

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:

RECEIVED
CLERK'S OFFICE

SEP 08 2009

STATE OF ILLINOIS
Pollution Control Board

WATER QUALITY STANDARDS AND)

EFFLUENT LIMITATIONS FOR)

THE CHICAGO AREA WATERWAY)

SYSTEM AND THE LOWER)

DES PLAINES RIVER:) No. R08-9

PROPOSED AMENDMENTS TO)

35 Ill. Adm. Code Parts)

301, 302, 303 and 304)

REPORT OF PROCEEDINGS had before the
ILLINOIS POLLUTION CONTROL BOARD held on August
14, 2009, at 9:00 o'clock a.m. at the Thompson
Center, Room-9-40, Chicago, Illinois.

1 A P P E A R A N C E S:

2

3 ILLINOIS POLLUTION CONTROL BOARD:

4 MS. MARIE TIPSORD, Hearing Officer

5 MR. THOMAS E. JOHNSON, Member

6 MS. ALISA LIU, Environmental Scientist

7 MR. LIN SHUNDAR, Member

8 MS. ANDREA MOORE, Member

9

10 ILLINOIS ENVIRONMENTAL PROTECTION AGENCY:

11 Ms. Stefanie Diers

12 Ms. Deborah Williams

13

14 ENVIRONMENTAL LAW AND POLICY CENTER

15 33 East Wacker Drive, Suite 1300

16 Chicago, Illinois 60601

17 (312) 795-3707

18 BY: MR. ALBERT ETTINGER and JESSICA DEXTER

19 Appeared on behalf of ELPC, Prairie Rivers

20 Network and Sierra Club;

21

22

23

24

1 APPEARANCE CONTINUED:

2 BARNES & THORNBURG LLP

3 One North Wacker Drive, Suite 4400

4 Chicago, Illinois 60606-2833

5 (312 357-1313

6 BY: MS. FRANZETTI

7 Appeared on behalf of the MWRDGC.

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

1 CHAIRMAN TIPSORD: Good morning,
2 everyone. My name is Marie Tipsord, and
3 I've been appointed by the Board to serve as
4 hearing officer in this proceeding entitled
5 "Water Quality Standards and Effluent
6 Limitations for the Chicago Area Waterway
7 System and Lower Des Plaines River, Proposed
8 amendments 35 IL Adm Code 301, 302, 303 and
9 304. This is docket number R08-9.

10 With me today to my immediate
11 left is acting chairman G. Tanner Girard,
12 the presiding board member. To his
13 immediate left is board member Shundar Lin
14 and to my far right board member Andrea
15 Moore will be joining us. To my immediate
16 right is Alisa Liu from our technical unit.
17 Nicole Meyer will be joining us. She is our
18 extern this semester. She should be down in
19 a little bit as well.

20 This is our 32nd day of
21 hearings. We are continuing to hear
22 testimony from members of the public today,
23 and today the focus of the hearing is to
24 hear testimony from Dr. David Thomas. The

1 testimony will marked as an exhibit and
2 entered as if read. After marking the
3 pre-filed testimony as an exhibit, we will
4 then proceed to questions for the testifier
5 beginning with Midwest Generation, and then
6 I have the District followed by the IEPA,
7 again, based on the sheer number of
8 questions. Anyone may ask a follow-up
9 question and you need not wait until your
10 turn to ask questions. I do ask that you
11 raise your hand and wait for me to
12 acknowledge you. After I have acknowledged
13 you, please state your name and whom you
14 represent before you begin your questions.
15 Please speak one at a time. If you are
16 speaking over each other, the court reporter
17 will not be able to get your questions on
18 the record. Please note that any questions
19 asked by a Board member or staff are just to
20 help build a complete record of the Board's
21 decision, and not to express any
22 preconceived notions that arise. And I
23 probably should have said this before we
24 went on the record, if anybody else comes in

1 and we need more chairs, there are plenty of
2 chairs over here. We can set them up back
3 there or over here on the side. And they
4 will have to sit in the front row.

5 Dr. Girard, do you have anything
6 at this point?

7 MEMBER GIRARD: Good morning, and
8 welcome to day No. 32. I see these are the
9 hard core participants on Friday morning.
10 We have a little smaller audience and it's
11 kind of like church, nobody wants to sit in
12 the front row. We look forward to your
13 testimony and questions today.

14 CHAIRMAN TIPSORD: With that,
15 Albert?

16 MR. ETTINGER: Did you swear in the
17 witness yet?

18 CHAIRMAN TIPSORD: Do you want to
19 introduce him before we swear him in?

20 MR. ETTINGER: This is Dr. David
21 Thomas.

22 CHAIRMAN TIPSORD: Thank you. Can
23 we have the witness sworn.

24 (Witness sworn.)

1 DAVID L. THOMAS, PH.D.,
2 having been first duly sworn, was examined and
3 testified as follows:

4 MR. ETTINGER: I guess we will offer
5 into evidence Dr. Thomas' pre-filed
6 testimony.

7 THE COURT: If there's no objection
8 we will mark the pre-filed testimony of
9 Dr. David Thomas as Exhibit No. 327. Seeing
10 none, it's Exhibit No. 327.

11 (Document marked as Exhibit
12 No. 327 for identification.)

13 AUDIENCE MEMBER: Ten exhibits per
14 hearing day it looks like.

15 CHAIRMAN TIPSORD: Pretty close.
16 And then did you want to go straight to
17 questions?

18 MR. ETTINGER: Yes.

19 EXAMINATION

20 BY MS. FRANZETTI:

21 Q. With that, good morning, Dr. Thomas.
22 My name is Suzanne Franzetti. I represent Midwest
23 Generation. To my right is Greg Seibert, and I
24 will be asking you the questions today, and they

1 are basically the pre-filed questions by Midwest
2 Gen. Am I correct in assuming that you have a
3 copy of those questions in front of you?

4 A. Yes, I do.

5 Q. With respect to my questions, when
6 I'm referring to your pre-filed testimony, I am
7 referring to what has now been marked as
8 Exhibit 327.

9 With that, I'm going to begin
10 with question No. 1: "Have you conducted any QHEI
11 surveys in the upper Dresden Pool and/or in the
12 Chicago Sanitary & Ship Canal?

13 A. No.

14 Q. So we can skip the follow-up
15 question. Let's move to question 2.

16 Have you conducted QHEI surveys
17 anywhere else?

18 A. Not formally QHEI. I have done
19 habitat studies, but not a formal QHEI survey.

20 Q. And I will get to those habitat
21 studies in the very next question. So let's go to
22 that.

23 Question 3, "Have you ever
24 conducted any type of aquatic life or habitat

1 survey in the upper Dresden Pool or in the Chicago
2 Sanitary & Ship Canal?"

3 A. Yes. I think it was 1991 I was
4 invited up to Chicago by Dick Lanyon (phonetic) of
5 the District to do a survey of some of the Chicago
6 waterways, specifically to look at whether there
7 might be some opportunities for habitat
8 improvement. So we started at the Stickney plant
9 and went upstream from there. We did get up into
10 the north channel of the Chicago River. I don't
11 believe we got to the Cal Sag. So we did a
12 portion of the Chicago waterways, but not all of
13 them. So that was probably the first time that I
14 had been on the waterways themselves to actually
15 look specifically at habitat. And, of course when
16 you are looking at it visually, you are looking at
17 shore line habitat, those things that are visible
18 obviously from the surface.

19 I have also been involved in
20 studies since 1985 in the Calumet system. So at
21 least in that part of the system I've been very
22 involved in, not what you might specifically call
23 habitat studies for fish, but looking at
24 contaminant levels and sediments, and the impacts

1 on aquatic wild. Then more recently I have been
2 on the waterway system again for looking at
3 habitats which was a more recent trip before this
4 hearing.

5 Q. Was this most recent trip in
6 preparation for this hearing?

7 A. That's correct.

8 Q. Okay. Let me just go back and ask
9 you some follow-up questions regarding that
10 answer.

11 So in 1991 you conducted a
12 survey that started at the Stickney plant?

13 A. Correct.

14 Q. And went north of there, correct?

15 A. Correct.

16 Q. So you have not conducted any
17 habitat survey for that portion of the waterways
18 included in this rulemaking that is located
19 downstream of the Stickney plant, correct?

20 A. I have not done any habitat surveys
21 per se. I've been, a number of times, to the
22 electric barrier. I actually helped collect some
23 round gobies with one of our grad students that
24 was doing some work on the round gobies in the

1 area of the electric barrier. I have -- last year
2 I did spend a little time looking at some of the
3 areas on the upper Dresden Island pool that I
4 could get access to from roads, and so I was able
5 to look at a few areas along that stretch of the
6 river.

7 Q. With respect to your visit to the
8 electric barrier that you just mentioned, would
9 that constitute a habitat survey?

10 A. No.

11 Q. With respect to your visit last
12 year, looking at some of the areas in the upper
13 Dresden Pool, would that constitute a habitat
14 survey?

15 A. Not formally a survey, but I was
16 able to observe a number of the emergent weed
17 beds, which I was surprised actually how extensive
18 some of them are. I could see egrets out there
19 and Great Blue Herons feeding on those, so you
20 could get an idea how shallow some of them are. I
21 also saw areas where there were logs or other
22 structures in the area that would be providing
23 habitat for fish and aquatic invertebrates.
24 So, no, not a formal study, but at least being

1 able to evaluate some of the habitat in that pool.

2 Q. Can we get a little more specific.

3 Approximately how many areas of the upper Dresden

4 Pool did you visit?

5 A. I might have been able to get to

6 like four -- four or five.

7 Q. Can you give me a description of

8 where those areas were within the upper Dresden

9 Pool?

10 A. Well, I was very interested in

11 looking at the spillway area below the Brandon

12 lochs and dam, and I was actually quite impressed

13 by the amount of habitat that is available there.

14 Lots of cormorants and egrets and herons feeding

15 on fish. I was able to get in by --

16 Q. I'm going stop you just for a moment

17 there. So you saw cormorants and egrets eating

18 fish there?

19 A. That's mostly what they feed on.

20 Q. What did you see in terms of

21 habitat?

22 A. There was a fair amount of emergent

23 vegetation in places, in some of the ripple areas.

24 Obviously, a lot of shallow habitat. But a pretty

1 major ripple area that's available to the pool
2 downstream.

3 Q. And this pretty major ripple area,
4 as you describe it, is in the spillway area just
5 below the Brandon loch and the dam?

6 A. That's correct.

7 Q. Okay. That was one of the areas,
8 and that's the habitat you observed. Can you move
9 to one of the other areas that you went to
10 concerning a habitat that you observed?

11 A. I'm not sure I have my notes.

12 Q. I'm sorry, Dr. Thomas, before you
13 do, can you give us some aerial estimate -- strike
14 that.

15 About what size area are you
16 talking about as having this emergent vegetation,
17 major ripple area?

18 A. Well, I think there's actual data in
19 the record. EA has done a lot work there
20 obviously. I think if -- someone correct me --
21 but I think I remember there's like seven percent
22 of the total pool area is considered part of that
23 ripple habitat. If I remember the figure right
24 out of the EA report --

1 MR. ETTINGER: Well, she asked a
2 question. It doesn't help her to tell her
3 what's in the EA report. I think her
4 question is directed to what you would have
5 estimated having seen yourself.

6 BY THE WITNESS:

7 A. I don't know how to put how many
8 acres it was. I suppose it looked like an acre.

9 BY MS. FRANZETTI:

10 Q. All right. Let's move on to one of
11 the other four or five areas that you visited.
12 Can you tell me where that was?

13 A. One was at the casino.

14 Q. Joliet Casino? I'm sorry, I don't
15 go to the casinos. Is it the Empress -- is it the
16 Empress that's down there?

17 A. Yes. And there was an extensive
18 weed bed in that area that I was able to observe,
19 as well some of the shore line.

20 Q. Do you recall what one of the other
21 areas was that you visited last year?

22 A. I was able to observe some of the
23 area over the I-55 bridge north of that, and I
24 think there was a fourth area, but I can't

1 remember where that was now. It was farther
2 downstream. I was working my way down from
3 upstream to downstream.

4 Q. Was the other area below the I-55
5 bridge?

6 A. No, I think it was above, but I'm
7 not sure.

8 Q. In the area that you said was just
9 north of the I-55 bridge, what habitat did you
10 observe?

11 A. There was a fairly extensive weed
12 bed there also.

13 Q. Would it be accurate for me, in
14 terms of trying to summarize the habitat that you
15 did see, to say that outside of the spillway area,
16 just outside of the Brandon loch and dam, the
17 habitat that you saw in these other areas was this
18 weed bed habitat?

19 A. Well, I would say -- fairly
20 extensive weed beds in places. Also logs and
21 brush overhanging and some of them into the water.
22 All of those are going to be habitat for fish and
23 invertebrates.

24 Q. Now, I know you were saying it's a

1 little difficult for you to estimate the aerial
2 extent of the habitat you are describing, but can
3 you, as best you can, in the Empress casino area,
4 estimate, was that about an acre or less than -- a
5 smaller area than the spillway area? However you
6 can --

7 A. I mean, you can see about a half
8 mile up and downstream. Obviously a more
9 restricted area in front of you, but you are
10 actually going to be able to observe vegetation,
11 but I could get a good overview. Plus one of the
12 EA reports had lots of photographs up and down the
13 pool, so I had some context to put what I was
14 seeing with other areas that I couldn't get to
15 without a boat.

16 Q. Okay. As you say, so you had
17 referred to an EA report?

18 A. Absolutely.

19 Q. As part of your preparation for and
20 during these observations you made?

21 A. That's correct.

22 Q. Which EA report?

23 A. It might have been an attachment to
24 the testimony. There's a lot of colored

1 photographs.

2 Q. It might have been attached to
3 Mr. Seibert's testimony that's been filed in this
4 proceeding?

5 A. I think so, yes.

6 Q. Did you basically find that your
7 observations in the areas you went to were
8 consistent with what had been reported in the EA
9 report you were referring to?

10 A. Yeah, I would say pretty much. I
11 don't remember my overview description in those
12 reports of the aquatic weed beds, but it may have
13 been in there.

14 Q. Did you get into the waters in the
15 Brandon tail water area?

16 MR. ETTINGER: What do you mean by
17 get into the water?

18 MS. FRANZETTI: I'm sorry. That was
19 bad language. I wasn't asking if you went
20 swimming.

21 THE WITNESS: I did not.

22 MS. FRANZETTI: Let me revise that.

23 BY MS. FRANZETTI:

24 Q. Did you go into the area known as

1 the Brandon tail waters?

2 A. No, I did not physically. I would
3 have loved to have gone down there with a seine
4 and collect the fish, but I did not get into the
5 water at all.

6 Q. Did you get into the area at all?
7 Did you walk along --

8 A. I was by the bridge there. There is
9 a bridge going right down below. I was on the
10 bridge looking upstream and downstream.

11 Q. From the bridge?

12 A. Right.

13 Q. So you did not wade along the
14 shoreline looking at habitat?

15 A. No.

16 Q. Did you in these other areas that
17 you went to?

18 A. No.

19 Q. So you did not wade along the
20 shoreline?

21 A. No. Although as I said, by seeing
22 herons and egrets out in the water, it gave me a
23 very good idea of what the water depth was what
24 where I saw them.

1 Q. Did you see the herons and egrets at
2 all of the locations that you visited?

3 A. I don't know if I noticed any at the
4 I-55 bridge, but I did at the casino. Of course
5 there were lots of them in the tail water area.

6 Q. I'd like to go back to -- you made
7 mention about being involved in some studies since
8 1985 in the Calumet system. You did note those
9 were not habitat studies.

10 Could you describe a little more
11 fully what type of studies you were referring to
12 in your answer?

13 A. Yeah. Well, probably from '85 to
14 almost '95 I was at the Hazardous Waste Research
15 And Information Center -- at least that's what it
16 was called at that time -- and we sponsored
17 research projects in the Calumet area almost
18 continuously during that period of time. Some of
19 those studies were done by natural history survey
20 staff looking at sediments in the Calumet system
21 and the toxicity of those sediments.

22 I've subsequently been involved
23 with the City of Chicago and their efforts for
24 habitat restoration in the Calumet area. So I

1 have been down there a number of times. I've been
2 on some of the pools there. We've had studies of
3 birds. We've had studies of contaminants and
4 Black Crown Night herons and also tree swallows.
5 We've done insect studies there. We've done
6 studies on Purple Wood Stripe control. So I would
7 say pretty continuously since '85. When I say
8 involved times, it was in the supervisory or
9 review fashion.

10 Q. Right, you weren't out there
11 actually collecting the samples?

12 A. I was occasionally with staff that
13 were doing collections, but that wasn't my primary
14 job.

15 Q. With respect to those sediment
16 studies that you referenced being conducted during
17 the 1985 to 95 period for the Hazardous Waste
18 Research and Information Center, do you recall
19 generally whether there were any conclusions
20 regarding the toxicity of the sediment?

21 A. Yes, there were a lot of
22 contaminants in the Calumet. And the interesting
23 thing that I found, which I'm not sure how
24 relevant it is here, but sometimes the sediments

1 that appeared to be the most toxic to -- and these
2 are small organisms, test organisms -- were
3 sometimes the elements that didn't have the whole
4 suite of chemicals we were looking at. So this is
5 one of the difficult things in any of these type
6 of studies in nature is that sometimes what you
7 are measuring doesn't necessarily show up into the
8 toxicity of the organisms you are looking at.

9 MS. WILLIAMS: Can you explain that
10 a little more in detail, Dr. Thomas, about
11 why we find sometimes the most toxic
12 sediments aren't always the ones with the
13 highest levels? What factors go into that?

14 THE WITNESS: Yeah, I'll give you my
15 little bit of speculation. There are
16 synergistic effects between variety of
17 chemicals. The other thing is even when you
18 measure a suite of 40 or 50 potential
19 contaminants, you may be missing something
20 in there. We found the same thing at
21 Vandalia, the old Joliet Arsenal. They were
22 looking at explosives, and there were a few
23 other contaminants identified there. But in
24 some of their studies they had the same

1 thing, that some of the lower levels of
2 contaminants they were looking at, some of
3 those sediments tend to be more toxic than
4 other sediment samples that had higher
5 levels than the chemicals they were focused
6 on. So it's hard to tell what's happening,
7 whether it's -- you haven't measured a
8 particular chemical that's there that may be
9 causing the problem or whether there's a
10 synergism between some of the chemicals
11 there that have made it more toxic. This is
12 why you end up going to laboratory studies,
13 just because you need to control the
14 variables. It's very hard in nature to
15 measure certainly all the chemicals and all
16 the variables that may be impacting an
17 organism.

18 BY MS. FRANZETTI:

19 Q. Dr. Thomas, with respect to your
20 visit last year to the upper Dresden Pool, prior
21 to then, when was the last time you had paid a
22 similar visit to the upper Dresden Pool?

23 A. Well, other than going by it a few
24 times when I was at the electric barrier in some

1 previous years, I made no other specific visit to
2 go to that pool.

3 Q. And while you were there going to
4 the four or five areas, did you examine the
5 substrates that existed in those areas?

6 A. No, I did not, other than what could
7 be observed --

8 Q. Well, when you say other than what
9 could be observed, what did you observe about the
10 substrate in any of those areas?

11 A. Well, maybe I should say inferred
12 rather than observed because I'm assuming there is
13 aquatic vegetation because they have a silt bottom
14 that those weeds were growing in there.

15 Q. But you made no observations
16 yourself of the substrate?

17 A. That's correct.

18 MS. DEXTER: Can I ask a follow-up.
19 How these emergent aquatic beds that you
20 have discussed, how do those beds compare to
21 what you know about the rest of the Illinois
22 Water Reclamation District of Illinois?

23 THE WITNESS: Well, there is other
24 information that I've relied on. One is the

1 Natural History Survey did a study of the
2 aquatic vegetation in the Dresden Pool back
3 in the later 1980's, and they actually
4 documented the size of the beds then over a
5 three or four-year period. There was
6 actually a big decrease in the size of beds
7 through the late 1980's partially due to a
8 drought here, I think, in 1988, and they
9 were also doing chemical analysis of the
10 sediments and some chemical analysis in the
11 aquatic vegetation.

12 The other thing that I have
13 relied on in thinking about the aquatic
14 vegetation in this pool was the work by the
15 Natural Historical Survey, which has been
16 doing long-term electro-fishing studies in
17 the upper Illinois -- actually starting from
18 farther south, maybe near Havana maybe up
19 into the upper Illinois since the late
20 1950's, so this electro-fishing survey has
21 gone on for the state for over 50 years.
22 And the biologists there tell me that the
23 most aquatic vegetation for the whole
24 Illinois system is in the Dresden pool area.

1 So they have the data from the other pools,
2 Marseilles and Starved Rock and some of the
3 others downstream, but the biggest aquatic
4 vegetation beds are in the Dresden Pool.

5 MR. ETTINGER: I haven't had you
6 read your testimony and background, but it
7 might be useful for you just to explain what
8 your role was in the Natural History Survey
9 since we are talking so much about it.

10 THE WITNESS: Well, I had two roles
11 actually. I started my career in the
12 Natural History Survey in the 1960's as a
13 field biologist working on the Kaskaskia
14 River, so a lot of my large river experience
15 occurred on the Kaskaskia, and then in --
16 I'm bad on my dates -- but for the last ten
17 years or so I was chief of the Illinois
18 Natural History Survey. So I review a lot
19 of the reports. I actually was out on the
20 Illinois River electro-fishing and sampling
21 with some of our crews at our Havana station
22 and out of our four biological stations and
23 also our station down in Dolton in the lower
24 Illinois River and Missouri River in Pool

1 26. Because I was particularly interested
2 in innovative species, I was out with some
3 of our crews at times looking at the
4 invasive species issues in the Illinois
5 River. So that was an area of particular
6 interest where I got more involved in
7 actually some of the data collection than in
8 some of the other areas where I was more of
9 an oversight rule.

10 MR. ETTINGER: And you ceased to be
11 chief of the Natural History Survey when?

12 THE WITNESS: The end of February of
13 last year.

14 MR. ETTINGER: Thank you. We're
15 talking so much about the Natural History
16 Survey, I thought I ought to explain where
17 that came from.

18 BY MS. FRANZETTI:

19 Q. Dr. Thomas, you mentioned the study
20 of aquatic vegetation in the late 1980's. Is that
21 study cited in your testimony?

22 A. No, it is not.

23 Q. Is a written report of that study
24 available; do you know?

1 A. Yes, it is. I think actually it was
2 done -- well, I'm trying to think -- I think it
3 was done for Com Ed actually, but I could pull out
4 a reference.

5 Q. That's okay. If you have one handy,
6 that would be great. Just to try and give a
7 little more clarity to the record in terms of what
8 study this is.

9 A. Yes. It was the final report went
10 to Commonwealth Edison Company of Chicago at that
11 time. It was dated July of 1992. The title of it
12 was, "Des Plaines River Long-Term Monitoring
13 Program, Vegetation Analysis and Habitat
14 Characterization." And the authors were Pamela
15 Tazik, T-A-Z-I-K and Steven Sobaski.

16 Q. For the court reporter's benefit,
17 would you please spell the last name?

18 A. Sobaski is S-O-B-A-S-K-I.

19 Q. Now, you also mentioned --

20 HEARING OFFICER TIPSORD: Excuse me,
21 Ms. Franzetti. Is it possible for us to get
22 a copy of that report for the record?

23 THE WITNESS: I don't have the whole
24 report with me. This is just a cover page,

1 and I think maybe the executive summary. Is
2 that what it is?

3 MS. DEXTER: We could get copies of
4 it.

5 HEARING OFFICER TIPSORD: If we
6 could get a full copy of it.

7 MR. ETTINGER: I think it's about
8 yeah big (indicating).

9 HEARING OFFICER TIPSORD: We can
10 reserve a Hearing Exhibit now if you'd like,
11 and you can give us the one copy as an
12 exhibit.

13 MR. ETTINGER: We'll get you a copy.
14 I don't know that we want to supply a copy,
15 too many copies, so we'll see how it is.

16 HEARING OFFICER TIPSORD: Well, if
17 you can get us a copy, we can always scan
18 it.

19 MR. ETTINGER: We will get you a
20 copy.

21 HEARING OFFICER TIPSORD: And then
22 people can get it from the website.

23 BY MS. FRANZETTI:

24 Q. Dr. Thomas, you mentioned there was

1 also some chemical analysis that was there as a
2 part of that study of aquatic vegetation?

3 A. That's right.

4 Q. Would you please elaborate what was
5 the nature of the chemical analysis that was done
6 as part of the study?

7 A. They looked at metals, PCB's.

8 Q. I'm sorry to interrupt, is that the
9 water column?

10 A. No, they were looking at those in
11 the sediment. I think also in the plant tissue
12 itself.

13 Q. Do you recall what they found in
14 terms of the results of the chemical analysis of
15 the sediments and plant tissue?

16 A. I don't think I could accurately
17 summarize.

18 Q. Now, you also made mention of --
19 excuse me, I'm sorry my notes couldn't keep up.
20 You made mention of there being areas of the most
21 developed aquatic vegetation in the UVP. I'm not
22 sure is that based on the studies in the late
23 1980's that we were just talking about for ComEd?

24 A. Would you -- I'm sorry would you

1 repeat your question.

2 Q. Let me ask it this way. You
3 testified that some of the most developed aquatic
4 vegetation is in the Upper Dresden Pool?

5 A. Right.

6 Q. What is that based on?

7 A. That's based on these long-term
8 electro fishing surveys done by the Natural
9 History Survey staff, which are yearly surveys,
10 and that's based on recent observations over the
11 last few years for instance.

12 Q. Are those quantitative observations?
13 Do they contain a quantification of the size of
14 the areas they believe have this most developed
15 aquatic vegetation?

16 A. No, I think these are general
17 statements. Within that pool, within the Upper
18 Dresden or Upper Dresden Island pool, those are
19 the most extensive weed beds they see anywhere in
20 the Illinois River.

21 Q. Now, we've been talking a lot about
22 these extensive weed beds. What type of fish like
23 extensive weed beds?

24 A. Good question.

1 Q. We're trying to figure out what kind
2 of fish can live here. So I guess we better get
3 to it.

4 A. Aquatic weed beds are great for
5 young of the year fish. If you are a small fish
6 worried about being eaten by other predators,
7 finding shelter is really important so aquatic
8 weed beds become a really important nursery area
9 for young fish. You are going to find sun fish.
10 Some of the basses in aquatic weed beds. You are
11 going to find a number of your minnows within
12 these weed beds.

13 Q. I'm sorry, is that minnows?

14 A. Yes.

15 Q. So sun fish, some basses, some
16 minnows?

17 A. Your crappie. There's really quite
18 a variety of fish that will make use of the weed
19 beds. Some on a more permanent basis. Some may
20 be just moving into them for feeding and then
21 moving back out.

22 Q. Any other classes of fish besides
23 these four that you've identified?

24 A. Well, some of the suckers like

1 buffalo, I think, you would find, but again, they
2 may be in there occasionally for feeding or
3 shelter or some other aspect of their life
4 history, not necessarily spending most of their
5 time there.

6 Q. And why not?

7 A. Well, fish prefer different habitat
8 types and different stages. So some of them may
9 be in deeper water at times. Some of them are
10 going to be in shallow water. It depends on what
11 they are feeding on.

12 Q. So generally do suckers and buffalos
13 prefer habitat that is not this weed bed habitat?

14 A. The reason I'm hesitating some is
15 because a lot of the areas in the large rivers
16 where reflective buffalos and red horns and that,
17 there hasn't been really aquatic weed beds for
18 them to go to. So to say that I know how they
19 would use it, I'm not sure that I could fully
20 answer that.

21 Q. Okay, that's fine.

22 A. I do know that for the large mouth
23 buffalo, that in the lower parts of some of our
24 rivers it tends to use flood plane pools, and

1 those pools often have more aquatic vegetation.
2 Now, whether that's important to them in their
3 lifecycle or not, I'm not totally sure.

4 Q. So you don't know what the preferred
5 habitat is of suckers and buffalos, is that what
6 you are trying to tell me?

7 A. Yes, well, I have a general idea.
8 But what I'm having trouble answering is what they
9 would use aquatic weed beds if they are available
10 to them.

11 Q. Okay. That's what you don't know?

12 A. That's how much I'm not sure.

13 Q. Okay. I'm going to move on to
14 question 4: "For the habitat studies and life
15 history studies referenced at the bottom of the
16 first page of your testimony" -- and I'm referring
17 to the first sentence of the third paragraph --
18 "'I have experience conducting habitat studies and
19 life history studies of various species of fish on
20 large rivers,'" and it goes on from there --

21 A. Right.

22 Q. But with respect to the studies you
23 are referring to there, can you delineate which
24 were habitat studies and which were life history

1 studies? If anyone was both, point that out to me
2 too. But I'm trying to get an understanding of
3 how many habitat studies versus life history
4 studies you've done.

5 A. Well, you know, I'm not sure. I
6 mean, any time you are studying fish in the
7 system, you are obviously studying the habitats
8 that they exist in. I go back to looking at the
9 definition for QHEI, which is really, I think,
10 Rankin described it this way, as a rapid
11 assessment tool used in lieu of large scale
12 monitoring programs. I would say I've been
13 involved in a large scale monitoring programs. In
14 most cases what I was interested in are the
15 habitats used by specific species of fish that we
16 were collecting at the time. Now, when I worked
17 on the Kaskaskia River in the 60's, I was focused
18 on some of the darters, the small, very small
19 fish, because I was doing life history studies on
20 those, but we were also doing habitat studies on
21 all of the fish that we were collecting there.
22 And in fact we were relating the distribution of
23 some of our fish and the food habits of some of
24 those fish to the populations of aquatic

1 invertebrates in the system because we were doing
2 a lot of drift sampling. Drift sampling is you
3 put fine mesh nets in the water, and you look at
4 the invertebrates that are up in the water column
5 drifting, and lot of those are available to fish
6 for fish food. So I'm not sure I could ever
7 separate it out. I never tried to do a
8 characterization of habitat without it being
9 associated with, tying it to the fish that were
10 there. So I've tended to today look more from the
11 fish end and then look at the habitat and why were
12 they distributed as they were across the range of
13 habitats that were available through there.

14 Q. So can you tell me what fish have
15 been the subject of these studies you are
16 referencing in your testimony?

17 A. Well, the Kaskaskia, there were up
18 to a hundred species. I wasn't doing detailed
19 studies of all of those, but actually I did food
20 habits on following 40 or 50 species from that
21 river. Again, my focus there was on darters.
22 When I moved on to Cornell, worked on my Ph.D. in
23 the lower Delaware River and upper Delaware Bay, I
24 was focused on drums, cyanid drums -- just say

1 drums. Some of those got up into fresh water and
2 I was looking at their habitats and the food
3 habits and how the habitats changed as the fish
4 grew larger. They changed their habitats. So the
5 habitat needed by the small young is different
6 from larger young and different from the adult,
7 and those were the types of things I was trying to
8 delineate.

9 Q. So was your study on the Kaskaskia
10 River primarily focused on darters?

11 A. Well, that's what my master's thesis
12 was on. It was one group of darters. But as I
13 said, it's part of my work on the river, for the
14 survey we were looking at all the fish that were
15 there. I also spent a lot of time looking at
16 flood plane pools and the river fish that utilize
17 those. And in fact I have continued with my
18 interest in those. We've had studies in the
19 survey of the last five, six years looking at some
20 of the same pools that I was involved in studying
21 back in the 1960's. So we've looked at how those
22 pools have changed and how they've functioned to
23 assist the life history of a number of fish.

24 A number of fish come out of the

1 river during spring floods. They moved into these
2 flood plane pools. A lot of them spawn there.
3 They are nursery areas for the young. Some of
4 them move back. Some of them get stranded there.
5 But those pools are part of the life history and
6 part of the habitat for many of our large river
7 fish.

8 Q. You've used this term flood plane
9 pools.

10 A. Right.

11 Q. Can you give us a definition of what
12 you mean by a flood plane pool?

13 A. Yes. Many of them are formed as
14 oxbows on the river. If you remember, rivers get
15 very sinuous and windy and the river will cut
16 through and it cuts off, sort of a moon-shaped
17 piece of river and that gets sometimes isolated
18 from the river and sometimes it's connected.
19 Those pools may get flooded every year or every
20 few years during floods of the river. At those
21 times of flooding, there's a whole variety of
22 large river fish that move into them, and they use
23 that for spawning and nursery habitat for the
24 young fish.

1 Q. Are there flood plane pools as
2 you've just defined them in the Upper Dresden
3 Island pool from I-55 up to the north end of the
4 pool?

5 A. No, I think what you have in that
6 pool, which you also find in much of our rivers --

7 Q. I'm sorry to interrupt you. "No,
8 there are no flood plane pools in the Upper
9 Dresden Island Area"?

10 A. I don't believe I would -- I'd have
11 to check into that. I don't believe there is. A
12 the typical flood plane pools, you have these back
13 channels and other habitat that's somewhat
14 similar. When I say flood plane pools, you have
15 the whole variety of the connected back water area
16 that's always connected to the river. Something
17 far up into the flood plane -- and that may be
18 only flooded every four or five years. We don't
19 have that range of habitat out at the Dresden
20 Island pool. But we do have some of the back
21 water areas that I would assume, many of them,
22 serve some function as at least a back water type
23 of pool.

24 Q. But you have not studied that?

1 A. That's correct.

2 Q. Moving on to question 5. During the
3 12-year period from May 1985 through November 1997
4 when you were director of the Illinois Waste
5 Management and Research Center, did your job
6 responsibilities involve projects that focused on
7 aquatic habitat quality and/or aquatic biology
8 and? If you feel you've already referred to any
9 studies in that time period that qualify as having
10 focused on aquatic habitat quality or biology,
11 please just point those out to me. You don't need
12 to repeat what those studies were.

13 A. Yeah, I did mention the Calumet
14 studies. We also had studies on Waukegan Harbor.
15 On Crab Orchard, and again, a lot of those studies
16 -- there were also studies up in Rock River. Most
17 of those studies were focused on the effects and
18 the role of contaminants on those systems on
19 aquatic organisms.

20 HEARING OFFICER TIPSORD: Mr. Lin?

21 MEMBER LIN: Most of those you
22 contracted out the whole summer?

23 THE WITNESS: That's correct.

24 MEMBER LIN: So you are not involved

1 in that research?

2 THE WITNESS: Right. We contracted
3 out various studies. Although, I have to
4 say, we did work with a number of the
5 researchers to sort of focus sometimes their
6 studies. They had planned to address what
7 we thought were some of the more pressing
8 issues.

9 BY MS. FRANZETTI:

10 Q. Moving on to Question 6, Dr. Thomas.
11 During the subsequent 11-year period from
12 December 1997 through February 2008, when you were
13 the chief of the Illinois Natural History Survey,
14 did you perform any field surveys of aquatic
15 habitat or conduct any QHEI surveys of the river?

16 A. Well, I certainly didn't do any QHEI
17 surveys because our staff are really involved with
18 the long-term monitoring. Let me give you a
19 couple things. I stayed involved in --

20 Q. Actually, before you do. So I
21 understand, no, you didn't do any QHEI surveys of
22 the river. Did you perform any field surveys of
23 the aquatic habitat?

24 A. I was involved with survey staff and

1 also with the Department of Natural Resources on
2 their basin surveys of the Kaskaskia River. I've
3 maintained an interest in what's happened to the
4 fish populations in the Kaskaskia Rivers, and I
5 still hope to put out bulletin from the survey on
6 a hundred years of changes of fish population in
7 the Kaskaskia. So when E&R and the Illinois EPA
8 did their basin surveys of the Kaskaskia River, I
9 went with them while they did their electro
10 fishing and surveys there. I also participated in
11 electro fishing surveys on Prairie Creek that goes
12 through the old Joliet Army arsenal. Lust Creek
13 in Southern Illinois, did collections there. The
14 Illinois River, Lake Michigan, I've been involved
15 with some of our staff in collections made there.

16 Q. Now, when you say you are involved,
17 are you observing?

18 A. I'm observing -- when I'm in the
19 field I'm helping net fish or whatever needs to be
20 done. I've also stayed involved by being on a
21 couple of advisory committees. I was on the
22 Nature Conservancy's Emiquon Science Advisory
23 Committee looking at the restoration efforts they
24 are trying to do there at Emiquon, which is in the

1 Havana area of the Illinois River, and I've been
2 on the Illinois River Science Advisory Committee,
3 which is an advisory committee to the lieutenant
4 governor's advisory council on the Illinois River.
5 So I've stayed involved in sort of river issues
6 through those.

7 Q. Question 7: "Please describe your
8 experience in handling projects that involve
9 constructing improvements to the physical habitat
10 in a river and the resulting effects on the
11 aquatic fishing community?"

12 A. Well, I'm not sure I can give you
13 the resulting effects but from --

14 Q. Let's start with -- tell me about
15 projects that you handled that involved
16 constructing improvements to physical habitats in
17 a river?

18 A. I'm just trying to think of the
19 dates. I worked for five and a half years for an
20 engineering firm in Boston, Massachusetts, and
21 they did a lot of work on hydro facilities, small
22 head hydros in New England, large hydro
23 facilities, pump storage projects, and some of the
24 work through them was looking at mitigation

1 projects, particularly for plum storage where you
2 have a lot of drawdown during the week of water.
3 And so we were looking at creating artificial
4 pools that would maintain water so when the water
5 was drawn down, you could maintain shallower water
6 habitat for some fish, like sun fish and that,
7 they could use them for spawning. So I have been
8 involved in some mitigation projects with large
9 engineering projects.

10 For your information on pump
11 storage, I think most of you are probably
12 familiar, but the concept is you pump water up the
13 top of a hill when electricity is cheap, either on
14 a weekend or at night, and then during the day
15 when you have to meet peak power, you let the
16 water come down through a turbine and generate
17 electricity to make up for when peak power is
18 needed. These have been particularly used in
19 conjunction with nuclear plants that have to have
20 more steady output of power. By doing that, the
21 water levels are constantly fluctuating in there,
22 so one of the issues was how do you -- is there a
23 way to maintain some habitat so some fish can
24 spawn or turtles could use the habitat for

1 spawning. So we've looked at some of these pools
2 as a way of mitigating drawn down, weekly drawn
3 down in these pools.

4 Q. All right. Can you give me
5 approximately when that five-and-a-half year
6 position with the engineering firm in Boston
7 occurred?

8 A. Yes, I think it's in my -- I have to
9 look at my resume. It was in the late 80's.

10 Q. Is that '79 to '85?

11 A. '79 to '85.

12 Q. That's your position with the
13 Charles -- is it Chaz or Charles?

14 A. It was Charles T. Mae, actually
15 bought out by Parson's Corporation now.

16 Q. Now, did you get involved in
17 creating, actually creating any of these pools?

18 A. I didn't myself. We helped design,
19 because I'm with an engineering firm. We told the
20 engineers what we'd like to see, and then they
21 worked on the design and then someone else did the
22 actual construction of the pools.

23 One other project out in the
24 pump storage --

1 Q. Can we stay on this project. I'll
2 let you get to any others in the minute, but let's
3 finish this one up.

4 So you were involved in
5 designing them. Did they get built?

6 A. Yes.

7 Q. All right. Were you still there
8 after they were built?

9 A. No.

10 Q. All right. So you do not know what
11 the effects of those pools were?

12 A. Right, and that's why I said I
13 couldn't answer that part of your question.

14 Q. That's what I was trying to
15 understand the basis for your answers.

16 All right. Any other projects
17 that you were involved in?

18 A. The only other one I was going to
19 mention is there was a water storage project on
20 the Delaware River that, I don't know, some of you
21 may have remembered, there was going to be a tox
22 island built, dam built on the Delaware River. It
23 was hugely controversial back in the 70's, I
24 believe. That was defeated, but downstream water

1 needed extra water during low water flows in the
2 summer. So what ended up happening is they
3 flooded a small valley along New Jersey along the
4 Delaware River. They pumped, during the
5 wintertime and during the spring high flows,
6 filled this reservoir, and then during the summer
7 when they needed water downstream, they would
8 release water from this reservoir. There was an
9 issue with a Bog turtle -- that's B-O-G -- that
10 was a threatened and endangered species. So we
11 designed some mitigation pools on that habitat.
12 Again, to provide habitat for these turtles for
13 breeding. To the best of my knowledge -- I know
14 that project has been built, and to the best of my
15 knowledge they did incorporate some of those pools
16 in the design.

17 Q. And do you know what the effects
18 were in creating any of those pools?

19 A. I have not heard whether they were
20 successful or not.

21 Q. Would you advocate -- are you
22 advocating here -- strike that.

23 Do you believe here that
24 creating these pools is something that could be

1 done in the upper Dresden Island pool to improve
2 habitats?

3 A. I'm not sure. Something similar to
4 that necessarily would be helpful. One of the
5 things that I have thought of though on the
6 waterways is that I think, and this is something
7 that Dick Lanyon and I talked about way back in
8 the early 90's when I took the trip, I think the
9 areas where there is a lot of riffraff and at
10 least there used to be on the shore a lot of
11 cinder block and cement and that, I think if some
12 of those were put just off shore you could
13 probably protect some of the areas behind those a
14 little bit away from barge traffic and potentially
15 create some, a little bit more stable habitat for
16 fish breeding or nursery areas for young fish. So
17 I think --

18 Q. How would you do that, Dr. Thomas?

19 A. I think you would need to create
20 sort of a long thin dike or small island or
21 whatever. You get almost some of that habitat
22 under the bridges where you have pilings there and
23 you have water on the shore with a side of those
24 pilings. So you have a little bit more protected

1 habitat because those pilings attenuate the waves
2 that are coming in from barges.

3 Q. And have you seen similar projects
4 done and what their effect was?

5 A. I have seen -- I was just trying to
6 think what -- I have seen some from the Army Corps
7 of Engineers, dredging projects where they've made
8 islands or which is created habitat for birds, but
9 also behind some of those they've created some
10 shallow habitats that may be less effected by
11 waves. Sometimes they will allow aquatic
12 vegetation to grow or it will provide some
13 different kind of protected habitat for fish so --
14 that wasn't the original intent of the project,
15 but that was the end result of some of those
16 projects.

17 Q. So are you inferring from Corps
18 projects where they created an island that helped
19 as a buffer to wave action that maybe the same
20 thing could be accomplished if you built your thin
21 dike?

22 A. Yes, but there's a lot of other
23 simple things you can do. I mean, there may be
24 areas that are less depositional areas. In other

1 words, areas where you don't have a lot of
2 deposition of sediment where you could add just
3 sand, for instance, or sand and gravel and create
4 a little bit of a shoreline habitat.

5 Q. Can I stop you there and ask a
6 question. What areas in the upper Dresden Pool
7 don't have the sediments that you are talking
8 about that might be appropriate for adding sand
9 to?

10 A. Well, I think the reports say that
11 there are a fair number of those areas. So you
12 may not need to do that in those areas. Again,
13 that would take an evaluation of the various
14 habitats that are available and what might be
15 limiting to some species of fish. But you asked
16 what could be done, and those are all things that
17 can be done. Whether they need or not to be
18 done --

19 Q. I'm sorry. I don't really mean to
20 be talking in terms of just hypotheticals because
21 what we're concerned about here is what can be
22 done.

23 MR. ETTINGER: I think part of our
24 problem is we're again talking about the

1 whole system, and you've been focusing your
2 questions on the upper Dresden Pool. And
3 some of your questions were directed to the
4 area from Stickney up. So there may be some
5 ambiguity there.

6 BY MS. FRANZETTI:

7 Q. I was trying to use upper Dresden
8 Island pool. So in the upper Dresden Island pool,
9 would you advocate the use of a long dikes?

10 A. I can't answer that it's needed.

11 Q. Okay.

12 A. All I'm saying is if there were
13 areas where someone did a study of that, deemed it
14 to be an improvement or improved fish habitat,
15 some of these can probably be done at not
16 unreasonable costs. That's all I'm saying.

17 Q. And what you are trying to tell me
18 is first there needs to be a study done of the
19 upper Dresden Island pool to determine whether
20 there are areas that would benefit from mitigation
21 projects and to try and determine to what extent,
22 correct?

23 A. I'm sure probably EA has that kind
24 of data because they've been out on the pool.

1 Q. Well, don't speculate as to what EA
2 has.

3 A. But I don't have it.

4 Q. I understand. You don't have the
5 data --

6 A. Right.

7 Q. -- on which to determine whether
8 there are areas in the upper Dresden Island pool
9 that would benefit from mitigation projects and to
10 what extent, correct?

11 A. That's correct.

12 Q. Okay. Moving on to question 8.
13 Have you conducted any field work that studied the
14 effects of ambient water temperatures on aquatic
15 species?

16 A. I find that sort of a strange
17 question.

18 Q. Oh, yes. Why?

19 A. Well, ambient water temperatures,
20 the effect -- I mean, what you see in most aquatic
21 systems is, I guess, where you have a gradient in
22 the natural environment, you may see fish respond
23 to that gradient, but --

24 Q. How are you using the term gradient?

1 A. Excuse me?

2 Q. What's the meaning of the term
3 gradient that you are using?

4 A. It's when you have a range of
5 temperatures available to a fish. We tend to do
6 those more in the laboratory where you have a
7 thermal preference study, and you have an actual,
8 what's called a gradient tank, so you might have
9 20 to 30 degrees centigrade available to a fish.
10 You acclimate a fish to a temperature, and they
11 will swim around and pick out an area that usually
12 is close to its preferred temperature.

13 In the natural environment it's
14 much more complicated than that because they are
15 probably not responding just to temperature. They
16 may be in an area because of the food or they are
17 getting away from predators for a variety of other
18 reasons. That's why I'm saying I didn't quite
19 understand the effects of ambient temperature.
20 I've seen fish kills in nature due to extremes in
21 temperature, but --

22 Q. Okay. Let me just --

23 MR. ETTINGER: I guess you are
24 saying field work, and I'm not sure we know

1 exactly what you mean by field work. Is
2 that something formal or just his
3 experience?

4 MS. FRANZETTI: No, I'm looking for
5 a more formal study first.

6 BY MS. FRANZETTI:

7 Q. Have you conducted or participated
8 in any studies of the effect of temperatures,
9 water temperatures on aquatic species?

10 A. Yes.

11 Q. Tell me what those studies were.

12 A. Well, I worked for probably seven
13 years at the Oyster Creek Nuclear Station in
14 New Jersey, and we did all kinds of studies
15 related to their intake system, to their discharge
16 system, to the movement of fish and their
17 discharge canal, to the effects of heated water on
18 local movements of fish, as well as fish
19 populations in the Oyster Creek system itself and
20 in Barnegat Bay, and actually have some
21 publications related to that. So that was
22 probably the most extensive work I did was at that
23 plant. And we had -- we were not only measuring
24 what was happening in the discharge canal, but we

1 had an experimental trailer set up there where we
2 would could run both ambient water and discharge
3 water through tanks and look at behavior and see
4 what was happening to fish in a more controlled
5 environment in the laboratory so --

6 Q. Now, what did you learn from the
7 Oyster Creek studies that is relevant here to the
8 question of the thermal regime of the upper
9 Dresden Island pool? How are those studies
10 relevant to the issues we're dealing with, the
11 thermal issues we are dealing with in the upper
12 Dresden Island pool?

13 A. I think the issues of fish
14 attraction, fish avoidance, potential lethality
15 due to entrainment through the power plant, I
16 think all of those are pertinent topics to any
17 heated discharge, and they would apply to the
18 Lockport plants, as well as any other.

19 Q. Okay. Then take each one of those.
20 Take the topic of avoidance. What did you learn
21 from your Oyster Creek studies that you think is
22 relevant for the board here in looking at the
23 thermal regime of the upper Dresden Island pool?

24 A. There were times of the year when

1 the fish avoided a good part of the thermal plume,
2 and then there were times when they were attracted
3 to the thermal plume.

4 THE COURT REPORTER: I need one
5 second, please.

6 HEARING OFFICER TIPSORD: Why don't
7 we take our first break. Ten minutes,
8 please.

9 (Whereupon a break was taken,
10 after which the following
11 proceedings were had:)

12 HEARING OFFICER TIPSORD: Do we
13 remember where we were or do we need the
14 court reporter to refresh us?

15 MS. FRANZETTI: I'm there, as
16 always.

17 BY MS. FRANZETTI:

18 Q. Dr. Thomas, before we broke part of
19 what we were talking about was your work with the
20 Oyster Creek nuclear station out in New Jersey.
21 And again can you approximate what year that
22 occurred? For example, was that for the time you
23 were working for the Charles Main?

24 A. No, that was before then. It would

1 have been in the 70's.

2 Q. And who were you doing that study
3 for? Was it for the utility that owned the Oyster
4 Creek station?

5 A. Yes, it was for Jersey Power And
6 Light, I believe.

7 Q. And did that study make any findings
8 with respect to the impact of the nuclear station
9 on the aquatic community?

10 A. Well, there were lots of reports
11 that were either submitted to the Nuclear
12 Regulatory Commission or some papers that came out
13 of it. So there's a lot of different aspects.
14 I'm not sure I can summarize in a few words what
15 the impacts were.

16 Q. Do you recall whether any of the
17 studies concluded that the thermal discharge from
18 the Oyster Creek station was having any
19 significant adverse effect on the aquatic
20 community?

21 A. Well, one of them I remember that
22 was -- let me backtrack.

23 Probably the most visible impact
24 was actually from cold shock, and a few times in

1 the colder months of the year they had to shut
2 down the power plant. Usually some unexpected
3 thing happened in the plant, and there were some
4 pretty significant fish kills. It seemed like two
5 Thanksgivings in a row I ended up having to leave
6 dinner and drive up to the Oyster Creek plant and
7 count the fish that had been killed when the plant
8 shut down. And that's a case where the fish are
9 adapted to warm water. The plant turns off. All
10 of a sudden the water is very cold. They have no
11 place to escape to in terms of finding other warm
12 water, and you get what's called cold shock of the
13 fish. So did that have an effect on the overall
14 population of those species? I don't think
15 anybody was able to measure that. But you could
16 measure the number of fish that were outright
17 killed. We also had estimates of the number of
18 fish killed on intake screens and going through
19 the plant in trying to --

20 Q. My question was on the thermal
21 effect in the river to the aquatic community. So
22 I don't think entrainment is part of my question.

23 A. Well part of mortality in
24 entrainment is thermal, part of it is potentially

1 chemical and part of it may be mechanical going
2 through the plant for entrained organisms.

3 Q. Okay, Dr. Thomas. That's fine, if
4 you think so. But with respect to the cold shock,
5 so that happened a few times to that plant in that
6 period?

7 A. Well, two or three times over seven
8 years say.

9 Q. And you were saying that you could
10 quantify the number of fish that were killed by
11 cold shock, but not what the lasting effect was,
12 if any?

13 A. That's correct, or population. It
14 becomes a different issue to then look at, did it
15 have a negative impact on the population, which I
16 think may be your underlying question, and we were
17 not able to demonstrate that there was any
18 population effect. There was an effect on the
19 fish that were residing there, but on the overall
20 population, most of these were coastal populations
21 so we were not able to determine the negative
22 impact on the population itself.

23 Q. When you say you were not able to
24 determine, did you make some attempt to determine

1 it?

2 A. We looked at the population levels
3 of some of the fish around the plant, and in
4 Barnegat Bay versus other populations up and down
5 the coast, because we had other studies going.
6 So, for instance, we had --

7 Q. Dr. Thomas, can I stop you there
8 because that's enough for me?

9 A. Sure.

10 Q. So you were trying to do a
11 comparison after the cold shock occurred with the
12 fish populations of the fish in area of the
13 nuclear station's discharge and fish populations
14 outside of the area of that discharge, correct?
15 And from that comparison did you find a negative
16 effect?

17 A. Well, none that we could document
18 statistically. The problem is in natural
19 environments, the fluctuation of populations is
20 great enough that you really need a very large
21 impact to actually be able to measure it
22 statistically. I think we found an entrainment
23 effects, and this is the only figure I remember,
24 that we need almost an 80 percent change in

1 population of a plankton organism for it to
2 actually show up as a statistically significant
3 negative impact. So this is one of the problems
4 with some of these studies, it's difficult to
5 quantify because of the large natural variation
6 that you are dealing with.

7 Q. So there was not enough of an impact
8 from the cold shock event to measure any
9 statistically significant difference?

10 A. Population, right. There was
11 definite impact on the population -- you have to
12 define the population. If you looked at the
13 population within the discharge canal, yes, that
14 was significant because it was a large percentage
15 of any particular species in the discharge canal
16 at that time. If you are looking at the broader
17 population like striped bass along the Atlantic
18 coast, no, there was no detectable impact from
19 that, no.

20 Q. Do I understand correctly then the
21 bulk of the fish that were killed because the
22 plant shut down causing a cold shock were in the
23 discharge canal area?

24 A. That is correct.

1 Now, just to finish answering
2 your question about thermal, probably the biggest
3 thermal impact that utility ended up having to
4 readily pay out was because a tropical marine
5 bore, a wood bore -- there's some boring. They
6 are called wood bores -- the invertebrate that
7 bore into wood. It must have gotten in with some
8 ships coming in from farther south, and it got
9 established in the heat of a discharge canal, and
10 actually some of it started destroying some of the
11 docks and parts of Barnegat Bay, and that was an
12 effect, not the kind of effect that you normally
13 think of, but that was an effect of the heated
14 water and that was something that could be
15 measured in terms of the amount of destruction of
16 docks, due to this more tropical wood bore that
17 was able to survive in the discharge canal.

18 Q. Dr. Thomas, are you aware of any
19 cold shock events occurring with respect to the
20 Midwest Generation stations either along the CAWS
21 or the upper Dresden Island pool?

22 A. No, I have not heard or read about
23 any.

24 Q. Given your work for nuclear plants,

1 although I'm not sure how much you are aware about
2 coal fire generating stations, but if you can't
3 answer this question because you don't know,
4 that's fine, just tell me, isn't it true that cold
5 shock occurs primarily at nuclear plants because
6 of their tendency to trip?

7 A. Well, I actually have worked at a
8 number of coal fire plants, but I don't know that
9 that's true. I couldn't say.

10 Q. Just a moment. Moving on to
11 question 9. What do you mean by the statement in
12 your testimony, Section 2, second page, first
13 paragraph, that, "I also understand the argument
14 that a QHEI score of 35 to 60 is a range in which
15 waterways may be able to meet the Clean Water Act
16 goal, depending upon particular characteristics of
17 the area"? Does that statement in your testimony
18 mean that you agree with that argument?

19 A. Yes, I agree with their basic
20 argument that it was a reasonable expectation for
21 that system.

22 Q. And what is the basis for your
23 agreement?

24 A. Well, Yoder testified that these

1 values need to be used in conjunction with the
2 fish data, which I agree with, and I think the
3 assemblage of fish species there indicates that
4 the potential is there to basically meet the
5 requirements of the Clean Water Act goal.

6 Q. Let me move on to the next question.
7 Regarding your testimony at Section 2, third page,
8 first paragraph, the QHEI scores above 45, "Seem
9 to be predominant," in the UDP. Did you review
10 the "particular characteristics of the area" of
11 these scores, and if so, what did you conclude as
12 to which ones may be able to meet the Clean Water
13 Act goal?

14 A. Well, I have to admit I had some
15 difficulty understanding the question.

16 Q. Let me give you a little more
17 clarification because I do want you to understand
18 it and answer the question as it's intended.

19 With respect to question 9,
20 where you answered that you do agree that a QHEI
21 score of 45 to 60 is in a range in which waterways
22 may be able to meet the Clean Water Act goal but
23 it depends on the particular characteristics of
24 the area. So my next question, the one we're on,

1 is for the scores above 45, that you say seem to
2 be predominant, and for those scores that were
3 between 45 -- above 45 but up to 60, not over 60,
4 did you look at the particular characteristics of
5 those areas to determine whether or not they could
6 meet the Clean Water Act goals?

7 A. Well, first, I mean, I don't
8 think these scores are an indication. They are an
9 index. I don't think there's anything magic
10 necessarily about 45 or 43 or -- so that's one
11 point.

12 The second is, I really think
13 that the QHEI scores for this system, and
14 particularly probably for large rivers in general,
15 probably underestimate the available habitat
16 that's available to fish in these systems. In
17 other words, I think these scores might be lower
18 than -- would not represent the variety of
19 habitats that might be available to species in the
20 system. They underestimate the value of those.
21 So I think it's a good index to give us an
22 overview of the area. It gives us some numbers to
23 compare between areas, but, you know, I --

24 Q. I think you told me earlier that you

1 have not conducted QHEI surveys?

2 A. Yes.

3 Q. So what's your basis for this
4 opinion that you believe these scores
5 underestimate the available habitat?

6 A. If one of the areas that they are
7 measuring is riffle areas, one of the habitat
8 things that's measured -- if you think about it
9 this way, in a small stream you might have six or
10 seven riffles per mile, let's say, in a stream.
11 As a river gets larger, you might be down to two
12 riffles per mile. When you get to really large
13 rivers, you might be lucky to have one every 10,
14 15 miles. Does that mean that that riffle is only
15 available to fish within 500 meters of that
16 500-meter section or 10,000-meter section? Most
17 large river fish are able to move, if they need
18 riffle habitat, and they do move fairly large
19 distances, maybe up a tributary stream and maybe
20 up a main river to get to a riffle habitat. I was
21 just talking to -- I was at a large river meeting
22 this week, and I was talking to a large river
23 ecologist from Missouri, and he was saying they
24 use the outside bends of the Missouri River,

1 consider that sort of as a riffle habitat because
2 you have more riffle there, but he said it's about
3 two miles or two-and-a-half miles between those
4 types of habitats.

5 So all I'm saying is, the fish
6 on large rivers are really adapted to moving over
7 a wider range, and I think using a set length,
8 which is my understanding, and someone can correct
9 me if I misunderstood how the QHEI is calculated,
10 but I thought it was calculated over a 500-meter
11 stretch, which corresponded to the stretch that
12 they were actually collecting the fish from, but
13 as you move to large systems, those fish tend to
14 move over longer distances to find a preferred
15 habitat. We talked earlier about many larger fish
16 will move out of the river itself or into flood
17 plane pools or mouths of tributaries or back water
18 areas to carry out parts of their life cycle, and
19 unless you include all of those habitats in your
20 index, you are really undervaluing the habitat
21 available to them.

22 So I'm not sure like in the
23 lower Kaskaskia, if you did the QHEI, I'm not sure
24 whether you would include the habitat available up

1 in the flood plane. My understanding of it was,
2 you would just include the habitat within the
3 river, and yet you would be excluding habitat
4 that's very important to many of those species to
5 carry out their life cycle. So all I'm saying is,
6 if anything, I think these numbers may be low in
7 the kinds of habitats that are available in the
8 systems that we're studying.

9 Q. I'm not sure I fully understand. So
10 let me ask you a few questions.

11 Are you saying that because
12 large fish are able to move large distances,
13 that -- are you referring to fish living outside,
14 for example, the upper Dresden Island pool and
15 saying that sometimes they will come in for a
16 visit, and you know, then move on? I am not
17 understanding the significance of your point that
18 they --

19 A. Let me give you just an example.
20 Say we have a collection -- habitat evaluations
21 done a mile down the stream of the tail waters of
22 the Brandon, the riffle habitat. When we do the
23 QHEI, that's going to get a zero for riffle. Yet
24 what I'm saying is, for many of the fish that need

1 a riffle habitat for some part of their life
2 history, that that riffle is still available to
3 them. Even small fish like the Black Sided
4 Garter, which is one of them I studied in the
5 Kaskaskia --

6 Q. Where is the riffle available to
7 them?

8 A. Below them in the tail water area.

9 Q. So you are saying they go up to the
10 tail water area to enjoy the riffle?

11 A. Well, they may breed there.

12 Q. Fine.

13 A. And then they move back down to the
14 pool afterwards. You collect them in the pool,
15 you do your habitat evaluation in that pool, which
16 doesn't include any -- you have zero for riffle
17 habitat, and yet what I'm saying from the fish's
18 point of view, that riffle habitat is still
19 available, even though it's still a mile away.

20 Q. But if you are doing, not just QHEI,
21 but you are also doing fish surveys in the pool --

22 A. Right.

23 Q. -- then don't you have the two
24 pieces that you are talking about?

1 A. You do. But that's why I'm saying
2 if you just -- and that's why they say, the QHEI
3 is often used in lieu of the monitoring. If you
4 have all the monitoring data, you are documenting
5 what the habitat is. You really don't need a
6 QHEI. But it becomes important in this case. All
7 I'm saying is, yes, we are talking about 45 to
8 60 -- I'm just testifying that this is a range
9 from what I know of the system in which you have
10 good potential of meeting the goals of the Clean
11 Water Act. I mean, in terms of habitat.

12 Q. Did you study here the fish survey
13 data that's available on the upper Dresden Island
14 pool in connection with the QHEI scores to draw
15 any opinion as to potential to attain the Clean
16 Water Act goals?

17 A. I think I have gone through all of
18 the fish data reports that have been made
19 available as part of this record. I've also
20 relied somewhat on some other data that the
21 Natural History Survey has collected regarding
22 fish and the upper Illinois River basin. In terms
23 of looking at the QHEI for a station versus the
24 fish collected there, and do I think -- I did not

1 do -- try to do that kind of analysis. I think it
2 would be hard to take an index and the fish that
3 are dead and totally match them up.

4 Q. Let's go back to my original
5 question here because I don't think that you've
6 answered it. With respect to the location that's
7 had QHEI scores in that 45 to 60 range, did you do
8 any review of what the particular characteristics
9 were in those areas in order to draw a conclusion
10 as to whether or not they would support attaining
11 the Clean Water Act aquatic life use goals?

12 A. Looked at the fish, looked at the
13 scores, I looked at what's been documented about
14 the habitat. So evaluating all of those things, I
15 would say, yes. I mean --

16 Q. What were the particular
17 characteristics of the areas that scored between
18 45 and 60 that you felt enabled them to meet the
19 Clean Water Act goals?

20 A. Well, I'm not sure I wrote down each
21 score to that degree to say these are the aspects,
22 and in fact it was a little bothersome --
23 Rankin's, when he did his work, it was in March or
24 April, I'm sure he didn't detect any emergent

1 aquatic weed beds during that time of the year, so
2 that wouldn't have been part of his score, yet
3 they are there, and I think they provide a
4 significant habitat for a lot of fish species. So
5 I don't feel I've been justified to rely just on
6 that habitat. And I think it was one --

7 Q. I'm not -- Dr. Thomas, I'm not
8 trying to force you to. You made the statement
9 that you agree with the argument that QHEI scores
10 between 45 and 60 may be able to meet the Clean
11 Water Act goal depending on the particular
12 characteristics of the area. You agreed with that
13 argument. So my question was, all right, so if
14 you do, did you look at the scores here between 45
15 and 60 and do some analysis of the particular
16 circumstances to try and conclude whether or not
17 they in fact can meet the Clean Water Act goals?
18 That's all I'm asking. And if you didn't do it,
19 that's fine.

20 MR. ETTINGER: I think there's some
21 ambiguity here in terms of the term the
22 area, did he look at a specific area where
23 there's a score and measure that against the
24 fish. But I believe Dr. Thomas has

1 testified in a big river system the area
2 might be bigger. The relevant area in terms
3 of their life cycle might be different. So
4 I think there's a little ambiguity in your
5 question and that may be confusing.

6 BY MS. FRANZETTI:

7 Q. Maybe I should ask this --

8 A. I did not rely totally on the QHEI
9 scores. I relied on the fisheries data as they
10 reflect their ability to live and grow in that
11 section of the river.

12 Q. Okay. Maybe I should have asked
13 you, what do you mean by "depending on the
14 particular characteristics of the area," what do
15 you mean that's an argument that you agree with?

16 A. All the areas, all the habitats that
17 might be available, logs in the water, sand,
18 gravel, shore line, some current, aquatic
19 vegetation.

20 Q. So did you go back to the QHEI
21 reports here and look at the locations that scored
22 in 45 to 60 to try and evaluate those particular
23 circumstances?

24 A. Well, I didn't look at all of them,

1 I can tell you that. I looked at the sheets that
2 gave all the scores, but I did look at some of
3 them, and that's why I gave the example, there's
4 one station downstream from the tail water area,
5 and that has zero for riffle, riffle habitat, and
6 yet my argument is those fish had that riffle
7 available to them and would have used it and
8 probably do use it if that's needed for carrying
9 out a portion of their life cycle. So that's what
10 I meant by some of these scores I think
11 underestimate the total habitat that's available
12 to some of these fish.

13 Q. And the scores you were referring to
14 those, those included the QHEI scores that were
15 produced by Mr. Yoder's company?

16 A. Well, I looked at all the ones that
17 were available I think.

18 Q. Do you know whether or not that work
19 was included in what you reviewed? You mentioned
20 Rankin?

21 A. Right.

22 Q. That's different from --

23 A. And I saw the Yoder ones.

24 Q. Okay, you did. That's what I'm

1 talking about.

2 A. Okay. But I saw also -- didn't EA
3 do a separate analysis themselves? And I looked
4 at those also.

5 Q. With respect to Mr. Yoder's firm's
6 QHEI work, did you look at the corrected QHEI
7 scores?

8 A. I saw that there were corrections
9 made, but I wasn't trying to analyze -- I mean,
10 when you have all this detailed information --

11 Q. Dr. Thomas, did you look at the
12 corrected QHEI scores?

13 A. I saw the corrected -- did it mean
14 anything to me, no. But I saw the corrected
15 scores. I think it does make a difference though
16 that I wasn't relying on those to tell me what's
17 happening to the fish populations.

18 HEARING OFFICER TIPSORD: Excuse me,
19 Ms. Franzetti. Just for clarification of
20 the record, we keep talking about the EA
21 report, and I have assumed and we should
22 probably put it on the record, when you talk
23 about the EA report that are a part of this
24 record, you are talking about materials that

1 are already in the record or were a part of
2 the pre-filed testimony for Midwest
3 Generation; is that correct?

4 THE WITNESS: I believe so. I'll
5 tell you, I've reviewed so many things.

6 HEARING OFFICER TIPSORD: But they
7 are items that are already in the record or
8 will be?

9 THE WITNESS: I hope so.

10 HEARING OFFICER TIPSORD: That was
11 your understanding?

12 THE WITNESS: That's my
13 understanding. I think everything you sent
14 me, the Plankton reports, the various
15 Fisheries reports.

16 MS. DEXTER: In terms of QHEI is
17 everything that he's reviewed.

18 HEARING OFFICER TIPSORD: I was
19 asking about the EA reports. We keep
20 talking about the EA reports. I just
21 assumed when he reviewed the record, that he
22 was talking about the reports that are part
23 of the pre-filed testimony or maybe placed
24 in. If that's not the case, then we need

1 him to provide us those that are not or
2 won't be introduced.

3 MR. ETTINGER: May I suggest that
4 the three of us should talk. EA has
5 actually been doing studies of these systems
6 since the '80s and I want to make sure we
7 didn't send him one of those earlier
8 studies. I don't think we did, but I'd like
9 to talk to Ms. Dexter and Dr. Thomas and
10 make sure that we didn't give him an earlier
11 EA report that wasn't in the record, and we
12 will get back to you on that.

13 HEARING OFFICER TIPSORD: And that's
14 fine. My only request is, if he did look at
15 something that is not part of the record,
16 that we make it part of the record.

17 MR. ETTINGER: We'll get back to you
18 with an answer on that.

19 HEARING OFFICER TIPSORD: Okay,
20 thank you. Sorry, Ms. Franzetti.

21 BY MS. FRANZETTI:

22 Q. Dr. Thomas, you've mentioned the
23 Brandon tail water area and -- are you aware that
24 the median QHEI score in the Brandon tail water

1 area is about 46?

2 A. I thought that was somewhat below
3 the actual -- does that include the whole tail
4 water?

5 Q. Yes.

6 A. That seems awfully low to me.

7 Q. I'm sorry, I think I just misstated
8 that. Except for the Brandon tail water area,
9 except for the Brandon tail water. I left out a
10 key word in formulating that question. Do you
11 agree from what the QHEI scores you reviewed that
12 the median is about 46?

13 MR. ETTINGER: I'm sorry, I'm still
14 unclear what we are talking about. The
15 upper Dresden Pool, the median score is 46,
16 outside of the Brandon tail water?

17 MS. FRANZETTI: Correct.

18 BY THE WITNESS:

19 A. I'm not positive. If I remember,
20 that sounds like it may be in the ballpark of what
21 someone has reported.

22 BY MS. FRANZETTI:

23 Q. That's fine. I'll ask you to assume
24 it. The record will bear out whether or not

1 that's an accurate median value. And do I
2 understand your testimony correctly that even
3 though that median value is at that very low end
4 of the 45 to 60 range, that you still believe it's
5 reasonable to conclude that the upper Dresden
6 Island pool can attain the Clean Water Act aquatic
7 life goals?

8 A. I wasn't sure when I was going to
9 get into this, but I guess I might as well jump in
10 now.

11 It's interesting when you
12 look -- and this is -- if you'll excuse me a
13 minute. I'm going to jump off to something else.
14 But I'm going to get back to your question -- if
15 you look at IBI scores and you look at the Fox
16 River, and that's been in the record. The IBI
17 scores for the flowing part of the Fox River, and
18 the IBI scores for the impounded parts, you see
19 that the IBI score for the impounded parts on the
20 Fox River is about the same as the Dresden Pool.
21 Maybe even a little bit lower. I think the values
22 have been reported. The problem here is -- and
23 there's no doubt, and there's been testimony, the
24 effects of impoundment of the effects of diversity

1 in the system. And that's true. I'm not going to
2 try to argue against that. The issue is, almost
3 every one of our large rivers are impounded to
4 some degree over some portion of their length. I
5 don't think as a nation we are going to start
6 going back and say, well, because they don't have
7 the same mix of species, the same, what we call,
8 balance indigenous population of a flowing river,
9 that we are going to downgrade the water quality
10 criteria for all of our reservoir areas and
11 impounded areas and all our large rivers. It's
12 just not going to happen. So, yes, it is a little
13 bit lower than you would find in a free-flowing
14 river, but it isn't that far out from many other
15 impounded areas of river. Almost all of which
16 that I'm thinking of are general use waters. And
17 so how the Board is going to treat that, I have no
18 idea because it's a broader issue than just this
19 system, but I find the populations and the mix of
20 species in this system, what one might expect,
21 it's probably even better than some other
22 impounded areas in other general use waters.

23 Q. Have you done any sort of
24 comparative analysis to support that statement?

1 A. I have collection data from --
2 electro fishing data from the Illinois Natural
3 History Survey for both Starved Rock, Marseilles
4 pool, downstream and general use water, and this
5 Dresden Island pool. You can see some difference
6 in species, but if you look at those lists, you
7 are going to see it's pretty well the mix of
8 species that you have there. Some species are
9 higher in the Dresden Island pool because, I
10 think, of the weed beds and other features of the
11 pool. Some species like the Red Horses might be
12 lower.

13 Q. And, Dr. Thomas, none of that have
14 been included in your pre-filed testimony,
15 correct?

16 A. That's correct.

17 Q. Do you agree that, except for the
18 Brandon tail waters, fast water is absent in the
19 upper Dresden Pool?

20 A. What do you mean by fast water?

21 Q. Well, you want me to give -- do I
22 have to give you a velocity range? I'm talking
23 about current.

24 A. Right, I understand that.

1 MR. ETTINGER: Are you including
2 treatment areas?

3 MS. FRANZETTI: To the extent they
4 are a part of what this proceeding has
5 defined as the upper Dresden Island pool,
6 yes.

7 BY THE WITNESS:

8 A. I would say that it would be
9 characterized as slower moving water for most of
10 the rest of the pool. I think there's somewhere
11 in the record what sort of an average velocity is
12 through the pool, but I'm not positive I remember
13 that.

14 BY MS. FRANZETTI:

15 Q. You do agree that, except for the
16 tail waters, riffles are absent from the upper
17 Dresden Island pool?

18 A. I'm not positive that other riffles
19 aren't available in some of the tributaries, but
20 yes, for the pool itself, I would agree.

21 Q. What tributaries to the upper
22 Dresden Pool are you talking about?

23 A. Let me see. Jackson Creek actually
24 comes in the downstream of I-55, correct?

1 Q. Yes.

2 A. So I am not sure.

3 Q. You are not sure if there are any
4 tributaries you are talking about?

5 A. Yes, I am not sure if there's any of
6 that kind of habitat available.

7 Q. Do you agree that hard substrates,
8 and in particular I mean gravel and cobble -- that
9 let me restate that.

10 Do you agree that hard
11 substrates, and in particular gravel and cobble,
12 hard substrates, in fast water, are lacking in the
13 upper Dresden Island pool, except in the Brandon
14 tail waters?

15 A. I wouldn't agree totally with that.
16 I think from the descriptions I read there are
17 sand bottom areas that were formed that's
18 considered a harder substrate. It depends on how
19 they are washed and that. There are also logs and
20 debris at times that will form a harder substrate
21 that could be used by some fish. But in general,
22 I would agree with that description with those
23 exceptions.

24 Q. Is it true that certain species or

1 groups of fish species such as most darters and
2 Red Horse, as well as some minnows, require the
3 habitats that we have just been discussing to
4 reproduce and feed successfully?

5 A. Not all of them, but most of them do
6 need that. The logperch, no. It does have
7 populations in lakes and will use a sandy
8 shoreline or sandy gravel, but, yes, in general
9 they need some flow over usually a harder
10 substrate. There are some other exceptions. The
11 mud garter and some others that will actually
12 spawn in back water pools for this vegetation. So
13 just for the record I should state that there are
14 some species that are adapted to sluggish water,
15 of those groups, but in general I would say the
16 large majority of them do need a habitat as you've
17 described.

18 Q. You mentioned earlier, and now I'm
19 going to refer to question 11, where it
20 specifically addresses these micro habitats. What
21 are micro habitats as you've used that term in
22 your testimony?

23 A. I use it -- and I'm not sure it's
24 necessarily in the literature. I use it as just a

1 very small portion of habitat. When we talk about
2 riffle areas, we talk about the whole riffle. But
3 within that riffle, there are a whole series of
4 micro habitats. There might be an area of real,
5 shallow, fine gravel, and there might be another
6 area of larger rocks and cobble. And one example
7 might be a log. A hollow log might be used by a
8 flat head cat fish for spawning. That would be a
9 micro habitat that it's using. It's just a very
10 small portion of all the habitat available there.

11 The QHEI as an index wouldn't
12 pick up necessarily these micro habitats that
13 might be available. It's giving you a general
14 snapshot of the whole area, but when you are
15 looking at it by a species by species basis and
16 what each of their requirements might be, then you
17 might be more concerned about some of these what
18 I'm calling micro habitats, small areas of habitat
19 that might be more suitable for them for spawning
20 or some other aspect of their life history.

21 Q. Dr. Thomas, the next part of the
22 question is, would you describe the location and
23 extent of the micro habitats that exist in the --
24 and let's take it one area at a time first --

1 describe the location and the extent of the
2 micro habitats that exist in the upper Dresden
3 Pool.

4 A. Well, I think I referenced, we just
5 talked about the tail water, for instance, that
6 even casual observation from the bridge reveals
7 the variety of smaller habitats that are
8 available. Some faster moving water. Some slower
9 pools. Some emergent vegetation. So if you get
10 downstream, the micro habitats are probably
11 provided by the aquatic vegetation, by logs in the
12 water, by overhanging branches. There's areas
13 along the shore where there might be riffraff or
14 gravel. So all of those things could provide
15 habitat for some species of fish.

16 Q. Okay. Am I correct that your
17 knowledge of the location and extent of micro
18 habitats in the upper Dresden Island pool is based
19 on your trip out there last year?

20 A. Well, not totally. I have
21 descriptions in some of the reports and that I've
22 read. There's photographs that the EA provided of
23 lots of the area throughout that pool.

24 Q. So some of these areas are described

1 in the QHEI survey reports?

2 A. Well, there, or the fisheries'
3 reports or photographs that show logs and
4 overhanging branches. So anyway, there's a
5 variety of places where someone has described or
6 pictured habitats.

7 Q. Is it your opinion that these micro
8 habitats are what enable the upper Dresden Island
9 pool to attain the Clean Water Act aquatic life
10 use goals?

11 A. I'm not sure it attained, as it was
12 capable of attaining. I think that's an important
13 aspect of it all. It's an important habitat. But
14 it, in and of itself, is not the only habitat
15 available.

16 Q. I understand that. I'm trying to
17 understand how you're using the existence of these
18 micro habitats, what their significance is. And
19 so are you saying that their presence makes the
20 upper Dresden Island pool capable of attaining the
21 Clean Water Act aquatic life use goals?

22 A. Yeah, I think there's enough variety
23 of habitat in that pool compared to other pool
24 areas of other river systems that it should be

1 capable of maintaining something close to the
2 Clean Water Act goal of a balanced indigenous
3 population.

4 Q. I haven't asked you, have you made
5 these determinations before as to whether or not a
6 particular body of water can attain the Clean
7 Water Act aquatic life use goals or is this the
8 first time you are opining on that topic?

9 A. Well, I find the whole concept of --
10 I tend to approach it from a species point of
11 view.

12 Q. Dr. Thomas, the question is whether
13 or not --

14 A. I'm getting there. I tend to
15 approach it from the species point of view. So a
16 broad, general term like that used in our legal
17 system doesn't have huge overriding meaning to me.
18 I mean, I'm not sure anybody could totally tell me
19 in any of these water bodies what the balanced
20 indigenous population should look like, for one
21 thing. And I have seen the historical data so I
22 could probably tell you better than most what it
23 was, but it's never going to be what it is now and
24 what it's going to be. What's the imbalance

1 indigenous population for Lake Michigan? We get a
2 new invasive species that takes off every year.
3 So populations are changing there every year, the
4 mix, the balance of them. So I'm not sure anybody
5 really could tell you very actively what a
6 balanced indigenous population should look like
7 there. What I'm saying is, for this system I
8 think we have a basic assemblage of species that
9 in my view would be close to probably what we
10 could expect in that system.

11 Q. Moving on to the Chicago Sanitary &
12 Ship Canal. Can you describe for me the location
13 and extent of the micro habitats that exist in
14 this Sanitary and Ship canal?

15 A. Well, of course, it's a very diverse
16 system with, you know, lots of difference between
17 the north channel --

18 Q. No, no, no, the Chicago Sanitary &
19 Ship Canal only.

20 A. Sorry, okay. Habitats in general
21 are more limited there, but on the other hand
22 there is --

23 Q. No, Dr. Thomas, where are the micro
24 habitats in the Chicago Sanitary & Ship Canal?

1 A. The broken riffraff.

2 Q. And where is it?

3 A. Along the shore.

4 Q. Of the --

5 MR. ETTINGER: Do you want a meets
6 and bounds description? Should we get a map
7 out? I'm not sure what your question is.

8 MS. FRANZETTI: Well, Albert, I'm
9 asking what is the basis for his statement
10 that there are micro habitats in the Chicago
11 Sanitary & Ship Canal?

12 MR. ETTINGER: Why don't you ask
13 that question, and he can answer that.

14 BY MS. FRANZETTI:

15 Q. I would like to know the extent of
16 them and their location in the ship canal,
17 otherwise these are just generalized statements
18 that really can't be evaluated. Number one, we
19 are using a term that he's admitted isn't even
20 used in the literature. It's his own term. So I
21 think I'm entitled to know what you are saying is
22 the extent of their location in the Chicago
23 Sanitary & Ship Canal and where are they located.
24 So I don't need meets and bounds, but I need a

1 little more specifics than there's micro habitats
2 out there.

3 A. Emergent vegetation. There's areas
4 of gravel and rock along portions of the
5 shoreline. There's some logs. There's other
6 debris in the water. There's sunken barges. Any
7 structure like that in the water is going to serve
8 as a micro habitat. This is why people sink
9 ships in lakes or the ocean or sink Christmas
10 trees in our lakes because they provide a habitat
11 from macro invertebrates to grow on and for fish
12 to use as a habitat. So that's what I mean by
13 that. Could be overhanging branches. Large
14 rubble, rocks in the water.

15 Q. What's the extent of the Chicago
16 Ship Canal? Do you think they are prevalent
17 throughout the length of the ship canal? Do you
18 think there are certain parts of it? Can you be
19 any more specific?

20 MR. ETTINGER: We were in the ship
21 canal last month. What did you see there in
22 terms of habitats that you know of?

23 BY THE WITNESS:

24 A. I mean, you go through areas that

1 have relatively limited habitat. There's straight
2 walls and probably somewhat uniform bottom,
3 although I didn't measure it. You have other
4 areas in which there appears to be a more
5 developed shore line and it provides more habitat.
6 I haven't gone through and analyzed that there's
7 five percent gravel shoreline, and one percent
8 emergent vegetation, but there are all those
9 micro habitats or small areas of habitat available
10 to a variety of fish that live in those areas.
11 That's all I'm saying.

12 Q. Moving on to question 12. Give me
13 just a moment to read it to myself. It may be
14 that we've covered parts of this. Question 12,
15 "Your pre-filed testimony refers to 'habitat
16 improvement' in the upper and lower Dresden pool
17 that could result in improvement of fish
18 communities, and also that physical habitat can be
19 improved 'by providing physical structures for the
20 growth of microbial organisms and macro
21 invertebrates that can provide food to fish.'
22 Please explain in greater detail the nature and
23 extent of improvements to habitat and their
24 location in the upper Dresden pool that you were

1 referring to in this testimony." And I will just
2 add, I know you talked about the potential
3 construction of a dike. We already have that.
4 But I don't know that you have identified any
5 other improvements you think, habitat
6 improvements, that could be made in the upper
7 Dresden pool that we haven't already discussed.
8 So I'm not asking you to repeat your testimony,
9 but to make sure I know all of what you are
10 referring to.

11 MR. ETTINGER: I'm sorry, you just
12 shifted back to the upper Dresden Pool. You
13 want to answer this for the upper Dresden
14 Pool or are we at the Sanitary Ship Canal?

15 MS. FRANZETTI: The question is the
16 Dresden Pool, and I believe his prior
17 testimony regarding construction of the dike
18 was also the Dresden Pool.

19 MR. ETTINGER: I was confused.

20 MS. FRANZETTI: So, yes, we are
21 staying in the Dresden Pool.

22 MR. ETTINGER: I was confused
23 because your last set of questions was about
24 the Chicago Sanitary & Ship Canal.

1 BY THE WITNESS:

2 A. Well, there's always lots of things
3 you can do to improve fish habitat. Again, I
4 think it takes an analysis of those habitat types
5 that might be limited for species of interest.
6 One of the things we recommend, like in Lake
7 Peoria, where the Corps is dredging, is the
8 creation of some islands with some deeper water
9 around them for over-wintering habitat. Because
10 deeper over-wintering habitat is an issue in that
11 part of the Illinois River. It may or may not be
12 an issue for the Dresden Pool. So depending upon
13 some of the species you were interested in and
14 what you were interested in enhancing, might
15 effect the types of things that you might want to
16 do in that pool. All I'm saying is there's a
17 number of possibilities of things to do to improve
18 fish habitat. But, again, it's got to be targeted
19 at what species you are interested in and what you
20 would like to see improved.

21 Q. And you have not done the analysis
22 you are talking about, the species type you want
23 to improve and what they would need and whether
24 you could do that in the upper Dresden Pool? You

1 haven't done that type of analysis?

2 A. That's correct.

3 Q. Moving on to Question 13, do you
4 believe the absence of sufficient food for fish is
5 currently a limiting factor to species abundance
6 and diversity in the upper Dresden Pool?

7 A. Well, I have not seen any data that
8 would indicate that food is a limiting factor,
9 with a possible exception of small mouth bass.
10 The EA study showed plankton in the upper Dresden
11 Pool to be similar to other large water bodies. I
12 think Burton and Siegert testified the condition
13 of fish in the upper Dresden Pool is similar to
14 other water bodies. But their reports did say
15 that small mouth bass had lower condition.
16 Whether that's temperature effect or a food effect
17 or some other thing, I don't really know. But the
18 data I've seen does not seem to indicate that food
19 is limiting for most of the fish in the system.

20 MS. FRANZETTI: And, again, the data
21 that you are referring to, is that
22 something, Counselor, that maybe we can get
23 some clarification on after you've had a
24 chance to talk to him?

1 MS. DEXTER: I think we need to go
2 back and look through the reports and
3 identify which ones he's talking about.

4 BY THE WITNESS:

5 A. I apologize if some of them weren't
6 in the records. My understanding was it was part
7 of the record.

8 BY MS. FRANZETTI:

9 Q. It may well be, Dr. Thomas. You
10 don't have to apologize for anything at this
11 point. We just need to get a little clarity when
12 you say the data you've seen. You can appreciate
13 that.

14 A. I'm sorry that I didn't get more
15 specific.

16 Q. Right, and it makes it difficult, if
17 not impossible, for me to ask follow-up questions
18 about that data.

19 MS. FRANZETTI: And on that note,
20 Madam Hearing Officer, I'm just going to
21 reserve the right to ask further questions
22 of Dr. Thomas when we do have a little more
23 clarity and certainty to the data that he's
24 referring to for some of these statements.

1 BY MS. FRANZETTI:

2 Q. Question 14. "Your pre-filed
3 testimony states that many structures will also
4 provide shelter and potential breeding habitat for
5 fish. What fish species are you referring to, and
6 of those species, will the suitability of the
7 habitat still be effected at all by the presence
8 of sediments"?

9 A. Well, in those areas of heavy
10 sedimentation, I mean, that's a problem for almost
11 all Illinois waterways. So that would be a
12 problem, if you put a structure in an area where
13 you have heavy deposition. So if you were going
14 to put sand and gravel in, for instance, or if you
15 are going to put in riffraff or something in, you
16 would put it in areas that tend not to be
17 depositional areas. In other words, areas where
18 you have a significant build-up of sediment, and
19 those are usually very quiet areas, back water
20 areas where the sediment can drop out and
21 accumulate.

22 Q. What fish were you referring to?

23 A. I think if, you know, if it was
24 determined that someone wanted to create more

1 habitat for small mouth bass, for instance, you
2 might look and see if there were areas where there
3 was some current. You haven't had enough depth
4 and you thought adding gravel or sand and gravel
5 mix or something might provide some habitat for
6 them to build a nest in. That could be just one
7 example.

8 Q. So with respect to upper Dresden
9 Island pool, you have not done an evaluation as to
10 what additional shelter and/or breeding habitat
11 for whatever species of fish you think are or
12 should be there, you have not done that type of
13 evaluation?

14 A. No. Other than saying that there's
15 pretty good sun fish population, pretty good large
16 mouth bass, I have to presume that there's habitat
17 for nest builders to successfully build nests and
18 have young and reproduce in the system already.

19 Q. Moving on to question 15. "Would
20 you please identify the facts that support your
21 belief that the upper Dresden Pool can 'support a
22 more balanced and diverse fish population'?"

23 A. Yes. And probably by that I meant a
24 greater number -- greater numbers, and

1 particularly some of the more sensitive species.
2 I mean, we already have a pretty large mix of
3 species, but we could see potential improvements
4 in this habitat for Walleye and small mouth bass
5 and channel cat fish, potentially some of the red
6 horses. So those would be species that we might
7 see greater numbers of with potentially improved
8 water quality in that pool.

9 Q. What facts are you relying on for
10 those opinions?

11 A. What's supported in other areas.

12 Q. Of the state? You mean other
13 rivers?

14 A. Yes, even in, say, the lower
15 Des Plaines River, for instance, or downstream
16 pools.

17 Q. Downstream of the I-55?

18 A. In the Illinois River, for instance.

19 Q. Any other facts that you are relying
20 on to support that opinion we haven't covered?

21 A. Well, I think the other is just the
22 history of the area. If you look, I mean, the
23 late 1960's, early 70's, we had basically carp and
24 goldfish with cancers on them, and today we have a

1 much more diverse population. As water quality
2 has improved over the last 20 or more years, we've
3 seen sort of steady improvements in the fish
4 community. Now, I realize that the data shown
5 over the last 15 years, you have some years that
6 are better than others in terms of the fish
7 population that's in the system, but the evidence
8 seems to indicate that as we've done things to
9 improve the water quality that the fish
10 populations have responded in a positive way to
11 that. So I don't have any reason to believe that
12 we couldn't continue to see some improvements
13 beyond where we are now in that system.

14 Q. And that's based on the fact because
15 there were improvements from the 60's and 70's to
16 today?

17 A. Well, and even more recently, and I
18 know I'm not testifying right now on the CAWS, the
19 Chicago area waterways, but I think even with the
20 TARP system, that portion that's gone into effect,
21 there was some fisheries that indicated some
22 improvement even after that. So I think we've
23 been doing things that have resulted in a positive
24 response from the fish community in the system.

1 Q. And what more are you saying can be
2 done in the upper Dresden Pool that you believe
3 will result in a more balanced and diverse fish
4 population?

5 A. Well, there's been a number of
6 potential stresses on the system that have been
7 identified, and I think as we continue to move to
8 reduce some of those, and I think temperature is
9 one of those, I think dissolved oxygen at times
10 may be a problem, contaminated sediments may be a
11 problem for some species in some places. Barge
12 traffic may be a problem. We're not going to
13 correct that. Or at least it's unlikely. So I
14 think we have a number of stresses, but I think as
15 some of those can be reduced, I think we can
16 expect that we'll see response from the aquatic
17 community.

18 Q. Now, is that based on any studies,
19 any analysis, any evaluations that you've done?

20 A. As I said, you can base it just on
21 what's happened in this whole upper Illinois River
22 system as water quality has improved since the
23 early 1970's or other systems. We ran into -- one
24 of the other areas that I worked on in New Jersey

1 was the lower Raritan River and Raritan Bay area,
2 and that actually was a coal fire plant we were
3 working on, and they never had any problem with
4 impingement there or entrainment until somewhere
5 in the mid-'70's as water quality started cleaning
6 up, all of a sudden fish populations moved in and
7 they started having plants grow and all of a
8 sudden they were having entrainment impacts on
9 things that weren't in that system before. So I
10 think there's a lot of data out there on how fast
11 the aquatic community can respond if you have
12 improvements in water quality.

13 Q. Speaking of temperature, question
14 16, what are the temperatures in the upper Dresden
15 Pool you are referring to as necessary to improve
16 species abundance and diversity?

17 A. Well, I was referring to probably
18 the IEPA recommended thermal maximum. Probably
19 very generally temperatures above 90 degrees
20 Farenheit in the system. I think as some of those
21 temperatures were reduced, we might expect less
22 avoidance and possibly better fish growth. I
23 think that's -- and possibly the better habitat
24 for fish like red horses and maybe white sucker

1 who might be a little more sensitive to warmer
2 temperatures.

3 Q. And those are the improvements that
4 you believe would occur if the IEPA proposed
5 thermal standards were adopted?

6 A. I think they would move us farther
7 in that direction of raising those periods, even
8 though they may be brief, of higher water
9 temperatures.

10 Q. All right. So they might move us in
11 the direction of better fish growth, less
12 avoidance; is that what you mean?

13 A. Yes.

14 Q. But you are not sure how far they
15 might move us?

16 A. Give you a quantitative -- no.

17 Q. Moving to 17, and you mentioned at
18 least one of these fish in that answer, you
19 testified that white sucker and logperch are
20 temperature sensitive species. "See Section 2,
21 fourth page, last paragraph, and the fifth page,
22 first paragraph of your testimony." What
23 information did you rely upon to determine that
24 these species are temperature sensitive?

1 A. Well, I -- for the white sucker, I
2 relied on -- Yoder had an upper avoidance
3 temperature of about 84 degrees Farenheit and an
4 upper incipient lethal temperature of about --
5 rounding it off to about 89 degrees Farenheit.
6 There was -- I had some data from Fish and Wild
7 Life Service that had a little bit higher upper
8 incipient lethal temperature for white sucker up
9 at 91.4 degrees Farenheit. So those are two
10 sources. They are off by a few degrees, but you
11 get that kind of variation in the literature.

12 The logperch, I had an upper
13 incipient temperature of 26 degrees centigrade.
14 I'm not sure the table I got is in the record or
15 not.

16 Q. Do you remember what table you got
17 it from?

18 A. Well, I have the table.

19 Q. That's a good start. Pull that baby
20 out.

21 A. You'll have to give me a minute
22 here. I am not sure if it's in the folder or not.

23 Q. You know what, what we can do is, I
24 think at a certain point here that I won't be done

1 that we're going to take a lunch break, do you
2 want to look for that over the lunch breach?

3 A. Yes, let me try to dig that out,
4 because -- actually, it's interesting, it's a
5 species that I worked on for my master's, and I
6 know where it's found, but I only had that one
7 reference that gave upper incipient lethal
8 temperature.

9 Q. Now, let me go back to the white
10 sucker, just to be clear on the record what you
11 did rely on. I appreciate you giving me the
12 temperatures for the white sucker that is your
13 basis for saying they are a temperature sensitive
14 species. But let's be clear about where you got
15 the data. You were relying on Mr. Yoder's data
16 that he presented in this proceeding with respect
17 to white sucker?

18 A. Yes, that was one of them.

19 Q. One of them, right. And then you
20 mentioned some fish and wild life temperature
21 data, correct?

22 A. Let me check something because it
23 may have been out of the "Temperature Criteria for
24 Fresh Water Fish" by Brungs and Jones. I'd have

1 to look through there to see if -- because they
2 have a number of species listed.

3 Q. Dr. Thomas, you want to just maybe
4 include that in the homework I'm giving you for
5 the lunch hour?

6 MR. ETTINGER: Is Brungs and Jones
7 in the record?

8 MS. FRANZETTI: It's been mentioned.
9 I'm not positive if it is or not. It's
10 definitely been mentioned. I'm not sure --

11 BY THE WITNESS:

12 A. I don't think that's where I -- I
13 don't think that's where I got it. I think it was
14 more recent data. I was just looking quickly. I
15 know there's a table.

16 HEARING OFFICER TIPSORD: Jess
17 indicates that's she's checked and it's not
18 in the record.

19 MS. DEXTER: If it becomes time, we
20 can put it in the record.

21 MS. FRANZETTI: Well, he just said,
22 at least on this one -- it may change on
23 logperch -- he didn't rely on that.

24 A. Yes, I was supposed to look at white

1 perch. I was looking at logperch. Yes, white
2 sucker is in there -- no, well --

3 Q. What's the temperature in there?

4 A. Well, they just list here the
5 maximum weekly average temperature for growth, and
6 they listed that at 82 degrees in Farenheit.

7 HEARING OFFICER TIPSORD: At this
8 point we need to put that in the record.
9 We're reading from it, we need to put it in
10 the record.

11 MR. ETTINGER: You can put it in the
12 record, but I need it back.

13 MS. FRANZETTI: At least Jessica
14 comes prepared unlike some other people we
15 won't name.

16 MR. ETTINGER: She's eager to get
17 rid of these.

18 HEARING OFFICER TIPSORD: I've been
19 handed Temperature Criteria for Fresh Water
20 Fish Protocol & Procedures, U.S. EPA,
21 Environmental Research Laboratory Office of
22 Research & Development. And it's got a May
23 1977 date on it. If there's no objection,
24 we will enter that as Exhibit 328. Seeing

1 none, it's Exhibit 328.

2 (Whereupon Exhibit No. 328 was
3 entered into the record.)

4 MS. WILLIAMS: I'd like to clarify
5 for the record. I don't want to object. I
6 believe Jessica is correct, that this is not
7 an exhibit, but I believe the Agency
8 submitted it.

9 MS. DEXTER: I believe I checked
10 through.

11 MS. DIERS: Mr. Yoder did follow
12 up, and it was attached.

13 MS. DEXTER: In the big one, yes.

14 MS. WILLIAMS: Well, when we had to
15 do supplemental to what people requested,
16 I'm pretty sure it was in there.

17 HEARING OFFICER TIPSORD: That's
18 fine, but since we are dealing with it at
19 the hearing, we'll go ahead and mark it
20 again.

21 THE WITNESS: I should just add on
22 to that, on page 51, Appendix B, they
23 actually have it listed by its scientific
24 name, which is Catostomidae, and they do

1 list some various lethal thresholds. That's
2 probably somewhat different than upper
3 incipient lethal temperature. Anyway, they
4 have some different values in there. They
5 are all in centigrade. So there is some
6 additional data in there, but I didn't see
7 any for the logperch.

8 BY MS. FRANZETTI:

9 Q. Dr. Thomas, recognizing you don't
10 have specifically what the thermal data was you
11 were relying on, let me ask you more generally,
12 with respect to demoting white sucker and logperch
13 as temperature sensitive species, were you
14 primarily focusing on upper incident lethal
15 temperatures, UILT?

16 A. No, where available I'd look at
17 avoidance temperature. I mean, if you have
18 temperature for growth, that's very important too.
19 A lot of the literature doesn't have that for a
20 lot of those species so --

21 Q. Okay. So you looked at, I guess,
22 then any thermal data for these two fish species
23 that you had in coming to the conclusion that they
24 are temperature sensitive species, correct?

1 A. Well, I looked at the RIS list, the
2 representative important species list that's been
3 present, and then as I looked at the temperatures
4 for those, I looked at what are the species on the
5 lower end of that range. We're saying temperature
6 sensitive. Maybe that's not the best term. They
7 are the most sensitive or they have the lowest
8 lethal temperatures or maybe on the lower end of
9 the avoidance temperatures of the RIS group. I
10 think that's a more accurate or better way of
11 characterizing it.

12 Q. Thank you. We'll leave it at that,
13 and when you can more specifically identify the
14 data --

15 A. I got it off a table, and I'll try
16 to identify what the source of that was.

17 Q. Great. Moving on to question 18,
18 will a reduction of temperatures in the upper
19 Dresden Pool without improvements in dissolved
20 oxygen levels achieve a diverse fish population?

21 A. That's sort of a funny question in a
22 way. I mean, I guess achieve a diverse fish
23 population indicates there is a not diverse fish
24 population there now. A better question might be,

1 would it improve to some degree the fish
2 population or some aspects of the fish population.
3 I think the two have to go together, the
4 temperature and the dissolved oxygen, which in
5 some ways they often do. I think from my reading
6 of some of the Midwest Generation reports, DO has
7 not been reported as a widespread problem, but
8 there has been indication that it may be a problem
9 at some times or some places within the pool.

10 Q. Do you have any -- do you have any
11 opinion as to whether you think temperature is a
12 more significant stressor in the upper Dresden
13 Pool as compared to dissolved oxygen?

14 A. From the data I've seen, I would say
15 that temperature is probably more significant than
16 dissolved oxygen.

17 Q. Why is that? What's the basis of
18 that?

19 A. Well, the basis of that, I guess, is
20 that temperatures at time go above the avoidance
21 temperature or approach lethal temperatures for
22 some species at times where I haven't seen data on
23 the dissolved oxygen in that pool that would
24 indicate that it's reaching a lethal level for

1 some fish. Now, I'll be the first to admit that I
2 haven't reviewed probably every DO record that's
3 been collected out there. So I'm just saying from
4 what I've seen in the record, that would be my
5 opinion at this point. I do -- I can say in
6 answer to that question that I did look at the
7 upper avoidance temperature for like red horse and
8 white sucker, and that seems to be in the 28 to 29
9 degrees centigrade range, and I'm sorry, I don't
10 have the quick Farenheit translation of that, but
11 it's in the 80's somewhere.

12 Q. Let's move on to question 19. What
13 are the temperatures that you are referring to in
14 your statement that the temperatures in the upper
15 Dresden Pool at times in the summer months are
16 sufficient for causing avoidance and limit the
17 carrying capacity of the system? So first start
18 with the temperatures that you are referring to.

19 A. Again, temperatures higher than the
20 avoidance temperatures of some of these fish would
21 indicate that the fish are going to move out of
22 those systems.

23 Q. And can you generally reference what
24 you are using as the avoidance temperature?

1 A. As I said for red horse and white
2 suckers it's in the 28 to 29 degree centigrade.
3 That's what's in the record. But I also based it
4 the UAA report that temperatures at times were
5 near or above the upper avoidance temperature of
6 some species and also the ecological analysts --
7 this time I did write it down, the 2003 report
8 regarding thermal standards on page 35 said that
9 resident fish can and do move temporarily out of
10 thermally enhanced areas and into portions of the
11 river that are more suited to their preferred
12 temperature range. So, again, I was using some of
13 the EA reports, as well as the UAA, as well as
14 some of the data that I saw on avoidance
15 temperatures.

16 Now, I'll tell you the one thing
17 that I found totally missing in terms of doing a
18 good analysis, if you will, or just overview of
19 the effects of temperature, I have not seen
20 thermal plumb data from the discharge down to the
21 I-55 bridge that shows the extent of the plumb,
22 the top to the bottom temperatures. I did see one
23 place, I can't remember where it was now, that
24 said thermal mixing of the plumb with the river

1 probably occurred somewhere between two and
2 four miles downstream. But I don't know -- I
3 mean, if I was one that was going to do a real
4 evaluation of that, I would -- and I think that
5 thermal plumb data was referenced somewhere in
6 someone's testimony that the plumb study was
7 done -- I just had not seen the results of that
8 plumb data. That would sort of be helpful, I
9 think.

10 Q. How would you use that data? Why
11 would it be helpful?

12 A. I mean, there's statements in here,
13 like there's room for fish to move under the plumb
14 or away from it, which I assume is correct, but I
15 haven't seen the data that really shows me. For
16 instance, suckers are going to be near the bottom
17 and the red horses. So what is the temperature
18 along the bottom, and when it fully mixes what are
19 the temperatures really there. I don't really
20 know. And without seeing that -- I mean, I think
21 I have seen some things from the I-55 bridge that
22 seems like it can be like up to 70 degrees
23 Farenheit, above ambient temperature, but, again,
24 without seeing good plumb data and how that plumb

1 operates and what the top to bottom and what the
2 one side to the other are, it's a little hard to
3 evaluate, what's available for fish for avoidance
4 or attraction or whatever so.

5 Q. What do you mean by the carrying
6 capacity of the system? I'm still on question 19.

7 A. Carrying capacity is just a term,
8 fisheries' term used to indicate, if you will, the
9 poundage of different fish that a system might
10 support. It's based on habitat and competition
11 and food availability and a variety of other
12 things. You might hear the term, you know, this
13 area will support, I don't know, X-number of large
14 mouth bass or so many pounds of fish or whatever,
15 so --

16 Q. So in that part of your statement,
17 are you basically saying that it's your opinion
18 that there would be more fish there?

19 A. I think certain species, we might
20 expect an increase of if temperatures were lower.

21 Q. Which ones?

22 A. The red horses, the white sucker
23 might be one. Walleye could be one. Small mouth
24 bass could be included in that. Those would be a

1 few of the species right offhand that I can think
2 of.

3 Q. Moving on to question 20. In your
4 testimony you note that you, "Have not seen data
5 that demonstrates that sediment toxicity is a
6 major factor limiting the aquatic life potential
7 of this system." Did you consider in your review
8 of QHEI scores to what extent sediments were
9 present in those areas that scored greater than 45
10 and to what extent the presence of those
11 sediments, separate and apart from the issue of
12 their toxicity, would impair the quality of that
13 location for aquatic habitat?

14 A. Well, sedimentation is a problem
15 throughout our state, actually throughout the
16 Midwest, and there's no doubt that just heavy
17 sedimentation in and of itself has been for a long
18 time and continues to be a problem. I think
19 actually from my view of, like the pool and the
20 data I've seen, probably the turbidity, the amount
21 of sediment in the water is probably a little bit
22 lower in the upper Des Plaines pool and probably
23 lower than it is lower down in the river or in
24 some other rivers like the Kaskaskia or some of

1 others now. So, yes, sedimentation is a problem.
2 It does preclude some habitats for fish that might
3 otherwise be used if we didn't have as heavy of a
4 sedimentation problem, but I'm not sure the upper
5 Dresden Pool in some ways probably has lower just
6 silt problem or sedimentation problems than some
7 of our other rivers in the state.

8 Q. You don't know whether or not it's
9 any worse or any better than any other rivers in
10 the state; is that what you are telling me?

11 A. I think it's better.

12 Q. What's that based on? Have you done
13 some comparison?

14 A. Well, one is aquatic vegetation
15 beds. Most aquatic vegetation in the Illinois has
16 been eliminating, other than, if we get a few
17 years of lower water, some of those vegetation
18 beds will start coming in in some of the back
19 waters in the lower Illinois River. But generally
20 that vegetation has been pretty well limiting. A
21 lot of that is heavy turbidity. If the water
22 stays turbid because of fine sediment in the water
23 and you can't get enough light in, vegetation
24 doesn't take hold.

1 Q. And that's based on last year's trip
2 to those four or five locations?

3 A. No, that's based on just long-term
4 data collection on the Illinois River.

5 Q. No, no, I'm asking you about the
6 upper Dresden Pool.

7 A. Well, I know from the reports that
8 we referenced earlier from the 80's and early
9 '90's that there were pretty good aquatic
10 vegetation beds then, and from my observations
11 last year, I know they are still there, and some
12 of the other reports I've seen, there's also been
13 reference to the aquatic vegetation beds.

14 Q. Did you take any time to study the
15 sediment report that was filed in this action
16 prepared by EA? It was an attachment to
17 Dr. Burton's pre-filed testimony.

18 A. Yes, I did look at that.

19 Q. And did you in that regard study
20 what the sediment sampling that was done last year
21 showed with respect to the presence and extent of
22 sediments in the upper Dresden Island pool?

23 A. It was done last year?

24 Q. Was that a particular exhibit?

1 A. It was part of that sediment report
2 by EA that was attached to Dr. Burton's testimony.
3 Yes, I think I did see that. That was part of --

4 Q. You may have seen it. I'm trying to
5 understand whether you considered the data that
6 was collected by EA last year from the upper
7 Dresden Pool in making these statements that you
8 think there is less degree of sediments in the
9 upper Dresden Island Pool than in other waters of
10 the state?

11 A. In some other waters. I'm not going
12 to say that it's -- I said in some other waters.
13 But some of it is by observation. You can tell
14 highly turbid waters when you see them, and most
15 of them don't have aquatic weed beds in them. Or
16 they have at times when water has been clearer,
17 but most of the time they are gone, and that's
18 true for most of the Illinois River.

19 Kaskaskia was all always sort
20 of -- it never did have a really well established
21 submersed aquatic leaves. They did have emergent
22 ones -- so, yes, I know that sedimentation is an
23 issue, and I'm not saying it's not an issue. I'm
24 just saying --

1 Q. It's not significant?

2 A. It's not of a magnitude that's
3 greater than, say, most other impounded large
4 rivers in Illinois or the Midwest.

5 MR. ETTINGER: Are we ready for a
6 lunch break yet?

7 HEARING OFFICER TIPSORD: We need to
8 try to get done with Ms. Franzetti.

9 BY MS. FRANZETTI:

10 Q. Dr. Thomas, the turbidity levels
11 that you are referring to, again, what is the
12 extent of your observations regarding turbidity
13 levels in the upper Dresden Island Pool?

14 A. My own personal observation would be
15 very limited.

16 Q. Let's move to question 21. Do you
17 have an opinion as to whether sediment toxicity is
18 a factor limiting the aquatic life potential of
19 this system? And I'm going to amend that question
20 to first just refer to the upper Dresden Island
21 pool.

22 A. There's no doubt that in laboratory
23 studies of some organisms, some of those sediments
24 are toxic. Having said that, it's sort of like

1 the same issue as the cold shock kill that we were
2 talking about earlier in terms of the Oyster Creek
3 plant. There could be some mortality potentially
4 to some organisms or some sediments that are toxic
5 but is having a population effect. I have not
6 seen any data that would indicate that it's having
7 an adverse effect on a population. With this
8 caveat, it may be creating some longer-term
9 chronic stress to some species. I don't know that
10 as a fact, but it could well be a stressor.
11 Particularly for some of the invertebrate species
12 that may be living near the sediments or in and on
13 the sediments.

14 Q. And included within your comment,
15 you've seen no data indicating sediment toxicity
16 as a factor in limiting the aquatic life
17 potential, you told me you reviewed the EA report
18 with sediment sampling, and you do not believe
19 that the data reported in that report in any way
20 indicates that sediment toxicity would be a
21 limiting factor in the upper Dresden Island pool;
22 is that correct?

23 A. Well, the same report that talked
24 about the toxic sediments, and I am not

1 disagreeing -- in fact, I heard a recent study
2 done by some researchers from Southern Illinois
3 University, they gave a presentation on their
4 report, and it basically supported the burden that
5 found that ammonia, more than ammonia, PAH's,
6 polychlorinated aromatic hydrocarbons, were
7 probably the principal source of toxicity to some
8 micro organisms that they were dealing with in the
9 sediment. They ran a slightly different test than
10 Burton ran. I don't want to get into detail. He
11 ran pour water. They did detail the sediment
12 itself. It was a similar kinds of test. That
13 being said, it was a jump to go from there to say
14 it's having a population effect. And in Burton's
15 report, while he talks about the toxicity, there
16 are other places where he takes about thriving
17 fish population. So I haven't -- that's what I
18 mean by haven't seen -- while I agree that there
19 are some toxic sediments, I haven't seen the data
20 that said, and this is having this adverse effect
21 on populations.

22 Q. You read Dr. Burton's pre-filed
23 testimony as well as his report, correct?

24 A. Yes.

1 Q. And you do not believe that he took
2 the position that sediment toxicity is a factor
3 limiting the aquatic life potential of this
4 system?

5 A. Well, I can't speak for him. He may
6 well have taken that opinion but --

7 Q. I'm not asking you to speak for him.
8 I'm asking you when you read his report, his
9 testimony with the attached report, with regard to
10 the sediment sampling and his findings, am I
11 correct that you did not believe he was saying
12 that sediment toxicity is a limiting constraint on
13 the system?

14 A. He may have said that, but he also
15 said there's a thriving fish population. He also
16 said that the population of plankton is similar
17 there to other large reservoirs. So I mean, I
18 don't know. There's two things. What he said and
19 my interpretation of what he said a couple
20 different places was what is in the record in
21 terms of the populations that are there.

22 Q. So you disagree with his
23 interpretation of the sediment data that was
24 presented in his report?

1 A. I don't disagree that some of the
2 sediments are toxic. If he said that it's having
3 an adverse effect on some of the populations, I
4 have not seen the population data that shows that
5 these populations are reduced and they are reduced
6 because of toxicity of the sediment. That's the
7 part I haven't seen. If it's in there, I'll be
8 more than happy to have someone point it out to me
9 because I'm -- you know, it's a big record, and I
10 read through a lot of things fairly quickly so --

11 Q. Now, do you have any basis for
12 stating that there's no effect on the aquatic life
13 from the presence of that contaminated sediment?

14 A. I didn't say no effect. In fact, I
15 said, there may be some chronic effect on some
16 populations. You know, the lower growth or the
17 slower growth apparently of small mouth bass or
18 the lower condition factor, I should say, does
19 that have anything to do with effects on their
20 food organisms? I don't know. It may not have
21 anything to do with the toxicity of the sediment.

22 Q. You mentioned I think you said a
23 recent study by some Southern Illinois researchers
24 regarding sediment toxicity. Would you describe

1 that more fully for me, please, what you are
2 referring to.

3 A. Yes, I could -- this is a paper
4 that's going to be published. It's not published
5 yet. So what I heard was a progress report.
6 Actually, it's a manuscript in preparation for
7 publication, but it hasn't been accepted yet or
8 published in the peer reviewed literature.

9 Q. Who did the study that they are
10 preparing to publish?

11 A. Michael Litti was the primary -- oh,
12 wait. There is a group of authors, and it's a
13 2009 study. The name of it was "Identifying The
14 Causes of Sediment Associated Contamination in the
15 Illinois River Using A Whole Sediment Toxicity
16 Evaluation, TIA.

17 Q. Why is that relevant here?

18 A. It's relevant because some of their
19 stations were in the Dresden Pool.

20 Q. Oh, okay.

21 A. Or in the Chicago waterways under
22 consideration. They did other parts of the
23 Illinois River, but really they found the toxic
24 effect only in the waterways we are talking about.

1 So a lot of their data supports Burton's findings.
2 That's all I was saying. But they use a slightly
3 different methodology. They use the effect of TIA
4 on sediment. My understanding is Dr. Burton used
5 it on the pour water. In other words, the water
6 between the sediment. We get somewhat different
7 results doing those two. I think he found
8 pneumonia as having a higher toxicity effect.
9 They found polychlorinated aromatic hydrocarbons,
10 especially in combination with possibly some of
11 the oils and greases as having the more toxic
12 effect. But, again, you are exposing organisms
13 into that mixture and then looking at the toxic
14 effects. That's quite different -- so as I said,
15 I don't disagree that these, some of these
16 sediments are toxic to some organisms, but to take
17 that to a population level on organisms that
18 aren't living right necessary in contact but maybe
19 in the water column but may be moving to different
20 areas, exposure becomes a lot different.

21 So whether it's having a
22 population effect is a whole another area, and I
23 have not -- and that's what my testimony was. I
24 have not seen the data showing it's been a

1 population effect or an effect on any particular
2 population due to contamination of the sediment.

3 Q. Now, can you tell us who these
4 researchers are associated with?

5 A. Southern Illinois University.

6 Q. I think all we had was Southern
7 Illinois, which could be a geographic location and
8 not the university.

9 A. Yes.

10 Q. And, again, their findings for
11 stations that were within the -- is it --

12 A. I think their upper station might
13 have been the Stickney plant or somewhere near
14 there, and then they had a few stations --

15 Q. Down stream?

16 A. -- including, I think, some in the
17 Dresden Island Pool.

18 Q. And with respect to their findings,
19 they found the sediments were toxic?

20 A. Some of them.

21 Q. Okay.

22 A. Like all studies, there's a lot of
23 variations between stations. So you may have a
24 toxic area in one area and the next area may not

1 be or may be much lower.

2 Q. So some of the stations within the
3 waterway system we're looking at in this
4 proceeding did show that the sediments would be
5 toxic to aquatic life, correct?

6 A. No, were toxic to the two test
7 organisms that they utilized.

8 Q. And those test organisms were not
9 aquatic life?

10 A. No, they are aquatic lives, but you
11 can't make the generalization to all aquatic life.
12 Fish might not have -- if you put fish in there,
13 these are planktonic organisms basically. So if
14 you put fish in there, they may have had very
15 different results or quite different results.

16 HEARING OFFICER TIPSORD: Dr.
17 Thomas, did I understand you that this is
18 not yet published? There's no written
19 material on this? This is based on you
20 seeing a presentation at a conference?

21 THE WITNESS: Well, and I also got a
22 draft of their paper that is going for
23 publication.

24 MS. FRANZETTI: Can you supply us

1 with a copy of the draft?

2 THE WITNESS: I would have to get
3 the author's permission I think. I'm sorry
4 for that.

5 HEARING OFFICER TIPSORD: That's
6 quite all right. I thought I might be able
7 to short circuit some questions if we could
8 have a copy of it.

9 THE WITNESS: I would be glad to
10 check to see when it would be able. I'm
11 sure it's going to be out and published and
12 read by a wide audience before this hearing
13 is over.

14 HEARING OFFICER TIPSORD: After.
15 But you under estimate me.

16 MS. DEXTER: Can I ask one follow-up
17 before you move on to the next topic. Have
18 you studied other rivers for toxic sediments
19 in them and observed what the fish
20 populations are like in those rivers? Do
21 you have any examples of that?

22 THE WITNESS: Yes, I'd say Raritan
23 Bay, there were highly toxic sediments
24 there. I'm trying to think of some other

1 ones that I was involved in. Of course the
2 Calumet we've already talked about with its
3 toxic sediments. Crab Orchard studies were
4 looking at the effects of both metals and
5 PCP's on their fish populations. And that's
6 a case where there didn't seem to be impact
7 on the fish themselves, but there was an
8 issue of bioaccumulation and impact on
9 potentially human health if fish were
10 consumed. So I think those are the some of
11 the major ones.

12 Well, I was just reminded of
13 some of the stripe bass data we were
14 involved in accumulation of PCB's. There
15 was a while where the best breeding
16 population of striped bass along the
17 Atlantic coast was a Hudson River striped
18 bass that had the highest levels of PCB's.
19 So sometimes you can't always associate a
20 contaminate with it's potential effect on
21 the population. It was not having an effect
22 on the bass, but there were concerns about
23 human consumptions of PCB's.

24 BY MS. FRANZETTI:

1 Q. Moving on to 22. What type of
2 habitat does the white sucker need in order to
3 spawn successfully in the waterway?

4 A. Usually gravelly areas at the lower
5 end of pools are sort of a traditional place that
6 they spawn.

7 Q. To what extent is that habitat
8 present in the upper Dresden Island pool as
9 defined in this proceeding obviously from the I-55
10 bridge up to the northern boundary of the pool?

11 A. Again, I would assume there's
12 habitat on the --

13 Q. No, Dr. Thomas, I don't want you to
14 assume. I'm asking you, do you know what type of
15 habitat, whether and to what extent there is that
16 type of habitat in the upper Dresden Island pool?
17 If you don't know, that's fine.

18 A. Yes, it is there, that kind of
19 habitat.

20 Q. Where in the upper Dresden?

21 A. In the tail water area.

22 Q. Any other place other than the tail
23 water?

24 A. I wouldn't know for sure.

1 Q. What type of habitat does the
2 loggerperch need in order to spawn successfully in
3 the waterway?

4 A. Let me go back to one other point in
5 the white sucker, if I may. I believe in some of
6 the EA collections that was in the top -- young of
7 the year were in the top ten species that they
8 collected in the pool, at least in one year of
9 data. So that would sort of indicate that there's
10 probably spawning other places in the pool besides
11 just the tail water area.

12 Q. That's sufficient data for you on
13 which to make that conclusion?

14 A. Well, my conclusion was that -- my
15 judgment was that if it's that common in their
16 collection, that there were probably other areas,
17 but it could have been all the spawning coming
18 from the tail water area. I don't know for sure.

19 Q. I'm just trying to -- with all due
20 respect, Dr. Thomas, I'm trying to understand when
21 it is you need data in order to draw a conclusion
22 and when it is you don't?

23 A. You always could use some kind of
24 data.

1 Q. What type of habitat does the
2 logperch need in order to spawn successfully in a
3 waterway?

4 A. Usually clear, weedy, sandy areas.
5 It will spawn in riffles, but it will also spawn
6 along shore lines and lakes. Could be actually
7 more habitat for them to spawn in, in the Dresden
8 Island pool, than possibly even the white sucker.

9 Q. And, again, do you know to what
10 extent that type of habitat is present in the
11 upper Dresden Island pool?

12 A. I just know from some of the things
13 I've read that there are sandy bottom areas in
14 places. I don't know -- I couldn't tell you how
15 many acres or foot of shore line or whatever.

16 Q. Do you know whether there's a
17 sufficient amount to support a logperch population
18 in the upper Dresden Island pool?

19 A. The data seemed to indicate that
20 there's not much of a logperch population in the
21 pool right now. In other words, there's not --
22 whereas I mentioned white sucker being in the top
23 ten list, I actually have the data to go back to
24 and look. But just off the top of my head, I

1 don't think there were that many logperch
2 captured.

3 MR. ETTINGER: Her question was not
4 what's there now but what would their
5 habitat support.

6 BY MS. FRANZETTI:

7 Q. Do you think -- in other words,
8 looking at the logperch numbers you've looked at,
9 do you think based on your knowledge of this type
10 of habitat being present, there should be more of
11 them? And, again, if you haven't made that
12 analysis, it's fine, tell me you don't know. But
13 if you do, I would like to know.

14 A. Well, there's a number of factors
15 that go into that. I'm trying to think of the
16 best way to answer that. I would think there
17 should be -- they should be able to do reasonably
18 well in that pool.

19 Q. Why is that?

20 A. Because I think there is, from what
21 I've read, it does seem to be the habitats
22 available that they could spawn in and carry out
23 their life history.

24 Q. And when you say they should be able

1 to do reasonably well, that means better than what
2 you are seeing in the fish studies that you've
3 seen?

4 A. Yes, probably higher numbers than
5 what I've seen.

6 Q. Can you quantify it at all? Do you
7 think another ten percent, another 50 percent?

8 A. One of the reasons I hesitated is a
9 lot of electro fishing has been done. It's not --
10 for some of darters like that, that don't have an
11 air bladder, it's not a -- it's not a very
12 efficient gear to collect them, especially if they
13 are in a little bit deeper water. So you tend to
14 get small numbers, which may or may not be very
15 reflective of the population. Seining, sometimes
16 if you catch them in shore, you could get bigger
17 numbers, and I do know that seining was done there
18 so.

19 Q. So there may be more of them right
20 now -- what you are saying is because electro
21 fishing, for example, does not do a great job of
22 collecting logperch, there could be more of them
23 there than the numbers bear out?

24 A. That's correct.

1 Q. Okay, so I understand you correctly.
2 So if that's the case, you are not sure how many
3 more could really be there?

4 A. That's correct.

5 Q. Moving on to question 24, do you
6 agree with the EA fish studies' conclusions that
7 the fish community in the upper Illinois waterway
8 is highly stressed and habitat limiting?

9 A. I actually could not find in their
10 report the use of the term highly stressed system.
11 I did see in Mr. Siegert's testimony a discussion
12 of habitat, what he considered habitat
13 limitations, but maybe somebody could point that
14 out to me. I just didn't see. I looked through
15 the report actually looking for that term "highly
16 stressed" and I did not see that.

17 Q. Okay, let's take it apart and then
18 state it. Why don't we just narrow it to, do you
19 agree with the EA fish studies conclusions that
20 the fish community in the upper Illinois waterway
21 is habitat limited?

22 A. Well, I mean, there are a lot of
23 other stresses that were talked about in addition
24 to habitat.

1 Q. Just asking if you agree with their
2 conclusion that the UIW is habitat limited?

3 A. To the degree that the most
4 impounded bodies of water are habitat limited, I
5 would agree with it.

6 Q. Moving on to 25, do you agree with
7 EA fish studies' conclusion, that diversity in
8 this system was dependent on species adapted to
9 contaminated conditions and that because of these
10 inherent limitations in the ichthyoplankton
11 community was not likely to change in the UIW for
12 the foreseeable future?

13 A. One, I did not find that conclusion
14 in the EA ichthyoplankton report.

15 Q. Okay.

16 A. And I don't think species can adapt
17 to contaminated conditions. So I don't agree with
18 that phrase.

19 Q. You don't agree that species can
20 adapt to contaminated conditions?

21 A. That's correct.

22 Q. What's that based on?

23 A. Based on a lot of years of studying
24 contaminant effects, on the literature, on

1 contamination. You can measure the mortality of
2 species to levels of contaminants, but I don't
3 think it's a matter of species adapting to
4 contaminants. Even when we did, years ago when we
5 did avoidance studies, you could get fish to be
6 attracted to or avoid high temperatures and they
7 may or may not move in and out of low DO or low
8 dissolved oxygen values, but if you put copper in
9 the water or some other contaminant, they do not
10 seem to respond. They either get killed, but they
11 are not adapting to it. They are not responding
12 to it. If you have a gradient of chemicals, for
13 instance. So maybe with further thought I would
14 think of something that's been an adaptation to a
15 contaminant, but generally I would say organisms
16 are not adapting to a chemical contaminant in the
17 water.

18 Q. All right. With respect to --
19 strike that.

20 I know you said you didn't find
21 this conclusion in the EA fish studies that you
22 reviewed. Let me ask you to assume that it was
23 their conclusion that because of contaminated
24 conditions in the UIW, that the ichthyoplankton

1 community was not likely to change in the
2 foreseeable future. Would you agree with that
3 conclusion?

4 MS. WILLIAMS: At this point I want
5 a clarification for the record of the use of
6 the term UIW, the definition of the term
7 UIW.

8 MS. FRANZETTI: I'll narrow it. I
9 think the way it was used in the reports was
10 a little broader than this, but for purposes
11 of this question, we'll go from the Chicago
12 Sanitary & Ship Canal down to the I-55
13 bridge?

14 THE WITNESS: I'm sorry, can you
15 repeat the question?

16 MS. FRANZETTI: Let me try and
17 rephrase it.

18 BY MS. FRANZETTI:

19 Q. I'm going to ask you to assume,
20 because you said you didn't find this conclusion
21 in the report --

22 A. Yes, that's correct.

23 Q. All right. So I want to just lay
24 out --

1 A. Assume that they did.

2 Q. -- lay out the question for you and
3 ask you if you agree with it. So with respect to
4 the conclusion that because of contaminated
5 conditions in the UIW as I've just defined it
6 creating inherent limitations in the
7 ichthyoplankton community, do you agree that it is
8 not likely to change in the foreseeable future?

9 A. Well --

10 Q. And you may not have an opinion on
11 this?

12 A. I do have an opinion. I don't
13 really think the chemicals in the bottom are
14 limiting the ichthyoplankton.

15 Q. Why is that?

16 A. Well, you've got a number of nest
17 builders out there, various sun fish species,
18 large mouth bass, their population. They are
19 doing as well in that pool as we find down river.
20 So they are at least finding areas of carrying out
21 their lifecycles and producing young that are
22 equivalent to other impounded parts of the
23 Illinois River, for example. On the other hand
24 there may be -- I mean, it wouldn't surprise me if

1 chemical contamination is a stressor on some fish
2 along with other stressors that have been
3 identified on the system. So it could well be,
4 especially if there were hot spots of
5 contamination that were identified, that removing
6 some of those or burying them or whatever, making
7 them less available to fish population could lead
8 to a reduction in that stressor, and whatever
9 response might come from that by the aquatic
10 community.

11 Q. Moving on to 26, in your testimony
12 you indicate that, "These waterways could support
13 tolerant or intermediately tolerant species."
14 That's Section 3, fifth page, second paragraph.
15 And indicate further that this conclusion is based
16 on your personal knowledge of the CAWS. Please
17 explain what personal knowledge you are referring
18 to?

19 MR. ETTINGER: Did your question say
20 CAWS?

21 MS. FRANZETTI: Yes, because that's
22 what I believe he referenced in this part of
23 testimony.

24 MR. ETTINGER: Okay, now we are

1 talking about the whole water body, not just
2 the upper Dresden Pool.

3 THE WITNESS: That I believe pretty
4 well came from the fisheries report, the
5 data in the fisheries' report that was
6 collected by the district, and that is in
7 the record. And I think that may have been
8 one of their -- I mean, their data really
9 showed that over the years there has been a
10 positive response from the fish population
11 in many parts of the Chicago area waterway.

12 BY MS. FRANZETTI:

13 Q. And what about -- can you just
14 elaborate in terms of your personal knowledge is,
15 having gone through the district's fish data,
16 correct?

17 A. Yeah. I mean -- right.

18 Q. Okay. And based on that data, you
19 have drawn the conclusion that these waterways can
20 support tolerant or intermediately tolerant
21 species, correct?

22 A. Some portions of the waterways, yes.

23 Q. Which portions?

24 A. Particularly those portions

1 designated as waterway A, the A category. There's
2 A and B waters. Those designated A, I think have
3 some that might be. Immediately tolerant is not
4 the term that's being used here. There's tolerant
5 and -- I get sort of mixed up in the different
6 terminology.

7 Q. Were you trying to mirror the
8 terminology that's being used in the proposed
9 resolution?

10 A. At that point I wasn't familiar with
11 the terms that were being used.

12 Q. I don't know I want to take the
13 time, but it might have been moderately tolerant.

14 MS. FRANZETTI: Off the record.

15 (Discussion off the record.)

16 BY MS. FRANZETTI:

17 Q. Dr. Thomas, maybe let me just ask
18 you directly, what did you mean by intermediately
19 tolerant, and can you explain that a little more?

20 A. I think that was like small mouth
21 bass or white sucker, possibly yellow perch.

22 Q. Moving on to 27. You used the
23 phrase in your testimony, lower Dresden Pool. So
24 please identify the boundaries of the area that

1 you are referring to at the bottom of page 4 of
2 your testimony where you reference "lower Dresden
3 Pool, and particularly is that -- does that
4 include any portion of the pool that is below
5 south of the I-55 bridge?

6 A. Yes, that needs to -- I probably
7 meant either the lower Des Plaines River, but more
8 specifically the upper Dresden. It should be the
9 upper Dresden Pool, rather than the lower. That's
10 a correction that should be made as a correction
11 in my testimony. It should be the upper Dresden
12 Pool.

13 Q. I'm trying not to talk over you, but
14 I'm never sure when you are done. For the court
15 reporter's sake, I apologize.

16 So there you are intending to
17 refer to the upper Dresden Island pool as the
18 Agency has defined its boundaries in this
19 rulemaking, correct?

20 A. Yes, that's correct.

21 Q. Dr. Thomas, I did have one more
22 follow-up question on this issue of tolerant,
23 intermediately tolerant species. My question is,
24 is that the fish community that -- strike that.

1 Is that how you would describe
2 the fish community that is already present in the
3 upper Dresden island pool as consisting of
4 tolerant and intermediately tolerant species?

5 A. You are asking me a slightly
6 different question than 28, I take it.

7 Q. Yes, yes. I'm asking you whether if
8 you were to describe the fish community that's
9 currently present in the upper Dresden Island
10 pool, would you describe it as consisting of
11 tolerant and intermediately tolerant species?

12 A. Yes, I think that would be
13 reasonable.

14 Q. I'm just trying to give more
15 description to what you meant by those terms.

16 Moving on to question 28. What
17 criteria do you believe should be used to identify
18 a species as a representative aquatic species for
19 purposes of aquatic life use designation?

20 MS. DIERS: I want to object to this
21 question. The wording "representative
22 aquatic species" has not been used in this
23 proceeding or Mr. Thomas' testimony for
24 purposes of aquatic life use designation.

1 It's only been used in the context of
2 establishing thermal criteria to support
3 those. If you are willing to rephrase, I'll
4 withdraw my objection, but I object.

5 MS. FRANZETTI: Well, let's do it
6 this way.

7 BY MS. FRANZETTI:

8 Q. Dr. Thomas, are you familiar with
9 the phrase representative aquatic species?

10 A. Are you using that as the same as
11 the RIS list?

12 Q. That's really my question. Separate
13 from the RIS list, do you have any familiarity
14 with the term representative aquatic species?
15 First let's start there.

16 A. Okay, I guess in my mind I was
17 looking at those as about the same. You are
18 taking a subsection of the total fish that are
19 there and using that, whether it's temperature
20 criteria or some other, you are using a smaller
21 group of organisms to represent a larger body of
22 organisms.

23 Q. Right. So you are equating RIS and
24 RAS as essentially having the same meaning?

1 A. Yes.

2 Q. So use RIS, given that that will get
3 us past the objection, what criteria do you
4 believe should be used to identify a species as a
5 resident -- what does the I stand for in RIS?

6 A. Important.

7 Q. So what criteria do you believe
8 should be used to identify a species as a resident
9 important species for purposes of aquatic life use
10 designations?

11 A. Well, I realize the RIS has been
12 used a lot in reference to temperature
13 particularly, but I think Yoder put it pretty
14 well, having an adequate representation of the
15 spectrum of thermal tolerances, that spectrum I
16 think hits other aspects of a life history too,
17 and one of the problems, I think Yoder actually
18 pointed this out is, we have -- whether the data
19 is on temperature or oxygen or a contaminant, we
20 tend to have much less information available on
21 some of the more sensitive species. One of the
22 reasons is they are not that easy to raise in the
23 laboratory or to work with. So the fathead minnow
24 that's used all the time. It's a fairly easy

1 species to raise. It's fairly hearty. But
2 protecting it isn't going to necessarily protect a
3 variety of other species in the system that are a
4 little more sensitive. So I think trying to pick
5 a range of species that sort of have a spectrum of
6 tolerances, if you will, temperature has been the
7 primary way of looking at that, but as I said, it
8 could relate to other things, is a way of trying
9 to assure whatever standard you are setting can be
10 protective of that community. And if you want to
11 be conservative about it, then you try to pick
12 things on the more sensitive end to make sure you
13 are protecting all of the system, not just the
14 more tolerant points.

15 Q. Okay. Moving on to question 29. On
16 page 5 of your testimony in the last paragraph of
17 Section 2, you reference that in the EA 1994
18 ichthyoplankton investigation, which is attachment
19 LL in this proceeding, that roughly 22,000 larval,
20 young of year fish were collected. Do you agree
21 that the EA 1994 investigation also stated that
22 only six species or taxa accounted for 86 percent
23 of those individuals collected?

24 A. Yes. And I think that's a number I

1 couldn't verify off the top of my head, that it
2 was actually 86 percent, but something in that
3 order I would certainly agree to, and I don't find
4 that unusual for a lot of water bodies.
5 Relatively few species may make a large portion of
6 ichthyoplankton.

7 Q. Moving on to the next question. Did
8 you review the EA findings that these six species
9 share early life history characteristics that
10 allow them to be successful in the system. Namely
11 certain adaptations that allowed their eggs or
12 larva to tolerate low dissolved oxygen levels and
13 to have minimal contact with bottom sediments?

14 A. Well, I'm not sure about the
15 tolerant low dissolved oxygen levels.

16 Q. Why are you not sure about that?

17 A. Because if you look at sun fish or
18 bass, they fan their eggs for the very purpose of
19 keeping oxygenated water flowing over the eggs.
20 So unless someone actually measured DO in the nest
21 and showed that those eggs are viable and hatching
22 out at one or two parts per million dissolved
23 oxygen, their very behavior is set up to keep
24 oxygen on the eggs or not whether, it's successful

1 or not, is another matter. Also, the blunt nose
2 minnows, which is another common fish in the
3 system, lays eggs under rocks or hard substrate.
4 It also will fan the eggs with its tail in moving
5 water past the eggs to provide more oxygen, and
6 obviously sun fish eggs which now --

7 Q. Dr. Thomas, can I just interrupt you
8 there and say, and you don't consider their
9 fanning of the eggs an adaptation as referenced in
10 this question?

11 A. Well, it is an adaptation. They've
12 been doing it for -- I don't know how far back you
13 have to go. That's part of their life history
14 strategy.

15 Q. My point being, if there's low DO
16 levels in the water, those two fishes, unlike
17 others, ability to fan their eggs is an adaptation
18 to deal with in part -- in part it helps them deal
19 with the low dissolved oxygen levels in the water,
20 correct?

21 A. Well, adaptation probably goes way
22 back to their history to the fact that sometimes
23 organics and bottom sediments can lower the
24 dissolved oxygen in those sediments, and fanning

1 insures that there's going to be more oxygen over
2 the eggs and insures a higher part of survival.
3 It's not an adaptation in the sense we're using
4 earlier in terms of contaminants, but it is a
5 strategy that insures that they are more
6 successful under a variety of conditions,
7 including a condition of low DO.

8 Q. Now, I'm sorry, I interrupted you.
9 Was there anything else about that EA finding that
10 the six species taxa shared early life history
11 characteristics that allowed them to be successful
12 in the system that you don't agree with or you
13 would like to distinguish?

14 A. Well, you say have minimal contact
15 with bottom sediments. Something like the blunt
16 nose minnow or fat head minnow, which will lay
17 eggs under a hard substrate, they are probably
18 under a rock or log or whatever, they are probably
19 not in -- generally, not in contact with bottom
20 sediments, but the sun fish and bass are making
21 their nests on the bottom. So they are going to
22 have some contact with the bottom materials. Now,
23 obviously when you fan a nest, one of the objects,
24 besides the DO, is to keep sediment off the eggs

1 too. So in that sense, they are not as exposed to
2 the fine sediments that may be settling out. That
3 was part of the statement. They are in contact
4 with the bottom gravel, sand or whatever they have
5 laid their eggs on.

6 Q. Any other distinctions you want to
7 draw with regard to those EA findings?

8 A. No, I don't think so.

9 Q. Moving on to question 30. Have you
10 evaluated the effect of the impounded nature of
11 the upper Dresden Island pool on the quality of
12 the aquatic life community that it can take?

13 A. Yes, and I'd like to take a little
14 time to answer this question because this is
15 actually both a past and present research interest
16 of mine. I mentioned the Kaskaskia River where I
17 had some earlier training. When I first started
18 studying on the Kaskaskia, there were no
19 impoundments on that river, although the Carlvle
20 dam was pretty well constructed, but one of my
21 interests has been the effects of impoundments on
22 fish populations. And I don't disagree with the
23 data that's been in this record that impoundments
24 do change the nature of the fish community. Taken

1 from a flowing river to a more impounded still
2 water, you help some species of fish, but often
3 you may even eliminate other species of fish that
4 need flowing waters.

5 Fish populations, as I think
6 I've testified before, in the Dresden Island pool
7 are similar to pools further downstream in the
8 Illinois River, with some exceptions. I think
9 because of the stresses that go with impoundments,
10 it makes it even more important that you have a
11 good water quality because you've already
12 generated some other stresses on some of the fish
13 populations that they might not have in a
14 free-flowing system.

15 Q. So in your opinion because of the
16 account impounded nature of the upper Dresden
17 Pool, in fact the water quality standards should
18 be stricter than they are in an unimpounded pool?

19 A. I didn't mean to comment on the
20 standards, but I think that when you have a
21 variety of stressors on a system to a degree that
22 you can reduce any of or all of those or at least
23 some of them, that's bound to be able to help
24 those fish populations that are there.

1 Q. Will it help if someone of the other
2 stressors is having a bigger, more significant
3 effect that will basically prevent your changing
4 one of them from having any significant impact?

5 A. I know that's an issue in this
6 hearing, and despite all the evidence seen, I
7 haven't really seen a quantification necessarily
8 of the impact of each of the stressors or the
9 stressors in combination. It just appears from
10 the record that when you can remove some of those
11 stressors, that you do see a positive response.
12 If we look in the Cal Sag, for instance, when they
13 put in the sequel stations in the area they seem
14 to get more small mouth bass and channel catfish,
15 and there seems to be some positive response from
16 the fish populations there. The TARP system,
17 removing some of the storm water overflow into the
18 system, seems to have shown a -- the aquatic
19 community has seemed to respond to that. So there
20 is evidence that as we've improved to what level
21 to what is the most significant, those are
22 difficult issues that scientists can and will
23 argue about.

24 MS. FRANZETTI: I think we have

1 covered many of those issues already today.

2 Thank you, Dr. Thomas, I'm done with
3 my questions.

4 HEARING OFFICER TIPSORD: Okay,
5 let's go ahead and break for lunch. We'll
6 come back in about an hour. It's twenty to
7 1:00.

8 (Whereupon a lunch recess was
9 taken.)

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

1 STATE OF ILLINOIS)
) SS.
2 COUNTY OF C O O K)
3

4 I, DENISE ANDRAS, being a Certified
5 Shorthand Reporter doing business in the City of
6 Des Plaines, Illinois, County of Cook, certify
7 that I reported in shorthand the proceedings had
8 at the foregoing hearing of the above-entitled
9 cause. And I certify that the foregoing is a true
10 and correct transcript of all my shorthand notes
11 so taken as aforesaid and contains all the
12 proceedings had at the said meeting of the
13 above-entitled cause.
14
15
16

17 Denise Andras
DENISE ANDRAS, CSR
18 CSR NO. 084-0003437
19
20
21
22
23
24

A				
ability 72:10	above-entitled	12:12 16:10	41:22 42:2,3,4	allow 48:11
149:17	155:8,13	20:11 24:3,6	advocate 46:21	148:10
able 5:17 11:4	absence 94:4	24:17 25:11,19	50:9	allowed 148:11
11:16 12:1,5	absent 80:18	26:7 27:1,3	advocating	150:11
12:15 14:18,22	81:16	35:19 40:20	46:22	almost 19:14,17
16:10 57:15	Absolutely	44:14,17 53:20	aerial 13:13	47:21 59:24
58:17,21,23	16:18	56:24 59:21	16:1	79:2,15 96:10
59:21 61:17	abundance 94:5	60:2 61:10	aforsaid 155:11	along 11:5 18:7
62:15 63:12,22	101:16	62:7 66:12	after 5:2,12 45:8	18:13,19 46:3
65:17 67:12	accepted 124:7	76:5 81:23	55:10 59:11	46:3 60:17
71:10 128:6,10	access 11:4	83:11 101:2	94:23 99:22	61:20 85:13
133:17,24	acclimate 52:10	104:4 107:23	128:14	89:3 90:4
152:23	accomplished	115:15,19	afterwards	113:18 129:16
about 13:15,16	48:20	124:6 132:6,23	68:14	132:6 140:2
16:4,7 19:7	account 152:16	135:9,15	again 5:7 10:2	already 39:8
21:10 23:9,21	accounted	146:17 148:2	32:1 35:21	75:1,7 92:3,7
24:13 25:9	147:22	148:20 151:15	39:15 46:12	97:18 98:2
26:15 28:7	accumulate	adapt 136:16,20	49:12,24 55:21	129:2 144:2
29:23 30:21	96:21	adaptation	93:3,18 94:20	152:11 154:1
31:6 42:14	accumulation	137:14 149:9	107:20 111:19	although 18:21
47:7 49:8,21	129:14	149:11,17,21	112:12 113:23	40:3 62:1 91:3
49:24 55:19	accurate 15:13	150:3	119:11 125:12	151:19
61:2,22 62:1	78:1 109:10	adaptations	126:10 130:11	always 21:12
64:10 65:8	accurately 29:16	148:11	132:9 133:11	28:17 38:16
66:2,15 68:24	achieve 109:20	adapted 57:9	against 71:23	55:16 93:2
69:7 70:13	109:22	66:6 83:14	79:2	118:19 129:19
74:1,20,23,24	acknowledge	136:8	Agency 2:10	131:23
75:19,20,22	5:12	adapting 137:3	107:7 143:18	ambient 51:14
77:1,12,14	acknowledged	137:11,16	ago 137:4	51:19 52:19
78:20 80:23	5:12	add 49:2 92:2	agree 62:18,19	54:2 113:23
81:22 82:4	acre 14:8 16:4	107:21	63:2,20 71:9	ambiguity 50:5
84:1,2,17 85:5	acres 14:8	adding 49:8	72:15 77:11	71:21 72:4
92:2,23 93:22	132:15	97:4	80:17 81:15,20	amend 119:19
95:3,18 103:3	across 35:12	addition 135:23	82:7,10,15,22	amendments
103:4,5 104:14	Act 62:15 63:5	additional 97:10	121:18 135:6	1:10 4:8
117:5 120:2,24	63:13,22 64:6	108:6	135:19 136:1,5	ammonia 121:5
121:15,16	69:11,16 70:11	address 40:6	136:6,17,19	121:5
124:24 129:2	70:19 71:11,17	addresses 83:20	138:2 139:3,7	amount 12:13
129:22 135:23	78:6 86:9,21	adequate 146:14	147:20 148:3	12:22 61:15
141:1,13	87:2,7	Adm 1:11 4:8	150:12	115:20 132:17
145:17 147:11	acting 4:11	admit 63:14	agreed 71:12	analysis 24:9,10
148:14,16	48:19	111:1	agreement	27:13 29:1,5
150:9 153:23	117:15	admitted 89:19	62:23	29:14 70:1
154:6	actively 88:5	adopted 102:5	ahead 107:19	71:15 74:3
above 15:6 63:8	actual 13:18	adult 36:6	154:5	79:24 93:4,21
64:1,3 101:19	44:22 52:7	adverse 56:19	air 134:11	94:1 100:19
110:20 112:5	77:3	120:7 121:20	Albert 2:18 6:15	112:18 133:12
113:23	actually 9:14	123:3	89:8	analysts 112:6
	10:22 11:17	advisory 41:21	Alisa 2:6 4:16	analyze 74:9

analyzed 91:6	apply 54:17	18:6 19:5,17	153:23	attached 17:2
ANDRAS 155:4	appointed 4:3	19:24 24:24	argument 62:13	107:12 118:2
155:17	appreciate	26:5 31:8 38:9	62:18,20 71:9	122:9
Andrea 2:8 4:14	95:12 104:11	38:15 42:1	71:13 72:15	attachment
and/or 8:11 39:7	approach 87:10	50:4 52:11,16	73:6	16:23 117:16
97:10	87:15 110:21	59:12,14 60:23	arise 5:22	147:18
another 84:5	appropriate	62:17 63:10,24	Army 41:12	attain 69:15
125:22 134:7,7	49:8	64:22 68:8,10	48:6	78:6 86:9 87:6
149:1,2	approximate	71:12,22,22	aromatic 121:6	attained 86:11
answer 10:10	55:21	72:1,2,14 73:4	125:9	attaining 70:10
19:12 32:20	approximately	76:23 77:1,8	around 52:11	86:12,20
45:13 50:10	12:3 44:5	84:4,6,14,24	59:3 93:9	attempt 58:24
62:3 63:18	April 70:24	85:23 96:12	arsenal 21:21	attenuate 48:1
76:18 89:13	aquatic 8:24	98:22 99:19	41:12	attracted 55:2
92:13 102:18	10:1 11:23	101:1 114:13	artificial 43:3	137:6
111:6 133:16	17:12 23:13,19	125:22 126:24	asked 5:19 14:1	attraction 54:14
151:14	24:2,11,13,23	126:24,24	49:15 72:12	114:4
answered 63:20	25:3 26:20	130:21 131:11	87:4	audience 6:10
70:6	29:2,21 30:3	131:18 141:11	asking 7:24	7:13 128:12
answering 33:8	30:15 31:4,7	142:24 153:13	17:19 71:18	August 1:15
61:1	31:10 32:17	areas 11:3,5,12	75:19 89:9	authors 27:14
answers 45:15	33:1,9 34:24	11:21 12:3,8	92:8 117:5	124:12
anybody 5:24	39:7,7,10,19	12:23 13:7,9	122:7,8 130:14	author's 128:3
57:15 87:18	40:14,23 42:11	14:11,21 15:17	136:1 144:5,7	availability
88:4	48:11 51:14,20	16:14 17:7	aspect 32:3	114:11
anyone 5:8 34:1	53:9 56:9,19	18:16 23:4,5	84:20 86:13	available 12:13
anything 6:5	57:21 70:11	23:10 26:8	aspects 56:13	13:1 26:24
64:9 67:6	71:1 72:18	29:20 30:14	70:21 110:2	33:9 35:5,13
74:14 95:10	78:6 85:11	32:15 37:3	146:16	49:14 52:5,9
123:19,21	86:9,21 87:7	38:21 47:9,13	assemblage 63:3	64:15,16,19
150:9	100:16 101:11	47:16 48:24,24	88:8	65:5,15 66:21
anyway 86:4	115:6,13	49:1,6,11,12	assessment	66:24 67:7
108:3	116:14,15	50:13,20 51:8	34:11	68:2,6,19
anywhere 8:17	117:9,13	64:5,23 65:6,7	assist 36:23	69:13,19 72:17
30:19	118:15,21	66:18 70:9,17	associate 129:19	73:7,11,17
apart 115:11	119:18 120:16	72:16 79:10,11	associated 35:9	81:19 82:6
135:17	122:3 123:12	79:15,22 81:2	124:14 126:4	84:10,13 85:8
apologize 95:5	127:5,9,10,11	82:17 84:2,18	assume 38:21	86:15 91:9
95:10 143:15	140:9 144:18	85:12,24 86:24	77:23 113:14	108:16 114:3
apparently	144:19,22,24	90:3,24 91:4,9	130:11,14	133:22 140:7
123:17	145:9,14 146:9	91:10 96:9,16	137:22 138:19	146:20
APPEARANCE	151:12 153:18	96:17,17,19,20	139:1	average 81:11
3:1	area 1:7 4:6 11:1	97:2 98:11	assumed 74:21	106:5
appeared 2:19	11:22 12:11	100:24 112:10	75:21	avoid 137:6
3:7 21:1	13:1,3,4,15,17	115:9 125:20	assuming 8:2	avoidance 54:14
appears 91:4	13:22 14:18,23	130:4 131:16	23:12	54:20 101:22
153:9	14:24 15:4,8	132:4,13	assure 147:9	102:12 103:2
Appendix	15:15 16:3,5,5	139:20	Atlantic 60:17	108:17 109:9
107:22	16:9 17:15,24	argue 79:2	129:17	110:20 111:7

111:16,20,24 112:5,14 114:3 137:5 avoided 55:1 aware 61:18 62:1 76:23 away 47:14 52:17 68:19 113:14 awfully 77:6 a.m 1:16	based 5:7 29:22 30:6,7,10 85:18 99:14 100:18 112:3 114:10 116:12 117:1,3 127:19 133:9 136:22 136:23 140:15 141:18 basic 62:19 88:8 basically 8:1 17:6 63:4 98:23 114:17 121:4 127:13 153:3 basin 41:2,8 69:22 basis 31:19 45:15 62:22 65:3 84:15 89:9 104:13 110:17,19 123:11 bass 60:17 94:9 94:15 97:1,16 98:4 114:14,24 123:17 129:13 129:16,18,22 139:18 142:21 148:18 150:20 153:14 basses 31:10,15 Bay 35:23 53:20 59:4 61:11 101:1 128:23 bear 77:24 134:23 become 31:8 becomes 58:14 69:6 105:19 125:20 bed 14:18 15:12 15:18 32:13 beds 11:17 15:20 17:12 23:19,20 24:4 24:6 25:4 30:19,22,23 31:4,8,10,12	31:19 32:17 33:9 71:1 80:10 116:15 116:18 117:10 117:13 118:15 before 1:1,14 5:14,23 6:19 10:3 13:12 40:20 55:18,24 87:5 101:9 128:12,17 152:6 begin 5:14 8:9 beginning 5:5 behalf 2:19 3:7 behavior 54:3 148:23 behind 47:13 48:9 being 11:24 19:7 20:16 29:20 31:6 35:8 41:20 121:13 132:22 133:10 142:4,8,11 149:15 155:4 belief 97:21 believe 9:11 30:14 38:10,11 45:24 46:23 56:6 65:4 71:24 75:4 78:4 92:16 94:4 99:11 100:2 102:4 107:6,7,9 120:18 122:1 122:11 131:5 140:22 141:3 144:17 146:4,7 below 12:11 13:5 15:4 18:9 68:8 77:2 143:4 bends 65:24 benefit 27:16 50:20 51:9 besides 31:22 131:10 150:24	best 16:3 46:13 46:14 109:6 129:15 133:16 better 31:2 79:21 87:22 99:6 101:22,23 102:11 109:10 109:24 116:9 116:11 134:1 between 21:16 22:10 64:3,23 66:3 70:17 71:10,14 88:16 113:1 125:6 126:23 beyond 99:13 big 24:6 28:8 72:1 107:13 123:9 bigger 72:2 134:16 153:2 biggest 25:3 61:2 bioaccumulati... 129:8 biological 25:22 biologist 25:13 biologists 24:22 biology 39:7,10 birds 20:3 48:8 bit 4:19 21:15 47:14,15,24 49:4 78:21 79:13 103:7 115:21 134:13 Black 20:4 68:3 bladder 134:11 block 47:11 Blue 11:19 blunt 149:1 150:15 board 1:1,15 2:3 4:3,12,13,14 5:19 54:22 79:17 Board's 5:20 boat 16:15 bodies 87:19 94:11,14 136:4	148:4 body 87:6 141:1 145:21 Bog 46:9 bore 61:5,5,7,16 bores 61:6 boring 61:5 Boston 42:20 44:6 both 34:1 54:2 80:3 129:4 151:15 bothersome 70:22 bottom 23:13 33:15 82:17 91:2 112:22 113:16,18 114:1 132:13 139:13 143:1 148:13 149:23 150:15,19,21 150:22 151:4 bought 44:15 bound 152:23 boundaries 142:24 143:18 boundary 130:10 bounds 89:6,24 branches 85:12 86:4 90:13 Brandon 12:11 13:5 15:16 17:15 18:1 67:22 76:23,24 77:8,9,16 80:18 82:13 breach 104:2 break 55:7,9 104:1 119:6 154:5 breed 68:11 breeding 46:13 47:16 96:4 97:10 129:15 bridge 14:23 15:5,9 18:8,9 18:10,11 19:4
--	--	---	---	--

85:6 112:21 113:21 130:10 138:13 143:5 bridges 47:22 brief 102:8 broad 87:16 broader 60:16 79:18 138:10 broke 55:18 broken 89:1 Brungs 104:24 105:6 brush 15:21 buffalo 32:1,23 buffalos 32:12 32:16 33:5 buffer 48:19 build 5:20 97:6 97:17 builders 97:17 139:17 build-up 96:18 built 45:5,8,22 45:22 46:14 48:20 bulk 60:21 bulletin 41:5 burden 121:4 Burton 94:12 121:10 125:4 Burton's 117:17 118:2 121:14 121:22 125:1 burying 140:6 business 155:5 B-O-G 46:9	129:2 came 26:17 56:12 141:4 canal 8:12 9:2 53:17,24 60:13 60:15,23 61:9 61:17 88:12,14 88:19,24 89:11 89:16,23 90:16 90:17,21 92:14 92:24 138:12 cancers 98:24 capable 86:12 86:20 87:1 capacity 111:17 114:6,7 captured 133:2 career 25:11 Carlisle 151:19 carp 98:23 carry 66:18 67:5 133:22 carrying 73:8 111:17 114:5,7 139:20 case 57:8 69:6 75:24 129:6 135:2 cases 34:14 casino 14:13,14 16:3 19:4 casinos 14:15 casual 85:6 cat 84:8 98:5 catch 134:16 category 142:1 catfish 153:14 Catostomidae 107:24 cause 155:9,13 Causes 124:14 causing 22:9 60:22 111:16 caveat 120:8 CAWS 61:20 99:18 140:16 140:20 ceased 26:10 cement 47:11	Center 1:17 2:14 19:15 20:18 39:5 centigrade 52:9 103:13 108:5 111:9 112:2 certain 82:24 90:18 103:24 114:19 148:11 certainly 22:15 40:16 148:3 certainty 95:23 Certified 155:4 certify 155:6,9 chairman 4:1,11 6:14,18,22 7:15 chairs 6:1,2 chance 94:24 change 59:24 105:22 136:11 138:1 139:8 151:24 changed 36:3,4 36:22 changes 41:6 changing 88:3 153:3 channel 9:10 88:17 98:5 153:14 channels 38:13 characteristics 62:16 63:10,23 64:4 70:8,17 71:12 72:14 148:9 150:11 characterizati... 27:14 35:8 characterized 81:9 characterizing 109:11 Charles 44:13 44:13,14 55:23 Chaz 44:13 cheap 43:13 check 38:11 104:22 128:10	checked 105:17 107:9 chemical 22:8 24:9,10 29:1,5 29:14 58:1 137:16 140:1 chemicals 21:4 21:17 22:5,10 22:15 137:12 139:13 Chicago 1:7,17 2:16 3:4 4:6 8:12 9:1,4,5,10 9:12 19:23 27:10 88:11,18 88:24 89:10,22 90:15 92:24 99:19 124:21 138:11 141:11 chief 25:17 26:11 40:13 Christmas 90:9 chronic 120:9 123:15 church 6:11 cinder 47:11 circuit 128:7 circumstances 71:16 72:23 cited 26:21 City 19:23 155:5 clarification 63:17 74:19 94:23 138:5 clarify 107:4 clarity 27:7 95:11,23 classes 31:22 Clean 62:15 63:5,12,22 64:6 69:10,15 70:11,19 71:10 71:17 78:6 86:9,21 87:2,6 cleaning 101:5 clear 104:10,14 132:4 clearer 118:16 close 7:15 52:12	87:1 88:9 Club 2:20 coal 62:2,8 101:2 coast 59:5 60:18 129:17 coastal 58:20 cobble 82:8,11 84:6 Code 1:11 4:8 cold 56:24 57:10 57:12 58:4,11 59:11 60:8,22 61:19 62:4 120:1 colder 57:1 collect 10:22 18:4 68:14 134:12 collected 69:21 69:24 111:3 118:6 131:8 141:6 147:20 147:23 collecting 20:11 34:16,21 66:12 134:22 collection 26:7 67:20 80:1 117:4 131:16 collections 20:13 41:13,15 131:6 colored 16:24 column 29:9 35:4 125:19 Com 27:3 combination 125:10 153:9 come 36:24 43:16 67:15 140:9 154:6 ComEd 29:23 comes 5:24 81:24 106:14 coming 48:2 61:8 108:23 116:18 131:17 comment 120:14 152:19
C C 2:1 155:2 Cal 9:11 153:12 calculated 66:9 66:10 call 9:22 79:7 called 19:16 52:8 57:12 61:6 calling 84:18 Calumet 9:20 19:8,17,20,24 20:22 39:13				

Commission 56:12	108:23 131:13 131:14,21	constitute 11:9 11:13	contracted 39:22 40:2	corresponded 66:11
committee 41:23 42:2,3	136:2,7,13 137:21,23	constraint 122:12	control 1:1,15 2:3 20:6 22:13	costs 50:16
committees 41:21	138:3,20 139:4 140:15 141:19	constructed 151:20	controlled 54:4	council 42:4
common 131:15 149:2	conclusions 20:19 135:6,19	constructing 42:9,16	controversial 45:23	Counsel 94:22
Commonwealth 27:10	condition 94:12 94:15 123:18 150:7	construction 44:22 92:3,17	Cook 155:6	count 57:7
communities 91:18	conditions 136:9 136:17,20	consumed 129:10	copies 28:3,15	County 155:2,6
community 42:11 56:9,20 57:21 99:4,24 100:17 101:11 135:7,20 136:11 138:1 139:7 140:10 143:24 144:2,8 147:10 151:12 151:24 153:19	conduct 40:15 conducted 8:10 8:16,24 10:11 10:16 20:16 51:13 53:7 65:1	consumptions 129:23	copy 8:3 27:22 28:6,11,13,14 28:17,20 128:1 128:8	couple 40:19 41:21 122:19
company 27:10 73:15	conducting 33:18	contact 125:18 148:13 150:14 150:19,22 151:3	core 6:9	course 9:15 19:4 88:15 129:1
comparative 79:24	conference 127:20	contain 30:13	cormorants 12:14,17	court 5:16 7:7 27:16 55:4,14 143:14
compare 23:20 64:23	confused 92:19 92:22	contains 155:11	Cornell 35:22	cover 27:24
compared 86:23 110:13	confusing 72:5	contaminant 9:24 136:24 137:9,15,16 146:19	Corporation 44:15	covered 91:14 98:20 154:1
comparison 59:11,15 116:13	conjunction 43:19 63:1	contaminants 20:3,22 21:19 21:23 22:2 39:18 137:2,4 150:4	Corps 48:6,17 93:7	Crab 39:15 129:3
competition 114:10	connected 37:18 38:15,16	contaminate 129:20	correct 8:2 10:7 10:13,14,15,19 13:6,20 16:21 23:17 39:1,23 50:22 51:10,11 58:13 59:14 60:24 66:8 75:3 77:17 80:15,16 81:24 85:16 94:2 100:13 104:21 107:6 108:24 113:14 120:22 121:23 122:11 127:5 134:24 135:4 136:21 138:22 141:16 141:21 143:19 143:20 149:20 155:10	create 47:15,19 49:3 96:24
complete 5:20	connection 69:14	contaminated 100:10 123:13 136:9,17,20 137:23 139:4	corrected 8:2 10:7 10:13,14,15,19 13:6,20 16:21 23:17 39:1,23 50:22 51:10,11 58:13 59:14 60:24 66:8 75:3 77:17 80:15,16 81:24 85:16 94:2 100:13 104:21 107:6 108:24 113:14 120:22 121:23 122:11 127:5 134:24 135:4 136:21 138:22 141:16 141:21 143:19 143:20 149:20 155:10	created 48:8,9 48:18
complicated 52:14	Conservancy's 41:22	contamination 124:14 126:2 137:1 140:1,5	creating 43:3 44:17,17 46:18 46:24 120:8 139:6	creation 93:8
concept 43:12 87:9	conservative 147:11	context 16:13 145:1	Creek 41:11,12 53:13,19 54:7 54:21 55:20 56:4,18 57:6 81:23 120:2	creation 93:8
concerned 49:21 84:17	consider 66:1 115:7 149:8	continue 99:12 100:7	crews 25:21 26:3	criteria 79:10 104:23 106:19 144:17 145:2 145:20 146:3,7
concerning 13:10	considered 13:22 82:18 118:5 135:12	continued 3:1 36:17	Crown 20:4	CSR 155:17,17
concerns 129:22	consideration 124:22	continues 115:18	corrected 74:6 74:12,13,14	current 72:18 80:23 97:3
conclude 63:11 71:16 78:5	consistent 17:8	continuing 4:21	correction 143:10,10	currently 94:5 144:9
concluded 56:17	consisting 144:3 144:10	continuously 19:18 20:7	corrections 74:8	cut 37:15
conclusion 70:9	constantly 43:21		correctly 60:20 78:2 135:1	cuts 37:16 cyanid 35:24

cycle 66:18 67:5 72:3 73:9	debris 82:20 90:6	96:13	58:21,24,24 64:5 102:23	121:1
D	December 40:12	depositional 48:24 96:17	determined 96:24	discharge 53:15 53:17,24 54:2 54:17 56:17 59:13,14 60:13 60:15,23 61:9 61:17 112:20
dam 12:12 13:5 15:16 45:22 151:20	decision 5:21	depth 18:23 97:3	developed 29:21 30:3,14 91:5	discussed 23:20 92:7
darters 34:18 35:21 36:10,12 83:1 134:10	decrease 24:6	Des 1:9 4:7 27:12 98:15 115:22 143:7 155:6	Development 106:22	discussing 83:3
data 13:18 25:1 26:7 50:24 51:5 63:2 69:4 69:13,18,20 72:9 80:1,2 87:21 94:7,18 94:20 95:12,18 95:23 99:4 101:10 103:6 104:15,15,21 105:14 108:6 108:10,22 109:14 110:14 110:22 112:14 112:20 113:5,8 113:10,15,24 115:4,20 117:4 118:5 120:6,15 120:19 121:19 122:23 123:4 125:1,24 129:13 131:9 131:12,21,24 132:19,23 141:5,8,15,18 146:18 151:23	deemed 50:13	describe 13:4 19:10 42:7 84:22 85:1 88:12 123:24 144:1,8,10	Dexter 2:18 23:18 28:3 75:16 76:9 95:1 105:19 107:9,13 128:16	discussion 135:11 142:15
date 106:23	deeper 32:9 93:8 93:10 134:13	described 34:10 83:17 85:24 86:5	Dick 9:4 47:7	dissolved 100:9 109:19 110:4 110:13,16,23 137:8 148:12 148:15,22 149:19,24
dated 27:11	defeated 45:24	describing 16:2	Diers 2:11 107:11 144:20	distances 65:19 66:14 67:12
dates 25:16 42:19	define 60:12	description 12:7 17:11 82:22 89:6 144:15	difference 60:9 74:15 80:5 88:16	distinctions 151:6
David 4:24 6:20 7:1,9	defined 38:2 81:5 130:9 139:5 143:18	descriptions 82:16 85:21	different 32:7,8 36:5,6 48:13 56:13 58:14 72:3 73:22 108:2,4 114:9 121:9 122:20 125:3,6,14,19 125:20 127:15 127:15 142:5 144:6	distinguish 150:13
day 4:20 6:8 7:14 43:14	definite 60:11	design 44:18,21 46:16	difficult 16:1 21:5 60:4 95:16 153:22	distributed 35:12
dead 70:3	definitely 105:10	designated 142:1,2	difficulty 63:15	distribution 34:22
deal 149:18,18	definition 34:9 37:11 138:6	designation 144:19,24	dig 104:3	district 5:6 9:5 23:22 141:6
dealing 54:10,11 60:6 107:18 121:8	degrees 52:9 101:19 103:3,5 103:9,10,13 106:6 111:9 113:22	designations 146:10	dike 47:20 48:21 92:3,17	district's 141:15
Deborah 2:12	Delaware 35:23 35:23 45:20,22 46:4	designed 46:11	dikes 50:9	diverse 88:15 97:22 99:1 100:3 109:20 109:22,23
	delineate 33:23 36:8	designing 45:5	dinner 57:6	diversity 78:24 94:6 101:16 136:7
	demonstrate 58:17	despite 153:6	directed 14:4 50:3	docket 4:9
	demonstrates 115:5	destroying 61:10	direction 102:7 102:11	docks 61:11,16
	demoting 108:12	destruction 61:15	direction 102:7 102:11	document 7:11 59:17
	DENISE 155:4 155:17	detail 21:10 91:22 121:10 121:11	dinner 57:6	documented 24:4 70:13
	Department 41:1	detailed 35:18 74:10	directed 14:4 50:3	documenting 69:4
	dependent 136:8	detect 70:24	director 39:4	doing 10:24 20:13 24:9,16 34:19,20 35:1
	depending 62:16 71:11 72:13 93:12	detectable 60:18	disagree 122:22 123:1 125:15 151:22	
	depends 32:10 63:23 82:18	determinations 87:5	disagreeing	
	deposition 49:2	determine 50:19 50:21 51:7		

35:18 43:20	26:19 28:24	117:6,22 118:7	earlier 64:24	150:17,24
56:2 68:20,21	40:10 47:18	118:9 119:13	66:15 76:7,10	151:5
76:5 99:23	55:18 58:3	119:20 120:21	83:18 117:8	egrets 11:18
112:17 125:7	59:7 61:18	124:19 126:17	120:2 150:4	12:14,17 18:22
139:19 149:12	71:7,24 74:11	130:8,16,20	151:17	19:1
155:5	76:9,22 80:13	132:7,11,18	early 47:8 98:23	either 43:13
Dolton 25:23	84:21 87:12	141:2 142:23	100:23 117:8	56:11 61:20
done 8:18 10:20	88:23 95:9,22	143:2,8,9,11	148:9 150:10	137:10 143:7
13:19 19:19	105:3 108:9	143:17 144:3,9	East 2:15	elaborate 29:4
20:5,5 27:2,3	117:17 118:2	151:11 152:6	easy 146:22,24	141:14
29:5 30:8 34:4	119:10 121:22	152:16	eaten 31:6	electric 10:22
41:20 47:1	125:4 127:16	drift 35:2,2	eating 12:17	11:1,8 22:24
48:4 49:16,17	130:13 131:20	drifting 35:5	ecological 112:6	electricity 43:13
49:18,22 50:15	142:17 143:21	drive 2:15 3:3	ecologist 65:23	43:17
50:18 67:21	145:8 149:7	57:6	Ed 27:3	electro 30:8 41:9
79:23 93:21	154:2	drop 96:20	Edison 27:10	41:11 80:2
94:1 97:9,12	draft 127:22	drought 24:8	effect 48:4 51:20	134:9,20
99:8 100:2,19	128:1	drums 35:24,24	53:8 56:19	electro-fishing
103:24 113:7	draw 69:14 70:9	36:1	57:13,21 58:11	24:16,20 25:20
116:12 117:20	131:21 151:7	due 24:7 52:20	58:18,18 59:16	elements 21:3
117:23 119:8	drawdown 43:2	54:15 61:16	61:12,12,13	eliminate 152:3
121:2 134:9,17	drawn 43:5 44:2	126:2 131:19	93:15 94:16,16	eliminating
143:14 154:2	44:2 141:19	duly 7:2	99:20 120:5,7	116:16
doubt 78:23	dredging 48:7	during 16:20	121:14,20	ELPC 2:19
115:16 119:22	93:7	19:18 20:16	123:3,12,14,15	emergent 11:16
down 4:18 14:16	Dresden 8:11	37:1,20 39:2	124:24 125:3,8	12:22 13:16
15:2 16:12	9:1 11:3,13	40:11 43:2,14	125:12,22	23:19 70:24
18:3,9 20:1	12:3,8 22:20	46:1,4,5,6 71:1	126:1,1 129:20	85:9 90:3 91:8
25:23 43:5,16	22:22 24:2,24		129:21 151:10	118:21
44:2,3 57:2,8	25:4 30:4,18	E	153:3	Emiquon 41:22
59:4 60:22	30:18 38:2,9	E 2:1,1,5	effected 48:10	41:24
65:11 67:21	38:19 47:1	EA 13:19,24	96:7	Empress 14:15
68:13 70:20	49:6 50:2,7,8	14:3 16:12,17	effects 21:16	14:16 16:3
112:7,20	50:19 51:8	16:22 17:8	39:17 42:10,13	enable 86:8
115:23 126:15	54:9,12,23	50:23 51:1	45:11 46:17	enabled 70:18
138:12 139:19	61:21 67:14	74:2,20,23	51:14 52:19	end 22:12 26:12
downgrade 79:9	69:13 77:15	75:19,20 76:4	53:17 59:23	35:11 38:3
downstream	78:5,20 80:5,9	76:11 85:22	78:24,24	48:15 78:3
10:19 13:2	80:19 81:5,17	94:10 112:13	112:19 123:19	109:5,8 130:5
15:2,3 16:8	81:22 82:13	117:16 118:2,6	125:14 129:4	147:12
18:10 25:3	85:2,18 86:8	120:17 131:6	136:24 151:21	endangered
45:24 46:7	86:20 91:16,24	135:6,19 136:7	efficient 134:12	46:10
73:4 80:4	92:7,12,13,16	136:14 137:21	Effluent 1:6 4:5	ended 46:2 57:5
81:24 85:10	92:18,21 93:12	147:17,21	efforts 19:23	61:3
98:15,17 113:2	93:24 94:6,10	148:8 150:9	41:23	engineering
152:7	94:13 97:8,21	151:7	eggs 148:11,18	42:20 43:9
Dr 4:24 6:5,20	100:2 101:14	each 5:16 54:19	148:19,21,24	44:6,19
7:5,9,21 13:12	109:19 110:12	70:20 84:16	149:3,4,5,6,9	engineers 44:20
21:10 22:19	111:15 116:5	153:8	149:17 150:2	48:7
		eager 106:16		

England 42:22	28:13,19 49:23	80:17 81:15	115:8,10	faster 85:8
enhanced	52:23 71:20	82:13	117:21 119:12	fat 150:16
112:10	76:3,17 77:13	exception 94:9	130:7,15	fathead 146:23
enhancing 93:14	81:1 89:5,12	exceptions 82:23	132:10	features 80:10
enjoy 68:10	90:20 92:11,19	83:10 152:8	extern 4:18	February 26:12
enough 59:8,20	92:22 105:6	excluding 67:3	extra 46:1	40:12
60:7 86:22	106:11,16	excuse 27:20	extremes 52:20	feed 12:19 83:4
97:3 116:23	119:5 133:3	29:19 52:1	E&R 41:7	feeding 11:19
enter 106:24	140:19,24	74:18 78:12		12:14 31:20
entered 5:2	evaluate 12:1	executive 28:1	F	32:2,11
107:3	72:22 114:3	exhibit 5:1,3 7:9	facilities 42:21	feel 39:8 71:5
entitled 4:4	evaluated 89:18	7:10,11 8:8	42:23	felt 70:18
89:21	151:10	28:10,12	fact 34:22 36:17	few 11:5 21:22
entrained 58:2	evaluating 70:14	106:24 107:1,2	70:22 71:17	22:23 30:11
entrainment	evaluation 49:13	107:7 117:24	99:14 120:10	37:20 56:14,24
54:15 57:22,24	68:15 97:9,13	exhibits 7:13	121:1 123:14	58:5 67:10
59:22 101:4,8	113:4 124:16	exist 34:8 84:23	149:22 152:17	103:10 115:1
environment	evaluations	85:2 88:13	factor 94:5,8	116:16 126:14
51:22 52:13	67:20 100:19	existed 23:5	115:6 119:18	148:5
54:5	even 21:17 68:3	existence 86:17	120:16,21	field 25:13 40:14
Environmental	68:19 78:2,21	expect 79:20	122:2 123:18	40:22 41:19
2:6,10,14	79:21 85:6	88:10 100:16	factors 21:13	51:13 52:24
106:21	89:19 98:14	101:21 114:20	133:14	53:1
environments	99:17,19,22	expectation	facts 97:20 98:9	fifth 102:21
59:19	102:7 132:8	62:20	98:19	140:14
EPA 41:7	137:4 152:3,10	experience	fair 12:22 49:11	figure 13:23
106:20	event 60:8	25:14 33:18	fairly 15:11,19	31:1 59:23
equating 145:23	events 61:19	42:8 53:3	65:18 123:10	filed 17:3 117:15
equivalent	ever 8:23 35:6	experimental	146:24 147:1	filled 46:6
139:22	every 37:19,19	54:1	familiar 43:12	final 27:9
escape 57:11	38:18 65:13	explain 21:9	142:10 145:8	find 17:6 21:11
especially	79:3 88:2,3	25:7 26:16	familiarity	31:9,11 32:1
125:10 134:12	111:2	91:22 140:17	145:13	38:6 51:16
140:4	everyone 4:2	142:19	fan 148:18 149:4	59:15 66:14
essentially	everything	explosives 21:22	149:17 150:23	79:13,19 87:9
145:24	75:13,17	exposed 151:1	fanning 149:9	135:9 136:13
established 61:9	evidence 7:5	exposing 125:12	149:24	137:20 138:20
118:20	99:7 153:6,20	exposure 125:20	far 4:14 38:17	139:19 148:3
establishing	exactly 53:1	express 5:21	79:14 102:14	finding 31:7
145:2	EXAMINATI...	extensive 11:17	149:12	57:11 139:20
estimate 13:13	7:19	14:17 15:11,20	Fahrenheit	150:9
16:1,4 128:15	examine 23:4	30:19,22,23	101:20 103:3,5	findings 56:7
estimated 14:5	examined 7:2	53:22	103:9 106:6	122:10 125:1
estimates 57:17	example 55:22	extent 16:2	111:10 113:23	126:10,18
ETTINGER	67:14,19 73:3	50:21 51:10	farther 15:1	148:8 151:7
2:18 6:16,20	84:6 97:7	81:3 84:23	24:18 61:8	fine 32:21 35:3
7:4,18 14:1	134:21 139:23	85:1,17 88:13	102:6	58:3 62:4
17:16 25:5	examples 128:21	89:15,22 90:15	fashion 20:9	68:12 71:19
26:10,14 28:7	except 77:8,9	91:23 112:21	fast 80:18,20	76:14 77:23
			82:12 101:10	

84:5 107:18 116:22 130:17 133:12 151:2 finish 45:3 61:1 fire 62:2,8 101:2 firm 42:20 44:6 44:19 firm's 74:5 first 7:2 9:13 33:16,17 50:18 53:5 55:7 62:12 63:8 64:7 84:24 87:8 102:22 111:1,17 119:20 145:15 151:17 fish 9:23 11:23 12:15,18 15:22 18:4 30:22 31:2,5,5,9,9,15 31:18,22 32:7 33:19 34:6,15 34:19,21,23,24 35:5,6,9,11,14 36:3,14,16,23 36:24 37:7,22 37:24 41:4,6 41:19 43:6,6 43:23 47:16,16 48:13 49:15 50:14 51:22 52:5,9,10,20 53:16,18,18 54:4,13,14 55:1 57:4,7,8 57:13,16,18 58:10,19 59:3 59:12,12,13 60:21 63:2,3 64:16 65:15,17 66:5,12,13,15 67:12,13,24 68:3,21 69:12 69:18,22,24 70:2,12 71:4 71:24 73:6,12 74:17 82:21 83:1 84:8	85:15 90:11 91:10,17,21 93:3,18 94:4 94:13,19 96:5 96:5,22 97:11 97:15,22 98:5 99:3,6,9,24 100:3 101:6,22 101:24 102:11 102:18 103:6 104:20,24 106:20 108:22 109:20,22,23 110:1,2 111:1 111:20,21 112:9 113:13 114:3,9,14,18 116:2 121:17 122:15 127:12 127:12,14 128:19 129:5,7 129:9 134:2 135:6,7,19,20 136:7 137:5,21 139:17 140:1,7 141:10,15 143:24 144:2,8 145:18 147:20 148:17 149:2,6 150:20 151:22 151:24 152:2,3 152:5,12,24 153:16 fisheries 72:9 75:15 86:2 99:21 114:8 141:4,5 fishes 149:16 fishing 30:8 41:10,11 42:11 80:2 134:9,21 fish's 68:17 five 12:6 14:11 23:4 36:19 38:18 42:19 91:7 117:2 five-and-a-half 44:5 flat 84:8	flood 32:24 36:16 37:2,8 37:12 38:1,8 38:12,14,17 66:16 67:1 flooded 37:19 38:18 46:3 flooding 37:21 floods 37:1,20 flow 83:9 flowing 78:17 79:8 148:19 152:1,4 flows 46:1,5 fluctuating 43:21 fluctuation 59:19 focus 4:23 35:21 40:5 focused 22:5 34:17 35:24 36:10 39:6,10 39:17 focusing 50:1 108:14 folder 103:22 follow 107:11 followed 5:6 following 35:20 55:10 follows 7:3 follow-up 5:8 8:14 10:9 23:18 95:17 128:16 143:22 food 34:23 35:6 35:19 36:2 52:16 91:21 94:4,8,16,18 114:11 123:20 foot 132:15 force 71:8 foregoing 155:8 155:9 foreseeable 136:12 138:2 139:8 form 82:20	formal 8:19 11:24 53:2,5 formally 8:18 11:15 formed 37:13 82:17 formulating 77:10 forward 6:12 found 20:23 21:20 29:13 59:22 104:6 112:17 121:5 124:23 125:7,9 126:19 four 12:6,6 14:11 23:4 25:22 31:23 38:18 113:2 117:2 fourth 14:24 102:21 four-year 24:5 Fox 78:15,17,20 Franzetti 3:6 7:20,22 14:9 17:18,22,23 22:18 26:18 27:21 28:23 40:9 50:6 53:4 53:6 55:15,17 72:6 74:19 76:20,21 77:17 77:22 81:3,14 89:8,14 92:15 92:20 94:20 95:8,19 96:1 105:8,21 106:13 108:8 119:8,9 127:24 129:24 133:6 138:8,16,18 140:21 141:12 142:14,16 145:5,7 153:24 free-flowing 79:13 152:14 fresh 36:1 104:24 106:19	Friday 6:9 from 4:16,22,24 9:9,18 11:4 15:2 18:11 19:13 24:17 25:1 26:17 28:22 33:20 35:10,20 36:6 36:6 37:18 38:3 39:3 40:11 41:5 42:13 46:8 47:14 48:2,6 48:17 50:4,20 51:9 52:17 54:6,21 56:17 56:24 59:15 60:8,18 61:8 65:23 66:12 68:17 69:9 73:4,22 77:11 79:14 80:1,2 81:16 82:16 85:6 87:10,15 90:11 99:15,24 100:16 103:6 103:17 106:9 110:5,14 111:3 112:20 113:14 113:21 115:11 115:19 117:7,8 117:10 118:6 121:2,13 123:13 130:9 131:18 132:12 133:20 138:11 140:9 141:4,10 145:13 152:1 153:4,9,15 front 6:4,12 8:3 16:9 full 28:6 fully 19:11 32:19 67:9 113:18 124:1 function 38:22 functioned 36:22 funny 109:21
---	---	--	---	--

further 95:21 137:13 140:15 152:7	76:10 80:21,22 91:12 102:16 103:21 144:14	119:19 124:4 127:22 128:11 138:19 147:2 150:1,21	106:5 108:18 123:16,17	132:1,7,10 133:5,10 135:8 135:12,12,21 135:24 136:2,4
future 136:12 138:2 139:8	given 61:24 146:2	goldfish 98:24	guess 7:4 31:2 51:21 52:23 78:9 108:21 109:22 110:19 145:16	habitats 10:3 34:7,15 35:13 36:2,3,4 42:16 47:2 48:10 49:14 64:19 66:4,19 67:7 72:16 83:3,20 83:21 84:4,12 84:18,23 85:2 85:7,10,18 86:6,8,18 88:13,20,24 89:10 90:1,22 91:9 116:2 133:21
G				
G 4:11	gives 64:22	gone 18:3 24:21 69:17 91:6 99:20 118:17 141:15	H	
garter 68:4 83:11	giving 84:13 104:11 105:4	good 4:1 6:7 7:21 16:11 18:23 30:24 55:1 64:21 69:10 97:15,15 103:19 112:18 113:24 117:9 152:11	habitat 8:19,20 8:24 9:7,15,17 9:23 10:17,20 11:9,13,23 12:1,13,21,24 13:8,10,23 15:9,14,17,18 15:22 16:2 18:14 19:9,24 27:13 32:7,13 32:13 33:5,14 33:18,24 34:3 34:20 35:8,11 36:5 37:6,23 38:13,19 39:7 39:10 40:15,23 42:9 43:6,23 43:24 46:11,12 47:15,21 48:1 48:8,13 49:4 50:14 64:15 65:5,7,18,20 66:1,15,20,24 67:2,3,20,22 68:1,15,17,18 69:5,11 70:14 71:4,6 73:5,11 82:6 83:16 84:1,9,10,18 85:15 86:13,14 86:23 90:8,10 90:12 91:1,5,9 91:15,18,23 92:5 93:3,4,9 93:10,18 96:4 96:7 97:1,5,10 97:16 98:4 101:23 114:10 115:13 130:2,7 130:12,15,16 130:19 131:1	habits 34:23 35:20 36:3
gave 18:22 73:2 73:3 104:7 121:3	glad 128:9	gotten 61:7	half 16:7 42:19	hand 5:11 88:21 139:23
gear 134:12	go 7:16 8:21 10:8 14:15 17:24 19:6 21:13 23:2 32:18 34:8 68:9 70:4 72:20 90:24 95:1 104:9 107:19 110:3 110:20 121:13 131:4 132:23 133:15 138:11 149:13 152:9 154:5	governor's 42:4	handed 106:19	handled 42:15
Gen 8:2	goals 64:6 69:10 69:16 70:11,19 71:17 78:7 86:10,21 87:7	grad 10:23	handing 42:8	handy 27:5
general 30:16 33:7 64:14 79:16,22 80:4 82:21 83:8,15 84:13 87:16 88:20	gobies 10:23,24	gradient 51:21 51:23,24 52:3 52:8 137:12	happen 79:12	happened 41:3 57:3 58:5 100:21
generalization 127:11	goes 33:20 41:11 149:21	gravel 49:3 72:18 82:8,11 83:8 84:5 85:14 90:4 91:7 96:14 97:4,4 151:4	happening 22:6 46:2 53:24 54:4 74:17	happy 123:8
generalized 89:17	going 8:9 12:16 15:22 16:10 18:9 22:12,23 23:3 31:9,11 32:10 33:13 45:18,21 57:18 58:1 59:5 67:23 78:8,13 78:14 79:1,5,6 79:9,12,17 80:7 83:19 87:23,24 90:7 95:20 96:13,15 100:12 104:1 111:21 113:3 113:16 118:11	gravely 130:4	Harbor 39:14	hard 6:9 22:6,14 70:2 82:7,10 82:12 114:2 149:3 150:17
generally 20:19 32:12 101:19 108:11 111:23 116:19 137:15 150:19	gods 33:20 41:11 149:21	greases 125:11	harder 82:18,20 83:9	hatching 148:21
generate 43:16	goes 33:20 41:11 149:21	great 11:19 27:6 31:4 59:20 109:17 134:21	having 7:2 13:16 14:5 33:8 39:9 56:18 57:5	
generated 152:12		greater 91:22 97:24,24 98:7 115:9 119:3		
generating 62:2		Greg 7:23		
Generation 5:5 7:23 61:20 75:3 110:6		grew 36:4		
geographic 126:7		group 36:12 109:9 124:12 145:21		
gets 37:17 65:11		groups 83:1,15		
getting 52:17 87:14		grow 48:12 72:10 90:11 101:7		
Girard 4:11 6:5 6:7		growing 23:14		
give 12:7 13:13 21:14 27:6 28:11 37:11 40:18 42:12 44:4 63:16 64:21 67:19		growth 91:20 101:22 102:11		

61:3 101:7,8 119:24 120:5,6 121:14,20 123:2 125:8,11 125:21 129:21 141:15 145:24 146:14 153:2,4	helps 149:18 her 14:2,2,3 133:3 herons 11:19 12:14 18:22 19:1 20:4 hesitated 134:8 hesitating 32:14 high 46:5 137:6 higher 22:4 80:9 102:8 103:7 111:19 125:8 134:4 150:2 highest 21:13 129:18 highly 118:14 128:23 135:8 135:10,15 hill 43:13 him 6:19,19 76:1 76:7,10 94:24 122:5,7 historical 24:15 87:21 history 19:19 24:1 25:8,12 25:18 26:11,15 30:9 32:4 33:15,19,24 34:3,19 36:23 37:5 40:13 68:2 69:21 80:3 84:20 98:22 133:23 146:16 148:9 149:13,22 150:10	hot 140:4 hour 105:5 154:6 Hudson 129:17 huge 87:17 hugely 45:23 human 129:9,23 hundred 35:18 41:6 hydro 42:21,22 hydrocarbons 121:6 125:9 hydros 42:22 hypotheticals 49:20	80:2 93:11 96:11 98:18 100:21 116:15 116:19 117:4 118:18 119:4 121:2 123:23 124:15,23 126:5,7 135:7 135:20 139:23 152:8 155:1,6 imbalance 87:24 immediate 4:10 4:13,15 Immediately 142:3 impact 56:8,23 58:15,22 59:21 60:3,7,11,18 61:3 129:6,8 153:4,8 impacting 22:16 impacts 9:24 56:15 101:8 impair 115:12 impingement 101:4 important 31:7 31:8 33:2 67:4 69:6 86:12,13 108:18 109:2 146:6,9 152:10 impossible 95:17 impounded 78:18,19 79:3 79:11,15,22 119:3 136:4 139:22 151:10 152:1,16 impoundment 78:24 impoundments 151:19,21,23 152:9 impressed 12:12 improve 47:1 93:3,17,23 99:9 101:15 110:1	improved 50:14 91:19 93:20 98:7 99:2 100:22 153:20 improvement 9:8 50:14 91:16,17 99:22 improvements 42:9,16 91:23 92:5,6 98:3 99:3,12,15 101:12 102:3 109:19 incident 108:14 incipient 103:4 103:8,13 104:7 108:3 include 66:19,24 67:2 68:16 77:3 105:4 143:4 included 10:18 73:14,19 80:14 114:24 120:14 including 81:1 126:16 150:7 incorporate 46:15 increase 114:20 index 64:9,21 66:20 70:2 84:11 indicate 94:8,18 99:8 110:24 111:21 114:8 120:6 131:9 132:19 140:12 140:15 indicated 99:21 indicates 63:3 105:17 109:23 120:20 indicating 28:8 120:15 indication 64:8 110:8 indigenous 79:8 87:2,20 88:1,6 individuals
		I		
	IBI 78:15,16,18 78:19 ichthyoplankt... 136:10,14 137:24 139:7 139:14 147:18 148:6 idea 11:20 18:23 33:7 79:18 identification 7:12 identified 21:23 31:23 92:4 100:7 140:3,5 identify 95:3 97:20 109:13 109:16 142:24 144:17 146:4,8 Identifying 124:13 IEPA 5:6 101:18 102:4 IL 4:8 Ill 1:11 Illinois 1:1,15 1:17 2:3,10,16 3:4 23:21,22 24:17,19,24 25:17,20,24 26:4 30:20 39:4 40:13 41:7,13,14 42:1,2,4 69:22			

147:23	88:2	42:5 43:22	91:13 92:1,11	32:18,22 33:4
inferred 23:11	invertibrate	54:10,11,13	95:11,20 97:6	33:11 34:5
inferring 48:17	61:6 120:11	153:22 154:1	98:21 100:20	45:10,20 46:13
information	invertibrates	items 75:7	104:10 105:3	46:17 52:24
19:15 20:18	11:23 15:23	I-55 14:23 15:4	105:14,21	62:3,8 64:23
23:24 43:10	35:1,4 90:11	15:9 19:4 38:3	106:4 107:21	67:16 69:9
74:10 102:23	91:21	81:24 98:17	111:3 112:18	73:18 88:16
146:20	investigation	112:21 113:21	113:7 114:7	89:15,21 90:22
inherent 136:10	147:18,21	130:9 138:12	115:16 116:5	92:2,4,9 94:17
139:6	invited 9:4	143:5	117:3 118:24	96:23 99:18
innovative 26:2	involve 39:6		119:20 129:12	103:23 104:6
insect 20:5	42:8	J	131:11,19	105:15 113:2
instance 30:11	involved 9:19,22	Jackson 81:23	132:12,24	113:20 114:12
49:3 59:6 85:5	19:7,22 20:8	Jersey 46:3	135:14,18	114:13 116:8
96:14 97:1	26:6 34:13	53:14 55:20	136:1 138:23	117:7,11
98:15,18	36:20 39:24	56:5 100:24	139:5 141:1,13	118:22 120:9
113:16 137:13	40:17,19,24	Jess 105:16	142:17 144:14	122:18 123:9
153:12	41:14,16,20	Jessica 2:18	147:13 149:7	123:16,20
insures 150:1,2	42:5,15 43:8	106:13 107:6	153:9	130:14,17,24
150:5	44:16 45:4,17	job 20:14 39:5	justified 71:5	131:18 132:9
intake 53:15	129:1,14	134:21		132:12,14,16
57:18	island 11:3	JOHNSON 2:5	K	133:12,13
intended 63:18	30:18 38:3,9	joining 4:15,17	K 155:2	134:17 137:20
intending	38:20 45:22	Joliet 14:14	Kaskaskia 25:13	142:12 149:12
143:16	47:1,20 48:18	21:21 41:12	25:15 34:17	153:5
intent 48:14	50:8,8,19 51:8	Jones 104:24	35:17 36:9	knowledge
interest 26:6	54:9,12,23	105:6	41:2,4,7,8	46:13,15 85:17
36:18 41:3	61:21 67:14	judgment	66:23 68:5	133:9 140:16
93:5 151:15	69:13 78:6	131:15	115:24 118:19	140:17 141:14
interested 12:10	80:5,9 81:5,17	July 27:11	151:16,18	known 17:24
26:1 34:14	82:13 85:18	jump 78:9,13	keep 29:19	
93:13,14,19	86:8,20 97:9	121:13	74:20 75:19	L
interesting	117:22 118:9	just 5:19 10:8	148:23 150:24	L 7:1
20:22 78:11	119:13,20	11:8 12:16	keeping 148:19	laboratory
104:4	120:21 126:17	13:4 15:8,16	key 77:10	22:12 52:6
interests 151:21	130:8,16 132:8	22:13 25:7	kill 120:1	54:5 106:21
intermediately	132:11,18	27:6,24 29:23	killed 57:7,17,18	119:22 146:23
140:13 141:20	143:17 144:3,9	31:20 35:24	58:10 60:21	lacking 82:12
142:18 143:23	151:11 152:6	38:2 39:11	137:10	laid 151:5
144:4,11	islands 48:8	42:18 47:12	kills 52:20 57:4	Lake 41:14 88:1
interpretation	93:8	48:5 49:2,20	kind 6:11 31:1	93:6
122:19,23	isolated 37:17	52:15,22 53:2	48:13 50:23	lakes 83:7 90:9
interrupt 29:8	issue 46:9 58:14	61:1 62:4,10	61:12 70:1	90:10 132:6
38:7 149:7	79:2,18 93:10	65:21 67:2,19	82:6 103:11	language 17:19
interrupted	93:12 115:11	68:20 69:2,8	130:18 131:23	Lanyon 9:4 47:7
150:8	118:23,23	71:5 74:19	kinds 53:14 67:7	large 25:14
introduce 6:19	120:1 129:8	75:20 77:7	121:12	32:15,22 33:20
introduced 76:2	143:22 153:5	79:12,18 83:3	know 14:7 15:24	34:11,13 37:6
invasive 26:4	issues 26:4 40:8	83:13,24 84:9	19:3 23:21	37:22 42:22
		85:4 89:17	26:24 28:14	43:8 59:20

60:5,14 64:14	48:24 101:21	133:23 144:19	72:18 91:5	150:18
65:12,17,18,21	102:11 118:8	144:24 146:9	132:15	logperch 83:6
65:22 66:6,13	140:7 146:20	146:16 148:9	lines 132:6	102:19 103:12
67:12,12 79:3	let 10:8 17:22	149:13 150:10	list 106:4 108:1	105:23 106:1
79:11 83:16	30:2 40:18	151:12	109:1,2 132:23	108:7,12 131:2
90:13 94:11	43:15 45:2	lifecycle 33:3	145:11,13	132:2,17,20
97:15 98:2	52:22 56:22	lifecycles 139:21	listed 105:2	133:1,8 134:22
114:13 119:3	63:6,16 67:10	light 56:6	106:6 107:23	logs 11:21 15:20
122:17 139:18	67:19 81:23	116:23	lists 80:6	72:17 82:19
148:5	82:9 104:3,9	like 6:11 7:14	literature 83:24	85:11 86:3
larger 36:4,6	104:22 108:11	12:6 13:21	89:20 103:11	90:5
65:11 66:15	131:4 137:22	14:8 19:6	108:19 124:8	long 47:20 50:9
84:6 145:21	138:16 142:17	28:10 30:22	136:24	115:17
larva 148:12	lethal 103:4,8	31:24 43:6	Litti 124:11	longer 66:14
larval 147:19	104:7 108:1,3	44:20 57:4	little 4:19 6:10	longer-term
last 11:1,11	108:14 109:8	60:17 66:22	11:2 12:2 16:1	120:8
14:21 22:20,21	110:21,24	68:3 76:8	19:10 21:10,15	long-term 24:16
25:16 26:13	lethality 54:14	77:20 80:11	27:7 47:14,15	27:12 30:7
27:17 30:11	let's 8:15,21	87:16,20 88:6	47:24 49:4	40:18 117:3
36:19 85:19	14:10 42:14	89:15 90:7	63:16 70:22	look 6:12 9:6,15
90:21 92:23	45:2 65:10	93:6,20 101:24	72:4 78:21	11:5 35:3,10
99:2,5 102:21	70:4 84:24	107:4 111:7	79:12 90:1	35:11 44:9
117:1,11,20,23	104:14 111:12	113:13,22,22	95:11,22 102:1	54:3 58:14
118:6 147:16	119:16 135:17	115:19,24	103:7 114:2	64:4 71:14,22
lasting 58:11	145:5,15 154:5	119:24 126:22	115:21 134:13	72:21,24 73:2
late 24:7,19	level 110:24	128:20 133:13	138:10 142:19	74:6,11 76:14
26:20 29:22	125:17 153:20	134:10 142:20	147:4 151:13	78:12,15,15
44:9 98:23	levels 9:24 21:13	150:13,15	Liu 2:6 4:16	80:6 87:20
later 24:3	22:1,5 43:21	151:13	live 31:2 72:10	88:6 95:2 97:2
LAW 2:14	59:2 109:20	likely 136:11	91:10	98:22 104:2
lay 138:23 139:2	119:10,13	138:1 139:8	lives 127:10	105:1,24
150:16	129:18 137:2	limit 111:16	living 67:13	108:16 111:6
lays 149:3	148:12,15	limitations 1:6	120:12 125:18	117:18 132:24
lead 140:7	149:16,19	4:6 135:13	LL 147:19	148:17 153:12
learn 54:6,20	lieu 34:11 69:3	136:10 139:6	LLP 3:2	looked 14:8 29:7
least 9:21 11:24	lieutenant 42:3	limited 88:21	local 53:18	36:21 44:1
19:15 38:22	life 8:24 32:3	91:1 93:5	located 10:18	59:2 60:12
47:10 100:13	33:14,19,24	119:15 135:21	89:23	70:12,12,13
102:18 105:22	34:3,19 36:23	136:2,4	location 70:6	73:1,16 74:3
106:13 131:8	37:5 66:18	limiting 49:15	84:22 85:1,17	108:21 109:1,3
139:20 152:22	67:5 68:1	94:5,8,19	88:12 89:16,22	109:4 133:8
leave 57:5	70:11 72:3	115:6 116:20	91:24 115:13	135:14
109:12	73:9 78:7	119:18 120:16	126:7	looking 9:16,16
leaves 118:21	84:20 86:9,21	120:21 122:3	locations 19:2	9:23 10:2 11:2
left 4:11,13 77:9	87:7 103:7	122:12 135:8	72:21 117:2	11:12 12:11
legal 87:16	104:20 115:6	139:14	loch 13:5 15:16	18:10,14 19:20
length 66:7 79:4	119:18 120:16	Lin 2:7 4:13	lochs 12:12	21:4,8,22 22:2
90:17	122:3 123:12	39:20,21,24	Lockport 54:18	26:3 29:10
less 16:4 48:10	127:5,9,11	line 9:17 14:19	log 84:7,7	34:8 36:2,14

36:15,19 41:23	142:23 143:2,7	28:15 34:3	123:15,20	61:15 65:8
42:24 43:3	143:9 149:23	37:6,13 38:21	125:19 126:23	148:20
53:4 54:22	lowest 109:7	66:15 67:4,24	126:24 127:1	measuring 21:7
60:16 69:23	lucky 65:13	75:5 79:14	127:14 131:5	53:23 65:7
84:15 105:14	lunch 104:1,2	96:3 114:14	134:14,14,19	mechanical 58:1
106:1 125:13	105:5 119:6	132:15 133:1	137:7,7 139:10	median 76:24
127:3 129:4	154:5,8	135:2 141:11	139:24 141:7	77:12,15 78:1
133:8 135:15	Lust 41:12	154:1	148:5 151:2	78:3
145:17 147:7		map 89:6	152:3	meet 43:15
looks 7:14	M	March 70:23	maybe 23:11	62:15 63:4,12
lot 12:24 13:19	macro 90:11	Marie 2:4 4:2	24:18,18 28:1	63:22 64:6
16:24 20:21	91:20	marine 61:4	48:19 65:19,19	70:18 71:10,17
25:14,18 30:21	Madam 95:20	mark 7:8 107:19	72:7,12 75:23	meeting 65:21
32:15 35:2,5	made 16:20 19:6	marked 5:1 7:11	78:21 94:22	69:10 155:12
36:15 37:2	22:11 23:1,15	8:7	101:24 105:3	meets 89:5,24
39:15 42:21	29:18,20 41:15	marking 5:2	109:6,8 125:18	member 2:5,7,8
43:2 47:9,10	48:7 69:18	Marseilles 25:2	135:13 137:13	4:12,13,14
48:22 49:1	71:8 74:9 87:4	80:3	142:17	5:19 6:7 7:13
56:13 71:4	92:6 133:11	Massachusetts	mean 16:7 17:16	39:21,24
101:10 108:19	143:10	42:20	34:6 37:12	members 4:22
108:20 116:21	Mae 44:14	master's 36:11	48:23 49:19	mention 19:7
123:10 125:1	magic 64:9	104:5	51:20 53:1	29:18,20 39:13
125:20 126:22	magnitude	match 70:3	62:11,18 64:7	45:19
134:9 135:22	119:2	material 127:19	65:14 69:11	mentioned 11:8
136:23 146:12	main 55:23	materials 74:24	70:15 72:13,15	26:19 27:19
148:4	65:20	150:22	74:9,13 80:20	28:24 73:19
lots 12:14 16:12	maintain 43:4,5	matter 1:3 137:3	82:8 87:18	76:22 83:18
19:5 56:10	43:23	149:1	90:12,24 96:10	102:17 104:20
85:23 88:16	maintained 41:3	maximum	98:2,12,22	105:8,10
93:2	maintaining	101:18 106:5	102:12 108:17	123:22 132:22
loved 18:3	87:1	may 5:8 17:12	109:22 113:3	151:16
low 46:1 67:6	major 13:1,3,17	21:19 22:8,16	113:12,20	mesh 35:3
77:6 78:3	115:6 129:11	31:19 32:2,8	114:5 121:18	metals 29:7
137:7,7 148:12	majority 83:16	37:19 38:17	122:17 135:22	129:4
148:15 149:15	make 31:18	39:3 45:21	139:24 141:8	meters 65:15
149:19 150:7	43:17 56:7	48:10,23 49:12	141:17 142:18	methodology
lower 1:8 4:7	58:24 74:15	50:4 51:22	152:19	125:3
22:1 25:23	76:6,10,16	52:16 58:1,16	meaning 52:2	Meyer 4:17
32:23 35:23	92:9 127:11	62:15 63:12,22	87:17 145:24	Michael 124:11
64:17 66:23	131:13 147:12	67:6 68:11	means 134:1	Michigan 41:14
78:21 79:13	148:5	71:10 72:5	meant 73:10	88:1
80:12 91:16	makes 86:19	76:3 77:20	97:23 143:7	micro 83:20,21
94:15 98:14	95:16 152:10	91:13 93:11,11	144:15	84:4,9,12,18
101:1 109:5,8	making 118:7	95:9 100:10,10	measure 21:18	84:23 85:2,10
114:20 115:22	140:6 150:20	100:12 102:8	22:15 57:15,16	85:17 86:7,18
115:23,23	Management	104:23 105:22	59:21 60:8	88:13,23 89:10
116:5,17,19	39:5	106:22 110:8	71:23 91:3	90:1,8 91:9
123:16,18	manuscript	118:4 120:8,12	137:1	121:8
127:1 130:4	124:6	122:5,14	measured 22:7	microbial 91:20
	many 12:3 14:7			

mid 101:5	misunderstood	134:19,22	53:18	112:5 113:16
Midwest 5:5	66:9	135:3 142:19	moving 31:20,21	120:12 126:13
7:22 8:1 61:20	mitigating 44:2	143:7,21	39:2 40:10	necessarily 21:7
75:2 110:6	mitigation 42:24	144:14 146:21	51:12 62:10	32:4 47:4
115:16 119:4	43:8 46:11	147:4,12,14	66:6 81:9 85:8	64:10 83:24
might 9:7,22	50:20 51:9	149:5 150:1,5	88:11 91:12	84:12 147:2
12:5 16:23	mix 79:7,19 80:7	152:1,10 153:2	94:3 97:19	153:7
17:2 25:7 49:8	88:4 97:5 98:2	153:14	102:17 109:17	necessary
49:14 52:8	mixed 142:5	morning 4:1 6:7	115:3 125:19	101:15 125:18
64:17,19 65:9	mixes 113:18	6:9 7:21	130:1 135:5	need 5:9 6:1
65:11,13 72:2	mixing 112:24	mortality 57:23	136:6 140:11	22:13 39:11
72:3,17 78:9	mixture 125:13	120:3 137:1	142:22 144:16	47:19 49:12,17
79:20 80:11	moderately	most 10:5 21:1	147:15 148:7	55:4,13 59:20
84:4,5,7,7,13	142:13	21:11 24:23	149:4 151:9	59:24 63:1
84:16,17,19	moment 12:16	29:20 30:3,14	much 17:10 25:9	65:17 67:24
85:13 93:5,14	62:10 91:13	30:19 32:4	26:15 33:12	69:5 75:24
93:15 97:2,5	monitoring	34:14 39:16,21	38:6 52:14	83:6,9,16
98:6 101:21	27:12 34:12,13	43:11 51:20	62:1 99:1	89:24,24 93:23
102:1,10,15	40:18 69:3,4	53:22 56:23	127:1 132:20	95:1,11 106:8
109:24 114:9	month 90:21	58:20 65:16	146:20	106:9,12 119:7
114:12,19,23	months 57:1	81:9 83:1,5	mud 83:11	130:2 131:2,21
116:2 126:12	111:15	87:22 94:19	must 61:7	132:2 152:4
127:12 128:6	moon-shaped	109:7 116:15	MWRDGC 3:7	needed 36:5
140:9 142:3,13	37:16	118:14,17,18	myself 44:18	43:18 46:1,7
152:13	Moore 2:8 4:15	119:3 136:3	91:13	50:10 73:8
mile 16:8 65:10	more 6:1 10:1,3	153:21		needs 41:19
65:12 67:21	12:2 16:8	mostly 12:19	N	50:18 143:6
68:19	19:10 21:10	mouth 32:22	N 2:1	negative 58:15
miles 65:14 66:3	22:3,11 26:6,8	94:9,15 97:1	name 4:2 5:13	58:21 59:15
66:3 113:2	27:7 31:19	97:16 98:4	7:22 27:17	60:3
million 148:22	33:1 35:10	114:14,23	106:15 107:24	nest 97:6,17
mind 145:16	40:7 43:20	123:17 139:18	124:13	139:16 148:20
mine 151:16	47:15,24 52:6	142:20 153:14	Namely 148:10	150:23
minimal 148:13	52:14 53:5	mouths 66:17	narrow 135:18	nests 97:17
150:14	54:4 61:16	move 8:15 13:8	138:8	150:21
minnow 146:23	63:16 66:2	14:10 33:13	nation 79:5	net 41:19
150:16,16	84:17,19 88:21	37:4,22 63:6	natural 19:19	nets 35:3
minnows 31:11	90:1,19 91:4,5	65:17,18 66:13	24:1,15 25:8	Network 2:20
31:13,16 83:2	95:14,22 96:24	66:14,16 67:12	25:12,18 26:11	never 35:7 87:23
149:2	97:22 98:1	67:16 68:13	26:15 30:8	101:3 118:20
minute 45:2	99:1,2,17	100:7 102:6,10	40:13 41:1	143:14
78:13 103:21	100:1,3 102:1	102:15 111:12	51:22 52:13	new 42:22 46:3
minutes 55:7	105:14 108:11	111:21 112:9	59:18 60:5	53:14 55:20
mirror 142:7	109:10,13	113:13 119:16	69:21 80:2	88:2 100:24
missing 21:19	110:12,15	128:17 137:7	nature 21:6	next 8:21 63:6
112:17	112:11 114:18	moved 35:22	22:14 29:5	63:24 84:21
Missouri 25:24	121:5 123:8	37:1 101:6	41:22 52:20	126:24 128:17
65:23,24	124:1 125:11	movement 53:16	91:22 151:10	148:7
misstated 77:7	132:7 133:10	movements	151:24 152:16	Nicole 4:17
			near 24:18	

night 20:4 43:14	119:14	124:20	73:16,23 95:3	45:16,18 48:22
nobody 6:11	observations	oils 125:11	114:21 118:22	48:24 52:17
none 7:10 59:17	16:20 17:7	okay 10:8 13:7	129:1,11	54:18 57:11
80:13 107:1	23:15 30:10,12	16:16 27:5	only 38:18 45:18	59:4,5 64:17
normally 61:12	117:10 119:12	32:21 33:11,13	53:23 59:23	69:20 79:14,21
north 3:3 9:10	observe 11:16	50:11 51:12	65:14 76:14	79:22 80:10
10:14 14:23	14:18,22 15:10	52:22 54:19	86:14 88:19	81:18 83:10
15:9 38:3	16:10 23:9	58:3 72:12	104:6 124:24	84:20 86:23,24
88:17	observed 13:8	73:24 74:2	145:1 147:22	88:21 90:5
northern 130:10	13:10 23:7,9	76:19 85:16	operates 114:1	91:3 92:5
nose 149:1	23:12 128:19	88:20 108:21	opining 87:8	94:11,14,17
150:16	observing 41:17	124:20 126:21	opinion 65:4	96:17 97:14
note 5:18 19:8	41:18	135:1,17	69:15 86:7	98:11,12,19,21
95:19 115:4	obviously 9:18	136:15 140:24	98:20 110:11	100:23,24
notes 13:11	12:24 13:20	141:18 145:16	111:5 114:17	106:14 114:2
29:19 155:10	16:8 34:7	147:15 154:4	119:17 122:6	114:11 115:24
noticed 19:3	130:9 149:6	old 21:21 41:12	139:10,12	116:7,9,16
notions 5:22	150:23	one 3:3 5:15	152:15	117:12 118:9
November 39:3	occasionally	10:23 13:7,9	opinions 98:10	118:11,12
nuclear 43:19	20:12 32:2	14:10,13,20	opportunities	119:3 121:16
53:13 55:20	occur 102:4	16:11 21:5	9:7	122:17 124:22
56:8,11 59:13	occurred 25:15	23:24 27:5	Orchard 39:15	125:5 128:18
61:24 62:5	44:7 55:22	28:11 36:12	129:3	128:24 130:22
number 4:9 5:7	59:11 113:1	43:22 44:23	order 70:9 130:2	130:22 131:4
10:21 11:16	occurring 61:19	45:3,18 47:4	131:2,21 132:2	131:10,16
20:1 31:11	occurs 62:5	54:19 55:4	148:3	132:21 133:7
36:23,24 40:4	ocean 90:9	56:21 60:3	organics 149:23	135:23 137:9
49:11 57:16,17	off 37:16 47:12	63:24 64:10	organism 22:17	139:22,23
58:10 62:8	57:9 78:13	65:6,7,13 68:4	60:1	140:2 145:20
89:18 93:17	88:2 103:5,10	71:6 73:4 76:7	organisms 21:2	146:16 147:3,8
97:24 100:5,14	109:15 132:24	79:3,20 84:6	21:2,8 39:19	151:6 152:3,12
105:2 133:14	142:14,15	84:24 87:20	58:2 91:20	153:1
139:16 147:24	148:1 150:24	89:18 91:7	119:23 120:4	others 25:3 45:2
numbers 64:22	offer 7:4	93:6 97:6	121:8 123:20	83:11 99:6
67:6 97:24	offhand 115:1	100:9,23	125:12,16,17	116:1 149:17
98:7 133:8	Office 106:21	102:18 104:6	127:7,8,13	otherwise 89:17
134:4,14,17,23	officer 2:4 4:4	104:18,19	137:15 145:21	116:3
nursery 31:8	27:20 28:5,9	105:22 107:13	145:22	ought 26:16
37:3,23 47:16	28:16,21 39:20	112:16,22	original 48:14	out 4:16 11:18
	55:6,12 74:18	113:3 114:2,23	70:4	13:24 18:22
O	75:6,10,18	114:23 116:14	other 5:16 11:21	20:10 25:19,22
O 155:2,2	76:13,19 95:20	126:24 128:16	13:9 14:11,20	26:2 27:3 31:1
object 107:5	105:16 106:7	131:4,8 134:8	15:4,17 16:14	31:21 34:1
144:20 145:4	106:18 107:17	136:13 141:8	18:16 21:17,23	35:7 36:24
objection 7:7	119:7 127:16	143:21 146:17	22:4,23 23:1,6	38:19 39:11,22
106:23 145:4	128:5,14 154:4	146:21 148:22	23:8,23 24:12	40:3 41:5
146:3	often 33:1 69:3	150:23 151:20	25:1 26:8 31:6	44:15,23 50:24
objects 150:23	110:5 152:2	153:4	31:22 32:3	52:11 55:20
observation	oh 51:18 124:11	ones 21:12 63:12	38:13 44:23	56:12 61:4
85:6 118:13				

66:16,18 67:5	110:13,16,23	participants 6:9	39:3,9 40:11	planktonic
73:9 77:9,24	137:8 146:19	participated	58:6	127:13
79:14 85:19	148:12,15,23	41:10 53:7	periods 102:7	planned 40:6
89:7 90:2	148:24 149:5	particular 22:8	permanent	plant 9:8 10:12
96:20 101:10	149:19,24	26:5 60:15	31:19	10:19 29:11,15
103:20 104:3	150:1	62:16 63:10,23	permission	53:23 54:15
104:23 111:3	oxygenated	64:4 70:8,16	128:3	57:2,3,6,7,9,19
111:21 112:9	148:19	71:11,15 72:14	personal 119:14	58:2,5 59:3
123:8 128:11	Oyster 53:13,19	72:22 82:8,11	140:16,17	60:22 101:2
133:22 134:23	54:7,21 55:20	87:6 117:24	141:14	120:3 126:13
135:14 137:7	56:3,18 57:6	126:1	pertinent 54:16	plants 43:19
138:24 139:2	120:2	particularly	phonetic 9:4	54:18 61:24
139:17,20	o'clock 1:16	26:1 43:1,18	photographs	62:5,8 101:7
146:18 148:22		64:14 98:1	16:12 17:1	please 5:13,15
151:2	P	120:11 141:24	85:22 86:3	5:18 27:17
output 43:20	P 2:1,1	143:3 146:13	phrase 136:18	29:4 39:11
outright 57:16	page 27:24	parts 1:11 32:23	142:23 145:9	42:7 55:5,8
outside 15:15,16	33:16 62:12	61:11 66:18	physical 42:9,16	91:22 97:20
59:14 65:24	63:7 102:21,21	78:18,19 90:18	91:18,19	124:1 140:16
67:13 77:16	107:22 112:8	91:14 124:22	physically 18:2	142:24
over 5:16 6:2,3	140:14 143:1	139:22 141:11	Ph.D 7:1 35:22	plenty 6:1
14:23 24:4,21	147:16	148:22	pick 52:11 84:12	plum 43:1
30:10 58:7	PAH's 121:5	past 146:3 149:5	147:4,11	plumb 112:20
64:3 66:6,10	paid 22:21	151:15	pictured 86:6	112:21,24
66:14 79:4	Pamela 27:14	pay 61:4	piece 37:17	113:5,6,8,13
83:9 99:2,5	paper 124:3	PCB's 29:7	pieces 68:24	113:24,24
104:2 128:13	127:22	129:14,18,23	pilings 47:22,24	plume 55:1,3
141:9 143:13	papers 56:12	PCP's 129:5	48:1	Plus 16:11
148:19 150:1	paragraph	peak 43:15,17	place 57:11	pneumonia
overall 57:13	33:17 62:13	peer 124:8	112:23 130:5	125:8
58:19	63:8 102:21,22	people 28:22	130:22	point 6:6 34:1
overflow 153:17	140:14 147:16	90:8 106:14	placed 75:23	39:11 64:11
overhanging	Parson's 44:15	107:15	places 12:23	67:17 68:18
15:21 85:12	part 9:21 13:22	Peoria 93:7	15:20 86:5	87:10,15 95:11
86:4 90:13	16:19 29:2,6	per 7:13 10:21	100:11 110:9	103:24 106:8
overriding	36:13 37:5,6	65:10,12	121:16 122:20	111:5 123:8
87:17	45:13 49:23	148:22	131:10 132:14	131:4 135:13
oversight 26:9	55:1,18 57:22	percent 13:21	Plaines 1:9 4:7	138:4 142:10
overview 16:11	57:23,24 58:1	59:24 91:7,7	27:12 98:15	149:15
17:11 64:22	68:1 69:19	134:7,7 147:22	115:22 143:7	pointed 146:18
112:18	71:2 74:23	148:2	155:6	points 147:14
over-wintering	75:1,22 76:15	percentage	plane 32:24	POLICY 2:14
93:9,10	76:16 78:17	60:14	36:16 37:2,8	POLLUTION
own 89:20	81:4 84:21	perch 106:1	37:12 38:1,8	1:1,15 2:3
119:14	93:11 95:6	142:21	38:12,14,17	polychlorinated
owned 56:3	114:16 118:1,3	perform 40:14	66:17 67:1	121:6 125:9
oxbows 37:14	123:7 140:22	40:22	plankton 60:1	pool 8:11 9:1
oxygen 100:9	149:13,18,18	period 19:18	75:14 94:10	11:3,13 12:1,4
109:20 110:4	150:2 151:3	20:17 24:5	122:16	12:9 13:1,22
	partially 24:7			

16:13 22:20,22	66:17 83:12	141:10 153:11	96:7 115:10	115:20,21,22
23:2 24:2,14	85:9 98:16	153:15	117:21 123:13	116:5 121:7
24:24 25:4,24	130:5 152:7	possibilities	present 109:3	131:10,16
30:4,17,18	population 41:6	93:17	115:9 130:8	134:4 143:6
37:12 38:3,4,6	57:14 58:13,15	possible 27:21	132:10 133:10	149:21 150:17
38:20,23 47:1	58:18,20,22	94:9	144:2,9 151:15	150:18
49:6 50:2,8,8	59:2 60:1,10	possibly 101:22	presentation	problem 22:9
50:19,24 51:8	60:11,12,13,17	101:23 125:10	121:3 127:20	49:24 59:18
54:9,12,23	79:8 87:3,20	132:8 142:21	presented	78:22 96:10,12
61:21 67:14	88:1,6 97:15	potential 21:18	104:16 122:24	100:10,11,12
68:14,14,15,21	97:22 99:1,7	54:14 63:4	presiding 4:12	101:3 110:7,8
69:14 77:15	100:4 109:20	69:10,15 92:2	pressing 40:7	115:14,18
78:6,20 80:4,5	109:23,24	96:4 98:3	presume 97:16	116:1,4,6
80:9,11,19	110:2,2 120:5	100:6 115:6	pretty 7:15	problems 60:3
81:5,10,12,17	120:7 121:14	119:18 120:17	12:24 13:3	116:6 146:17
81:20,22 82:13	121:17 122:15	122:3 129:20	17:10 20:7	Procedures
85:3,18,23	122:16 123:4	potentially	57:4 80:7	106:20
86:9,20,23,23	125:17,22	47:14 57:24	97:15,15 98:2	proceed 5:4
91:16,24 92:7	126:1,2 129:16	98:5,7 120:3	107:16 116:20	proceeding 4:4
92:12,14,16,18	129:21 132:17	129:9	117:9 141:3	17:4 81:4
92:21 93:12,16	132:20 134:15	poundage 114:9	146:13 151:20	104:16 127:4
93:24 94:6,11	139:18 140:7	pounds 114:14	prevalent 90:16	130:9 144:23
94:13 97:9,21	141:10	pour 121:11	prevent 153:3	147:19
98:8 100:2	populations	125:5	previous 23:1	proceedings
101:15 109:19	34:24 41:4	power 43:15,17	pre-filed 5:3 7:5	1:14 55:11
110:9,13,23	53:19 58:20	43:20 54:15	7:8 8:1,6 75:2	155:7,12
111:15 115:19	59:4,12,13,19	56:5 57:2	75:23 80:14	produced 73:15
115:22 116:5	74:17 79:19	Prairie 2:19	91:15 96:2	producing
117:6,22 118:7	83:7 88:3	41:11	117:17 121:22	139:21
118:9 119:13	99:10 101:6	preclude 116:2	primarily 36:10	Program 27:13
119:21 120:21	121:21 122:21	preconceived	62:5 108:14	programs 34:12
124:19 126:17	123:3,5,16	5:22	primary 20:13	34:13
130:8,10,16	128:20 129:5	predators 31:6	124:11 147:7	progress 124:5
131:8,10 132:8	151:22 152:5	52:17	principal 121:7	project 44:23
132:11,18,21	152:13,24	predominant	prior 22:20	45:1,19 46:14
133:18 139:19	153:16	63:9 64:2	92:16	48:14
141:2 142:23	portion 9:12	prefer 32:7,13	probably 5:23	projects 19:17
143:3,4,9,12	10:17 73:9	preference 52:7	9:13 19:13	39:6 42:8,15
143:17 144:3	79:4 84:1,10	preferred 33:4	43:11 47:13	42:23 43:1,8,9
144:10 151:11	99:20 143:4	52:12 66:14	50:15,23 52:15	45:16 48:3,7
152:6,17,18	148:5	112:11	53:12,22 56:23	48:16,18 50:21
pools 20:2 25:1	portions 90:4	preparation	61:2 64:14,15	51:9
32:24 33:1	112:10 141:22	10:6 16:19	73:8 74:22	proposed 1:10
36:16,20,22	141:23,24	124:6	79:21 85:10	4:7 102:4
37:2,5,9,19	position 44:6,12	prepared 106:14	87:22 88:9	142:8
38:1,8,12,14	122:2	117:16	91:2 97:23	protect 47:13
43:4 44:1,3,17	positive 77:19	preparing	101:17,18	147:2
44:22 45:11	81:12,18 99:10	124:10	108:2 110:15	protected 47:24
46:11,15,18,24	99:23 105:9	presence 86:19	111:2 113:1	48:13

protecting 147:2 147:13	64:13 65:1 66:9,23 67:23	140:19 143:22 143:23 144:6	123:10 128:12 132:13 133:21	27:7,22 69:19 74:20,22,24
PROTECTION 2:10	68:20 69:2,6 69:14,23 70:7	144:16,21 145:12 147:15	readily 61:4	75:1,7,21
protective 147:10	71:9 72:8,20 73:14 74:6,6	148:7 149:10 151:9,14	reading 106:9 110:5	76:11,15,16 77:24 78:16
Protocol 106:20	74:12 75:16 76:24 77:11	questions 5:4,8 5:10,14,17,18	ready 119:5	81:11 83:13 95:7 103:14
provide 46:12 48:12 71:3	84:11 86:1 115:8	6:13 7:17,24 8:1,3,5 10:9	real 84:4 113:3	104:10 105:7 105:18,20
76:1 85:14 90:10 91:21	qualify 39:9	50:2,3 67:10 92:23 95:17,21	146:11	106:8,10,12 107:3,5 111:2
96:4 97:5 149:5	quality 1:5 4:5 39:7,10 79:9	128:7 154:3	really 31:7,8,17 32:17 34:9	111:4 112:3 122:20 123:9
provided 85:11 85:22	98:8 99:1,9 100:22 101:5	quick 111:10	40:17 49:19 59:20 64:12	138:5 141:7 142:14,15
provides 91:5 providing 11:22 91:19	101:12 115:12 151:11 152:11 152:17	quickly 105:14 123:10	65:12 66:6,20 69:5 88:5	151:23 153:10
public 4:22	quantification 30:13 153:7	quiet 96:19 quite 12:12 31:17 52:18	89:18 94:17 113:15,19,19	records 95:6
publication 124:7 127:23	quantify 58:10 60:5 134:6	125:14 127:15 128:6	118:20 124:23 135:3 139:13	red 32:16 80:11 83:2 98:5
publications 53:21	quantitative 30:12 102:16		141:8 145:12 153:7	101:24 111:7 112:1 113:17
publish 124:10	question 5:9 8:10,15,15,21	R	reason 32:14 99:11	114:22
published 124:4 124:4,8 127:18	8:23 14:2,4 30:1,24 33:14	R 2:1	99:11	reduce 100:8 152:22
128:11	39:2 40:10 42:7 45:13	raise 5:11 146:22 147:1	reasonable 62:20 78:5 144:13	reduced 100:15 101:21 123:5,5
pull 27:3 103:19	49:6 51:12,17 54:8 57:20,22	raising 102:7	reasonably 133:17 134:1	reduction 109:18 140:8
pump 42:23 43:10,12 44:24	58:16 61:2 62:3,11 63:6	ran 100:23 121:9,10,11	reasons 52:18 134:8 146:22	refer 83:19 119:20 143:17
pumped 46:4	63:15,18,19,24 70:5 71:13	range 35:12 38:19 52:4	recall 14:20 20:18 29:13	reference 27:4 104:7 111:23
Purple 20:6	72:5 77:10 78:14 83:19	62:14 63:21 66:7 69:8 70:7	56:16	117:13 143:2 146:12 147:17
purpose 148:18	84:22 87:12 89:7,13 91:12	78:4 80:22 109:5 111:9	recent 10:3,5 30:10 105:14	referenced 20:16 33:15
purposes 138:10 144:19,24	91:14 92:15 94:3 96:2	112:12 147:5	121:1 123:23	85:4 113:5 117:8 140:22
146:9	97:19 101:13 109:17,21,24	Rankin 34:10 73:20	recently 10:1 99:17	149:9
put 14:7 16:13 35:3 41:5	111:6,12 114:6 115:3 119:16	Rankin's 70:23	recess 154:8	referencing 35:16
47:12 74:22	119:19 133:3 135:5 138:11	rapid 34:10	Reclamation 23:22	referred 16:17 39:8
96:12,14,15,16	138:15 139:2	Raritan 101:1,1 128:22	recognizing 108:9	referring 8:6,7 17:9 19:11
105:20 106:8,9		RAS 145:24	recommend 93:6	33:16,23 67:13 73:13 92:1,10
106:11 127:12		rather 23:12 143:9	recommended 101:18	94:21 95:24 96:5,22 101:15
127:14 137:8		reaching 110:24	record 5:18,20 5:24 13:19	
146:13 153:13		read 5:2 25:6 61:22 82:16		
Q		85:22 91:13 121:22 122:8		
QHEI 8:10,16 8:18,19 34:9				
40:15,16,21 62:14 63:8,20				

101:17 111:13 111:18 119:11 124:2 140:17 143:1 refers 91:15 reflect 72:10 reflective 32:16 134:15 refresh 55:14 regard 117:19 122:9 151:7 regarding 10:9 20:20 63:7 69:21 92:17 112:8 119:12 123:24 regime 54:8,23 Regulatory 56:12 relate 147:8 related 53:15,21 relating 34:22 relatively 91:1 148:5 release 46:8 relevant 20:24 54:7,10,22 72:2 124:17,18 relied 23:24 24:13 69:20 72:9 103:2 rely 71:5 72:8 102:23 104:11 105:23 relying 74:16 98:9,19 104:15 108:11 remember 13:21 13:23 15:1 17:11 37:14 55:13 56:21 59:23 77:19 81:12 103:16 112:23 remembered 45:21 reminded 129:12 remove 153:10	removing 140:5 153:17 repeat 30:1 39:12 92:8 138:15 rephrase 138:17 145:3 report 1:14 13:24 14:3 16:17,22 17:9 26:23 27:9,22 27:24 74:21,23 76:11 112:4,7 117:15 118:1 120:17,19,23 121:4,15,23 122:8,9,24 124:5 135:10 135:15 136:14 138:21 141:4,5 reported 17:8 77:21 78:22 110:7 120:19 155:7 reporter 5:16 55:4,14 155:5 reporter's 27:16 143:15 reports 16:12 17:12 25:19 49:10 56:10 69:18 72:21 75:14,15,19,20 75:22 85:21 86:1,3 94:14 95:2 110:6 112:13 117:7 117:12 138:9 represent 5:14 7:22 64:18 145:21 representation 146:14 representative 109:2 144:18 144:21 145:9 145:14 reproduce 83:4 97:18	request 76:14 requested 107:15 require 83:2 requirements 63:5 84:16 research 19:14 19:17 20:18 39:5 40:1 106:21,22 151:15 researchers 40:5 121:2 123:23 126:4 reserve 28:10 95:21 reservoir 46:6,8 79:10 reservoirs 122:17 resident 112:9 146:5,8 residing 58:19 resolution 142:9 Resources 41:1 respect 8:5 11:7 11:11 20:15 22:19 33:22 56:8 58:4 61:19 63:19 70:6 74:5 97:8 104:16 108:12 117:21 126:18 131:20 137:18 139:3 respond 51:22 101:11 137:10 153:19 responded 99:10 responding 52:15 137:11 response 99:24 100:16 140:9 141:10 153:11 153:15 responsibilities 39:6 rest 23:21 81:10 restate 82:9	restoration 19:24 41:23 restricted 16:9 result 48:15 91:17 100:3 resulted 99:23 resulting 42:10 42:13 results 29:14 113:7 125:7 127:15,15 resume 44:9 reveals 85:6 review 20:9 25:18 63:9 70:8 115:7 148:8 reviewed 73:19 75:5,17,21 77:11 111:2 120:17 124:8 137:22 revise 17:22 rid 106:17 rifle 65:7,14,18 65:20 66:1,2 67:22,23 68:1 68:2,6,10,16 68:18 73:5,5,6 84:2,2,3 riffles 65:10,12 81:16,18 132:5 riffraff 47:9 85:13 89:1 96:15 right 4:14,16 7:23 13:23 14:10 18:9,12 20:10 29:3 30:5 33:21 37:10 40:2 44:4 45:7,10 45:12,16 51:6 60:10 68:22 71:13 73:21 80:24 95:16,21 99:18 102:10 104:19 115:1 125:18 128:6	132:21 134:19 137:18 138:23 141:17 145:23 ripple 12:23 13:1,3,17,23 RIS 109:1,9 145:11,13,23 146:2,5,11 river 1:9 4:7 9:10 11:6 25:14,14,20,24 25:24 26:5 27:12 30:20 34:17 35:21,23 36:10,13,16 37:1,6,14,15 37:17,18,20,22 38:16 39:16 40:15,22 41:2 41:8,14 42:1,2 42:4,5,10,17 45:20,22 46:4 57:21 65:11,17 65:20,21,22,24 66:16 67:3 69:22 72:1,11 78:16,17,20 79:8,14,15 86:24 93:11 98:15,18 100:21 101:1 112:11,24 115:23 116:19 117:4 118:18 124:15,23 129:17 139:19 139:23 143:7 151:16,19 152:1,8 rivers 2:19 32:15,24 33:20 37:14 38:6 41:4 64:14 65:13 66:6 79:3,11 98:13 115:24 116:7,9 119:4 128:18 128:20 roads 11:4
--	--	---	---	---

rock 25:2 39:16 80:3 90:4 150:18	112:14 saying 15:24 50:12,16 52:18 52:24 58:9 65:23 66:5 67:5,11,15,24 68:9,17 69:1,7 86:19 88:7 89:21 91:11 93:16 97:14 100:1 104:13 109:5 111:3 114:17 118:23 118:24 122:11 125:2 134:20	96:18,20 115:5 115:21 116:22 117:15,20 118:1 119:17 120:15,18,20 121:9,11 122:2 122:10,12,23 123:6,13,21,24 124:14,15 125:4,6 126:2 150:24	113:20,24 127:20 134:2 seem 63:8 64:1 94:18 129:6 133:21 137:10 153:13 seemed 57:4 132:19 153:19 seems 77:6 99:8 111:8 113:22 153:15,18 seen 14:5 48:3,5 48:6 52:20 87:21 94:7,18 95:12 99:3 110:14,22 111:4 112:19 113:7,15,21 115:4,20 117:12 118:4 120:6,15 121:18,19 123:4,7 125:24 134:3,5 153:6 153:7	Service 103:7 set 6:2 54:1 66:7 92:23 148:23 setting 147:9 settling 151:2 seven 13:21 53:12 58:7 65:10 shallow 11:20 12:24 32:10 48:10 84:5 shallower 43:5 share 148:9 shared 150:10 sheer 5:7 sheets 73:1 shelter 31:7 32:3 96:4 97:10 shifted 92:12 ship 8:12 9:2 88:12,14,19,24 89:11,16,23 90:16,17,20 92:14,24 138:12 ships 61:8 90:9 shock 56:24 57:12 58:4,11 59:11 60:8,22 61:19 62:5 120:1 shore 9:17 14:19 47:10,12,23 72:18 85:13 89:3 91:5 132:6,15 134:16 shoreline 18:14 18:20 49:4 83:8 90:5 91:7 short 128:7 shorthand 155:5 155:7,10 show 21:7 60:2 86:3 127:4 showed 94:10 117:21 141:9 148:21 showing 125:24
RO8-9 4:9	100:1 104:13	sedimentation 96:10 115:14 115:17 116:1,4 116:6 118:22	seen 14:5 48:3,5 48:6 52:20 87:21 94:7,18 95:12 99:3 110:14,22 111:4 112:19 113:7,15,21 115:4,20 117:12 118:4 120:6,15 121:18,19 123:4,7 125:24 134:3,5 153:6 153:7	
roughly 147:19	109:5 111:3	sediments 9:24 19:20,21 20:24 21:12 22:3 24:10 29:15 49:7 96:8 100:10 115:8 115:11 117:22 118:8 119:23 120:4,12,13,24 121:19 123:2 125:16 126:19 127:4 128:18 128:23 129:3 148:13 149:23 149:24 150:15 150:20 151:2	seibert 7:23 Seibert's 17:3 seine 18:3 seining 134:15 134:17 semester 4:18 send 76:7 sense 150:3 151:1 sensitive 98:1 102:1,20,24 104:13 108:13 108:24 109:6,7 146:21 147:4 147:12 sent 75:13 sentence 33:17 separate 35:7 74:3 115:11 145:12 sequel 153:13 series 84:3 serve 4:3 38:22 90:7	
round 10:23,24	118:24 122:11	see 6:8 11:18 12:20 15:15 16:7 19:1 28:15 30:19 44:20 51:20,22 54:3 78:18 80:5,7 81:23 90:21 93:20 97:2 98:3,7 99:12 100:16 102:20 105:1 108:6 112:22 118:3,14 128:10 135:11 135:14,16 153:11	Seibert 7:23 Seibert's 17:3 seine 18:3 seining 134:15 134:17 semester 4:18 send 76:7 sense 150:3 151:1 sensitive 98:1 102:1,20,24 104:13 108:13 108:24 109:6,7 146:21 147:4 147:12 sent 75:13 sentence 33:17 separate 35:7 74:3 115:11 145:12 sequel 153:13 series 84:3 serve 4:3 38:22 90:7	
rounding 103:5	125:2 134:20	seeing 7:9 16:14 18:21 106:24		
row 6:4,12 57:5	scale 34:11,13			
RO8-9 4:9	scan 28:17			
rubble 90:14	Science 41:22 42:2			
rule 26:9	scientific 107:23			
rulemaking 10:18 143:19	Scientist 2:6			
run 54:2	scientists 153:22			
R08-9 1:9	score 62:14 63:21 70:21 71:2,23 76:24 77:15 78:19			
<hr/> S <hr/>	scored 70:17 72:21 115:9			
S 2:1	scores 63:8,11 64:1,2,8,13,17 65:4 69:14 70:7,13 71:9 71:14 72:9 73:2,10,13,14 74:7,12,15 77:11 78:15,17 78:18 115:8			
Sag 9:11 153:12	screens 57:18			
sake 143:15	se 10:21			
same 21:20,24 36:20 48:19 78:20 79:7,7 120:1,23 145:10,17,24	second 55:5 62:12 64:12 140:14			
samples 20:11 22:4	section 62:12 63:7 65:16,16 72:11 102:20 140:14 147:17			
sampling 25:20 35:2,2 117:20 120:18 122:10	sediment 20:15 20:20 22:4 29:11 49:2			
sand 49:3,3,8 72:17 82:17 96:14 97:4 151:4				
sandy 83:7,8 132:4,13				
Sanitary 8:12 9:2 88:11,14 88:18,24 89:11 89:23 92:14,24 138:12				
saw 11:21 12:17 15:17 18:24 73:23 74:2,8 74:13,14				

shown 99:4 153:18	42:21 46:3 47:20 65:9	83:10,11,14 84:17,20 85:8	someone's 113:6	121:2 123:23 126:5,6
shows 112:21 113:15 123:4	68:3 84:1,10 84:18 91:9	85:8,9,15,21 85:24 90:5	something 21:19 38:16 46:24	spawn 37:2 43:24 83:12
Shundar 2:7 4:13	94:9,15 97:1 98:4 114:23	93:8,8,13 94:17,23 95:5	61:14 76:15 78:13 87:1	130:3,6 131:2 132:2,5,5,7 133:22
shut 57:1,8 60:22	123:17 134:14 142:20 153:14	95:24 97:3,5 98:1,5 99:5,12	94:22 96:15 97:5 104:22	spawning 37:23 43:7 44:1 84:8
side 6:3 47:23 114:2	smaller 6:10 16:5 85:7	99:21,21 100:8 100:11,11,15	137:14 148:2 150:15	84:19 131:10 131:17
Sided 68:3	145:20	101:20 103:6	sometimes 20:24 21:3,6,11	speak 5:15 122:5,7
Siegert 94:12	snapshot 84:14	104:20 106:14	37:17,18 40:5 48:11 67:15	speaking 5:16 101:13
Siegert's 135:11	Sobaski 27:15 27:18	108:1,4,5 110:1,2,5,6,9,9	129:19 134:15 149:22	species 26:2,4 33:19 34:15
Sierra 2:20	some 9:5,7 10:9 10:22,24 11:2	110:22 111:1 111:20 112:6	somewhat 38:13 69:20 77:2	35:18,20 46:10 49:15 51:15
significance 67:17 86:18	11:12,18,20 12:1,23 13:13	112:12,14 113:21 115:24	91:2 108:2 125:6	53:9 57:14 60:15 63:3
significant 56:19 57:4	14:19,22 15:21 16:13 19:7,18	115:24 116:2,5 116:6,13,17,18	somewhere 81:10 101:4	64:19 67:4 71:4 79:7,20
60:2,9,14 71:4 96:18 110:12	20:2 21:24 22:1,2,10,24	117:11 118:11 118:12,13	111:11 113:1,5 126:13	80:6,8,8,11 82:24 83:1,14
110:15 119:1 153:2,4,21	24:10 25:2,21 26:2,7,8 29:1	119:23,23 120:3,4,4,8,9	sorry 13:12 14:14 17:18	84:15,15 85:15 87:10,15 88:2
silt 23:13 116:6	30:3 31:10,15 31:15,19,19,24	120:11 121:2,7 121:19 123:1,3	29:8,19,24 31:13 38:7	88:8 93:5,13 93:19,22 94:5
similar 22:22 38:14 47:3	32:3,8,9,14,23 34:18,23,23	123:15,15,23 124:18 125:10	49:19 76:20 77:7,13 88:20	96:5,6 97:11 98:1,3,6
48:3 94:11,13 121:12 122:16	36:1,19 37:3,4 38:20,22 40:7	125:15,16 126:16,20	92:11 95:14 111:9 128:3	100:11 101:16 102:20,24
152:7	41:15 42:23 43:6,8,23,23	127:2 128:7,24 129:10,13	138:14 150:8	104:5,14 105:2 108:13,20,22
simple 48:23	44:1 45:20 46:11,15 47:11	131:5,23 132:12 134:10	sort 37:16 40:5 42:5 47:20	108:24 109:2,4 110:22 112:6
since 9:20 19:7 20:7 24:19	47:13,15,21 48:6,9,9,12,15	137:9 140:1,6 141:22 142:3	51:16 66:1 79:23 81:11	114:19 115:1 120:9,11 131:7
25:9 76:6 100:22 107:18	49:15 50:3,4 50:15 53:20	145:20 146:21 150:22 151:17	99:3 109:21 113:8 118:19	136:8,16,19 137:2,3 139:17
sink 90:8,9	56:12 57:2,3 58:24 59:3	152:2,8,12,12 152:23 153:10	119:24 130:5 131:9 142:5	140:13 141:21 143:23 144:4
sinuous 37:15	60:4 61:5,7,10 61:10 63:14	153:15,17	147:5	144:11,18,18 144:22 145:9
sit 6:4,11	64:22 68:1 69:20 71:15,20	somebody 135:13	sounds 77:20	145:14 146:4,8 146:9,21 147:1
six 36:19 65:9 147:22 148:8	72:18 73:2,10 73:12 79:4,4	someone 13:20 44:21 50:13	source 109:16 121:7	147:3,5,22 148:5,8 150:10
150:10	79:21 80:5,8 80:11 81:19	66:8 77:21 86:5 96:24	sources 103:10	
size 13:15 24:4,6 30:13	82:21 83:2,9	123:8 148:20 153:1	south 24:18 61:8 143:5	
skip 8:14			Southern 41:13	
slightly 121:9 125:2 144:5				
slower 81:9 85:8 123:17				
sluggish 83:14				
small 21:2 31:5 34:18,18 36:5				

152:2,3	83:13 98:12	storage 42:23	33:14,15,18,19	83:4 97:17
specific 12:2	115:15 116:7	43:1,11 44:24	33:22,24 34:1	130:3 131:2
23:1 34:15	116:10 118:10	45:19	34:3,4,19,20	132:2
71:22 90:19	135:18 155:1	storm 153:17	35:15,19 36:18	sucker 101:24
95:15	stated 147:21	straight 7:16	39:9,12,14,14	102:19 103:1,8
specifically 9:6	statement 62:11	91:1	39:15,16,17	104:10,12,17
9:15,22 83:20	62:17 71:8	stranded 37:4	40:3,6 53:8,11	106:2 108:12
108:10 109:13	79:24 89:9	strange 51:16	53:14 54:7,9	111:8 114:22
143:8	111:14 114:16	strategy 149:14	54:21 56:17	130:2 131:5
specifics 90:1	151:3	150:5	59:5 60:4 76:5	132:8,22
spectrum	statements	stream 65:9,10	76:8 100:18	142:21
146:15,15	30:17 89:17	65:19 67:21	119:23 126:22	suckers 31:24
147:5	95:24 113:12	126:15	129:3 134:2	32:12 33:5
speculate 51:1	118:7	stress 120:9	135:6,19 136:7	112:2 113:16
speculation	states 96:3	stressed 135:8	137:5,21	sudden 57:10
21:15	stating 123:12	135:10,16	study 11:24 24:1	101:6,8
spell 27:17	station 25:21,23	stresses 100:6	26:19,21,23	sufficient 94:4
spend 11:2	53:13 55:20	100:14 135:23	27:8 29:2,6	111:16 131:12
spending 32:4	56:4,8,18	152:9,12	36:9 50:13,18	132:17
spent 36:15	69:23 73:4	stressor 110:12	52:7 53:5 56:2	suggest 76:3
spillway 12:11	126:12	120:10 140:1,8	56:7 69:12	suitability 96:6
13:4 15:15	stations 25:22	stressors 140:2	94:10 113:6	suitable 84:19
16:5	61:20 62:2	152:21 153:2,8	117:14,19	suite 2:15 3:3
sponsored 19:16	124:19 126:11	153:9,11	121:1 123:23	21:4,18
spots 140:4	126:14,23	stretch 11:5	124:9,13	suited 112:11
spring 37:1 46:5	127:2 153:13	66:11,11	studying 34:6,7	summarize
SS 155:1	station's 59:13	stricter 152:18	36:20 67:8	15:14 29:17
stable 47:15	statistically	strike 13:13	136:23 151:18	56:14
staff 5:19 19:20	59:18,22 60:2	46:22 137:19	subject 35:15	summary 28:1
20:12 30:9	60:9	143:24	submersed	summer 39:22
40:17,24 41:15	stay 45:1	stripe 20:6	118:21	46:2,6 111:15
stages 32:8	stayed 40:19	129:13	submitted 56:11	sun 31:9,15 43:6
stand 146:5	41:20 42:5	striped 129:16	107:8	97:15 139:17
standard 147:9	staying 92:21	129:17	subsection	148:17 149:6
standards 1:5	stays 116:22	stripped 60:17	145:18	150:20
4:5 102:5	steady 43:20	structure 90:7	subsequent	sunken 90:6
112:8 152:17	99:3	96:12	40:11	supervisory
152:20	Stefanie 2:11	structures 11:22	subsequently	20:8
start 42:14 79:5	Steven 27:15	91:19 96:3	19:22	supplemental
103:19 111:17	Stickney 9:8	students 10:23	substrate 23:10	107:15
116:18 145:15	10:12,19 50:4	studied 38:24	23:16 82:18,20	supply 28:14
started 9:8	126:13	51:13 68:4	83:10 149:3	127:24
10:12 25:11	still 41:5 45:7	128:18	150:17	support 70:10
61:10 101:5,7	68:2,18,19	studies 8:19,21	substrates 23:5	79:24 97:20,21
151:17	77:13 78:4	9:20,23 19:7,9	82:7,11,12	98:20 114:10
starting 24:17	96:7 114:6	19:11,19 20:2	successful 46:20	114:13 132:17
Starved 25:2	117:11 152:1	20:3,5,6,16	148:10,24	133:5 140:12
80:3	stop 12:16 49:5	21:6,24 22:12	150:6,11	141:20 145:2
state 5:13 24:21	59:7	24:16 29:22	successfully	supported 98:11

121:4	swim 52:11	131:11,18	50:17 53:11	term 37:8 51:24
supports 125:1	swimming 17:20	149:4	62:4 73:1	52:2 71:21
suppose 14:8	sworn 6:23,24	take 49:13 54:19	74:16 75:5	83:21 87:16
supposed	7:2	54:20 55:7	87:18,22 88:5	89:19,20 109:6
105:24	synergism 22:10	70:2 84:24	112:16 118:13	114:7,8,12
sure 13:11 15:7	synergistic	104:1 116:24	126:3 132:14	135:10,15
20:23 29:22	21:16	117:14 125:16	133:12	138:6,6 142:4
32:19 33:3,12	system 1:8 4:7	135:17 142:12	telling 116:10	145:14
34:5 35:6	9:20,21 10:2	144:6 151:12	temperature	terminology
42:12 47:3	19:8,20 24:24	151:13	52:10,12,15,19	142:6,8
50:23 52:24	34:7 35:1 50:1	taken 55:9 122:6	52:21 94:16	terms 12:20
56:14 59:9	53:15,16,19	151:24 154:9	100:8 101:13	15:14 27:7
62:1 66:22,23	62:21 64:13,20	155:11	102:20,24	29:14 49:20
67:9 70:20,24	69:9 72:1 79:1	takes 88:2 93:4	103:3,4,8,13	57:11 61:15
76:6,10 78:8	79:19,20 87:17	121:16	104:8,13,20,23	69:11,22 71:21
82:2,3,5 83:23	88:7,10,16	taking 145:18	106:3,5,19	72:2 75:16
86:11 87:18	94:19 97:18	talk 74:22 76:4,9	108:3,13,17,18	90:22 99:6
88:4 89:7 92:9	99:7,13,20,24	84:1,2 94:24	108:24 109:5	112:17 120:2
102:14 103:14	100:6,22 101:9	143:13	110:4,11,15,21	122:21 141:14
103:22 105:10	101:20 111:17	talked 47:7	111:7,24 112:5	142:11 144:15
107:16 116:4	114:6,9 115:7	66:15 85:5	112:12,19	150:4
128:11 130:24	119:19 122:4	92:2 120:23	113:17,23	test 21:2 121:9
131:18 135:2	122:13 127:3	129:2 135:23	145:19 146:12	121:12 127:6,8
143:14 147:12	135:10 136:8	talking 13:16	146:19 147:6	testified 7:3 30:3
148:14,16	140:3 147:3,13	25:9 26:15	temperatures	62:24 72:1
surface 9:18	148:10 149:3	29:23 30:21	51:14,19 52:5	94:12 102:19
surprise 139:24	150:12 152:14	49:7,20,24	53:8,9 101:14	152:6
surprised 11:17	152:21 153:16	55:19 65:21,22	101:19,21	testifier 5:4
survey 8:19 9:1	153:18	68:24 69:7	102:2,9 104:12	testifying 69:8
9:5 10:12,17	systems 39:18	74:1,20,24	108:15 109:3,8	99:18
11:9,14,15	51:21 64:16	75:20,22 77:14	109:9,18	testimony 4:22
19:19 24:1,15	66:13 67:8	80:22 81:22	110:20,21	4:24 5:1,3 6:13
24:20 25:8,12	76:5 86:24	82:4 93:22	111:13,14,18	7:6,8 8:6 16:24
25:18 26:11,16	100:23 111:22	95:3 120:2	111:19,20	17:3 25:6
30:9 36:14,19	S-O-B-A-S-K-I	124:24 141:1	112:4,15,22	26:21 33:16
40:13,24 41:5	27:18	talks 121:15	113:19 114:20	35:16 62:12,17
69:12,21 80:3		tank 52:8	137:6	63:7 75:2,23
86:1		tanks 54:3	temporarily	78:2,23 80:14
surveys 8:11,16	T	Tanner 4:11	112:9	83:22 91:15
10:20 30:8,9	T 44:14	targeted 93:18	ten 7:13 25:16	92:1,8,17 96:3
40:14,15,17,21	table 103:14,16	TARP 99:20	55:7 131:7	102:22 113:6
40:22 41:2,8	103:18 105:15	153:16	132:23 134:7	115:4 117:17
41:10,11 65:1	109:15	taxa 147:22	tend 22:3 52:5	118:2 121:23
68:21	tail 17:15 18:1	150:10	66:13 87:10,14	122:9 125:23
survival 150:2	19:5 67:21	Tazik 27:15	96:16 134:13	135:11 140:11
survive 61:17	68:8,10 73:4	technical 4:16	146:20	140:23 142:23
Suzanne 7:22	76:23,24 77:3	tell 14:2,12 22:6	tended 35:10	143:2,11
swallows 20:4	77:8,9,16	24:22 33:6	tendency 62:6	144:23 147:16
swear 6:16,19	80:18 81:16	35:14 42:14	tends 32:24	thank 6:22
	82:14 85:5			
	130:21,22			

26:14 76:20	94:17 112:16	109:10 110:3,5	97:4 128:6	28:5,9,16,21
109:12 154:2	things 9:17 21:5	110:11 113:4,9	137:13	39:20 55:6,12
Thanksgivings	36:7 40:19	113:20 114:19	threatened	74:18 75:6,10
57:5	47:5 48:23	115:1,18	46:10	75:18 76:13,19
their 19:23	49:16 65:8	116:11 118:3,8	three 24:5 58:7	105:16 106:7
21:24 32:3,4	70:14 75:5	123:22 125:7	76:4	106:18 107:17
33:2 36:2,4	85:14 93:2,6	126:6,12,16	thresholds 108:1	119:7 127:16
40:5 41:2,8,9	93:15,17 99:8	128:3,24	thriving 121:16	128:5,14 154:4
48:4 53:15,15	99:23 101:9	129:10 133:1,7	122:15	tissue 29:11,15
53:16 62:6,19	113:21 114:12	133:9,15,16,20	through 24:7	title 27:11
66:18 67:5	122:18 123:10	134:7 136:16	35:13 37:16	today 4:10,22,23
68:1 72:3,10	132:12 147:8	137:3,14 138:9	39:3 40:12	6:13 7:24
73:9 79:4	147:12	139:13 141:7	41:12 42:6,24	35:10 98:24
84:16,20 86:18	think 9:3 13:18	142:2,20	43:16 54:3,15	99:16 154:1
86:19 89:16,22	13:20,21 14:3	144:12 146:13	57:18 58:2	together 110:3
91:23 94:14	14:24 15:6	146:16,17	69:17 81:12	told 44:19 64:24
112:11 115:12	17:5 24:8 27:1	147:4,24 151:8	90:24 91:6	120:17
121:3 123:19	27:2,2 28:1,7	152:5,8,20	95:2 105:1	tolerances
124:18 125:1	29:11,16 30:16	153:24	107:10 123:10	146:15 147:6
126:10,12,18	32:1 34:9 38:5	thinking 24:13	135:14 141:15	tolerant 140:13
127:22 129:5	42:18 43:11	79:16	throughout	140:13 141:20
131:15 133:4	44:8 47:6,8,11	third 33:17 63:7	85:23 90:17	141:20 142:3,4
133:23 135:9	47:17,19 48:6	Thomas 2:5	115:15,15	142:13,19
136:1 137:23	49:10,23 54:13	4:24 6:21 7:1,5	TIA 124:16	143:22,23
139:18,21	54:16,21 57:14	7:9,21 13:12	125:3	144:4,4,11,11
141:8,8 148:11	57:22 58:4,16	21:10 22:19	time 5:15 9:13	147:14 148:15
148:18,23	59:22 61:13	26:19 28:24	11:2 19:16,18	tolerate 148:12
149:8,13,17,22	63:2 64:8,9,12	40:10 47:18	22:21 27:11	tool 34:11
150:21 151:5	64:17,21,24	55:18 58:3	32:5 34:6,16	top 43:13 112:22
themselves 9:14	65:8 66:7 67:6	59:7 61:18	36:15 39:9	114:1 131:6,7
74:3 129:7	69:17,24 70:1	71:7,24 74:11	55:22 60:16	132:22,24
thermal 52:7	70:5 71:3,6,20	76:9,22 80:13	71:1 84:24	148:1
54:8,11,23	72:4 73:10,17	84:21 87:12	87:8 105:19	topic 54:20 87:8
55:1,3 56:17	74:15 75:13	88:23 95:9,22	110:20 112:7	128:17
57:20,24 61:2	76:8 77:7	105:3 108:9	115:18 117:14	topics 54:16
61:3 101:18	78:21 79:5	119:10 127:17	118:17 142:13	total 13:22
102:5 108:10	80:10 81:10	130:13 131:20	146:24 151:14	73:11 145:18
108:22 112:8	82:16 85:4	142:17 143:21	times 10:21 20:1	totally 33:3 70:3
112:20,24	86:12,22 88:8	144:23 145:8	20:8 22:24	72:8 82:15
113:5 145:2	89:21 90:16,18	149:7 154:2	26:3 32:9	85:20 87:18
146:15	92:5 93:4	Thompson 1:16	37:21 54:24	112:17
thermally	94:12 95:1	THORNBURG	55:2 56:24	tox 45:21
112:10	96:23 97:11	3:2	58:5,7 82:20	toxic 21:1,11
thesis 36:11	98:21 99:19,22	though 47:5	100:9 110:9,22	22:3,11 119:24
thin 47:20 48:20	100:7,8,9,14	68:19 74:15	111:15 112:4	120:4,24
thing 20:23	100:14,15	78:3 102:8	118:16	121:19 123:2
21:17,20 22:1	101:10,20,23	thought 26:16	Tipsord 2:4 4:1	124:23 125:11
24:12 48:20	102:6 103:24	40:7 47:5	4:2 6:14,18,22	125:13,16
57:3 87:21	105:12,13,13	66:10 77:2	7:15 27:20	126:19,24

127:5,6 128:18	50:7,17 57:19	139:5	49:6 50:2,7,8	84:7 87:16
128:23 129:3	59:10 71:8	unclear 77:14	50:19 51:8	89:20 114:8
toxicity 19:21	74:9 86:16	under 47:22	54:8,11,23	116:3 125:4
20:20 21:8	118:4 128:24	113:13 124:21	61:21 67:14	138:9 142:4,8
115:5,12	131:19,20	128:15 149:3	69:13,22 77:15	142:11,22
119:17 120:15	133:15 142:7	150:6,17,18	78:5 80:19	144:17,22
120:20 121:7	143:13 144:14	underestimate	81:5,16,21	145:1 146:4,8
121:15 122:2	147:4,8	64:15,20 65:5	82:13 85:2,18	146:12,24
122:12 123:6	turbid 116:22	73:11	86:8,20 91:16	useful 25:7
123:21,24	118:14	underlying	91:24 92:6,12	using 51:24 52:3
124:15 125:8	turbidity 115:20	58:16	92:13 93:24	66:7 84:9
traditional	116:21 119:10	understand	94:6,10,13	86:17 89:19
130:5	119:12	40:21 45:15	97:8,21 100:2	111:24 112:12
traffic 47:14	turbine 43:16	51:4 52:19	100:21 101:14	124:15 145:10
100:12	turn 5:10	60:20 62:13	103:2,4,7,12	145:19,20
trailer 54:1	turns 57:9	63:17 67:9	104:7 108:2,14	150:3
training 151:17	turtle 46:9	78:2 80:24	109:18 110:12	usually 52:11
transcript	turtles 43:24	86:16,17 118:5	111:7,14 112:5	57:2 83:9
155:10	46:12	127:17 131:20	115:22 116:4	96:19 130:4
translation	twenty 154:6	135:1	117:6,22 118:6	132:4
111:10	two 25:10 57:4	understanding	118:9 119:13	utility 56:3 61:3
treat 79:17	58:7 65:11	34:2 63:15	119:20 120:21	utilize 36:16
treatment 81:2	66:3 68:23	66:8 67:1,17	126:12 130:8	utilized 127:7
tree 20:4	103:9 108:22	75:11,13 95:6	130:16,20	UVP 29:21
trees 90:10	110:3 113:1	125:4	132:11,18	U.S 106:20
tributaries	122:18 125:7	undervaluing	135:7,20 141:2	
66:17 81:19,21	127:6 148:22	66:20	143:8,9,11,17	<hr/> V <hr/>
82:4	149:16	unexpected 57:2	144:3,9 151:11	valley 46:3
tributary 65:19	two-and-a-half	uniform 91:2	152:16	value 64:20 78:1
tried 35:7	66:3	unimpounded	upstream 9:9	78:3
trip 10:3,5 47:8	tying 35:9	152:18	15:3 18:10	values 63:1
62:6 85:19	type 8:24 19:11	unit 4:16	use 31:18 32:19	78:21 108:4
117:1	21:5 30:22	university 121:3	32:24 33:9	137:8
tropical 61:4,16	38:22 93:22	126:5,8	37:22 43:7,24	Vandalia 21:21
trouble 33:8	94:1 97:12	unless 66:19	50:7,9 65:24	variables 22:14
true 62:4,9 79:1	130:1,14,16	148:20	70:11 73:8	22:16
82:24 118:18	131:1 132:1,10	unlike 106:14	79:16,22 80:4	variation 60:5
155:9	133:9	149:16	83:7,23,24	103:11
try 27:6 50:21	types 32:8 36:7	unlikely 100:13	86:10,21 87:7	variations
70:1 71:16	66:4 93:4,15	unreasonable	90:12 113:10	126:23
72:22 79:2	typical 38:12	50:16	125:2,3 131:23	variety 21:16
104:3 109:15	T-A-Z-I-K	until 5:9 101:4	135:10 138:5	31:18 37:21
119:8 138:16	27:15	unusual 148:4	144:19,24	38:15 52:17
147:11	<hr/> U <hr/>	upper 8:11 9:1	146:2,9	64:18 85:7
trying 15:14	UAA 112:4,13	11:3,12-12:3,8	used 34:11,15	86:5,22 91:10
27:2 31:1 33:6	UDP 63:9	22:20,22 24:17	37:8 43:18	114:11 147:3
34:2 36:7	UILT 108:15	24:19 30:4,17	47:10 63:1	150:6 152:21
41:24 42:18	UIW 136:2,11	30:18 35:23	69:3 73:7	various 33:19
45:14 48:5	137:24 138:6,7	38:2,8 47:1	82:21 83:21	40:3 49:13
				75:14 108:1

139:17	114:23	85:5,8,12 86:9	133:16 138:9	109:1 110:19
vegetation 12:23	walls 91:2	86:21 87:2,6,7	145:6 147:7,8	112:13,13
13:16 16:10	want 6:18 7:16	87:19 90:6,7	149:21	115:14 116:14
23:13 24:2,11	28:14 63:17	90:14 93:8	ways 110:5	116:20 117:7
24:14,23 25:4	76:6 80:21	94:11,14 96:19	116:5	118:20 120:10
26:20 27:13	89:5 92:13	98:8 99:1,9	website 28:22	120:23 121:23
29:2,21 30:4	93:15,22 104:2	100:22 101:5	weed 11:16	122:5,6 127:21
30:15 33:1	105:3 107:5	101:12 102:8	14:18 15:11,18	129:12 131:14
48:12 72:19	121:10 130:13	104:24 106:19	15:20 17:12	133:14,18
83:12 85:9,11	138:4,23	115:21 116:17	30:19,22,23	134:1 135:22
90:3 91:8	142:12 144:20	116:21,22	31:4,8,10,12	139:9,16,19
116:14,15,17	147:10 151:6	118:16 121:11	31:18 32:13,17	140:3 141:4
116:20,23	wanted 96:24	125:5,5,19	33:9 71:1	145:5 146:11
117:10,13	wants 6:11	130:21,23	80:10 118:15	146:14 148:14
velocity 80:22	warm 57:9,11	131:11,18	weeds 23:14	149:11,21
81:11	warmer 102:1	134:13 136:4	weedy 132:4	150:14 151:20
verify 148:1	washed 82:19	137:9,17 141:1	week 43:2 65:22	went 5:24 9:9
versus 34:3 59:4	wasn't 17:19	148:4,19 149:5	weekend 43:14	10:14 13:9
69:23	20:13 35:18	149:16,19	weekly 44:2	17:7,19 18:17
very 8:21 9:21	48:14 74:9,16	152:2,11,17	106:5	27:9 41:9
12:10 18:23	76:11 78:8	153:17	welcome 6:8	were 11:21 12:8
22:14 34:18	142:10	waters 17:14	well 4:19 12:10	15:24 17:7,9
37:15 57:10	Waste 19:14	18:1 67:21	13:18 14:1,19	19:5,9,11,19
59:20 67:4	20:17 39:4	79:16,22 80:18	15:19 19:13	20:13,19,21
78:3 84:1,9	water 1:5 4:5	81:16 82:14	22:23 23:8,11	21:2,4,21,22
88:5,15 96:19	15:21 17:15,17	116:19 118:9	23:23 25:10	22:2,5 23:3,14
101:19 108:18	18:5,22,23	118:11,12,14	27:2 28:16	24:9 27:14
119:15 127:14	19:5 23:22	142:2 152:4	31:24 32:7	29:10,23 33:24
134:11,14	29:9 32:9,10	waterway 1:7	33:7 34:5	33:24 34:16,20
148:18,23	35:3,4 36:1	4:6 10:2 127:3	35:17 36:11	34:21,22 35:1
viable 148:21	38:15,21,22	130:3 131:3	40:16 42:12	35:9,11,12,13
view 68:18	43:2,4,4,5,12	132:3 135:7,20	49:10 51:1,19	35:17 36:7,14
87:11,15 88:9	43:16,21 45:19	141:11 142:1	53:12,18 54:18	36:14 39:4,12
115:19	45:24 46:1,1,7	waterways 9:6	56:10,21 57:23	39:16,17 40:7
visible 9:17	46:8 47:23	9:12,14 10:17	58:7 59:17	40:12 43:3
56:23	51:14,19 53:9	47:6 62:15	62:7,24 63:14	45:4,7,8,11,17
visit 11:7,11	53:17 54:2,3	63:21 96:11	64:7 68:11	46:18,19 47:12
12:4 22:20,22	57:9,10,12	99:19 124:21	70:20 72:24	50:3,12 53:11
23:1 67:16	61:14 62:15	124:24 140:12	73:16 78:9	53:23 54:24
visited 14:11,21	63:5,12,22	141:19,22	79:6 80:7,21	55:2,2,11,13
19:2	64:6 66:17	Waukegan	83:2 85:4,20	55:19,23 56:2
visually 9:16	68:8,10 69:11	39:14	86:2 87:9	56:10,11,15
	69:16 70:11,19	wave 48:19	88:15 89:8	57:3,16 58:9
W	71:11,17 72:17	waves 48:1,11	93:2 94:7 95:9	58:10,16,19,20
Wacker 2:15 3:3	73:4 76:23,24	way 15:2 30:2	96:9 98:21	58:21,23 59:10
wade 18:13,19	77:4,8,9,16	34:10 43:23	99:17 100:5	60:21,22 64:2
wait 5:9,11	78:6 79:9 80:4	44:2 47:7 65:9	101:17 103:1	66:12 70:9,16
124:12	80:18,20 81:9	99:10 109:10	103:18 105:21	73:13,14,17
walk 18:7	82:12 83:12,14	109:22 120:19	106:2,4 107:14	74:8 75:1
Walleye 98:4				

82:17 90:20	39:22 50:1	44:21 53:12	Yoder's 73:15	2
91:24 93:13,14	77:3 84:2,3,14	62:7 100:24	74:5 104:15	2 8:15 62:12
96:13,22 97:2	87:9 100:21	104:5	young 31:5,9	63:7 102:20
99:15 101:2,8	124:15 125:22	working 15:2	36:5,6 37:3,24	147:17
101:21 102:5	141:1	25:13 55:23	47:16 97:18	20 52:9 99:2
104:15 108:11	wide 128:12	101:3	131:6 139:21	115:3
108:13 112:4	wider 66:7	worried 31:6	147:20	2003 112:7
114:20 115:8	widespread	worse 116:9	Z	2008 40:12
117:9 120:1	110:7	wouldn't 71:2	zero 67:23 68:16	2009 1:16
121:6,8 124:19	wild 10:1 103:6	82:15 84:11	73:5	124:13
126:11,19	104:20	130:24 139:24	0	21 119:16
127:6,8 128:23	Williams 2:12	write 112:7	084-0003437	22 130:1
129:3,9,13,22	21:9 107:4,14	written 26:23	155:17	22,000 147:19
131:7,16 133:1	138:4	127:18	1	24 135:5
135:23 140:4,5	willing 145:3	wrote 70:20		25 136:6
142:7,11 144:8	windy 37:15	X		26 26:1 103:13
147:20 151:18	wintertime 46:5	X-number	1 8:10	140:11
weren't 20:10	withdraw 145:4	114:13	1:00 154:7	27 142:22
95:5 101:9	witness 6:17,23	Y	10 65:13	28 111:8 112:2
we'll 28:13,15	6:24 14:6	yeah 17:10	10,000-meter	144:6,16
76:17 100:16	17:21 21:14	19:13 21:14	65:16	29 111:8 112:2
107:19 109:12	23:23 25:10	28:8 39:13	11 83:19	147:15
138:11 154:5	26:12 27:23	86:22 141:17	11-year 40:11	
we're 26:14 31:1	39:23 40:2	year 11:1,12	12 91:12,14	3
49:21,24 54:10	75:4,9,12	14:21 22:20	12-year 39:3	3 8:23 140:14
63:24 67:8	77:18 81:7	26:13 31:5	13 94:3	30 52:9 151:9
100:12 104:1	90:23 93:1	37:19 44:5	1300 2:15	301 1:12 4:8
106:9 109:5	95:4 105:11	54:24 55:21	14 1:16 96:2	302 1:12 4:8
127:3 150:3	107:21 127:21	57:1 71:1	15 65:14 97:19	303 1:12 4:8
we've 20:2,3,5,5	128:2,9,22	85:19 88:2,3	99:5	304 1:12 4:9
30:21 36:18,21	138:14 141:3	117:11,20,23	16 101:14	312 2:17 3:5
44:1 91:14	wood 20:6 61:5	118:6 131:7,8	17 102:17	32 6:8
99:2,8,22	61:6,7,16	147:20	18 109:17	32nd 4:20
129:2 153:20	word 77:10	yearly 30:9	19 111:12 114:6	327 7:9,10,12
while 23:3 41:9	wording 144:21	years 23:1 24:21	1950's 24:20	8:8
121:15,18	words 49:1	25:17 30:11	1960's 25:12	328 106:24
129:15	56:14 64:17	36:19 37:20	36:21 98:23	107:1,2
white 101:24	96:17 125:5	38:18 41:6	1970's 100:23	33 2:15
102:19 103:1,8	132:21 133:7	42:19 53:13	1977 106:23	35 1:11 4:8
104:9,12,17	work 10:24	58:8 99:2,5,5	1980's 24:3,7	62:14 112:8
105:24 106:1	13:19 24:14	116:17 136:23	26:20 29:23	357-1313 3:5
108:12 111:8	36:13 40:4	137:4 141:9	1985 9:20 19:8	
112:1 114:22	42:21,24 51:13	year's 117:1	20:17 39:3	4
130:2 131:5	52:24 53:1,22	yellow 142:21	1988 24:8	4 33:14 143:1
132:8,22	55:19 61:24	Yoder 62:24	1991 9:3 10:11	40 21:18 35:20
142:21	70:23 73:18	73:23 103:2	1992 27:11	43 64:10
whole 21:3	74:6 146:23	107:11 146:13	1994 147:17,21	4400 3:3
24:23 27:23	worked 34:16	146:17	1997 39:3 40:12	45 63:8,21 64:1
37:21 38:15	35:22 42:19			64:3,3,10 69:7
				70:7,18 71:10

71:14 72:22 78:4 115:9 46 77:1,12,15	90's 47:8 117:9 91.4 103:9 95 19:14 20:17			
<hr/> 5 <hr/>				
5 39:2 147:16 50 21:18 24:21 35:20 134:7 500 65:15 500-meter 65:16 66:10 51 107:22				
<hr/> 6 <hr/>				
6 40:10 60 62:14 63:21 64:3,3 69:8 70:7,18 71:10 71:15 72:22 78:4 60's 34:17 99:15 60601 2:16 60606-2833 3:4				
<hr/> 7 <hr/>				
7 42:7 70 113:22 70's 45:23 56:1 98:23 99:15 101:5 79 44:10,11 795-3707 2:17				
<hr/> 8 <hr/>				
8 51:12 80 59:24 80s 76:6 80's 44:9 111:11 117:8 82 106:6 84 103:3 85 19:13 20:7 44:10,11 86 147:22 148:2 89 103:5				
<hr/> 9 <hr/>				
9 62:11 63:19 9:00 1:16 90 101:19				