ILLINOIS POLLUTION CONTROL BOARD

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

REPORT OF PROCEEDINGS held in the above-entitled cause before Hearing Officer Marie Tipsord, called by the Illinois Pollution Control Board, taken before Laura Mukahirn, CSR, a notary public within and for the County of Cook and State of Illinois, at the Thompson Building, 100 West Randolph, Chicago, Illinois, on the 2nd day of December, 2008, commencing at the hour of 1:00 p.m.

A P P E A R A N C E S

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MR. THOMAS JOHNSON, Acting Chairman
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HEARING OFFICER TIPSORD: Good morning. My name is Marie Tipsord. I've been appointed by the Board to serve as hearing officer in this proceeding entitled Water Quality Standards and Effluent Limitations for the Chicago Area Waterway System and Lower Des Plaines proposed amendments to 35 Ill. Admin. Code 301, 302, 303, and 304. The docket number is R08-9. As we discussed, due to a family emergency Dr. Girard is not with us today, but for him to my left is board member Thomas Johnson. Also present are board members Andrea Moore to my right and Dr. Shundar Lin. Also to my immediate right is Anand Rao for technical staff.

This is our eighth set of hearings to be held, and the purpose of today's hearing is to continue hearing testimony from the participants other than the proponents, the Illinois Environmental Protection Agency. At the close of hearing on November 17, we had finished with 18 witnesses from the Metropolitan Water Reclamation District of

Greater Chicago, and we'll continue with the district starting with Dr. Scudder Mackey to be followed by Jennifer Wasik, and if we have time in these two days Samuel Dennison. The testimony will be marked as an exhibit and entered as if read. After marking the prefiled testimony as an exhibit, we will then proceed to questions for the testifier. And I believe for Dr. Mackey the only prefiled questions are from the IEPA.

MS. DEXTER: We have some, too.

HEARING OFFICER TIPSORD: I'm sorry. The Environmental Law and Policy Center has some as well. Anyone may ask a follow-up question, and you need not wait until your turn to ask questions. I do ask that you raise your hand, wait for me to acknowledge you. After I've acknowledged you, please state your name and whom you represent before you begin your questions. Please speak one at a time. If you're speaking over each other, the court reporter will not be able to get your questions on the record. Please note that any question asked by a board

member or staff are intended to help build a complete record for the Board's decision and not express any preconceived notion or bias. I plan to try to go to around 5:00 today. If we have a natural break before then, we'll break then. We'll also have about an hour for lunch.

Member Johnson, do you have anything to add?

MEMBER JOHNSON: No. I suspect the day will come when we'll all look back fondly on Day 22, but.

MEMBER MOORE: Tomorrow.

MEMBER JOHNSON: Thanks for coming, and we'll get started.

HEARING OFFICER TIPSORD: Mr. Andes, will you have your witness sworn in.

(Witness sworn.)

MR. ANDES: I have a copy of the prefiled testimony.

HEARING OFFICER TIPSORD: All right. We will mark that as Exhibit No. 179, if there's no objection. Seeing none, it's Exhibit 179. By the way, I haven't found out

what the exhibit record is, but the hearing is 35 days, so.

MS. WILLIAMS: Thank you.

HEARING OFFICER TIPSORD: And with that, we'll begin with the IEPA.

MS. DIERS: Good morning, Dr. Mackey. My name is Stephanie Diers with Illinois EPA. I'll start with our prefiled questions. And I'm going to go to Page 97 of those. After looking over them and bouncing around a little bit, so I'm going to try to do a better job keeping it in line with the record. I'm going to start with Question 13. On Page 3 of your prefiled testimony, you mention that you will provide an alternative strategy that integrates all of the fundamental habitat characteristics necessary to maximize the productive and ecological capacity of the CAWS. You proceed to say on Page 4 of your prefiled testimony that biological characteristics are also an important element of aquatic habitat but will not be discussed in detail in this testimony or not included in Figure 1.

And the question is by not including biological characteristics, how are you integrating all characteristics as mentioned on Page 3 of your prefiled testimony?

MR. MACKEY: As stated clearly in my prefiled testimony on Page 4, and contrary to what's implied here, I do believe that biological interactions are a fundamental part of how an organism relates to its environment. But that is not what I was asked to review or comment on in my testimony. My testimony is focussed primarily on how aspects of physical habitat were considered and evaluated by the Illinois EPA with respect to the CAWS. Other witnesses will discuss in more detail the biological aspects of the CAWS. In other words, I'm a geologist. I'm not a biologist, okay, and I do not feel qualified to address what I consider to be purely biological questions, nor is that what I was asked to do.

MS. DIERS: And do you know who the

biological witnesses are to address those questions to?

MR. MACKEY: I believe Sam Dennison from the District. I believe he's a fisheries biologist, ecologist. And I believe Jennifer Wasik has a biological background as well. I'm not sure that that's what she will be speaking to.

MS. DIERS: Moving on to Question 14. What do you mean by maximize the productive and ecological capacity?

MR. MACKEY: I use the term maximize the productive and ecological capacity to mean healthy self-sustaining aquatic community that is balanced and supported by diverse habitat structure. I believe this definition would be compatible with a concept of the Clean Water Act general use waters aquatic life use designation. However, physical habitat limitations within the CAWS do not provide the diverse habitat structure necessary to meet Clean Water Act general aquatic life use goals. Irrespective of improvements in water quality or as proposed

in IPCB R08-9, to establish appropriate and attainable aquatic life use goals in the CAWS, it is necessary to consider all of the fundamental habitat elements, not just the water quality element.

MS. DIERS: When you say fundamental habitat, what are you referring to?

MR. MACKEY: What I'm talking about are the components that are illustrated in Figure 1 of my prefiled testimony. You're talking primarily about energy, you're talking about biology -- not biology. I'm sorry. Substrate which is the geology. And you're also talking about water mass characteristics or the hydrology of the system. So from a perspective of physical habitat, I'm talking about the three fundamental physical components that, when integrated together with appropriate ranges, actually represent usable habitat for a particular species, organism, or, if you want, community or ecological function.

MR. ANDES: We have copies of that particular figure.

HEARING OFFICER TIPSORD: And this is the identical Figure 1 in the testimony?

MR. MACKEY: Yes.

HEARING OFFICER TIPSORD: For ease of referring to it here today, and since this one is in color and mine is not, we will mark this.

MR. MACKEY: I did that last night, okay?

HEARING OFFICER TIPSORD: We will mark this as Exhibit No. 180 if there is no objection.

Seeing none, it's Exhibit 180.

MR. MACKEY: This diagram was originally put together for a paper that I wrote for the International Joint Commission, my national commission in the Canada and the U.S., where I was asked to evaluate and actually define the concept of physical integrity with respect to the Great Lakes Water Quality Agreement which is currently under review by both federal governments for a provision.

MS. DIERS: So this figure that you

put together is this a concept you developed?

MR. MACKEY: It's one that, yes, I developed even though there are other types of conceptual systems, if you want, that are very similar to this.

MS. DIERS: What would those be?

DR. MACKEY: In terms of other systems?

MS. DIERS: Yes.

DR. MACKEY: There was a publication that was put together that looked at how to classify habitats basically in lake systems where they have not a similar diagram, but a similar set of characteristics that when integrated together also are describing habitat.

MS. DIERS: So this concept that we are talking about in Figure 1, did you design it for lakes?

DR. MACKEY: No. This actually, the interesting thing is that, No. 1, yes, it was designed initially for use in the Great Lakes, but it also translates very nicely into riverine systems. Because physical

habitat is physical habitat, whether it's in a lake system or whether it's in a riverine system. And the fundamental components here are present in a riverine system as well such as the CAWS. For example, when you look at the right-hand column here on this diagram, you see the topic of energy estimated from hydraulic calculations for oscillatory and unidirectional flows. On oscillatory flows, you're talking about the back and forth movement due to wave action, and that typically is what will either transport sediments or imparts energy into the water column. In riverine systems, it's predominantly unidirectional flows, where you have flow from upstream to downstream, water does flow down hill. So this diagram is actually applicable to both types of environments.

MS. DIERS: And have you used this concept on any other river besides -- I assume -- I guess I should start first you've used this concept on the CAWS right now?

DR. MACKEY: Yes.

MS. DIERS: Okay. Have you done it with other rivers besides the CAWS?

DR. MACKEY: Yes.

MS. DIERS: And what rivers would those be?

DR. MACKEY: I've worked on the Maumee River in Northwest Ohio, the Sandusky River in Northwest Ohio and the Grand River in Northern Ohio. I've worked on the Detroit River, I've applied it to the Don River in Toronto, Ontario Canada, to the Rouge River and to the Dufference (ph.) River, all in Ontario, Canada, in terms of specific evaluations.

MS. DIERS: And are those rivers that you just mentioned, are they comparable to how the CAWS is set up like the nonwadable have a lot of impact on the system? Are those comparable to that?

DR. MACKEY: They have -- yes and no. The answer to that question is that it's an ending river. There are navigable portions in many cases where you can't wade. It's too deep, unless, perhaps, you've a professional

basketball player. There are wadable portions as well. And I have used this approach by evaluating these different fundamental elements in all these riverine systems in both wadable and nonwadable areas of those rivers.

MS. DIERS: I'm going to go back to our prefiled question 15. And the question is what is this strategy an alternative to. When you're using a strategy that was in your prefiled testimony on Page 3 where you said your alternative strategy.

DR. MACKEY: If I recall, your question is focussed on as an alternative to, and I think what I am proposing here is something that's different than the apparent focus of the Illinois EPA on water quality in lieu of almost any other habitable element. It's almost an exclusive focus on the hydrology, water quality aspect, and really didn't pay much attention to the substrate or the energy conditions within the CAWS. Some of these other examples in particular that are important from habitat perspective, which

is what I focus on as well, is what's the structure and the pattern and the connectivity of these different types of habitats in these riverine systems as well. That is extremely important. And I think there's a quote by Yoder and Rankin in 1998 out of one of their papers which I included in my prefiled testimony. And it basically says this: Because biological integrity is influenced and determined by multiple chemical, physical, and biological factors, a singular strategy emphasizing the control of chemicals alone does not assure the restoration of biological integrity. In other words, we need to look at the whole package, not to just one very narrow portion of that package.

HEARING OFFICER TIPSORD: For the record, that quote is actually on Page 4 and 5 of your prefiled testimony, which is Exhibit 180 or 179.

DR. MACKEY: That's correct.

MS. DIERS: I'm going to move on to Question 19. Would the physiochemical water

standards proposed by Illinois EPA, if met, fail to support attainment of the aquatic life goals proposed by Illinois EPA for the CAWS?

DR. MACKEY: Well, first, Illinois EPA has not presented any data or information that would support the contention that an incremental increase in water quality standards will result in attainment of the proposed aquatic life use goals. According to the testimony presented by Illinois EPA, the increase in the dissolved oxygen standard for Aquatic Use A Waters is designed to protect early life stage fish based on the, quote, undocumented assumption that fish spawning is occurring within the CAWS. However, no data or evidence has been collected by the District or the CAWS UAA contractors to indicate that spawning activity has occurred in the CAWS. No eggs or larval fish indicative of spawning activity have been collected nor have fish been observed and actively spawning within the CAWS. Until spawning activity is

observed directly and/or eggs or larval fish are recovered from potential spawning sites, one cannot conclude that fish are spawning or propagating in the CAWS.

Second, Illinois EPA has suggested that different size classes of fish -- different size classes of fish may indicate the presence of an early life stage fish. But different size classes are not determinative of spawning or reproductive activity. Different size classes could be indicative of different growth rates and/or the presence of different strains of the same species. I know, based on some of the work that I've done in Lake Erie with the fisheries biologist in the agencies, that we do see some substantial differences in the size classes of fish, even though they are the same, and it's more related to growth rates and productivity and food supply and, in part, water temperature than whether or not these fish are coming from spawning substrates.

Again, unless there's some direct

evidence such as either observing or sample collection that link these fish to specific spawning locations within the CAWS, these fish could just as easily have migrated from areas outside of the CAWS in either from Lake Michigan or perhaps another tributary.

Third, with respect to physical habitat, review of prior reports and associated literature suggest that these factors such as a lack of habitat availability and diversity are more limiting than degraded water quality in the CAWS. For example, the CAWS UAA report on Page 5-3 states, "Improvements to water quality through various technologies like reaeration may not improve the fish communities due to lack of suitable habitat support fish populations. Unless habitat improvements are made in areas like the Chicago Sanitary and Ship Canal, additional aeration may not result in the attainment of higher aquatic life use. Ignoring their recommendations of the CAWS UAA contractor, Illinois EPA has recommended result oxygen standards that are

in, in essence, identical to general use dissolved oxygen standards for the Type A waters.

And, fourth, the implicit assumption in Illinois EPA's proposal is that improvements in water quality alone are sufficient to attain the aquatic life uses proposed by Illinois EPA and that the CAWS is not habitat limited. I believe that is incumbent upon Illinois EPA to demonstrate that there is sufficient aquatic habitat available in the CAWS to attain the proposed aquatic life uses, and to show that the system is not habitat limited. Unfortunately, Illinois EPA has not provided any data, information, or analyses to show that there is sufficient aquatic habitat to support attainment of the appropriate -- sorry -- attainment of the proposed aquatic life uses in the CAWS.

We will have a better understanding of the habitat conditions when the ongoing habitat evaluation and improvement study has been completed. Only

after comprehensive evaluation of habitat can this question be answered properly. In other words, we really don't have enough information on the physical habitat and characteristics in the CAWS to determine whether or not the system -- if there is enough habitat there to actually support the proposed aquatic life uses.

HEARING OFFICER TIPSORD: Miss Dexter?

MS. DEXTER: Jessica Dexter. Do you do any fish sampling yourself?

DR. MACKEY: No, I do not.

MS. DEXTER: Do you know anything about the limitations of the equipment that has been used for sampling?

DR. MACKEY: I have some familiarity with the limitations. But, again, I would qualify that statement that I am not a fisheries biologist, and so that any answer I may give will be from basically a lay person's perspective.

MS. DEXTER: All right. So you might say that your opinion on the samples is also qualified down as -- You're not a biologist,

so what you're saying about the -- about the biology --

DR. MACKEY: In my responses here and in my prefiled testimony, I'm basically quoting from other sources from people who have more expertise in this issue than I.

MS. DEXTER: Thank you.

MS. DIERS: Where are you quoting from?

DR. MACKEY: I was referring to the life -- Actually, there's a report from the District that discusses a lack of early life stage fish. I believe it was a report 98-10. It was an attachment to my testimony.

HEARING OFFICER TIPSORD: It was listed as a reference, but I'm not sure it was an actual attachment.

DR. MACKEY: Okay.

HEARING OFFICER TIPSORD: Let me check. I'm looking right now.

DR. MACKEY: It may have been as an attachment to the original report, a longer piece that was in support of the prefiled testimony. But I do believe we did include

that.

HEARING OFFICER TIPSORD: Yes. It's M-3, attachment M-3.

MS. DIERS: Have you seen any reports on the CAWS that shows that spawning is not occurring in these waters?

DR. MACKEY: No.

MS. DIERS: I'm going to go to Question 20. On Page 4 of your prefiled testimony, you mention that fish will not propagate successfully if spawning habitat is not connected, connected is in quotes, to suitable nursery and forage habitats. If all detrimental reversible human impacts were mitigated in the CAWS, do you believe that there would be insufficient spawning habitat, nursery habitat, and foraging habitat in the CAWS to support the aquatic life uses proposed by Illinois EPA for these waters? And what biological information do you base this conclusion on?

DR. MACKEY: Well, first, the implicit assumption in Illinois EPA's proposal is that improvements in water quality alone are

sufficient to attain aquatic life uses, proposed aquatic life uses, and that the CAWS is not habitat limited. And, once again, I'll state I believe that it's incumbent upon Illinois EPA to demonstrate that there was sufficient aquatic habitat available in the CAWS to attain the proposed aquatic life uses and to show that the system is not habitat limited.

Second, the habitat assessment and analysis used by Illinois EPA propose these aquatic life use designations were deficient and severely flawed. The existing data and analyses are not sufficient to show that the CAWS has enough spawning, nursery, or foraging habitat to support attainment of the proposed aquatic life uses.

Third, the CAWS is an artificial system originally constructed to convey wastewater and serve as a commercial waterway to promote commerce. The CAWS still performs those functions, and those functions are not likely to change in the foreseeable future. Fish habitat and ecological function

were not on the radar screen when the waterways were originally constructed. It is not reasonable to expect that the system will have habitat characteristics similar to a natural system, nor is it reasonable to assume that existing physical habitats within the CAWS are sufficient to support the proposed aquatic life use goals.

So based currently on the current -- currently available habitat data, I do not believe that there is sufficient habitat diversity or connectivity to support the aquatic life uses proposed by Illinois EPA for these waters.

I would also say, as stated in my prefiled testimony on Page 14, I think we've already went through this comment. But basically, again, restate this improvement to water quality through various technology like reaeration may not improve the fish communities due to a lack of suitable habitat to support the fish populations. And unless habitat improvements are made in areas like sanitary -- the ship sanitary canal,

additional reaeration may not result in the attainment of higher aquatic life uses.

MR. ANDES: Is that a quote from the UAA report?

DR. MACKEY: Yes, it is.

HEARING OFFICER TIPSORD: The CAWS UAA Attachment B to the proposal.

DR. MACKEY: Also in my prefiled testimony I listed several other potential limiting factors. One is physical limitations such as a lack of shallow bank edge habitats and riparian cover, lack of in-stream habitat cover and diversity, lack of suitable substrates and substrate heterogeneity or altered flow regimes. And we're talking about flow, flow magnitude, and also changes in water levels.

Second, biological limitations such as limited, primary productivity, degraded macrobenthic communities which is, in essence, a food supply issue, predation or lack of appropriate spawning and nursery habitats.

Third, chemical limitations

such as legacy contaminants in the sediments.

And, fourth, functional limitations such as navigation, prop wash and/or turbulence, sediment resuspension and waves from commercial vessels moving up and down through the channel, and conveyance of waste and flood waters. And that -- we're in a regulated flow regime which regulates flows in the system, but also regulates water levels in part for navigation purposes.

In terms of the biological information, I would refer you to Attachment 1 of Dr. Melching's prefiled testimony, where based on species specific habitat suitability index models, HSIs, he concludes that the CAWS is No. 1 for habitat for adult smallmouth bass and channel catfish; two, is near optimal habitat for adult largemouth bass which is consistent with the fish abundance data report in the CAWS UAA report which I believe is Attachment B.

And, furthermore, Dr. Melching suggests that the high abundance of

largemouth bass demonstrates that current water quality of the CAWS is sufficient for a healthy largemouth bass community, and that higher dissolved oxygen standards are not needed. However, Dr. Melching does state that the CAWS does not have suitable habitat to support early life stages of these target fish species, and that's a result of the habitat suitability indeces analysis.

MS. DIERS: So you don't have personal knowledge of this? You're going at what Melching did and quoting back to us what he said? Is that --

DR. MACKEY: Well, that's in part true. But I've also spent some time on the waterway. I've collected side-scan sonar data where I'm actually able to image and develop an image of the entire channel bottom substrate in a continuous nature. So I have a very good feel for what the different types of substrates are, what the in-stream habitat structures are. And compared to a natural system, the CAWS system is extremely limited in terms of the habitat types, but also the

patterns and the juxtaposition of different types of habitat next to one another, which I believe are critical to a naturally functioning system that would support appropriate aquatic life uses.

MS. DIERS: When were you on the waterway?

DR. MACKEY: I've been on the waterway intermittently for the last probably four months.

MS. DIERS: And was that -- Were you on the waterway to do this habitat study that you're doing for the District? Is that your --

DR. MACKEY: I have a small subcontract with LimnoTech to provide some of this data on a reconnaissance basis to evaluate its potential utility to help develop a more formal index that could be applied to urban systems.

MS. DEXTER: Have you been on the entire waterway?

DR. MACKEY: I have not been -- I have been on the entire waterway, yes, on various

vessels. With respect to this work, I've only done a portion of the waterway. Again, this is a reconnaissance study. It's not a complete survey of the entire waterway system at this time.

MS. DEXTER: Which portions have you been on?

DR. MACKEY: I have been on about two-thirds of the Cal-Sag channel. I have been on several different segments of the Sanitary and Ship Canal, I have been on the north branch, of the upper portion of the north branch and the lower portion of the North Shore Channel in terms of using the side-scan sonar. I've also been in the Indiana harbor area, and that was a separate project that I was under contract with the United States Coast Guard doing similar types of surveys in Lake Michigan.

MS. DEXTER: Thank you.

MS. DIERS: Sir, are you relying on the habitat suitability indeces for your biological support that you're offering today?

DR. MACKEY: I would have to say that that is part of it. And really I'm not -- I wouldn't say that I'm necessarily relying on biological data. I am relying predominantly on what I see in terms of the types of physical habitat and the physical habitat characteristics that I observe in the system. And also relying on my, I think, considerable expertise in evaluating other natural systems. And this system is definitely different than a natural system.

MS. DIERS: Do you know if Dr. Melching was a biological expert?

DR. MACKEY: I do not believe that he is.

MS. DIERS: Question 21: What do you mean by connected, that we had in quotes, based on your testimony on Page 4?

DR. MACKEY: Okay. This will be a short answer, okay? What I mean by connected is it's accessible land organism subject to appropriate time, distance, and energy constraints. This term is based on the concept of a functional habitat mosaic. In

other words, the distribution, pattern, and juxtaposition of habitats needed to support a healthy balanced self-sustaining aquatic community.

MS. DIERS: I'm going to go to prefiled Question 24. On Page 4 of your prefiled testimony, you mention that there are three major classes of variables that must be considered when assessing aquatic habitat: Flow regime, substrate, and water chemistry and quantity. What do you mean by when assessing aquatic habitat?

DR. MACKEY: When assessing aquatic habitat means an assessment of the physical -- chemical characteristics and the physical structure, processes, and energy that allows specific life stages of aquatic organisms to use an area or location as habitat. And, again, I would refer back to Figure 1 which is this, the three-ring diagram, this sort of like half of the Olympic rings, I guess, here. And the definition of physical habitat provided in my prefiled testimonies on Pages 3 and 4 that

clearly describe a conceptual foundation used to assess physical habitat, and I quote, "Physical habitats are defined by a range of physical characteristics and energy conditions that can be delineated geographically to meet the needs of the specific species biological community or ecological function. To be utilized as habitat, these physical characteristics and energy conditions must exhibit an organizational pattern, persist, and be reputable elements that are essential to maintain a sustainable and renewable resource. The reputable nature of habitat implies that the natural processes that create physical habitat must be reputable and may persist over a range of spatial and temporal scales.

MS. DIERS: I'm going to go to Question 26. On Page 4 of your prefiled testimony, you state: All of these variables must be spatially and temporally connected by physical and biological processes in ways that support diverse aquatic communities.

What do you mean by diverse aquatic communities?

DR. MACKEY: Diverse aquatic community means biological community composed of different aquatic species and taxa. In this context it means a diverse, balanced, healthy aquatic community created by the interaction of chemical, physical and biological processes within the CAWS.

MS. DIERS: Is it true that the Illinois EPA is proposing an aquatic life use designation that is below the Clean Water Act goal?

DR. MACKEY: That's an interesting question. From a narrative perspective, the answer would be yes in the way it's described in the Illinois EPA statement of reasons. But then when you look at the dissolved oxygen standards, let's say they're associated with the Type A waters, they're, in essence, the same as general use water standards. So I don't really see the difference here. In other words, okay, yeah, you've said that your proposed aquatic life

uses are below the general use criteria. But the criteria or the standards are, in essence, identical. So I don't see a difference.

MS. DIERS: Can you explain how you see that the Class A waters that you said the Illinois EPA proposed is just like the general use that was adopted from the dissolved oxygen?

DR. MACKEY: Well, if I recall, and, again, I'm not an expert on dissolved oxygen and water chemistry, okay, but if I recall in your -- I just want to refer to the proper table here. Right. If you go to the statement of reasons, Table 1, Page 50, there is a table that is put together that basically shows the different dissolved oxygen standards proposed for the Type A and Type B waters.

MS. WILLIAMS: What page?

DR. MACKEY: Page 50 on the Illinois EPA statement of reasons.

MS. DIERS: We have Page 60. I don't know if our pages are different, but.

DR. MACKEY: I'm sorry. It's the one with the two little dark areas down at the bottom here.

MS. DIERS: We have it Page 60 in the statement of reasons.

DR. MACKEY: And basically I believe it's 5 milligrams per liter is for the period from March through July is the standard that's been proposed for the Type A waters, and I believe that is to protect early life stage fish, and I believe the general use water standard is also 5 milligrams per liter.

MS. DIERS: Looking at this table, and if you go to Chicago Area Waterway System Aquatic Life Use A waters, is there a seven-day mean of daily means proposed for those waters?

DR. MACKEY: I don't know the answer to that question.

MS. DIERS: I'm going to move on to Question 27 of our prefiled questions. On Page 5 of your prefiled testimony you state, "This assessment should include an integrated

analysis of current physical habitat, flow, temperature, water quality, and existing aquatic communities."

Did the CAWS UAA, which was Attachment B, include water quality, sediment, temperature, habitat, biological and flow information?

DR. MACKEY: I guess I would have to answer yes. But I'm going to make that a qualified yes. Because as described in my prefiled testimony, I believe the Illinois EPA's analyses of these data to be inadequate and flawed. In fact, from what I can gather from Illinois EPA's statement of reasons and its subsequent testimony, the process used by Illinois EPA was not based on clear scientific methodology, at least that I can determine from reading the testimony today. But, rather, was based more on general perceptions as to what areas had good aquatic life potential and what areas had poor aquatic life potential based on the data collected by the CAWS UAA contractor, and, perhaps, some other systems.

For example, in an artificial system such as the CAWS, an assessment of physical habitat is necessary, and I believe required, to assess whether or not proposed aquatic life uses can be attained. An incomplete habitat assessment such as I believe has occurred in the CAWS will lead to the development of unattainable aquatic life uses. The habitat assessment and analyses used by Illinois EPA to propose these aquatic life use designations were deficient and severely flawed in my opinion. Illinois EPA has not provided any data, information, or analyses to show that there is sufficient aquatic habitat to support attainment of the proposed aquatic life uses in the CAWS or that the system is not habitat limited.

And with respect to water quality, Illinois EPA has not presented any data or information that would support the contention that an incremental increase in water quality standards will result in attainment of the proposed aquatic life use goals. In the CAWS UAA report on Page 5-3 it

states, improvements to water quality through various technologies like reaeration may not improve the fish communities due to lack of suitable habitat to support fish populations. Unless habitat improvements are made in areas like the Chicago Sanitary and Ship Canal, additional aeration may not result in the attainment of higher aquatic life use.

Illinois EPA ignored the data and the recommendations made by the UAA contractor and recommended dissolved oxygen standards that are, in essence, identical to the standards for use in the general use waters.

MS. DIERS: Did you say Illinois EPA has concluded that the CAWS is not habitat limited?

DR. MACKEY: I'm saying that I don't believe the Illinois EPA has shown that there is adequate habitat to support proposed aquatic life uses.

MS. DIERS: I'm going to move on to Question 28. On Page 5 of your prefiled testimony, you state, "Unfortunately the CAWS

UAA report and supporting documents submitted by IEPA in this rulemaking effort did not meet these criterion, contain data area and flaws in the methodology used to develop the proposed aquatic life use designation. Can you please explain what data errors and flaws you're referring to?

DR. MACKEY: Okay. It's very difficult, it has been very difficult to evaluate habitat in the CAWS and exactly what Illinois EPA has done. Because in some of the testimony there are apparently some errors reported in the QHEI values that were used in part of the assessment. And this specifically I am referring to the hearing testimony of Essig on April 23, 2008, Pages 192 and 193, where he reports that the values reported on Table 3 on Page 5 of the Rankin 2004 report are supposedly the correct values. The corrected value -- are the supposedly correct values. Table 2, which is what was used by the UAA contractor in their analysis, apparently contains incorrect QHEI values. There are four sites where the

values were transposed: North Shore Channel had a value, original value of -- I'm sorry. Had an original value of 54, and, in fact, that was the reference site that was used, the IBI reference site that was used by the CAWS UAA contractor in that analysis. But apparently that value was transposed with the Route 83 on the Cal-Sag channel. And so the new revised value is a 42. So it's dropped considerably in terms of its habitat quality. And at the Dempster Road site on the North Shore Channel, the original value was a 47.5, which is -- it's a poor habitat, but it's probably one of the better habitat areas within the CAWS. But the revised values are now down to 37.5. And that, the Dempster Road, that North Shore Channel Dempster Road site was transposed or switched with the Cicero Road site on the Cal-Sag channel. And we have a hand-out that we'd like to show you that shows the changes in a bit more detail.

MR. ANDES: This will need to be an exhibit.

HEARING OFFICER TIPSORD: I've been

handed what is titled at the top Original QHEI Scores and a table below that with the corrected QHEI values. If there is no objection, we will mark this as Exhibit 181.

Seeing none, it's Exhibit 181.

DR. MACKEY: What this exhibit is showing and what it is, it's based on Figure 5-2 on Page 59 of the CAWS UAA report. And this diagram has issues which we don't need to discuss right now, but basically is a way the contractor chose to display geographic distribution of IBI scores, fish IBI scores which is a measure of the health of the aquatic community, at least the fish aspect of it. And then the black dots are the QHEI scores which is a measure of habitat quality, okay, and of macrohabitat quality, in essence. What I'm going to ask you to do is let's not focus on the top plot, but let's look at the bottom plot, because that's what we're discussing right now. What I had plotted there on Figure 5-2 is, No. 1, that the colored areas are where Illinois EPA has proposed aquatic life use A and B waters,

okay, to give you a feel for what's apparently better or not so good. Secondly what I've shown, there are three horizontal red lines, and those red lines represent boundaries that are established by Ed Rankin and his group that delineate different types or narrative scores for -- different narrative descriptions for the QHEI values. And those are listed on the right-hand side. A QHEI value of 30 is very poor, 30 to 45 is poor, 45 to 60 is fair, and then above 60 is good habitat conditions. And then, again, take a look at the black dots. And what I've done, have actually put the corrected QHEI values there. You can see on the bottom are the geographic locations, and the locations that are outlined in the red box are the ones where the changes were made. And what I'm showing is there is an open circle with a couple of horizontal lines. That was the original score, and actually was the score used by the UAA CAWS contractor, and I believe also used by Illinois EPA in their initial designation process. And what's

happened is with the changes is that you can see for the North Shore Channel, the one to the furthest to the left, that we've had a drop from a fair habitat to, in essence, a poor habitat. For the next one, which is the North Shore Channel at Dempster Street, it's listed there, not Dempster Road. You also see a substantial drop in the QHEI scores. And then if you move to the right side of that figure, you'll see the Cal-Sag Channel, it's Cicero Ave, is that what was originally classified as poor habitat has now moved up to the fair habitat area. And the Cicero Road site has also moved from the poor to fair. So those are the changes.

MS. DIERS: Where did you get the corrected QHEI values at?

DR. MACKEY: That was from the testimony of Essig. It was in the hearing testimony. And they provided -- they said those were transposed values. And those were the values that were reported in the hearing testimony. And the point is is that, and this is really important, that these

transposition errors can only be verified by examining the original field data sheets that score each of the six major metrics and/or submetrics that are used to calculate the QHEI scores. Based on the hearing testimony, we understand that Illinois EPA has not reviewed the original field data sheets to validate the reported QHEI scores. In other words, which of these values are real? We really don't know until we look at the original data sheets, okay?

In a follow-up question as to whether or not Mr. Rankin would change his recommendation based on the revised scores, the response from Illinois EPA was we have not fully examined all of the corrected scores. And this is testimony by, and let me pronounce, Smogor, is that correct, on April 23, 2008 on Page 212. Through the District and through Mr. Andes, I have requested copies of the original field data sheets to evaluate how different metrics and submetrics were scored. These requests apparently went to Illinois EPA, and we understand that

Illinois EPA does not have copies of the field data sheets inhouse, nor did they review those original field data sheets prior to submitting their proposal to the Board. In my mind, if you have a question about what these numbers are and if they're in the right place, you need to go back to the original field data sheets to see exactly how they were scored to be sure what the values were, which is correct. I don't know because I don't have the original data. I mean I'm not so good at adding things. You know, my fingers and toes and if it goes above that I sometimes have problems. But it would be a very simple matter to go back to those original field data sheets, add those things up, and see what the real scores are.

A couple other notes tied to that. QHEI scores have some value from a very regional perspective. But, for me, the real intrinsic value in these scores is what are the submetric scores, what are the metrics telling us. Because if you're looking for restoration, improvement, or

enhancement opportunities, a value of a 54 doesn't tell you anything about, well, what is it really that needs to be fixed in the system, you know. What do you have to do to reach a proposed aquatic life use. And if you just have, well, it's a 54 and you say, well, is it pool depth, is it pool riffle sequences, are they there or are they absent. Is there in-stream habitat structure there, is it not there, what are the substrate materials like? Well, the score is a 54. That doesn't tell you anything. And I don't see how you could possibly use the QHEI scores to do any sort of habitat assessment without actually looking at the field data sheets to see exactly what's going on at each of these sites in part because, No. 1, you need to assess whether or not the problems with the habitat are systemic, are they across the entire watershed in the entire system or are they a very local phenomenon. And those scores are not necessarily going to tell you that.

MS. DIERS: Do we get any value out of

these scores?

DR. MACKEY: As I said before, I think you could use them for a general regional macrohabitat assessment. But I think in terms of actually trying to do -- to take action or to determine what the actual problems are, just a number is not going to do it -- is not going to really help you out.

I would use the analogy of a stock market. So I don't know what it is today, I'm not sure I want to know what it's doing today, but the stock market, a value of 8,000, okay? Well, six months from now it may be up at 10,000. Then you say, okay, well, what component of the economy has really taken off here? Well, the stock market scores, it's 8,000. The DOW is at 10,000. Those numbers are basically meaningless, just an index. It doesn't tell you about the underlying fundamental structure or what the different components are doing. It's the analogy, you just take it right back to habitat. You need to understand the details, you need to

understand what is happening with each of the individual submetrics here.

MR. ANDES: Dr. Mackey, on that point, you talked a little bit about reasons why you might have questioned about the particular new corrected values for those sites on your chart.

DR. MACKEY: Sure. I'm going to ask the Board, have any of you been on a boat on the waterway or actually seen portions of the waterway at all? I'm just curious.

HEARING OFFICER TIPSORD: The Board has their offices in the Thompson Center, so I think it's safe to say the board members --

DR. MACKEY: You've seen it. Okay. I don't know. I'm clueless, all right, at least in that respect. The reason I'm saying it is that if right now with the corrected revised scores, if you look at state Route 83, the bridge at state Route 83 across the Cal-Sag Channel, that right now, based on the QHEI scores, is the best habitat available in the CAWS. Have you seen state Route 83 on the Cal-Sag Channel? Have you

looked at that area?

HEARING OFFICER TIPSORD: You need to tell us about that area.

DR. MACKEY: Okay. Here we go. Okay. It's on the Cal-Sag channel, the channel is about 260 feet wide. Water depths there are running around 12 feet. On the north side of the channel for many miles there is a vertical concrete bulkhead that rises up about 8 to 10 feet off the water surface, and there is silt that comes right up to the base of that. So it's a straight-walled channel, and there's not a whole heck of a lot of habitat there. On the south side of the channel, you have large limestone blocks, bedrock slabs, some bedrock exposed. The smallest blocks are, at least that I've observed there, are in the order of 12 to 16 inches across. There is a small, very narrow littoral zone, which is what I believe Illinois EPA calls it. Water depths there range from probably about two feet, and then it just sort of slopes right down and grades into a silt area along the flanks of both

sides of the channel. And based on the side-scan sonar data, what you see in the center part of the channel is bedrock. It's exposed bedrock within the lower areas, those small pockets are filled with silt, okay? So you basically have, in terms of in-stream substrates, you have basically two types of substrate present there. You have hard bedrock surface, you have silts on the flanks of the channel and filling in some of the lower impressions. And then on the north side of the channel you have a concrete bulkhead, and on the south side you have this very coarse, it's almost like a -- It's really not a revetment. It's, I think, construction debris and material that was left behind as people -- the channel was built. And we have an exhibit that shows some of these features. In terms of the riparian habitat associated with it, it's a good 12 to 15 feet up off the water column, almost a vertical area.

MR. ANDES: Hold up for a minute.

DR. MACKEY: Sure. There is a

riparian area --

HEARING OFFICER TIPSORD: Dr. Mackey, let's mark this first.

DR. MACKEY: I'm getting excited about this. Okay.

HEARING OFFICER TIPSORD: If there's no objection, I've been handed Calumet Sag Channel Side-Scan Sonar Data State Route 83 Sampling Site. If there's no objection, I will mark in as Exhibit 182.

Seeing none, it's Exhibit 182. Go ahead, Dr. Mackey.

DR. MACKEY: Okay. We'll get to the exhibit in just a second. With respect to riparian habitat, there is some trees and waterway available, but they're well back from the channel. There is no overhanging trees or brush anywhere near the water surface or the water itself. And, in fact, based on the side-scan data there is very little wood at the bottom of the channel. A little further to the east of here, though, I did find a car in the center of the channel, so we'll discuss that another time.

The exhibit that was just handed out is an example of a side-scan sonar data, and this was collected probably about three weeks ago, three to four weeks ago. And what I'm showing here is -- and these are basically segments that are on the order of several hundreds of feet long or greater. And it's an area, on the right-hand panel here, it's an area about a half mile east on the Cal-Sag Channel of the Route 83 bridge. And the panel on the left-hand side is an area that it's about a half mile, located about a half mile to the west. So I'm just trying to give you a feel for what it's like. And we can produce a continuous strip of the entire channel bottom. What you're looking at is side-scan sonar data. It's like an aerial photograph, okay, except it's made with sound rather than light. So it allows us to pick up features on the bottom. We can see shipwrecks, you can see cars, you can see bedrock, you can see sand, you can see riffles. And in one pass, I can basically scan the entire width of the channel. So I

see what's on the bottom. And it's a very, very useful tool for mapping different types of substrate materials and different types of structure on the bottom. This is what I do for a living all over the Great Lakes, okay. And on the right-hand side here, let's look at the right panel. This is oriented properly. Again, the channel is 260 feet wide, so it's -- that's the scale that we're looking at. Both along the north edge and south edge of the channel we have a silt, and you can see the bedrock area right in the center of the channel exposed there. And, in fact, if you look, there is sort of irregular pattern of a pock marks there, and I suspect that those are old drill hole sites, and they were going to blow it out but they just walked away. But those are remnants of the old drill hole sites.

On the north shore, that black line, is that vertical concrete wall. That's what it looks like, a very hard surface acoustically. So it will show up black on this particular image. And on the south

shore you can actually see that coarse shoreline. And the thing is is that you have to consider the scale of this. These blocks that you're seeing here are quite large, and look at the scale. That's -- This channel is 260 feet wide, and those blocks, you can discern them. So you know that those have to be several feet across. On the left-hand side you can see the same sort of features, not quite as dramatic. Again, you have silt along the edges of the channel, and in the center you have bedrock exposed. And I expect that's in part due to the prop wash effects. The interesting thing on this is that there is a swamp boat. You can see that, sort of that block mass up there is actually a steel, a small steel barge which has actually sunk. The only thing that's sticking out of the water is the cabin. And then to the right, even though it's very small in this case, there's actually a vessel that you don't even know there, that's a sunken vessel sitting on the bottom. So that gives you an idea of the scale.

MR. ANDES: If I can ask, so under the corrected scores, this is the best habitat in the CAWS?

DR. MACKEY: That's correct, right. Now, I don't have a similar image. I have collected side-scan sonar data up on the north branch and the North Shore Channel. The habitat conditions there are considerably different. It is, in many areas, heavily vegetated. There are overhanging trees. The channel isn't quite as deep. It's about eight to ten feet deep, and the side-scan sonar data shows three or four different substrate types there. It appears that you have sand, you have cobbles and boulders, you have silt. So you have a juxtaposition of different types of substrate materials which may actually be somewhat useful in terms of you have potential spawning habitat, nursery habitat, or just refuser (ph.) for different types of organisms.

MR. ANDES: And that Sheridan Road site in the North Shore Channel I understand was the highest quality reference stream for

this assessment by IEPA?

DR. MACKEY: It was done by the UA -- by the CAWS UAA contractor, yes. That -- Those sites also have some of the highest IBI, fish IBI scores within the CAWS as well. So I have some issues. Even if Ed Rankin's scores, if we get the original field data sheets and we look at them and, indeed, he ranks this as a 54, I would have serious concerns about that based on this information. All due respect to Ed Rankin. He did not have access to a side-scan sonar. And if I understand correctly, Sam Dennison, who I believe will be a witness coming up shortly or sometime down the road, depending how long it takes to get through this, Sam Dennison was with Ed when they actually did the habitat assessments. And the way they did the habitat assessments is they used a steel rod and they just sort of drip it around and were poking the bottom. And that can be a very effective technique, but it is very limited in terms of being able to spatially connect all the different types of

substrates together.

MR. ANDES: So in terms of where we're standing here, what you're saying is the corrected scores indicate that the Cal-Sag channel at Route 83 is the best habitat in the CAWS, and you have reason to doubt that. Am I right?

DR. MACKEY: I would not call this the best habitat that I have observed in the CAWS.

MR. ANDES: Now let's switch to north shore channel at Sheridan Road which is used as the highest quality habitat in the CAWS. And what do the new corrected values tell you there?

DR. MACKEY: There was a significant drop in those scores, and they basically went, I believe, from a fair habitat quality to a poor habitat quality.

MR. ANDES: And what would that do to the Agency's assessment if their referenced highest quality stream is, in fact, in the poor range?

DR. MACKEY: Well, it would

certainly -- I would have some questions about the IBI scores from a comparative perspective. In other words, one of the reasons that you establish a reference stream for an area is to say you try to find the highest quality stream that you can to say this is what you should be able to attain. And it is the standard by which you measured the other IBI scores in terms of the, let's say, fish communities, okay? And if, for some reason, your referenced stream really doesn't represent the best of the best, then your comparisons are not going to be terribly meaningful in terms of when you're trying to evaluate one area versus another, or in terms of determining what is actually potentially attainable in the system. The IBI system, as I understand it, again, this is a more of a biological indeces to which I do not claim to be an expert. But from my understanding, and as described in the CAWS UAA report as they describe the IBI process, the establishment of a reference stream is an important component of that analysis for comparison.

MS. DIERS: Is there too much silt for the water body to be unable to attain IEPA's proposed aquatic life uses?

DR. MACKEY: It depends on where you are in the system. I would probably say no. And you have exposed bedrock here, and there are areas -- I think there are some areas in the CAWS where you may have sands, from what I understand. I have not imaged that yet. I have not been around the O'Brien Lochs and whatever. But I don't believe that is a lack of -- that is too much silt. I believe it's a problem of not having enough of a diversity of a substrate material. Let's go down a slightly different path here. You've got me on a roll here, okay, guys? This is important from a geological perspective. There's this concept, it's called provenance in geology, okay? And what it means, it's a very simple concept. And if you have a river and it's flowing across to a watershed, the river has plenty of energy, it has stream pumps, and it can transport materials that are available to it. And that's the key is

the materials that are available to it. In northwest Ohio when you look at the Maumee or the Sandusky River systems, you will find that that's an old glacial lake plane with virtually no sand available in that system; very, very small percentage of the sand that these rivers flow through. And so it's unreasonable to expect these systems to be sand rich. In other words, they have very high suspend loads because the only material available for them to transport is either clay or silt because that's all that's there. So let's switch that concept back to the CAWS, all right? In many areas of the CAWS, you've got limestone and bedrock. This thing was carved out of bedrock, all right? Not easily erodible material. What other materials are available to be transported in the system? Where is the sand going to come from? Where is there sand exposed in the CAWS that can be eroded by flows to actually put sand in the system? Now, there is sand in the system, I believe, but much of that sand probably came from earlier this last

century before we put road salt on. We probably sanded the streets and all that sand went into the storm water sewers and eventually worked its way into the CAWS. But it's not a huge volume of sand. So if you have no sand to transport, there's not going to be any sand available to help construct habitat. The same thing with gravel and coarse sand and all of those really need substrates that you need to perform, to create spawning habitat if that's what you're interested in doing here. Where is it going to come from? The flows in the CAWS system are highly regulated, all right? And typically in a gravel bed stream you have rock that's being tumbled and rolled because of high flow velocities, and they get chipped off and the rock gradually gets smaller and smaller. And I think, based on the flows in the Cal-Sag or in the San Ship or some of these other channels, we're going to be around for a long time before we see a lot of the bedrock around here broken down into gravel and coarse sand material. It's just

not going to happen in our lifetimes. And so we have a severe limitation in terms of the materials available to create the different types of substrates and different types of habitat structure in the CAWS. Okay.

MS. DIERS: Where did the UAA contractors call the North Shore Channel a reference stream?

DR. MACKEY: I believe if you looked at -- I'll have to see if I can find the page, but the Sheridan Road site was defined as the reference stream for the CAWS system, and I believe it's --

MR. ANDES: We can look for the page and cite it later.

MS. DIERS: That's fine.

DR. MACKEY: It's explicitly stated. They talk about the importance of the reference streams and how this was the best that they could do in the CAWS because this was predominantly an artificial system.

MS. DIERS: I want to go back to QHEI. Were high and moderate influence attributes included along with the QHEI in Rankin's

report which was Attachment A?

DR. MACKEY: Yes.

MS. DIERS: So it's more than just a number? I mean they're out there doing observations, correct?

DR. MACKEY: Yes.

HEARING OFFICER TIPSORD: Miss Diers, Attachment A, are you referring to the UAA report?

MS. DIERS: Attachment R, I'm sorry, was Rankin.

DR. MACKEY: I might point out that that's Table 2, I believe, that you were referring to. That has a number of different metrics and submetrics there, but it doesn't provide any sort of a meaningful waiting in terms of what's there and what's not there at the sites. There's a series of characters that show up in it, but there are no scores, per se.

MS. DEXTER: What parts of the CAWS have the limestone channel that you described?

DR. MACKEY: Bear in mind that I've

not been everywhere on the CAWS. What is certainly a significant portion of the Cal-Sag Channel has been cut out of bedrock. The southern -- significant portion of the southern section of the Sanitary and Ship Canal has been disposed, and those are the two primary areas where bedrock appears to be exposed in the banks and/or where channels were cut through bedrock.

MS. DEXTER: Did you see any evidence that the limestone is eroding along the sides?

MR. MACKEY: Yes.

MS. DEXTER: All right. And I'm not sure I understood you correctly when you said that there were no trees along the Cal-Sag channel. Can you describe what you mean by that?

DR. MACKEY: What I mean by that, I'm referencing that with respect to water, the aquatic system. There are many trees -- in fact, I believe there's some forest preserves, and it's really a pretty neat area. But those trees are sitting back off

the channel. They're not trees that are hanging over into the water for the most part, nor did I observe much in the way of any debris. I think maybe there were -- maybe I found three trees, trunks, if you want, on the bottom of the Cal-Sag Channel in the two-thirds of the area that I went. There's not much wooded debris there at all.

MS. DEXTER: You wouldn't say that there were no trees leaning over the Cal-Sag Channel?

DR. MACKEY: No. I don't think I would make -- I'm sure you could probably point someplace that there's a branch or two that hang over, but it's not the, let's say, a more, if you're thinking about shading effects or things of this sort, it's not the type of thing where the trees are actually in the water and providing some sort of shore line habitat structure in water, okay?

MS. DEXTER: And on your side-scan sonar data in Exhibit 182, you have a littoral zone here indicated. How wide would you say that is?

DR. MACKEY: In this location, my guess is probably 18 to 20 feet apart.

MS. DEXTER: All right. And do you know whether fish tend to live in the center of a channel or if they might migrate towards the sides of the channel?

DR. MACKEY: I don't know. I don't know the answer to that question. I'm not a fisheries biologist.

MS. DEXTER: Thanks.

MS. DIERS: I think we're back to Question 29 in the prefiled questions. On Page 6 of your prefiled testimony you state, "These new aquatic life tiers were based on a comparison of IBI percentile scores and QHEI scores at each sample location." Are you aware that it was discussed at the hearings and that Illinois EPA indicated that current biological conditions were not the primary criteria used to determine the proposed aquatic life uses?

DR. MACKEY: Actually, I'm unsure exactly what methods or criteria were used by Illinois EPA to determine the proposed

aquatic life uses. In the hearing testimony, Illinois EPA stated that they used habitat, for example, the QHEI scores, and individual attributes to determine the attainable biological potential of the waterway. And that's in Smogor's testimony on January 29, 2008, on Pages 238, 241, and 243. Illinois EPA also stated that, quote, we designate uses based on existing habitat and some other factors and then we set criteria to protect those uses. And that's in testimony by Sulski on January 29, 2008, on Pages 246 and 247. And later testimony, Illinois EPA indicated that a combination of habitat and fish IBI scores were used to categorize aquatic life uses within the CAWS. And that was testimony by Sulski on March 10, 2008, Pages 14 to 18. Then the following testimony, Illinois EPA indicated that they used a weight of evidence approach and/or a weight of evidence judgment call that includes the use of both habitat QHEI scores and biological condition, which are the fish IBI scores maybe with some MBI data thrown in

as well. That's unclear. To categorize aquatic life uses within the CAWS. And that's in Sulski -- testimony by Sulski on March 10, 2008, Pages 20 to 21, and testimony by Sulski on March 10, as well, on Page 30.

From what I can gather from the testimony, the process used by Illinois EPA was not based on a clear scientific methodology, but rather was based more on general perceptions as to what areas had good aquatic life potential and what areas had poor aquatic life potential.

In answer to your question, the IBI scores presented in the CAWS UAA report were not derived from current data, but represent a range of historic IBI values from fish data collected by the District during the period 1992 through 2002, and that's in the CAWS UAA report on Page 5-8. However, in IEPA's statements of reasons, this is the section on aquatic life use designations, IEPA explicitly describes ranges of QHEI and IBI scores for Aquatic Life Use B and Aquatic Life Use A

designations in the CAWS. Moreover, the prefiled testimony of Sulski on Pages 16 and 17 and the hearing testimony of Smogor on Page 238, 241, and 243, the dates are the same as we had earlier. On Sulski on Pages 14 and 18, and Essig on Pages 19 and 21, clearly describe the ranges and uses of QHEI and IBI values and the use of Figure 5-2 of the CAWS UAA report and how those values justify the distribution of Aquatic Life Use A and B waters.

MS. WILLIAMS: Excuse me, Mr. Mackey. You lost me when you said the dates are the same.

DR. MACKEY: I'm sorry. In my text here I don't have the dates that were set testimony. It's the same dates that I referred to earlier when I was talking about the testimony --

HEARING OFFICER TIPSORD: That April 23?

DR. MACKEY: Yes. I believe so.

MR. ANDES: March 10.

MS. WILLIAMS: You referred to several

dates. That's why I'm confused.

DR. MACKEY: Okay.

MR. ANDES: I believe March 10.

DR. MACKEY: March 10. I believe it's March 10.

MR. ANDES: 2008. We can double-check that.

DR. MACKEY: We're going to get there in a few seconds. Let's go back to the handout on the offering QHEI scores. We'll look at the top --

HEARING OFFICER TIPSORD: Exhibit 181?

DR. MACKEY: Yes. And the thing I want to point out here, as I indicated before, what I'm going to ask you to do at this time is to ignore all the big black circles, the QHEI scores. Because right now the question is about IBI scores and whether or not they were used for the aquatic use designation. What I want you to look at are the box-and-whisker plots. Those are the rectangles and these are -- and the error bars associated with the IBI scores. That's the lighter things behind the block dots.

And you'll note that I have highlighted in green the A designation waters, and in sort of red or orange color, the B designation waters. And look what the UAA contractor did was if you will see on the far left side, the Sheridan Road site, that is the reference site. So what they did is took the 75th percentile of that site and said that is going to basically be the boundary for, in essence, general use waters. In other words, IBI scores higher than that are general use waters. And then if you look at the 25th percentile line, that's a black, the black horizontal line that says 75th percentile IBI of all data within the CAWS. What they've done is looked at all of the historic IBI data and then calculated the 25th percentile from all of the data sets, and that's this lower line, okay, the lower black horizontal line. Just bear with me here. Because where I want to go is to basically say that with two exceptions, that the A and B designations are almost an exact match for where the IBI scores either fall at or above this 25th

percent -- the 75th percentile IBI for all of the CAWS versus the areas that don't, that fall below the two exceptions are outlined in the red boxes. One is the inner harbor area where you have very low habitat scores, but you have very high IBI scores. And I suspect that is because of proximity to Lake Michigan that you're probably getting the higher fish IBIs because you actually got some lake water there or there is some lake access at one time or another. And at the Cicero Ave. score, and this is interesting, this has some of the -- not the lowest, but certainly the lower IBI scores, and yet Illinois EPA has designated that as an aquatic Use A water.

The point is is that there is a very, very good correspondence between what the UAA contractor did here in terms of the percentile analysis and the IBI scores. It's a virtual lay-down for how they actually did, how they actually had geographically designated aquatic life Use A and B waters.

MS. DIERS: Did Illinois EPA testify that they exclusively relied on Figure 5.2 in

the CAWS UAA?

DR. MACKEY: No, they did not.

MS. DIERS: I'm going to go to prefiled Question 31. In what way and for what purpose do you believe the Illinois EPA relied almost exclusively on fish IBI scores?

DR. MACKEY: That's Question 31. Well, I basically would -- I don't want to give the same testimony again, but I think that, in essence, this upper figure here entitled original QHEI scores, again, basically tells the story that there is a very, very good correspondence between the A and B water designations. It's almost an exact match for the variations in the IBI scores here.

MS. DIERS: Question 32: In what way and for what purpose do you believe that the Illinois EPA adopted the percentile approach to which you refer?

DR. MACKEY: As I stated in my prior testimony, I believe you can see that the 75th percentile IBI line for all of the data within the CAWS seems to be a very clear sort

of demarcation line, if you want, between the A and B waters as proposed by Illinois EPA.

MS. DIERS: Question 33: On Page 6 of your prefiled testimony, you mention that spatial distribution of the CAWS sites selected for QHEI analysis in 2004 were not based on an appropriate statistical sample design. Does the QHEI data from these sites provide no useful information for determining the biological potential of the CAWS?

DR. MACKEY: All right. I have real concerns if these are the only -- if the QHEI data were the only habitat data used to determine the biological potential in the CAWS. And that is assuming that Illinois EPA did, indeed, use the QHEI data and habitat. Primarily because the QHEI was designed to be applied to natural systems, not artificial systems such as the CAWS. Rankin in 1989, they were testing and developing this whole sort of indicator system described in the QHEI as a macro scale approach that uses qualitative metrics to describe the, quote, emergent properties of habitat. Examples of

emergent properties would be sinuosity or pool or riffle development. These are the large macro habitat features, okay. This is what QHEI is designed to look at. However, because many of the metrics and submetrics are held constant throughout most of the CAWS, only a few of the emergent properties of habitat or the QHEI metrics are actually used to calculate QHEI scores. And I believe we have an exhibit for this. The point is here -- sorry.

HEARING OFFICER TIPSORD: I've been handed QHEI metrics in the CAWS. If there's no objection, we will mark this as Exhibit 183.

Seeing none, it's Exhibit 183.

DR. MACKEY: My printer only has three colors: Black, red, and green, so.

Where I'm going with this is that the QHEI is a metric or an indicator that's designed for natural systems, and primarily for degraded natural systems. The CAWS is an artificial system. The CAWS was never a degraded system. It never had high

quality habitat to begin with because it's basically equivalent to a concrete pipe, okay, in many respects. And because many of the characteristics of the CAWS are pretty much constant or are the same throughout most of the water, not all, but most of the waterway, many of the submetrics here are basically the same throughout the entire waterway. And this is another reason why it's really important to get or take a look at those original field data sheets to see exactly what different submetrics were held constant throughout the system and/or how much did those scores vary. Because right now we really don't know. I have no idea between one site to the next what was it that was actually varied. So if we take a look at this exhibit entitled QHEI Metrics in the CAWS, and there's some text to it which is of interest, but really the table is the key. What I have attempted to do here is to break out the major QHEI metrics, and it's in the very left-hand column. There are really six major ones, okay. And then the next column

over called metric component rates out the different factors that are sort of summed together that make that total QHEI metric, and I've shown you what the scoring ranges are. And what that means is that you actually have the ability to assess which of these components is more important than others relative to the potential range of scores. And it also, the next column shows the metric maximum score. In other words, what is the max -- if this is -- if this is God's gift to the earth in terms of habitat, this, the -- you know, you end up with a total score of 100, a QHEI score of 100, and this is what each of these components, the maximum values, could be. And then on the far right-hand side what I've done is for the CAWS, is I have basically identified where I believe these metrics were in essence held constant throughout most of the waterway system. And those are the areas that are in red. So if they are being held constant, the only changes or variation that you get in the calculated QHEI scores are based on two

sub -- basically on the two QHEI metrics: No. 1 and 2, substrate and instream cover, and to a lesser extent perhaps some submetrics of the riparian zone. I don't have the page number, but in the UAA, the CAWS UAA report, I do know that they talk about gradient being held constant. And the reason -- where I inferred whether or not these values varied is that if you look at Table 2 in Rankin's report where you talk about the moderate influence and high influence and low influence and you see the individual submetrics, for many of these things, the values are the same for every site all the way through. And that means that more than likely they're being held constant for the entire waterway. So these scores are -- the QHEI scores, if they're calculated properly, are based on just two, possibly three components, and all of the rest of the values are held constant. This is one of the reasons why the QHEI has some severe limitations in this type of a system. It was not designed for an artificial system,

okay.

MS. DIERS: So if we're not supposed to use the QHEI for this type of system, what are we supposed to use?

DR. MACKEY: Well, that's what the habitat evaluation improvement study is attempting to do. It's currently ongoing and funded by the District. It's taking a good -- as I understand it, it's taking a good, hard look at physical habitat in this system, a more detailed sampling regimen. They have done a number of things in addition that I think are very important in terms of collecting additional habitat data, and I'm not one who wants to see studies going on forever, but you've got to have some minimum information. And I don't think we even have the minimum information yet necessary to adequately characterize the habitat in the system. The idea is, in the study, is to do the physical habitat assessment. I understand that they're looking at some biological data as well and they hope to integrate that together and actually develop

an index that may be much more appropriate for a highly urbanized or an artificial system such as the CAWS rather than using a metric or an indeces that was developed for natural system, a natural system that has been degraded. They're two completely different animals.

MS. DIERS: So what the habitat study will be developing is something that's never been done in the United States; is that correct?

DR. MACKEY: That's probably correct.

MR. ANDES: Do we want to take a break?

HEARING OFFICER TIPSORD: Yes. Sure. Ten minutes.

(Short break taken.)

HEARING OFFICER TIPSORD: We can go back on the record. Okay. We're back on the record. Miss Diers?

MS. DIERS: I think we're on Question 34. What statistical design guarantees that additional physical habitat information from the CAWS will provide more

accurate characterization of the biological potential of the CAWS than does the currently available data?

DR. MACKEY: Okay. As you may know, I have some very strong concerns about the habitat data that was used as part of this physical habitat assessment used as part of this aquatic use designation. The habitat sampling sites used in CAWS UAA report and in the Illinois EPA analyses were based on existing Water Reclamation District fish sampling sites. And I'm referring specifically to, I think it's Attachment R of the Rankin report. And in terms of what I would do, in other words, to improve this, the sampling protocols, is first in addition to using the sites that were selected for the biological sampling, I would also select additional sites based on the inferred physical processes and anticipated differences in substrate distribution and/or in-stream habitat structure within the CAWS. In other words, I would have looked at the system and said where might I expect to see

some changes in substream, where might I expect to see accumulations of woody debris or other types of in-stream structure that may be important from a habitat perspective. And I would also use remote sensing and geophysical tools such as side-scan sonar, which you've seen a small example already, to continuously map the entire submerged area of the channel within the CAWS. Then I would use the acoustic data to select additional sampling sites to confirm substrate materials and to identify areas with in-stream and bank edge habitat structure. If water clarity is appropriate, I would attempt to validate substrate and instream bank edge habitats with underwater video. I own underwater video cameras and use them on a regular basis on Lake Michigan and the other great lakes in order to validate what I see with the side-scan sonar. Unfortunately, having been on the CAWS waterway, it's -- I'm not sure what the second depths are, but it's very turbid, and there's not a lot of light at that depth. So I don't think the underwater

camera would work. But you can do some additional sampling work either with a Ponar samplers or other types of sampling devices to validate what you see on the side-scan data.

Second -- And that takes care of the instream habitat and substrate data which is really, really important as we know the key components as part of the analysis. Second, I would undertake a comprehensive inventory of the CAWS shore line where I would document type, composition, location, distribution, and condition of shore line and bank edge features in the CAWS. And I would use these data to identify and map the location of the potential bank edge habitat structure. In other words, for example, some of Illinois EPA's littoral zones, I've taken a really good close look at those areas and to assess the pattern and juxtaposition of different type of bank edge habitats. The key thing here is that, and this is a real problem I have with the proship (ph.) Rankin used is that they didn't look at what's along

the banks. When you look at aquatic habitat in these channel systems, you either have structural or materials on the bottom of the channel or on the sides of the channel. You know, what's sitting up here hundreds of feet away is not going to make any difference for the most part for the fish that are in the water. And so if you're just going to look at what's on the bottom of the channel and not look at what's along the sides or in the banks, you're missing a big part of the picture. Let's use an example here. On the Sanitary and Ship Canal you have the bedrock walls that goes straight down, okay? And I will tell you there actually is some structure down at the bottom. We'll talk about that another time. But from there you transition into different types of materials, more I'm going to call it alluvial materials and those materials erode fairly easily or have a potential to. So those banks have been armored and they've been armored with different types of materials. In many places it's concrete, in many cases it's sheet piled

walls, vertical, but in many places and some extensive places they construct what they call revetments. These are large blocks of stone or rock or even concrete slabs that are sort of filed up along the side at a fairly steep angle to protect shore line from erosion. And what most people don't remember is that what you see up at the surface, that extends down below the water surface well out into the channel. And actually I've mapped a fair number of those areas with the side-scan sonar. And the point is is that you can infer what areas may have additional habitat potential by doing this sort of comprehensive shore line inventory. This is really important, and this is something that was not done as part of this habitat assessment.

And, third, what I would do is I would integrate shore line assessment, bank edge materials, and what you see just above the water and just below the water with the in-stream habitat. And you build a series of data layers and you put them together, and that allows you to actually connect the two.

I see this type of thing here along the bank edge, this is generally the type of thing that I see down in the channel itself; not only in the bank edge, but in the instream portions as well. And I would use that data to construct a set of data layers that can be used to illustrate the type, quality, location, distribution, and connectivity of these different types of habitats. And the connectivity issue is really, really important. Because you need to understand if you have a habitat of a certain type here, what's adjacent to it. And is there a reasonable expectation that organisms that use this may also use this for the purpose of the adjacent habitats for a different purpose. Without understanding that habitat juxtaposition and connectivity, you really don't have an understanding of habitat at all. In fact, it's just a pile of rocks sitting in the water.

MS. DIERS: So is your habitat evaluation something that you're involved in, is it using those recommendations that you

just stated?

DR. MACKEY: Yes.

MS. DIERS: And do your recommendations involve a statistical design?

DR. MACKEY: The answer to that would be no.

MR. ANDES: Can you clarify what you mean by a statistical design?

DR. MACKEY: Well, a statistical design is basically a mathematical process whereby you have, let's say, a certain expectation with certain distribution of, let's say, organisms or whatever. And you design, you use a statistical design to sample that distribution in a way that is statistically valid, such that the result that you get are actually real and you can actually assess the error and have some competence in the results.

MS. DIERS: So what's wrong with the District's choice sampling sites that the EPA used in their evaluation?

DR. MACKEY: There is nothing wrong with the District's choice of sampling

locations. But you have to remember that the objectives and the reasons why, if I understand correctly, those sites were selected were not to perform a habitat assessment. They were performed to evaluate the aquatic communities associated -- that may be associated with outfalls or other specific characteristics within the waterway. The reasons that those sites were selected were different than for a habitat assessment.

MS. DIERS: Can you explain the reasons they were selected?

DR. MACKEY: I cannot. I would refer you to someone who works with the District and/or has responsibility for those sampling locations.

MS. DIERS: Do you know the bank edge habitat requirements of aquatic life that can potentially live in the CAWS?

DR. MACKEY: Well, No. 1, Illinois EPA has not defined what the organisms are that could potentially live in the CAWS. And, No. 2, that is a biological question. When I do my habitat assessment work, I am focussed

almost exclusively on the physical characteristics. I am a physical scientist by nature. But I always work cooperatively with the fisheries biologist or with aquatic ecologists, and I rely on their expertise. And it's actually the integration of that expertise with my expertise that usually ends up with a sum that's greater than its parts and a better understanding of the habitat.

MS. DIERS: How will this integration work here?

MR. ANDES: This integration in terms of the habitat study? Is that what you're asking?

MS. DIERS: Yes, the habitat study of the biology.

DR. MACKEY: That's actually going to be done, I believe, internally by LimnoTech probably in conjunction with the District. And I have not been -- I have not had discussions with LimnoTech as to actually how that integration is going to work. So the answer is I don't know.

MS. DIERS: Thank you. Prefiled

Question 36: On Page 7 of your prefiled testimony, you state that the channel morphology of flow characteristics of South Branch Chicago River differ distinctively from those of the South Fork of the South Branch Chicago River. What information is the basis for this conclusion?

DR. MACKEY: My conclusion is based on several things: No. 1, I've been there. I actually ran the side-scan sonar survey through that confluence and also above the creek until side-scan -- the fish, which was totally in the water, actually was -- it was like real crop agriculture on the bottom. Let's put it this way. It was in the bottom it was fairly shallow. So I have an idea of what the actual bottom materials are and what that structure actually looks like.

Second, the U.S. Army Corps of Engineers, and this also has -- and the USGS, I believe, both have performed detailed bathymetric surveys within Bubbly Creek or within the South Fork of the Chicago River as they have also within the Sanitary and Ship

Canal. And there are some very clear differences based on that bathymetric data in terms of the bathymetry within the two different channels.

Third, also based in part on the field examination, and also if you look at the NOAA navigation charts which extend down through the Chicago waterway in that South Fork area, there are clear differences in water depth marked on the navigation charts and also clear differences that show areas that are generally navigable and not navigable. It's very clear if you've been into the Bubbly Creek area, South Fork area, that it's very difficult to get some of those large barges up that system. It's very, very narrow. So it's not subject to commercial navigation. So there are some substantive differences.

MS. WILLIAMS: Did you say NOAA navigation charts? I'm sorry to interrupt.

MR. MACKEY: NOAA, the National Oceanic and Atmospheric Administration. They generally, they generate virtually all of the

navigation charts used in the lakes and in many of the navigable portion of the rivers.

MS. DIERS: Question 37: On Page 7 of your prefiled testimony, you criticize the Illinois EPA proposal for not including a comprehensive habitat assessment that includes knowing the relative percentage, location, pattern, and distribution of shore line types and bank edge habitat for each CAWS segment and knowing the pattern in juxtaposition of different types of aquatic habitats for each CAWS segment. Is it your opinion that the Clean Water Act requires this type of comprehensive habitat assessment for a defining and designating aquatic life uses in fresh water streams throughout the United States?

DR. MACKEY: I'm not an expert on the Clean Water Act. I want to make that clear. So taking that as a caveat, I don't know if the Clean Water Act would require a comprehensive habitat assessment for every fresh water stream throughout the United States. But common sense would dictate that

where there is a reasonable expectation that the system is habitat limited, and that would be especially in an artificial waterway such as the CAWS, an assessment of physical habitat is necessary, and I believe required, to determine whether or not a proposed aquatic life use can be attained. Unfortunately, Illinois EPA has not provided any data information or analyses to show that there is sufficient aquatic habitat to support containment of the proposed aquatic life uses in the CAWS. Irrespective of improvements in water quality, the proposed aquatic life use is not attainable if aquatic organisms are habitat limited.

MS. DIERS: Question 39: On Page 8 of your prefiled testimony you state, however, Illinois EPA contends that these shallow water bank edge habitats in the Calumet-Sag Channel should be considered to be spawning habitat, which is problematic given that no direct data was -- is available to support that contention. Could you please point out in the hearing record where Illinois EPA

contends that shallow water bank edge habitats in the Calumet-Sag Channel should be considered to be spawning habitat?"

DR. MACKEY: This statement is an inference from the testimony and the information provided by Illinois EPA. The primary reason to designate Cal-Sag Channel as an Aquatic Life Use A water is based on the presence of a shallow water, predominantly based on the presence of a shallow water littoral study, L-I-T-T-O-R-A-L, associated with bank edge areas of that channel. And I'll refer to you the prefiled system of Sulski on Pages 16 and 17 and the hearing testimony by Rob Sulski on March 10, 2008, on Pages 30 to 31; Smogor on -- testimony by Smogor on March 10, also, 2008, on Page 32; and Essig on March 10, 2008, on Page 35. Since the primary physical difference, according to Illinois EPA, between the Chicago Sanitary and Ship Canal and the Cal-Sag Channel is the presence of an undocumented shallow water -- I'm sorry -- is the presence of a shallow water littoral zone

in the Cal-Sag Channel, one may infer that since Illinois EPA is proposing that the Cal-Sag Channel be designated as a type A water, that Illinois EPA believes that these shallow littoral zones within the Cal-Sag Channel may serve as potential spawning sites and/or refuges for early life stage fish. Otherwise why apply a dissolved oxygen standard designed to protect early life stage fish during the months of March through July to Cal-Sag Channel?

MS. DIERS: What do you mean by direct data? That was Question 40.

DR. MACKEY: Yes. Direct data means sampled or directly observed, not inferred. And the type of data collected will depend on the type of water body and the complexity of the system. In the case of a complex artificial system such as the CAWS, Illinois EPA has not provided data or analyses sufficient to show that the proposed aquatic life uses are attainable for that associated physical chemical standards.

MS. DIERS: This is 41: Do you

believe that no fish are spawning or propagating is occurring in the Calumet-Sag Channel?

DR. MACKEY: I believe we discussed this earlier in another question, and I'll just restate that no data or evidence has been collected by the District or by the CAWS UAA contractors to indicate that spawning activity has occurred in the Cal-Sag Channel, nor have eggs or larval fish indicative of spawning activity been collected by the District from the channel. Until spawning activity is observed directly and/or eggs or larval fish are recovered from potential spawning sites, one cannot conclude that fish are spawning or propagating in the Cal-Sag Channel. I think the point here is that if you're proposing an aquatic life use standard that requires, in essence, general use, dissolved oxygen standards, I would suspect or I think it would be appropriate to say that, hey, you're doing this for a reason and that you have -- and that you actually can show that fish actually are using these areas

as spawning habitat. Right now there's no data available that show that that's the case.

MS. DIERS: Question 42: How does one determine scientifically with direct data that no fish spawning or propagation are occurring in the Calumet-Sag Channel?

DR. MACKEY: Okay. Your questions are really interesting, because it's really difficult to prove a negative. However, inductive reasoning leads to the logical conclusion that spawning activity is not occurring within the Cal-Sag Channel. Again, first, no evidence is presented by Illinois EPA to demonstrate that fish spawning and propagation are occurring within the Cal-Sag Channel.

Second, no data or evidence has been collected by the district or the UAA contractors to indicate that spawning activity has occurred in the channel, nor have eggs or larval fish indicative of spawning activity been collected from the channel.

And, third, in Dr. Melching's hearing testimony on November 17, 2008, he presented an analysis based on the habitat's suitability indeces that describe the CAWS as being habitat limited for early life stages of largemouth bass, channel catfish, and smallmouth bass, the three species that have been specifically identified by Illinois EPA. They haven't identified any others, okay, at this point.

So, based on what we know about the habitat requirements of an early life stage fish, the HSI, the habitat suitability indeces suggest that the Cal-Sag Channel is not the place to be. In other words, it's really not a good place for fish to spawn. This combined with the fact that we haven't recovered any eggs or larval fish from the Cal-Sag Channel and no direct observation of fish spawning activity in the Cal-Sag Channel doesn't support the idea that fish spawning or propagation are occurring in the Channel. I mean you don't see it, you don't collect any data suggesting it's

happening, so it's difficult to conclude that it is without some documentation. In other words, until spawning activity is observed directly and/or eggs or larval fish are recovered from potential spawning sites, one cannot conclude that fish are spawning or propagating in the Cal-Sag Channel.

MS. DIERS: Do you know if the district tried to collect spawning data in the CAWS?

DR. MACKEY: I don't know.

MS. DEXTER: Are you saying that you believe that you have enough information where you sit right now to decide that this is not a false negative reading?

DR. MACKEY: Could you --

MS. DEXTER: That you say that there's no data that shows this, and you just listed a bunch of reasons why you think that this is not -- Because we don't have data you just said it's difficult to prove a negative. But then I took your testimony to say that you think that the negative has been proved.

DR. MACKEY: I'm not saying that. I'm

not saying that the negative has been proved. All I'm saying is that until you see some larval fish and you see spawning activity in this system, that is I don't believe you can make the conclusion that spawning activity is occurring in the Cal-Sag.

MS. DEXTER: Right. But you can't conclude at this point that it is not occurring?

DR. MACKEY: I can't make a conclusion either way.

MR. ANDES: Is it reasonable to infer that it is not occurring based on the available --

DR. MACKEY: I think that's a reasonable inference to make based on the data that's been collected.

MS. DEXTER: Even though you don't know how adequate the sampling equipment is at getting larval fish and getting eggs.

MR. ANDES: I think you're putting words in his mouth.

MS. DEXTER: I asked him earlier today whether he knows about the --

HEARING OFFICER TIPSORD: She did.

DR. MACKEY: I do not know -- I do not know what type of equipment is being used for sampling. I am not a biologist.

MS. DEXTER: And you don't know whether that equipment is actually adequate to sample --

DR. MACKEY: That's correct. All I can say is that up to this point no larval fish have been collected or eggs or spawning activity has been observed in this system.

MS. WILLIAMS: Didn't you just say you don't even know if the District has tried?

DR. MACKEY: I have no idea if they have. All I'm saying is look at the data that has been collected. There are no reports of larval fish. That's all I have to say. Whether they've tried, whether they've used the appropriate equipment or not, I cannot address that question because I'm not a biologist.

MR. ANDES: Did Illinois EPA in support of this ruling put forward any evidence of spawning or larval fish?

DR. MACKEY: To my knowledge, no.
MR. ANDES: Thank you.
MS. DIERS: Did you review the ichthyoplankton and fish size data in the record? And, if so, what is the relevance of the data in determining whether early life stages use is or is not existing and, therefore, attainable in the CAWS? And that's a follow-up question.
DR. MACKEY: I understand. I have a response to that question. I know that the Illinois EPA has suggested that different size classes of fish may indicate the presence of early life stage fish, and I know there was some reference made to three inch or five inch size fish from the data. Personally, I have not reviewed the size class data in detail. Again, that is not my area of expertise. What I would also say based on experience in working with fisheries biologists in rivers and also in lakes, that the different size classes are not necessarily determinative of spawning or reproductive activity. Different size

classes quickly indicative of different growth rates and/or the presence of different genetic strains of the same species. And I had mentioned this before. We have seen this -- I've seen this in lake environments where there are different strains that have different growth rates as a function of age. Moreover, unless there was some direct evidence that link these fish to specific spawning locations, even if you have small fish there, you don't know if they came from within the Cal-Sag Channel or they came from Lake Michigan or if they came -- if they somehow went through the electric field barrier in Romeoville and came -- well, they could have come across from the flood waters from the Des Plaines River. I mean there is a connection there that occurs. So, again, this is the idea about direct evidence showing. Present some information or data that says there are fish spawning data. We've got eggs in these substrate materials, that we have larval fish that we found. And then we move forward from there. But right

now that data does not exist to my knowledge.

MS. DIERS: I want to jump back to the comprehensive habitat assessment we talked about. Can you give an example of a UAA where it's this type of comprehensive habitat assessment approach you've advocated has been used?

DR. MACKEY: No, I can't. And the reason is is that in general I have not been involved much with the UAA process; and so, therefore, I do not know what necessarily has been done across the country with the UAA samples or assessments.

MEMBER RAO: May I ask a follow-up. You mentioned that you had done the similar kinds of studies in great lakes and other -- and rivers in Ohio. In what context were you asked to do these evaluations?

DR. MACKEY: That's a really good question; take a minute or two to answer this one. My work in the great lakes and in the tributaries to the great lakes, as I say, is focussed primarily on habitat assessment. And I use a side-scan sonar and wadable

systems. I actually walk the streams with GPS equipment and actually map the substrate contacts and map the channel morphology. My work is done primarily with the natural resource management agencies. I've worked with virtually every DNR in the great lakes basin. I also worked with the provincial fisheries biologist, the Ontario Ministry Natural -- Ministry of Natural Resources, Department of Fisheries Oceans in Canada, and Environment Canada. I've worked with all of those folks doing fisheries related and habitat assessment work, not associated with UAA. This has to do with management of the fisheries resources.

Couple important points to make here, this is a really good question, I just want to touch base on this. In all this work for many years that I've done with all of these resource management agencies, the agencies that are actually charged with managing fisheries in the great lakes, and that includes the riverine stocks as well. Never once have we ever used the QHEI

analysis for habitat assessment to identify any sort of restoration or enhancement opportunity. Only times -- and I have calculated the QHEIs. We do it on a very infrequent basis. The only times we have to do that is when we're trying to satisfy a regulatory requirement of an EPA of either -- not so much Illinois EPA, but Ohio EPA or the organizations in Michigan or the other states. The natural resource management agencies, the most of the DNRs do not use the QHEI for habitat assessment, period. Okay. It just doesn't work to identify restoration opportunities. The context of what I do is in lakes and in shore areas I am working on identifying potential sites for protection and restoration work and/or for fish stocking efforts. An example would be on the project with the U.S. Fish and Wildlife Service, New York EBC (ph.), USGS, Ohio Division of Wildlife and Ontario Ministry of National Resources and Environment Canada, the Eastern Basin of Lake Erie. We are using side-scan sonar and other tools to map potential lake

trout spawning habitat in the eastern basin of Lake Erie. Lake trout were extrapolated in the early 1900s from the lake. One of the fish community goals and objectives of the Great Lakes Fishery Commission is to restore native fish species of which lake trout is one. So I've been mapping these habitat areas, identifying these areas on the lake bed because nobody knows where they are based on a set of characteristics similar to the habitat suitability indeces. Over the next three to five years, the fish hatcheries in the province of Ontario and U.S. Fishing and Wildlife Service are ramping up production of lake trout. And there is going to be a massive stocking done within the next three years where they're going to be placing these fish on the locations on the habitat that we've identified as part of the study to maximize the potential sites -- success in terms of restoring reproducing sustainable populations of lake trout in Lake Erie. This is the type of thing that we do. We are also doing this in riverine systems. I've done

the habitat mapping in Sandusky River. And, in fact, involvement now at the major dam removal there in order to open up 22 more river miles of potential spawning habitat for walleye. That's the context in which I'm working. It's about protecting, improving accessibility, connectivity for habitat in order to improve the aquatic communities. And that includes not just the four fisheries and commercial fisheries, but we're also working to improve the forage fisheries which there are other species. Does that answer your question?

MEMBER RAO: Yes.

HEARING OFFICER TIPSORD: Can we go off the record for just a second.

(Off the record.)

HEARING OFFICER TIPSORD: Back on the record. Miss Diers, I think we're ready for you.

MS. DIERS: Prefiled Question 6 on Page 96. Do you believe that Cal-Sag Channel should be designated as a Use B water as Illinois EPA proposed rather than a Use A

water? And, if so, why?

MEMBER JOHNSON: I'm still thinking about his answer to the last question. And I guess the natural follow-up to me would be had you been asked to look at the CAWS system to determine whether or not it had the potential for restoration, what would be your conclusion?

DR. MACKEY: I would say that in certain reaches of the CAWS that there is potential for restoration. I believe that whatever type of restoration occurs has to be done intelligently and efficiently. I will tell you right up, straight up right now that I don't believe necessarily that system-wide solutions are the answer here and that it doesn't make sense to impose system-wide standards necessarily, particularly if only portions of the system may have a potential habitat to actually accomplish some of the things that you wish to accomplish within this system.

MEMBER JOHNSON: Thank you.

MS. DIERS: So what reaches do you

believe could be restored?

DR. MACKEY: That I cannot answer at this point, No. 1, because existing data sets are not adequate to answer that question. And, No. 2, I would wait and see what the results are from the habitat evaluation improvements study are; I think a much better handle on what the actual physical habitats are in this system.

MS. DIERS: That will take me back to our Question 6 that I asked before we did the follow-ups. Do you believe the Cal-Sag Channel should be designated as a Use B water rather than a Use A water? And, if so, why.

DR. MACKEY: Well, I'll first put in the caveat and say, again, that I don't believe that -- I think the Cal-Sag Channel there were two sampling sites for the entire length of the channel, and that's two sites were looked at that were evaluated, and that basically has characterized the entire Cal-Sag habitat condition. And those sites were spaced I think a little over ten miles apart. So there's an awful lot that can go

on between those sites. And so I really think that we don't have adequate data to -- for me to make a necessarily informed decision. I will give you an answer in a second. And the caveat is this, that I think we really need to see what comes out of this habitat evaluation and improvement study to see what may actually be possible. But based on the available data I would say that, yes, I believe the Cal-Sag Channel should be designated as a Use B water rather than a Use A water. And my initial assessment is based on the reconnaissance field observations of the shore line features, some of which you've seen in the handout already, an examination of the high resolution bathymetric data collected by the U.S. Army Corps of Engineers and that data set is, I believe it's a one foot contour or less, six inch contour interval. It gives you a real good feeling of how the depths are changing in that system, and there's not a lot of shallow water area there. It's very small. Based in part on that data and on the

side-scan data, this littoral zone that Illinois EPA refers to may represent it most at 5 to 8 percent of the total channel area, if you want. And one of the things I would say about the littoral zone, Illinois EPA has not clearly defined what it means by a littoral zone. In the lakes it usually means depth of closure or wave base. And that is that -- it's the depth at which waves no longer significantly impact the bottom, and that would be the littoral zone in the lake. And the riverine system or system such as the CAWS you have to say, well, you're not going to have ten footers generally and the winds aren't strong enough to do that. So the primary source of wave energy there is probably going to be in barges and tows. And I don't know what the wavelength of those waves would be, but I'm guessing that might be a wavelength of maybe six to seven feet between the crest, half of that distance is the depth that the waves are close to bottom. So you're looking at maybe water depths of three feet or less would be defined as a

littoral zone. Those areas are very small, probably less than 1 to 2 percent of the total channel bottom area; very, very small area along the edge.

MS. DIERS: The habitat study that you're working on, are you currently sampling in the Cal-Sag Channel?

DR. MACKEY: I am not sampling, I'm not doing any sort of biological sampling or any sort of direct sampling in terms of dragging sediments or whatever at this point. I've done side-scan sonar and that's all I've done, and done visual observations as well.

MS. DIERS: I think it was stated that two sites were sampled in the Cal-Sag Channel, the UAA --

DR. MACKEY: Yes.

MS. DIERS: Is your goal with this study to do more sampling in the Cal-Sag Channel, more than two sampling sites?

DR. MACKEY: I believe that there are several more sites that are -- have been identified in that site. I cannot specifically tell you what they are, but,

again, if you have -- if you are able to utilize a device, a remote sensing device such as the side-scan, what it allowed you to do is to basically generate an image of the entire channel bottom. And then what you would do is you say I have maybe three or four different types of acoustic patterns or reflectors that I see, then you go and sample each of those types of reflectors. And you would sample like a bedrock area if you can, you know. Sampling bedrock is a tough thing. Usually the sampling devices, they bounce right off. But for areas where you think you can't clearly distinguish between silt or sand or gravel, you would see a certain type of acoustic pattern and you'd sample that. And if you see a similar type of acoustic pattern in another place in the channel, you'd sample that. If they both come up as gravel, you'd say, in general, every time I see that type of acoustic pattern I can actually call that gravel. The way you go about doing this analysis is that you saw just from these small images here, this is

all geospatially correct. In other words, this is the GIS. This is a GeoTIFF image, georeferenced; accuracy is within one meter or less. So what you can do, you can actually go in there and actually digitize and actually generate polygons around each of the substrate types. And assuming you're in the right projection, that allows you to calculate how many square meters of bedrock is exposed on the bottom of the Cal-Sag Channel, how many square meters of silt, how many square meters of sand that exist of any of the substrates. And you can actually walk up or look at any reach, and you can actually calculate relative to the area surveys exactly what percentages of water are there. And if you want to behave like a fish say you're swimming in from Lake Michigan, and I don't know why you'd want to do this, but if you do, you can actually go through a series of distributions that actually tell you how much and what type of habitat you have crossed on your way in. This is what we do with some of these rivers in Ohio and in

Canada and in Michigan.

MS. DIERS: So is this what you're doing in the CAWS now?

DR. MACKEY: This is something that potentially could be done in the CAWS. Whether it's actually going to be done, I don't know at this point.

MR. ANDES: And I would add to that in terms of the details of being done with regard to that study, I would say that we could get other people to answer those particular questions sort of beyond the particular work that Dr. Mackey is doing.

DR. MACKEY: My work is very constrained. It's focussed predominantly on the side-scan sonar data.

MS. DIERS: Who would those witnesses be?

MR. ANDES: Let me get back to you on that. We will identify them.

MS. DIERS: Thank you.

MR. ANDES: I would also just -- I want to add, I think we stopped Dr. Mackey in the middle of his explanation on the Cal-Sag

Channel in terms of the reasons why it should be Use B.

MS. WILLIAMS: I thought he answered the question.

MR. ANDES: He had more to go.

DR. MACKEY: It's just a couple more sentences here. Basically the side-scan sonar data that I've collected from the Cal-Sag Channel -- sorry about that, guys. We got twisted off here on a different topic for a while and it takes a while for me to reengage.

HEARING OFFICER TIPSORD: That's quite all right.

MR. MACKEY: With the side-scan sonar data is that I've done certain reaches of the Cal-Sag, but I've also done in confluence and worked my way up into the San-Ship as well. And in terms of the relative differences between the two, now if you recall the Sanitary and Ship Canal is designated as an Aquatic Life Use B water, okay? But based on the side-scan sonar data what's really interesting is that there are some

differences between the two, but they are very, very minor. It's not surprising, actually, along the northwest wall that vertical bedrock wall in the San-Ship down to the bottom there there actually is a ridge, if you want, that's made up of moderately coarse material, and in terms of its dimensions are very similar to what you actually see in the Cal-Sag. The Cal-Sag, that little narrow littoral bench there is shallower, but the same type of habitat structure is in the San-Ship as well. So some of the differences in terms of -- that Illinois EPA has used as the basis for saying, well, gee, the Cal-Sag is really a different system. You know, if you look at it a little bit more closely and a little bit more continuously, there's a lot more similarities than there are differences. And I don't believe that those differences necessarily warrant a different designation for the Cal-Sag.

The other issue, and I've mentioned this already, and that is is that

the shallow littoral zone blocks up this area that is shown on this example side-scan sonar. These blocks are not small blocks. If you have a chance to drive a boat along there or walk along the shore line, these are good-size blocks. They're on the order of many feet across in some cases. They're bedrock slabs. The smallest ones that I've really observed have only been about twelve inches is the smallest. Now there may be some finer material in there, but it's very, very rare to see. And the interesting thing about this is that this is not the material that one would anticipate to be ideal spawning habitat or used by early life stage fish. And, in fact, in work that we've done along the shores of Lake Erie, we go to the Western Basin, and I have to go back to Lake Erie because that's the place where I have some comparative experience here. In the Western Basin of Lake Erie in the near shore waters, it's primary historic nurseries for most of the larval fish that are produced out of the western basin which is the bulk of the

fish in Lake Erie, and that's by far and away the most productive of the great lakes. Immediately adjacent to those nursery areas it's very low relief areas, and there are wetlands there. And those wetlands have been diked and the lakeward side of those clay court dikes are armored with large blocks of stone very similar to what's here on the Cal-Sag Channel. And they extend out into the lake, because once you armor the shore line, the beaches disappear.

All right. I don't know if any of you folks know Dr. Roger Tomo (ph.) with the Ohio EPA, he was a good friend of Chris Yoder and he works with Chris Yoder and Ed Rankin. He has done extensive work along the Lake Erie shore line looking at fish communities in the aquatic communities that inhabit these very coarse rocky areas. And it turns out that virtually no larval fish are found there, and he does sample with the appropriate equipment, I believe. But what he does find that these large blocks are ideal habitat for predators, largemouth bass

and other predators. And so basically -- and this is sort of like the forage raining wetlands on one hand and then protecting them on the other. Here we are in Lake Erie where we have this nursery habitat, and we really want to protect this area, and yet we're putting in this shore protection and these structures, and basically it's ideal habitat for preditors. So we're basically putting the preditors right in the front of the grocery store, okay. It's just not -- we really haven't thought it through. And so I suspect in the Cal-Sag Channel that I know supposedly from the fish data that there are lots of largemouth bass present, and those are pretty voracious preditors, is that these large blocks are actually going to be the hotel preditor, if you want. And so if you really think that these large blocks or these rocks and this coarse shallow littoral shelf is going to serve as a refuge for larval fish and young-of-the-year fish, I think it's basically going to serve as a grocery store for those largemouth bass.

Again, this is from a nonbiologist, but this is based on information coming from experience and other systems.

MS. DIERS: Did Rankin indicate in Attachment R that the Cal-Sag littoral areas are not isolated but occur along much of the shore line?

DR. MACKEY: What question was that?

MS. DIERS: It's a follow-up.

DR. MACKEY: It's a follow-up question, okay. Yes. I believe he did -- That's what he did indicate. But I have, again, concerns about whether that's an accurate assessment.

MS. DIERS: So do you disagree with that statement?

DR. MACKEY: I do. I think that -- Could you say his statement again, please.

MS. DIERS: I'll just read from Page 10 of Attachment R, his statement. The Cal-Sag Channel had QHEI scores in a fair range largely because of the limestone rubble and coarse materials left behind in the

littoral areas from the construction of the channel. Unlike Wolf Point site on the Chicago River, this littoral habitat is not isolated but occurs along much of the shore line. So do you agree with that statement?

MR. ANDES: What page were we on?

MS. DIERS: Page 10 of Attachment R.

MS. WILLIAMS: They're not actually numbered.

MS. DIERS: I counted. I'm sorry.

MS. WILLIAMS: There's a page for the Cal-Sag.

DR. MACKEY: I got the message. I have a copy of it here, too. In general I would agree with that based on the shore structure inventory that has been gone under the habitat assessment. It's my understanding that about 20 percent of the Cal-Sag Channel has a vertical, some sort of vertical type of wall with none of this type of littoral habitat, this coarse block of habitat that is discussed. And on the western portion, the western portion of the Cal-Sag Channel, it actually has a much

higher percentage of the vertical wall. And you saw that in the side-scan data, the north wall extends for many miles along the Cal-Sag Channel.

MS. DIERS: Back to prefiled Question 43. On Page 8 of your prefiled testimony, you mention that QHEI protocol is, quote, based on hydrogeomorphic metrics in a natural stream. Then at the bottom of Page 8 you mention flows in the CAWS are related and controlled by manmade structures and are not natural. Do you believe that QHEI cannot provide useful information in a stream impacted by human activities?

DR. MACKEY: The QHEI is a habitat classification monitoring tool that can be used to compare the physical habitat characteristics of different stream reaches. So, therefore, it has some use from a regional comparison respect. For a simple cursory evaluation, general habitat characteristics, QHEI protocol can certainly be applied to natural streams impacted by human activities. However, with respect to

the CAWS, I have real concerns that these are the only habitat data used to determine biological potential, primarily because the QHEI was developed for natural systems, not artificial systems such as the CAWS. Rankin in 1989 describes the QHEI as a macro scale approach that uses qualitative metrics to describe the emergent properties of habitat. And we discussed this earlier: Sinuosity, pool or riffle development, et cetera. However, many of the emergent properties of habitat do not exist in the CAWS, and this is important, nor have they ever existed in the CAWS. Thus, the low QHEI scores are not unanticipated because they are the result of a misapplication of the QHEI to an artificial system.

MS. DIERS: How do you define a natural stream?

DR. MACKEY: A natural stream is generally a channelized area. And I'm not talking about channelized in terms of manmade channelization. It's a channel cut by flowing water in which there are certain

structures and characteristics that are rated by the application of energy of stream power and by the flowing water. And that's basically what I would call a natural stream from a physical perspective.

MS. DIERS: Is it inappropriate to use the QHEI in a stream that is not 100 percent natural?

DR. MACKEY: No. I think it's certainly appropriate. And I think in Rankin in 1989, when they originally developed the QHEI, it was very clear that they applied the QHEI and attempted to calibrate the QHEI metrics to take into account certain types of degradation of the natural system. And that there is a range of degradation that can occur.

MS. DIERS: So if a channel is cut by something other than flowing water, is it artificial in your opinion?

DR. MACKEY: Yes.

MS. DIERS: Do you believe that relatively low QHEI scores in the CAWS streams indicate that the QHEI is not

functioning as intended? This was the end of 43.

DR. MACKEY: Well, I think that the QHEI has been misapplied in this system. The QHEI is designed to identify certain emergent or macro habitat features, most of which don't exist in the system; and, thus, many of the values, and we have already gone through this in the handout entitled QHEI Metrics in the CAWS, most of the metrics in a natural system would be relatively important are held constant within the CAWS. So I don't think that the -- personally, I don't think that the QHEI is necessarily functioning appropriately, because most of the metrics upon which they're based don't even apply in this system.

MS. DIERS: Question 44: On Page 8 of your prefiled testimony you state, "The QHEI protocol is not designed for use in low gradient, nonwadable streams and rivers." Then on Page 9 you state, "The QHEI protocol was not designed to be applied to a flow regulated artificial waterway system such as

the CAWS."

Do you believe that state of Ohio is incorrect in using the QHEI to help determine aquatic life use attainability in human impacted streams throughout Ohio?

DR. MACKEY: Certainly the QHEI can be used to evaluate and monitor for natural streams that are impacted by human activity. So an answer to the question would be I have nothing against the state of -- I used to work for them. I used to work for the Ohio DNR, so I have my issues with the state of Ohio. But that's not one of them, okay.

However, my two statements that I made in my prefiled testimony are still valid, because the CAWS is an artificial system, not a natural system. And the QHEI protocol was not designed to be applied to an artificial waterway such as the CAWS.

MS. DIERS: Are all parts of the CAWS entirely artificial?

DR. MACKEY: No.

MS. DIERS: Forty-six: Do you believe that the aquatic life uses proposed by

Illinois EPA for the CAWS represent natural conditions?

DR. MACKEY: Conceptually, I don't believe that any proposed aquatic life uses for the CAWS represent natural conditions because the CAWS is an artificial system. The aquatic life that inhabits the waterway today colonized the waterway after the waterway was built from the waters of Lake Michigan. These organisms were derived from Lake Michigan or the smaller rivers and/or tributaries that feed into the CAWS and/or the Des Plaines or Illinois River Systems. This is before the electric field bearing was built. Some of the organisms may have been transported and inadvertently released by commercial vessels transporting into the system as well, invasive species, for example. The biological communities within the system are severely limited by the artificial nature of the CAWS. Moreover, actually, I think where we want to go here is it's also important to realize that the CAWS is not a degrading system, this is an

important concept I'd like to get across, but rather an artificial system that has been improving since it was originally constructed beginning with this last century, okay? I'm trying to wrap you around a different concept here. Because probably about 98 percent of the environmental work we do is in degraded natural systems. The CAWS is not a degraded natural system. It is an artificial system, and it didn't exist before it was constructed. And organisms that live there now have come in from the outside probably as they passed through in the water and said, oh, I think I can live here. So they're eeking out in the existence. But this is not a natural system. This was not a natural meandering river system with a flood plane; all of the classic, you know, types of different types of habitat structure, instream habitat structure that you have or a broad variation and substrates that are here. This thing, at least a significant portion of it, was dug, it was cut out of limestone, bedrock, and/or overlying overburden, the

alluvial material or glacial material. It was created from nothing. And a good analogy would be you could view, and I -- with all deference to the District here, you could view this thing as a concrete pipe, all right? This thing didn't exist. It's like a culvert in a road. And now we put a culvert, we put this concrete pipe, and we put a road across it, all right, and now we have water that flows through this pipe, all right, and the flow is regulated. All right. There was no aquatic habitat there before the pipe was there, all right? And it was not built or designed to be an aquatic habitat or to support aquatic life. But organisms in the water have colonized the edge of this pipe, if you want. It could be algae, it could be anything that lives in here. And they are opportunistic organisms. It is by no means a natural community that is degraded. It's one that has basically been created because of construction of this artificial feature. And if you try to apply metrics and tools and strategies that we use for environmental

protection to a nondegrading system, in other words, an artificial system like this, they are probably not going to work because they're based on a different foundation, different basis which is trying to prevent things from getting worse. And in a sense I understand what you're trying to do. CAWS is a different system. It's an artificial system that's coming up and it's not coming down in terms of its relative ecological characteristics, let's just put it this way.

MS. DIERS: Is it your understanding that no natural stream channel existed in the CAWS before human impact?

DR. MACKEY: That is not my understanding at all. Certainly there are portions of the river system that existed in some way, shape, or form prior. The Chicago River was a natural system, but considerably different than it is right now. From the perspective the board, have any of you been up to Illinois Beach State -- I don't have to ask you. I'm not asking for -- looking for an answer here. My apologies.

HEARING OFFICER TIPSORD: We'll consider it rhetorical.

DR. MACKEY: If you were to visit the Southern Unit of Illinois Beach State Park, there is a river there called the Dead River, and it's inappropriately named. But that is probably very similar to what -- in fact, that is very similar to what the original presettlement conditions were here in the Chicago area, okay? And this is based on work that's been done by Dr. Mike Waskowski (ph.) with the Illinois State Geological Survey. It's a very shallow river system that's draining a series of ridge and swale wetlands and a very sand rich environment, secretion area of sand as sands are being transported by waves along the coast from Wisconsin. So it's Wisconsin sand Chicago is built on. And I think that that is the condition the original presettlement condition existed. What exists here now is a completely different system. It's an artificial channel. It doesn't have any of the flow or any of the natural channel

characteristics.

MS. DIERS: So you're saying the north branch Chicago River and the little Calumet River were natural?

DR. MACKEY: Portions of them are, I think, yes. They've been highly modified, but certainly.

MS. DIERS: Would you agree that the south branch Chicago River was formerly natural before the human impact?

DR. MACKEY: There may be just a slight portion, a portion of the south branch, yes, but it wasn't by any means connected to the Illinois waterway system.

MS. DIERS: What about the Grand Calumet?

DR. MACKEY: I don't know. I honestly don't know. I am old, but I'm not that old.

MS. DIERS: Back to prefiled Question No. 48. Do you know if the original development and application of the QHEI as per Rankin 1989 included waters that were not natural?

DR. MACKEY: What you're referring to

is Appendix 1C in Rankin 1989 where he lists the sites in Ohio that were used to test and develop the QHEI. Again, this is all based almost entirely on data from the state of Ohio. And I will point out that all of the test sites were nationally flowing rivers and streams. There were no artificial systems such as the CAWS. That doesn't mean to say that there weren't some heavily modified systems. I know they've looked at several impoundments and applied QHEI to impoundments which is probably the closest thing you're going to get to the CAWS. But those impoundments are still connected to a natural flowing river system. And those impoundments represent degradation. They're not created from natural. So, in essence, the QHEI was evaluated in degraded stream reaches of that, and I mentioned the impoundments. But it was still part of a natural river system. That's basically all I have to say.

MS. DIERS: Prefiled Question 51. On Page 8 of your prefiled testimony you state, "This assumption is not valid for low

gradient urbanized artificial channels such as the CAWS." Does the QHEI include matrix for channel morphology, flood plane quality, current velocity, and gradient?

DR. MACKEY: Yes. But most of those parameters, in fact the ones that you have listed there, are ones that are being held constant throughout virtually the entire waterway system which really negates their value as habitat submetrics within the QHEI indeces.

MS. DIERS: What do you mean by held constant?

DR. MACKEY: What I meant by held constant is that, again, without the original data sheets, I cannot be sure, but I believe that the scores are basically the same throughout most of the system. Notice I'm not saying all of the system, but most of the main parts of the system the scores are held constant. For example, an important parameter would be pool depth. And in virtually all cases the pool depths are greater than one meter, and so the score for

that value is going to be held constant throughout the entire system.

MS. DIERS: If a metric scores low consistently, does this mean it has held constant?

DR. MACKEY: Not necessarily, no.

MR. ANDES: But if it's held low consistently throughout the area, does it provide value in terms of valuating various reaches?

DR. MACKEY: I wouldn't think so. In other words, it would be -- the comparisons that are being made from a regional perspective between various segments are going to be based on one or two different metrics and that's it. The rest of them are held relatively constant.

And to follow-up on that, the metrics that were -- that we're discussing are the in-stream habitat structure and substrate. And in-stream habitat structure and substrate are based on 20 samples within the CAWS, only 20 samples, with an average spacing of 4.3 miles apart, minimum spacing

of a half mile and maximum spacing of a little over 15 miles apart. And that's the basis for the habitat assessment that's been done, which I think was insufficient to adequately categorize the physical habitat within the CAWS.

MS. DIERS: So how many samples do you think would be taken so you can make an assessment? If 20 is not enough then --

DR. MACKEY: I cannot give you a number, nor would I want to. As I described earlier, if one were to use a continuous mapping regimen such as the side-scan sonar, the number of samples would depend on the number of different types of acoustic patterns that you see. And until you actually do the mapping work, you don't know. But I would certainly design a sampling program so that it not only is compatible with some of the existing biological data because obviously -- and biological sampling because you would want to develop some linkages there, but in addition I would also go beyond that, as I mentioned before, and

tie that to the other different types of, say, acoustic areas so that I would know exactly what I'm seeing on the bottom is indeed sand or bedrock or silt or other material.

MS. DIERS: I may have already asked this earlier, but are you designing a sampling plan for the District to follow?

DR. MACKEY: No.

MS. DIERS: Question 52: On Page 9 of the prefiled testimony you mentioned that there was considerable uncertainty in the QHEI scores for locations in the North Shore Channel and locations in the Calumet-Sag Channel. Later in that paragraph you mention that if the QHEI score of 42 is correct for one of North Shore Channel sites, then the boundaries of the proposed aquatic life use categories for the CAWS are invalid and should be redefined. Based on information in the hearing record, are the correct QHEI scores for the North Shore Channel and the Calumet-Sag channel depicted in Table 3 on Page 5 of the Rankin 2004 report which is

Attachment R?

DR. MACKEY: We've, in part, already discussed this. But I will just state again in my opinion based on field observations, side-scan data, and the lack of actually having the original data sheets to even look at how this thing was scored, I would say no, I do not agree that the value is reported on Table 3 on Page 5 of the Rankin 2004 report, which is Attachment R, are correct based on my experience. Assessing different types of aquatic habitat under a broad range of conditions, it is just not credible to believe that the Cal-Sag Channel, Route 83 site, represents the best aquatic habitat in the CAWS.

MS. DIERS: Question 54: On Page 9 of your prefiled testimony you state, "Proper application of the Ohio boatable IBI requires identification of high quality reference streams which serve as yardsticks to measure the biological health in similar regional water bodies." Does every valid use of the Ohio fish IBI for unwadable streams require

one to identify high quality reference streams?

DR. MACKEY: Could you please clarify on what you mean every valid use?

MS. DIERS: Can it be used?

MR. ANDES: Can it be used for any purpose?

MS. DIERS: Yes.

DR. MACKEY: Well, all that I can say, again, I am not a biologist, so I'm not an expert on the IBI and all of the potential uses for that indeces. But it's my understanding that a high quality reference stream that's being discussed already represents the highest level of physical, chemical, and biological integrity that can be attained in a system. That's what this whole concept is. The use of the reference stream is necessary to establish the highest potential IBI scores in the system with similar hydrogeomorphic and environmental conditions. It is only by identifying the highest potential IBI scores that comparisons can be made to determine the appropriate and

attainable aquatic life use scores and whether or not those scores have been attained.

MS. DIERS: Prefiled Question 57. On Page 10 of your prefiled testimony you state, "In fact, the minimum IBI scores observed at the two monitoring stations in the Cal-Sag Channel are among the lowest in the CAWS." Do you believe that the minimum IBI scores for the Calumet-Sag channel provide useful information about the biological potential of the stream?

DR. MACKEY: Well, as you know, my expertise is focussed on characterizing and mapping physical habitat and linking those habitats to physical processes. I'm not a biologist, so I'm not sure I feel qualified to answer that question. Other witnesses to follow, I believe, will discuss biological aspects of the CAWS.

MS. DIERS: Would that be the same answer for the next question in that did you believe that the maximum fish IBI scores from the Calumet-Sag channel provide useful

information about the biological potential of the stream?

DR. MACKEY: Yes. I just don't feel qualified to answer that question.

MS. DIERS: So what was the point of your statement that I referenced in Page 10 of your prefiled testimony?

MR. ANDES: Which statement?

MS. DIERS: Quoted in Question 57.

DR. MACKEY: Question 57?

MS. DIERS: I provided the quote. I just want to know what the purpose of that statement was.

DR. MACKEY: Just a second here. I only put part of your questions -- your questions are pretty massive.

HEARING OFFICER TIPSORD: It's at the bottom of Page 10, the last paragraph. It's the last sentence at the bottom of Page 10.

DR. MACKEY: On my prefiled testimony. If I understand, again, I'm not an expert on this particular -- on the IBI, but I understand that there is a specialized protocol for the wadable versus the

nonwadable IBIs, fish IBIs, and that apparently when the actual IBI values were calculated that they did not use the -- they used the wadable approach rather than the nonwadable approach. And what it means is that most of the IBI scores that were reported, as I understand it, and, again, this is in discussion with fisheries biologists, that the IBI scores that were reported by the CAWS UAA contractor are a bit inflated by several points over what would be the correct way to have calculated the IBI.

MS. DIERS: How are they inflated?

DR. MACKEY: I would refer you to fisheries biologist to describe that in more detail.

I viewed this process in a little more detail on I believe Page 11 on the next paragraph. This is, I think, a different type of -- but that's okay.

MS. DIERS: So did you say you talked to a fishery biologist that told you they were inflated, or did I misunderstand?

DR. MACKEY: I looked for guidance. I

worked collaboratively with fisheries biologists and/or aquatic ecologists and -- with respect to the IBI. And, again, I am a geologist by training. Certainly there are supposedly linkages, and certainly the IEPA -- in the Illinois EPA's testimony and in their statement for reasons, there are linkages made between the QHEI and IBI scores. Certainly you can agree with others there are some statistical relationships to develop. And so I inquired, since I'm not a, quote, expert on the IBI, I said how good are these IBI values? Are they a reasonable way to do this? And these folks took a look and they said, hey, we don't think that this was done properly, and that's what I reported in my testimony.

MS. DIERS: Who are these folks you're referring to?

MR. MACKEY: Speaking to some of the fisheries biologists in the district. And also I discussed this in part with fisheries biologists from the Ohio Division of Wildlife as well.

MS. DIERS: Can you provide any names who you talked to at the District and at Ohio?

DR. MACKEY: It would be Jennifer Wasik, I think I discussed this briefly with Sam Dennison; and then within the Ohio Division of Wildlife it was Jeff Tyson who was the supervisor of Lake Erie Fisheries.

MR. ANDES: Was it also -- Was it basically your point of the IBI scores that the low IBI scores for Cal-Sag seemed to indicate that it should not be put in Class A?

DR. MACKEY: Yes.

MR. ANDES: Thank you.

MS. DIERS: I'll go to Question 58.

HEARING OFFICER TIPSORD: Miss Diers, before you go to Question 58, we've been back at it for about an hour and a half. I've got 12:20. But I did want to ask you, I notice you're -- And I appreciate the way you've put these questions together. They are flowing. But you have skipped about 23 of them. So if you could give us an indication perhaps after

lunch of which -- how many of those are already answered or you're saving just so we have an idea of where we're at this afternoon as far as how many questions we have left to go. With that, let's take an hour for lunch. Come back at about 1:25.

(Lunch break taken.)

HEARING OFFICER TIPSORD: Good afternoon, everyone. I want to compliment you all on getting back here on time and all of that. It's greatly appreciated. Miss Diers, we're ready to go.

MS. DIERS: I'm going to start on Page 105. I know you asked prior before we left for lunch, I have about four questions on Page 96 I will go back to, but everything else between 96 and 104 is done.

HEARING OFFICER TIPSORD: All right.

MS. DIERS: I'm going to start on Page 105, Question 58. I'm going to go to the last question in that paragraph. Did Rankin's report also indicate that the Chicago Sanitary and Ship Canal at Lockport was wider and had some littoral habitat,

however, this was very limited in scope and were extremely embedded with silty mucks and sand that were poor quality?

DR. MACKEY: Just hang on one second.

MS. DIERS: That would be Attachment R that I'm referring to.

DR. MACKEY: With respect to Rankin's 2004 survey, Attachment R and the quote that you have quoted in the question, yes, Rankin's survey did indicate the presence of littoral habitat in the Cal-Sag Channel; and, yes, Rankin's survey did indicate the presence of poor quality littoral habitat in Chicago Sanitary and Ship Canal at Lockport. But, and the but is in the sentence that follows those two sentences, Rankin reported that littoral habitat was similar, littoral habitat was also present between the Harlem and Cicero bridges in the Chicago Sanitary and Ship Canal. So his statement isn't correct, but that's in combination, if you take it in full context where he's talking about some similar habitat characteristics that also exist in the Sanitary and Ship

Canal.

MS. DIERS: Question 59: On Page 10 of your prefiled testimony you state, "The weathering of the bank walls provides a slight shallow shelf with limited habitat for fish." What is the basis for this statement and how are you using the term slight and limited?

DR. MACKEY: We've already been through some of this in the testimony in the morning. But these statements were based on -- in my prefiled testimony were based on the reconnaissance field observations which I did on the ground and looking at the high resolution bathymetric data collected by the U.S. Army Corps of Engineers, which I've described briefly as well. That gives you an idea of what the channel morphology is like and what's shallow and what's deep. And also what some of the materials are, at least that are exposed above the water surface. And then as we talked about as part of the habitat evaluation improvement study, we also, or I also collected side-scan sonar

data, some of which you've seen an example of from the Route 83 area that basically, you actually can see what the submerged area of that area looks like. And so that forms the basis for that statement based on at least three different sets of different types of observations from my work along the Cal-Sag Channel.

MS. DIERS: Did that answer quantify how you -- using the term slight and limited?

DR. MACKEY: You're right. Thank you.

Actually, we talked briefly about this as well. Based on the reconnaissance side-scan sonar surveys, the percentage of bank edge habitat structure varies by reach; and, where present, ranges from 5 to 8 percent of the total channel area in the Cal-Sag Channel. We discussed that earlier. The littoral zone referred to by Illinois EPA and the Cal-Sag Channel is, as I mentioned before, undefined, but in making an assumption that it is a depth limitation, and we talked about the possible size of waves and the wavelength, is just, say, perhaps

less than the three foot water depth. Looking at the bathymetry and also the side-scan data, the littoral zone that I think Illinois EPA is thinking about is less than 2 percent of the total channel area. And I think numbers like that are certainly -- one can characterize as slightly limited. I hesitate to put a percentage on, well, if it's greater than 10 percent it's something else. But I think you understand the gist of what I'm getting at here. It is not a large area in the Cal-Sag.

MS. DIERS: I'm going to strike Question 60, and that will take us to Question 61. On Page 10 of your prefiled testimony you state, "A small amount of rubble from the crumbling walls does very little to improve the overall physical habitat for fish and invertebrates in the Cal-Sag Channel." How did you determine this?

DR. MACKEY: Well, just as I described just a few minutes ago or seconds ago, the actual physical characteristics are based on

a combination of field site visits where I actually observed what was above the water column, the bathymetry from the U.S. Army Corps of Engineers, and then also the side-scan data that was collected. And that's the physical aspects of that. And that's fairly clear. I think in terms of the overall physical habitat for fish and invertebrates, I think for invertebrates it's probably okay. I mean large blocks like that, the inverts, they like that large, that substrate. And from what I understand, again, I'm not a biologist, but from what I understand the large relatively stable substrate like that, you know, the inverts, I think, I think they'd be pretty happy there assuming there's an appropriate food supply.

For fish, we've already had a part of the discussion on that based on some of my discussions with fisheries biologists who have worked in Lake Erie and some other areas. Certainly these large blocks serve as, in essence, predator habitat for, let's say largemouth bass. Again, I don't believe

that these are going to be terribly useful for -- as spawning habitat or nursery habitat or either early life stage or young-of-the-year fish.

MS. DIERS: Question 62: On Page 11 of your prefiled testimony, you interpret that there is no one-to-one correspondence of IBI scores to QHEI scores. Do you believe that statistical relationships established for QHEI scores and fish IBI scores similar to those in Figures 1 and 2 on Page 7 and 8 and Rankin 1989 are not useful for informing the determination of appropriate aquatic life uses for a stream?

DR. MACKEY: In answer to your question, yes, I do agree that statistical relationships may exist between the QHEI scores and fish IBI scores, and that those relationships can be useful. In general what they tell us is that as habitat quality improves in general, one can expect an increase in the IBI scores, which means you may have a somewhat more healthy, let's say, fish community, however you want to define

that. Even though there is a tremendous amount of scatter associated with that. In other words, it's not a direct one to one. You could be off by an order of magnitude or two, but the trends are fairly clear. The issue here, though, is that in Figure 5-2 the CAWS UAA report, that's not the type of plot that is described that you're describing here by Rankin. And, in fact, the plots that provided examples in the 1989 report were not included in any way, shape, or form, within the CAWS UAA report. In the Rankin 2004 report on habitat which is Attachment R, or in any of the materials or hearing testimony submitted by Illinois EPA as part of the proposed aquatic life use designations. So my answer is yes, as it was applied here in Ohio. Yes, it certainly is valid. But this is not what was done here in Illinois in the CAWS.

MS. DIERS: And I know we've made reference to Rankin 1989. I believe that's Exhibit 175, for the record.

Question 63: Is it your

opinion that quantitative graphs and relationships between QHEI scores and fish IBI scores similar to Figure 19 on Page 40 in Rankin 1989, Exhibit 175, are not useful for informing the determination of appropriate aquatic life uses for a stream?

DR. MACKEY: No. That's not my opinion. I think these types of plots can be useful. What she's describing on Page 40, it's a plot that actually a percentage of sites on the left-hand access and IBI range scores on the bottom access basically from 12 up to 60 are grouping. It's almost like a histogram plot in a sense. And then they have a couple of different line types and/or dot types as a function of whether you're looking at different QHEI or habitat characteristics. What it is, in essence, it's a frequent -- it's showing a frequency distribution of IBI scores for a certain range of QHEI values. And what this does, in essence, shows you the patterns or the linkages in a broad way between the IBI and the QHEI. And as it's plotted in the Rankin

1989 paper on Page 40, it's a good plot. It's reasonable and it could conceivably be useful. However, the type of frequency distribution plot referred to here was not included in the report by Rankin 2004, which is Attachment R, or in the CAWS UAA report or in any of the materials or testimony submitted by the Illinois EPA in support of the proposed aquatic life use designations. So, yeah, Rankin, it's a good plot, but this type of plot was not presented in any of the information that I've seen related to this aquatic life use designation.

MS. DIERS: Question 64: Do you believe that the Clean Water Act requires that aquatic life uses represent desired aquatic communities as you mention on Page 13 of your prefiled testimony?

MR. ANDES: I'll object to that one because it's clearly asking a legal question of whether the Clean Water Act requires something.

MS. DIERS: I didn't see it as a legal question. I was just asking his knowledge of

the Clean Water Act, if he had an opinion based on his understanding of the Clean Water Act.

MR. ANDES: I still think it's a legal question. He's not a lawyer.

HEARING OFFICER TIPSORD: Give me a second. I'm trying to think of another word other than requires that wouldn't be a legal interpretation.

How about this. Why don't you give us your opinion based upon your lay view of the Clean Water Act and your knowledge as a lay person.

DR. MACKEY: That's pretty easy to do. Well, first of all, again, just to reemphasize, my expertise is not in the Clean Water Act, and it is focussed on characterizing and mapping of habitat. And the answer for this for you is very short. I don't believe, as a lay person, that the Clean Water Act specifies or defines what a desired aquatic community is. However, it would seem reasonable to assume that there would be a correspondence between desired

aquatic communities and aquatic life uses for general waters. Okay.

MS. DIERS: I'm going to strike Question 65.

Sixty-six: Do you believe the CAWS waters have the capability to potentially support balanced populations of aquatic organisms?

MR. ANDES: And he's answering this again as a lay person with his own judgment, not as a legal matter?

HEARING OFFICER TIPSORD: Absolutely.

MS. DIERS: Right.

DR. MACKEY: With the appropriate caveats, this is a really short answer. On a system-wide basis, no.

MS. DIERS: I'm going to strike Question 67.

68: Of the states that have aquatic life uses based on the concepts of tiered aquatic life use approach, do you know of any aquatic life uses that are defined by lists of particular species or taxa of aquatic organisms? And, if so, could you

provide some explicit examples.

DR. MACKEY: Yeah. Again, with the caveat that I have -- I think I mentioned earlier that I'm not an expert on the UAA and the aquatic life use designations. My expertise is primarily focussed on characterizing and mapping physical habitat and linking those habitats to physical processes.

But in response to this question, I do not believe that lists of particular species or taxa of aquatic organisms should be used to define an aquatic life use. I need to make it clear, nor have I suggested such, in my prefiled testimony. However, I do believe that is incumbent on Illinois EPA to clearly explain all the anticipated biological outcomes that will result from a set of actions taken to achieve proposed aquatic life use. Unfortunately, Illinois EPA has not defined what tolerant or intermediately tolerant fish communities are, nor have they identified the species associated with those communities.

Second, Illinois EPA has not described the measures or metrics used to assess whether or not the proposed aquatic life uses are attained. Depending on the metrics used, a description of the fish communities and/or species anticipated would probably be required for the CAWS. And, third, the CAWS is an artificial system, and the tolerant or intermediately tolerant fish communities, whatever they are, anticipated to be within the CAWS are likely to be different than tolerant or intermediately tolerant fish communities in a degraded natural system. The organisms that live in the CAWS today are opportunistic and are severely limited by the artificial nature of the CAWS.

So if you're thinking, well, jeeze, if other states have tolerant and intermediately tolerant descriptions, that's based on a natural system. And those are from a natural system that has become degraded. Those types of communities, whatever they are, may be different than the

CAWS which has started from basically a concrete pipe and is basically moved upward and has become colonized by organisms that happen to be passing through the system. I think that there would be a difference between the two.

MS. WILLIAMS: Dr. Mackey, can I ask a follow-up, what you base that opinion on?

DR. MACKEY: Pardon?

MS. WILLIAMS: What do you base that opinion on that the tolerant organisms here would be different here than in a natural degraded system.

DR. MACKEY: It's an inference that I'm making based on best professional judgment. I have no data or information that would suggest that that would be the case.

MS. WILLIAMS: That's professional geologic judgment or --

DR. MACKEY: I'm not sure I would call it geologic judgment.

MS. WILLIAMS: Can you give examples?

DR. MACKEY: I cannot give an example of that. It's just one would think that in a

system that is natural and is degraded, that there were existing communities, say existing biological communities that exist for organisms. And as you degrade those systems, that community structure may change. And, again, this is an assumption I make in just having general discussions with fisheries people.

MS. WILLIAMS: And do they mean that the specific species that would be present are different or the relative abundance of certain species?

DR. MACKEY: It could be either. It could be either.

MS. WILLIAMS: But you can't point to any examples?

DR. MACKEY: I cannot point to anything. I just -- The point I'm trying to make here is that, again, I believe that there is a difference between a natural system that is degraded and an artificial statement that has been created from nothing and has been opportunistically colonized by organisms that happen to be passing through

the system. And to assume that both of those types of systems would be equivalent or would have similar characteristics, I do not believe is a reasonable assumption.

MS. WILLIAMS: But aren't you making the assumption also that they're different? I don't understand how that assumption is more reasonable.

DR. MACKEY: Absolutely. But that's my prerogative.

MR. ANDES: Well, you believe there's a reasonable basis for the assumption that these two water bodies would be different in terms of the population they support?

DR. MACKEY: Yeah, I do. I do. Definitely.

MS. WILLIAMS: Thank you.

MS. DIERS: I'm going to strike 69, 70, 71, 72, 73, 74, and go to, I believe, Question 75. Just give me a minute.

Question 75: Did Mr. Rankin in his report, Attachment R, indicate that because of effects of often multiple stressors, the biological results may

underestimate the potential attainment that could be expected in the absence of such stressors? In these cases, the QHEI and metric scores at a site, scores of nearby reaches, and accrual of important limiting habitat factors and the loss of positive habitat factors are used as evidence and in support of given aquatic life use along with the knowledge of the feasibility of restoring the limiting factors.

DR. MACKEY: Yes.

MS. DIERS: On Page -- This is Question 76: On Page 13 of your prefiled testimony, you state, "In a statement of reasons, the IEPA hypothesizes that increased DO and reductions in temperature will significantly improve fish diversity and community structure within the CAWS. Would you please identify the specific part in Illinois EPA statement of reasons to which you refer?

DR. MACKEY: IEPA or the Illinois EPA has proposed incremental increases in the minimum dissolved oxygen standards for the

proposed Aquatic Life Use A and B Waters on Table 1, Page 50 in the IEPA statement of reasons.

MS. WILLIAMS: I think we agreed that was Page 60.

DR. MACKEY: I apologize. That's a typo on my part. Thank you. Higher dissolved oxygen standards are proposed for Aquatic Life Use A waters to protect larval and young-of-the-year fish emerging from potential undocumented spawning sites in the CAWS. Illinois EPA in the statement of reasons on Page 48 also states that they anticipate tolerant and intermediately tolerant fish communities in response to the proposed standards associated -- I'm sorry -- also states that they anticipate tolerant and intermediately tolerant fish communities to be present in response to the proposed standards associated with Aquatic Life Use A Waters. Since Illinois EPA has not presented any data or information that would support the contention that an incremental increase in water quality standards will result in

attainment of the proposed aquatic life use goals. Illinois EPA is hypothesizing that an incremental increase in water quality, or the dissolved oxygen standards, will result in tolerant and intermediately tolerant fish communities, whatever they are, since these communities have not been defined.

MS. DIERS: I'm going to strike 77. You might have answered 78, but I'll go ahead and ask it anyway. On Page 14 of your prefiled testimony you state, "Physical limitations such as lack of shallow bank edge habitats and riparian cover, lack of instream cover diversity, in quotes. Are you aware that these types of habitat attributes are taken into account in the QHEI?"

DR. MACKEY: Yes. These factors are certainly considered in the QHEI scores. However, many of the QHEI metrics and submetrics are the same. In other words, they've been held constant throughout a good portion of the CAWS, and we've already discussed that. And the scores reflect variability, and only a few of the submetrics

used to calculate the overall QHEI scores. Two of the most important metrics, substrate and instream and bank edge habitat have not been properly assessed due to a reliance on a limited number of lively spaced point samples, 20, to be exact. With minimum ranges between sampling sites of about half a mile, the mean is 4.3 miles and the maximum distance is 15.8 miles. So there's an awful lot of habitat there that we really don't know that much about or have any data on. For example, the substrates and instream habitat at bank edge habitat in the 16-mile long Cal-Sag Channel are characterized by only two widely-spaced sampling sites 10.7 miles apart. My experience mapping aquatic habitat in great lakes tributaries and near shore areas clearly shows considerable heterogeneity and habitat structure within these systems. Unfortunately, existing data are insufficient to properly assess substrate distributions and instream habitat within the CAWS. The ongoing habitat evaluation improvement study is designed to address many

of those deficiencies.

MS. DIERS: I'm going to strike Question 79.

Do you understand that the proposed Aquatic Life Use A and B Waters by Illinois EPA are designated uses that are below the Clean Water Act goal?

DR. MACKEY: What question is this?

MS. DIERS: It's actually the last question on prefiled Question 79. I struck the beginning of it, but I'm going to ask the last half.

DR. MACKEY: Okay. All right. Well, I think we discussed this already a bit. I think from the narrative description, yes, the proposed Aquatic Life A and B designated uses are below the Clean Water Act goal, but from a standards perspective they are, in essence, the same as the Clean Water Act goal. And we talked about that, I think, earlier this morning. In other words, in terms of dissolved oxygen standards.

MS. WILLIAMS: I thought this morning that you said that you didn't know if the

standard had all the components of the general use.

DR. MACKEY: That's not what I stated, I believe. I think I referred to that, the table that was in the Illinois statement of reasons, and that described the dissolved oxygen as to whether or not that's an exact lay-down. I said in essence. There may be some minor variation of differences between, but from a dissolved oxygen standard and for all intents and purposes, it's basically the same.

MS. DIERS: I'm going to strike Question 80.

Question 81 on Page 15 of your prefiled testimony you state, "For much of the CAWS, fish richness and diversity has improved remarkably since effluent chlorination was terminated in 1984." Is it true that MWRDGC did not dechlorinate prior to this time?

DR. MACKEY: That quote, I believe, is on Page 14 of my testimony. I think that's an error in your question. Other than what's

published in the district fisheries report by Dennison, et al., in 1998, I think it's report 98-10, I do not know the dechlorination history of the CAWS. I do not have the background or expertise to evaluate the potential effects of wastewater, nitrification, nonfish-richness and diversity within the CAWS, and nor am I aware of any significant improvements in physical habitat and quality overview from that time period. That answers the entire question, okay?

MS. DIERS: So you -- Would you consider the addition of nitrification to wastewater treatment plants to also be major factor --

DR. MACKEY: I have no opinion. I've not done any. I don't have that expertise.

MS. DIERS: Question 82: On Page 15 of your prefiled testimony you state, "Moreover, the existence of active angler groups in bass fishing tournaments on the waterway also suggest that for many species, water quality, DO and temperature for much of the CAWS is not a significant limiting

factor."

What is the scientific basis for this statement and what species are you referring to?

DR. MACKEY: The answer to this is fairly simple. If fisherman are catching significant numbers of largemouth bass in the waterway, then current environmental conditions in the waterway are not limiting the abundance of the largemouth bass. Anglers may be catching other species as well, but I don't have a list of species commonly caught on the waterway. And I would refer you to fisheries biologists who worked on the waterway to get a better assessment of what fish are actually being caught there. In terms of the species in this particular statement, I was referring to largemouth bass.

MS. DIERS: Do you believe the Agency needs to establish dissolved oxygen standards to protect largemouth bass?

DR. MACKEY: I would say at this point no, because I think you've already got a --

from what I understand largemouth bass are abundant within many portions of the CAWS. And I would suggest that existing dissolved oxygen levels are adequate to maintain the largemouth bass population.

MS. DEXTER: Are you making a distinction between an existing level and a standard?

DR. MACKEY: I'm not sure that I am.

MS. DEXTER: Well, there is a difference.

DR. MACKEY: Okay.

MR. ANDES: Was the question does he think there should be any standard or does he think that the standard should be tightened? I think he was responding to whether he thought the standard should be tightened.

MS. DEXTER: I think her question was should dissolved oxygen standards protect largemouth bass.

DR. MACKEY: In that case I would say yes, the answer is yes. It certainly is an appropriate species to be protected, yes. I misinterpreted that question.

MR. ANDES: Do you think the existing standards do already protect the largemouth bass?

DR. MACKEY: Given the numbers of largemouth bass, apparent numbers of largemouth bass in the system, I would say yes.

MR. ANDES: Thank you.

MS. WILLIAMS: Do you know what the current levels of dissolved oxygen are in the system?

DR. MACKEY: No, I do not.

MS. WILLIAMS: Do you know what the current standards are?

DR. MACKEY: No. I'm not prepared to answer that.

MS. WILLIAMS: Thank you.

MS. DIERS: I'm going to go to Question 83. On Page 15 of your prefiled testimony you state, "Certainly there continue to be DO and temperature limitations for other desirable less tolerant species."

Do you understand that the proposed dissolved oxygen standards are based

on protecting early life stages as sensitive as those as the channel catfish and other life stages as sensitive as those of the largemouth bass, USEPA 1986?

DR. MACKEY: That's my understanding.

MR. ANDES: Could you put your statement into context in terms of what you said in your prefiled testimony more fully?

MS. WILLIAMS: What did you ask, Fred? I missed your question.

MR. ANDES: The statement that was quoted, I asked him to please put it in context.

DR. MACKEY: Okay. The place to quote in context in the prefiled, in my prefiled testimony, I said certainly there continue to be dissolved oxygen and temperature limitations for other desirable less tolerant species. And that's what was in the question. But also included, in parentheses, which are not specifically identified in the UAA report or Illinois EPA's statement of reasons. But if suitable habitats are not present, sustainable populations of these

species will not become established in the CAWS irrespective of how much improvement there is in water quality. So when taken in context, I'm basically suggesting that the habitat limitations in the CAWS may be more significant or are more significant than some of the apparent DO or temperature limitations in the CAWS.

MS. DIERS: Question 84: On Page 15 of your prefiled testimony you state, "In fact, fair to good Macroinvertebrate Biotic Index, the MBI scores, from the in-water column Hester-Dendy samplers an very poor MBI scores within the CAWS sediments on our graph samples suggest that water quality improvements may already be sufficient to support a more robust and diverse macroinvertebrate community if suitable habitats were present in the CAWS." That's Wasik testimony. Is it true that in the Wasik testimony -- the Wasik testimony does not discuss nor provide any MBI data?

DR. MACKEY: You're correct. Miss Wasik did not present nor discuss any

MBI data. This was a typo in my prefiled testimony. The corrected version should state, quote, "If suitable habitats were present in the CAWS, and then parentheses, prefiled testimony of Dr. Melching on Page 9."

MS. DIERS: What is the MBI based on?

DR. MACKEY: Again, my expertise is in habitat and not in macroinvertebrate communities. So I am not, I think, qualified to answer that question in terms of -- Oh, okay.

However, just follow on, a description of the macroinvertebrate biotic index and sampling protocols as used by Illinois IPA and the CAWS UAA contractor are described in more detail in the CAWS UAA report in Attachment B. And that's on Pages 4-17 through 4-19. And in answer to that question based on the description, again, I don't actually calculate MBIs. I don't pick bugs, at least these types of bugs. The MBI is based on the pollution tolerance for individual species where the average

tolerance ratings are rated by species abundance.

MS. DIERS: Question 85: On Page 15 of your prefiled testimony you state, "The substantial investment needed for infrastructure to provide incremental increases in DO and/or reductions in temperature will not yield a proportionate biological response with respect to attaining sustainable fish communities and/or beneficial uses."

What is the substantial investment to which you refer?

DR. MACKEY: I was making a general comment based just on common sense. And that is if you're going to spend substantial sums of money to upgrade the infrastructure to meet new proposed aquatic life use standards, then you'd better be sure that you do homework to be sure, No. 1, it's going to work and that it's cost-effective, and that the anticipated benefit's worth the cost.

MS. DIERS: So you haven't performed --

DR. MACKEY: No. I do not have that expertise or capability. I can't balance my checkbook, according to my wife, so.

MS. DIERS: Question 86: On Page 16 of your prefiled testimony you state, "The lack of diverse bank edge and instream habitats in the CAWS may be a much more significant limitation on the development of sustainable fish communities and current levels of DO or temperature." Do you believe that current levels of DO and temperature in the CAWS are having no detrimental impact on the present fish community?

DR. MACKEY: Illinois EPA has not presented any data or information that would support the contention that a system-wide incremental increase in dissolved oxygen standards or reductions in temperature result in attainment of the proposed aquatic life use goals. Illinois EPA has not presented data sufficient to show that current dissolved oxygen or temperature levels are having a detrimental impact on the present fish communities. If this were the case, one

would expect frequent fish kills in the waterway. However, it's my understanding that fish kills are not common which would suggest that current DO and/or temperature levels are adequate to maintain and support the fish -- the existing fish and aquatic communities that are currently in the waterway. So I guess my answer is no, I don't -- I don't see evidence that the dissolved -- the current dissolved oxygen levels are necessarily having a detrimental impact on the fish communities in the waterway.

MS. DEXTER: Did you say that you also believe that was true with temperature also?

DR. MACKEY: I've not -- It's in my statement that I've responded to, but I have not done an analysis of temperature. So I will step back from that and say that's not my area of expertise.

MS. DIERS: To be negatively affected by low DO or temperature, do fish have to die?

MR. MACKEY: Not necessarily, I would

think. But I would think that that would certainly, if you have fish kills, that would be one reason to have for those fish to die, of coarse, would be low dissolved oxygen levels. And that does occur in some areas in the Great Lakes. And we have what they call the Dead Zone in the central basin of Lake Erie.

MS. DIERS: Question 87: Do you believe that the chemical, physical, and biological information available from the CAWS indicates that insufficient physical habitat conditions are the primary reason for the existing low fish IBI scores in the CAWS?

DR. MACKEY: Again, qualifying this more as a lay person because of the IBI scores, that's not something I calculate directly. But from the perspective of a habitat, yes, I believe the CAWS has a habitat limited system and that limited habitat availability is the primary cause of existing low fish IBI scores in the CAWS. However, I do not agree with the statement that the physical habitat has been degraded.

The CAWS channels were originally constructed and maintained without regard to habitat or ecological function. The CAWS channels -- I'm sorry -- high quality physical habitat has never existed in the CAWS; and, therefore, degradation has not occurred. In fact, current waterway system is, for the most part, entirely artificial and does not bear any resemblance to the natural conditions that existed prior to construction of the waterway.

MS. DIERS: Question 88: Is it your opinion that the habitat index that I believe you're involved with working on will show that the aquatic life uses proposed by Illinois EPA for the CAWS are not attainable?

DR. MACKEY: That's what we discussed earlier. I'm not directly involved with the development of that habitat index at this time. And so really I can't predict if the habitat index will show whether or not the aquatic life use as proposed by Illinois EPA for the CAWS are attainable. I do believe that a new habitat index will provide a more

accurate assessment of habitat quality in the CAWS and in other urban systems as well. And I think that the assessment will be much more appropriate than an assessment that's based on existing indices that are derived from natural systems.

MS. DIERS: Question 89: How will a CAWS specific habitat index be used to determine the biological potential; i.e., the best possible biological conditions assuming that all reversible -- reversible detrimental impacts are mitigated?

DR. MACKEY: Again, same caveat applies about my involvement with or the involvement of the habitat index. As I mentioned in the previous statement, I believe that a new habitat index will provide a more accurate assessment of habitat quality in these urban systems and artificial systems. And I would envision this new index being applied in conjunction, perhaps, with a more rigorous biological index, something a bit different than the IBI. How that would play out and whatever I don't know, but I

would think that there may be a more appropriate or a different type of biological evaluation that would be applicable in these types of artificial or highly modified systems. And what I would envision is the linkage of these two types of indices and give us a very powerful tool to evaluate not only habitat, but the biological linkages to that habitat; and, even more importantly, it would be done at a much finer scale than we're currently doing it now, which would give us a much better feel for where potential enhancement or improvement opportunities may exist within the system. And I think that's -- We'll have to wait and see what the results are from habitat assessment evaluation and improvement study. But I think that there is a potential here to develop something that could be incredibly useful and helpful in terms of moving this process forward.

MS. DIERS: That's going to take me to Question 9 on Page 96. When was it determined that the habitat evaluation and

improvement study referred to on Page 16 of your prefiled testimony needed to be done?

DR. MACKEY: This is Question 9?

MS. DIERS: Yes.

DR. MACKEY: I have go up here. Question 9. I don't know -- I'm not privy to the internal machinations or discussions of the District. All I can answer is that the District issued a request for proposals in the fall of 2007 for the habitat evaluation improvement study. I have to assume that sometime before that that the District made the decision that they needed more detailed and accurate habitat information.

MS. DIERS: So, in your opinion, is this habitat evaluation and improvement study, is it redoing what CDM did with the UAA or will it be building on what was done with the UAA Attachment B?

DR. MACKEY: Well, in answer to your question, the -- I'm not sure that's necessarily redoing the CDM report. My understanding is that the study is focussed on characterizing the physical habitat

characteristics and evaluating the biological communities, some very specific taxa that may be important to the system that use those habitats within the CAWS. We have a handout here, and Fred will -- and then we can discuss this for a few minutes. This was an attachment in my prefiled testimony, I believe. It's also in color. Red, green, and black, as I said, are the only colors I have.

HEARING OFFICER TIPSORD: This is an attachment to your testimony.

DR. MACKEY: I believe it's Attachment 3 to my prefiled testimony.

HEARING OFFICER TIPSORD: For ease of reference, and since this one is in color, we'll mark this as Exhibit 184, if there is no objection.

Seeing none, it's Exhibit 184.

MS. WILLIAMS: You just want to break the exhibit record, don't you?

HEARING OFFICER TIPSORD: I'm working on it.

DR. MACKEY: If this wasn't in color,

would it still be an exhibit?

HEARING OFFICER TIPSORD: No. It's because of the color. It makes it Christmas.

MR. ANDES: We'll remember that for future handouts.

DR. MACKEY: It has to be seasonal, right? Okay.

I'm not going to go through everything on this thing, but what this really does is it describes some of the major sort of assessment factors or characteristics which I think are important in terms of looking at physical habitat and some other aspects of this system. And whether or not those assessment factors, what they're really applicable to, whether they're applicable to natural and/or artificial types of systems. And what I've done is on the two columns to the right, the column that says Rankin 2004 CAWS UAA and the statement of reasons, this is basically in red a summary of sort of the approach that was taken up to this point in terms of the current habitat assessment and I believe analysis, as I understand it. And

then on the right-hand side is the habitat evaluation improvement study, and there's a bit more of a detailed description of some of the similarities and differences that this study is going to be actually, from what I understand, going to be doing. This document was reviewed and updated by LimnoTech. So I think it is a reasonable summary of what the habitat evaluation and improvement study will be doing.

Just to sort of skip on down here, there's going to be some more sampling work done. It will be geospatially integrated with the continuous monitoring stations. LimnoTech has run a survey of all the bank areas in the CAWS. They actually hooked up a video camera and tied it to the GPS and actually ran a boat up. So they have pictures along all of the CAWS shoreline now with GPS coordinates. So for the side-scan data we can tie that and integrate it right together geospatially into a series of different types of data layers.

Again, there's the, let's say,

the type and extent of substrates. They are using all of the historic data, and that would include CAWS UAA report data. So none of that is going to be chucked out the window necessarily. But I believe they also will be using some newer techniques such as some of the side-scan sonar and other data to integrate this altogether.

In terms of substrate quality, they are going to be looking at the sediment quality data which is talking about grain size. And if I recall from Dr. Melching's description when he's talking about the macroinvertebrate communities, it was a real concern about the predominance of silt in some areas of the waterway. And that was a major limitation. I think they're also looking at some of the inorganic chemical data, some of the potential trace metals, contaminants, and toxicity issues; and looking at some of the historic chemistry and contaminants data as well.

Instream habitat, they're looking at the 30 sampling sites, and that's based in

part on physical habitat characteristics. It's also linked back to some of the biological sampling sites. And also that will be tied in with the -- with some of the side-scan data as well. The type and extent of shoreline and bank edge habitats, we've already talked about that. That's the digital shoreline video. Riparian cover, it's the same sort of thing where part of it is based on the video data and then you've also got some high resolution aerial photography. They're not doing anything with flow regime or water levels. And the reason is this is primarily a regulated system, and the chances for us really modifying the flows in this system, you're not going to -- You know, it's going to be regulated by the lochs, it's going to be regulated for navigation purposes, it's going to be regulated for public health and safety. We don't want to flood out the south side of Chicago during a major storm event -- or the north side either, as a matter of fact. I think that happened recently. In fact, when

I was up in the North Shore Channel, I was driving -- there was a pontoon boat. It was actually flipped upside down on top of the dock, and the motor was upside down as well. And I think that was the result of some of this flooding activity. That's a side point.

Water quality is a rigorous evaluation of the continuous dissolved oxygen data. And they have other supplemental sites. Again, the details of that I'm not as familiar with. They are working on a new physical habitat metric --

MS. DIERS: Dr. Mackey, can I stop you for just a second?

DR. MACKEY: Please.

MS. DIERS: Just so I understand, LimnoTech is going all this work? Not you?

DR. MACKEY: That's correct.

MS. DIERS: Are you assisting LimnoTech?

DR. MACKEY: Yes.

MS. DIERS: Exactly what are you doing for LimnoTech?

DR. MACKEY: I have a subcontract with

them to acquire side-scan sonar data within the CAWS, and then to assist them down the road once we see what are the different characteristics that come out of the side scanning, how can we best integrate that in with these other different data sets, the historic data sets, and the data that is currently being collected by their biologists and by their sampling.

MS. DIERS: Do you know when the new biological index you mentioned will be completed?

DR. MACKEY: I do not know. I believe the study is anticipated to be completed sometime in the summer of 2009, but that was an estimate several months ago. I don't know if there's been an update or a change in that date.

MS. DIERS: And do you know if this study, is it going to have to go through peer review and everything? Do you know how that's going to work?

DR. MACKEY: I would suspect -- Again, that's something that just -- this is work

being done for the District, and that would be up to the District to decide as to what sort of external review or peer review would be required. I would suspect that a portion of this work were to be published in a scientific journal that it would undergo professional peer review as any sort of publication would.

MS. DIERS: So do you know if that 2009 date we talked about, did that factor in a peer review time frame?

DR. MACKEY: I have no idea.

MR. ANDES: We can address some of those issues. I know there were some issues about the habitat study addressed to the District witnesses Wasik and Dennison. They can answer some of those questions. And then if we need to bring in folks from LimnoTech, the managers of that project, we can make available to answer more detailed questions.

MS. DIERS: Thank you.

DR. MACKEY: I don't need to go through the rest of this?

MS. DIERS: No. It speaks for itself.

DR. MACKEY: But you understand it gives you a pretty good summary of the detailed work that's ongoing, and they've made very good progress to date from what I understand.

MS. DIERS: Thank you. Question 91: On Page 18 of your prefiled testimony you state that, "The objective of the habitat evaluation and improvement study is to identify the most efficient and cost-effective means to further protect and enhance aquatic life use waters and associated benefited uses in the CAWS."

Is the primary objective of the habitat and evaluation improvement study to determine the best attainable aquatic life uses required by Clean Water Act in the CAWS?

DR. MACKEY: Counsel has reminded me that I'm speaking as a nonlawyer, and this is from a layman -- a lay person's perspective here.

HEARING OFFICER TIPSORD: Often more informed than the attorneys.

DR. MACKEY: Pardon?

HEARING OFFICER TIPSORD: Lay person often more informed than attorneys.

DR. MACKEY: I'm not going to --

MR. ANDES: No objection.

DR. MACKEY: I'm sitting right next to Fred here, okay? This is a dangerous place to be.

The habitat evaluation improvement study is designed to address physical habitat characteristics of the CAWS and to develop and apply new habitat metrics and indices that are appropriate for urban waterways or artificial waterways. This study may develop a more rigorous biological index based in part on habitat suitability analysis for taxon, and linkages would be developed; the more detailed and comprehensive evaluation of biological potential than is currently possible.

A comprehensive geospatial data set also be developed to link together environmental data sets associated with the CAWS. And a copy of the District's request for proposals, I believe, was attached to my

written summary report, and I believe it was Attachment M if you want to see the details. And where I'm going with this, what I've just said, is that all of these are components and things that need to be considered in terms of moving toward determining what the best attainable aquatic life uses are going to be that are required by the Clean Water Act. What I cannot say that this report specifically, in terms of its objectives and goals at this stage, is to come up with recommendations for, let's say, new aquatic life uses for the CAWS. But I think it puts some pretty good pieces of the puzzle into place. That will allow others to move forward to get to where you want to be in terms of actually identifying attainable aquatic life uses that are appropriate for the CAWS.

MS. DIERS: Do you believe habitat improvements are not possible anywhere in the CAWS; and, if not, why not? And this is just a follow-up question based on the habitat we've been talking about today.

MR. ANDES: Can you restate that?

MS. DIERS: Do you believe habitat improvements are not possible anywhere in the CAWS; and, if not, why not?

DR. MACKEY: I believe we touched on this topic this morning, is that I do -- I do not believe that there is no hope for the CAWS. I do believe that there may be reaches in the CAWS or areas within the CAWS where either existing habitat characteristics, which are very limited at this point, but there may be opportunities for some types of habitat enhancements or perhaps different management strategies that would allow us to improve the habitat conditions in the CAWS. I can't answer specifically where or how that would be done, because right now I don't believe we have adequate data, habitat data inhouse to make that type of assessment. But, again, you know, the habitat evaluation and improvement study, one of the objectives, I think, is to identify potential opportunities for enhancement or improvement in the system. And I think with some of that

data, perhaps coupled with other information, one could probably -- certainly I think we could see improvements in the system. But I don't think you'll see it on a system-wide basis. I think there will be more local improvements on a system-wide basis.

MS. DIERS: I'm done with my prefiled questions. I think Miss Williams might have a question she wanted to follow-up with.

MS. WILLIAMS: I just want to follow-up real quick on a question that was asked of Mr. Melching that he punted to future witnesses, and you were one of the folks he named. I'm not sure that he should have named you, so I just want to --

DR. MACKEY: That's okay.

MS. WILLIAMS: I want to clear that up just in case we don't have you back again.

DR. MACKEY: Steve Melching doesn't get mad, he gets even. So he's getting even.

MS. WILLIAMS: He was asked, it was Question 11 on Page 84 of his testimony, he was asked about wet weather standards and how whether wet weather standards would be

intended to protect recreational aquatic life uses and whether -- how can aquatic life potential vary before and after a storm event. And he thought maybe you or Mr. Friedman or others would better to answer that question.

MR. ANDES: The question is how aquatic life uses can vary or is it potential?

MS. WILLIAMS: Potential, aquatic life potential.

DR. MACKEY: I'm trying to find out what the question is here, what are you asking? Is that how the aquatic life use potential may change as a function of wet weather impacts or whatever? I really don't have the expertise to answer that question. The only area I might be able to touch on that might be that it's from flow regime perspective, if you have very high flows that could be associated with wet weather. It may have potential to change some of the bottom habitat structure perhaps some of the grain size of the material that is potentially

available to be transported. But I can't really speak to some of the other wet weather impacts or the time dependencies which he was discussing in his testimony.

MS. WILLIAMS: Okay. Thank you. I'll continue.

HEARING OFFICER TIPSORD: Miss Dexter, you had some prefiled questions?

MS. DEXTER: Yes. And I have a couple of follow-ups before I ask, before I ask the prefiled questions. My first you had listed a number of rivers that you've studied previously. How many of those are artificial systems that you would liken to this system?

DR. MACKEY: None of them are artificial systems like the CAWS. I'm not sure I would call the CAWS to be a unique system, but it's a very rare and unusual type of system. I would say the closest system that I have worked in that is similar to this would be the Don River in Toronto.

MS. DEXTER: Is that D-O-N-N?

DR. MACKEY: D-O-N, just the Don River. That is the river system that -- It

is a natural river, but there are extensive portions that had been channelized. It's a straight channel reach, and either have sheet pile structures or concrete or timber crib structures along both banks. It is in downtown Toronto, so it is every bit as urban as downtown Chicago. It's concrete parking lots right up to the edge, very few trees. The only trees that are there are, in some cases, there's woods on the bridges of which there are tens of them going across. The main difference in that system between the CAWS is that it's considerably shallower water depth. It is not used for any sort of navigation. In fact, I think our boat, which was an 18-foot John boat was probably the only boat that had been up there in about six months. And it is almost completely, the substrate on bottom is almost completely a median defined sand and some gravel. Virtually no clay exposed, no bedrock exposed. Discharges, it's an extremely flashy system, and by that I mean that because it is in an urban environment is that

water hits that pavement, it runs off and the flood peaks are almost instantaneous and very, very high.

The interesting thing is down at the bottom where it flows into Lake Ontario, this is going into the eastern-most of the great lakes, the river actually takes a 90 degree turn and heads due west, and it's all armored. There are boats and ships. It's just like a port where there are loading and offloading facilities there. The reason I'm involved in that work is that we are -- a number of us have been thinking a lot about river mouth systems, river mouths, which in virtually all of the rivers in the great lakes are highly altered, channelized, and carved in shoreline banks very much like the CAWS. And the Toronto Regional Conservation Authority has, I think, around $65 million, it's Canadian, but $65 million, and they are looking to do habitat restoration and actually modifying the channel design down at the mouth of the river to try to attempt to restore some of the natural habitat

functionality there. And so they'll straighten the channel, they'll do some other things. The issues are the same, though, in the sense that they still have flooding issues and storm water issues to deal with. There's public health and infrastructure. And those are all things that you have to consider in these urban environments just as you do in the CAWS. Because for the sake of habitat, you can do certain things, but if it floods out half the city, habitat is not going to be a very popular issue, okay.

MS. DEXTER: Okay. Also earlier today you stated that the Sanitary and Ship Canal and the Cal-Sag are more similar than they are different. Can you tell me whether the Sanitary and Ship Canal has a shallow littoral zone as the Cal-Sag does?

DR. MACKEY: In some areas there is a shallow littoral zone. It's not as extensive or as well developed or necessarily -- it's not necessarily 80 percent of the San-Ship, but there is something -- there is -- There are some shallower water areas where the

channel widens out. And basically once you get north of some of the bedrock areas and you go more into the clay areas, you'll see armor stone revetments that are behaving very similarly to the coarse blocks that I described in the Cal-Sag. The other issue, as I mentioned before, along the vertical bedrock walls. These are things that you wouldn't necessarily be able to check very easily, but on the side-scan it's very clear that there is a series of lineal ridges that are right along the edge of that bank and it's made up of somewhat coarser material. And that extends for, you know, it is discontinuous. It also happens to have a few car bodies down there as well, so there's some anthropogenic in stream habitat as well.

MR. ANDES: I'm sorry to clarify. You were saying that in the Cal-Sag, and I assume this to be the same case possibly in the Ship Canal, those could provide habitat for predators, but you would not believe it would provide spawning habitat?

DR. MACKEY: That's correct. That's

correct.

MS. DEXTER: Do you think it would be reasonable to set water quality standards to protect species presently found in the CAWS?

DR. MACKEY: I would think that that would be appropriate, sure.

MS. DEXTER: Okay. My next question is regarding your Exhibit 180 that you passed out today.

MR. ANDES: Which one was that?

MS. DEXTER: It's the Exhibit 180, the circle graph. Under water mass, you describe that he -- you describe temperature as one of the qualities of water mass. Is that -- Do you think the temperature is a component of habitat?

DR. MACKEY: I do from the perspective of I'm thinking about the seasonal fluctuations that occur in temperature, and from what I understand how temperature is one of the primary triggering mechanisms to initiate certain types of, say, spawning activity or when fish move up into tributary systems to begin their spawning runs or

whatever. And that's the reason that I think that -- that's the context in which I'm discussing temperature here. In the great lakes, that's on the riverine system. On the great lakes, many times in the summer there's a thermal structure that's built in the lakes. You have a thermal climb where the upper 10 or 15 meters are much warmer, and then you go through a very rapid drop-off, and then below about 15 meter water depths and the water is incredibly cold. And it turns out that a lot of the fish communities and how they're geographically distributed and the types of communities are tied very much to that temperature, internal temperature structure within the lakes. And that in the fall that whole thing just basically turns over as the upper waters cool down. In a riverine system or in a system such as the CAWS, I suspect that the turbulence is such, and even though the flows aren't great, there's still enough mixing of the water column that you're -- you probably cannot get that type of -- that temperature

stratification at least in the active areas that you get in the lakes.

MS. DEXTER: Do you have any reason to believe that this system is being impacted by temperature?

DR. MACKEY: I've not evaluated any of the temperature data or information in this system, so I can't answer your question.

MS. DEXTER: Okay. I'm looking now to my prefiled questions. I don't know given your answer to that how well they are, but I'll try. In various parts of your testimony, you mention temperature effects as something you do not believe that IEPA has adequately studied. What portions of the CAWS do you believe need further study with regard to temperature effects, if you actually believe --

DR. MACKEY: Basically I say my expertise is primarily focussed on characterizing mapping and physical habitat and linking those habitats to physical processes. And, as I said just a short while ago, the comments in my prefiled testimony

refer to temperature in a general way and were primarily focussed on seasonal changes in temperature that occur in natural systems. I did not consider temperature in my prefiled testimony, nor do I have any recommendations on the need for further study with regard to temperature effects.

MS. DEXTER: In that case, I'll strike my second question and just ask this last one here. Are there ways -- And I think you may have answered this, but I'll just let you try to again. Are there ways to categorize subsections of the CAWS that make more sense to you than the categories proposed by IEPA?

DR. MACKEY: Yes. As I've indicated before, I think that there -- with more detailed information such is that -- similar to that which maybe coming out from the habitat evaluation and improvement study. We'll get a much better feel. And it's not just for the habitat itself, but also for the distribution and the pattern and juxtaposition of that habitat. It's important to understand that because I think

if you get the patterns right, I think you have an opportunity to maybe do some things on a more local basis or on a reach basis that would be very effective in terms of trying to reach some of the biological data or biological outcomes that I think that you folks are interested and I suspect others are as well.

And that's the type of thing that I think that really we need to focus on. You get the best data that we can. And I'm not talking about doing a study for the next 20 years. I think we can have some good data in hand within the next year, maybe eight months to a year from now that will allow us to move forward in a very effective and intelligent way. And that's what I hope to see.

MS. DEXTER: I just have one more question, just because it occurred to me. Do you think that habitat needs to be continuous to be useful to fish?

DR. MACKEY: Not necessarily. And by -- See, I would ask you what you mean by discontinuous. Certainly the patch I nature

of habitat, you know, habitat -- you know, the distribution of habitat, the pattern of habitat is important. And it doesn't necessarily mean that, you know, you necessarily have a continuous sequence. This goes back to my definition of connectivity where I'm saying, hey, there are some limits to this. There are time, distance relationships, there are energy relationships. I mean you can't expect a fish to come out of a spawning bed and then swim for 200 miles to get to the nearest nursery habitat. It's just not going to work. And there are examples, and I don't think we need to go into it, but there are examples in the number of the tribs where I've worked where they've actually done the calculations where really very much show the upstream limits of how it could be effective spawning habitat for certain species of fish, primarily because of time and distance relationships.

The Sandusky River is one of the examples. If you want to show that stuff,

you can.

MR. ANDES: I would.

DR. MACKEY: You're in for it now, guys.

MR. ANDES: We have two exhibits.

DR. MACKEY: He's been chomping at the bit for this one.

HEARING OFFICER TIPSORD: He knows he's falling down on his responsibility.

DR. MACKEY: Do you need to --

HEARING OFFICER TIPSORD: We've got to beat all the records, not just the hearing records.

DR. MACKEY: Do you want to go over 200 then?

HEARING OFFICER TIPSORD: I have been handed a Side-Scan Sonar Mosaic of Calumet-Sag Channel, which I will mark as Exhibit 185 if there is no objection.

Seeing none, it's Exhibit 185.

DR. MACKEY: You should know that the originals are in color.

MR. ANDES: My fault.

HEARING OFFICER TIPSORD: And the

lower Sandusky River Northwest Ohio, which I'll mark as Exhibit 186 if there is no objection.

Seeing none, it's Exhibit 186.

DR. MACKEY: Well, tied to this time distance connectivity -- I'll get into these things in a second here, but the time distance relationships have to do with the upstream limits of potential spawning habitat. So we're in the process of pulling out one of the largest dams in the great lakes Boulder Dam, and opening up 22 more miles of potential spawning habitat. We need to know as to whether or not the fish are actually going to use it and whether it actually makes sense to do this. It turns out the calculations suggest that it's appropriate, but this has to do with the whole connectivity issue.

So in answer to your question, no, they don't necessarily have to be continuous. What Fred has just handed out are a little bit more extensive side-scan data. I think you can see on the side-scan

sonar mosaic for the Calumet-Sag Channel, this is basically an area, I don't know if any of you have launched out of Howy's Landing in Alsip boat ramp, but this is an area that goes for about 1.2 or 1.3 miles west from that. And you can see basically a continuous coverage of the side-scan sonar. And if you were to zoom in in the center of that, you'll see where it says car. There actually is a car on the bottom of the Cal-Sag Channel. And for scale I've circled a car on 294 there as well. So you can see that we're, you know, this is like we're probably 5,000 feet in the air when we're looking at this system. And what I've done is zoomed in on this one over here to the east or on the right-hand side. This is showing an area that was very similar to Route 83 in a sense where you have, in this case, the littoral zone is on the north side. There's no hard concrete wall. You have bedrock in the center of the channel and silt on either side. Again, you're looking at fairly large blocks again. So this shows you

again that this is laterally continuous for quite a way. If you move for a little bit to the west here, what you find is that the character of the channel changes. Again, on north side you have these large armor stone rock slabs and blocks, but in the middle the entire channel is still mud. So what we have just done over a distance of perhaps a couple tenths of a mile is transitioned from an area where bedrock is actually exposed on the channel bottom, and then I think the bedrock actually takes a bit of a dive here, they actually dug it a little bit deeper, and now it's 100 percent silt. And this extends for many miles until you get to within about three miles of Route 83 where bedrock starts coming back up again. And what I'm trying to illustrate here is that if you have two sampling points and if you look at the Cicero bridge site, the two sampling points, there's one just to right here or to the east, and then over to the far left they both show bedrock. And you would have completely missed this stretch here which is almost 100

percent silt the bottom with no bedrock. So there is a distinct difference in the habitat -- the instream habitat and substrate characteristics here which are not captured because you have such a wide sample spacing.

The other thing I want to show is on the Lower Sandusky River plot, this river actually flows north into lake Erie into Sandusky Bay and this is the lower reaches of the river. The Ballville Dam is probably another twelve river miles upstream from here, and this is some work I've done with the Ohio State University side-scan sonar. This is a natural system. So what I want to do with you just for a few seconds is to just take a look at -- look at the structure and what you see in the Cal-Sag and then look at the different all the different patterns and shapes and things that you see in the natural system. This is the compare and contrast between the natural and the CAWS and -- the natural and the artificial systems. And you can certainly see that it's a sinuous meandering system. In this case it's

approaching Lake Erie water levels. So you have some large shallow riverine embayments which are great spawning habitats and great nursery habitat. But at the areas that I've highlighted, let's say the one to the left or the center of the Lower Sandusky River that sort of blow-up there, what you're seeing is that these channels, because this channel is created by the flow of the river, this is not artificially dug or channelized. That there is an internal structure to the river where it's -- you have shallow water areas, and then as you head towards the outside of the bank and the flow is from the lower left to the upper right in the system, the -- it actually scours out a deeper pool, and in there you have a range of different substrate materials. You have sand, you have sand and gravel, you have cobbles. You have exposed cohesive clays which are the old lake bed deposits. And you can see some of that sort of lines and actually the bedding planes there. And you also have lots of woody debris here, too. There are trees and stumps

and logs, and there's some areas where these materials preferentially accumulate. And that's a function of the hydraulics of flow. The point being is that this is the type of thing that gives you incredible diversity in terms of habitat. This is not present in the CAWS for the most part. Now, the North Shore Channel and a few other areas approaches this. But this is what the natural system should look like. And this is what -- This is how you get aquatic diversity. It's because of the habitat diversity. And these patterns of the different types of substrates and structures are connected together in a pattern which organisms can use. They can go to deep areas to rest, they can come out and go to shallower water areas and feed or spawn, and then they can move back and it's connectivity of the different types of areas. And that's the type of thing I'm not sure you'll ever be able to mimic that type of thing in the CAWS. So I think we have some severe limitations there. But I wanted to illustrate this is an important difference

between the natural system and an artificial system which we have in the CAWS.

Same sort of patterns here on the right-hand side, the sort of the blow-up there. What's interesting there is that there's woody debris, but they've also -- this an area where they've put in this armored shoreline docks, large limestone blocks, very similar to the limestone that we have here or drop along the shoreline. And you can see some of that extending down into the river channel. Again, similar types of habitat characteristics, not what I would consider to be ideal spawning habitat, but it's good predator habitat. And I know that in this reach here there's really good fishing.

So this is just a compare and contrast and shows you what you can do. Thank you.

MS. DEXTER: I'm done.

HEARING OFFICER TIPSORD: Anything further for Dr. Mackey?

Let's take a ten-minute break

and we'll come back with Ms. Wasik.

(Short break taken.)

HEARING OFFICER TIPSORD: I think we're ready to go back on the record. Could we have Ms. Wasik sworn in.

(Witness sworn.)

HEARING OFFICER TIPSORD: And Mr. Andes and I talked at the break. And rather than resubmit Miss Wasik's testimony in the form of hard copy since it's so large with all the attachments, he's going to provide us with a CD-ROM. If there's no objection, we will mark the CD-ROM as Exhibit 187.

Seeing none, it's Exhibit 187. And I understand Miss Wasik is going to clarify some --

MR. ANDES: There are a couple of points that were raised in the questioning of Dr. Mackey that I think Miss Wasik will provide some helpful information on. One of them was as to the IBI scores and some errors and corrections, and why don't you take that one.

MS. WASIK: In terms of the mistakes

in calculating the IBI on Page 4-17 of the UAA report, which I believe is Attachment B to EPA's testimony, there's a Table 4-11 and at the very bottom row it says fish numbers, and it says that five points were given if there were less than 200 fish caught and one point was given if there was greater than 450 fish caught. Those were swapped. It should be the opposite, because the more fish you get the higher score should be reflected.

And then in Footnote C it says excludes tolerant species. Special scoring procedures are used when relative numbers are less than 200 per .3 kilometers. And that should read 200 per 1.0 kilometer, because that is the nonwadable IBI. The .3 would be appropriate for the wadable IBI. So that's why we believe there are incorrect calculations of the IBI.

MR. ANDES: And then in terms of the comparison Dr. Mackey was making of the Use A Water Quality Standards to the general use standards, if you can compare those.

MS. WASIK: Dr. Mackey basically said

that the Aquatic Life Use A CAWS proposed standards for DO were essentially the same as the general use standards. The 5.0 minimum during March through July is, indeed, the same; during August through February there's a 3.5 minimum and a 4.0 mean of minimums. And then the difference is that in the general use dissolved oxygen standards, there's a 6.0 mean of means for a seven-day mean of means, and there's also a 5.5 daily mean averaged over 30 days.

MR. ANDES: And that's in the general use standards?

MS. WASIK: Right. So that's the difference. But then on Page 59 of the IEPA's statement of reasons, it does state that, however, Illinois EPA does not propose these two chronic standards, meaning the seven-day mean of means and the 5.5 daily mean averaged over 30 days because this level of protection is already provided by the other applicable standards. Specifically for early life stages, if dissolved oxygen concentrations remain at all times above the

proposed acute standard of 5.0 milligrams per liter, it is mathematically impossible for a daily mean averaged over seven days to be less than 5.0 milligrams per liter. Similarly for other life stages, if seven-day averages of daily minimum remain above the proposed 4.0 milligrams per liter standard, it is unnecessarily redundant to require that daily means averaged over seven days remain less than 4.0 milligrams per liter. So I interpret that to mean that they actually are, as Dr. Mackey said, essentially the same.

MR. ANDES: Thank you.

MS. DEXTER: Could I just ask one question to clarify. This is -- You just compared CAWS Use A waters to the general use waters. It doesn't apply to Use B?

MS. WASIK: Yes.

MS. DEXTER: Thank you.

HEARING OFFICER TIPSORD: With that I think we're ready for the IEPA.

MS. WILLIAMS: I'd like to ask a similar follow-up at this point.

HEARING OFFICER TIPSORD: Absolutely.

MS. WILLIAMS: Do you think the general use standards are more stringent by including the seven-day mean and the 30-day mean of daily means?

MS. WASIK: My understanding based on Page 59 is that they are the same because it would be mathematically impossible to actually violate one of the standards without violating the chronic standard. I think they're saying they're redundant. I'm just trying to interpret what was in the statement of reasons, but.

MS. WILLIAMS: Right.

MS. WASIK: But I think they're in that way essentially the same.

MS. WILLIAMS: I think -- I don't want to misparaphrase Dr. Mackey, but would you agree with his testimony regarding if one of the water quality standards is similar or even the same as a general use standard that that automatically means the designated use must be the same as the general use designated use?

MS. WASIK: I think the idea is that because the aquatic life use is admittedly not meeting or able to meet the Clean Water Act goals that it should not have a general use water quality standard that's reflective of an aquatic life use that is meeting the Clean Water Act goals.

MS. WILLIAMS: Do you agree in some cases it would be possible for two different aquatic life uses to require the same numeric criteria to be protected?

MS. WASIK: I'm not sure why that would be the case.

MS. WILLIAMS: So in every case when you have a different tier of designated uses, you would always have a different numeric standard to go with each one?

MS. WASIK: Well, there could be other parameters that are affecting the achievement of aquatic life use. But in general --

MS. WILLIAMS: I don't think I'm talking about whether the use is attained or not. Just in terms of adopting standards necessary to protect the use. Would you

always have to have a different standard for each parameter for each use?

MS. WASIK: I couldn't say in every case if that would be impossible, but I would think with the CAWS, strictly for the CAWS, I believe they should have different standards than the general use standards considering they're very altered in state.

MS. WILLIAMS: For every parameter? I know you're not saying speaking for every waterway, but for every numeric criteria, would you suggest that they would have to be --

MS. WASIK: No, not necessarily.

HEARING OFFICER TIPSORD: Ms. Wasik, you need to be sure to let her finish her question before you answer.

MS. WASIK: Thank you.

MS. WILLIAMS: I'm sure I'll interrupt her at some point, so it will be a wash.

HEARING OFFICER TIPSORD: And I will point it out, but.

MR. ANDES: If I can follow up on that. When we're talking about standards, is

specifically designed to protect early life stages. I assume you want to make sure there were actually early life stages to protect?

MS. WASIK: Right, yes.

MS. WILLIAMS: Okay. Why don't we start with the prefiled questions. And just to be clear for the record and folks following along, on Page 34, the questions for Miss Wasik begin first with the set of questions on a different piece of her testimony. So I'll start with the questions that say sediment and macroinvertebrate testimony.

Question 1: On Page 1 you state that, quote, "Twenty-eight of the stations are in the CAWS, whereas the other stations are located in the general use shallow draft waterways," unquote.

Based on Attachments 1 and 2, there appear to be only 26 stations within the CAWS reaches that are part of the rulemaking. Can you -- The question asks could you identify which 28 stations are in the CAWS. I think maybe if you could help us

identify which two --

MS. WASIK: Right. There are 26 stations that we monitor that are in the CAWS. I had included Ashland on the Little Calumet River South which is not part of the rulemaking, and I think I had included Wolf Lake which actually is not part of the CAWS as defined by IEPA.

MS. WILLIAMS: When you say I've included them, can you explain where you've included them?

MS. WASIK: Just in that count of the 26. I don't think I listed them out in my testimony, although I can, if you'd like me to.

MS. WILLIAMS: No, no, no.

MS. WASIK: They are in, as you said, in the map attachment.

MS. WILLIAMS: Okay. So they're on the maps. But did you include the data in the reports?

MS. WASIK: Yes. The Attachments 1 and 2 are reports for all of our ambient stations, so they actually include all 59 of

our ambient stations; 26 of which are in the CAWS.

MS. WILLIAMS: And then Attachment 3 is a map that lists various stations, I think.

MS. WASIK: Yes. That's the monitoring map.

MS. WILLIAMS: And that's where there's 28 identified but only 26 are technically in the CAWS; is that correct? And if I'm not correct, do not hesitate to tell me no.

MS. WASIK: Actually, that map, I'm trying to think, might include all of our ambient stations. So you'd have to go through yourself and determine which ones were at the waterways that are part of the rule-making. But in the second part of your first question I can clarify which other parts of our -- of the waterways aren't included.

MS. WILLIAMS: I guess could you just tell me from this map what numbers represent this Wolf Lake and the Little Calumet South.

MR. ANDES: Are you talking about Figure 1?

MS. WASIK: It's Attachment 3. I'm just wondering are there -- Does that have the general use waterways on it as well?

MR. ESSIG: Yes, it does.

MS. WASIK: Okay. So I can read through here and pick out the ones that are in the CAWS.

MS. WILLIAMS: No, no, no. I would just like to know, to be sure that I can identify, because I'm assuming these two are close, right, Wolf Lake?

MS. WASIK: Okay. Wolf Lake would be No. 50 and then the Little Calumet at Ashland would be 57. So that's in the more shallow portion of the Little Calumet. That's not part of this rulemaking.

MS. WILLIAMS: Thank you. So I'm assuming then the answer to -- I think you've sort of already answered to Question No. 2, but are there other waterways in the Districts's ambient water quality monitoring network that are not part of this rulemaking?

MS. WASIK: Yes. There are -- the shallow portion of the north branch Chicago River System including the Skokie River, the middle and west forks of the north branch Chicago River and also the shallow portion of the north branch Chicago River upstream of the confluence with the North Shore Channel. Also in the Calumet River system, Thorn reek, and the southern tributary of the Little Calumet River were not included in the rulemaking.

MS. WILLIAMS: Question 3: During biological collections, physical habitat is assessed at -- I'm sorry. This is a quote from Page 2 of your testimony. "Physical habitat is assessed at four locations at each sampling station: At the beginning and end of the sampling reach, at the side and center of the waterway," unquote.

How long are the sampling reaches?

MS. WASIK: We have 400 meter sampling reaches.

MS. WILLIAMS: And which side of the

waterway is evaluated?

MS. WASIK: The side of the waterway that's evaluated is whichever side the Hester-Dendy sampler is located. This is -- The side on which the Hester-Dendy is installed is based on basically where a cable can be easily fastened to a tree or some other fixed object on the shore and where there's least likely a chance of vandalism.

MS. WILLIAMS: Why don't you try to reach both sides of the reach?

MS. WASIK: We evaluate the ponars and the Hester Dendys from one side, because it's an acceptable procedure to get samples from the same place. And we don't need both sides, because the side ponar and Hester-Dendy are representing a lower flow area as opposed to the center which would be a high flow area. And we expect both sides in the lower flow areas to be similar. U.S. EPA 2006, the document that I referred to in my testimony, it's called Concepts and Approaches For the Bioassessment of Nonwadable Streams and Rivers. That document

says that Hester-Dendy colonization can differ based on whether it's in a high or low flow area of the waterway. So that is why we look at one Hester-Dendy in each.

HEARING OFFICER TIPSORD: May I ask a follow-up? You said it was an approved method for placing them on the side. Is that approved by U.S. EPA or approved scientific standard?

MS. WASIK: Well, in general when you're -- for monitoring you want to collect your samples from I think it's as proximate a location as possible. And I believe this is in the 2006 document that I mentioned.

MS. WILLIAMS: Do you know whether this U.S. EPA 2006 is a guidance document or an approved method as --

MS. WASIK: I guess not technically a guidance document. It's called Concepts and Approaches. It's an EPA report, so I suppose it's not necessarily called an approved method.

MR. ANDES: We can provide a copy or at least a link.

HEARING OFFICER TIPSORD: Thank you very much.

MS. WILLIAMS: And do you consider four locations on a site to be representative of the sampling range?

MS. WASIK: Not necessarily, but in many of the channelized waterways of the CAWS I don't think that habitat varies too much necessarily in a 400 meter stretch, as Dr. Mackey has previously testified. However, I want to point out that we did evaluate habitat at two locations at each of our 26 ambient locations in the CAWS, so that would be a total of 52 locations. So that is still quite a bit more than the 23 locations that were evaluated by Ed Rankin in the Attachment R because there are -- for the entire 78 miles of the CAWS this is one of the main reasons that we initiated a habitat RFP for the CAWS was because we wanted to get a more complete picture of the habitat at smaller increments.

MS. WILLIAMS: When did you decide this would be necessary?

MS. WASIK: There were inhouse discussions regarding habitat RFP after the UAA report came out and after the initial IEPA draft proposal came out in January of 2007, is it? So we had been talking about it early 2007. And, in fact, it does take a while to initiate an RFP, but I think even late in 2006 there were discussions about that.

MS. WILLIAMS: Do you recall if this was ever raised by the District either in any of the stakeholder meetings or in comments on the draft proposal that more detailed habitat --

MS. WASIK: I wasn't at any of the earlier stakeholder meetings, so I'm sorry I don't know.

MS. WILLIAMS: Do you know who would know?

MS. WASIK: I think Mr. Lanyon attended those meetings, but I think that they're on record, the minutes from the meetings.

HEARING OFFICER TIPSORD: Excuse me,

Miss Williams if I may. Just to back up for a little bit for the lay people out there. RFP is request for proposal?

MS. WASIK: Yes.

MS. WILLIAMS: Mr. Lanyon, I believe, is not being presented by the District as an aquatic life use witness.

MS. WASIK: Right.

MS. WILLIAMS: So do you know if there are any other aquatic life use witnesses for the District that I could ask that question of?

MS. WASIK: That could say whether or not it was brought up at the stakeholder meetings?

MS. WILLIAMS: Correct.

MR. ANDES: I would say probably Dr. Grenada who's going to summarize the aquatic testimony for the District.

MS. WILLIAMS: That sounds good.

MS. WASIK: I don't --

MR. ANDES: I'm not sure why it's relevant, but.

MS. WASIK: I'm not sure how many

stakeholder meetings were actually, if any, actually took place between January at the time the proposed draft came out and October when the final draft came out.

MS. WILLIAMS: I don't think that's what I'm asking. I'm just trying to understand, and I think it's better that I ask Mr. Grenada why the first we're hearing of a need for more habitat studies or any habitat index, in fact, actually, is with this testimony submitted by the District this summer.

MR. ANDES: Doesn't the Agency know what was said at its own meetings?

MS. WILLIAMS: I'm not sure if you heard what I just asked then. I just -- Did you hear what I just clarified for her?

MR. ANDES: I'm sorry. I didn't hear the whole thing. Can you repeat what was said?

HEARING OFFICER TIPSORD: I think the issue is there is some question as to whether or not this was raised. The Agency doesn't believe it was necessarily raised.

MS. WASIK: I would only say that the discussions to have more habitat were raised after this January 2007 proposal, and I don't know that there were opportunities in terms of stakeholder meetings after that point to raise it.

MS. WILLIAMS: Okay. So you're saying now that it -- because I thought what you said was that the internal meetings began after the draft UAA came out. So I was thinking you were referring to Attachment B. So there was quite a bit of time between Attachment B being developed and the January 2007 --

MS. WASIK: I can't remember the exact date in which the draft UAA came out.

MS. WILLIAMS: Okay. We can move on to Question --

MR. ANDES: When did that come out? I'm sorry. When did the UAA report come out?

MS. WILLIAMS: I can refer to the time line if you want me to. I mean I'm just going to ask Dr. Grenado.

MR. ANDES: Fine.

MS. WILLIAMS: That's fine with me.

Question 4: You testify on Page 2 that, quote, "A sediment evaluation is one component of the habitat assessment process," unquote.

Describe the other habitat attributes that are assessed and how this assessment is conducted.

MS. WASIK: Again, this is described in my Attachments 1 and 2 in the methodology section. A team biologist also assesses the following habitat features on a field data sheet which is Figure 2 in those attachments. We assess weather, channel development, water depth, channel width, water level, manmade structures, channelization, bank erosion, presence of floatable materials, aquatic vegetation, instream cover for fish, canopy cover, immediate shore cover, riparian land use, sediment composition, sediment color, sediment odor, oil present in sediment, embeddedness in the sediment, sinuosity, and the depth of fines.

MS. WILLIAMS: Question five: On Page

2 you mention that --

HEARING OFFICER TIPSORD: Excuse me. I'm sorry, Miss Williams. Before you go ahead, fines is a term that I know is defined and was defined in Dr. Mackey's written testimony, but I think it's the first time it's been used in the testimony today. So if we could -- could you explain what fines is, since it's not the normal --

MS. WASIK: Sure. That would be the depth of the fine sediment that's deposited on the river bed. We measure it with a one inch diameter rod, telescoping rod, to basically push it into the sediment and see how far it goes before you get to the --

HEARING OFFICER TIPSORD: Like I said, I know it was defined in the written testimony, but it is a word that will jump out when we read the transcript. Sorry, Miss Williams. Please go ahead.

MS. WILLIAMS: So the list of habitat attributes that are assessed, are they assessed at four separate locations at the site?

MS. WASIK: Right. Yes.

MS. WILLIAMS: And just to finish the thought, what are those?

MS. WASIK: Four locations?

MS. WILLIAMS: Yes.

MS. WASIK: At the beginning of the sampling reach in the center and the side, and at the end of the sampling reach at the center and the side.

MR. ANDES: So two at the beginning and two at the end.

MS. WILLIAMS: Thank you. On Page 2 you mention that fine grade sediment increases the probability of contaminants absorption and desorption, thus silt and sand generally support tolerant organisms.

Other than the possibility of contamination, are there other reasons why tolerant organisms predominate in silt and sand?

MS. WASIK: Yes. Homogenous sediments like the ones present in the CAWS are correlated with lower species richness, irrespective of contamination. Fine

sediments are not preferred habitat, nor do they support several varieties of benthic invertebrates because their food requirements are not met. Abundant availability of bacteria in the sediment provides food for the more tolerant organisms that are deposit feeders like the oligochaete worms. There's little space for dissolved oxygen in the interstitial spaces of silt. So both the physical characteristics and the contamination of sediment are separate stressors in the CAWS.

MS. WILLIAMS: So you would agree that tolerant organisms tend to predominate in uncontaminated silt and sand?

MS. WASIK: Yes, in general.

MS. WILLIAMS: Question 6: On Page 3 of your sediment testimony it states that, quote, "In the absence of sediment toxicity data, the CAWS UAA report employed sediment screening levels from McDonald et al., 2000, in order to identify potential problem areas and constituents."

Subpart A, do you agree that

another sediment quality guideline developed by Morgan was also used?

MS. WASIK: Yes. Morgan's guideline was also referenced in in the UAA report. Long and Morgan was based on literature in the marine environment, I believe, from sampling stations from NOAA, the National Oceanic and Atmospheric Administration. McDonald was a more recent paper. I think it's more widely recognized especially for fresh water.

MS. WILLIAMS: Subpart B, it says was the use of these guidelines agreed to by the members of the CAWS UAA work group?

MS. WASIK: Again, I'll have to say I wasn't a member of the work group, so I'm not sure.

MS. WILLIAMS: Do you know if other possible impacts to aquatic life, such as water quality and habitat, were considered in the development of the threshold effects concentrations or TEC and probable effects concentrations or PEC or was it assumed that degraded biological conditions for CAWS

exclusively by sediment contamination?

MS. WASIK: My understanding of the McDonald publication is that TECs and PECs were based on the consensus of published numerical SQGs or sediment quality guidelines. These sediment quality guidelines appeared to be limited to approaches described by sediment chemical contamination. I think this is why the author suggests that these screening tools should be used in conjunction with other tools and tests.

MS. WILLIAMS: Subpart D: McDonald, et al., 2000 defined TEC as threshold effects concentration below which adverse effects are not expected to occur. And PEC as probable effects concentration above which adverse effects are expected to occur. Would you agree that potential biological effects in sediments with contaminant concentrations between the TEC and PEC are uncertain.

MR. ANDES: Before we answer that, I want to introduce a copy of that particular document, the McDonald paper.

HEARING OFFICER TIPSORD: If there is no objection, we'll mark Development and Evaluation and Consensus-Based Sediment Quality Guidelines For Fresh Water Ecosystems by D.D. McDonald, C.G. Ingersoll, T.A. Berger, authors, published January 2000 as Exhibit No. 188 if there is no objection.

Seeing none, it's Exhibit 188.

MS. WASIK: Well, I would say it that these TEC and PEC thresholds deal in probabilities. So if the concentration of a contaminants is greater than the PEC then sediment is presumably or probably toxic; whereas concentration, if it's above the TEC, they're possibly toxic. This is how the IEPA contractor interpreted the McDonald paper on Page 4-11 of the UAA report, Attachment B. And Figure 4-4 of that report indicates that if the concentration of a contaminants is above the TEC then it is possibly toxic. And if it is above the PEC it's presumed toxic. And my testimony I just used the exact wording that I found in this UAA report in order to be consistent. And to read from

Exhibit 188, the McDonald paper, they actually say that -- This is on Page 21 in the second column, the PECs were intended to identify contaminants concentrations above which harmful effects on sediment dwelling organisms were expected to occur frequently. So the word frequently there is important because if chemical contaminants concentration is less than the PEC, there are harmful effects. They just aren't expected frequently.

MR. ANDES: And the word frequent was not in the question as prefiled by the Agency, am I right?

MS. WASIK: Yes.

MS. WILLIAMS: Can you explain what's meant by possibly toxic?

MS. WASIK: I think, again, dealing with probabilities, if possibly toxic, there, again, are some harmful effects expected, but it's not expected to occur frequently. So it's less frequent than the -- above the PECs where it's considered presumed toxic, but it still occurs. And I think the quote kind of

sums that up. It's -- They're expected to occur, but possibly not frequently. And, again, the reason I use the words possibly and presumed toxic are because they were in the UAA report. So I was just trying to be consistent with the IEPA contractor.

MS. WILLIAMS: Can you send us back to the page you're reading from again?

MS. WASIK: Sure. In the UAA report it was --

MS. WILLIAMS: I'm sorry. In the McDonald.

MS. WASIK: Yeah. That's Page 21. There's pages on the top. That's Page 21. There's also pages on the bottom. That would be Page 9800 on the bottom.

MS. WILLIAMS: Question 7: You testify on Page 4 of your prefiled testimony that, quote, "Hester-Dendy samples tend to indicate benthic invertebrate taxa that might be present at a given location if there were habitat available."

Subpart A: Do Hester-Dendy artificial substrate samples indicate taxa

that are present with other collection techniques such as petite ponar grabs are inadequate to sample substrates such as coarse gravel, cobble, bolder, or woody debris at a given location?

MS. WASIK: No. They indicate organisms present in the drift that may not be able to survive in the sediments due to the wide spread homogenous silt sediments or contamination possibly.

MS. WILLIAMS: Do you agree that petite ponar grabs are more selective of finer grain substrate such as silt, sand, and fine gravel because larger material can interfere with complete jaw closure of the ponar?

MS. WASIK: Yes. And the reason we use ponar samples is because I think they're especially appropriate for a system like the CAWS, because cobble and woody debris are more rare than in a natural system.

MS. WILLIAMS: I mean I'm trying to understand, I guess, if the CAWS was a more natural system what would you do differently

than you did here?

MS. WASIK: Well, I think that our sampling methods for benthic invertebrates being ponars and Hester Dendys are perfectly appropriate given that 2006 document because they are deep draft, you couldn't really use a kick net or anything like that that you might use in a wadable stream. So I think they are the most appropriate sampling techniques and possibly the only appropriate sampling techniques for the system.

MS. WILLIAMS: But those methods would also be appropriate in a general use water as well, right? I mean do you -- I guess maybe I should ask it this way. Do you vary your sampling method for the areas in the network that are not part of this rulemaking?

MS. WASIK: We actually do not, no. We also do ponars -- There's a lot of siltation in those waterways as well, but we do ponars and Hester-Dendys in those as well.

MS. DEXTER: Is there a limit on the ponar's ability to catch the finest sediments that sit on the top of the -- that would be

on the top?

MS. WASIK: I suppose some of the fine materials may fall out of the jaw of the ponar grab sample. But in general I think it would be the best way to collect those kind of sediments.

MS. DEXTER: Thanks.

MS. WILLIAMS: Is it your testimony that Hester-Dendy sampling in the CAWS attract macroinvertebrates from outside the CAWS?

MS. WASIK: No, not at all. Hester-Dendys, they provide an artificial habitat and that they represent drift organisms.

MS. WILLIAMS: Can you discuss for us nonbug people here, can you just explain drift organisms. I don't know that that's a term that's come up.

MS. WASIK: So organisms that are drifting in the water column could colonize an artificial substrate, but would be possibly unable to live in the fine sediments at the bottom which is shown in our

comparison of ponar samples with the Hester-Dendy samples.

MS. WILLIAMS: Do you believe the Hester-Dendy substrates reflect the organisms that would be found on gravel, cobble, or woody debris substrates?

MS. WASIK: They reflect organisms that might be able to survive in these waterways were there appropriate habitat for them and heterogeneous substrates.

MS. WILLIAMS: But they are surviving in these waterways, aren't they?

MS. WASIK: Right. They would be able to survive on the actual river bottom without an artificial substrate if there were habitat present for them to colonize in.

MR. ANDES: We can, to help -- I'm sorry. To help people understand what we're talking about, we have a picture of a Hester-Dendy sampler which we thought might be useful.

MS. WILLIAMS: I think he's padding the exhibit numbers.

MR. ANDES: This is from the 2006

document EPA document, Concepts and Approaches For the Bioassessment of Nonwadable Streams and Rivers.

HEARING OFFICER TIPSORD: Oh, and it's color.

MR. ANDES: That was my home printer.

HEARING OFFICER TIPSORD: If there's no objection, we'll mark this picture as Exhibit 189.

Seeing none, it's Exhibit 189.

MS. WASIK: So if you do look at that U.S. EPA document on Page 6-6 of the benthic invertebrate chapter, one of the advantages mentioned for these Hester-Dendy or artificial substrate samplers is that it can be especially effective in reflecting water quality as a result of the standardized habitat they provide. So you're basically standardizing the habitat and putting something in there they can colonize when there may not be actually any kind of habitat that they can colonize in the system.

MS. WILLIAMS: Does it say that part in there where it may not be --

MS. WASIK: I'm sorry. I ended the quote after the standardized habitat they provide.

MS. WILLIAMS: Okay. Do you believe the sample of macroinvertebrates collected only from fine bottom sediment provides useful indication of overall biological condition in the stream?

MS. WASIK: A sample from fine bottom sediments is useful in combination with other information and other collection techniques which is why we also collect the Hester-Dendy samples. Samples from the fine bottom sediments, which are pretty ubiquitous in the CAWS, are a good indicator sediment quality.

MS. WILLIAMS: Do you know of any macroinvertebrate indices that focus solely on samples from fine bottom sediments in streams?

MS. WASIK: No. I don't know of an index that focusses only on the fine bottom sediments, but I also don't know of a macroinvertebrate index that's created specifically for a system like the CAWS.

MS. WILLIAMS: So are you saying if there was an MBI specifically for the CAWS that it would focus on only fine bottom sediments?

MS. WASIK: Not necessarily. But I'm just saying that -- I don't know of an index just for fine bottom sediments, and I don't know of an index for waterways such as CAWS.

MS. WILLIAMS: I mean I think this question is getting at do you think it would be appropriate in any water body, natural or the CAWS, to only look at macroinvertebrate samples for fine bottom sediments?

MS. WASIK: Well, we don't do that, but --

MS. WILLIAMS: Is there a reason that we don't do that?

MS. WASIK: We don't only look at fine bottom sediments. We also look at Hester-Dendys. So I don't know that it's relevant to our sampling program, but I think it's part of the picture that you would look at, and it is certainly the adequate sampling technique for the CAWS because silts is

mostly what we see there.

MS. WILLIAMS: We would look at both -- we would want to look at both Hester-Dendys and the bottom sediments in any system, correct?

MR. ANDES: You mean Hester-Dendy and the ponar samples?

MS. WILLIAMS: Correct.

MS. WASIK: Yes.

MS. WILLIAMS: Okay. Question 8: You indicate on Page 4 that, "Sand and silt dominated sediment throughout the North Shore Channel and the depth of fines measured greater than four feet at two stations."

Can you identify these two stations?

MS. WASIK: The two stations that had a depth of fines greater than four feet were Oakton at the end center location and Touhy at the end center and beginning center locations.

MS. WILLIAMS: Are these stations located in the upper or lower North Shore Channel?

MS. WASIK: Where do you draw the line between the upper and lower?

MS. WILLIAMS: The North Side Plant.

MS. WASIK: Oakton is above north side Water Reclamation Plant and Touhy is below it.

MS. WILLIAMS: Question 9: When you indicate on Page 4 that, quote, "Toxicity results show significantly lethality from exposure to North Shore Channel sediments from one station," unquote.

Are you referring to Foster Avenue?

MS. WASIK: Yes.

MS. WILLIAMS: Subpart A: Is it true that there were two samples from this site, and only one sample showed a significant difference in persistent survival compared to only one of the two control samples?

MS. WASIK: Yes. Again, we collect a side and a center sample from each station. Only the side sediment sample showed significant toxicity; flow was highest in the center of the waterways and lower along the

sides often causing the fine sediment particles to deposit on the sides. So there's -- It stands to reason that the toxicity would be shown on the side sample.

MS. WILLIAMS: Is it also true that the other sample from this site had a survival of 94 percent?

MS. WASIK: Yes. I was only highlighting the areas of concern in my testimony. But, actually, if I could go back to your first question, I also notice that you asked -- compared to only one of the two control samples. And you get into this in Question 26. But I just wanted to clarify now that there's technically only one official control, and that one is called the West Bear Skin Lake. The other control is an inhouse control run by our contractor. But I can explain that later when you get to --

MS. WILLIAMS: I think if it makes more sense now, that's fine. I think Question 26 asks why was the number of control samples for toxicity test reduced from two controls to only one?

MS. WASIK: During 2002, our contractor happened to be running the, what was called the NC-Sand control which is acid washed sand, which they run every month for QC at their lab alongside with the tests that they're running. Technically the West Bear Skin, also referred to as WBS in some of our toxicity reports, that control is the one that was set up specifically for our experiment and that is the one that should be used in -- to determine significant differences. The contractor said that the negative control should be a field sample like the West Bear Skin as opposed to acid wash sand that you have to buy from a vendor.

MS. WILLIAMS: I don't think I understood that. I'm sorry. Could you simplify it for me a little bit?

MS. WASIK: Basically they were only ever supposed to or required by the protocol to run one sample which is called the West Bear Skin sample. That's from a lake in Minnesota. So that is the control that they are comfortable comparing with our samples.

They also had an inhouse for their own QC for all of their samples because they're running other samples from other -- with other contracts. So they run this NC-Sand control which is an acid washed sand, and that wasn't meant to be specifically compared to our samples.

MS. WILLIAMS: Why? Maybe that's what I'm missing. Why?

MS. WASIK: Because it's not a field sample. They like to use a control that's a field sample like the one from the lake in Minnesota and in all of the future sediment tox reports, that's all that there is because they're just comparing --

MR. ANDES: So just happened in 2002, they happened to run that acid wash sand --

MS. WASIK: With our samples, yeah.

MR. ANDES: And that didn't happen after that?

MS. WASIK: Right.

MR. ANDES: Okay.

MS. WILLIAMS: I have to go back. I think we left off on B.

MS. WASIK: I believe 9B I answered yes. I was just highlighting areas of concern in my testimony.

MS. WILLIAMS: Is it yes to the second part as well? Did percent survival at the other sites on the North Shore Channel range from 79 percent to 96 percent?

MS. WASIK: Yes.

MS. WILLIAMS: How many different types, and by types I mean taxa, of test organisms were used in these toxicity tests?

MS. WASIK: The toxicity test we use is a ten-day chironomus tentans toxicity test with both sediment. So that's just one kind of organism. And this is one of the tests recommended by U.S. EPA in methods for measuring the toxicity and bioaccumulation of sediment associated contaminants with fresh water invertebrates. One reason this organism was chosen for our toxicity test is because it's useful in assessing chemical toxicity in the CAWS is because according to this U.S. EPA publication, quote, larva of c. tentans appeared to be tolerant of a wide

range of particle-sized conditions in substrates. So this essay can better isolate the chemical effects from grain size -- from the grain size effects.

MS. WILLIAMS: Do you have an EPA number for that publication you've referred to?

MS. WASIK: Let me see if it's in there. In my testimony it's referenced. Let me see if I have it there. Okay. That is research and development report No. EPA-600-R-99-064.

MS. DEXTER: Could I ask a question to clarify. You said that the test was done with one organism. Do you mean one species?

MS. WASIK: Yes. One kind of organism.

MS. DEXTER: Not just one?

MS. WASIK: Right.

MS. WILLIAMS: Are there -- Question D asks, are there sources of contaminants located upstream of the Foster Avenue Station such as CSOs or points or dischargers?

MS. WASIK: Yes.

MS. WILLIAMS: Ten: When you state on Page 4 that, "Concentrations of trace metals in North Shore Channel sediments were generally below the PEC, but most samples exhibited cadmium, copper, lead, nickel, and zinc concentrations above the TEC," end quote.

Are these results comparable with the North Shore Channel as presented in the CAWS UAA Attachment B?

MS. WASIK: Yes. The results for the North Shore Channel are consistent with what was reported in Attachment B. However, I'd note that their conclusions are based on a different set of -- or a different data set at different locations from, I believe they maybe used one year of our data, but then it was also based on U.S. EPA data.

MR. ANDES: But the overall conclusions --

MS. WASIK: Are the same.

MS. WILLIAMS: Do you know which year of your data they used?

MS. WASIK: 2002.

MS. WILLIAMS: And do you know why they limited it to 2002 data?

MS. WASIK: I think that's when they started preparing the report possibly, or I'm not really sure.

MS. WILLIAMS: And the data -- In Attachments 1 and 2, what are the years' worth of data we're looking at?

MS. WASIK: Attachment 1 is 2001 through 2004 and Attachment 2 is 2005.

MS. WILLIAMS: Now, what was the purpose of these two reports? Because I believe their data in 2008, correct?

MS. WASIK: Right. The purpose of the reports is to report our biological findings and of the ambient water quality monitoring program. And as to why they're dated 2008, is that what you were --

MS. WILLIAMS: Right. I'm just sort of trying to understand the schedule of sampling compared to when the reports come out.

MS. WASIK: We're basically running behind. That's why they came out in 2008,

but normally we would try to get them out as quickly as we could. But they, the contractor, the IEPA contractor, contacted us directly and got sediment data, I believe. I don't know that they got it from the report.

MS. WILLIAMS: Okay. Question 11: You also state on Page 4 that, quote, "Oligochaeta was the dominant taxa collected from the North Shore Channel," unquote.

Was this true for all sampling sites for both petite ponar and Hester-Dendy substrate samples?

DR. MACKEY: If you consider both sampling methods together, the oligochaete worms were the dominant benthic swana (ph.) In the North Shore Channel. Oligochaete worms dominated ponar samples but some Hester-Dendy samples were not dominated by oligochaete worms.

MS. WILLIAMS: What about Foster Avenue?

MS. WASIK: Foster had a higher percentage of turbellaria, which is a free-living flat form, 49 percent, than

oligochaetes which were 32 percent in the Hester-Dendy sample. 2005 Foster ponars contained 98 percent oligochaete.

HEARING OFFICER TIPSORD: Could you spell both of those.

MS. WASIK: Oligochaete is are spelled o-l-i-g-o-c-h-a-e-t-e, and the turbellaria is t-u-r-b-e-l-l-a-r-i-a.

HEARING OFFICER TIPSORD: Thank you.

MS. WILLIAMS: Question 12: Along the North Branch Chicago River -- I'm sorry. This is a quote from Page 4 of your testimony. "Along the North Branch Chicago River, sediments were less dominated by fine sediments at the furthest upstream location," end quote.

Is this station located within the CAWS just downstream of the confluence with the North Shore Channel?

MS. WASIK: The furthest upstream location along the deep portion of the north branch would be Wilson, and it's .6 miles downstream of the confluence with the North Shore Channel.

MS. WILLIAMS: What station are you referring to on Page 4 when you testify that, quote, "Depth defined at this station was as deep as greater than five feet"?

MS. WASIK: Depth of fines were five feet or greater at our Grand Avenue Station.

MS. WILLIAMS: According to your testimony on Page 5, quote, "Five of six sediment samples from North Branch Chicago River during 2005 had PAH concentrations presumed toxic. Generally trace metal concentrations in sediment samples were either above the PEC or TEC screening levels in all samples," unquote.

First, can you clarify for the record what PAH stands for?

MS. WASIK: Poly aromatic hydrocarbon.

MS. WILLIAMS: How do these findings compare to those reported in the CAWS UAA Attachment B to the statement of reasons?

MS. WASIK: These results are consistent with the UAA report Page 4-53, although I'm -- It's not apparent to me from the statement of reasons how exactly they

were used, but it is consistent with what was reported on the UAA report.

MS. WILLIAMS: You state on Page 5 that, quote, "Toxicity results show significantly lethality from exposure to Diversey Parkway and Grand Avenue on the North Branch Chicago River.

A: Is it true there were two samples from both of these stations and that only one sample at each site showed a significant difference at percent survival compared to the control?

MS. WASIK: If you're comparing it to the West Bear Skin control, since the contractor did tell us to ignore the acid wash sand control, the side samples from Grand and Diversey exhibited 13 and 49 percent survival respectively. And the center samples from Grand and Diversey exhibited 93 and 86 percent survival which is compared to 96 percent in the controls. So that was not significant. And, again, that's somewhat expected because these are in the side channel area. That's where we saw the

toxicity from the increase sediment deposition.

MS. WILLIAMS: Did you just say that the contractor advised you not to use the acid wash sand control? Did I call it the right thing, acid wash sand control?

MS. WASIK: I actually called the contractor in response to your Question No. 26 because I wasn't clear on why there was the two controls, and that's when he explained to me that we should look at the West Bear Skin control because it was a field sample and that would be the appropriate comparison.

MS. WILLIAMS: So he told you that on the phone?

MS. WASIK: Yeah, recently.

MS. WILLIAMS: Do you have your attachments in front of you?

MS. WASIK: Some of them.

MS. WILLIAMS: I have one. I believe it's -- Does 16 sound right? Titled --

MS. WASIK: 2003 Sediment Toxicity Report.

MS. WILLIAMS: September 2003 Results of Ten-Day Chironomus Tentans Toxicity Test?

MS. WASIK: Actually, I don't have printed out copies of those. I have a summary which is my attachment 14.

MS. WILLIAMS: I'm going to show you this document and ask you to identify whether it looks like Attachment 16 to your testimony. Does this look correct?

MS. WASIK: Yes.

MS. WILLIAMS: Okay. Then I'd like you to read the highlighted portion on Page 9.

MS. WASIK: Second control set, negative control sand was employed for the first test set. However, after consulting with personnel at MWRDOGC it was decided one controlled exposure was sufficient for each set of toxicity exposures.

So I guess all I can say is that I recently talked to the contractor and he said that they were only using the negative sand control for the purposes of their own internal QC. So I don't know. I'd

have to ask them about the discrepancy. But in the U.S. EPA methodology reference that I gave you, only one control is required for the chironomus tentans.

MS. WILLIAMS: But you don't know for sure whether it could have been someone at the District that advised them not to use the second control in the future?

MS. WASIK: In 2002 possibly. It wouldn't have been me.

MS. WILLIAMS: Okay.

MS. WASIK: But one control is consistent with, like I said, with the EPA.

MS. WILLIAMS: And I don't -- I don't think I disagree with that. I'm just questioning if you had two controls and one was ignored, ordinarily that would not be a valid scientific approach, would it?

MS. WASIK: To ignore one of the controls? No. I would say none of the survival data resulted in an instance where toxicity -- toxicity was different from one control but not the other. I think there was one instance where the dry weight was

significantly different from one and not the other, but there was never a conflict with the survival data.

MS. WILLIAMS: Is it true that more samples showed significant difference with the West Bear Skin control than with the NC-Sand or the sand control?

MS. WASIK: For toxicity or growth?

MS. WILLIAMS: I'm sorry. For what?

MS. WASIK: For --

MS. WILLIAMS: For survival. I'm sorry.

MS. WASIK: For survival. Significantly, not that I'm aware of. I thought they were the same.

MS. WILLIAMS: So you thought the survival was the same when compared to both controls?

MS. WASIK: Yes. If you look at my Attachment 14, it's a summary of the 2002 through 2007 sediment toxicity results.

MS. WILLIAMS: Okay. Go ahead.

MS. WASIK: I believe there was one sample that has the Footnote B significantly

different from the negative control sand control results. And that only occurred once at Cicero in the Chicago Sanitary and Ship Canal.

MS. WILLIAMS: And do you know how significant is defined is in this context?

MS. WASIK: Well, it's a statistical significance. So they run a statistical test. I couldn't really describe more than that.

MS. WILLIAMS: And then what does Footnote A mean in this table?

MS. WASIK: Significantly different from the West Bear Skin Lake control results.

MS. WILLIAMS: Well, I mean I can read what it says. What does that mean? I'm sorry. And I don't mean to be difficult. I just don't understand.

MS. WASIK: That there's a statistical difference between the tests that they ran, the amount of either survival or growth in the organisms from the West Bear Skin Lake control than there was in the samples that we sent them.

MS. WILLIAMS: Okay. And did they determine what was the statistical difference or did you determine?

MS. WASIK: Yes. They did that and provided it in this report.

MS. WILLIAMS: This report -- I mean do you mean this summary?

MS. WASIK: Not in this attachment, but in the report that you showed me earlier.

HEARING OFFICER TIPSORD: Attachment 16.

MS. WILLIAMS: And the name of that contractor is --

MS. WASIK: It's ASCI Corporation.

MS. WILLIAMS: But you developed Attachment 14, this summary table?

MS. WASIK: Right. Just taking directly what they had in their report.

HEARING OFFICER TIPSORD: Cut and paste, not interpretation of the document?

MS. WASIK: Right.

MS. WILLIAMS: I think I left off on Subpart B of Question 14. Is it true that the other samples at these sites, referring

back to Diversey Parkway and Grand Avenue, had survivals of 86 percent and 93 percent with no significant difference when compared to the control?

MS. WASIK: Yes.

MS. WILLIAMS: And was survival at Wilson Avenue 84 percent and 93 percent with no significant difference from the control?

MS. WASIK: Yes.

MS. WILLIAMS: Question B: When you state on Page 5 that, quote, "Pollution tolerant aquatic worms were the dominant organisms collected from the deep draft portion of the North Branch Chicago River, do you mean that this was true for all sampling sites, for both petite ponar and Hester-Dendy substrate samples?

HEARING OFFICER TIPSORD: This is Question 15.

MS. WILLIAMS: Fifteen.

MS. WASIK: Yes. Oligochaetes made up 84, 79, and 95 percent was 2001 Hester-Dendy samples at Wilson, Diversey, and Grand Avenue respectively. And 33, 29, and 75 percent

during 2005 samples. Of those six Hester-Dendy samples, there were two in which oligochaetes did not comprise a majority of the sample. In the ponar samples oligochaetes made up 88 to 99 percent of the samples from all three stations in both years in which we had focussed sampling on the north branch system.

MS. WILLIAMS: What about the sites at Diversey Parkway and Grand Avenue?

MS. WASIK: Yes. That's -- It includes those stations.

MS. WILLIAMS: Okay. Question 16, please indicate where in the record the data is located to support the statement that, quote, "Approximately 13 percent of midge specimens collected and examined from Grand Avenue in the North Branch Chicago River during 2002 exhibited head capsule deformities."

MS. WASIK: Page 3-44 of Attachment 22 entitled A Study of the Benthic Macroinvertebrate Community in Selected Chicago Metropolitan Area Waterways during

2001 and 2002 states, quote, "Chironomid head capsule deformities were observed only in the Hester-Dendy samples at Grand Avenue or station 46, parentheses Table 3-41. Of the 117 midge specimens examined from Grand, 15 were 12.8 percent exhibited deformities."

MS. WILLIAMS: And what types of deformities were found?

MS. WASIK: The contractor does not report what kind of specific head capsule deformities they observe in the specimen. I believe it's common practice to count all types of head capsule deformities together when you're evaluating incident rates. During 2002 no other stations in North Shore Channel or deep draft North Branch Chicago River exhibited head capsule deformities besides Grand Avenue.

MR. ANDES: And give us an example of what a head capsule deformity is.

MS. WASIK: Could I show you an example?

MR. ANDES: Or just describe.

MR. SULSKI: Are you going to stand on

the chair?

MR. ANDES: Can you describe what that means? Does it have a malformed head?

MS. WASIK: Right. It could be a jaw deformity or other sort of mandible deformities. There's various ones that we have an expert to identify. And I considered showing a photograph, but you can hardly kind of tell what's going on unless you really know what they're supposed to look like, so.

MS. WILLIAMS: What species exhibited these deformities?

MS. WASIK: Let's see. The two taxa with malformed specimens were chironomus and dicrotendipes, d-i-c-r-o-t-e-n-d-i-p-e-s simpsoni, s-i-m-p-s-o-n-i. Just over half of the 19 chironomus examined from station 46 or Grand were deformed.

MS. WILLIAMS: Do we know why this station was unique in that respect?

MS. WASIK: No. I couldn't say.

MS. WILLIAMS: Question 17: Is the statement on Page 5 that, quote, "Fine sediments dominated the Chicago River bottom

with one to five feet depth of fines," unquote, based on a physical habitat analysis of the sampling sites such as QHEI or the analysis of the petite ponar sediment samples?

MS. WASIK: It was based on both.

MS. WILLIAMS: What was the predominant fine sediment: Silt, sand, fine gravel, or other?

MS. WASIK: Well, in terms of the first part of your question, based on physical habitat analysis for which we take a ponar sample, place it in a tray, and then visually characterize the sediment as well as probing the bottom with a telescoping rod, during our most recent assessment in 2006, silt made up 90 percent or more of the sediment samples taken from the center of the Chicago River at Wells and Lake Shore Drive. The sides varied, mostly consisting of silt, sludge, and zebra mussel shells.

MS. WILLIAMS: So you're relying on 2006 information in this question -- I mean in this quote.

MS. WASIK: Yes. That may be true also for 2002. I'll have to go back and check.

MS. WILLIAMS: And then what was the predominant fine sediment then?

MS. WASIK: Like I said, it was the sides were varied, but it consists mostly of silt, sludge, and zebra mussel shells. Whereas the silt made up 90 percent or more of the sediment samples from the center at both Chicago River -- I mean in Chicago River at both Wells and Lake Shore Drive station.

MS. WILLIAMS: When you state on Page 5 that, quote, "Analysis of sediments from the Chicago River main stem sampling stations showed presumed toxic concentrations of PAHs and polychlorinated biphenyls or PCBs," are these results comparable to what was reported the CAWS UAA Attachment B?

MS. WASIK: Yes. PAH and PCBs are listed on Page 4-53 of the UAA report as being above presumed toxic levels. Since -- sorry. That's all.

MS. WILLIAMS: Did all eight toxicity

tests indicate 80 percent and 99 percent survival with no significant difference compared to the control?

HEARING OFFICER TIPSORD: A point of clarification. The written question is 88 percent to 99 percent.

MS. WILLIAMS: Yes. That's correct. I hope. 88 percent to 99 percent.

MS. WASIK: Since one of our samples wasn't sealed properly, it was ruined during transport to the consultant. Therefore, there were only sediment -- seven total sediment toxicity reports, not eight, for the Chicago River. But the percent survival did range from 88 to 99 percent with no significant difference from the control.

MS. WILLIAMS: Question 19: Was it true of both Hester-Dendy substrate and petite ponar samples at both Lake Shore Drive and Wells Street that, quote, "A majority of benthic invertebrates collected from the Chicago River were aquatic worms"?

MS. WASIK: The ponar samples from the Chicago River constituted 98 to just over --

under 100 percent of the total organisms at both stations. In the Hester-Dendy, 92 percent were oligochaetes and the Wells sample; whereas the dominant organism in the Lake Shore Drive Hester-Dendy sample was gammarus fasciatus, an amphipod.

MS. WILLIAMS: Question 20 --

HEARING OFFICER TIPSORD: Miss Williams, I don't think we're going to get the rest of these in the next half hour, so with that, let's close for today, give everybody a break, and we'll start at 9:00 a.m. tomorrow morning.

MR. ANDES: One other scheduling matter. I've been receiving e-mails from our next round of witnesses, and it does appear that after Dr. Dennison, our next three Garcia, Friedman, and Nemura are all available on the 17th and 18th of February. So if we want to lock those dates in.

HEARING OFFICER TIPSORD: I already asked in advance because you can always cancel the rooms for the Thompson Center for rooms. So if we get rooms, we'll go the 17th

and 18th of February. Great. Thank you.
See you all tomorrow morning.

(At which time the hearing was continued to December 6, 2008.)

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STATE OF ILLINOIS)
) SS.
COUNTY OF COOK)

I, LAURA MUKAHIRN, being a Certified Shorthand Reporter doing business in the City of Chicago, Illinois, County of Cook, certify that I reported in shorthand the proceedings had at the foregoing hearing of the above-entitled cause. And I certify that the foregoing is a true and correct transcript of all my shorthand notes so taken as aforesaid and contains all the proceedings had at the said meeting of the above-entitled cause.

_____
LAURA MUKAHIRN, CSR
CSR NO. 084-003592