6 ten metrics.

7 Q. How were they scored to determine  
8 the combined metric?

9 A. We have an example that we can share  
10 with you.

11 MR. ANDES: We're looking for it.  
12 Okay. We had prepared a table to give you an  
13 example. We can't seem to find it in the stack we  
14 brought. So --

15 BY MS. WILLIAMS:

16 Q. Why don't we move on. I'd be happy  
17 with coming back if you find it.

18 MR. ANDES: We can certainly provide  
19 it.

20 MS. WILLIAMS: You can explain,  
21 right?

22 MR. ANDES: Yes, we can explain.

23 BY THE WITNESS:

24 A. I can explain it, but I think seeing

1 an example would be much -- it would be more  
2 productive to show you the example, but I don't  
3 know.

4 MS. WILLIAMS: What do you want to  
5 do, Fred?

6 MR. ANDES: Do you want to ask the  
7 question again?

8 BY MS. WILLIAMS:

9 Q. How were they scored, naming the  
10 fish metrics, scored to determine the combined  
11 fish metric? A description of your methodology, I  
12 think, would suffice.

13 A. The raw scores were transformed.  
14 The raw scores for each of the metrics represented  
15 numbers that fell on different scales. So some  
16 were decimals, some were on a scale of zero to one  
17 hundred percentages. So we couldn't just add them  
18 up. So we transformed them and that has to do  
19 with some statistical transformations which are in  
20 the table that we had an example of, but basically  
21 the transformation takes all those numbers and  
22 without losing their position in their original  
23 scale puts them on a scale which makes them all  
24 comparable.



1                   So they were all transformed to  
2   a decimal scale of zero to one -- I take that  
3   back. It wasn't zero to one, but on a comparable  
4   scale that we could then -- so that we could then  
5   add them up. They weren't weighted individually,  
6   which is a difference between what we did and what  
7   a real index would do because they weren't  
8   intended to be measures of absolute quality. They  
9   were supposed to be relative measures of fish  
10  quality. So, generally, that was the approach.

11           Q.       So explain -- normally, an IBI would  
12  weight them, correct?

13           A.       Yes.

14           Q.       Why?

15           A.       Because a true IBI is something that  
16  you can use to go out and say I have a fish sample  
17  and I can measure metrics and just looking at that  
18  sample with an IBI, an index of biotic integrity,  
19  I'll know something about that fish sample and  
20  when researchers develop IBI's they first create  
21  these metrics and then they compare them to some  
22  other factor such as human disturbance or levels  
23  of pollution or something in order to scale this  
24  system and they make judgments about good fish

1 samples and bad fish samples as a result. So with  
2 an IBI you can say this is good, that's bad.

3 Well, that wasn't really our  
4 goal. Our goal was just to take the available  
5 fish and create a gradient to which we could  
6 compare habitat. So our combined fish metric in  
7 and of itself doesn't tell you anything about a  
8 particular fish sample. It tells you if you have  
9 two fish samples and you apply the metric and you  
10 compare the numbers. It tells you relative  
11 goodness or badness, but it doesn't tell you  
12 whether both are good or both are bad. All it  
13 does is give you where they fall on sort of a  
14 scale and that's all we were trying to do. It  
15 isn't intended to replace an IBI.

16 Q. And it's not intended to reflect  
17 fish health?

18 A. No. It's intended to reflect  
19 relative fish health. As I said, we just wanted  
20 to create a gradient that reflected the conditions  
21 in the CAWS.

22 MR. ETTINGER: I have a question. I  
23 was a little confused. You said it's not  
24 weighted. I'm looking at this Table 6-2 with

1 selected fish metrics. Are these the -- those are  
2 the metrics we're talking about?

3 THE WITNESS: Just a second.

4 MR. ETTINGER: It's on Page 107.

5 THE WITNESS: 107?

6 MR. ETTINGER: All right. You came  
7 out with a combined figure that somehow took  
8 account of all of these factors at once and gave  
9 you a number, a single number?

10 THE WITNESS: Yes.

11 MR. ETTINGER: Okay. How did you go  
12 about figuring out one sites got a lousy  
13 lithophilic spawners by count and another one has  
14 a lousy Illinois ratio of generalist feeders? How  
15 do you decide which factor is more important so  
16 you can weigh it?

17 THE WITNESS: We didn't. I think I  
18 said we didn't weight them. We took them all as  
19 indicators of the quality of the fish community  
20 and scored them on an equivalent basis and summed  
21 them and the difference between what we did and  
22 what an index would do is an index would weight  
23 them and compare them so that you could look at a  
24 single number for a single sample and say that's a

1 good sample or that's a bad sample.

2 Q. I don't know, but I suspect that if  
3 we got a few biologists here they could probably  
4 argue about the relative importance of these  
5 various factors. You didn't make any -- you just  
6 sort of took a percentage basis or a range of  
7 the -- I'm not really clear. So you have a score  
8 of one to ten for each of these factors in some  
9 way?

10 THE WITNESS: We got a score for  
11 each of them.

12 MR. ETTINGER: You got a score for  
13 each of them?

14 THE WITNESS: For each sample.

15 MR. ETTINGER: You explicitly  
16 assumed that each of these factors were equally  
17 important, didn't you?

18 THE WITNESS: Yes, they were all  
19 given equal weight.

20 MR. ETTINGER: Okay. So, in fact,  
21 when you say you didn't weigh them, what you did  
22 actually was you basically assumed that they were  
23 all of equal importance when you came out with  
24 your formula?

1 THE WITNESS: Yes.

2 MR. ETTINGER: Okay. Thank you.

3 BY MS. WILLIAMS:

4 Q. Why didn't you use one of the  
5 existing available fish IBI's such as a Wisconsin  
6 or Ohio that had been developed for large rivers?  
7 It seems like it would have been a lot easier.

8 A. It would have been a lot easier.  
9 The reason we didn't do that is twofold. We  
10 didn't use the existing IBI's because, as I said,  
11 they were developed largely for natural systems  
12 and we wanted to make sure that the variable used  
13 in our analysis was reflective of fish condition  
14 in the CAWS and we also wanted to have a fish  
15 variable that exhibited as much variability across  
16 the system as we could. We saw calculations of  
17 IBI's that had been made using District data by  
18 the District and the numbers simply didn't reflect  
19 a lot of variation across the system.

20 So we felt that trying to find a  
21 measure that really drew out more of the  
22 variability would give us stronger statistical  
23 relationships.

24 MR. ANDES: Let me go back.

1 BY MS. WILLIAMS:

2 Q. Which one did you look at, which IBI  
3 did you look at?

4 A. We looked at results calculated by  
5 the District and it was the Wisconsin IBI, I  
6 believe it was the Ohio Boatable IBI and I don't  
7 think they used the draft Illinois IBI, but I  
8 think -- again, I'm going by memory, but I believe  
9 it was the -- it may have been Carr's original  
10 IBI.

11 MR. ANDES: Let me go back for a  
12 second. In terms of -- in terms of these  
13 variables, these ten variables that were all  
14 folded into the equation and you said you didn't  
15 assign dominance with any of them. Can you go  
16 back a second and explain why these were the ones  
17 you decided to use in this analysis? Why these  
18 were the ones you felt were significant?

19 THE WITNESS: The process we used to  
20 select the fish metric that we ultimately relied  
21 on was -- is explained in Appendix A of the  
22 Habitat Evaluation Report and it is a process that  
23 is typically followed to reduce data to extract  
24 the most variable metrics and so what we were

1 looking for was metrics that were representative  
2 of different aspects of fish condition and I think  
3 I mentioned things like reproductive function and  
4 trophic function and species richness. There are  
5 others and we wanted to make sure we represented  
6 those different aspects of the fisheries and we  
7 also wanted to make sure the metrics that we chose  
8 were exhibiting variation in the system.

9                   So the process and I suppose I  
10 could walk through it in more detail by referring  
11 to the appendix, but it was a very methodical  
12 process and one that is mirrored, I think, in some  
13 well-cited documents in the scientific literature.  
14 So, for example, the question was asked about  
15 other IBI's, but the development of the Wisconsin  
16 IBI relied on some of the same steps we used to  
17 whittle down our list of metrics.

18                   So we didn't arbitrarily select  
19 them. It was a fairly methodical process.

20 BY MS. WILLIAMS:

21                   Q.       Question 47, Page 107 of the CAWS  
22 Habitat Evaluation Report mentions two fish  
23 variables that, quote, had relatively weak  
24 correlation with habitat.

1                   A, doesn't this result indicate  
2                   that the correlation between individual fish  
3                   variables and individual habitat variables was  
4                   examined and, B, if so, why weren't these  
5                   correlations provided in the Habitat Evaluation  
6                   Report?

7                   A.        The first question we didn't look at  
8                   specific -- at individual correlations between  
9                   habitat and these fish metrics.  What we did was  
10                  we grouped the metrics by functional categories  
11                  such as reproductive function and we looked at the  
12                  relationship of those groupings of fish metrics to  
13                  the habitat variables overall.

14                  Again, trying to extract the  
15                  metrics that had the most variation in the system.  
16                  We didn't include them in the report because they  
17                  were an intermediate evaluation and there weren't  
18                  actually a lot of things calculated that aren't in  
19                  the report.  There just wasn't room to put  
20                  everything in.  We didn't think they were central  
21                  to the findings, but they could be provided.

22                  Q.        Forty-eight.  Since the multiple  
23                  fish variables available for each fish sample were  
24                  reduced to a single number, wouldn't it have been



1 more consistent to reduce the multiple habitat  
2 variables into a single habitat number such as a  
3 combined habitat metric?

4 A. That's what we did in the study by  
5 developing the habitat index was reducing those  
6 variables into a single number.

7 Q. By the r squared value is that what  
8 you're saying, the habitat metric?

9 A. The question was --

10 Q. So you have a habitat value for each  
11 site somewhere in the report?

12 A. The way I understood the question  
13 was why didn't we develop a single metric or a  
14 single measure of habitat quality and that's  
15 ultimately what we did. I didn't read it as  
16 meaning did we calculate that for each specific  
17 station. I think we did do that.

18 Q. Okay.

19 A. We did it on a reach basis, which is  
20 in the report. No, we didn't do it on a station  
21 by station basis, but I can find one.

22 MR. ANDES: Let me ask a question to  
23 clarify because I think we're talking about two  
24 different things here. Can you clarify what your

1 analysis would have been on each sample versus on  
2 a particular reach? This is talking -- this  
3 question is talking about your analysis you did on  
4 particular samples in comparing fish and habitat  
5 information on a particular sample? Perhaps you  
6 can clarify how the analysis was performed.

7 THE WITNESS: I guess I'm confused  
8 by that even more. We didn't -- rereading the  
9 question to try to clarify my question. So we did  
10 calculate, we did create this habitat index and we  
11 did use it to score stations. The report on Page  
12 132 does list the scores for each of the variables  
13 that would go into that, but we don't present the  
14 scoring by station. We didn't base any findings  
15 on that. I think we did it just as an example.

16 BY MS. WILLIAMS:

17 Q. Would the statistic have been a lot  
18 simpler if you had one habitat value correlating  
19 against one combined fish value?

20 A. Well, the math would have been  
21 simpler, but I don't know how you would get there  
22 and I don't know that you would have learned as  
23 much or been able to understand as much about how  
24 fish were varying.

1 Q. About what?

2 A. About how fish vary in the system.

3 I'm just not sure I understand how that would have  
4 worked.

5 MR. ETTINGER: You didn't go into  
6 this study with a presumption of how the various  
7 habitat values would be reflected in the fish, is  
8 that correct?

9 THE WITNESS: No, that's correct.

10 MR. ETTINGER: You let the  
11 statistics tell you how to weigh the various  
12 variables?

13 THE WITNESS: That's correct.

14 MR. ETTINGER: But that's what you  
15 didn't do as to the fish variables there, you  
16 assumed that the variables that you had should be  
17 equally weighed?

18 THE WITNESS: That's right or not  
19 weighed at all.

20 MR. ETTINGER: Thank you.

21 THE WITNESS: Treated uniformly.

22 MR. ANDES: Is that -- can you  
23 explain how that helped you in terms of looking at  
24 variability? You weren't looking at an absolute

1 sense of fish health, you were looking at  
2 variability?

3 THE WITNESS: Right. The objective  
4 of what we were doing wasn't to try to determine  
5 how healthy fish were or weren't in the system.  
6 The objective was to try to figure out what  
7 factors in their environment are most affecting  
8 how they vary. So we wanted to capture the  
9 variability, but not necessarily try to discern  
10 qualities of good or bad fish.

11 BY MS. WILLIAMS:

12 Q. Question 49, I'm not sure if this is  
13 going to tie back to our missing exhibit, but  
14 we'll find out. It is not clear from the CAWS  
15 Habitat Evaluation Report how the single value of  
16 combined fish metric was derived for each of the  
17 81 fish samples used in the regression analysis.  
18 Page 106 of the CAWS Habitat Evaluation Report  
19 indicates that prior to regression with habitat  
20 variables the already reduced subset of 12 fish  
21 variables were subdivided into five categories.  
22 Each fish variable was standardized and then the  
23 variables in each of the five categories were  
24 summed and A asks for each fish sample how were

1 the raw values for each of the fish variables  
2 standardized? What are these values and what do  
3 they represent about the fish variable?

4 A. I can answer in words. It would  
5 have been perhaps better with the example, but the  
6 standardization -- again, what we did was we  
7 simply took the values, subtracted the mean and  
8 divided by the standard deviation. Simple  
9 standardization approach. What this does is it  
10 allows you to represent all of the variables on  
11 approximately the same range of values and the --  
12 there's a second part to that question. The  
13 standardized values I don't have, but we can  
14 provide them and they don't really say much in and  
15 of themselves. If you want to compare one example  
16 to another, it would give you some information  
17 about how two samples compare or three samples  
18 compare, but in isolation they don't have a lot of  
19 meaning.

20 Q. Would you agree that the method used  
21 to standardize these values was different than you  
22 would go about standardizing IBI values?

23 A. I don't know.

24 MR. RAO: Would it be possible for

1 you to submit your illustration or example at the  
2 next hearing?

3 THE WITNESS: Sure. Absolutely.

4 BY MS. WILLIAMS:

5 Q. B, after the raw values were changed  
6 into a standardized value, is it correct that the  
7 subsets of the standardized values were summed and  
8 each subset represented one of the five created  
9 categories of fish variables? This is 49(b).

10 A. All of the metrics were summed to  
11 create the combined fish metric.

12 Q. All of how many?

13 A. Ten.

14 Q. All ten?

15 A. Were summed to give us the combined  
16 fish metric.

17 Q. Didn't you start with 12 or  
18 something?

19 A. We started with 12, but two we found  
20 as we talked about a moment ago when we compared  
21 classes to -- I think I see what you're getting  
22 at. We did at that point sum them by category in  
23 order to compare the habitat data, but -- that's  
24 whether we eliminated the two for abundance of

1 condition. So there were two metrics that we  
2 eliminated because they were just the same  
3 everywhere. They were fairly uniform.

4 Q. And they were --

5 A. I'll look them up so I don't  
6 misspeak. The two metrics that we didn't include  
7 in the combined fish metric were catch per unit  
8 effort and percent diseased or with eroded fins,  
9 lesions or tumors.

10 Q. And then did that result in you  
11 eliminating one of the categories of variables?

12 A. Yes.

13 Q. Question 50, what does the single  
14 combined fish metric of all fish variables  
15 indicate about each fish sample?

16 A. As I said before, the combined fish  
17 metric doesn't necessarily say anything about a  
18 single sample. What it does is provide a uniform  
19 way to compare fish samples relatively across the  
20 system.

21 Q. When you compare them, what is the  
22 difference?

23 A. A higher number means better fish  
24 condition and a lower number means poorer fish

1 condition.

2 Q. So it does reflect fish condition  
3 you think?

4 A. Relative fish condition, yes.

5 Q. How large of a difference in a  
6 combined fish metric constitutes a significant  
7 difference? This is 50(c). I'm sorry.

8 A. Okay. The significance and the  
9 differences in the combined fish metric are really  
10 reflected in the regression with the habitat and  
11 in multiple regression we look at the independent  
12 variable significance, not necessarily changes in  
13 the dependant variable.

14 So what we used to measure the  
15 statistical significance of the independent  
16 variables, which would be the habitat variables in  
17 the case, the P value, and those were all less  
18 than 0.1, which is 90 percent confidence level  
19 with the exception of perhaps one, but we didn't  
20 try to determine the statistical significance of  
21 any level of difference between combined fish  
22 metric measures.

23 Q. Okay.

24 MR. ANDES: Are you saying that



1 various habitat variables indicate a statistical  
2 significance?

3 THE WITNESS: The response of those  
4 habitat variables to the combined fish metric is  
5 an indirect measure of how significant the  
6 differences in the combined fish metric are. So,  
7 in that sense, yes.

8 BY MS. WILLIAMS:

9 Q. Were there any procedures used to  
10 standardize raw values for fish samples with fewer  
11 than 50 individuals?

12 A. Can you tell me what you mean by  
13 standardize?

14 Q. To look at them differently.

15 A. No, we didn't do any procedures to  
16 look at samples with fewer than 50 or 200.

17 Q. Would you agree that IBI's often do  
18 that -- often don't consider fish samples with  
19 fewer than 50 individuals?

20 A. They can, but in this case we felt  
21 that just the act of not finding a lot of fish was  
22 an important piece of information that we wanted  
23 to carry forward. Again, we weren't trying to  
24 determine anything about absolute quality of the

1 fish samples. We were trying to determine how  
2 fish vary and make sure we were describing that  
3 range of variability to the best we could.

4 MR. ETTINGER: I thought you said  
5 the catch per effort was one of the factors you  
6 wound up tossing out?

7 THE WITNESS: It was a metric we  
8 didn't include.

9 MR. ETTINGER: I was confused. I  
10 thought you just said the number of fish was an  
11 important metric and that you said -- you tossed  
12 it out.

13 THE WITNESS: Let me clarify. What  
14 the question had to do was if a sample originally  
15 as collected had a certain -- had a relatively few  
16 number of individuals, I understood the question  
17 to mean did we do anything to treat that sample  
18 differently or to, perhaps, screen it out and my  
19 answer was, no, we didn't. We kept the sample in.  
20 Now, the measure catch per unit effort would be a  
21 measure of that sample, but we didn't use that  
22 metric.

23 BY MS. WILLIAMS:

24 Q. Can you explain for us do you

1 understand why Ohio throws out samples with less  
2 than 50 individuals?

3 A. I don't recall what the rationale  
4 is.

5 Q. So just generally you don't  
6 necessarily understand the reasoning behind not  
7 relying on samples with a small number of  
8 individuals?

9 A. I'm saying off the top of my head I  
10 don't know what the reasoning is. So I can't tell  
11 you if I agree or not.

12 Q. That's fine.

13 MR. ETTINGER: What would ordinarily  
14 the reasoning be in your experience in terms of  
15 tossing out small datasets?

16 THE WITNESS: In general, small  
17 datasets are considered to be unrepresentative.  
18 So, in general, that's the reason one would  
19 exclude those.

20 BY MS. WILLIAMS:

21 Q. Did the CAWS Habitat Evaluation  
22 Report provide categorization for each CAWS fish  
23 species?

24 A. Yes. In Attachment B of Appendix A

1 of the Habitat Evaluation Report, we give  
2 tolerance assignments which is part of what you're  
3 asking.

4 Q. Right.

5 A. The assignment of species to the  
6 other metrics was not included in the report, but  
7 we brought a table. I hope we can find -- it was  
8 kind of the other table.

9 MR. ANDES: We will provide it.

10 MS. WILLIAMS: You mean later or  
11 today?

12 MR. ANDES: I don't think we can do  
13 it today. We're not going to be finishing  
14 Mr. Bell's testimony today probably anyway so we  
15 will be prepared to provide that at the next  
16 hearing.

17 MS. WILLIAMS: Okay.

18 MR. ANDES: We can even submit it  
19 for the record before then.

20 MS. WILLIAMS: That would be my  
21 preference.

22 MR. ANDES: Fine.

23 BY MS. WILLIAMS:

24 Q. H, for deriving each of the fish

1 variables that represent a percentage, the  
2 appropriate value for the denominator of the  
3 fraction must be used. How is the denominator  
4 determined for these variables in the CAWS Habitat  
5 Evaluation Report?

6 A. Where percentages were calculated  
7 the percent was derived by a denominator equal to  
8 the total number of individuals in the sample.

9 Q. Did you include hybrid individuals  
10 or nonnative individuals in the denominator?

11 A. I don't recall specifically, but  
12 I --

13 Q. Question --

14 MR. ANDES: Wait.

15 BY THE WITNESS:

16 A. That wasn't one of your pre-filed,  
17 was it?

18 BY MS. WILLIAMS:

19 Q. Yes -- no. Maybe it was a follow  
20 up. I just asked how it was determined. I didn't  
21 ask the second part.

22 A. I'm sorry. There's some things --  
23 it's been like two and a half years since we did  
24 this and I don't remember all of it.

1 Q. That's okay. Question 51.

2 MS. TIPSORD: You know what, I was  
3 going --

4 MR. ANDES: We can check on that  
5 issue and get back to you.

6 MS. TIPSORD: Okay. Let's take a  
7 ten minute break.

8 (Whereupon, a break was taken  
9 after which the following  
10 proceedings were had.)

11 MS. TIPSORD: Mr. Andes has an  
12 exhibit that Mr. Bell is going to explain to us  
13 the exhibit. It is Exhibit 451. Seeing no  
14 objection to admitting it, we'll admit it as  
15 Exhibit 451.

16 (Document marked as IEPA Exhibit  
17 No. 451 for identification.)

18 MS. TIPSORD: It is a table with  
19 variable positive or negative contribution to CFM,  
20 score at Touhy Avenue station on 9/29/2004 and  
21 several other columns and, Mr. Bell, if you'd like  
22 to explain to us what these mean.

23 THE WITNESS: Thank you. A short  
24 while ago some questions arose about how we

1 calculated our combined fish metric and we  
2 compared this example to illustrate how we did  
3 that. On the left-hand side of this table, the  
4 first column is headed by the word variable and  
5 beneath that are the ten metrics that we included  
6 in our combined fish metric. Each of these is  
7 measuring an aspect of fish sample.

8                   The second column has a positive  
9 or negative sign and those are intended to  
10 indicate whether those are positive or negative  
11 attributes for fish. The third column is the  
12 actual score and this example is from the Touhy  
13 Avenue station on September 29th, 2004. So these  
14 are the actual scores that were assigned at that  
15 station on that date for the fish sample in  
16 question.

17                   The next column has some -- has  
18 the word none or some mathematical expressions.  
19 The raw scores assigned to each of the metrics in  
20 some cases, in eight out of ten cases, were  
21 transformed to approximate a normal distribution  
22 before use in the regression. This is a standard  
23 step in processing data. So then the next column  
24 has the transformed score following the

1 transformation in the preceding column.

2 The sixth column is headed mean  
3 at all stations and this is a mean value recorded  
4 at all stations for the data and the next column  
5 is a standard deviation at all stations for each  
6 metric.

7 The standardization that we  
8 performed was to subtract the mean from the  
9 transformed score and divide by the standard  
10 deviation and that yields the value in the last  
11 column and the values in the last column are then  
12 all on a comparable scale, if you will.

13 These are the numbers that we  
14 added to calculate a combined fish metric at each  
15 station and at the bottom lower right corner of  
16 the table you see the value of 3.04, which would  
17 be the combined fish metric for this sample of  
18 fish.

19 MS. TIPSORD: At that station?

20 THE WITNESS: At that station on the  
21 date shown.

22 MR. ETTINGER: This is a relatively  
23 good station in terms of good score, right?

24 THE WITNESS: Actually, it is. I



1 believe because the scale ultimately was  
2 approximately on a negative/positive ten scale.  
3 So this is on -- it was on the plus side.

4 MR. ETTINGER: One that was exactly  
5 average would have a CFM of zero?

6 THE WITNESS: I didn't calculate the  
7 average so I can't say.

8 MR. ETTINGER: I can just look at  
9 these numbers --

10 THE WITNESS: It would have been a  
11 median I think might be a better way to say it.

12 MR. ETTINGER: Median. I'm just  
13 eyeballing the numbers and, for example,  
14 proportion of Illinois tolerant species which is a  
15 negative feature is lower than the mean at all  
16 stations so that weighs in its favor and the  
17 Illinois ratio of non-tolerant species is three  
18 times the mean in all stations so that would also  
19 be in our favor.

20 THE WITNESS: Yes.

21 MR. ETTINGER: It would be a higher  
22 score and I'm just trying -- so what would be the  
23 CFM of something that was exactly the mean for all  
24 of these factors?

1 THE WITNESS: I didn't calculate  
2 that. I don't know.

3 MR. ETTINGER: It's a math question  
4 if it is at all. If I had a station that was  
5 exactly at the mean on all of -- for all of these  
6 factors, what would I come up with as a CFM score?

7 THE WITNESS: I see. You would come  
8 up with a zero.

9 MR. ETTINGER: Thank you. That's  
10 what I was trying to get at. So since this is  
11 better than zero, it's better than average station  
12 in terms of fish control?

13 THE WITNESS: You could say that.

14 BY MS. WILLIAMS:

15 Q. So looking at the right-hand column  
16 the values range from negative 0.055, I think  
17 below, to 1.173, does that seem like a large range  
18 to you? Would you expect a typical IBI to allow  
19 for such a large range?

20 A. In order to say whether that's a  
21 large range or not for the data, I would have to  
22 compare it to all the ranges for all the data and  
23 I haven't done that. So I can't say if the range  
24 for this particular sample is large compared to

1 our dataset.

2 Q. Why don't I ask 52 --

3 MS. TIPSORD: Wait. Actually, Fred  
4 had a couple more things to say first.

5 MR. ANDES: The second table that we  
6 found was an answer when Mr. Bell was talking  
7 about various fish and how they contributed to the  
8 various fish metrics. So we have a table which  
9 lists fish and various metrics which he can  
10 explain.

11 MS. TIPSORD: I've been handed a  
12 table with -- actually, in the upper right-hand  
13 corner a 33 on it. Common name and under that in  
14 column one is a list of types of fish. If there's  
15 no objection, we will admit this as Exhibit 452.  
16 Seeing none, it's Exhibit 452.

17 (Document marked as IEPA Exhibit  
18 No. 452 for identification.)

19 MS. WILLIAMS: Can we just clarify  
20 which question were we referring to when we wanted  
21 to enter this, do you recall? Even which topic --

22 THE WITNESS: Give me a moment.

23 MR. ANDES: Yes. That was in 50(g).

24 THE WITNESS: You're right.

1 MR. ANDES: It was in response to  
2 50(g).

3 THE WITNESS: So the question 50(g)  
4 said did the CAWS Habitat Evaluation Report  
5 provide categorizations for each CAWS fish species  
6 and the answer is it did not, but that's the table  
7 that we've provided you. There are fish metrics  
8 across the top of the table and species on the  
9 left-hand side and this was the -- this represents  
10 the assignments for each of the species we  
11 encountered for the metrics.

12 Q. Can you tell us where in the report  
13 is the code for the metrics at the top?

14 A. Yes, just a moment. So I'm looking  
15 at Appendix A of the Habitat Evaluation Report  
16 which is entitled Review and Selection of Fish  
17 Metrics and on Page 21 is a list -- a table, Table  
18 3-1, which provides a list of fish metrics with  
19 the abbreviations we used and their full names.

20 MR. ETTINGER: Were you going to ask  
21 questions about this, Fred?

22 MR. ANDES: Go ahead. We just  
23 wanted to provide that information that was asked  
24 for so if there are any questions about it --

1 MR. ETTINGER: Okay. How exactly  
2 did you use this or how generally did you use  
3 this?

4 THE WITNESS: We use this to score  
5 individual metrics for each sample. So when the  
6 fish sample is collected, the species are counted  
7 and those values are used to calculate the metrics  
8 at the top of the table.

9 MR. ETTINGER: On some of these --

10 BY MS. WILLIAMS:

11 Q. Why isn't every fish checked under  
12 CPUE? Does that mean catch per unit effort?

13 A. It does mean catch per unit effort  
14 and I don't know why every sample isn't checked.  
15 It could be because -- I don't know.

16 Q. Wouldn't you think that every fish  
17 could go into that metric?

18 A. I would, but I don't know why that's  
19 not checked.

20 MR. ETTINGER: Okay. So, basically,  
21 these are all the fish you looked at and you  
22 looked at all of them for all of these things that  
23 are at the top?

24 THE WITNESS: Yes.

1 MR. ETTINGER: Now, how did you deal  
2 with alewife, chinook salmon, coho, Nile tilapia,  
3 were they all treated like any other fish in the  
4 system?

5 THE WITNESS: Yes.

6 MR. ETTINGER: You'd agree that  
7 those are not fish you would expect in the system?

8 THE WITNESS: They're uncommon.

9 MR. ETTINGER: Okay. But they get  
10 counted like everything else?

11 THE WITNESS: Yes.

12 MR. ETTINGER: I may have some more  
13 questions about that later.

14 BY MS. WILLIAMS:

15 Q. I'm just going to ask one question  
16 to make sure there's maybe not a problem with the  
17 table similar to my last question about catch per  
18 unit efforts. If you look at -- if you look at  
19 black bullhead and you look at the fourth metric,  
20 I think, TC, is that top carnivore?

21 A. Yes.

22 Q. Is that correct, black bullhead is  
23 the top carnivore?

24 A. It is correct, but I would have --

1 Q. What about creeked hub, that's also  
2 checked?

3 A. I'm relying on -- I didn't make  
4 these designations personally so I would have to  
5 confirm them with my staff.

6 MR. ETTINGER: Yellow perch.

7 MR. ANDES: What about the yellow  
8 perch, Albert?

9 BY MS. WILLIAMS:

10 Q. You might want to check to see if  
11 there's errors --

12 A. I will definitely check that.

13 MR. ETTINGER: We'll ask about these  
14 Great Lakes species that we found in the Chicago  
15 River later at the appropriate time to get through  
16 Ms. Williams' questions.

17 BY MS. WILLIAMS:

18 Q. Question --

19 MS. TIPSORD: Sorry. There's one  
20 more.

21 MR. ANDES: There was a question  
22 raised earlier by Mr. Harley about dissolved  
23 oxygen related parameters that were considered in  
24 the process of developing the metrics. So I want

1 to ask Mr. Bell to read particularly from Page 11  
2 of Appendix C.

3 THE WITNESS: Appendix C of the  
4 Habitat Evaluation Report.

5 MR. ANDES: Page 11 and then there's  
6 information provided there and then he has some  
7 additional information to provide as to the  
8 details on these dissolved oxygen metrics.

9 THE WITNESS: So earlier there were  
10 a couple of questions about which other metrics  
11 were dissolved oxygen that we evaluated. In our  
12 report, we only provided a few. We provided  
13 regressions of fish versus dissolved oxygen for  
14 percent of time dissolved oxygen was less than  
15 five mg's/L June through September and for 48 hour  
16 average antecedent dissolved oxygen and 48 hour  
17 antecedent minimum dissolved oxygen, but I  
18 commented on the time that we had considered a  
19 number of other metrics for dissolved oxygen as  
20 well. It's just that these were the most strongly  
21 correlated with the fish samples.

22 So what the report says is a  
23 wide range of representations of the dissolved  
24 oxygen concentrations were examined, results were



1 presented here for the representation to show the  
2 strongest correlations which consisted of the  
3 three that I just named.

4 While we were at lunch, I called  
5 my office and asked someone to send me a list of  
6 the other ones so I could provide that and I'd  
7 just like -- I have an e-mail on my phone that I'd  
8 like to read if I could and then I presume we can  
9 provide these --

10 MR. ANDES: In writing.

11 THE WITNESS: -- in writing. So the  
12 complete list, if I may, is percent compliant --  
13 I'm sorry. Let me make sure I'm reading the right  
14 part. 24 hour antecedent average dissolved  
15 oxygen.

16 MR. ETTINGER: Antecedent is a long  
17 word for before?

18 THE WITNESS: Yes. It means the  
19 period immediately preceding the fish sample. So  
20 when we say antecedent, we mean the period before  
21 the 24 hour, 48 hour leading up to the fish  
22 sampling event. So 24 hour antecedent average DO,  
23 48 hour antecedent average DO, which we included  
24 in the report, 24 hour antecedent minimum DO, 48

1 hour minimum antecedent DO, percent of time June  
2 through September when DO was less than five  
3 mg's/L, which is in the report, percent of time  
4 June through September when DO is less than six  
5 mg's/L, percent of time April through July when DO  
6 is less than five mg's/L. I believe there was a  
7 question of springtime. So we did look at that  
8 period of April through July which is late spring,  
9 early summer, percent of time April through July  
10 when DO is less than six mg's/L, percent of time  
11 March though July when DO is less than five  
12 mg's/L, percent of time March through July when DO  
13 is less than six mg's/L, percent of time August  
14 through February when DO is less than five mg's/L,  
15 percent of time August through February when DO is  
16 less than six mg's/L, percent of year when DO is  
17 less than five mg's/L and percent of year when DO  
18 is less than six mg's/L.

19                   And the reason we looked at  
20 various permutations like this is we wanted to  
21 determine which representation was showing the  
22 most correlation with the fish data and the three  
23 that we determined to have the most correlation  
24 with fish data were included in the report, but we

1 could provide results for the others if required.

2 MS. TIPSORD: I think we're ready  
3 then to move on, Mr. Andes.

4 MR. ANDES: Yes.

5 MS. TIPSORD: Go ahead, Ms.  
6 Williams.

7 BY MS. WILLIAMS:

8 Q. Question 51, Attachment B to  
9 Appendix A of the CAWS Habitat Evaluation Report  
10 provides tolerant ratings for CAWS fish species.  
11 Several of the fish variables used in the study  
12 rely -- depend, I should say, on these tolerance  
13 ratings.

14 A, is it correct that nearly  
15 half of the fish species tolerance assignments  
16 used for the study are based on the reference  
17 entitled USGS 2008?

18 A. Yes, that's correct.

19 Q. Do you agree that USGS 2008 does not  
20 provide general tolerance rankings -- general  
21 tolerance ratings as are required for valid  
22 derivation and standardization of the fish metrics  
23 that constitute Wisconsin, Ohio and Illinois fish  
24 IBI's?

1           A.       I'm not sure I would agree with that  
2           statement, but our approach first went -- to  
3           determine tolerance ratings, our approach first  
4           went to the Illinois IBI and the Wisconsin IBI and  
5           I want to make sure I clarify that we only refer  
6           to the USGS reference in question when we couldn't  
7           determine from either of those IBI's what the  
8           tolerance designation ought to be for species in  
9           question.

10          Q.       Are you sure?

11          A.       I beg your pardon?

12          Q.       I said are you sure.

13          A.       About what?

14          Q.       That you relied on the tolerance  
15          rankings from Wisconsin and Ohio when they were  
16          available?

17          A.       Wisconsin and Illinois.

18          Q.       Illinois. I'm sorry.

19                   MR. ANDES: And Ohio.

20          BY THE WITNESS:

21          A.       We didn't. I can't remember if we  
22          consulted Ohio, but when my staff -- and, again, I  
23          did not personally do this, but my staff when they  
24          compiled the tolerance ratings used in their

1 study, it is my understanding they first went to  
2 the Illinois IBI -- the draft Illinois IBI and  
3 made assignments where assignments were available  
4 in that and where we had species that weren't  
5 addressed in that IBI, we then went to the  
6 Wisconsin IBI.

7 BY MS. WILLIAMS:

8 Q. Are you aware that Wisconsin and  
9 Illinois species that are not rated as tolerant,  
10 are intolerant, are considered intermediate  
11 tolerance? Did you look at intermediate  
12 tolerance?

13 A. I would have to -- I don't recall  
14 all the designations. I would have to refer to  
15 the protocol and again --

16 Q. Let's look at D. Do you agree that  
17 the following fish species rated as tolerant for  
18 the CAWS study are consistently rated of  
19 intermediate tolerance for Wisconsin, Ohio and  
20 Illinois IBI's; large mouth bass, black crappie,  
21 white crappie, white bass, channel cat fish,  
22 emerald shiner and black stripe cat minnow?

23 A. My understanding is that those  
24 species are listed as intermediately tolerant in

1 the Ohio IBI. My understanding is further that  
2 the draft Illinois IBI doesn't list these fish as  
3 tolerant or intolerant and that the Wisconsin IBI  
4 lists them as other except the black stripe top  
5 minnow, which doesn't have a rating.

6 Q. Do you agree -- I'm going to go back  
7 to C and skip it for logic reasons. Do you agree  
8 the tolerance classifications provided by USGS  
9 2008 are determined largely by tolerance to only  
10 four parameters; suspended sediment, specific  
11 conductance, chloride and total phosphorous?

12 A. It is my understanding that the  
13 authors of that study relied primarily on those  
14 four parameters. They did consider dissolved  
15 oxygen temperature and pH, but the strongest  
16 relationships in their study were for the four  
17 parameters named.

18 Q. But you didn't think that including  
19 suspended sediment, conductance, chloride, total  
20 phosphorus in your analysis was necessarily  
21 appropriate?

22 A. No.

23 Q. Question E. Doesn't using tolerance  
24 ratings other than those from the IBI's that the

1 borrowed fish metrics are obtained from raise  
2 concerns about the validity of the fish variables  
3 used to derive the final combined fish metric for  
4 each sample?

5 A. I would disagree to the extent that  
6 we borrowed, quote, unquote, fish metrics from  
7 those IBI's. We used tolerance ratings and those  
8 IBI's as the first choice and we only turn to  
9 other resources such as USGS when we couldn't  
10 discern a definitive rating from the Illinois or  
11 Wisconsin IBI's.

12 Q. So if you made a mistake in  
13 interpreting the Illinois and Wisconsin IBI and  
14 there was something available on tolerance, would  
15 it be have more appropriate to go back and would  
16 you have chosen then to -- would you choose then  
17 if you were -- I'm sorry -- to realign those  
18 species based on the state that you pulled the  
19 metric from? Do you understand what I'm saying?

20 MR. ANDES: I'm going to object to  
21 the question.

22 BY MS. WILLIAMS:

23 Q. Let me try again. Strike that,  
24 please. If you found out that you made a mistake

1 and there were tolerance ratings available where  
2 you thought there were not tolerance ratings  
3 available, you would have used those or you would  
4 use them doing it over again? That would have  
5 been the appropriate way to do it?

6 MR. ANDES: This is awfully  
7 hypothetical.

8 MS. WILLIAMS: I don't think it's  
9 hypothetical at all.

10 MR. ANDES: It's an if question. If  
11 there is information showing that there is  
12 something that is not correct then we should hear  
13 that, but the abstract question of if you were  
14 wrong would you change your conclusions I think is  
15 way more hypothetical.

16 MS. WILLIAMS: Not change your  
17 conclusions. Change your tolerance rankings.

18 MR. ANDES: It's the same thing.  
19 It's the same question.

20 BY MS. WILLIAMS:

21 Q. Would you change your tolerance  
22 rankings if they were wrong?

23 MR. ANDES: Again, I'll object. I  
24 think that's a really abstract hypothetical



1 question to answer. I guess you can answer it in  
2 the abstract.

3 MS. TIPSORD: I would say answer it  
4 in the abstract. I'm really lost on this line of  
5 questioning. I apologize.

6 MS. WILLIAMS: It's okay.

7 MS. TIPSORD: I'm not sure where  
8 you're going or what this -- I mean, he has  
9 testified what they use.

10 MS. WILLIAMS: He has testified that  
11 there are not tolerance rankings available and we  
12 believe they are available, he missed them and it  
13 was a mistake. So we would like to see if that  
14 was true, if we're right and there was a mistake  
15 and there were tolerant rankings available, would  
16 you have used them? Was it your intent to use  
17 them if they were available?

18 MR. ANDES: Let me ask you.

19 MS. WILLIAMS: I think he said yes.

20 MR. ANDES: The Agency had every  
21 opportunity to raise possible incorrect aspects in  
22 its questions.

23 MS. WILLIAMS: We just got this just  
24 now.

1 MR. ANDES: But you asked questions  
2 about use of the USGS numbers. If you thought  
3 that those were incorrect, you certainly could  
4 have raised questions about that and I don't have  
5 any --

6 MS. WILLIAMS: That's what I'm  
7 doing.

8 MS. TIPSORD: I'm sorry, Deb. I  
9 don't think you can ask him what he would have  
10 done if he thought he was wrong. I think you can  
11 provide evidence that he is incorrect, there were  
12 tolerance levels. What he stated is "When we did  
13 our study this is what we used."

14 MR. ANDES: And those are in the  
15 report.

16 BY MS. WILLIAMS:

17 Q. Did it say in the report that  
18 clearly if you couldn't find the tolerance  
19 rankings, that's when you turn to USGS?

20 A. So to answer your last question, we  
21 did state that preferential approach for tolerance  
22 ratings in our report. Would you like me to tell  
23 you where?

24 Q. The page will be fine.

1           A.       It's Page 22 of Appendix A of the  
2       Habitat Evaluation Report.

3           Q.       Thank you.

4           A.       And I'd also like to point out that  
5       the table attached to that Attachment B to  
6       Appendix A entitled List of Fish Species  
7       Identified in the CAWS and their tolerance  
8       assignments list the species and the tolerance  
9       assignments we used and provides references for  
10      those assignments. The references are listed in  
11      order in the first, which is reflected in the text  
12      that I just cited is IDNR 2000, which is the  
13      Illinois --

14      BY MS. WILLIAMS:

15           Q.       I think Fred is correct. This might  
16      be something we'll need to provide some more  
17      supplemental information on before we close  
18      Subdocket C.

19                   MR. ANDES: That's fine. I'd just  
20      like Mr. Bell to read one part on Page 22 which I  
21      think summarizes his report.

22                   THE WITNESS: So the section  
23      referred to says the approach for assigning CAWS  
24      species to pollution tolerance categories of

1 tolerant, intolerant and moderately tolerant  
2 attempted to rely on locally derived sources.  
3 Although no single source covered all the species  
4 found within the CAWS, the approach started with  
5 tolerant assignments established at the state  
6 level and we give an Illinois DNR reference, then  
7 for the Midwest and we give the reference to the  
8 Wisconsin IBI and then at the national level and  
9 we give the reference for USGS and only then  
10 followed by specific references where those three  
11 primary sources couldn't identify tolerant  
12 species.

13 Q. Okay. Fifty-two, is it correct that  
14 most of the 46 fish variables that were available  
15 from CAWS fish samples were eliminated from  
16 further consideration because they were  
17 statistically correlated with other fish variables  
18 and I refer to Page 26 of the Appendix A.

19 A. Twenty-four fish variables were  
20 eliminated because of correlation with other  
21 variables and I think this is a valid approach  
22 because validity in a regression model can lead  
23 to instability in the model as I discussed  
24 previously. In addition, it's a common screening

1 step used by other researchers.

2 Q. Why was the variable that represents  
3 the total number of native fish species in the  
4 sample eliminated?

5 A. The variable representing total  
6 number of native fish was eliminated because it  
7 was significantly correlated with a number of  
8 other metrics and I could list those, but in our  
9 dataset it was correlated with a long list of  
10 metrics.

11 Q. Isn't it unusual for a fish IBI to  
12 lack a metric that addresses total species  
13 richness?

14 A. The combined fish metric isn't  
15 intended to be a fish IBI.

16 Q. So -- and I would probably have  
17 worded this question differently after hearing  
18 everything this morning, but I guess my question  
19 I'm still getting at is it was correlated to other  
20 variables, but why did you pick this one? It's a  
21 pretty important one, isn't it? Species richness,  
22 I would have thought you maybe would have thrown  
23 out others that were correlated to it, but why  
24 would you throw out total species richness?

1 MR. ANDES: So is the question why  
2 was total species richness discarded?

3 MS. WILLIAMS: Uh-huh. He said it  
4 correlated to several other metrics. Couldn't it  
5 have represented those metrics instead?

6 THE WITNESS: I thought we were  
7 talking about total number of native fish species.

8 MS. WILLIAMS: No. We're on B.

9 THE WITNESS: I see.

10 BY MS. WILLIAMS:

11 Q. Is there a difference? Do you think  
12 there's a difference?

13 A. I don't know. I just wanted to  
14 clarify.

15 Q. You're right. I changed  
16 terminology, but I intended them to be the same.

17 A. I would say an IBI as it's intended  
18 to be used generally does have a reflection  
19 species richness, yes.

20 MR. ANDES: So let me be clear. So  
21 when you asked about total species richness, are  
22 you asking about the same variable you were asking  
23 about in A, which was the total number of native  
24 fish species?

1 MS. WILLIAMS: Yes, that's fine.

2 MR. ANDES: And, Mr. Bell, you  
3 believe, in essence, you address that issue  
4 because you had a significant correlation with  
5 other metrics?

6 THE WITNESS: Yes.

7 MR. ANDES: And can you list those  
8 metrics briefly that it's significantly correlated  
9 with?

10 THE WITNESS: Well, there's a long  
11 list. Not all of these metrics appeared in the  
12 final combined fish metric, but the list was of  
13 all the metrics that it was strongly correlated  
14 with was CPUE, which -- all I have in front of me  
15 is the abbreviations for these.

16 MR. ANDES: Read them off.

17 THE WITNESS: And I don't know all  
18 the definitions by heart so I'll give you the  
19 abbreviations and if we need to provide the  
20 definitions, I can do that.

21 MR. ETTINGER: I'm sorry. I kind of  
22 lost my place in the scorecard here. Where are  
23 the final -- where were the winners of the fish  
24 metrics? Are they listed somewhere in here?

1 MS. WILLIAMS: You can find them on  
2 Exhibit 451, right, is that one way to look at it?

3 THE WITNESS: Yeah.

4 MR. ETTINGER: The winning metrics  
5 were --

6 MR. ANDES: When we say winning, we  
7 are talking about the ones that were used for the  
8 combined fish metric.

9 MR. ETTINGER: Okay. That's the  
10 ones listed on 451?

11 THE WITNESS: Yes, this is 451.

12 MR. ANDES: Yes.

13 THE WITNESS: Yes.

14 MR. ETTINGER: Sorry. You were in  
15 the middle of an answer and I interrupted. I lost  
16 my place.

17 THE WITNESS: Total number of native  
18 fish was correlated with these metrics; CPUE,  
19 NFSH, NSUN, OH\_B\_SUN, RIV, SR, SUN 1, SUN 2, SUN  
20 3, TNI and TOL.

21 MR. ANDES: Is it fair to say it  
22 would have been redundant?

23 THE WITNESS: Well, including it,  
24 carrying it forward with other variables it was



1 correlated with would have been redundant, yes.

2 BY MS. WILLIAMS:

3 Q. Do we understand why it was that one  
4 that got thrown out instead of one of the others  
5 that was correlated to it?

6 A. I don't recall.

7 Q. Why are two of the final -- okay.

8 MR. ETTINGER: I got my winners here  
9 on 451. Isn't it almost by definition that the  
10 proportion of Illinois tolerant species negatively  
11 correlated with the percentage of intolerant  
12 species by count?

13 THE WITNESS: No. There were three  
14 tolerance ratings. So high tolerance doesn't  
15 necessarily mean low intolerance. Is that what  
16 you're asking?

17 MR. ETTINGER: Yes, that's what I  
18 was asking.

19 MS. WILLIAMS: I'm going to re-ask  
20 the question. Why are two of the final ten fish  
21 variables so similar; percent with lithophilic  
22 spawners by count, which is the first one on  
23 Exhibit 451 and Illinois ratio of non-tolerant  
24 coarse mineral substrate spawners, number five?

1 Why are those not redundant?

2 A. It's my understanding from my  
3 biologist that percent with lithophilic spawners  
4 by count includes all the lithophilic spawners and  
5 the Illinois ratio of non-tolerant coarse mineral  
6 substrate spawners includes only non-tolerant  
7 spawners in that category.

8 Q. One is total and one is  
9 non-tolerant?

10 A. Yes.

11 Q. Fifty-three.

12 MR. ANDES: Let me just clarify one  
13 thing here. Are the lithophilic spawners the same  
14 as the coarse mineral substrate spawners? Is the  
15 only difference here one is tolerant and --

16 THE WITNESS: I would have to  
17 consult with a biologist.

18 MR. ANDES: They're different  
19 categories, correct?

20 THE WITNESS: They're different  
21 categories.

22 BY MS. WILLIAMS:

23 Q. But they're pretty similar, correct?

24 A. I don't know off the top of my head.

1           Q.       Question 52. Is it correct that the  
2           statistical sample of 81 fish samples that was  
3           used to relate the combined fish metrics to the  
4           habitat variables was not the same statistical  
5           sample of fish samples that was used to correlate  
6           the combined fish metric with dissolved oxygen?

7           A.       It is correct that the number of  
8           pairs used to compare habitat with fish was 81  
9           data pairs and the number of pairs used to compare  
10          dissolved oxygen with fish was 67. So 67 was a  
11          subset of the 81 and this was because when we  
12          trying to pair fish samples with CDOM stations we  
13          didn't think we could reliably assign CDOM  
14          stations to a certain number of fish sampling  
15          stations.

16                   MS. TIPSORD: Just to be clear, the  
17          67 is a subset of the 81 so the 67 is all of the  
18          81?

19                   THE WITNESS: Yes, that's correct.

20                   BY MS. WILLIAMS:

21           Q.       I'm going to move onto 56. Page 57  
22           of the CAWS Habitat Evaluation Report states,  
23           quote, fish metrics from observations where  
24           standards were being attained were generally

1 better than fish metrics where standards were not  
2 in attainment, but most differences were not  
3 statistically significant.

4 Because CAWS fish data showed a  
5 better condition existed at sites that more  
6 consistently attained water quality standards at  
7 sites that did not, isn't it logical to interpret  
8 that fish are at least partly limited by water  
9 quality conditions in the CAWS?

10 A. Although we saw slightly larger fish  
11 metrics at sites where quality standards were  
12 being attained than where they weren't being  
13 attained I think the report says and it's  
14 important to remember that the differences were  
15 for the most part not statistically significant.  
16 So it's difficult to draw generalizations from  
17 that.

18 Q. Would you say that when you're doing  
19 linear regression that you're necessarily assuming  
20 that there's a linear relationship between what  
21 you're studying?

22 A. Yes, the assumption of linearity  
23 does come into play.

24 Q. Would you agree that it's likely

1 that --

2 MR. ANDES: Is this a follow-up  
3 question? I'm sorry.

4 MS. WILLIAMS: Yes, it's a follow-up  
5 question.

6 BY MS. WILLIAMS:

7 Q. Is it likely that fish are related  
8 to water chemistry in ways that are nonlinear such  
9 as threshold effects?

10 A. It's possible that fish are related  
11 in nonlinear ways to water quality.

12 MR. ANDES: Is it a recognized  
13 method of looking at effects on fish to use linear  
14 regressions?

15 THE WITNESS: It would be a  
16 nonlinear regression, but it's a valid way of  
17 analyzing the data. Generally, let me just add  
18 that one would inspect the data and if there  
19 appeared to be some sort of nonlinear pattern  
20 consistently throughout the data we would try to  
21 assign a nonlinear relationship.

22 BY MS. WILLIAMS:

23 Q. I'd like to -- given your answer I'd  
24 like to turn to Appendix C of the lab at the

1 evaluation report Attachment B, Attachment B to  
2 Appendix D of the Habitat Evaluation Report. I'm  
3 not sure that the pages are numbered well, but if  
4 you look at the bottom within Appendix C the pages  
5 start to be numbered with B's and I'm going to go  
6 to Page B6 and a bunch of charts with points that  
7 mean not a lot to me. Did you find the page?

8 A. Yes.

9 Q. I'm looking at the box in the top  
10 right-hand corner of that page, percent intolerant  
11 species count versus percent of June and September  
12 where DO is less than five mg's/L?

13 A. Yes.

14 Q. Doesn't that plot indicate that the  
15 highest percentage of intolerant fish are present  
16 in the best dissolved oxygen conditions?

17 MR. ANDES: Are you asking about one  
18 particular data point on that chart?

19 MS. WILLIAMS: No.

20 BY THE WITNESS:

21 A. When I look at this chart, I see  
22 higher values of the percent intolerant species by  
23 count at the lower end of a percent of DO  
24 measurements less than five, but the percentage

1 values for the intolerant species are in the two  
2 or three percent range.

3 So you see more zero at the  
4 upper end of the range than you do at the lower  
5 end of range, but -- is that what you're getting  
6 at?

7 BY MS. WILLIAMS:

8 Q. What about let's look at the same  
9 concept, but I want to turn to Page 10, B10. And  
10 I'm looking at the right-hand side the second one  
11 down percent intolerant species by count versus 48  
12 hour average antecedent DO concentration?

13 A. Yes.

14 Q. Do you agree that the better fish  
15 conditions are towards the right side where the DO  
16 is higher?

17 A. There appears to be some data points  
18 higher on the right-hand side, but I don't see a  
19 pattern.

20 Q. You don't see a pattern?

21 A. No.

22 Q. Can you look below four, DO levels  
23 below four? What do you see in terms of fish  
24 quality there?

1           A.       So for that metric, if we look below  
2       four on the exhibit axis we see all the data  
3       points are zero.

4           Q.       Let's try real quick. I don't want  
5       to spend too much time, but can we get into  
6       Attachment C for the temperature box?

7           A.       I beg your pardon?

8           Q.       I want to flip a couple of pages  
9       ahead. It's Attachment C to Appendix B which is  
10      the temperature conditions and when we go to Page  
11      C2 the right-hand column the second one down  
12      percent intolerant species by count versus percent  
13      time the daily max exceeded in the previous 12  
14      months, do you see that one, that plot there?

15          A.       Yes.

16          Q.       Doesn't this plot show the highest  
17      percentage of intolerant fish occur only when the  
18      temperature is at the possible condition as  
19      indicated on the left most side of the X axis?

20          A.       I just want to make sure. Would you  
21      please repeat that?

22          Q.       Sure. The highest percentage of  
23      intolerant fish occurs where water conditions are  
24      at the best possible condition?



1           A.       Yes.

2           Q.       You agree with that? I'll move on.

3   Thank you. Fifty-seven, you state on Page 2 of  
4   your pre-filed testimony that the CAWS habitat  
5   study was a thorough and data-intensive  
6   examination of the relationships between fish,  
7   physical habitat, and water quality in the CAWS, I  
8   want to ask Subpart B of this one.

9                   Did you examine the data to  
10   discover whether there was a correlation between  
11   habitat in the water chemistry and I'm not talking  
12   about fish here just habitat.

13          A.       No, we did not. Let me add that  
14   that wasn't part of our scope. That wasn't what  
15   we were trying to evaluate.

16                   MR. ANDES: Can you clarify the  
17   statement on Page 2 that is being quoted here in  
18   terms of what factors and what relationships you  
19   were trying to assess? Were you assessing three  
20   variables all at once; fish, habitat --

21                   THE WITNESS: No. We were trying to  
22   determine the relative importance of physical  
23   habitat of fish versus water quality to fish, but  
24   not between physical habitat and water quality.

1 BY MS. WILLIAMS:

2 Q. Do you agree that's it possible that  
3 the correlation -- this is C. Is it possible that  
4 the correlation between habitat and water quality  
5 can confound interpretation of the correlation  
6 between fish and habitat or between fish and water  
7 quality?

8 A. It's possible that there is a  
9 relationship between physical habitat and water  
10 quality in the CAWS, but we didn't have any reason  
11 to suspect that being the case.

12 Q. Fifty-eight. Which segment of the  
13 CAWS demonstrated the greatest potential for  
14 habitat improvement?

15 MR. ETTINGER: Can I go back to one  
16 thing? You said there's no correlation. You had  
17 no reason to believe there was any correlation  
18 between --

19 THE WITNESS: We didn't investigate  
20 it.

21 MR. ANDES: Let him finish the  
22 question.

23 MR. ETTINGER: You said you thought  
24 there was no reason to believe there was no

1 correlation between habitat and water quality?

2 THE WITNESS: Yes.

3 MR. ANDES: Water quality meaning  
4 pollutant levels?

5 MR. ETTINGER: Right. But by that  
6 do you include turbidity?

7 THE WITNESS: No. We treated  
8 turbidity as a habitat variable.

9 MR. ETTINGER: So if barges were  
10 coming through and causing increased turbidity,  
11 that would be considered a habitat factor rather  
12 than a water quality factor?

13 THE WITNESS: In our study, yes.

14 BY MS. WILLIAMS:

15 Q. The rest of my questions are just  
16 kind of details that have information that we were  
17 looking for and then I'll be done. Fifty-nine --

18 MS. TIPSORD: You asked 58. I don't  
19 think we got which segment of the CAWS  
20 demonstrated the greatest potential for habitat  
21 improvement?

22 MS. WILLIAMS: Thank you.

23 MS. TIPSORD: Go ahead, Mr. Bell.

24 BY THE WITNESS:

1           A.       Based on the hypothetical habitat  
2       improvement assessment that we presented in the  
3       habitat improvement report, the South Branch of  
4       the Chicago River had the greatest habitat  
5       improvement potential based on the possible  
6       increase to the habitat index score.

7       BY MS. WILLIAMS:

8           Q.       You referred to a digital video  
9       survey of the entire system on Pages 4 to 5 of  
10      your pre-filed testimony. Was that presented  
11      somewhere?

12          A.       I have not presented it.

13                 MR. ANDES: Where is it available?

14                 THE WITNESS: We have copies on our  
15      network and at the District on their network.

16       BY MS. WILLIAMS:

17          Q.       Is it publicly available on the  
18      District's network drive?

19                 MR. ANDES: I don't believe so, but  
20      it can be provided.

21       BY THE WITNESS:

22          A.       It's very long.

23       BY MS. WILLIAMS:

24          Q.       How many hours?

1 A. Actually, you can fast forward it.

2 Q. A similar question was asked here  
3 about the side stream sonar mapping.

4 A. I believe you mean side scan sonar  
5 and we have the images collected. We definitely  
6 have that information on our network. I believe  
7 it's also available on the District's network, but  
8 I don't know if it's publicly available. It can  
9 be provided if you want.

10 MS. WILLIAMS: You mean on the  
11 Internet, Fred?

12 MR. ANDES: I am not sure if it is  
13 available on the Internet, but we can provide it  
14 in this proceeding.

15 MS. WILLIAMS: Okay.

16 BY MS. WILLIAMS:

17 Q. Question 60 refers to a paper that's  
18 cited, Flotermersch, F-L-O-T-E-R-M-E-R-S-C-H, et  
19 al 2006. That was a paper that we had trouble  
20 locating and we were wanting you to provide. The  
21 table from the paper. Let me go back to read the  
22 question as it's written. I think I've caused  
23 more confusion than necessary. Table 2-3 on Page  
24 25 of the CAWS Habitat Evaluation Report is cited

1 as Flotermersch, et al, 2006.

2 Illinois EPA could not find this  
3 table in the Flotermersch, et al 2006. Could you  
4 verify the source of this table?

5 A. Yes. The Table 2-3 in our report is  
6 a synthesis of the findings reported in Table 4-1.  
7 It's not an exact replication.

8 Q. Okay. Thank you.

9 A. And that's Table 4-1 of -- and its  
10 supporting text in Section 4.4 Flotermersch and  
11 everyone has trouble with that name.

12 Q. My last question. Page D1 of  
13 Appendix D in the CAWS Habit Evaluation Report  
14 states, quote, matrices of Spearman correlation  
15 coefficients for each of the five habitat variable  
16 categories are included in the Appendix E.  
17 Illinois EPA could not find any matrices of  
18 correlation coefficients in Appendix E. Are they  
19 available?

20 A. That was a reproduction omission  
21 that we apologize for. We brought them.

22 MR. ANDES: We saved the largest  
23 table for last. This exhibit is entitled Spearman  
24 Correlation Matrices and it was not legible until

1 we reproduced it very large so excuse the size.

2 MS. TIPSORD: If there's no  
3 objection, we will admit this Spearman Correlation  
4 Matrices as Exhibit 453. Seeing none, it's  
5 Exhibit 453.

6 (Document marked as IEPA Exhibit  
7 No. 453 for identification.)

8 MR. ANDES: No more questions?

9 MS. WILLIAMS: That was it.

10 MS. TIPSORD: Are there any  
11 questions on that? Rather than start a brand new  
12 set of questions today, it is 4:40. How about we  
13 call it a day? I will see you all May 16th and  
14 I'll talk to some of you on March 24th. We're  
15 adjourned. Thank you.

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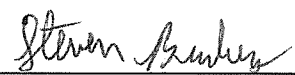
23

24

1 STATE OF ILLINOIS )  
2 ) SS.  
3 COUNTY OF COOK )  
4

5 I, Steven Brickey, Certified Shorthand  
6 Reporter, do hereby certify that I reported in  
7 shorthand the proceedings had at the trial  
8 aforesaid, and that the foregoing is a true,  
9 complete and correct transcript of the proceedings  
10 of said trial as appears from my stenographic  
11 notes so taken and transcribed under my personal  
12 direction.

13 Witness my official signature in and for  
14 Cook County, Illinois, on this 22nd day of  
15 March, A.D., 2011.  
16  
17  
18  
19

20   
21 STEVEN BRICKEY, CSR  
22 8 West Monroe Street  
23 Suite 2007  
24 Chicago, Illinois 60603  
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