ORIGINAL

THE ILLINOIS POLLUTION CONTROL BOARD

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

TRANSCRIPT FROM THE PROCEEDINGS

taken before HEARING OFFICER MARIE TIPSORD by LORI ANN ASAUSKAS, CSR, RPR, a notary public within and for the County of Cook and State of Illinois, in Room 2-025 at the James Thompson Center, Chicago, Illinois, on the 18th day of May, 2011, A.D., at 9:00 o'clock a.m.

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

ILLINOIS POLLUTION CONTROL BOARD,
100 West Randolph Street
Suite 11-500
Chicago, Illinois 60601
(312) 814-6983
BY: MS. MARIE TIPSORD, HEARING OFFICER,

ILLINOIS POLLUTION CONTROL BOARD MEMBERS PRESENT:

Mr. Thomas E. Johnson, Board Member
Mr. G. Tanner Girard, Board Member
Ms. Andrea S. Moore, Board Member
Mr. Gary L. Blankenship, Board Member
Ms. Carrie Zalewski, Board Member
Mr. Anad Rao, Technical Unit
Ms. Alisa Liu, Technical Unit

ILLINOIS ENVIRONMENT PROTECTION AGENCY,
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276
(217) 782-5544
BY: MS. DEBORAH J. WILLIAMS,

A P P E A R A N C E S: (Continued)

ALSO PRESENT:

Ms. Stacy Meyer-Glen
Mr. Albert Ettinger
Mr. Fredric P. Andes

I N D E X

	PAGES
Introduction by Hearing Officer Tipsord....	5 - 7
Testimony questions of Dr. David Zenz.....	7 - 103
Conclusion by Hearing Officer Tipsord.....103	- 105

E X H I B I T S

	Marked	Admitted
Hearing Exhibit No. 463.....	7	7
Hearing Exhibit No. 464.....	89	89

HEARING OFFICER TIPSORD: Good morning everyone. My name is Marie Tipsord and I've been appointed by the Board to serve as the hearing officer in this proceeding entitled, "Water Quality Standards and Effluent Limitations for the Chicago Area Waterways System and the Lower Des Plaines River, Proposed Amendments to 35 Ill. Adm. Code Parts 301, 302, 303, and 304." This is Docket No. R08-9, Subdocket C.

With me today to my immediate left is Acting Chairman G. Tanner Girard. To his left, Board Member Carrie Zalewski and to my far right is Board Member Thomas Johnson. To my immediate right is Alisa Liu from our technical unit. Board Member Gary Blankenship and Board Member Andrea Moore are attending a different hearing upstairs and will be joining us as will Anad Rao at the conclusion of that hearing.

Today's hearing is the seventh day of hearings in Subdocket C and, yes, another landmark, the 50th overall in these proceedings.

Today, we're going to hear the testimony of David Zenz. He will be questioned by the IEPA and then Prairie Rivers and the Sierra

Club.

The testimony will be marked as an exhibit and entered as if read. Anyone may ask follow-up questions. You need not wait until your turn to ask questions. I do ask that you raise your hand and wait for me to acknowledge you. After I have acknowledged you, please state your name and whom you represent before you begin your questions.

Please speak one at a time. if you are speaking over each other, the court reporter will not be able to get your questions on the record.

Please note that any questions asked by a Board member or staff are intended to help build a complete record for the Board's decision and not to express any preconceived notions or bias. Dr. Girard?

BOARD MEMBER GIRARD: Good morning. Welcome to historic day 50. I can't think of any other Board proceeding that have had 50 days of hearings. So certainly, this is historic and I'm sure you all share the same joy I do at this moment. Let's get on with it.

HEARING OFFICER TIPSORD: With that, could we have Mr. Zenz sworn in, please?

(Dr. David Zenz sworn.)

HEARING OFFICER TIPSORD: And do we have a copy of his testimony?

MR. ANDES: I do.

HEARING OFFICER TIPSORD: If there is no objection, we will mark the pre-filed testimony filed February 2, 2001, of David Zenz as Exhibit 263. Seeing none, it's Exhibit 263. I'm sorry. Exhibit 463.

(Document marked as Hearing Exhibit No. 463 for identification, 5/18/11.)

(Hearing Exhibit No. 463 admitted as evidence.)

MS. WILLIAMS: Whoops. That was with attachments?

HEARING OFFICER TIPSORD: Yes.

MS. WILLIAMS: Okay. Thank you.

HEARING OFFICER TIPSORD: Based on the size.

MR. ANDES: Yes. That would be true.

MS. WILLIAMS: Good morning, Mr. Zenz.

DR. ZENZ: Good morning.

MS. WILLIAMS: Is it Dr. Zenz?

DR. ZENZ: It is Dr. Zenz.

HEARING OFFICER TIPSORD: Oh, I apologize.

MS. WILLIAMS: It's hard to keep track. We have had so many doctors here.

DR. ZENZ: It's not important.

MS. WILLIAMS: Let's start with my pre-filed question number one today. In Paragraph 1 on Page 1 of your pre-filed testimony, you state, "I was employed by the Metropolitan Water Reclamation District of Greater Chicago in the now Environmental Monitoring and Research Division. I worked on a variety of projects at the District and helped develop the design criteria for the existing District supplemental aeration stations on the Chicago Area Waterway System."

In Paragraph 1 on Page 2 of your pre-filed testimony, you state, "The District asked AECOM to perform these cost estimates in response to dissolved oxygen water quality

standards currently proposed for the CAWS by the Illinois Environmental Protection Agency." A, what existing District supplemental aeration stations did you help development?

DR. ZENZ: I developed the design criteria for the existing side stream elevated pool SEPA aeration stations.

MS. WILLIAMS: All of them?

DR. ZENZ: Yes.

MS. WILLIAMS: And how many of them are there now?

DR. ZENZ: There are five.

MS. WILLIAMS: Can you describe in more detail your involvement --

DR. ZENZ: I can't --

MS. WILLIAMS: -- in the five -- in the SEPA stations on the Calumet River? Sorry.

DR. ZENZ: In 1986 and 1987, the then research and development department conducted a full scale pilot study of the SEPA station technology, which is free fall weirs. From that --

MS. WILLIAMS: For all the stations?

DR. ZENZ: Yes. This was one pilot

study used in developing the design criteria for all five stations.

MS. WILLIAMS: That was your extent of your involvement in the pilot study?

DR. ZENZ: That's correct.

MS. WILLIAMS: Why did the District install the existing supplemental aeration stations? This is Question B.

DR. ZENZ: Yes. It is my understanding -- you have to understand that these stations were completed in the early 90s, many years ago. My recollection is, and I couldn't find any written documents to support this, but this was approved by U.S. EPA as an alternative to installing tertiary treatment at the Calumet plant. That is my understanding.

MS. WILLIAMS: Do you know why they were -- would have been installed in the Chicago river system?

DR. ZENZ: Why they weren't?

MS. WILLIAMS: Why they were.

DR. ZENZ: They are in the Cal Sag.

MS. WILLIAMS: Well, strike that.

DR. ZENZ: Okay.

MS. WILLIAMS: How would you rate the success of the SEPA system's performance in maintaining the existing water quality standards on the Calumet River system?

DR. ZENZ: I can't answer that question.

MS. WILLIAMS: Question C?

MR. ANDES: Question 1-C?

MS. WILLIAMS: You can't comment whether they are performing as intended or with regard to --

DR. ZENZ: I just don't know what -- I'm not familiar with the water quality data.

MS. WILLIAMS: Okay. So you -- do you believe from an operational standpoint they are performing as designed and intended?

DR. ZENZ: Yes.

MS. WILLIAMS: You just don't have an opinion on whether they're successful in improving water quality?

DR. ZENZ: I have no basis for that.

MS. WILLIAMS: Okay.

MR. ETTINGER: I believe Ms. Williams might have been thinking in her earlier questions

about the plants that are at the canal and I think we heard about that. Just to complete things here, when were those put in?

DR. ZENZ: Those were installed in 1979 and 1980.

MR. ETTINGER: And what kinds of plants were those as opposed to the SEPA stations?

DR. ZENZ: They have porous ceramic diffusers in the bottom of the canal, a blower onshore, a blower that delivers compressed air underneath these giant -- the diffusers are placed in these concrete boxes where the air pressure bubbles up and you can you can see bubbles on the surface. So it's a diffused air system. It's completely different from the SEPA station.

MR. ETTINGER: And do you know why the diffused air systems were put in as opposed to the SEPA stations?

DR. ZENZ: I just don't know.

MS. WILLIAMS: Let's go to E.

MS. LIU: Mr. Zenz, may I ask a follow-up question?

DR. ZENZ: Certainly.

MS. LIU: You mentioned that based

on your recollection that the SEPA stations were installed in lieu of tertiary treatment at Calumet.

DR. ZENZ: Sand filters, yes.

MS. LIU: Was that because the tertiary treatment would have removed BOD?

DR. ZENZ: That's correct.

MS. LIU: Okay.

DR. ZENZ: It would have removed BOD and solids from the effluent.

MS. LIU: Okay.

DR. ZENZ: So it's another level of treatment and at that time in the '80s, and I'm just giving you my recollection because I have no written document, and hopefully my recollection is correct, but my recollection is that discussions between U.S. EPA and the District regarding the need for tertiary treatment at the Calumet plant and District proposed installing extreme aeration systems on the Little Cal and Cal Sag Channel as an alternative.

I did find that in 1972, the District presented this plan to the Pollution Control Board and the Pollution Control Board actually said that this was a good idea. That's

all I can tell you.

HEARING OFFICER TIPSORD: Mr. Harley?

MR. HARLEY: Keith Harley, Southeast Environmental Task Force. Do you know if tertiary filters were ever installed at the Calumet facility?

DR. ZENZ: No, they were not.

MR. HARLEY: Thank you.

HEARING OFFICER TIPSORD: Okay. Ms. Williams?

MS. WILLIAMS: For the record, I will go ahead and ask my Question D.

DR. ZENZ: Okay.

MS. WILLIAMS: Is the existing SEPA system capable of maintaining DO levels above existing DO water quality standards 100 percent of the time; and if not, do you know what percent of the time the existing SEPA stations are unable to maintain DO levels above existing DO water quality standards?

DR. ZENZ: I can't answer that question.

MS. WILLIAMS: How would you rate the successfulness of the in-stream aeration station system's performance in maintaining

existing water quality standards in the Chicago River systems?

DR. ZENZ: I just can't answer that question. Again, I might just refer you to -- I know -- I think I just mentioned yesterday that the District produces an annual report, which is sent to the EPA with all the water quality monitoring information that they have, but I've never looked at those reports.

So that would require me to look at 10 years of data, analyze it and maybe do statistics. I haven't done any of that. I can't answer the question.

MS. WILLIAMS: From an operational standpoint, have you found that the in-stream aeration stations have been effective and maintain their operational efficiency over time?

DR. ZENZ: That is my understanding. We have had discussions with the District about those stations. From what I can recall from what they have told me, they are operating from a performance and engineering point of view and they are working nicely.

I don't want to say there's

not problems in operating; there is. As in any mechanical system, there will be. But as I understand it, basically, they're working well.

MS. WILLIAMS: Can you give us an idea from both in-stream and SEPA stations of how much they are operated?

DR. ZENZ: I have no idea.

MS. WILLIAMS: Okay.

HEARING OFFICER TIPSORD: I'm sorry. Mr. Harley?

MR. HARLEY: Do the SEPA stations, in addition to providing oxygen, filter out solids?

DR. ZENZ: No. They are simply -- while there may be some, and there is, some settling of solids in the pools -- in the SEPA stations, I understand there is a free fall weir and it's a five-foot drop and it plunges down into a pool and solids do accumulate in these pools.

That's a maintenance problem that they have. So there is some removal, but it is probably insignificant. I know of no studies to determine what the removal would be.

MR. HARLEY: Thank you.

MS. LIU: Mr. Zenz, I have another question for you.

DR. ZENZ: Sure.

MS. LIU: One of the topics the District has raised as impacting this rulemaking is the possibility of nutrient removal standards in the future. The District had provided some information on the impact of nutrient removal and bacteria removal. I was wondering whether or not you could comment on the impact of nutrient removal -- on BOD removal.

DR. ZENZ: I think I'm going to say I can't answer that question. I'm familiar with the technology to remove phosphorous. We spend a lot of time and effort with clients providing alternatives and designing and constructing facilities to remove phosphorous, but I think that would be a question better answered by an aquatic biologist than myself.

MR. ANDES: If that's information that the Board is looking for, we can certainly provide that.

MS. LIU: That might be helpful.

BOARD MEMBER JOHNSON: If Alisa

asks for it, we will want it.

MR. ANDES: We will get it.

HEARING OFFICER TIPSORD: Mr. Harley?

MR. HARLEY: Do you know if solvents of the type discharged by wastewater treatment plants contribute to turbidity in receiving waters?

DR. ZENZ: In a general sense, the answer is yes.

MR. HARLEY: Thank you.

MR. ETTINGER: You were just asked about phosphorous, would there be some affect on denitrifying from the SEPA stations basically running an aeration tank?

DR. ZENZ: Yes. Well, denitrification actually takes place under anaerobic conditions. It's a different microbial population. Nitrification is an aerobic process converting ammonia into nitrates. When a nitrate is converted into basically nitrogen gas, it's under anaerobic conditions. So no, it wouldn't have any affect.

MR. ETTINGER: I'm sorry. Denitrification, breaking the ammonia down, would not have some --

HEARING OFFICER TIPSORD: Gentlemen,

don't forget you're talking to us.

MR. ETTINGER: Yes. I'm sorry.

HEARING OFFICER TIPSORD: When you face each other, your voices start dropping and I can't -- we can't hear you.

MR. ETTINGER: I apologize.

MR. ANDES: I lost track of the question.

MR. ETTINGER: I lost track of the chemistry. So as I understand the basic process, and please correct me, you start out with ammonia, which is NH, and then we -- what's the term -- denitrify that?

DR. ZENZ: Okay. We actually oxidize it.

MR. ETTINGER: Oxidize that.

DR. ZENZ: Then nitrify it.

MR. ETTINGER: Nitrify. I'm sorry. Denitrification is the next step where we go from nitrate to hopefully into -- back into the air?

DR. ZENZ: That's correct.

MR. ETTINGER: All right. Would this aeration help provide the first step of breaking some of the ammonia down into nitrate?

DR. ZENZ: In a general -- in a general sense, because I know of no studies where anybody has looked at that specifically with the SEPA stations and the Chicago area water system. So I don't know of that, but in a general sense, the answer is it could have.

MS. LIU: Would the following steps necessary to complete the process be able to happen in-stream after that stage?

DR. ZENZ: Yes. They are -- I mean, in a general sense, there is nitrification taking place in Illinois streams. Ammonia being discharged by various point and non-point sources, because the streams are generally aerobic absolve oxygen, the ammonia that's being discharged will be nitrified to nitrate.

Going even further, depending on the situation, bottom sediments in the stream and the anaerobic conditions usually denitrify and bacteria will be present. So there will be some denitrification perhaps happening in the bottom of the stream.

But I'll be very honest and say I am not familiar with what studies have been done

specifically for the Chicago Area Waterway System or the Illinois Waterway System to say how much that affects.

So I'm giving you a general answer for a theoretical stream, shall we say, where this could happen.

MS. LIU: Is that something the District might want to supplement?

DR. ZENZ: Well, that's a very -- that's an interesting theoretical question. I don't think I'm qualified to answer it. I certainly can't speak for the District.

MR. ETTINGER: Just to kind of summarize it, it's logical to think that the SEPA stations are doing some nitrification because that involves adding oxygen to ammonia, but it's not likely that the SEPA stations are helping us at all on denitrification because that's an anaerobic process?

DR. ZENZ: I think that's a fair statement and again, in a general sense.

MR. ETTINGER: I try to do one fair statement a day.

MR. ANDES: So we done with that

one.

MR. ETTINGER: Yeah.

HEARING OFFICER TIPSORD: It's awfully early in the day for that.

MR. ETTINGER: Now I'm free the rest of the day.

HEARING OFFICER TIPSORD: Okay. I think we're ready -- oh, Mr. Harley? Sorry.

MR. HARLEY: Could you describe the relationship between the SEPA stations and the main discharge at the Calumet facility?

DR. ZENZ: I'm sorry. I don't -- I don't understand your question.

MR. HARLEY: All right. Is the water coming from the Calumet wastewater treatment plant, which is diverted to the SEPA stations, or is it simply water taken from the Calumet River aerated and replaced?

DR. ZENZ: It's simply water taken from the Calumet River, which, of course, would contain some effluent from the Calumet Plant, but other discharges, of course, of the water from other tributary streams and so forth, but the SEPA stations themselves are actually onshore, on

the Calumet River system, various parts of that Calumet River system. You take the water out, pump it up to usually 15 feet, it goes over three waterfalls five feet in height, and then back to the stream again.

MR. HARLEY: Thank you.

HEARING OFFICER TIPSORD: Okay. Ms. Williams?

MS. WILLIAMS: I'm going to go a little bit out of order to try and keep us on the same topics.

DR. ZENZ: That's fine.

MS. WILLIAMS: I'm going to ask Question 4 now.

DR. ZENZ: All right.

MS. WILLIAMS: Paragraph 1 on Page 4 of your pre-filed testimony, you state, "Based upon the results provided by Marquette University, the operation of supplemental aeration stations is expected to be relatively infrequent." What does relatively infrequent mean?

DR. ZENZ: Well, if you look at Tables 1 and 7 of my testimony, it lifts the actual hours of operation that's required for

each aeration station to meet the proposed standard. That would be the IEPA standard in one case and the District's standard in the other.

So to meet the IEPA proposed standards, annual operation hours range from a low of 21 hours to a high of 946 hours. Of the 28 aeration stations, these are new aeration stations that would have to be constructed. Eleven will operate 100 hours or less. Eleven will operate 100 hours or less over an entire year. That's only four days out of 365. So in my opinion, that's fairly infrequent.

MS. WILLIAMS: So I would like to go back a little bit to my earlier question, then, when I asked about how often the current stations operate. You don't know the answer to that?

DR. ZENZ: No, I don't. I can tell you that Marquette University took the data for the existing operation of the SEPA stations and put that into their computer model so that whatever existing operation of the SEPA stations is in the model, but I don't have --

MS. WILLIAMS: So you're saying in

the model, they did not assume that existing stations would operate all the time, just that they would operate as they do now?

DR. ZENZ: They assumed that they would operate as they exist now and then they calculated what additional hours would be required to --

MS. WILLIAMS: But you, sitting here today, can't tell us the current number hours they are operating? I just -- I'm missing something. If you're the wrong witness, I can understand that, but I don't understand how you can't know that.

DR. ZENZ: Well, I just -- I couldn't find it.

MR. ANDES: Are you saying that information is --

DR. ZENZ: It's in -- it's perhaps -- I just couldn't find it. I'm sorry.

MR. ANDES: Is that part of the analysis Dr. Melching did?

DR. ZENZ: Yes. You have to understand that Dr. Melching did all these analyses and we did not have that information. It didn't pass through us and I just couldn't

find it.

MS. WILLIAMS: Do you understand why Dr. Melching didn't come to present testimony on this issue?

DR. ZENZ: I don't know.

HEARING OFFICER TIPSORD: Excuse me. Dr. Zenz, I'm looking at Table 1.

DR. ZENZ: Yes.

HEARING OFFICER TIPSORD: And I have a couple questions of Table 1.

DR. ZENZ: Sure.

HEARING OFFICER TIPSORD: But one of them is more -- it has operation hours for 2001. Would that be the current operating hours as of 2001 for the stations?

DR. ZENZ: No, no, it's not.

HEARING OFFICER TIPSORD: Okay.

DR. ZENZ: Let me explain.

HEARING OFFICER TIPSORD: Okay.

DR. ZENZ: Dr. Melching, as all modelers do, has to use the input information, some information from some water year. Okay. All the inputs into the system, the discharges from the water reclamation plants, discharges

from the various pump stations, rainfall events that influence CSO events, he has to predict what the CSOs will be in the system and so forth.

So what he does is he picks particular years. So in this case, Dr. Melching looked at about 11 years of data that the District had, various years, and he picked two years which he thought were representative. Okay. The two years he picked were 2001 and 2003.

MR. ANDES: One of those was a dry year and one was a wet year?

DR. ZENZ: One is a wet year.

MR. ANDES: And are the operating hours during those years of each stage as set forth in the table?

DR. ZENZ: That's correct. This is a computer result from a modeling run that he ran. So in the year 2001, he is saying that that particular -- this happens to be the first station, which is .2 miles downstream of the Wilmette pumping station.

That station -- aeration station will operate for 134 hours for the year

2001 as his model tell me. That's what his model tells me.

And then in 2003, which is a different year, it has different inputs, the water reclamation plant outputs are different for the different year, rainfall events are different, et cetera, et cetera, and his model tells him that it will operate for 233 years.

HEARING OFFICER TIPSORD: Okay. That --

MR. ETTINGER: Just to clarify our language a little here --

DR. ZENZ: Can I just --

MR. ETTINGER: I just want to clarify this. Sometimes we say SEPA and sometimes we say in-stream aeration. I just want to make sure we're talking about all types of aeration on this model.

DR. ZENZ: Well, there's always a nomenclature problem with regard to -- the general term for all types of aeration systems on a waterway will be supplemental. Okay?

MR. ETTINGER: Okay.

DR. ZENZ: That's a general term.

So in-stream would be something such as Devon and Webster Avenue stations because the diffusers are actually in the water so they're in-stream. SEPA is not an in-stream station. It's a supplemental aeration. Why? Because it's not in the water. It takes the water out and processes it on land, it has to dissolve oxygen and puts it back in the stream.

MR. ETTINGER: I was just trying to make clear that when we were talking about these percentages of operation, we were talking about all types of aeration systems without saying that we were taking about one type or another?

DR. ZENZ: Yes. Can I just go back to her question? She was asking me questions about what is the existing hours of operation in SEPA stations. I'll go back to what I said before, which is that Melching did include that. But if you look at Page 7 of my testimony, Table 3, you will see that Dr. Melching indicated what are the additional operating hours needed for existing SEPA stations to meet the dissolved oxygen water quality standards proposed by IEPA. So he did --

he did.

In this model, in this theoretical exercise, understand, he says, for station number two, in order to meet the standards -- now, don't forget, that's in conjunction with the 28 new aeration stations in the three new flow augmentation stations, I have to operate that station for 4,464 hours. So he did determine what additional hours of operation are.

What I could not find easily is what is the existing -- this is the additional. So there would be operating existing plus this addition. That's the best I can do for you.

MS. WILLIAMS: Okay. So you're an engineer, right? I mean, you have your calculator in your pocket? Can you -- I'm going to ask you to try to convert these hours for me.

DR. ZENZ: Well, I don't have my calculator.

MS. WILLIAMS: It would appear to be around -- between 184 and over 200 extra days of operation, is that what it looks like, these hours to convert to?

DR. ZENZ: That sounds right. I mean, I didn't check your numbers. They are operated a lot, yeah.

MS. WILLIAMS: No, they will be operated.

DR. ZENZ: They will be, that's correct. They will be.

MS. WILLIAMS: Does that mean currently -- the current stations are operated relatively infrequently, as you use that term in your testimony?

DR. ZENZ: Well, you reached that conclusion, I think. I don't know what the existing hours of operation is of the stations.

MR. ETTINGER: Do you know if some of the SEPA stations now are operating for astatic purposes or other purposes as opposed to strictly necessary for DO?

DR. ZENZ: This is my understanding of the way that the SEPA stations are operated and the way that the in-stream aeration stations on Webster Avenue are operating. They have a dissolved oxygen probe, and I think it's only one,

upstream each of those stations.

If the probe shows that the standard for its particular stream is below that for SEPA, they actually have to send a man out to the station and put pumps in operation. Depending on what the DO level was, they put one, two, three -- whatever number of pumps are available and each station is different, the number of pumps, they will put those pumps into operation. Then if they feel that the DO is good, they will either take pumps out of operation or stop the station all together.

At Webster Avenue, it's a little -- and Devon Avenue, it's a little different. They also have a DO probe upstream of each aeration station, but they can control the operation of the blower directly at the north side plant so they will just turn one blower on or two blowers on, whatever they think is necessary, to meet the standard. That's how they operate.

MR. ETTINGER: Actually, you can even pass the upstream aeration stations. You don't want to turn on those unnecessarily because they don't serve any fun purpose at all, but the

SEPA stations -- my question was, do you know whether the SEPA stations are now run sometimes for astatic purposes?

DR. ZENZ: I have -- I guess my direct answer is I don't know the answer to that question.

HEARING OFFICER TIPSORD: Mr. Harley?

MR. HARLEY: You testified you participated in the design of the SEPA stations? From a design point of view, is there a maximum of hours that a SEPA station is designed to operate in any given year?

DR. ZENZ: Well, as any facility is designed to operate 24 hours a day, seven days a week, you know, every -- all of the time. There are standby -- there is a standby blower at each of the stations in case a blower should come out of service. With proper maintenance, these facilities can operate at a full capacity all the time.

MR. HARLEY: Thank you.

HEARING OFFICER TIPSORD: Okay.

MS. WILLIAMS: Question 5, in Paragraph 1 on Page 4 of your pre-filed testimony,

you state, "Achieving compliance with the standards will require a complex waterway DO monitoring network and facilities operation plan. Cost for a monitoring network and operations plan have not been included in this cost estimate." A, What do you mean by complex DO monitoring network?

DR. ZENZ: Well, we did not determine the specifics. We did not perform a cost estimate for such a system nor did we determine what the specifics are, but since you asked the question, I would think it would consist of, first, some kind of DO monitoring probe throughout the whole system.

Don't forget we're talking about seven existing aeration stations and 28 more. So we're talking about 35 aeration stations that have to be operated. So it would be a fairly extensive DO monitoring system. Just like they have now except --

MS. WILLIAMS: I was going to say don't they have a pretty extensive system now? Do you think it will require that this would require them expand it?

DR. ZENZ: I don't know.

MS. WILLIAMS: All right.

MR. ANDES: One of the questions that I would ask you to explain is as you go through the rest of this, when this system is constructed to monitor DO, explain how it differs from how things are being done now. Is "now" a simpler system?

What issues are you going to have to look at for the whole system that you're not looking at right now, just on the Calumet?

DR. ZENZ: Well, the existing system operates with basically seven dissolved oxygen probes. That's the controlled one. These other monitoring --

MR. ANDES: Where are those probes?

DR. ZENZ: They are directly up-stream of the aeration systems.

MR. ANDES: So each one deals only with the DO level at that station?

DR. ZENZ: That's correct, and these other probes are used for monitoring purposes by the R and D department. They are not used for operational purposes by the M and O

department. It's a different system.

MR. ANDES: What's the purpose of the new DO monitoring system?

DR. ZENZ: We think -- AECOM thinks, and the District tends to agree, that you want some kind of a system that would operate automatically. They don't want to behave as they have now for the SEPA stations where they get a probe reading and then they send a man out to go turn on the station, you know, one, two or three pumps. They want to have a centralized control system. That's what we talked about.

Again, I did not estimate the cost for such a system, but you can see where you would have, you know, a centralized system where all the DO probes would be coming in, but I don't think any human being would try to figure out during a rainstorm event, for example, how the heck these folks are going to turn stations on or not turn stations on in various parts of the system.

So I think the other part that you want is you want wireless telemetering to the

central location, which they do not have now. Then you want some kind of central computer system that would analyze the data and that requires some kind of software package that somebody would have to develop. I have no idea how much that would cost. It's not included.

This system, of course, would have manual overrides of some kind, but the system would help the operator or operators to figure out what to turn on and what stuff not to turn off. I think everybody recognizes there are local storms that come through.

I should say clearly here that Dr. Melching found that many of the stations that operate only need to be operated during wet weather conditions. That is, some stations will be completely turned off in dry weather conditions. They will not be needed.

So you will be turning it on maybe on the north side or not turning it on on the south side. That could happen. So we see a centralized system of monitoring, telemetering, to a central steam and some kind of software

package and we did not include that cost.

MR. ANDES: Is it your understanding the aim of that system would be to make sure that you are actually complying the DO throughout the system?

DR. ZENZ: That's correct.

MS. WILLIAMS: You have answered the rest of my Question 5 and so I'm going to skip onto Question 8.

On Pages 3 and 4 of your testimony, you state, "Any additional hours of operation of the existing Devon and Webster Avenue aeration stations or the existing SEPA stations required beyond their operation during water years 2001 and 203 were provided by Marquette University for use in estimating the additional costs of operating these existing stations."

Then, on Page 5, you state, "Marquette University determined that additional operation of the existing Devon and Webster Avenue aeration stations was not needed to comply with the IEPA standards." A, why was the analysis restricted to the years 2001 and 2003?

DR. ZENZ: I will repeat what I said before. You can find in Dr. Melching's report, which is attached to my testimony, by the way, somewhere in this pile of stuff -- oh, here it is. If you look at Pages 7 to 13 of his report, he describes why he selected the years 2001 to 2003.

I'm repeating myself again, but he looked at ten or 11 years of data. He looked at the rainfall and he looked at, you know, quite frankly how robust each of the model years data was. Do I have good dissolved oxygen data? Okay. He has to calibrate his model according to existing dissolved oxygen conditions in the Chicago area water system and make sure that that model is calibrated properly so when he makes his leap to putting in stations and predicting what the DO would be with these new stations, he wanted to make sure this model is giving him good results.

Anyway, to make a long story short, he decided that 2001 and 2003 were good representative years of a wet and dry year. The dry year was 2003 and the wet year was 2001. So he felt -- it's his modeling choice.

Again, I will state he was not a subcontractor to AECOM. He was a contractor for the District. That was his responsibility and he made that choice. I have no reason to doubt that that was a good choice.

MS. WILLIAMS: Can you clarify whether the Devon and Webster stations will need to operate for additional hours?

DR. ZENZ: Well, according to Dr. Melching's model, as stated in my report, no, they don't.

MS. WILLIAMS: Okay.

DR. ZENZ: So whatever existing operation, unlike the SEPA stations, which I've already pointed out, Dr. Melching said they would have to be -- again, for the system he came up with, the 28 stations, the three floor augmentation stations, he is saying that additional operation hours of SEPA would be required and these hours can be provided by the SEPA stations.

The District can do that, but for Devon Avenue and Webster Avenue, given the waterway conditions in 2001 and 2003, they do not have to be operated any additional hours. They

still will be operating, but not for additional hours.

MS. WILLIAMS: Again, we don't know how many hours they will be operated for?

DR. ZENZ: I could not locate the information either in Dr. Melching's report or anything in front of me that said what the existing hours of the stations are. I'm trying to be helpful to the Board. I know they are not operated in the wintertime. They are not because there is no significant oxygen demand at low waterway temperatures. We understand bacteria is not really active then.

They are basically rarely operated in the wintertime. I won't say never, but they are mainly operated in the spring, summer and fall and probably mainly during the summer when the temperatures are high and the oxygen demand is high. That's all I can tell you. I don't have any specific information other than the general statements now.

MS. WILLIAMS: Do you know whether they have to be operated in the wintertime under the Dr. Melching model?

DR. ZENZ: Whatever is the existing database that he used, and I'm assuming the existing database, as I made my general statement before, there is little need to operate the stations in the winter. So I'm assuming that the database -- he is using the actual data from 2001 and the actual data from 2003 from the operation of the SEPA stations and so I would think since he doesn't require any additional hours that there would be very infrequent use of the Devon Avenue aeration station during the winter or even the spring. Long answer, but that's the answer.

MR. ETTINGER: Since you mentioned that, do you know of a reason there would be DO crashes in January or November?

DR. ZENZ: I'm the wrong guy to ask questions about the existing water quality data for the Chicago Area Waterway System. There are many more qualified people at the District than I would be. I just don't have an answer to that.

MR. ETTINGER: You wouldn't happen to know who those people are, would you? Go on.

HEARING OFFICER TIPSORD: Mr. Harley?

MR. HARLEY: In a general sense, CSO overflows would contribute to DO crashes as you are describing it?

DR. ZENZ: Absolutely.

MR. HARLEY: Thank you.

MS. WILLIAMS: So your testimony today addresses the cost to the District of complying with the District's proposal?

DR. ZENZ: And the IEPA, both. I have costs for both.

MS. WILLIAMS: Have you determined the cost of complying with the current water quality standards?

DR. ZENZ: No.

MS. WILLIAMS: Is the cost of complying with the current water quality standards factored into your final cost for complying with what was --

DR. ZENZ: I can only tell you what we did. We determined what additional equipment -- 28 aeration stations, four flow augmentation stations -- the cost of that additional equipment that would be required to meet the District's

proposed standards for additional equipment, to meet the just the IEPA proposed standards. That's all I can tell you.

MS. WILLIAMS: I understand. Would you agree from the Board's point of view that the cost of complying with the current standards should be subtracted from the total cost in determining the actual cost of complying with the proposed standards?

DR. ZENZ: Well, I'm trying to think of a diplomatic way to say this, but as I understand it -- well, there is no way to know from my study what the cost would be -- that's included, you know, in the cost to meet the current standard. It would be a fairly complicated analysis.

Let's say you said to me, okay, AECOM, go figure out what it costs to meet the existing standard. Well, I'd go back to Dr. Melching. He would, in his model, figure out what additional equipment was needed to meet the existing standard. Of course, plugged into that would be whatever is happening now in the system in terms of meeting the water quality standards.

So, for example, if they are 98 percent compliant, I don't know -- I don't know what compliance they are. It may not be very much at all. So you have to kind of figure that out.

But on just another, shall we say a general sense, we are all here because you guys didn't like the existing standard, so why would you want to bother figuring out -- I mean, I don't understand why you would want to figure out what the cost is to meet the existing standard. What use would that be? Well, I don't know.

MS. WILLIAMS: The reason -- I mean, I don't know that I should have to explain, but I'm happy to explain the reason for the question is that it's over-estimating the cost to the District and include the fact that they are not meeting the current standard and to throw all of that in as the cost complying with a slightly improved future standard, it's very slight, what's being proposed here comparatively.

MR. ANDES: I would object to that characterization, but I think we've answered question.

MS. WILLIAMS: Thank you.

MR. ETTINGER: Well, the bottom line is you -- at no time have you moved to calculate the costs to comply with the existing standard?

DR. ZENZ: No.

MR. ETTINGER: And if -- if somehow IEPA's proposal was defeated and somehow the District's proposal was rejected by the Board or the U.S. EPA, then, you probably have to do that -- that study and that would be done by Dr. Melching probably in the same way that he's done this study for the other standards?

DR. ZENZ: (Nodding.)

MR. ETTINGER: You have to speak.

MR. ANDES: Are you asking him what the District would plan to do in terms of hiring him?

MR. ETTINGER: No. I'm just asking him how --

MR. ANDES: He, of course, would support the District hiring him.

MR. ETTINGER: And I would support that, too, but I would like him to state something

on the record rather than nod because the court reporter can't take down nods.

My question was actually not directed towards what the District would hire, but rather how he would calculate the numbers if he were hired.

DR. ZENZ: I'll try to give a direct answer to your question. It would be the same type of procedure. Since Dr. Melching has been continuously improving his model, he has actually had two improvements over the original model work he did for the District, he would probably try to improve it and find better ways to handle the CSOs, et cetera, et cetera, et cetera.

But yes, the only way you can conduct such an exercise, in my opinion, would be the same procedures we used to determine the cost to meet the IEPA standards, additional equipment required to meet the IEPA standards, or the additional equipment the District requires. You're really trying to predict a condition which doesn't necessarily exist now.

So then -- and then after he had determined what that equipment was, we would

perform some kind of a cost estimate. That would -- the detail of that cost estimate would have to be worked out with the District so they could determine whether they want a level five cost estimate, which I am presenting here today or a level four cost estimate or all three cost estimates and how detailed and how much effort is going to go into the cost estimate. The procedure we used here is going to be the same.

BOARD MEMBER GIRARD: So it seems to me we've got a fairly simple question and we keep getting very long answers and then even longer questions.

MS. WILLIAMS: Sorry.

MR. ETTINGER: That's why the lawyers are here.

BOARD MEMBER GIRARD: The task here was to simply come up with the cost of complying with either the Illinois EPA proposed DO standards or the District's proposed standards and so you had two tasks.

Did you simply assume that the District was currently complying and then base your cost estimates on what additional

equipment and operations would be necessary to meet either the IEPA's proposed standard for DO or the District's proposed standard for DO?

DR. ZENZ: I will repeat what I already said, which is that if the modeling was the basis for the cost estimate and in the modeling, Dr. Melching took in whatever the existing operation of these stations were in 2001 and 2003. That's all I can tell you, whatever the existing was.

There is no attempt to -- I mean, there was no attempt to figure out what was the required operation of those stations to meet the existing standard. No attempt.

MR. ANDES: So it was based on existing data concerning hours that those stations were currently operating?

DR. ZENZ: That's it.

BOARD MEMBER GIRARD: Thank you.

DR. ZENZ: Whether they were meeting standards or not meeting this under the standards, for those existing operational hours for those years, I don't know.

MR. ANDES: Is it your understanding that that was done because the standards were being changed anyway?

DR. ZENZ: That's correct. Was it simply an attempt to get some kind of baseline? Here's what they are spending now. Here's what they have already spent. Let me make it perfectly clear, in our cost estimate, there are no capital costs included for Devon/Webster Avenue stations, no capital costs included for any of the five SEPA stations, no costs included in my cost estimate for any existing personnel to operate those stations or equipment to maintain them. The electricity to run the stations, it's not included in this cost estimate. It's only the additional equipment that's required. None of that cost is here. Whatever the District spends now, it's not in this cost estimate.

BOARD MEMBER GIRARD: Thank you. That helps.

HEARING OFFICER TIPSORD: Okay. Ms. Williams?

MS. WILLIAMS: I'll move on to question nine.

DR. ZENZ: Okay.

MS. WILLIAMS: In Bullet No. 1 and 2 on Page 3 of your pre-filed testimony, you state, "Supplemental aeration technology considered was ceramic disk diffusers installed in the waterway with an onshore blower facility. Aerated flow augmentation technology considered was forced main aeration of pump flow using a U-Tube aerator and high purity oxygen. A, what other aeration technologies did you consider?

DR. ZENZ: For this level five cost estimate that we did, we looked at -- now, we did the standard things an engineer does where we looked at a long list of alternatives and we looked at a short lift of alternatives.

The long list of alternatives included porous ceramic diffusers, membrane diffusers, we looked at jet aerators, which is a pump system where you pump water out of the canal and run it through a Venturi, put oxygen into the low side of the Venturi, and then water comes back into the system.

Of course, we looked at head loss structures, free fall weirs, which is really

just what the SEPA station, a free fall weir. If you've ever looked at a SEPA station, it comes off the weir, plunges down into a pool and it's really the plunge into the pool where all that turbulence takes place and that's where the dissolved oxygen is added to the water.

We looked at cascades. That's a different thing. If you've ever seen a typical cascade, it kind of flows almost on a laminar flow over a cascade and then transfer is from the air through that thin film of water that flows over the cascade.

We looked at mechanical aerators, which is just a device sitting on the surface of the waterway, which would literally beat the surface up and cause a lot of turbulence.

We looked at U-Tubes. A U-Tube is typically a 100-foot tube that's drilled down below the surface and brings the water out, shoves to down to the bottom of the U-Tube. You have 100 feet of hydrostatic head at the bottom of the U-Tube. You inject your oxygen there under that pressure, under the physics of the situation. You can get very supersaturated conditions of the

water. You can get dissolved oxygen concentrations of 30, 40, 50 milligrams per liter and then you eject the water back out again.

We looked at barge mounted aeration and we looked at screw pump aeration because the District felt that the screw pumps at SEPA were also causing some additional aeration in addition to the waterfalls themselves.

But our short list only included four technologies and the one with the highest score was ceramic diffusers with a total score of 252.

Also included on that short list were compressed air U-Tubes, jet aerators and, of course, SEPA stations. So only four made the short list.

MS. WILLIAMS: That's based on performance?

DR. ZENZ: It's based on a matrix. We used a matrix where we produced an evaluation matrix like this. By the way, this is contained in the report, which IEPA submitted to the Board. You can find it in what we call Technical Memorandum 4WQ, and it's -- the title of it is -- give me a

second here.

MR. ANDES: This is part of the Agency's initial filing with the Board?

DR. ZENZ: That's correct.

MS. WILLIAMS: So would you agree with the Agency that these technologies would be at the upper end of the cost?

DR. ZENZ: No.

MS. WILLIAMS: Or ranking?

DR. ZENZ: No. Let me go further. After we determined that these four technologies would be on the short list through the matrix system, we did a cost estimate -- a level five cost estimate. This was done -- I want to caution everybody that these were for stations only on the north branch and the south branch, only four aeration stations. They were pretty small and they were to meet a District standard at the time, which was 90 percent compliance with five milligrams per liter. We didn't know what the heck you guys were going to come up with. I'm giving you these costs so you have some idea of the relative costs of these four systems.

MR. ANDES: So this analysis was done

before the Agency issued the proposed rule?

DR. ZENZ: Correct.

MR. ANDES: But it explains how various aeration technologies were considered?

DR. ZENZ: Correct.

MR. ANDES: Okay.

DR. ZENZ: Of the four technologies, ceramic diffusers had the lowest capital cost. It had the second lowest operation of maintenance cost and to give you some idea of the present worth here for these systems, which combines -- and I think everybody knows now what present worth is or I hope so -- capital and operation maintenance costs and the ceramic diffuser had a $56 million present worth. This is all in the report. U-Tubes had $47 million.

Now, that's within our range and ability to estimate costs at a level five. So I consider them to be the same, but since you've got -- since ceramic diffusers are something the District uses, it had the highest total score, we decided to do a cost estimate. I feel justified in doing this. So it's not the highest cost. It's lowest capital cost.

MS. WILLIAMS: In your initial analysis, you said that's based on a 90 percent compliance with five milligrams per liter?

DR. ZENZ: That's correct.

MS. WILLIAMS: Do you have any --

DR. ZENZ: I'm just giving you -- I'm giving you these costs so you understand the relative costs of the various technologies so you have some idea of why -- why did we choose ceramic diffusers for the cost estimate in my testimony.

MR. ANDES: And that particular document, which is done at the request of IEPA, was done for the Agency proposed the rule?

MS. WILLIAMS: And before the District proposed their DO standard, correct?

MR. ANDES: Yes.

DR. ZENZ: And understand the costs going into these here, the basic costs, we took all of those spreadsheets at the UAA study, all the costs for ceramic diffusers, come out of this short and then comes into my testimony. That level five cost estimating, all the costs that we had in there came out of that cost estimate and made it into my testimony, that's where the costs

come from. They come from these numbers.

HEARING OFFICER TIPSORD: Do you have a follow-up?

MR. QUAIL: I'm John Quail, Friends of Chicago River. As part of your cost estimates, did you look at installing a cascade or a free weir -- the pre-drop weir system at the north branch dam and using natural elevation change as a lower cost alternative to a SEPA station to meet any sort of DO?

DR. ZENZ: We didn't look at anything specific like that. We looked at SEPA stations as a technology. We didn't look at a particular technology at a particular location anywhere in the system. We just looked at that technology. We were trying to determine a cost estimate. That's what we were trying to do. What technology would be the most likely -- we wanted a cost estimate for a practical technology that could be implemented.

MR. ANDES: Let me just clarify. Is it fair to say your cost analysis was based on the modeling that Dr. Melching did, which his report indicates is needed to bring the

waterways into compliance with the water quality standards?

DR. ZENZ: Correct.

MR. ANDES: You took his analysis in terms of what was needed and cost it out?

DR. ZENZ: Correct.

MR. QUAIL: In your expertise for the SEPA stations, is much of the cost in the pumps and blowers and is that something you could accomplish using natural elevation changes with tributaries as the weight increased the OM system?

DR. ZENZ: You're asking a fairly complex engineering question. I will give you a general answer, which is that because of the elevation in the river -- water elevation, the need for a SEPA station to be onshore, it's already up above. Then you have another 15 feet ahead that has to be pumped up to the top. The chances of using natural elevation in the Chicago area would be pretty slim. I'm not saying it's impossible, but I'm saying it's pretty slim.

HEARING OFFICER TIPSORD: Okay. Ms. Williams?

MS. WILLIAMS: I would like to avoid repetitiveness so I believe based on your prior answers, would you just agree that in response to Question 10, the aeration requirements and cost figures do not take into account the completion of TARP reservoirs, correct?

DR. ZENZ: They do not.

HEARING OFFICER TIPSORD: Mr. Harley?

MR. HARLEY: Hypothetically, if TARP completion eliminates CSO overflows, is it possible that the aeration stations that you anticipate would not be necessary at all?

DR. ZENZ: Well, one thing I've learned through this process is that trying to predict what the future conditions are is extremely difficult.

Let me just give you an example. If you're going to be predicting TARP under construction, then, you also have to say what other situations will occur in that same point of time? So for example, what would be the effluence -- what would be the effluence from the treatment plants? What would they be?

Well, the issue is well, what

would be the standard then? It gets to be somewhat -- then even, like, Lake Michigan diversions, while there is a schedule, as I understand it, that lake diversions will decrease in the future, but that could change. So you are in a situation where you are trying to predict some future event, which includes all of these somewhat unknowns and then to say that TARP would eliminate all CSO, I think, is a stretch.

Then for me to sit down and say that I would know just sitting here without any modeling, I would say that could be a very interesting study, but a very complex one to figure out what it is. We did not do that for that simple reason. We decided that we weren't going to try to start talking about, you know, what the cost would be in the year 2025. I don't think that would be useful to anybody because everybody would be picking apart every assumption that we made for the year 2025.

So what we decided to do is predict what the cost would be for basically the existing situation. So we have some idea what the cost would be. I guess I would just say I

decline to answer your question.

MR. HARLEY: That was the longest declination ever.

MR. ETTINGER: Actually, though, hypothetically if we had schedule for TARP completion, maybe a consent decree or something, and we set that down, would you then be able to do your modeling and come up with numbers that would meet the dissolved oxygen levels based on assumed completion dates for TARP?

DR. ZENZ: It would be a very difficult to say, very difficult to say.

MR. ETTINGER: Would you like the challenge?

DR. ZENZ: Sure.

MR. ANDES: Would you have to predict first exactly how TARP would operate 18 years from now?

DR. ZENZ: That's correct. I can tell you from talking to Dr. Melching, the modeling required to figure out what -- you know, it's going to have an affect on CSO, no question. That's what the TARP reservoir system is designed to do, but figuring out what that is is a very difficult

assignment, very difficult. It would be a huge challenge. Probably, quite honestly, the one dimensional model -- he is using a DUFLOW model, you know, to put together specifically for the Chicago Area Waterway System and to modify it also to an extent. I'm not sure that model would actually be the right one for the job. So you would have to get a model to figure out what would be the best model. Then the challenge would be to really figure out what the inputs would be, what are the discharges from the -- not only figure out what the discharges from the CSOs are in this future event, but then try to figure to out what the discharges from the treatment plants are.

MR. ANDES: Wouldn't there also be other wet weather sources?

DR. ZENZ: Yes. The model also takes into account the runoff directly from surrounding areas of the stream, storm water discharges from storm water sewers and so forth. I mean, it would be a very complex exercise. It would be extremely difficult. It could it be done, yes.

MR. ETTINGER: Just to break that

down a little bit, then we will go on here, does the District have estimates as to what degree the CSOs will be shut down given various levels of completion of TARP?

DR. ZENZ: I'm not privy to that. I don't know.

MR. ETTINGER: Thank you.

MS. WILLIAMS: Dr. Zenz, given all the uncertainty that you just described, can you at least tell us in the future at the completion of TARP, is it possible that the SEPA stations would have to run more frequently than they do now or would they have to run less frequently than they do now?

DR. ZENZ: Believe it or not, that's a fairly complex question. Just to give you an example, Dr. Melching he made a decision. He could have -- he could have decided to not increase the operational hours of the SEPA stations, but as he did his modeling, he placed -- it's a very complex process. I was at Marquette University. The model -- to make a run, the model runs for, like, two to three hours -- two to three hours. So if he puts a station here and it's 80 grams per second,

let's see what happens with that. Then he runs it. Well, that's not good enough. Then he tries this other -- so he was trying to work with the existing system and he would change the hours of the SEPA stations. So it's quite possible that he might decide to change the operation of the SEPA stations to less hours. I don't know.

MR. ANDES: But at that point, Dr. Zenz, you would have already built all 28 additional aeration stations?

DR. ZENZ: Oh, I see what you mean.

MR. ANDES: Right. So that cost would be sunk.

DR. ZENZ: Correct.

MR. ANDES: So you might have to operate the stations less hours, but you are capital costs would already have been incurred.

DR. ZENZ: Correct.

MS. WILLIAMS: Are you willing to say today, yes or no, that the stations would operate less hours?

DR. ZENZ: I think from a -- you know, I'm going to try to be as responsive as possible. Since Dr. Melching has said repeatedly

that many of the aeration stations are operated simply because of CSO events -- because of CSOs -- and since TARP should reduce CSOs, yes, you are right, from a theoretical standpoint. The extent of it, how much it would be, is pure speculation. It would just be pure speculation.

MS. WILLIAMS: No one asked him or you to look into that?

DR. ZENZ: Absolutely not.

MS. WILLIAMS: Okay. Thank you. Can you tell us how long it's going to take to construct the stations as they are designed in your study?

DR. ZENZ: I can. In my previous testimony, I did present testimony before the Board, which indicated a construction schedule and at that time, I said that full scale studies would take about two years. Design of required facilities, I would think, would take about three and a half years, and construction about three years. I think total time of about eight and a half years would be the time I would think to get it done and I would stick to that.

MS. WILLIAMS: So today, I do recall

maybe in Joliet, we had this discussion, but as we sit here today, we're talking about 2020?

DR. ZENZ: Yes, give or take.

MS. WILLIAMS: Thank you.

MR. ETTINGER: Can you generalize that basically eight years from whenever or eight and a half years from whenever we decide we're going to put in supplemental aeration is when we can expect it to go in?

DR. ZENZ: Yes. Maybe it's helpful to -- you know, history is sometimes useful and I went back and looked at the schedule of what happened with SEPA. It turns out that in 1984, the District did a planning study determining that SEPA was the way to go.

Again, I'll repeat what I said before. I think this was done because the EPA was willing to forego a requirement for tertiary treatment in Calumet of in lieu of these five stations.

In '84, the planning document was prepared. Then in '86 and '87, the pilot studies were put together. In '88, which is pretty good for the industry, they hired a

consulting engineer to design it. They began construction in 1989, which proceeded forward and SEPA stations three and four were completed in 1992 and then SEPA stations one and two were completed in 1994. This was 10 years from the beginning. So I don't think I'm too far away from when I said eight and a half years.

MR. ETTINGER: So hypothetically, if we were to come up with a schedule for the completion of the TARP, that would be the time to start looking at what stations -- supplemental aeration stations would be necessary so that we wouldn't have to wait 10 years after the completion of TARP after that to get the job done?

MR. ANDES: Are you saying that they could start all of this process immediately after setting forth a TARP schedule?

MR. ETTINGER: Yes.

MR. ANDES: And have the modeling done at that point in terms of --

MR. ETTINGER: Oh, I didn't say that the modeling would be done, but the modeling should be started. Once you know what the TARP schedule is going to be, at that point you could

then begin modeling what supplemental dissolved oxygen would be needed based on TARP.

DR. ZENZ: You could do that and again, I'm going to repeat what I said before, that is a very difficult and complex assignment.

HEARING OFFICER TIPSORD: Mr. Harley?

MR. HARLEY: I actually want to go back to one of the questions that Ms. Williams had. Do you know when TARP will be finalized for Thornton reservoir?

DR. ZENZ: I have no idea. I'm not involved in the project, I haven't been involved in the project, and I have no information.

MR. HARLEY: And you were not given that information as part of developing your cost estimates?

DR. ZENZ: No. Again, we assumed whatever was in place in 2001 and 2003 and so we just didn't even discuss TARP reservoir. There was no discussion whatsoever. I have no information to help you.

MR. HARLEY: And I know you participated in previous Board proceedings. Were you present general September 8, 2008,

when general superintendent Dick Langdon testified that the Thornton reservoir was to be completed in 2014?

DR. ZENZ: I wasn't there.

MR. HARLEY: If, in fact, the Thornton reservoir is completed in 2014 and virtually eliminating CSO events in the Calumet area, would that change the figures that you put forward here?

DR. ZENZ: Well, you know, you said virtually eliminate CSOs, I don't know if that's a fact or not. I will give the same answer that I gave to the EPA representative, which is yes, obviously some CSOs would be reduced if --

HEARING OFFICER TIPSORD: Dr. Zenz, we're losing you. Please keep your voice up.

DR. ZENZ: Some CSOs would be reduced if the Thornton reservoir was put in place and, therefore, since the Dr. Melching has indicated in his workshops with us as he presented his results that of the aeration stations were there simply for CSO events and some big ones. Yes, I think it would probably reduce the number of stations if they weren't built yet or possibly if they were built,

they wouldn't have to be operated at all.

MR. ETTINGER: That would be as to aeration stations on, say, the Calumet River?

DR. ZENZ: Of course, on the Calumet River system only.

MR. ETTINGER: It wouldn't change anything on any other parts of the system?

DR. ZENZ: No.

MR. ETTINGER: Thanks.

MR. ANDES: Is it true that most of the 28 aeration systems are on the other parts of the system?

DR. ZENZ: That's true because the SEPA stations are already there.

MR. ANDES: So there's less improvement that needs to be made to Calumet system and more to other parts of the system?

DR. ZENZ: Yes.

HEARING OFFICER TIPSORD: Mr. Harley?

MR. HARLEY: But as to the Calumet, if the Thornton reservoir is completed by 2014/2015 and CSO events are reduced as a result and we have existing SEPA stations, the cost of achieving the DO standard would be zero?

DR. ZENZ: I wouldn't go that far. I don't know how -- all I can tell you is that if the stations were not constructed, it's possible that less stations would be constructed or if they were already in place, that they would be operated less. What the affects on cost would be, that would be pure speculation on my part.

MR. HARLEY: And just to follow-up and just so the record is absolutely clear on this point, you don't know how often the SEPA stations that are already existing in the Calumets are operated?

DR. ZENZ: I don't have any specific information unfortunately to give you.

MR. ANDES: To follow-up on that, Dr. Zenz, if you refer to Table 1, which listed 28 additional aeration stations, how many of those are located in the Cal Sag?

DR. ZENZ: Two.

MR. ANDES: How many are located in the Little Cal?

DR. ZENZ: Three.

MR. ANDES: The other 23 are on other parts of the system?

DR. ZENZ: That's correct.

MR. HARLEY: Thank you.

DR. ZENZ: Again, this is based on the fact that we already have the existing SEPA stations in place and also operating additional hours over and above what they are now.

MR. HARLEY: Thank you.

MS. LIU: Dr. Zenz, would your schedule for pilot and full scale study and design and construction be any different for under the District's proposal?

DR. ZENZ: Yes, it would. I have that somewhere. It's a question of finding it. What did I do with that? You know what, I don't think I brought that with me. Darn it.

MR. ANDES: But, Dr. Zenz, perhaps we can talk that through. If you are talking about constructing two new aeration stations simply increasing -- and the inflow augmentation at one site, is it your sense that can be done a lot faster than eight and a half years?

DR. ZENZ: Absolutely. I'm not going to try to refresh my recollection here without anything in front of me. I meant to

bring that with me and I apologize. We can certainly furnish that to the Board later.

MS. LIU: That would be nice. Thank you.

DR. ZENZ: I'm not going to -- it's less. It's less than what you would expect it would be.

MS. LIU: If you could submit that later, then that would be terrific. Thank you.

MS. WILLIAMS: I'm going to ask my Question 11 now if we are ready.

DR. ZENZ: Okay.

MS. WILLIAMS: On Page 9 of your pre-filed testimony, you state, "The time period during which the wet weather provision would apply, during and after each event, measured in hours, would depend on specific rainfall amounts." In Table 6, the maximum duration is listed in days. Can you explain this discrepancy?

DR. ZENZ: Well, I apologize for any misunderstanding there, but the first sentence was meant as a general statement and the Table 6 actually contains the District's proposal and the hours are -- not the hours -- the time period is

measured in days and that's correct. Table 6 is correct. The other sentence is just a general statement talking about what the attributes of the District's proposal is. That's all.

MS. WILLIAMS: So the District's proposal will full days and it will be based on full days, not on portions of days?

DR. ZENZ: Just as Table 6 days. That's the correct proposal from the District and as far as I know, it matches everything that came out of the District.

MS. WILLIAMS: Is flow augmentation used in the cost estimate for the District's proposal?

DR. ZENZ: Yes.

MS. WILLIAMS: Okay. Can you go back to Question 12 and can you show us where in Table 4 we can find the approximate cost?

DR. ZENZ: Yes. It's in Table 4, Stations A, B and C.

MR. ANDES: So that's for the IEPA proposed standards, correct?

DR. ZENZ: That's correct. And then for the District's standards, which is in Table 9,

it's flow augmentation shown in Station A.

MS. WILLIAMS: So under the District's proposal, flow augmentation would be necessary in the north shore channel only?

DR. ZENZ: That's correct.

MS. WILLIAMS: Is that what I'm seeing here?

DR. ZENZ: That's correct.

MS. WILLIAMS: Whereas under the Agency's proposal, you are looking at flow augmentation where?

DR. ZENZ: On Bubbly Creek and on the Little Cal.

MS. WILLIAMS: And can you explain for us why the District's proposal caused elimination of flow augmentation of Bubbly Creek? What about the District's proposal changed that?

DR. ZENZ: Well, I guess the short answer is that's what the model showed. I don't meant to be flip, but...

MS. WILLIAMS: Okay. Let's try a long answer. What information was put into the model to come to that conclusion with regard to the District's proposal?

DR. ZENZ: Many different things.

MS. WILLIAMS: Was there an assumption of no DO standard in Bubbly Creek? Maybe I should have asked it that way.

DR. ZENZ: I think you're right. I believe that's correct.

MS. WILLIAMS: Okay. Thank you. I don't think I have any other questions.

MR. ANDES: Let me clarify. You mean no numeric DO standards for Bubbly Creek?

DR. ZENZ: That's correct.

MS. LIU: May I ask one more question to follow-up?

MS. WILLIAMS: He's all yours.

MR. ANDES: Why don't you add that.

DR. ZENZ: On the bottom of Page 9 of my testimony, it specifically says, and I apologize for not remembering this, but it says, numerical minimum DO standards should not be specified for Bubbly Creek as the District considered it to be a unique complex waterway which is stagnant, et cetera. I assumed you have learned that from the District witnesses that they are not proposing a numeric standard?

HEARING OFFICER TIPSORD: And just for the record, I appreciate you pointing us to page number, but there aren't any page numbers your testimony. That's okay. I just wanted to note that for the record so that people who were looking at the pre-filed testimony weren't --

DR. ZENZ: I'd have to say there are page numbers on mine.

HEARING OFFICER TIPSORD: I don't want anyone to think they've got the wrong testimony.

MR. ANDES: I believe Ms. Liu had a question.

DR. ZENZ: Oh, okay.

MS. LIU: Dr. Zenz, if either nutrient removal or disinfection were to provide BOD or biochemical oxygen demand removal from the water reclamation plants, would that affect the number of SEPA stations for the amount of additional aeration that would be needed to either meet the Agency's proposal or the District's proposal?

DR. ZENZ: Yes. If nutrient removal or removal of phosphorous or the removal of nitrogen from the system were to cause reduction, it had a

number -- in my previous answer, I said I wasn't -- I really didn't know and I would hate to speculate whether that's true or not true, but if it did, certainly, it could change just as the question was asked about TARP. If there were reduced CSOs, could it potentially reduce the number of stations or the amount of flow augmentation, yes, of course. Any reduction in the organic loads could cause a change in the system, but determining the extent of it, if any, requires a modeling because the system is so complex so you would have to do that.

MS. LIU: Thank you.

HEARING OFFICE TIPSORD: Mr. Harley?

MR. HARLEY: For the record, I think you responded to the nutrient removal, but not the disinfection part of the question. The question also asked about disinfection.

DR. ZENZ: The District proposes, as you probably know, it would not affect the organic load coming in. Newly disinfection would not. That, I am willing to say.

HEARING OFFICER TIPSORD: Okay. Ms. Williams, anything further?

MS. WILLIAMS: I have nothing further.

HEARING OFFICER TIPSORD: Let's take a ten-minute break and we'll come back and start with Albert and Prairie Rivers.

MR. ETTINGER: I have very little, by the way.

(Whereupon, after a short break was had, the following proceedings were held accordingly.)

HEARING OFFICER TIPSORD: We are ready to get going with Mr. Ettinger.

MR. ETTINGER: I slashed and burned most of my pre-filed questions. We will still go to No. 5 and ask, are you aware of any other possible approaches to the problem of low dissolved oxygen levels caused by CSOs other than supplemental aeration stations?

DR. ZENZ: Well, we are continuing to work with the District to refine our cost estimate for the District for meeting the EPA standards and as part of that program, we had been looking at other technologies in addition to supplemental aeration.

MR. ETTINGER: So does the District

have some idea of which CSOs will be definitely taken care of by the various stages of TARP and which ones might still be going after TARP is completed?

DR. ZENZ: I assume they do. Unfortunately, I don't know what those are.

MR. ETTINGER: You don't?

DR. ZENZ: No.

MR. ETTINGER: And you don't know what plans there might be to address any remaining CSOs or CSOs to the extent they remain after the completion of TARP?

DR. ZENZ: I just have not been involved in any parts of that TARP program and I just don't have an answer to that question.

MR. ETTINGER: All right. Well, let's go back to what you have been involved in. you said you've been working on alternative approaches to CSOs. Can you just describe that?

DR. ZENZ: Sure. Give me a second here. Sediments in the Chicago area waterway system are DO demand and so one of the things that we are looking at is what they call sediment treatment and one of the alternatives that -- there are several

different types of alternatives that could be used. First is sediment capping where you just put a sand layer over the type of these organic deposits and then limit the SOD -- sediment oxygen demand in that way or you could treat them with chemical treatment. You could stabilize them with organic methods. There are even -- some people have talked be onsite sediment management. So we would be looking at that.

MR. ETTINGER: What is on-site sediment management?

DR. ZENZ: Well, it's a little drastic, but it was it's been talked about as you would -- if you had, like, a slip or inlet, which was full of lots of sediment and wasn't really part of the main body of waterway, you could actually block that that inlet out and then put in some devices to aerate and somewhat stabilize the organics in the sediment that way.

It really wouldn't -- to be honest with you right now, the only one that we thought might be viable would be sediment capping where you would add a sand layer over the top.

MR. ETTINGER: Some of these site -- well, some of these abandoned slips and things, if they contain sediment --

DR. ZENZ: Yes.

MR. ETTINGER: -- have you looked at things there?

DR. ZENZ: Some specifically there, but as a general concept, it's a possibility.

MR. ETTINGER: What have you looked at there?

DR. ZENZ: For the slips and inlets?

MR. ETTINGER: Yes.

DR. ZENZ: Quite frankly, we didn't look at the slips and inlets. There are many of these in there. We made an early decision talking with Dr. Melching that the difficulty of trying to model for these slips and inlets so --

MR. ANDES: But for this analysis?

DR. ZENZ: For this analysis.

MR. ANDES: But there is a continuing analysis.

MR. ETTINGER: That's what I was asking. I thought we were just talking in general rather --

DR. ZENZ: Yes.

MR. ETTINGER: -- than what you did with Dr. Melching, but for the District, you are looking for doing things with slips and inlets. I'm just asking in general, what sorts of things are you talking about for the slips and inlets?

DR. ZENZ: Well, I'm talking about sediment capping, sediment treatment, onsite sediment management, those kind of things. I want to make sure everybody understands this is just a study. Looking at them, there is no -- it's not going much further than that. One of the difficulties here is Dr. Melching has spent some modeling time looking at what is the component of sediment oxygen demand in his model and it doesn't appear to him based on a workshop he has done recently for us that sediment oxygen demand is a major component of the oxygen demand in the system.

You know, the CSOs, the discharges from the treatment plants, storm water discharges, are so great that sediment oxygen demand is really not a big portion. So that doesn't appear to be extremely viable alternative right now in our

opinion.

MR. ETTINGER: So what are the big portions? What are the things documented as DO?

DR. ZENZ: CSOs is a very big part of it. Now, as I said before, Dr. Melching and his workshops discussing the results of the model indicated that many of the stations are required simply because of CSOs, but then you do have dry weather flows, you do have oxygen demand from the treatment plants themselves.

MR. ANDES: Also stagnant areas.

DR. ZENZ: Stagnant areas that are present, yes.

MR. ETTINGER: Have you looked at creating any wetlands in any of the slips or inlets in the system?

DR. ZENZ: We have not. I know other people have, but not us.

MR. ETTINGER: What other people do you know of who --

DR. ZENZ: I don't know. I heard Jennifer talking about wetland restoration.

MR. ETTINGER: You know generally someone did, but --

MR. ZENZ: Somebody I don't have any specifics.

MR. ETTINGER: -- you have no knowledge?

HEARING OFFICER TIPSORD: Mr. Harley, did you have a follow-up?

MR. HARLEY: I'm sorry to interrupt, but the workshop that you were describing, have any presentation materials from that workshop been included in the record, to your knowledge, in these proceedings?

DR. ZENZ: No.

MR. HARLEY: Would that be possible?

MR. ANDES: Well, will the -- let me ask a question which might help clarify that. Were those workshops part of developing the integrated strategy for the District.

DR. ZENZ: Yes.

MR. ANDES: So is it your understanding that the final report from that integrated strategy will be available at some point?

DR. ZENZ: Correct.

MR. HARLEY: At some point?

MR. ANDES: That report, I believe,

will be available in the near future and will be provided to the docket.

MR. HARLEY: And that will include specific reference to the allocation of oxygen demand from CSOs, dry weather flows from treatment facilities, stagnant waters?

DR. ZENZ: Yes.

MR. HARLEY: Thank you.

MR. ETTINGER: Okay. I think I'm down to eight. Are there problems caused by CSOs in addition to their effect on dissolved oxygen levels?

DR. ZENZ: I really don't feel like I'm qualified to answer that question. I think this is more for an aquatic biologist and not for an engineer.

MR. ETTINGER: Okay. Well, have you studied wastewater treatment of CSOs?

DR. ZENZ: Have I studied wastewater treatment of CSOs? The answer is yes.

MR. ETTINGER: Okay. What are you treating them for?

DR. ZENZ: Well, let me give some background information. As part of the use

attainability analysis study, the IEPA asked the District to perform a study of end of pipe CSO treatment for certain portions of the Chicago Area Waterway System. So we did look at this, but this was designed, as I understand it, to look at disinfecting -- end of pipe disinfection of certain CSOs.

MR. ETTINGER: So you only looked at CSOs from the point of view of disinfection? You didn't look at them in terms of TSS or BOD or anything else?

DR. ZENZ: As part of the process to disinfect it, we felt it was -- you know, each of these -- for an end of pipe CSO treatment system, you would have to put in some kind of system to get the water up to groundwater level to disinfect it. So the CSOs are down below grade so it would have to be pumped.

So we figured well, we're going to pump it. We'll have to screen it to protect the pumps. Then we put it fine screens downstream of the pumps to remove any other additional screening materials that would screw up or just mess up the pumping system and the disinfection system.

Then we since we decided in the study that the disinfection system would be UV disinfection, which the District feels is the future for disinfection, I'm sure you have heard that enough times during the testimony, that we would have to remove some solids to make the UV disinfection system affective and not waste a lot of money on UV disinfection because the solids are too high and are coating up the bulbs and the rest of it.

So we did have some solids removed, but only about 30 percent solids removed so still 70 percent of the organic load would still go based on this study, but that would be followed by UV disinfection.

MR. ETTINGER: Okay. So you're not -- although the aim of your study was disinfection, it sounds to me like you did learn that there's a lot of sediment in CSOs that has to be removed for it to be disinfected?

DR. ZENZ: Absolutely.

MR. ANDES: And we have copies of the report at issue to provide, which is entitled, "Technical Memorandum 3WQ Study of End of Pipe

Combined Sewer Overflow CSO Treatment."

DR. ZENZ: For whatever reason, it was not part of submittal.

MR. ANDES: Many other TMWQ documents are in the record, but not this one.

HEARING OFFICER TIPSORD: If there is no objection, we will mark the technical memorandum 3WQ file as of 10/16/06 as Exhibit 464. Seeing none, it's Exhibit 464.

(Document marked as Hearing Exhibit No. 464 for identification, 5/18/11.)

(Hearing Exhibit No. 463 admitted as evidence.)

MR. ETTINGER: I did look at this at some point, but I don't think I want to go too far on that today. I think we've had a lot of fun here this week already and we will all read the report at our leisure.

My point, though, is in the course of -- my question is in the course of preparing this study, did you take a look at what was likely to be in CSOs so that you could figure out how to screen

them out properly or how to address them properly in terms of disinfection treatment?

DR. ZENZ: Again, this was a study so within a general sense, yes, we did. We knew the District provided us with some information about the solids, load, and so forth. So we had some idea what it was. We quickly figured -- I mean, in a general sense, we quickly figured out that it would have to have some kind of solids removal system if we are going to have an affective and reasonable sized UV disinfection system.

MR. ETTINGER: And that's because the UV doesn't work very well when there's a lot of the TSS in the water?

DR. ZENZ: Uv does not work very well when there is a lot of TSS in the water, that's correct.

HEARING OFFICER TIPSORD: Mr. Harley?

MR. HARLEY: Is UV disinfection the only way to disinfect wastewater from a CSO?

DR. ZENZ: No. It's not the only way.

MR. HARLEY: What are the only other alternatives.

DR. ZENZ: Or you could use -- there's

very many disinfection systems that could be used; chlorination either with gaseous form or with the liquid -- there is liquid chlorine that's available. There is ozone at that could be used. It's not used very extensively, because it could be used.

MR. ANDES: Did your memorandum on the cause of disinfection lay out the reasons why the District has selected UV as the preferred option?

DR. ZENZ: Yes. In my previous testimony and reports that we gave to the Board, as typical of an engineering firm, before we selected UV disinfection as the method of choice, we did look at other alternatives and I just mentioned a few and I may have forgotten some of the ones we looked at. I haven't looked at that report in a while.

MR. HARLEY: Are you aware of any CSOs where the District is presently doing CSO-specific disinfections?

DR. ZENZ: No. I'm not aware of any.

MR. HARLEY: Are you aware of the fact that for the Calumet wastewater treatment plant draft permit issued by the Illinois EPA for public

comment, it includes CSO-specific disinfection for two CSOs within the Calumet River system?

DR. ZENZ: I did not know that.

MR. HARLEY: Thank you.

MR. ETTINGER: And I think you said this, but you have never looked at treating CSOs for any purpose other than achieving disinfection?

DR. ZENZ: Yes. In my career, that's the only thing I've ever -- in my career, that's the only thing I've looked at and that would that be study.

MR. ETTINGER: So you never looked at treating CSOs to take out nutrients or turbidity for anything like that?

DR. ZENZ: No.

MR. ANDES: What would be some of the challenges involved in treating specific CSOs outfalls to deal with nutrients or DO?

DR. ZENZ: Well, I can only tell you when we -- and Jennifer already testified to this affect. There were numerous CSOs, which we just could not find land in the vicinity of the CSO where we could put a treatment system. Literally any -- for example, part of the study

area was the Chicago River, which runs right through the downtown area. Well, there really was no place to put a CSO treatment system there.

MR. ETTINGER: What about the post office?

DR. ZENZ: I mean, no practical way. You would literally have to -- you know, I mean, it just -- you can do anything if you have enough money and you want to buy a multi-story building and move roads around, but that's a very difficult problem. The CSO is where it is. It's right at this particular spot.

So you've got to get, you know, some kind of a system to get it up to ground level and treat it. I suppose you could come up with a system where you do it underground in some tunneled area, but I mean we're getting into areas where it's coming a little silly, but anyway, that would be one of the biggest challenges, just locating them in a spot where you could buy the land and getting the land condemned and so forth. It would be a nightmare.

MR. ETTINGER: And unlike -- I forget whether it was Dr. Bell or Mr. Bell, but you have

not been involved in building wetlands for treatment of CSOs?

DR. ZENZ: Not in my career, no.

MR. ETTINGER: My next to pre-filed questions refer to reports that I must have thought were fascinating at the time. Do you have copies of them that you wanted to introduce or either of them?

MR. ANDES: We didn't see a reason to introduce them. We thought you might to introduce them. Not unless you do. The second one, we don't even know what you're refer to.

MR. ETTINGER: Then you know what, I'm drop those questions. The second one may be a typo from -- as far as the date goes with regard to --

MR. ANDES: We could not locate any document with that name.

MR. ETTINGER: Okay. And the first one, I'll have to find it in my files. If I find it fascinating again, you will probably see it in the final comments, but I doubt it.

MR. RAO: As far as No. 11, there is a document, "Development of a Framework for an Integrated Water Quality Strategy for Chicago Area

Waterway." Is that in the record?

MR. ANDES: I don't believe it is. We can certainly provide it for the record. As I indicated earlier, the actual final report from the "Integrated Water Quality Strategy for Chicago Area Waterway" will be available at some point in the near future.

MR. RAO: Okay. And that will summarize what the strategy is all about?

MR. ANDES: Yes.

MR. RAO: Okay.

DR. ZENZ: Just for your information, all that document is, the one that Albert is referring to, is really a scope of work for the study report that will eventually come out. That's all it is. It really isn't any -- there really isn't any information. It just says we're going to begin with a long list. We'll go through a short list. We'll develop a model. I mean, it's all the things we've talk about. It's jut a scope of work. It might be interesting to you, but there's no -- there's not conclusions. There's no costs. There's no -- there's nothing.

MR. RAO: We heard you mention. We

were not aware of this document. So I just wanted to make sure.

MS LIU: Could you give us a little idea of what the integrated strategy is for? Is it for aquatic life or is it for recreation or is it for both or is it for other things as well?

DR. ZENZ: It really is just a refinement of what my testimony is here. The --

MS. LIU: I see.

DR. ZENZ: -- objective is come up with a more refined cost estimate.

MR. ANDES: For dissolved oxygen compliance?

DR. ZENZ: That's correct.

MR. RAO: Thank you.

MR. ETTINGER: Question 13, are you familiar with MWRD-supported efforts to develop treatment wetlands for CSO or nutrient pollution?

DR. ZENZ: I'm not. Sorry.

MR. ETTINGER: Have you ever heard of a proposal to create wetlands in the Lake Calumet area as a way of addressing nutrients?

DR. ZENZ: I've heard about it, but my knowledge is strictly, you know, from newspapers

an other places. I don't have enough knowledge to give you any good information.

MR. ETTINGER: Okay. I'm going to dump 16 and 17. I think -- where is this. There's not a page here because my copy is not paginated either, but below Table 6 of the document that I have and then behind the word Table 6, it says, "The wet weather provision would not be applied during a wet weather event when DO levels were greater than or equal to the minimum DO criteria." What was meant by that?

HEARING OFFICER TIPSORD: And for the record, what you were referring to was his pre-filed testimony?

MR. ETTINGER: I'm referring -- I'm sorry. I'm referring to his pre-filed testimony. Did we ever mark that as an exhibit?

HEARING OFFICER TIPSORD: Yes. It was Exhibit 463.

MR. ETTINGER: I'm referring to the third to last page of your pre-filed testimony.

MR. ANDES: Table 6.

DR. ZENZ: Yes. I see that sentence and it's just simply as what other District

witnesses have explained, which I thought pretty well, which is that during -- once these trigger events take place and the duration of wet weather exemption is two days, four days or six days as shown in Table 6, there just wouldn't be any dissolved oxygen standard during that period of time.

MS. WILLIAMS: I just want to clarify something. When you say, "I think other District witnesses have already explained well already," which witnesses are you referring to?

DR. ZENZ: I thought Jennifer did a pretty good job yesterday talking about this wet weather provision.

MR. ANDES: The particular sentence at issue --

MR. ETTINGER: My sentence is a little more confusing that than.

MR. ANDES: Let me ask you this. The sentence that says the wet weather provision would not be applied when the DO level was greater than or equal to --

DR. ZENZ: Oh, I see. Yes.

MR. ANDES: Does that mean that if

the DO levels meet the criteria or were better, that the wet weather provision doesn't apply during those circumstances?

DR. ZENZ: That's correct.

MR. ANDES: So if the DO is equal to or better than the minimum DO criteria, then, the wet weather provision would not apply, the minimum DO criteria would apply and they would be met; is that true.

DR. ZENZ: I was answering another question. I apologize.

MR. ETTINGER: And I guess I was confused by that because obviously if you're -- well, it seems if you're meeting the criteria, you're meeting the criteria, right?

MR. ANDES: That's the intent.

MR. ETTINGER: Is that what you're about to say there?

DR. ZENZ: That's correct.

MR. ETTINGER: So what is the import of this sentence and how did that lead us here.

DR. ZENZ: It was my attempt to try to explain the District's proposed standard. If I've done a poor job, I apologize.

MR. ETTINGER: Well, I was just trying to understand how this related to how you had to ran aerators or something like that.

MR. ANDES: Is the intent to say that during those times, there is no intent to exempt the District from meeting the DO criteria?

DR. ZENZ: Correct.

MR. ANDES: Okay.

MR. ETTINGER: So if you're meeting it, you don't need to be exempted from it?

MR. ANDES: Right.

DR. ZENZ: Right.

MR. ETTINGER: Okay. That was -- okay. It was so obvious to me, it was confusing. With that, I conclude.

HEARING OFFICER TIPSORD: Are there any other questions for Dr. Zenz?

All right. Let's go off the record for just one movement.

(Whereupon, a discussion was had off the record.)

MR. ANDES: Can I go back on the record for just one second? We just realized there was a question the Illinois EPA had asked Dr. Zenz.

He has located the information to answer the question. So we thought we would conclude with that.

DR. ZENZ: The question is what would be the schedule for pilot studies designed and construction required to meet the District's proposed standard.

We found the document and I didn't want to trust my memory, but I'm saying the pilot full scale studies would take two years, design would take two years and construction would take two years for a total of six years as opposed to the 28 stations and the three flow augmentation was eight and a half years.

MS. LIU: Does that schedule incorporate time for modeling or would modeling be in addition?

DR. ZENZ: It incorporates, yes.

MR. ETTINGER: Let me just ask this. The two stations that the District proposes that it would build to meet its schedule, would those also be built to meet the IEPA proposed standards?

DR. ZENZ: I don't think so. I think they are in different locations. I'm almost

positive. That's an interesting question.

MR. ETTINGER: I may one fair summary and one interesting question. I'm doing really well.

HEARING OFFICER TIPSORD: Well, you can go home.

DR. ZENZ: Oh, boy. We don't have the mile markers. These are given in, like, mile markers.

MR. ANDES: Dr. Zenz, if you look at table --

DR. ZENZ: Yes, yes, yes. Here we go. Yes.

MR. ANDES: Let me clarify this. On Table 7, these two aeration stations, those are on the south branch of the Chicago River?

DR. ZENZ: Correct.

MR. ANDES: One and a half miles downstream of Jackson Boulevard and at Throop Street, correct?

DR. ZENZ: Correct.

MR. ANDES: Okay. And on Table 1 here, it lists the aeration stations needed to meet the IEPA proposal. There are four south branch

stations?

DR. ZENZ: Correct.

MR. ANDES: Are two of them the same ones?

DR. ZENZ: Well, one is on Throop Street and the other one is on -- so one is identical and the other one is 1.5 miles downstream of Jackson Boulevard.

MR. ANDES: That's not shown exact same location as Table 1?

DR. ZENZ: Not the same exact location.

DR. ZENZ: One is and one isn't.

MR. ETTINGER: Okay. Thank you.

HEARING OFFICER TIPSORD: Anything else for Dr. Zenz?

As I indicated while we were off the record, the District's final witness, Adrienne Nemura, is ill and not able to be with us today. We are going to continue this hearing on the record until noon, May 26th. If Ms. Nemura is not available on that date, I will issue a hearing officer order canceling that continuation so we will not have to meet on May 26th if she is

not available.

I also will be doing a hearing officer order asking for people to let me know their availability for a prehearing conference to start looking at scheduling additional hearings and start looking at moving on to Subdocket D in this proceeding.

MS. WILLIAMS: Can you tell us what dates you are looking at for the prehearing conference?

HEARING OFFICER TIPSORD: Yes. I'm looking at May 26, May 27th and May 31st. If we do not have a hearing on May 26th and we were to do a prehearing conference, it would have to be in the afternoon. The Board has a session in the morning. But will hopefully get those hearing officer orders out as soon as I hear from Mr. Andes.

MR. ANDES: Yes. One other question; there's a pending motion to stay as to Subdocket A.

HEARING OFFICER TIPSORD: There is?

MR. ANDES: And I assume that parties will have an opportunity to respond to that before any decisions?

HEARING OFFICER TIPSORD: Their motion

is asking that the Board not consider a second notice in Subdocket at tomorrow's Board meeting and the Board's agenda is out for tomorrow's Board meeting. The Board's agenda has R08-9 Subdocket A on pending decisions. So I personally think that moots the motion. I mean, the motion was only to hold off on May 19th so the Board's agenda had actually -- the agenda came out about the same time we got the motion. The agenda has it on pending decisions and so it is not up for the Board's consideration tomorrow.

MR. ANDES: Thank you.

HEARING OFFICER TIPSORD: So that moots the motion. Like I said, although it looked like it was for a stay, it really was only for the May 19th meeting.

MR. ANDES: Thank you for the clarification.

HEARING OFFICER TIPSORD: Sure. Anything else? All right. Look for hearing officer orders. Thank you all. Again, it's been a pleasure.

(Whereupon, the hearing was adjourned sine die.)

STATE OF ILLINOIS)
) SS.
COUNTY OF C O O K)

I, LORI ANN ASAUSKAS, CSR, RPR, do hereby state that I am a court reporter doing business in the City of Chicago, County of Cook, and State of Illinois; that I reported by means of machine shorthand the proceedings held in the foregoing cause, and that the foregoing is a true and correct transcript of my shorthand notes so taken as aforesaid.

Lori Ann Asauskas, CSR, RPR.
Notary Public, Cook County, Illinois

SUBSCRIBED AND SWORN TO before me this 1st day of June, A.D., 2011.

Notary Public

OFFICIAL SEAL
NICHOLAS A PERAZZOLO
NOTARY PUBLIC - STATE OF ILLINOIS
MY COMMISSION EXPIRES:03/14/15

A
abandoned 82:2
ability 55:18
able 6:12 20:8 61:7 103:19
about 12:1,2 15:19 18:11 24:15 27:7 28:17 29:10 29:12,13,17 34:16,17 36:13 42:18 60:16 65:18 65:19,20,21 66:2 72:18 74:3 75:16 78:5,17 81:13 83:6 83:7 84:22 88:12 90:5 93:4 95:9 95:20 96:23 98:13 99:18 105:8
above 14:14 14:18 58:18 72:6
absolutely 43:5 65:9 71:9 72:22 88:21
absolve 20:14
accomplish 58:10
according 39:14 40:9
accordingly 79:9
account 59:5 62:18
accumulate 16:18
achieving 34:1 70:23 92:7
acknowledge 6:6
acknowled... 6:7
Acting 5:11
active 41:13
actual 23:24 42:6,7 44:8 95:4
actually 13:24 18:15 19:14 22:24 29:3 32:4 32:21 38:4 47:3,11 61:4 62:7 68:7 73:23 81:17 105:8
add 76:15 81:23
added 52:6
adding 21:16
addition 16:12 30:13 53:8 79:22 86:11 101:17
additional 25:6 29:22 30:8,11 38:11,17,20 40:8,18,24 41:1 42:10 43:21,23 44:1,21 47:18,20 48:24 50:15 53:7 64:10 71:17 72:5 77:19 87:22 104:5
address 80:10 90:1
addresses 43:8
addressing 96:22
adjourned 105:24
Adm 1:11 5:8
admitted 4:9 7:18 89:15
Adrienne 103:19
AECOM 8:23 36:4 40:2 44:18
aerate 81:18
aerated 22:18 51:7
aeration 8:19 9:3,7 10:7 13:18 14:23 15:16 18:13 19:23 23:19 24:1,7,7 27:23 28:16 28:17,21 29:5,12 30:6 31:22 32:15,22 34:16,17 35:18 38:13 38:22 42:11 43:22 51:4 51:8,10 53:5,5,8 54:17 55:4 59:4,11 64:10 65:1 66:8 67:12 69:21 70:3 70:11 71:17 72:18 77:20 79:17,23 102:15,23
aerator 51:9
aerators 51:18 52:13 53:14 100:3
aerobic 18:17 20:14
affect 18:11 18:20 61:22 77:18 78:19 92:21
affective 88:7 90:10
affects 21:3 71:6
aforesaid 106:13
after 6:7 20:9 47:23 54:11 67:13,14,17 73:16 79:6 80:3,11
afternoon 104:15
again 15:4 21:21 23:5 36:14 39:9 40:1,16 41:3 53:3 66:16 68:4 68:17 72:3 90:3 94:20 105:21
Agency 2:21 9:2 54:6 55:1 56:13
Agency's 54:3 75:10 77:21
agenda 105:3 105:4,7,8,9
ago 10:12
agree 36:5 44:5 54:5 59:3
ahead 14:11 58:18
aim 38:3 88:17
air 12:10,12 12:14,17 19:20 52:10 53:14
Albert 3:3 79:3 95:13
Alisa 2:19 5:14 17:24
allocation 86:4
almost 52:9 101:24
already 40:15 49:6 50:7 58:17 64:9,17 70:14 71:5 71:11 72:4 89:19 92:20 98:10,10
alternative 10:15 13:20 57:9 80:18 83:24
alternatives 17:16 51:14 51:15,16 80:24 81:1 90:23 91:14
although 88:17 105:14
always 28:19
Amendme... 1:10 5:7
ammonia 18:18,22 19:11,24 20:12,15 21:16
amount 77:19 78:7
amounts 73:17
Anad 2:18 5:18
anaerobic 18:15,19 20:19 21:19
analyses 25:23
analysis 25:20 38:23 44:16 54:24 56:2 57:22 58:4 82:18 82:19,21 87:1
analyze 15:11 37:3
Andes 3:4 7:7 8:1 11:8 17:20 18:2 19:7 21:24 25:15,19 27:11,14 35:3,16,19 36:2 38:2 45:22 46:16 46:21 49:16 50:1 54:2 54:24 55:3 55:6 56:11 56:16 57:21 58:4 61:16 62:15 64:8 64:12,15 67:15,19 70:10,15 71:15,20,23 72:16 74:21 76:9,15 77:12 82:18 82:20 84:11 85:14,19,24 88:22 89:4 91:6 92:16 94:9,16 95:2,10 96:12 97:22 98:15,19,24 99:5,16 100:4,8,11 100:22 102:10,14 102:18,22 103:3,9 104:17,18 104:21 105:12,17
Andrea 2:15 5:16
Ann 1:17 106:6,17
annual 15:6 24:5
another 5:20 13:11 17:1 29:14 45:6 58:18 99:10
answer 11:5 14:20 15:3

15:13 17:13 18:8 20:6 21:5,11 24:16 33:5 33:5 42:13 42:13,21 47:8 58:15 61:1 69:12 75:19,22 78:1 80:15 86:14,20 101:1
answered 17:18 38:7 45:23
answering 99:10
answers 48:12 59:3
anticipate 59:12
anybody 20:3 60:18
anyone 6:3 77:10
anything 41:7 57:11 70:7 72:24 78:23 87:11 92:14 93:8 103:15 105:20
anyway 39:20 50:3 93:18
anywhere 57:14
apart 60:19
apologize 8:7 19:6 73:1 73:20 76:18 99:11,24
appear 30:21 83:16,23
applied 97:8 98:21
apply 73:15 99:2,7,8
appointed 5:3
appreciate 77:2
approaches 79:15 80:19
approved 10:14
approximate 74:18
aquatic 17:19 86:15 96:5
area 1:8 5:6 8:20 20:4 21:1 39:15 42:19 58:20 62:5 69:8 80:21 87:3 93:1,2,17 94:24 95:5 96:22
areas 62:19 84:11,12 93:17
around 30:22 93:10
Asauskas 1:17 106:6 106:17
asked 6:15 8:23 18:10 24:15 34:12 65:7 76:4 78:5,17 87:1 100:24
asking 29:16 46:16,19 58:13 82:23 83:5 104:3 105:1
asks 18:1
assignment 62:1 68:5
assume 25:1 48:22 80:5 104:21
assumed 25:4 61:10 68:17 76:22
assuming 42:2,5
assumption 60:19 76:2
astatic 31:18 33:3
attached 39:3
attachments 7:20
attainability 87:1
attempt 49:12,13,15 50:5 99:22
attending 5:16
attributes 74:3
augmentati... 30:6 40:17 43:22 51:7 72:19 74:12 75:1,3,11 75:16 78:7 101:13
automatica... 36:7
availability 104:4
available 32:7 85:21 86:1 91:3 95:6 103:22 104:1
Avenue 2:21 29:2 31:23 32:13,14 38:13,21 40:22,22 42:11 50:9
avoid 59:2
aware 79:14 91:18,21,22 96:1
away 67:7
awfully 22:4
A.D 1:21 106:21
a.m 1:21

B

B 4:8 10:8 74:20
back 19:20 23:4 24:14 29:8,16,18 44:19 51:22 53:3 66:12 68:8 74:17 79:2 80:17 100:22
background 86:24
bacteria 17:9 20:20 41:12
barge 53:4
base 48:24
based 7:23 12:24 23:17 49:16 53:17 53:19 56:2 57:22 59:2 61:9 68:2 72:3 74:6 83:16 88:14
baseline 50:5
basic 19:10 56:18
basically 16:3 18:12 18:19 35:13 41:14 60:22 66:6
basis 11:21 49:7
beat 52:15
before 1:16 6:8 29:18 39:2 42:4 55:1 56:14 65:15 66:17 68:4 84:5 91:12 104:22 106:20
began 67:1
begin 6:8 68:1 95:18
beginning 67:6
behave 36:8
behind 97:7
being 20:12 20:15 35:7 36:18 45:21 50:2
believe 11:15 11:23 59:2 63:15 76:6 77:12 85:24 95:2
Bell 93:24,24
below 32:3 52:19 87:17 97:6
best 30:13 62:9
better 17:18 47:13 99:1 99:6
between 13:16 22:10 30:22
beyond 38:14
bias 6:18
big 69:22 83:23 84:2 84:4
biggest 93:19
biochemical 77:17
biologist 17:19 86:15
bit 23:10 24:14 63:1
Blankenship 2:16 5:15
block 81:17
blower 12:9 12:10 32:17 32:18 33:16 33:17 51:6
blowers 32:18 58:9
Board 1:2 2:3,11,13 2:14,15,16 2:17 5:3,12 5:13,15,15 6:15,19,21 13:23,23 17:21,24 41:9 46:10 48:10,17 49:20 50:19 53:22 54:3 65:16 68:23 73:2 91:11 104:15 105:1,2,3
Board's 6:16 44:5 105:3 105:4,7,10
BOD 13:5,9 17:11 77:17 87:10
body 81:16
both 16:5 43:10,11 96:6
bother 45:9
bottom 12:9 20:18,22 46:2 52:20 52:21 76:16
Boulevard 102:19 103:8
Box 2:22
boxes 12:12
boy 102:7
branch 54:16 54:16 57:7 102:16,24
break 62:24 79:2,7
breaking 18:22 19:24
bring 57:24 73:1
brings 52:19
brought 72:15
bubbles 12:13,13
Bubbly 75:12 75:16 76:3

76:10,20
build 6:16 101:21
building 93:9 94:1
built 64:9 69:24,24 101:22
bulbs 88:9
Bullet 51:2
burned 79:12
business 106:8
buy 93:9,20

C

C 1:7 2:1 3:1 5:9,20 11:7 74:20 106:3
Cal 10:22 13:19,19 71:18,21 75:13
calculate 46:4 47:5
calculated 25:6
calculator 30:16,20
calibrate 39:13
calibrated 39:16
call 53:23 80:23
Calumet 9:17 10:16 11:4 13:2,17 14:5 22:11 22:15,17,20 22:21 23:1 23:2 35:11 66:19 69:7 70:3,4,16 70:20 91:23 92:2 96:21
Calumets 71:11
came 40:16 56:23 74:10 105:8
canal 12:1,9 51:20
canceling 103:23
capable 14:14
capacity 33:19
capital 50:8 50:10 55:8 55:13,24 64:16
capping 81:2 81:23 83:8
care 80:2
career 92:8,9 94:3
Carrie 2:17 5:12
cascade 52:9 52:10,12 57:6
cascades 52:7
case 24:2 27:6 33:17
cause 52:16 77:24 78:8 91:7 106:11
caused 75:15 79:16 86:10
causing 53:7
caution 54:14
CAWS 9:1
Center 1:20
central 37:1 37:2,24
centralized 36:12,16 37:23
ceramic 12:8 51:5,17 53:11 55:8 55:14,20 56:9,20
certain 87:3 87:6
certainly 6:22 12:23 17:21 21:12 73:2 78:4 95:3
cetera 28:7,7 47:14,14,14 76:22
Chairman 5:11
challenge 61:14 62:2 62:9
challenges 92:17 93:19
chances 58:19
change 57:8 60:5 64:4,6 69:8 70:6 78:4,9
changed 50:3 75:17
changes 58:11
channel 13:19 75:4
characteriz... 45:23
check 31:2
chemical 81:5
chemistry 19:10
Chicago 1:8 1:20 2:6 5:6 8:15,20 10:18 15:1 20:4 21:1 39:15 42:19 57:5 58:20 62:5 80:21 87:3 93:1 94:24 95:5 102:16 106:8
chlorination 91:2
chlorine 91:3
choice 39:24 40:4,5 91:13
choose 56:9
circumstan... 99:3
City 106:8
clarification 105:18
clarify 28:11 28:15 40:6 57:21 76:9 85:15 98:8 102:14
clear 29:10 50:8 71:9
clearly 37:14
clients 17:15
Club 6:1
coating 88:9
Code 1:11 5:8
Combined 89:1
combines 55:11
come 26:3 33:17 37:13 48:18 54:21 56:20 57:1 57:1 61:8 67:9 75:23 79:2 93:15 95:15 96:10
comes 51:22 52:2 56:21
coming 22:15 36:17 78:20 93:18
comment 11:9 17:10 92:1
comments 94:21
comparativ... 45:21
complete 6:16 12:2 20:8
completed 10:11 67:3 67:5 69:2,6 70:21 80:4
completely 12:15 37:18
completion 59:6,10 61:6,10 63:4,10 67:10,13 80:12
complex 34:2 34:7 58:14 60:13 62:21 63:16,20 68:5 76:21 78:11
compliance 34:1 45:3 54:19 56:3 58:1 96:13
compliant 45:2
complicated 44:15
comply 38:22 46:4
complying 38:4 43:9 43:13,17,18 44:6,8 45:19 48:19 48:23
component 83:15,18
compressed 12:10 53:14
computer 24:21 27:18 37:2
concentrati... 53:1
concept 82:8
concerning 49:17
conclude 100:15 101:2
conclusion 4:4 5:18 31:13 75:23
conclusions 95:22
concrete 12:12
condemned 93:21
condition 47:21
conditions 18:16,20 20:19 37:17 37:18 39:14 40:23 52:24 59:15
conduct 47:16
conducted 9:19
conference 104:4,10,14
confused 99:13
confusing 98:18 100:14
conjunction 30:5
consent 61:6
consider 51:10 55:19 105:1
considerati... 105:11
considered 51:5,7 55:4 76:21
consist 34:13
construct 65:12
constructed 24:8 35:6 71:3,4
constructing 17:16 72:18
construction 59:19 65:16 65:20 67:2

72:10 101:6 101:11
consulting 67:1
contain 22:21 82:3
contained 53:21
contains 73:23
continuation 103:23
continue 103:20
Continued 3:1
continuing 79:18 82:20
continuously 47:10
contractor 40:2
contribute 18:6 43:3
control 1:2 2:3,11 13:23,23 32:16 36:12
controlled 35:14
convert 30:17,24
converted 18:18
converting 18:17
Cook 1:18 106:8,18
copies 88:22 94:6
copy 7:6 97:5
correct 10:5 13:6,15 19:11,21 27:17 31:7 35:21 38:6 50:4 54:4 55:2,5 56:4 56:15 58:3 58:6 59:6 61:19 64:14 64:18 72:1 74:1,2,9,22 74:23 75:5 75:8 76:6 76:11 85:22 90:17 96:14 99:4,19 100:7 102:17,20 102:21 103:2 106:12
cost 8:23 34:4,6,10 36:15 37:6 38:1 43:8 43:13,16,18 43:23 44:6 44:7,8,13 44:14 45:11 45:16,19 47:18 48:1 48:2,4,6,6,8 48:18,24 49:7 50:8 50:11,14,16 50:18 51:11 54:7,13,14 55:8,9,22 55:23,24 56:10,22,23 57:5,9,16 57:18,22 58:5,8 59:5 60:17,22,24 64:12 68:15 70:23 71:6 74:13,18 79:19 96:11
costs 38:17 43:11 44:18 46:4 50:9 50:10,11 54:22,22 55:13,18 56:7,8,17 56:18,20,22 56:24 64:17 95:22
County 1:18 106:3,8,18
couple 26:10
course 22:20 22:22 37:8 44:22 46:21 51:23 53:15 70:4 78:7 89:21,22
court 6:11 47:1 106:7
crashes 42:16 43:3
create 96:21
creating 84:15
Creek 75:12 75:16 76:3 76:10,20
criteria 8:18 9:6 10:1 97:10 99:1 99:6,8,14 99:15 100:6
CSO 27:2 43:3 59:10 60:9 61:22 65:2 69:7 69:22 70:22 87:2,14 89:1 90:20 92:23 93:3 93:11 96:18
CSOs 27:3 47:14 62:12 63:3 65:2,3 69:11,14,17 78:5 79:16 80:1,11,11 80:19 83:20 84:4,8 86:5 86:10,18,20 87:7,9,17 88:19 89:24 91:19 92:2 92:6,13,17 92:21 94:2
CSO-specific 91:20 92:1
CSR 1:17 106:6,17
current 24:15 25:9 26:14 31:9 43:13,17 44:6,14 45:18
currently 9:1 31:9 48:23 49:18

D

D 4:1 14:11 35:23 104:6
dam 57:8
Darn 72:15
data 11:13 15:11 24:19 27:7 37:3 39:9,12,13 42:6,7,19 49:17
database 42:2,3,6
date 94:15 103:22
dates 61:10 104:9
David 4:3 5:23 7:3,10
day 1:20 5:20 6:20 21:23 22:4,6 33:14 106:20
days 6:21 24:11 30:23 33:14 73:18 74:1,6,7,7,8 98:4,4,4
deal 92:18
deals 35:19
DEBORAH 2:23
decide 64:6 66:7
decided 39:21 55:22 60:15,21 63:18 88:1
decision 6:17 63:17 82:15
decisions 104:23 105:5,10
declination 61:3
decline 61:1
decrease 60:4
decree 61:6
defeated 46:8
definitely 80:1
degree 63:2
delivers 12:10
demand 41:11,19 77:17 80:22 81:4 83:15 83:18,18,22 84:9 86:5
denitrificat... 18:15,22 19:19 20:21 21:18
denitrify 19:13 20:19
denitrifying 18:12
department 9:19 35:23 36:1
depend 73:17
depending 20:17 32:6
deposits 81:3
Des 1:9 5:7
describe 9:13 22:9 80:19
described 63:9
describes 39:6
describing 43:4 85:8
design 8:18 9:5 10:1 33:9,10 65:18 67:1 72:9 101:11
designed 11:16 33:11 33:14 61:23 65:12 87:5 101:5
designing 17:16
detail 9:14 48:2
detailed 48:7
determine 16:23 30:8 34:9,11 47:17 48:4 57:16
determined 38:20 43:12 43:21 47:24 54:11
determining 44:7 66:14 78:9
develop 8:18 37:5 95:19 96:17
developed 9:5
developing 10:1 68:15 85:16
development 9:4,19 94:23
device 52:14
devices 81:18
Devon 29:1 32:14 38:12 38:21 40:7 40:22 42:11
Devon/We... 50:9
Dick 69:1
die 105:24
different

5:16 12:15 18:16 28:4 28:4,5,6,6 32:8,14 36:1 52:8 72:10 76:1 81:1 101:24
differs 35:6
difficult 59:16 61:12 61:12,24 62:1,22 68:5 93:10
difficulties 83:13
difficulty 82:16
diffused 12:14,17
diffuser 55:14
diffusers 12:9,11 29:2 51:5 51:17,18 53:11 55:8 55:20 56:10 56:20
dimensional 62:3
diplomatic 44:11
direct 33:5 47:8
directed 47:4
directly 32:17 35:17 62:18
discharge 22:11
discharged 18:5 20:12 20:15
discharges 22:22 26:23 26:24 62:11 62:12,14,20 83:20,21
discrepancy 73:19
discuss 68:19
discussing 84:6
discussion 66:1 68:20 100:20
discussions 13:15 15:19
disinfect 87:13,16 90:20
disinfected 88:20
disinfecting 87:6
disinfection 77:16 78:16 78:17,20 87:6,9,24 88:2,3,4,7,8 88:15,17 90:2,11,19 91:1,7,13 92:1,7
disinfections 91:20
disk 51:5
dissolve 29:7
dissolved 8:24 29:23 31:24 35:13 39:12,14 52:6 53:1 61:9 68:1 79:15 86:11 96:12 98:6
District 8:15 8:18,19,22 9:3 10:6 13:16,18,22 15:6,19 17:5,7 21:8 21:12 27:7 36:5 40:3 40:21 42:20 43:8 45:17 46:17,22 47:4,12,20 48:3,23 50:17 53:6 54:18 55:21 56:14 63:2 66:14 74:9 74:11 76:20 76:23 78:18 79:19,20,24 83:3 85:17 87:2 88:3 90:5 91:8 91:19 97:24 98:9 100:6 101:20
District's 24:3 43:9 43:24 46:9 48:20 49:3 72:11 73:23 74:4,5,13 74:24 75:2 75:15,17,24 77:21 99:23 101:6 103:18
diversions 60:3,4
diverted 22:16
Division 8:17
docket 5:9 86:2
doctors 8:9
document 7:13 13:14 56:12 66:21 89:10 94:17 94:23 95:13 96:1 97:6 101:8
documented 84:3
documents 10:13 89:4
doing 21:15 55:23 83:4 91:19 102:3 104:2 106:7
done 15:12 20:24 21:24 35:7 46:11 46:13 50:2 54:14,24 56:12,13 62:23 65:23 66:17 67:14 67:19,22 72:20 83:17 99:24
doubt 40:5 94:21
down 16:17 18:22 19:24 47:2 52:3 52:18,20 60:10 61:7 63:1,3 86:10 87:17
downstream 27:21 87:21 102:19 103:7
downtown 93:2
Dr 4:3 6:18 7:3 8:3,4,5 8:5,10 9:5,9 9:12,15,18 9:24 10:5,9 10:20,22,24 11:5,12,17 11:21 12:4 12:8,19,23 13:3,6,8,11 14:6,12,20 15:3,18 16:7,13 17:3,12 18:7,14 19:14,17,21 20:1,10 21:9,20 22:12,19 23:12,15,22 24:18 25:4 25:13,17,20 25:21,22 26:3,5,7,8 26:11,16,18 26:20,20 27:6,13,17 28:13,19,24 29:15,21 30:19 31:1 31:6,12,20 33:4,13 34:8 35:1 35:12,17,21 36:4 37:15 38:6 39:1,2 40:9,10,13 40:15 41:5 41:6,24 42:1,17 43:5,10,15 43:20 44:10 44:20 46:6 46:12,14 47:7,9 49:5 49:8,19,21 50:4 51:1 51:11 53:19 54:4,8,10 55:2,5,7 56:4,6,17 57:11,23 58:3,6,13 59:7,13 61:11,15,19 61:20 62:17 63:5,8,15 63:17 64:9 64:11,14,18 64:22,24 65:9,14 66:3,10 68:3,11,17 69:4,10,15 69:17,19 70:4,8,13 70:18 71:1 71:13,16,19 71:22 72:1 72:3,8,12 72:16,22 73:5,12,20 74:8,15,19 74:23 75:5 75:8,12,18 76:1,5,11 76:16 77:7 77:14,15,22 78:18 79:18 80:5,8,13 80:20 81:12 82:4,7,11 82:13,16,19 83:1,3,7,13 84:4,5,12 84:17,21 85:12,18,22 86:7,13,19 86:23 87:12 88:21 89:2 90:3,15,21 90:24 91:10 91:21 92:3 92:8,15,19 93:6,24 94:3 95:12 96:7,10,14 96:19,23 97:23 98:12 98:23 99:4 99:10,19,22 100:7,12,17 100:24 101:4,18,23 102:7,10,12 102:17,21 103:2,5,11 103:13,16
draft 91:24
drastic 81:13
drilled 52:18
drop 16:17 94:14
dropping 19:4
dry 27:11 37:18 39:22 39:23 84:8 86:5
DUFLOW 62:3
dump 97:4

duration 73:18 98:3
during 27:15 36:19 37:16 38:15 41:17 42:12 73:15 73:16 88:5 97:9 98:2,6 99:2 100:5

E

E 2:1,1,13 3:1,1 4:1,8 12:20
each 6:11 19:4 24:1 27:15 32:1 32:8,15 33:16 35:19 39:11 73:16 87:13
earlier 11:24 24:14 95:4
early 10:11 22:4 82:15
easily 30:10
East 2:21
effect 86:11
effective 15:16
efficiency 15:17
effluence 59:22,22
effluent 1:7 5:5 13:9 22:21
effort 17:15 48:7
efforts 96:17
eight 65:21 66:6,6 67:7 72:21 86:10 101:14
either 32:10 41:6 48:19 49:2 77:15 77:20 91:2 94:7 97:6
eject 53:3
electricity 50:13
elevated 9:6
elevation 57:8 58:10 58:16,16,20
Eleven 24:9,9
eliminate 60:9 69:11
eliminates 59:10
eliminating 69:7
elimination 75:15
employed 8:14
end 54:7 87:2 87:6,14 88:24
engineer 30:15 51:13 67:1 86:16
engineering 15:22 58:14 91:12
enough 64:2 88:5 93:8 97:1
entered 6:3
entire 24:10
entitled 5:4 88:23
ENVIRON... 2:21
Environme... 8:16 9:2 14:4
EPA 10:14 13:16 15:7 46:10 48:19 66:18 69:13 79:20 91:24 100:24
equal 97:10 98:22 99:5
equipment 43:21,23 44:1,21 47:19,20,24 49:1 50:13 50:15
estimate 34:6 34:10 36:14 48:1,2,5,6,8 49:7 50:8 50:11,15,18 51:12 54:13 54:14 55:18 55:22 56:10 56:23 57:16 57:19 74:13 79:20 96:11
estimates 8:23 48:7 48:24 57:5 63:2 68:16
estimating 38:16 56:22
et 28:7,7 47:14,14,14 76:22
Ettinger 3:3 11:23 12:6 12:16 18:10 18:21 19:2 19:6,9,16 19:18,22 21:13,22 22:2,5 28:11,14,23 29:9 31:16 32:21 42:14 42:23 46:2 46:7,15,19 46:23 48:15 61:4,13 62:24 63:7 66:5 67:8 67:18,21 70:2,6,9 79:4,11,12 79:24 80:7 80:9,16 81:10 82:1 82:5,9,12 82:22 83:2 84:2,14,19 84:23 85:3 86:9,17,21 87:8 88:16 89:16 90:12 92:5,12 93:4,23 94:4,13,18 96:16,20 97:3,15,20 98:17 99:12 99:17,20 100:1,9,13 101:19 102:2 103:14
evaluation 53:20
even 20:17 32:22 42:12 48:12 60:2 68:19 81:7 94:12
event 36:19 60:7 62:13 73:16 97:9
events 27:2,2 28:6 65:2 69:7,22 70:22 98:3
eventually 95:15
ever 14:5 52:2,8 61:3 92:9 96:20 97:17
every 33:15 60:19
everybody 37:12 54:15 55:12 60:19 83:10
everyone 5:2
everything 74:10
evidence 7:18 89:15
exact 103:9 103:11
exactly 61:17
example 36:19 45:1 59:17,21 63:17 92:24
except 34:20
Excuse 26:6
exempt 100:6
exempted 100:10
exemption 98:4
exercise 30:3 47:16 62:21
exhibit 4:10 4:11 6:3 7:11,11,12 7:14,17 89:8,9,11 89:14 97:17 97:19
exist 25:5 47:22
existing 8:19 9:3,6 10:7 11:3 14:13 14:15,17,18 15:1 24:20 24:22 25:1 29:17,22 30:11,12 31:14 34:16 35:12 38:12 38:13,17,21 39:14 40:13 41:8 42:1,3 42:18 44:19 44:22 45:8 45:11 46:4 49:9,11,15 49:17,23 50:12 60:23 64:3 70:23 71:11 72:4
expand 34:24
expect 66:9 73:6
expected 23:20
expertise 58:7
explain 26:18 35:4,6 45:14,15 73:19 75:14 99:23
explained 98:1,10
explains 55:3
express 6:17
extensive 34:19,22
extensively 91:5
extent 10:4 62:6 65:4 78:9 80:11
extra 30:22
extreme 13:18
extremely 59:15 62:22 83:24

F

face 19:4
facilities 17:17 33:19 34:3 65:19 86:6
facility 14:5 22:11 33:13 51:6
fact 45:17 69:5,12 72:4 91:22
factored 43:18
fair 21:20,23 57:22 102:2
fairly 24:12 34:19 44:15 48:11 58:13 63:16
fall 9:21 16:16 41:17 51:24 52:1
familiar 11:13 17:13 20:24 96:17

far 5:12 67:6 71:1 74:10 89:17 94:15 94:22
fascinating 94:6,20
faster 72:21
February 7:10
feel 32:10 55:22 86:13
feels 88:3
feet 23:3,4 52:21 58:18
felt 39:24 53:6 87:13
few 91:15
figure 36:18 37:11 44:18 44:20 45:4 45:10 49:13 60:14 61:21 62:8,10,11 62:13 89:24
figured 87:19 90:7,8
figures 59:5 69:8
figuring 45:9 61:24
file 89:8
filed 7:10
files 94:19
filing 54:3
film 52:11
filter 16:12
filters 13:3 14:5
final 43:18 85:20 94:21 95:4 103:18
finalized 68:9
find 10:13 13:21 25:14 25:18 26:1 30:10 39:2 47:13 53:23 74:18 92:22 94:19,19
finding 72:13
fine 23:12 87:21
firm 91:12
first 19:23 27:20 34:13 61:17 73:21 81:2 94:18
five 9:12,16 10:2 23:4 48:4 50:10 51:11 54:13 54:19 55:18 56:3,22 66:20
five-foot 16:17
flip 75:20
floor 40:17
flow 30:6 43:22 51:7 51:8 52:9 74:12 75:1 75:3,10,16 78:7 101:13
flows 52:9,11 84:9 86:5
folks 36:20
followed 88:14
following 20:7 79:8
follow-up 6:4 12:22 57:3 71:8,15 76:13 85:6
Force 14:4
forced 51:8
forego 66:18
foregoing 106:11,11
forget 19:1 30:5 34:15 93:23
forgotten 91:15
form 91:2
forth 22:23 27:4,16 62:20 67:17 90:6 93:21
forward 67:2 69:9
found 15:15 37:15 101:8
four 24:11 43:22 48:6 53:10,15 54:11,16,23 55:7 67:3 98:4 102:24
Framework 94:23
frankly 39:11 82:13
Fredric 3:4
free 9:21 16:16 22:5 51:24 52:1 57:6
frequently 63:12,13
Friends 57:4
from 1:15 5:14 9:21 11:15 12:15 13:9 15:14 15:20,20,21 16:5 18:12 19:19 22:15 22:17,20,21 22:23 24:5 26:22,24 27:1,18 33:10 35:7 42:7,7,7 44:5,7,13 52:10 57:1 57:1 59:22 61:17,20 62:11,12,14 62:18,20 64:22 65:4 66:6,7 67:5 67:7 74:9 76:23 77:17 77:24 83:21 84:9 85:9 85:20 86:5 86:5 87:9 90:20 94:15 95:4 96:24 100:6,10 104:17
front 41:7 72:24
full 9:20 33:19 65:17 72:9 74:6,6 81:15 101:10
fun 32:24 89:18
furnish 73:2
further 20:17 54:10 78:23 78:24 83:12
future 17:7 45:20 59:15 60:5,7 62:12 63:10 86:1 88:4 95:7

G

G 2:14 5:11
Gary 2:16 5:15
gas 18:19
gaseous 91:2
gave 69:13 91:11
general 18:7 20:1,2,5,11 21:4,21 28:20,24 41:21 42:3 43:2 45:7 58:15 68:24 69:1 73:22 74:2 82:8 82:23 83:5 90:4,8
generalize 66:5
generally 20:14 84:23
Gentlemen 18:24
gets 60:1
getting 48:12 93:17,20
giant 12:11
Girard 2:14 5:11 6:18 6:19 48:10 48:17 49:20 50:19
give 16:4 47:7 53:24 55:10 58:14 59:17 63:16 66:3 69:12 71:14 80:20 86:23 96:3 97:2
given 33:12 40:22 63:3 63:8 68:14 102:8
giving 13:13 21:4 39:19 54:21 56:6 56:7
go 12:20 14:11 19:19 23:9 24:14 29:15,18 35:4 36:10 42:24 44:18 44:19 48:8 54:10 63:1 66:9,15 68:7 71:1 74:16 79:14 80:17 88:14 89:17 95:18 100:18,22 102:6,12
goes 23:3 94:15
going 5:22 17:12 20:17 23:9,13 30:17 34:21 35:9 36:20 38:8 48:8,9 54:21 56:18 59:18 60:16 61:21 64:23 65:11 66:8 67:24 68:4 72:23 73:5 73:10 79:11 80:3 83:12 87:19 90:10 95:17 97:3 103:20
good 5:1 6:19 8:2,3 13:24 32:10 39:12 39:19,21 40:5 64:2 66:24 97:2 98:13
grade 87:17
grams 63:24
Grand 2:21
great 83:22
greater 8:15 97:10 98:21
ground 93:14
groundwater 87:16
guess 33:4 60:24 75:18 99:12
guy 42:17
guys 45:8 54:20

H

H 4:8
half 65:20,22 66:7 67:7 72:21 101:14 102:18
hand 6:6
handle 47:14
happen 20:8 21:6 37:22 42:23
happened 66:13
happening

20:21 44:23
happens 27:20 64:1
happy 45:15
hard 8:8
Harley 14:2 14:3,3,7 16:10,11,24 18:3,4,9 22:8,9,14 23:6 33:7,8 33:21 43:1 43:2,6 59:8 59:9 61:2 68:6,7,14 68:22 69:5 70:19,20 71:8 72:2,7 78:13,14 85:5,7,13 85:23 86:3 86:8 90:18 90:19,22 91:18,22 92:4
hate 78:2
head 51:23 52:21
hear 5:22 19:5 104:17
heard 12:2 84:21 88:4 95:24 96:20 96:23
hearing 1:16 2:8 4:3,4,10 4:11 5:1,4 5:17,18,19 7:1,5,8,14 7:17,21,23 8:6 14:2,8 16:9 18:3 18:24 19:3 22:3,7 23:7 26:6,9,12 26:17,19 28:9 33:7 33:22 43:1 50:21 57:2 58:23 59:8 68:6 69:15 70:19 77:1 77:9 78:13 78:22 79:1 79:10 85:5 89:6,11,14 90:18 97:12 97:18 100:16 102:5 103:15,20 103:23 104:2,11,13 104:16,20 104:24 105:13,19 105:20,23
hearings 5:20 6:22 104:5
heck 36:20 54:20
height 23:4
held 79:9 106:10
help 6:16 9:4 19:23 37:10 68:21 85:15
helped 8:18
helpful 17:23 41:9 66:10
helping 21:18
helps 50:20
her 11:24 29:16
high 24:6 41:18,19 51:9 88:9
highest 53:11 55:21,23
him 28:7 39:19 46:16 46:18,20,22 46:24 65:7 83:16
hire 47:4
hired 47:6 66:24
hiring 46:17 46:22
historic 6:20 6:22
history 66:11
hold 105:7
home 102:6
honest 20:23 81:21
honestly 62:2
hope 55:12
hopefully 13:14 19:20 104:16
hours 23:24 24:5,6,6,9 24:10 25:6 25:9 26:13 26:14 27:15 27:24 29:17 29:22 30:8 30:8,17,24 31:14 33:11 33:14 38:11 40:8,19,19 40:24 41:2 41:4,8 42:10 49:17 49:23 63:19 63:23,23 64:4,7,16 64:21 72:5 73:16,24,24
huge 62:1
human 36:18
hydrostatic 52:21
hypothetic... 59:9 61:5 67:8

I

idea 13:24 16:5,7 37:6 54:22 55:10 56:9 60:23 68:11 80:1 90:6 96:4
identical 103:7
identificati... 7:15 89:12
IEPA 5:24 24:2,4 29:24 38:23 43:10 44:2 47:18,19 53:22 56:12 74:21 87:1 101:22 102:24
IEPA's 46:8 49:2
ill 1:10 5:7 103:19
Illinois 1:2 1:19,20 2:3 2:6,11,21 2:22 9:2 20:12 21:2 48:19 91:24 100:24 106:1,9,18
immediate 5:10,14
immediately 67:16
impact 17:8 17:10
impacting 17:5
implemented 57:20
import 99:20
important 8:10
impossible 58:22
improve 47:13
improved 45:20
improveme... 70:16
improveme... 47:11
improving 11:20 47:10
include 29:19 38:1 45:17 86:3
included 34:5 37:7 44:14 50:9 50:10,11,14 51:17 53:10 53:13 85:10
includes 60:7 92:1
incorporate 101:16
incorporates 101:18
increase 63:18
increased 58:11
increasing 72:19
incurred 64:17
indicated 29:21 65:16 69:19 84:7 95:4 103:17
indicates 57:24
industry 66:24
inflow 72:19
influence 27:2
information 15:8 17:8 17:20 25:16 25:23 26:21 26:22 41:6 41:20 68:13 68:15,20 71:14 75:22 86:24 90:5 95:12,17 97:2 101:1
infrequent 23:20,21 24:12 42:11
infrequently 31:10
initial 54:3 56:1
inject 52:22
inlet 81:14,17
inlets 82:11 82:14,17 83:4,6 84:15
input 26:21
inputs 26:23 28:4 62:10
insignificant 16:22
install 10:7
installed 10:18 12:4 13:2 14:5 51:5
installing 10:15 13:18 57:6
integrated 85:17,21 94:24 95:5 96:4
intended 6:15 11:10 11:16
intent 99:16 100:4,5
interesting 21:10 60:13 95:21 102:1 102:3
interrupt 85:7
introduce 94:7,10,10
Introduction 4:3
involved 68:12,12 80:14,17 92:17 94:1
involvement 9:14 10:4
involves 21:16

14:23 15:15 16:5 20:9 28:16 29:1 29:3,4 31:22
issue 26:4 59:24 88:23 98:16 103:22
issued 55:1 91:24
issues 35:9

J

J 2:23
Jackson 102:19 103:8
James 1:19
January 42:16
Jennifer 84:22 92:20 98:12
jet 51:18 53:14
job 62:7 67:14 98:13 99:24
John 57:4
Johnson 2:13 5:13 17:24
joining 5:17
Joliet 66:1
joy 6:23
just 11:12,18 12:2,19 13:13 15:3 15:4,5 18:10 21:13 25:2,10,13 25:18,24 28:11,13,14 28:16 29:9 29:15 32:18 34:20 35:11 42:21 44:2 45:6 46:19 52:1,14 56:6 57:15 57:21 59:3 59:17 60:11 60:24 62:24 63:9,16 65:6 68:19 71:8,9 74:2 74:8 77:1,4 78:4 80:13 80:15,19 81:2 82:23 83:5,11 87:23 91:14 92:22 93:8 93:19 95:12 95:17 96:1 96:7 97:24 98:5,8 100:1,19,23 100:23 101:19
justified 55:22
jut 95:20

K

K 106:3
keep 8:8 23:10 48:12 69:16
Keith 14:3
kind 21:13 34:13 36:6 37:2,4,9,24 45:4 48:1 50:5 52:9 83:9 87:15 90:9 93:14
kinds 12:6
knew 90:4
know 10:17 11:12 12:16 12:19 14:4 14:16 15:5 16:22 18:4 20:2,5 24:16 25:12 26:5 31:13 31:16 33:1 33:5,15 35:1 36:11 36:16 39:11 41:4,9,22 42:15,24 44:13,14 45:2,3,12 45:14 49:24 54:20 60:11 60:16 61:21 62:4 63:6 64:7,23 66:11 67:23 68:9,22 69:10,11 71:2,10 72:14 74:10 78:2,19 80:6,9 83:20 84:17 84:20,21,23 87:13 92:3 93:7,13 94:12,13 96:24 104:3
knowledge 85:4,10 96:24 97:1
knows 55:12

L

L 2:16
lake 60:2,4 96:21
laminar 52:9
land 29:7 92:22 93:20 93:21
landmark 5:21
Langdon 69:1
language 28:12
last 97:21
later 73:2,9
lawyers 48:15
lay 91:7
layer 81:3,23
lead 99:21
leap 39:17
learn 88:18
learned 59:14 76:23
least 63:10
left 5:11,12
leisure 89:20
less 24:9,10 63:13 64:7 64:16,21 70:15 71:4 71:6 73:6,6
let 26:18 50:7 54:10 57:21 59:17 76:9 85:14 86:23 98:19 101:19 102:14 104:3
let's 6:24 8:11 12:20 44:17 64:1 75:21 79:1 80:17 100:18
level 13:11 32:6 35:20 48:4,6 51:11 54:13 55:18 56:22 87:16 93:14 98:21
levels 14:14 14:18 61:9 63:3 79:16 86:12 97:9 99:1
lieu 13:2 66:19
life 96:5
lift 51:15
lifts 23:23
like 24:13 30:23 34:20 45:8 46:24 53:21 57:12 59:1 60:2 61:13 63:22 81:14 86:13 88:18 92:14 100:3 102:8 105:14,15
likely 21:17 57:18 89:23
limit 81:4
Limitations 1:7 5:5
line 46:3
liquid 91:3,3
list 51:14,16 53:9,14,16 54:12 95:18 95:19
listed 71:16 73:18
lists 102:23
liter 53:2 54:20 56:3
literally 52:15 92:24 93:7
little 13:19 23:10 24:14 28:12 32:14 32:14 42:4 63:1 71:21 75:13 79:4 81:12 93:18 96:3 98:18
Liu 2:19 5:14 12:21,24 13:4,7,10 17:1,4,23 20:7 21:7 72:8 73:3,8 76:12 77:12 77:15 78:12 96:3,9 101:15
load 78:20 88:13 90:6
loads 78:8
local 37:13
locate 41:5 94:16
located 71:18 71:20 101:1
locating 93:19
location 37:1 57:14 103:10,12
locations 101:24
logical 21:14
long 39:20 42:13 48:12 51:14,16 65:11 75:22 95:18
longer 48:13
longest 61:2
look 15:11 23:22 29:20 35:10 39:5 57:6,11,13 65:8 82:14 87:4,5,10 89:16,23 91:14 102:10 105:20
looked 15:9 20:3 27:7 39:9,10,10 51:12,14,14 51:18,23 52:2,7,13 52:17 53:4 53:5 57:12 57:15 66:12 82:5,9 84:14 87:8 91:16,16 92:6,10,12 105:14
looking 17:21 26:7 35:11 67:11 75:10 77:6 79:22 80:23 81:9 83:4 83:11,14 104:5,6,9 104:12
looks 30:23
Lori 1:17

losing 69:16
loss 51:24
lost 19:7,9
lot 17:15 31:3 52:16 72:21 88:7,18 89:18 90:13 90:16
lots 81:15
low 24:6 41:11 51:21 79:15
lower 1:9 5:6 57:8
lowest 55:8,9 55:24

M

M 35:24
machine 106:10
made 40:4 42:3 53:16 56:24 60:20 63:17 70:16 82:15
main 22:11 51:8 81:16
mainly 41:16 41:17
maintain 14:18 15:16 50:13
maintaining 11:3 14:14 14:24
maintenance 16:20 33:18 55:9,13
major 83:18
make 28:16 29:10 38:3 39:15,19,20 50:7 63:22 83:10 88:6 96:2
makes 39:16
man 32:5 36:10
management 81:8,11 83:9
manual 37:9
many 8:9 9:10 10:12 37:15 41:4 42:20 65:1 71:17,20 76:1 82:14 84:7 89:4 91:1
Marie 1:16 2:8 5:2
mark 7:9 89:7 97:17
marked 4:9 6:2 7:13 89:10
markers 102:8,9
Marquette 23:18 24:19 38:16,20 63:21
matches 74:10
materials 85:9 87:23
matrix 53:19 53:20,21 54:12
MATTER 1:4
maximum 33:10 73:18
may 1:21 6:3 12:21 16:14 45:3 76:12 91:15 94:14 102:2 103:21,24 104:12,12 104:12,13 105:7,16
maybe 15:11 37:21 61:6 66:1,10 76:3
mean 20:10 23:21 30:15 31:2,8 34:6 45:9,13 49:13 62:21 64:11 76:9 90:7 93:6,7 93:17 95:19 98:24 105:6
means 106:9
meant 72:24 73:22 75:20 97:11
measured 73:16 74:1
mechanical 16:2 52:13
meet 24:1,4 29:23 30:4 32:19 43:24 44:2,14,18 44:21 45:11 47:18,19 49:2,15 54:18 57:9 61:9 77:20 99:1 101:6 101:21,22 102:23 103:24
meeting 44:24 45:18 49:21,22 79:20 99:14 99:15 100:6 100:9 105:2 105:4,16
Melching 25:20,22 26:3,20 27:6 29:19 29:21 37:15 40:15 41:24 44:20 46:12 47:9 49:8 57:23 61:20 63:17 64:24 69:19 82:16 83:3,13 84:5
Melching's 39:2 40:10 41:6
member 2:13 2:14,15,16 2:17 5:12 5:13,15,16 6:15,19 17:24 48:10 48:17 49:20 50:19
MEMBERS 2:11
membrane 51:17
memorand... 53:23 88:24 89:8 91:6
memory 101:9
mention 95:24
mentioned 12:24 15:5 42:14 91:15
mess 87:23
met 99:9
method 91:13
methods 81:7
Metropolit... 8:14
Meyer-Glen 3:3
Michigan 60:2
microbial 18:16
might 11:24 15:4 17:23 21:8 64:5 64:15 80:3 80:10 81:22 85:15 94:10 95:21
mile 102:8,8
miles 27:21 102:18 103:7
milligrams 53:2 54:19 56:3
million 55:14 55:16
mine 77:8
minimum 76:19 97:10 99:6,8
missing 25:10
misunderst... 73:21
model 24:21 24:23 25:1 28:1,1,7,18 30:2 39:11 39:13,16,19 40:10 41:24 44:20 47:10 47:12 62:3 62:3,6,8,9 62:17 63:22 63:22 75:19 75:23 82:17 83:15 84:6 95:19
modelers 26:21
modeling 27:18 39:24 49:6,8 57:23 60:12 61:8,20 63:20 67:19 67:22,22 68:1 78:10 83:14 101:16,16
modify 62:5
moment 6:24
money 88:8 93:8
monitor 35:6
monitoring 8:16 15:8 34:3,4,7,13 34:19 35:15 35:22 36:3 37:23
Moore 2:15 5:16
moots 105:6 105:14
more 9:14 26:13 34:17 42:20 63:12 70:17 76:12 86:15 96:11 98:18
morning 5:2 6:19 8:2,3 104:15
most 57:18 70:10 79:13
motion 104:19,24 105:6,6,9 105:14
mounted 53:4
move 50:23 93:9
moved 46:3
movement 100:19
moving 104:6
much 16:6 21:2 37:6 45:4 48:7 58:8 65:5 83:12
multi-story 93:9
must 94:5
MWRD-su... 96:17
myself 17:19 39:8

N

N 2:1 3:1 4:1
name 5:2 6:8 94:17
natural 57:8 58:10,20
near 86:1 95:7
necessarily

47:22
necessary 20:8 31:19 32:19 49:1 59:12 67:12 75:3
need 6:4 13:17 37:16 40:7 42:4 58:17 100:10
needed 29:22 37:19 38:22 44:21 57:24 58:5 68:2 77:20 102:23
needs 70:16
Nemura 103:19,21
network 34:3 34:4,7
never 15:9 41:15 92:6 92:12
new 24:7 30:5,6 36:3 39:18 72:18
Newly 78:20
newspapers 96:24
next 19:19 94:4
NH 19:12
nice 73:3
nicely 15:23
nightmare 93:22
nine 50:24
nitrate 18:18 19:20,24 20:16
nitrates 18:18
nitrification 18:17 20:11 21:15
nitrified 20:15
nitrify 19:17 19:18
nitrogen 18:19 77:23
nod 47:1
Nodding 46:14
nods 47:2
nomenclat... 28:20
none 7:11 50:16 89:9
non-point 20:13
noon 103:21
north 2:21 32:17 37:21 54:16 57:7 75:4
notary 1:17 106:18,23
note 6:14 77:5
notes 106:12
nothing 78:24 95:23
notice 105:2
notions 6:18
November 42:16
number 8:12 25:9 30:3 32:7,8 69:23 77:3 77:19 78:1 78:6
numbers 31:2 47:5 57:1 61:8 77:3,8
numeric 76:10,24
numerical 76:19
numerous 92:21
nutrient 17:6 17:8,10 77:16,22 78:15 96:18
nutrients 92:13,18 96:22

O

O 35:24 106:3,3
object 45:22
objection 7:9 89:7
objective 96:10
obvious 100:14
obviously 69:14 99:13
occur 59:20
off 37:12,18 52:3 100:18 100:21 103:18 105:7
office 78:13 93:5
officer 1:16 2:8 4:3,4 5:1,4 7:1,5 7:8,21,23 8:6 14:2,8 16:9 18:3 18:24 19:3 22:3,7 23:7 26:6,9,12 26:17,19 28:9 33:7 33:22 43:1 50:21 57:2 58:23 59:8 68:6 69:15 70:19 77:1 77:9 78:22 79:1,10 85:5 89:6 90:18 97:12 97:18 100:16 102:5 103:15,23 104:3,11,16 104:20,24 105:13,19 105:21
often 24:15 71:10
oh 8:6 22:8 39:5 64:11 67:21 77:14 98:23 102:7
okay 7:22 10:24 11:14 11:22 13:7 13:10 14:8 14:12 16:8 19:14 22:7 23:7 26:17 26:19,22 27:9 28:9 28:22,23 30:14 33:22 39:13 40:12 44:17 50:21 51:1 55:6 58:23 65:10 73:12 74:16 75:21 76:7 77:4,14 78:22 86:9 86:17,21 88:16 94:18 95:8,11 97:3 100:8 100:13,14 102:22 103:14
OM 58:12
once 67:23 98:2
one 6:10 8:12 9:24 17:4 21:22 22:1 24:2 26:12 27:11,12,13 29:13 31:24 32:6,18 35:3,14,19 36:11 53:10 59:13 60:13 62:2,7 65:7 67:4 68:8 72:20 76:12 80:22,24 81:21 83:12 89:5 93:18 94:11,14,19 95:13 100:19,23 102:2,3,18 103:5,6,6,7 103:13,13 104:18
ones 69:22 80:3 91:16 103:4
only 24:11 31:24 35:19 37:16 43:20 47:15 50:15 53:9,15 54:15,16 62:11 70:5 75:4 81:21 87:8 88:12 90:20,21,22 92:9,10,19 105:6,15
onshore 12:10 22:24 51:6 58:17
onsite 81:8 83:8
onto 38:9
on-site 81:10
operate 24:9 24:10,16 25:2,3,5 27:24 28:8 30:7 32:20 33:11,14,19 36:7 37:16 40:8 42:4 50:12 61:17 64:16,21
operated 16:6 31:3,5 31:9,21 34:18 37:16 40:24 41:4 41:10,15,16 41:23 65:1 70:1 71:5 71:12
operates 35:13
operating 15:21 16:1 25:10 26:14 27:14 29:22 30:12 31:17 31:23 38:17 41:1 49:18 72:5
operation 23:19,24 24:5,20,22 26:13 29:11 29:17 30:9 30:23 31:14 32:5,9,11 32:16 34:3 38:12,14,21 40:14,18 42:8 49:9 49:14 55:9 55:13 64:6
operational 11:15 15:14 15:17 35:24 49:23 63:19
operations 34:5 49:1
operator 37:10
operators 37:10
opinion 11:19 24:12 47:16 84:1
opportunity 104:22
opposed 12:7 12:17 31:18 101:12
option 91:9
order 23:10 30:4 103:23 104:3

104:16 105:21
organic 78:8 78:20 81:3 81:6 88:13
organics 81:19
original 47:11
other 6:11,21 19:4 22:22 22:23 24:3 31:18 35:14 35:22 36:23 41:20 46:13 51:10 59:20 62:16 64:3 70:7,11,17 71:23,23 74:2 76:8 79:14,16,22 84:17,19 87:22 89:4 90:22 91:14 92:7 96:6 97:1,24 98:9 100:17 103:6,7 104:18
out 16:12 19:11 23:2 23:10 24:11 29:6 32:5 32:11 33:17 36:10,19 37:11 40:15 44:18,20 45:5,9,11 48:3 49:13 51:19 52:19 53:3 56:20 56:23 58:5 60:14 61:21 61:24 62:8 62:10,11,13 66:13 74:11 81:17 89:24 90:1,8 91:7 92:13 95:15 104:17 105:3,8
outfalls 92:18
outputs 28:5
over 6:11 15:17 23:3 24:10 30:22 47:11 52:10 52:12 72:5 81:3,23
overall 5:21
Overflow 89:1
overflows 43:3 59:10
overrides 37:9
over-estim... 45:16
oxidize 19:14 19:16
oxygen 8:24 16:12 20:14 21:16 29:7 29:23 31:24 35:13 39:12 39:14 41:11 41:19 51:9 51:20 52:6 52:22 53:1 61:9 68:2 77:17 79:16 81:4 83:15 83:17,18,22 84:9 86:4 86:11 96:12 98:6
ozone 91:4
o'clock 1:21

P

P 2:1,1 3:1,1 3:4
package 37:4 38:1
page 8:13,21 23:16 29:20 33:24 38:19 51:3 73:13 76:16 77:3 77:3,8 97:5 97:21
Pages 4:2 38:10 39:5
paginated 97:5
Paragraph 8:13,21 23:16 33:24
part 25:19 36:23 54:2 57:5 68:15 71:7 78:16 79:21 81:16 84:4 85:16 86:24 87:12 89:3 92:24
participated 33:9 68:23
particular 27:6,20 32:3 56:11 57:13,14 93:12 98:15
parties 104:21
parts 1:11 5:8 23:1 36:21 70:7 70:11,17 71:24 80:14
pass 25:24 32:22
pending 104:19 105:5,9
people 42:20 42:24 77:5 81:7 84:18 84:19 104:3
per 53:2 54:20 56:3 63:24
percent 14:15,16 45:2 54:19 56:2 88:12 88:13
percentages 29:11
perfectly 50:7
perform 8:23 34:9 48:1 87:2
performance 11:2 14:24 15:22 53:18
performing 11:10,16
perhaps 20:21 25:17 72:16
period 73:14 73:24 98:6
permit 91:24
personally 105:5
personnel 50:12
phosphorous 17:14,17 18:11 77:23
physics 52:23
picked 27:8 27:10
picking 60:19
picks 27:5
pile 39:4
pilot 9:20,24 10:4 66:22 72:9 101:5 101:10
pipe 87:2,6 87:14 88:24
place 18:15 20:12 52:5 68:18 69:18 71:5 72:5 93:2 98:3
placed 12:11 63:20
places 97:1
Plaines 1:9 5:7
plan 13:22 34:4,5 46:17
planning 66:14,21
plans 80:10
plant 10:16 13:17 22:16 22:21 28:5 32:17 91:23
plants 12:1,7 18:6 26:24 59:23 62:14 77:18 83:21 84:10
please 6:7,10 6:14 7:2 19:11 69:16
pleasure 105:22
plugged 44:22
plunge 52:4
plunges 16:17 52:3
plus 30:12
pocket 30:16
point 15:22 20:13 33:10 44:5 59:20 64:8 67:20 67:24 71:10 85:21,23 87:9 89:17 89:21 95:6
pointed 40:15
pointing 77:2
pollution 1:2 2:3,11 13:22,23 96:18
pool 9:7 16:18 52:3 52:4
pools 16:15 16:19
poor 99:24
population 18:16
porous 12:8 51:17
portion 83:23
portions 74:7 84:3 87:3
positive 102:1
possibility 17:6 82:8
possible 59:11 63:11 64:5,24 71:3 79:15 85:13
possibly 69:24
post 93:4
potentially 78:6
practical 57:19 93:6
Prairie 5:24 79:3
preconceived 6:17
predict 27:3 47:21 59:15 60:6,22 61:16
predicting 39:17 59:18
preferred 91:8
prehearing 104:4,9,14
prepared 66:22
preparing 89:22
present 2:11 3:2 20:20 26:3 55:10 55:12,14 65:15 68:24 84:13
presentation 85:9
presented

13:22 69:20
presenting 48:5
presently 91:19
pressure 12:12 52:23
pretty 34:22 54:17 58:21 58:22 66:24 98:1,13
previous 65:14 68:23 78:1 91:10
pre-drop 57:7
pre-filed 7:9 8:12,13,22 23:17 33:24 51:3 73:14 77:6 79:13 94:4 97:13 97:16,21
prior 59:3
privy 63:5
probably 16:22 41:17 46:10,12 47:13 62:2 69:23 78:19 94:20
probe 31:24 32:2,15 34:14 36:9
probes 35:14 35:16,22 36:17
problem 16:20 28:20 79:15 93:10
problems 16:1 86:10
procedure 47:9 48:9
procedures 47:17
proceeded 67:2
proceeding 5:4 6:21 104:7
proceedings 1:15 5:21 68:23 79:8 85:11 106:10
process 18:17 19:10 20:8 21:19 59:14 63:21 67:16 87:12
processes 29:6
produced 53:20
produces 15:6
program 79:21 80:14
project 68:12 68:13
projects 8:17
proper 33:18
properly 39:16 90:1 90:1
proposal 43:9 46:8,9 72:11 73:23 74:4,6,9,14 75:3,10,15 75:17,24 77:21,21 96:21 102:24
proposed 1:10 5:7 9:1 13:18 24:1 24:4 29:24 44:1,2,8 45:21 48:19 48:20 49:2 49:3 55:1 56:13,15 74:22 99:23 101:7,22
proposes 78:18 101:20
proposing 76:24
protect 87:20
Protection 2:21 9:2
provide 17:22 19:23 77:16 88:23 95:3
provided 17:7 23:18 38:15 40:20 86:2 90:5
providing 16:12 17:15
provision 73:15 97:8 98:14,20 99:2,7
public 1:17 91:24 106:18,23
pump 23:3 27:1 51:8 51:19,19 53:5 87:20
pumped 58:19 87:18
pumping 27:22 87:24
pumps 32:5,7 32:8,9,11 36:11 53:6 58:9 87:21 87:22
pure 65:5,6 71:7
purity 51:9
purpose 32:24 36:2 92:7
purposes 31:18,18 33:3 35:23 35:24
put 12:3,17 24:21 32:5 32:6,9 51:20 62:4 66:8,23 69:8,18 75:22 81:2 81:18 87:15 87:21 92:23 93:3
puts 29:7 63:24
putting 39:17
P.O 2:22

Q

Quail 57:4,4 58:7
qualified 21:11 42:20 86:14
quality 1:6 5:5 8:24 11:3,13,20 14:15,19 15:1,8 29:24 42:18 43:13,17 44:24 58:1 94:24 95:5
question 8:12 10:8 11:6,7 11:8 12:22 14:11,21 15:4,13 17:2,13,18 19:8 21:10 22:13 23:14 24:14 29:16 33:1,6,23 34:12 38:8 38:9 45:15 45:24 47:3 47:8 48:11 50:24 58:14 59:4 61:1 61:22 63:16 72:13 73:11 74:17 76:12 77:13 78:4 78:16,16 80:15 85:15 86:14 89:22 96:16 99:11 100:24 101:2,4 102:1,3 104:18
questioned 5:23
questions 4:3 6:4,5,9,12 6:14 11:24 26:10 29:16 35:3 42:18 48:13 68:8 76:8 79:13 94:5,14 100:17
quickly 90:7 90:8
quite 39:11 62:2 64:5 82:13

R

R 2:1 3:1 35:23
rainfall 27:1 28:6 39:10 73:17
rainstorm 36:19
raise 6:6
raised 17:5
ran 27:19 100:2
Randolph 2:4
range 24:5 55:17
ranking 54:9
Rao 2:18 5:18 94:22 95:8,11,24 96:15
rarely 41:14
rate 11:1 14:22
rather 47:1,5 82:24
reached 31:12
read 6:3 89:19
reading 36:9
ready 22:8 73:11 79:11
realized 100:23
really 41:13 47:21 51:24 52:4 62:10 78:2 81:16 81:20 83:22 86:13 93:2 95:14,16,16 96:7 102:3 105:15
reason 40:4 42:15 45:13 45:15 60:15 89:2 94:9
reasonable 90:10
reasons 91:7
recall 15:20 65:24
receiving 18:6
recently 83:17
reclamation 8:15 26:24 28:5 77:18
recognizes 37:12
recollection 10:12 13:1 13:13,14,15 72:23
record 6:13 6:16 14:10 47:1 71:9 77:2,5 78:14 85:10 89:5 95:1,3 97:13 100:19,21 100:23 103:18,21
recreation

reduce 65:3 69:23 78:6
reduced 69:14,17 70:22 78:5
reduction 77:24 78:8
refer 15:4 71:16 94:5 94:12
reference 86:4
referring 95:14 97:13 97:15,16,20 98:11
refine 79:19
refined 96:11
refinement 96:8
refresh 72:23
regard 11:11 28:20 75:23 94:15
regarding 13:16
rejected 46:9
related 100:2
relationship 22:10
relative 54:22 56:8
relatively 23:20,21 31:10
remain 80:11
remaining 80:10
rememberi... 76:18
removal 16:21,23 17:6,8,9,11 17:11 77:16 77:17,22,23 77:23 78:15 90:9
remove 17:14 17:17 87:22 88:6
removed 13:5,8 88:12,12,19
repeat 39:1 49:5 66:16 68:4
repeatedly 64:24
repeating 39:8
repetitiven... 59:2
replaced 22:18
report 15:6 39:3,6 40:10 41:6 53:22 55:15 57:24 85:20 85:24 88:23 89:19 91:17 95:4,15
reported 106:9
reporter 6:12 47:2 106:7
reports 15:9 91:11 94:5
represent 6:8
representat... 27:9 39:22 69:13
request 56:12
require 15:10 34:2,23,24 42:9
required 23:24 25:6 38:14 40:19 43:24 47:19 49:14 50:16 61:21 65:18 84:7 101:6
requirement 66:18
requireme... 59:4
requires 37:4 47:20 78:10
research 8:16 9:19
reservoir 61:23 68:10 68:19 69:2 69:6,18 70:21
reservoirs 59:6
respond 104:22
responded 78:15
response 8:24 59:4
responsibil... 40:3
responsive 64:23
rest 22:6 35:5 38:8 88:9
restoration 84:22
restricted 38:24
result 27:18 70:22
results 23:18 39:19 69:20 84:6
right 5:13,14 19:22 22:14 23:15 30:15 31:1 35:2 35:11 62:7 64:12 65:4 76:5 80:16 81:21 83:24 93:1,11 99:15 100:11,12 100:18 105:20
river 1:9 5:7 9:17 10:19 11:4 15:2 22:17,20 23:1,2 57:5 58:16 70:3 70:5 92:2 93:1 102:16
Rivers 5:24 79:3
roads 93:10
robust 39:11
Room 1:19
RPR 1:17 106:6,17
rule 55:1 56:13
rulemaking 17:5
Rulemakin... 1:8
run 27:18 33:2 50:14 51:20 63:12 63:13,22
running 18:13
runoff 62:18
runs 63:22 64:1 93:1
R08-09 1:7
R08-9 5:9 105:4

S

S 2:1,15 3:1 4:8
Sag 10:22 13:19 71:18
same 6:23 23:11 46:12 47:9,17 48:9 55:19 59:20 69:12 103:3,10,11 105:8
sand 13:3 81:3,23
saying 24:24 25:15 27:19 29:13 40:18 58:21,22 67:15 101:9
says 30:3 76:17,18 95:17 97:7 98:20
scale 9:20 65:17 72:9 101:10
schedule 60:3 61:5 65:16 66:12 67:9,17,24 72:9 101:5 101:15,21
scheduling 104:5
scope 95:14 95:20
score 53:11 53:12 55:21
screen 87:20 89:24
screening 87:22
screens 87:21
screw 53:5,6 87:23
second 54:1 55:9 63:24 80:20 94:11 94:14 100:23 105:1
sediment 80:23 81:2 81:4,8,11 81:15,19,22 82:3 83:8,8 83:9,15,17 83:22 88:19
sediments 20:18 80:21
see 12:13 29:21 36:15 37:22 64:1 64:11 94:9 94:20 96:9 97:23 98:23
seeing 7:11 75:6 89:9
seems 48:10 99:14
seen 52:8
selected 39:6 91:8,13
send 32:4 36:10
sense 18:7 20:2,5,11 21:21 43:2 45:7 72:20 90:4,8
sent 15:7
sentence 73:21 74:2 97:23 98:15 98:17,20 99:21
SEPA 9:7,17 9:20 11:2 12:7,15,18 13:1 14:14 14:17 16:5 16:11,15 18:12 20:4 21:15,17 22:10,16,24 24:20,22 28:15 29:4 29:18,23 31:17,21 32:4 33:1,2 33:9,11 36:8 38:14 40:14,19,20 42:8 50:10 52:1,2 53:7 53:15 57:9 57:12 58:8 58:17 63:11 63:19 64:4 64:6 66:13 66:15 67:3 67:4 70:14 70:23 71:10 72:4 77:19
September 68:24
serve 5:3 32:24
service 33:18

session 104:15
set 27:15 61:7
setting 67:17
settling 16:15
seven 33:14 34:16 35:13
seventh 5:19
several 80:24
Sewer 89:1
sewers 62:20
share 6:23
shore 75:4
short 39:21 51:15 53:9 53:13,16 54:12 56:21 75:18 79:6 95:18
shorthand 106:10,12
shoves 52:19
show 74:17
showed 75:19
shown 75:1 98:5 103:9
shows 32:2
shut 63:3
side 9:6 32:17 37:21 37:22 51:21
Sierra 5:24
significant 41:11
silly 93:18
simple 48:11 60:15
simpler 35:8
simply 16:13 22:17,19 48:18,22 50:5 65:2 69:21 72:19 84:8 97:24
since 34:11 42:9,14 47:9 55:19 55:20 64:24 65:3 69:19 88:1
sine 105:24
sit 60:10 66:2
site 72:20 82:2
sitting 25:8 52:14 60:11
situation 20:18 52:23 60:6,23
situations 59:20
six 98:4 101:12
size 7:24
sized 90:11
skip 38:9
slashed 79:12
slight 45:20
slightly 45:19
slim 58:21,22
slip 81:14
slips 82:2,11 82:14,17 83:4,6 84:15
small 54:17
SOD 81:4
software 37:4,24
solids 13:9 16:12,15,18 88:6,8,11 88:12 90:6 90:9
solvents 18:4
some 16:14 16:14,21 17:7 18:11 18:23 19:24 20:21 21:15 22:21 26:22 26:22 31:17 34:13 36:6 37:2,4,9,17 37:24 48:1 50:5 53:7 54:22 55:10 56:9 60:7 60:23 69:14 69:17,22 80:1 81:7 81:18 82:1 82:2,7 83:14 85:21 85:23 86:23 87:15 88:6 88:11 89:17 90:5,6,9 91:15 92:16 93:14,16 95:6
somebody 37:5 85:1
somehow 46:8,8
someone 84:24
something 21:7 25:10 29:1 46:24 55:20 58:9 61:6 98:9 100:3
sometimes 28:15,15 33:2 66:11
somewhat 60:2,8 81:18
somewhere 39:4 72:13
soon 104:17
sorry 7:12 9:17 16:9 18:21 19:2 19:18 22:8 22:12 25:18 48:14 85:7 96:19 97:16
sort 57:9
sorts 83:5
sounds 31:1 88:18
sources 20:13 62:16
south 37:22 54:16 102:16,24
Southeast 14:3
speak 6:10 21:12 46:15
speaking 6:11
specific 41:20 57:12 71:13 73:17 86:4 92:17
specifically 20:3 21:1 62:4 76:17 82:7
specifics 34:9 34:11 85:2
specified 76:20
speculate 78:2
speculation 65:5,6 71:7
spend 17:14
spending 50:6
spends 50:17
spent 50:7 83:13
spot 93:12,20
spreadsheets 56:19
spring 41:16 42:12
Springfield 2:22
SS 106:2
stabilize 81:6 81:19
Stacy 3:3
staff 6:15
stage 20:9 27:15
stages 80:2
stagnant 76:22 84:11 84:12 86:6
standard 24:1,2,3 32:3,20 44:15,19,22 45:8,11,18 45:20 46:5 49:2,3,15 51:13 54:18 56:15 60:1 70:24 76:3 76:24 98:6 99:23 101:7
standards 1:6 5:5 9:1 11:3 14:15 14:19 15:1 17:6 24:5 29:24 30:4 34:2 38:23 43:14,17 44:1,2,6,9 44:24 46:13 47:18,19 48:20,20 49:22,22 50:2 58:2 74:22,24 76:10,19 79:21 101:22
standby 33:16,16
standpoint 11:15 15:15 65:4
start 8:11 19:4,11 60:16 67:11 67:16 79:2 104:5,6
started 67:23
state 1:18 6:7 8:14,22 23:17 34:1 38:11,19 40:1 46:24 51:4 73:14 106:1,7,9
stated 40:10
statement 21:21,23 42:3 73:22 74:3
statements 41:21
station 9:20 12:15 14:24 24:1 27:21 27:22,23,24 29:4 30:3,7 32:5,8,11 32:16 33:11 35:20 36:10 42:12 52:1 52:2 57:9 58:17 63:24 75:1
stations 8:20 9:4,7,17,23 10:2,7,11 12:7,18 13:1 14:17 15:16,20 16:5,11,16 18:12 20:4 21:15,17 22:10,16,24 23:19 24:7 24:8,16,20 24:22 25:2 26:15 27:1 29:2,18,23 30:6,7 31:9 31:15,17,21 31:22 32:1 32:22 33:1 33:2,9,17 34:16,18 36:8,20,21 37:15,17 38:13,14,18 38:22 39:17 39:18 40:7 40:14,17,18 40:20 41:8 42:5,8 43:22,23 49:9,14,17

50:9,11,12 50:14 53:15 54:15,17 57:12 58:8 59:11 63:11 63:19 64:5 64:6,10,16 64:20 65:1 65:12 66:20 67:3,4,11 67:12 69:21 69:23 70:3 70:14,23 71:3,4,10 71:17 72:4 72:18 74:20 77:19 78:6 79:17 84:7 101:13,20 102:15,23 103:1
statistics 15:12
stay 104:19 105:15
steam 37:24
step 19:19,23
steps 20:7
stick 65:23
still 41:1 79:13 80:3 88:13,13
stop 32:11
storm 62:19 62:20 83:21
storms 37:13
story 39:20
strategy 85:17,21 94:24 95:5 95:9 96:4
stream 9:6 20:18,22 21:5 23:5 29:8 32:3 62:19
streams 20:12,14 22:23
Street 2:4 102:20 103:6
stretch 60:9
strictly 31:19 96:24
strike 10:23
structures 51:24
studied 86:18 86:19
studies 16:23 20:2,24 65:17 66:23 101:5,10
study 9:20 10:1,4 44:13 46:11 46:13 56:19 60:13 65:13 66:14 72:9 83:11 87:1 87:2 88:2 88:14,17,24 89:23 90:3 92:11,24 95:15
stuff 37:11 39:4
subcontrac... 40:2
Subdocket 1:7 5:9,20 104:6,19 105:2,4
submit 73:8
submittal 89:3
submitted 53:22
SUBSCRI... 106:20
subtracted 44:7
success 11:2
successful 11:19
successfuln... 14:23
Suite 2:5
summarize 21:14 95:9
summary 102:2
summer 41:17,18
sunk 64:13
superinten... 69:1
supersatur... 52:24
supplement 21:8
supplemen... 8:19 9:3 10:7 23:19 28:22 29:5 51:4 66:8 67:11 68:1 79:16,23
support 10:13 46:22 46:23
suppose 93:15
sure 6:23 17:3 26:11 28:17 38:3 39:15,19 61:15 62:6 80:20 83:10 88:4 96:2 105:19
surface 12:14 52:14,16,19
surrounding 62:19
sworn 7:2,4 106:20
system 1:8 5:6 8:20 10:19 11:4 12:14 14:14 16:2 20:4 21:1,2 23:1 23:2 26:23 27:3 34:10 34:14,19,22 35:5,8,10 35:12 36:1 36:3,6,12 36:15,16,22 37:3,8,10 37:23 38:3 38:5 39:15 40:16 42:19 44:23 51:19 51:22 54:13 57:7,15 58:12 61:23 62:5 64:4 70:5,7,12 70:16,17 71:24 77:24 78:9,10 80:21 83:19 84:16 87:4 87:14,15,24 87:24 88:2 88:7 90:9 90:11 92:2 92:23 93:3 93:14,16
systems 12:17 13:19 15:2 28:21 29:12 35:18 54:23 55:11 70:11 91:1
system's 11:2 14:24

T

T 4:8
table 26:7,10 27:16 29:20 71:16 73:18 73:22 74:1 74:8,18,19 74:24 97:6 97:7,22 98:5 102:11 102:15,22 103:10
Tables 23:23
take 23:2 32:11 47:2 59:5 65:11 65:18,19 66:3 79:1 89:23 92:13 98:3 101:10 101:11,12
taken 1:16 22:17,19 80:2 106:13
takes 18:15 29:6 52:5 62:18
taking 20:11 29:13
talk 72:17 95:20
talked 36:13 81:7,13
talking 19:1 28:17 29:10 29:11 34:15 34:17 60:16 61:20 66:2 72:17 74:3 82:15,23 83:6,7 84:22 98:13
tank 18:13
Tanner 2:14 5:11
TARP 59:6 59:10,18 60:8 61:5 61:10,17,23 63:4,11 65:3 67:10 67:14,17,23 68:2,9,19 78:5 80:2,3 80:12,14
task 14:4 48:17
tasks 48:21
technical 2:18,19 5:14 53:23 88:24 89:7
technologies 51:10 53:10 54:6,11 55:4,7 56:8 79:22
technology 9:21 17:14 51:4,7 57:13,14,15 57:17,19
telemetering 36:24 37:23
tell 14:1 24:18 25:9 28:1 41:19 43:20 44:3 49:10 61:20 63:10 65:11 71:2 92:19 104:8
tells 28:2,7
temperatur... 41:12,18
ten 39:9
tends 36:5
ten-minute 79:2
term 19:12 28:21,24 31:10
terms 44:24 46:17 58:5 67:20 87:10 90:2
terrific 73:9
tertiary 10:15 13:2 13:5,17 14:4 66:19
testified 33:8 69:1 92:20
testimony 4:3 5:23 6:2 7:6 7:10 8:13 8:22 23:17 23:23 26:3 29:20 31:11 33:24 38:11 39:3 43:7 51:3 56:10 56:21,24 65:15,15

73:14 76:17 77:4,6,11 88:5 91:11 96:8 97:14 97:16,21
Thank 7:22 14:7 16:24 18:9 23:6 33:21 43:6 46:1 49:20 50:19 63:7 65:10 66:4 72:2,7 73:3 73:9 76:7 78:12 86:8 92:4 96:15 103:14 105:12,17 105:21
Thanks 70:9
their 15:17 24:21 38:14 56:15 86:11 104:4,24
themselves 22:24 53:8 84:10
theoretical 21:5,10 30:2 65:4
thin 52:11
thing 52:8 59:13 92:9 92:10
things 12:3 35:7 51:13 76:1 80:22 82:3,6 83:4 83:5,9 84:3 95:20 96:6
think 6:20 12:2 15:5 17:12,17 21:11,14,20 22:8 31:13 31:24 32:19 34:12,23 36:4,18,23 37:12 42:9 44:11 45:23 55:11 60:9 60:18 64:22 65:19,21,22 66:17 67:6 69:22 72:15 76:5,8 77:10 78:14 86:9,14 89:17,18 92:5 97:4 98:9 101:23 101:23 105:5
thinking 11:24
thinks 36:5
third 97:21
Thomas 2:13 5:13
Thompson 1:19
Thornton 68:9 69:2,6 69:18 70:21
though 61:4 89:21
thought 27:9 81:22 82:23 94:5,10 98:1,12 101:2
three 23:3 30:6 32:7 36:11 40:17 48:6 63:23 63:23 65:19 65:20 67:3 71:22 101:13
Throop 102:19 103:5
through 25:24 35:5 37:13 51:20 52:11 54:12 59:14 72:17 93:1 95:18
throughout 34:14 38:4
throw 45:18
time 6:10 13:12 14:16 14:17 15:17 17:15 25:2 33:15,20 46:3 54:18 59:21 65:17 65:21,22 67:10 73:14 73:24 83:14 94:6 98:7 101:16 105:8
times 88:5 100:5
Tipsord 1:16 2:8 4:3,4 5:1,2 7:1,5 7:8,21,23 8:6 14:2,8 16:9 18:3 18:24 19:3 22:3,7 23:7 26:6,9,12 26:17,19 28:9 33:7 33:22 43:1 50:21 57:2 58:23 59:8 68:6 69:15 70:19 77:1 77:9 78:13 78:22 79:1 79:10 85:5 89:6 90:18 97:12,18 100:16 102:5 103:15 104:11,20 104:24 105:13,19
title 53:24
TMWQ 89:4
today 5:10,22 8:12 25:9 43:8 48:5 64:20 65:24 66:2 89:18 103:20
Today's 5:19
together 32:12 62:4 66:23
told 15:21
tomorrow 105:11
tomorrow's 105:2,3
top 58:19 81:24
topics 17:4 23:11
total 44:7 53:11 55:21 65:21 101:12
towards 47:4
track 8:9 19:7,9
transcript 1:15 106:12
transfer 52:10
treat 81:5 93:15
treating 86:22 92:6 92:13,17
treatment 10:15 13:2 13:5,12,17 18:5 22:15 59:23 62:14 66:19 80:23 81:6 83:8 83:21 84:10 86:5,18,20 87:3,14 89:1 90:2 91:23 92:23 93:3 94:1 96:18
tributaries 58:11
tributary 22:23
tries 64:2
trigger 98:2
true 8:1 70:10,13 78:3,3 99:9 106:11
trust 101:9
try 21:22 23:10 30:17 36:18 47:7 47:13 60:16 62:13 64:23 72:23 75:21 99:22
trying 29:9 41:8 44:10 47:21 57:16 57:17 59:14 60:6 64:3 82:16 100:1
TSS 87:10 90:14,16
tube 52:18
tunneled 93:16
turbidity 18:6 92:13
turbulence 52:5,16
turn 6:5 32:18,23 36:10,20,21 37:11,12
turned 37:18
turning 37:20,21
turns 66:13
two 27:8,10 30:4 32:7 32:18 36:11 47:11 48:21 63:23,23 65:18 67:4 71:19 72:18 92:2 98:4 101:10,11 101:12,20 102:15 103:3
type 18:5 29:13 47:9 81:3
types 28:17 28:21 29:12 81:1
typical 52:8 91:12
typically 52:18
typo 94:14

U

UAA 56:19
unable 14:17
uncertainty 63:9
under 18:15 18:19 41:23 49:22 52:22 52:23 59:18 72:10 75:2 75:9
undergrou... 93:16
underneath 12:11
understand 10:10 16:3 16:16 19:10 22:13 25:11 25:12,22 26:2 30:3 41:12 44:4 44:12 45:10 56:7,17 60:4 87:5 100:2
understan... 10:10,16 15:18 31:20 38:2 50:1 85:20
understands 83:10
unfortunat... 71:14 80:6
unique 76:21

unit 2:18,19 5:15
University 23:18 24:19 38:16,20 63:21
unknowns 60:8
unless 94:11
unlike 40:14 93:23
unnecessar... 32:23
until 6:4 103:21
upper 54:7
upstairs 5:17
upstream 32:1,15,22
up-stream 35:17
use 26:21 31:10 38:16 42:11 45:12 86:24 90:24
used 10:1 35:22,24 42:2 47:17 48:9 53:20 74:13 81:1 91:1,4,4,5
useful 60:18 66:11
uses 55:21
using 42:6 51:8 57:8 58:10,20 62:3
usually 20:19 23:3
Uv 88:2,6,8 88:15 90:11 90:13,15,19 91:8,13
U-Tube 51:9 52:17,20,22
U-Tubes 52:17 53:14 55:15
U.S 10:14 13:16 46:10

V

variety 8:17
various 20:13 23:1 27:1,8 36:21 55:4 56:8 63:3 80:2
Venturi 51:20,21
very 20:23 21:9 42:10 45:4,20 48:12 52:24 60:12,13 61:11,12,24 62:1,21 63:20 68:5 79:4 84:4 90:13,15 91:1,5 93:10
viable 81:22 83:24
vicinity 92:22
view 15:22 33:10 44:5 87:9
virtually 69:7,11
voice 69:16
voices 19:4

W

wait 6:4,6 67:13
want 15:24 18:1 21:8 28:14,16 32:23 36:6 36:7,11,24 36:24 37:2 45:9,10 48:4 54:14 68:7 77:10 83:10 89:17 93:9 98:8 101:9
wanted 39:18 57:18 77:4 94:7 96:1
wasn't 69:4 78:1 81:15
waste 88:7
wastewater 18:5 22:15 86:18,19 90:20 91:23
water 1:6 5:5 8:15,24 11:3,13,20 14:15,18 15:1,7 20:4 22:15,17,19 22:22 23:2 26:22,24 28:4 29:3,6 29:6,23 38:15 39:15 42:18 43:13 43:17 44:24 51:19,21 52:6,11,19 53:1,3 58:1 58:16 62:19 62:20 77:18 83:21 87:16 90:14,16 94:24 95:5
waterfalls 23:4 53:8
waters 18:6 86:6
waterway 8:20 21:1,2 28:21 34:2 40:23 41:12 42:19 51:6 52:15 62:5 76:21 80:21 81:16 87:4 95:1,6
waterways 1:8 5:6 58:1
way 31:21,22 39:4 44:11 44:12 46:12 47:15 53:21 66:15 76:4 79:5 81:5 81:19 90:20 90:21 93:6 96:22
ways 47:13
weather 37:17,18 62:16 73:15 84:9 86:5 97:8,9 98:3 98:14,20 99:2,7
Webster 29:2 31:23 32:13 38:12,21 40:7,22
week 33:15 89:19
weight 58:11
weir 16:16 52:1,3 57:7 57:7
weirs 9:21 51:24
Welcome 6:20
well 10:23 16:3 18:14 21:9 23:22 25:13 28:19 30:19 31:12 33:13 34:8 35:12 40:9 44:10,12,19 45:12 46:2 59:13,24,24 64:2 69:10 73:20 75:18 79:18 80:16 81:12 82:2 83:7 85:14 86:17,23 87:19 90:13 90:16 92:19 93:2 96:6 98:2,10 99:14 100:1 102:4,5 103:5
went 66:12
were 10:11 10:18,21 12:3,4,7,17 13:1 14:5,6 18:10 27:9 27:10 29:10 29:11,13 38:15 39:21 47:6 49:9 49:18,21 50:2 53:7 53:14 54:15 54:17,18,21 55:4 57:16 57:17 66:23 67:3,4,9 68:14,24 69:21,24 71:3,5 77:5 77:16,24 78:5 79:9 82:23 85:8 85:16 92:21 94:6 96:1 97:9,13 99:1 103:17 104:13
weren't 10:20 60:15 69:24 77:6
West 2:4
wet 27:12,13 37:16 39:22 39:23 62:16 73:15 97:8 97:9 98:3 98:13,20 99:2,7
wetland 84:22
wetlands 84:15 94:1 96:18,21
we'll 79:2 87:20 95:18 95:19
we're 5:22 22:8 28:17 34:15,17 66:2,7 69:16 87:19 93:17 95:17
we've 45:23 48:11 89:18 95:20
whatsoever 68:20
while 16:14 60:3 91:17 103:17
whole 34:14 35:10
Whoops 7:19
Williams 2:23 7:19 7:22 8:2,4,8 8:11 9:8,10 9:13,16,23 10:3,6,17 10:21,23 11:1,7,9,14 11:18,22,23 12:20 14:9 14:10,13,22 15:14 16:4 16:8 23:8,9 23:13,16 24:13,24 25:8 26:2 30:14,21 31:4,8 33:23 34:21 35:2 38:7 40:6,12 41:3,22 43:7,12,16 44:4 45:13 46:1 48:14 50:22,23 51:2 53:17 54:5,9 56:1 56:5,14 58:24 59:1

63:8 64:19 65:7,10,24 66:4 68:8 73:10,13 74:5,12,16 75:2,6,9,14 75:21 76:2 76:7,14 78:23,24 98:8 104:8
willing 64:19 66:18 78:21
Wilmette 27:22
winter 42:5 42:12
wintertime 41:10,15,23
wireless 36:24
witness 25:11 103:18
witnesses 76:23 98:1 98:10,11
wondering 17:9
word 97:7
work 47:12 64:3 79:19 90:13,15 95:14,20
worked 8:17 48:3
working 15:23 16:3 80:18
workshop 83:16 85:8 85:9
workshops 69:20 84:6 85:16
worth 55:10 55:12,15
wouldn't 18:20 42:23 62:15 67:13 70:1,6 71:1 81:20 98:5
written 10:13 13:14
wrong 25:11 42:17 77:10

X

X 4:1,8

Y

yeah 22:2 31:3
year 24:11 26:22 27:12 27:12,13,19 27:24 28:4 28:6 33:12 39:22,23,23 60:17,20
years 10:12 15:11 27:6 27:7,8,8,10 27:15 28:8 38:15,24 39:7,9,12 39:22 49:24 61:17 65:18 65:20,21,22 66:6,7 67:5 67:7,13 72:21 101:10,11 101:12,12 101:14
yesterday 15:5 98:13

Z

Zalewski 2:17 5:12
Zenz 4:3 5:23 7:2,3,10 8:2 8:3,4,5,5,10 9:5,9,12,15 9:18,24 10:5,9,20 10:22,24 11:5,12,17 11:21 12:4 12:8,19,21 12:23 13:3 13:6,8,11 14:6,12,20 15:3,18 16:7,13 17:1,3,12 18:7,14 19:14,17,21 20:1,10 21:9,20 22:12,19 23:12,15,22 24:18 25:4 25:13,17,21 26:5,7,8,11 26:16,18,20 27:13,17 28:13,19,24 29:15 30:19 31:1,6,12 31:20 33:4 33:13 34:8 35:1,12,17 35:21 36:4 38:6 39:1 40:9,13 41:5 42:1 42:17 43:5 43:10,15,20 44:10 46:6 46:14 47:7 49:5,19,21 50:4 51:1 51:11 53:19 54:4,8,10 55:2,5,7 56:4,6,17 57:11 58:3 58:6,13 59:7,13 61:11,15,19 62:17 63:5 63:8,15 64:9,11,14 64:18,22 65:9,14 66:3,10 68:3,11,17 69:4,10,15 69:17 70:4 70:8,13,18 71:1,13,16 71:19,22 72:1,3,8,12 72:16,22 73:5,12,20 74:8,15,19 74:23 75:5 75:8,12,18 76:1,5,11 76:16 77:7 77:14,15,22 78:18 79:18 80:5,8,13 80:20 81:12 82:4,7,11 82:13,19 83:1,7 84:4 84:12,17,21 85:1,12,18 85:22 86:7 86:13,19,23 87:12 88:21 89:2 90:3 90:15,21,24 91:10,21 92:3,8,15 92:19 93:6 94:3 95:12 96:7,10,14 96:19,23 97:23 98:12 98:23 99:4 99:10,19,22 100:7,12,17 100:24 101:4,18,23 102:7,10,12 102:17,21 103:2,5,11 103:13,16
zero 70:24

$

$47 55:16
$56 55:14

1

1 8:13,13,21 23:16,23 26:7,10 33:24 51:2 71:16 102:22 103:10
1-C 11:8
1.5 103:7
10 15:11 59:4 67:5,13
10/16/06 89:8
100 2:4 14:15 24:9,10 52:21
100-foot 52:18
1021 2:21
103 4:3,4
105 4:4
11 27:7 39:9 73:11 94:22
11-500 2:5
12 74:17
13 39:5 96:16
134 27:24
15 23:3 58:18
16 97:4
17 97:4
18 61:17
18th 1:20
184 30:22
19th 105:7,16
19276 2:22
1972 13:21
1979 12:5
1980 12:5
1984 66:13
1986 9:18
1987 9:18
1989 67:2
1992 67:4
1994 67:5

2

2 7:10 8:21 27:21 51:3
2-025 1:19
200 30:22
2001 7:10 26:14,15 27:10,19 28:1 38:15 38:24 39:7 39:21,23 40:23 42:7 49:10 68:18
2003 27:10 28:3 38:24 39:7,21,23 40:23 42:7 49:10 68:18
2008 68:24
2011 1:21 106:21
2014 69:3,6
2014/2015 70:21
2020 66:2
2025 60:17 60:20
203 38:15
21 24:6
217 2:23
23 71:23
233 28:8
24 33:14
252 53:12
26 104:12
26th 103:21 103:24 104:13
263 7:11,11
27th 104:12
28 24:7 30:5 34:16 40:17 43:22 64:9 70:11 71:17 101:13

3

3 29:20 38:10 51:3
3WQ 88:24 89:8
30 53:2 88:12
301 1:11 5:8
302 1:11 5:8
303 1:11 5:8
304 1:12 5:8
31st 104:12

312 2:7
35 1:10 5:7 34:17
365 24:11

4

4 23:14,16 33:24 38:10 74:18,19
4WQ 53:24
4,464 30:7
40 53:2
463 4:10 7:12 7:14,17 89:14 97:19
464 4:11 89:8 89:9,11

5

5 4:3 33:23 38:8,19 79:14
5/18/11 7:16 89:13
50 6:20,21 53:2
50th 5:21

6

6 73:18,22 74:1,8 97:6 97:7,22 98:5
60601 2:6
62794-9276 2:22

7

7 4:3,3,10,10 23:23 29:20 39:5 102:15
70 88:13
782-5544 2:23

8

8 38:9 68:24
80 63:24
80s 13:12
814-6983 2:7
84 66:21
86 66:22
87 66:22
88 66:23
89 4:11,11

9

9 73:13 74:24 76:16
9:00 1:21
90 54:19 56:2
90s 10:11
946 24:6
98 45:2