STATE WATER RESOURCES CONTROL BOARD

PUBLIC HEARING

CALIFORNIA DEPARTMENT OF FISH AND GAME'S LOWER YUBA RIVER FISHERIES MANAGEMENT PLAN AND A COMPLAINT BY THE UNITED GROUP AGAINST YUBA COUNTY WATER AGENCY AND OTHER DIVERTERS OF WATER FROM THE LOWER YUBA RIVER IN YUBA COUNTY

MONDAY, MARCH 6, 2000

PAUL R. BONDERSON BUILDING

SACRAMENTO, CALIFORNIA

9:00 A.M.

Reported by: MARY R. GALLAGHER, CSR #10749

A P P E A R A N C E S

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HEARING OFFICER:

JOHN BROWN

BOARD MEMBER:

ARTHUR BAGGETT

COUNSEL:

DANIEL N. FRINK, ESQ.

STAFF:

ALICE LOW - ENVIRONMENTAL SPECIALIST
ERNEST MONA - ENGINEER

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REPRESENTATIVES

---oOo---

YUBA COUNTY WATER AGENCY:

BARTKIEWICS, KRONICK & SHANAHAN
1011 Twenty-Second Street
Sacramento, California 95816
BY: ALAN B. LILLY, ESQ.

BROWNS VALLEY IRRIGATION DISTRICT:

BARTKIEWICS, KRONICK & SHANAHAN
1011 Twenty-Second Street
Sacramento, California 95816
BY: RYAN BEZERRA, ESQ.

SOUTH YUBA WATER DISTRICT &
CORDUA IRRIGATION DISTRICT:

MINASIAN, SPRUANCE, BABER, MEITH, SIARRES & SEXTON
1681 Bird Street
Oroville, California 95965
BY: PAUL R. MINASIAN, ESQ.

CALIFORNIA DEPARTMENT OF WATER RESOURCES:

DAVID A. SANDINO, ESQ.
1416 Ninth Street, Room 1138-2
Sacramento, California 95814

SOUTH YUBA RIVER CITIZENS LEAGUE:

LAWRENCE D. SANDERS, ESQ.
216 Main Street
Nevada City, California 95959

CALIFORNIA SPORTFISHING PROTECTION ALLIANCE:

ROBERT J. BAIOCCHI
P.O. Box 1790
Graegle, California 96103

---oOo---

REPRESENTATIVES

---oOo---

BROPHY WATER DISTRICT:

DANIEL F. GALLERY, ESQ.
929 J Street, Suite 505
Sacramento, California 95814

WESTERN WATER COMPANY & WESTERN AGGREGATES, INC.:

KRONICK, MOSKOVITZ, TIEDEMANN & GIRARD
400 Capitol Mall, 27th Floor
Sacramento, California 95814
BY: SCOTT A. MORRIS, ESQ.

NATIONAL MARINE FISHERIES SERVICE:

STEVEN A. EDMONDSON
777 Sonoma Aveneue, Room 325
Sant Rosa, California 95404

CALIFORNIA DEPARTMENT OF FISH & GAME:

OFFICE OF THE ATTORNEY GENERAL
1301 I Street, Suite 1101
Sacramento, California 95814
BY: WILLIAM D. CUNNINGHAM, ESQ.

UNITED STATES DEPARTMENT OF THE INTERIOR:

REGIONAL SOLICITOR'S OFFICE
2800 Cottage Way, E-1712
Sacramento, California 95825
BY: EDMUND GEE, ESQ.

WALTER COOK:

WALTER COOK
42 Northwood Commons
Chico, California 95973

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I N D E X (Cont'd.)

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MONDAY, MARCH 6, 2000, 9:00 A.M.

SACRAMENTO, CALIFORNIA

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HEARING OFFICER BROWN: Good morning, ladies and gentlemen. This is the continuation of the order of proceedings in the hearing for the supplemental water rights hearings regarding the Lower Yuba River.

Mr. Frink, you had a message for us?

MR. FRINK: Yes, Mr. Brown. I just wanted to make sure that the record was clear on one exhibit that the National Marine Fishery Service had offered into evidence toward the close of their presentation. And I'm not sure if that was ever resolved.

It is National Marine Fishery Service Exhibit 13. It's an excerpt from the Federal Register, Volume 65, Number 32. It deals with the designated critical habitat for salmon and steelhead.

And I believe Mr. Lilly had a question, or just wanted to make clear that any hearsay information in this exhibit is treated in accordance with the applicable provisions of the Government Code and the Board's Regulations.

And that would be the case, if the exhibit is admitted. But just as a housekeeping matter, if there aren't any other objections I think it should be admitted.

H.O. BROWN: Mr. Lilly?

MR. LILLY: Good morning. And thank you, Mr. Brown. I assume counsel is referring to Exhibit S-NMFS-13. And we do not object to that coming in as background information. We do raise the similar objection that we raised on the other exhibits regarding the relevance of ESA documents for this Board's decision. And a request that it will be admitted subject to the limitations of the use of hearsay evidence, this clearly being a hearsay document.

H.O. BROWN: Okay. So noted, Mr. Lilly.

Any other objections? Then I'll accept the exhibit into evidence, Mr. Frink.

Mr. Lilly, I believe you're up with your second panel.

MR. LILLY: And, Mr. Brown, before we get started on Dr. House, I have prepared two new exhibits, at staff's request, from last Friday's hearing. And we are offering them. Again, these are pursuant to staff's request. I have delivered six copies to Board staff and put copies out on the table for all the other parties.

The first one is a multipage document. And the first page says, "Yuba County Water Agency 1987 Irrigation Season Surface Water." And it goes on with similar tables for each year through 1999.

This exhibit supplements Exhibit YCWA-81 that was offered in the 1992 hearing. And, in fact, the pages for 1987 through 1991 are the exact same as the corresponding pages in that prior exhibit. The new pages, obviously, are for the years since the 1992 hearing.

We are offering this at staff's request. And if there are any questions about this exhibit those can be handled during Mr. Wilson's testimony, because he is familiar with these numbers. It would probably be easiest to just offer this into evidence at this point, unless there's any other procedure that the Board would prefer.

H.O. BROWN: So you haven't offered any of your other exhibits into evidence, have you?

MR. LILLY: Yes. We took care of all the other exhibits at the end of the day last Friday, all the other exhibits that were covered by those witnesses.

H.O. BROWN: All right. Do you want to offer that now, then?

MR. LILLY: Well, let me just cover the other one as well, I'll offer both of them.

H.O. BROWN: Okay.

MR. LILLY: The other exhibit is a two-page document. It's pages 10 and 11 from the Demand Report, which had been S-YCWA-15. We propose that these two pages be limited S-YCWA-15A. And what we have done here is

Mr. Grinnell has edited the table and the text to reflect the changes in demand numbers that are shown in Exhibit S-YCWA-27.

It turned out that when they were preparing the table on Page 11 of this document, which is Table 10, that there was a computer error, which Mr. Frink had brought out in his questioning. And, if necessary Mr. Grinnell is prepared to testify about that.

But, basically, what he has done is he's corrected Table 10 so that it is consistent with Exhibit 27. And, basically, it's corrected that computer error that they had and made some corresponding edits in the text to reflect the different numbers. So at this time we would offer into evidence S-YCWA-15A and S-YCWA-27.

H.O. BROWN: All right. Are there any objections to the acceptance of those exhibits into evidence?

Mr. Baiocchi.

MR. BAIOCCHI: Bob Baiocchi. What are the numbers, again? 27 is on the two pager and the multiple is -- so I can, at least, identify it.

MR. LILLY: You've got them backwards. The Exhibit S-YCWA-27 is the exhibit that's approximately 13 pages. The first page, at the top, says, "Yuba County Water Agency 1987 Irrigation Season Surface Water." That's Exhibit S-YCWA-27.

The other exhibit is S-YCWA-15A, which is a two-page document. At the very top it says, "Lower Yuba River Diversion Requirements, Present and Full Development." And at the bottom of the first page is Page 10. And at the bottom of the second page is page number 11.

H.O. BROWN: Any objections?

MR. CUNNINGHAM: Mr. Brown, if I might?

H.O. BROWN: Mr. Cunningham.

MR. CUNNINGHAM: On S-YCWA-27, the category identified in the various pages as, "Waterfowl Habitat," it's unclear from what's provided here and it's unclear from the testimony that's already been provided whether this is water provided for rice straw decomposition, or specifically at the request of the Department of Fish and Game, or other resources agency for waterfowl habitat protection.

Without an ability to ask questions about what is waterfowl habitat in this class, I'm concerned that this is now being presented as evidence of specific waters provided, but we've had no opportunity to explore what these waters are.

Earlier testimony indicated that these waters were routinely being used for rice straw decomposition and not waterfowl habitat.

H.O. BROWN: Thank you, Mr. Cunningham.

Mr. Lilly.

MR. LILLY: I guess we're getting off where we finished last time. Number one, Mr. Cunningham is wrong. In 1992 there was extensive opportunity for questioning about the pages of this exhibit for the years 1987 through 1991. Mr. Cunningham's predecessor, in fact, had that opportunity.

Number two, as I just said about ten minutes ago, Mr. Wilson will be testifying and is fully prepared to answer any questions about this exhibit at that time.

H.O. BROWN: Mr. Cook.

MR. COOK: Mr. Brown, it would appear to me that the proper approach would be to offer this in evidence after cross-examination of Mr. Wilson.

H.O. BROWN: I agree with you, Mr. Cook. We'll hold that one off for the time being, if that's all right with you, Mr. Lilly?

MR. LILLY: That's fine. We offered this at staff's request. We'll be glad to follow your procedure on that. We would suggest that 15A be admitted now and we'll have 27 ruled on later.

H.O. BROWN: That will be fine. All right. Any objections on 15A? Seeing none, it will be accepted into evidence. And we'll hold the decision on Exhibit 27 until

after the testimony of Mr. Wilson.

All right, Mr. Lilly. I'm sure you will not let me forget that.

MR. LILLY: Well, most likely, Mr. Frink will not let you forget, because he's the one that wanted it anyway. It wasn't even our request.

H.O. BROWN: Yes.

MR. LILLY: With that, we will call Dr. Lon House as our next witness. And since he was not here last week, I would ask, before he sits down and gets comfortable, if you would be willing to administer the oath to him.

H.O. BROWN: You promise to tell the truth during these proceedings? If so, answer I do.

DR. HOUSE: I do.

H.O. BROWN: Be seated.

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DIRECT EXAMINATION OF YUBA COUNTY WATER AGENCY

BY ALAN LILLY

MR. LILLY: Good morning, Dr. House. Would you, please, just state your name and spell your last name for the record.

DR. HOUSE: My name is Lon --

MR. LILLY: First of all, get a lot closer to the microphone. You have to be about three inches away from it.

DR. HOUSE: My name is Lon House, H-o-u-s-e.

MR. LILLY: And is Exhibit S-YCWA-5 an accurate statement of your education and work experience?

DR. HOUSE: Yes, it is.

MR. LILLY: And is Exhibit S-YCWA-12 an accurate statement of your testimony for this hearing?

DR. HOUSE: Yes, it is.

MR. LILLY: And would you, please, summarize that testimony?

DR. HOUSE: With your permission, I'm going to stand and use the overhead.

MR. LILLY: Just make sure to keep that real close.

DR. HOUSE: I was asked to discuss any changes that have occurred in the electric industry since this testimony was originally filed in 1992.

And what my testimony does is it describes the two major changes in the deregulated electricity market in California. One is the creation of a California Power Exchange, or the PX; and one is the creation of California Independent System Operator, the ISO.

The PX does a marginal-cost based energy auction, a kilowatt auction. And the ISO is sort of an air traffic controller for the transmission lines. But they do, basically, also, an auction for reliability services. So the one thing that has really changed since the initial

testimony, and this is my Figure 1, is that --

MR. LILLY: Just to be clear for the record, this is Figure 1 from Exhibit S-YCWA-12.

DR. HOUSE: In the previous world, utilities were given cost-based rate making, which meant that they were, basically, allowed to flow through the cost of whatever the power was that they produced or they purchased.

In this new world, what happens is the utilities have to buy all of their electricity from the PX, from this hourly auction. And the ISO provides the ancillary services. But what -- the thing that's most important here is that the prices for -- the prices and the value of the electricity generated varies tremendously. And this is my Figure 1 in my testimony.

And you can see, what I did was I picked out the last three days in the last of May, June, and July of last year. And you can see in May the average price, which is this little line down here, the average price for the day was about one cent per kilowatt hour. And there were four hours of that day in which the price for electricity was zero. So it meant if you produced electricity you didn't get any money for it at all.

And, then, you can see that what I've done here -- and I've shown the prices for the summer peak, for one of the summer days, which is 27th of August. And the

prices went from about three cents a kilowatt hour to over 20 cents a kilowatt hour.

Now, one of the things that -- the record price that we've hit thus far was October 1 of this last year. And for the hours ending at 10:00 a.m., 7:00 p.m., 8:00 p.m., and 9:00 p.m. in the PG&E area, which is called Pan-P 15, the price for electricity was 72.5 cents a kilowatt hour.

So the point that we are making here is that in the old world, when you had flat prices of electricity, it really didn't matter that much when the electricity was produced. But in this new world, the more and more that you constrain when they can produce the electricity, the more and more it costs.

What that graph was dealing with was kilowatt hours, which is the actual generation of electricity. What these graphs are -- and this is Figure 2, Figure 3 and I'm going to go to Figure 4, and Figure 5, and this is copied just straight from the California ISO webpage.

What the ISO does, in addition to the generation of electricity, the ISO buys ancillary services, which are reserves or emergency replacement. And you can see from this, from these figures that the value of having a generator that can produce electricity on very short notice is totally dependent upon when that generator can

operate.

Now, you can see that in most of the week for the nonspin reserve -- and these are replacement clearing prices, and then the last two are day ahead regulation, which is -- which is the ability to change generation in order to meet an in balance in electricity that's coming from the PX.

And the spinnings are -- you can see that for many hours of the week the price is worth nothing. I mean, if you've got a generator sitting there, you don't get paid anything for it. But if you can operate it in these periods, it's very, very short periods of time you can make a substantial amount of money. And you can see that these are all capped at $250 a megawatt hour, which is 25 cents a kilowatt hour. And this is the cap that was put on --

MR. LILLY: Is that a kilowatt hour, or a kilowatt?

DR. HOUSE: It's a kilowatt, but over an hour it turns out to be a kilowatt hour. It is, actually, 25 cents a kilowatt for that hour. These -- in July the 13th of 1998, the ISO paid $9.99 a kilowatt for power.

They went to the -- they realized that there was some problems with the depth of the market and other things, and they went to FERC and they got a cap put on it. The cap is at $250 a megawatt, or 25 cents a kilowatt

hour.

Now, I included another figure, which is the last figure that I have, which showed what happened when they were released -- this was the day that that cap went off. The cap went from 25 cents a kilowatt hour to 75 cents a kilowatt hour. And you can see that day, the price went up to $534 a megawatt hour, 53.4 cents a kilowatt hour.

MR. LILLY: Just for the record, you're now referring to Figure 6 from your testimony.

DR. HOUSE: Yeah. So in conclusion -- and what I've done is, I've calculated some numbers in there. I used the 19- -- the first year of operation for the PX, the average price was 2.5 cents a kilowatt hour. For 1999, which was the calendar year, the average price was 2.8 cents a kilowatt hour.

And for the PG&E area, which they call NP 15, it was 3 cents a kilowatt hour. But I didn't have those numbers when I had this testimony, so I used 2.5 cents a kilowatt hour. Given the flow scenarios that we were looking at, on the generation side, which is the kilowatt hour side, the changes that are being suggested will cost between 290,000 and about $1.4 million.

MR. LILLY: Is that per year?

DR. HOUSE: Per year. And for the ISO, what I did for the ISO is I took the total number, the total cost of

ancillary services for the first year, which is $1.47 billion, divided by the number of kilowatt hours that were used in that year, or were -- yeah, were used in that year. And that gave me 5 cents -- well, .05 cents a kilowatt hour.

I multiplied that by the number of hours, about half of the year that the capacity from the Colgate plant would be not used, because when you go into the ancillary services market, you can't be generating electricity. You have to be able to be called on to use the electricity.

So the number that I got in here, which is 7.3 million per year for the ancillary services, is the cost of having that capacity from Colgate on reserve, water behind the dam, and being available to be used and bid into the ISO. And that completes my oral testimony.

MR. LILLY: All right. We'll -- we propose, now, that Dr. House be available for cross-examination.

H.O. BROWN: Mr. Edmundson, is he here?

MR. FRINK: No.

H.O. BROWN: Mr. Gee?

MR. GEE: Mr. Brown.

H.O. BROWN: Good morning, sir.

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CROSS-EXAMINATION OF YUBA COUNTY WATER AGENCY
BY U.S. DEPARTMENT OF INTERIOR, FISH AND WILDLIFE SERVICE
BY MR. GEE

MR. GEE: Mr. House, my name is Edmund Gee. I am an attorney with the Department of Interior. I have some questions for you.

Now, in your testimony you made reference to SYW -- excuse me, Exhibit SCWA 16, I believe that's the Bookman-Edmonston report.

DR. HOUSE: Right.

MR. GEE: Did you prepare any portion of this report?

DR. HOUSE: Bookman-Edmonston, no. I simply took the tables that they provided, which were -- I looked them up, the kilowatt hour, generation changes, based upon the eight different scenarios, and used those to develop the numbers that I have in here for the energy changes.

MR. GEE: But did you perform any independent studies of your own outside of --

DR. HOUSE: No.

MR. GEE: If you can refer to your testimony, Exhibit S-YCWA-12. On Page 2, the full paragraph there on Page 2 there's -- the third sentence and you state that, (Reading):

"However, in the current world there is no doubt that changes in instream flow requirements," blah, blah, blah.

Do you see that sentence there?

DR. HOUSE: Yes, "Will have a major impact on prices and revenues"?

MR. GEE: That's correct.

DR. HOUSE: Yes.

MR. GEE: Did you conduct any studies to support that statement there of your own?

DR. HOUSE: What I did is I took the changes in generation and just simply multiplied that by the value of the generation. But I did not -- and I talked about this in here. If you really wanted to do --

MR. GEE: Well, my question is: Did you perform any independent studies of your own to support that particular conclusion?

MR. LILLY: And I'm going to object. The question is ambiguous whether Mr. Gee is referring to independent studies of the power generation, or of the subsequent analysis of the value of that power.

MR. GEE: My question relates to his statement there on Page 2 of his written testimony. And my question is simply: Did he -- did Mr. House perform any studies of his own as to that particular conclusion?

DR. HOUSE: It is obvious that the more that you constrain the system, constrain the operation of the system, the more money that you will lose, because you don't have the flexibility to operate it in the hours in which you would maximize revenue. And that's what I based that statement on.

MR. GEE: And is that based on your own supposition? I'm trying to get some kind of idea on what you base that conclusion on.

DR. HOUSE: If you look at the figures that I have in there -- well, for example, if you were forced to generate in the early morning hours of May, you would be getting zero for your electricity. If you could have generated in the end of October, you would be getting 72 cents per kilowatt hour for electricity.

So the ability of the operator to choose when to generate electricity based upon these market prices -- see, these market prices are posted a day ahead. And so if they have the flexibility to either store water, or to generate during that time, they will be able to make -- then it will be more economic for them if they are constrained from doing that.

You're asking me sort of like a -- you're asking me sort of an optimization question.

MR. GEE: I don't think I am. I'm just wondering

where you got your information to base your conclusion?

DR. HOUSE: I got it from the PX hourly numbers and from ISO weekly numbers.

H.O. BROWN: It might help to identify those acronyms.

DR. HOUSE: Excuse me. I'm used to talking that way. I apologize. The PX is the power exchange. And that's the kilowatt hour, that's the energy market. The ISO is the Independent System Operator and that's the reliability agency that you bid reserves and capacity into.

H.O. BROWN: Thank you.

MR. GEE: Mr. House, I'm going to refer you to Page 3 of your testimony. That's Exhibit S-YCWA-12. And the very first sentence you state,

(Reading):

> "That it is obvious that any increase in instream flow requirements that decreases the flexibility to operate the Colgate and Narrows 2 power plants will decrease the value of these facilities, hydroelectric generation."

Is that correct?

DR. HOUSE: Correct.

MR. GEE: And, again, I'm wondering if you personally conducted any studies of your own to reach that

conclusion?

DR. HOUSE: Well, I think the next sentence states it. It says that if you could shift four hours of generation from the night of May the 31st to the afternoon of June 30th, you'd have $151,000 in increased revenues. If you could shift from the morning to the afternoon of August 27th, you would make 247- -- or $243,000.

And so I mean I'm looking at that saying, the ability to choose when to generate versus having some other parameter put on the system, you will have to generate regardless of what the price of electricity is. That's the conclusion that I reached, which is: It will decrease the value. At least, decrease the hydroelectric and ancillary services value of this facility.

MR. GEE: And if you would turn to Page 4 of your testimony. The very last sentence it states, (Reading):

> "Instream flow requirements that reduce," or eliminate this flexibility will significantly reduce --

THE COURT REPORTER: I'm sorry. You're going to have to speak up a little bit.

MR. GEE: If you could just read that last sentence on Page 4.

DR. HOUSE: Okay.

(Reading):

"Instream flow requirements that reduce or eliminate this flexibility will significantly reduce or eliminate the ability of the operators of the Colgate power plant to participate in the ancillary services market."

MR. GEE: Okay. My question is: Have you performed any studies to determine that draft decision instream flow requirements, actually, impair storage levels to such a degree that the operators of the Colgate power plant would not be able to participate in the ancillary services market?

DR. HOUSE: The previous sentence says that in order to participate in this market, they have to have water in storage and the ability to ramp up generation when called upon by the ISO.

My understanding of the discussion that you're talking about in this proceeding, is the requirement that they will be -- water will be running through those facilities. If water is running through those facilities, then they do not have water in storage and the ability to turn on generation.

So it is -- it is a logical conclusion, at least to me, that they will -- it will reduce their ability to bid ancillary services into the ISO market.

MR. GEE: That's precisely my point. I'm looking at your conclusion, I'm wondering is there any study that you can -- I can look at where your conclusion -- that your conclusion is based on? I'm just looking at the conclusion here.

DR. HOUSE: I guess that it was -- it appeared to be so obvious to me, that I didn't see a need to get the hourly values.

MR. GEE: Okay. Well, it's obvious to you, but it wasn't obvious to me.

DR. HOUSE: Okay.

MR. GEE: So I'm wondering what you based your observation on. With that, if you'll turn to Page 7 of your testimony. And it's the very first sentence of the bottom paragraph, if you could read that.

DR. HOUSE: (Reading):

> "Absent assessment of the potential hourly impacts of the SWRCB draft decision on the operation of the YCWA hydroelectric facilities and the forecast of hourly PX and ISO ancillary services prices, it is very difficult to predict the magnitude of the revenues that would be lost due to the instream flow requirements in the draft decision."

MR. GEE: Okay. And my question is similar to the

prior ones: Did you personally assess the potential hourly impacts of the draft decision on the operation of Yuba County Water Agency's hydroelectric facilities?

DR. HOUSE: No. I did not have hourly values available.

MR. GEE: Have you personally forecasted the hourly PX and ISO ancillary services prices?

DR. HOUSE: If I had successfully forecasted the ISO and the PX ancillary services market, I would not be here. I would be in Tahiti on my own private yacht.

MR. GEE: Thank you.

H.O. BROWN: That was, certainly, descriptive.

DR. HOUSE: There is a lot of money in an accurate forecast of ISO and PX prices, if someone could do it.

H.O. BROWN: Yes. Mr. Baiocchi?

MR. BAIOCCHI: Good morning, Mr. Brown.

H.O. BROWN: Good morning, sir.

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CROSS-EXAMINATION OF YUBA COUNTY WATER AGENCY

BY CALIFORNIA SPORTFISHING PROTECTION ALLIANCE

BY MR. BAIOCCHI

MR. BAIOCCHI: Good morning, staff. Good morning, Mr. House. And good morning, Mr. Lilly. It's another day. I'm not going to take up too much of the Board's time on this, I just have a few simple, fundamental

questions.

Mr. House, the first question is: Does Yuba County Water Agency receive $8 million a year from PG&E from the production of energy produced at the Yuba River Development Project regardless of the power produced at the project?

DR. HOUSE: The $8 million sounds familiar, but I don't know the exact contractual arrangement between PG&E and Yuba County. But I assume Mr. Wilson does, but I don't know that contract. I've never seen it.

MR. BAIOCCHI: Okay. Thank you. You're an advisor for RCRC?

DR. HOUSE: Yes.

MR. BAIOCCHI: RCRC is 27 counties, correct?

DR. HOUSE: 27 rural counties, yes.

MR. BAIOCCHI: Okay. The question is: Do members of the RCRC propose to bid on PG&E's projects in the event the bidding matter goes before the PUC?

DR. HOUSE: The bidding matter is before the PUC. And there are several counties that I'm aware of that are looking at purchasing the PG&E hydrofacilities.

MR. BAIOCCHI: Thank you. I have one more question. In the event PG&E's Narrows project goes before the PUC for bidding, does the Yuba County Water Agency propose to bid for the project?

DR. HOUSE: I don't know. You'll have to ask Mr. Wilson.

MR. BAIOCCHI: Thank you.

H.O. BROWN: Thank you, Mr. Baiocchi.

Mr. Sanders.

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CROSS-EXAMINATION OF SOUTH YUBA COUNTY WATER AGENCY AND CORDUA IRRIGATION DISTRICT SOUTH YUBA RIVER CITIZEN'S LEAGUE

BY MR. SANDERS

MR. SANDERS: Good morning. Well, I wasn't planning on asking any questions, so I have just one or two.

It sounds to me like when you talk about maximizing the revenue it's -- it's one in the same or integrally related with the ability to choose when you generate. Is that a correct statement?

DR. HOUSE: From a hydroelectric revenues perspective, that's true.

MR. SANDERS: Okay. Do you know if Yuba County Water Agency currently operates the Yuba River project to maximize revenues?

DR. HOUSE: Hydroelectric revenues?

MR. SANDERS: Yeah.

DR. HOUSE: You'd need to ask Mr. Wilson that question, but my understanding is that there are certain

rule curves in which they operate the facility. But I'm not that intimately familiar with those operations, so you'll need to ask Mr. Wilson.

MR. SANDERS: Okay. A big issue in this hearing is flow fluctuation patterns. Now, if you were going to maximize revenue, how quickly do you have to have -- how much flow fluctuation are you going to have in the river?

MR. LILLY: And I'm going to object. The question is ambiguous, because, obviously, changes in generation at Colgate would have very different ramifications from changes in generation at Narrows 1 or Narrows 2. So the question is ambiguous, unless it splits it up between the two different locations for power generation.

H.O. BROWN: Mr. Sanders?

MR. SANDERS: I'd have to give it a little bit of thought.

H.O. BROWN: Start with one and then the other.

MR. SANDERS: Okay. If we're talking about -- well, to maximize revenues you have to be able to, basically, turn on and off the generator within a moment's notice; is that correct?

DR. HOUSE: Within certain parameters, that's true. And those parameters -- I mean you've got -- you've got some mechanical parameters on the operation of the facility that you will need to deal with. But the ability

to change your generation or to start generating in response to market prices is what the value of the facilities are. But most of the values are in Colgate, not in Narrows.

MR. SANDERS: Okay. And the value is the ability to be able to turn Colgate on and off during a 24-hour period, is that --

DR. HOUSE: During a 24-hour period.

MR. SANDERS: During the peak demand of the 24-hour demand period --

DR. HOUSE: Right.

MR. SANDERS: -- it might be turned on -- okay, I get it. And do you know what sort of flow fluctuations that would cause downstream?

DR. HOUSE: I -- I think you've already talked to all the hydrologists. And I don't know the answer to that, but what I do know is that it will depend upon what happens at Englebright.

If there is space in Englebright, when Colgate changes, then it will only be the stretch of river between Colgate and Narrows that's affected. But if there is nothing, no space in Englebright and water comes down, then it will have to -- yeah, no space in Englebright and water comes down, it will have to go out. But I don't know what the magnitude of those changes would be.

MR. SANDERS: Okay. Thank you very much.

H.O. BROWN: Mr. Cook?

MR. COOK: Thank you, Mr. Brown.

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CROSS-EXAMINATION OF YUBA COUNTY WATER AGENCY

BY MR. COOK

MR. COOK: Mr. House, attempting to simplify this a little bit, your basic testimony is to the effect that price is dependent upon fluctuating flows and to the total amount of flows, I assume. Is that a fair statement?

DR. HOUSE: Let me rephrase what I think you said. The value of the hydroelectric generation is dependent upon the ability to change generation in response to market prices. Market prices are determined absolutely independently of anything that could happen at these facilities. It's a much bigger market than those. So those are, basically, an extraneous variable.

MR. COOK: However, the market value of price changes often, as you've indicated previously, does it not?

DR. HOUSE: Yes.

MR. COOK: And so the difference in price indicates the amount of money, the amount of income that would be received by PG&E for its generation of electricity dependent upon the time of the fluctuating flows; is that

correct?

DR. HOUSE: What is catching me is the fluctuating flows, because my interpretation is the fluctuating flows are a result -- if the question you're asking: The fluctuating flows are the result of the operations of the facility, or -- that is a different question than are the fluctuating flows determined by some other force, like visbore, and the ability -- well, PG&E under the current contract until 2014, or something like that, PG&E is getting all of the revenues associated with the sale of the hydroelectric generation. And then they're paying Yuba whatever they want. Then after that point, then whoever the owner of these facilities is will be getting the revenue.

MR. COOK: If there's a problem with the phrase, "fluctuating flows," I think your testimony is that on a daily basis, and maybe on an hourly basis, the value of electricity generated either increases or decreases. And to maximize the value, it would be necessary to regulate these flows dependent upon when the prices were the highest, and to reduce flows when the prices were the lowest; isn't that correct?

MR. LILLY: And, again I'm going to object. Again, "these flows" is ambiguous whether we're talking flows from Colgate into Englebright Reservoir, or whether we're

talking flows out of Narrows into the Lower Yuba River.

MR. COOK: Okay. I'll change that --

H.O. BROWN: Wait a minute until I respond.

MR. COOK: I'm sorry.

H.O. BROWN: Go ahead, Mr. Cook.

MR. COOK: Well, then let's divide this up into Colgate and Englebright. And I believe you have indicated that if the draft decision flows are adopted that there will be, what, $7.3 million of lost revenue to PG&E?

DR. HOUSE: Potential lost revenue due to the inability -- well, it could be based upon the inability of the operator of Englebright to participate in the ancillary services market.

MR. COOK: So are you familiar with the operation of the Bullards Bar Dam and the Colgate Powerhouse and Englebright Dam? Please, answer "yes" or "no."

DR. HOUSE: Define in greater detail what you mean by "operation."

MR. COOK: Do you know -- do you know that Englebright Dam, actually, is a control for the flows into the Yuba River below Bullards Bar Dam, that it's, actually, an after bay for Bullards Bar?

DR. HOUSE: Yes.

MR. COOK: And when you fluctuate the flows into the Colgate Powerhouse, those fluctuations go into

Englebright, do they not?

DR. HOUSE: Correct.

MR. COOK: And the amount of flows out of Englebright do not necessarily turn on the amount of fluctuating flows, or the amount of flows coming from Colgate?

DR. HOUSE: Correct, based upon how much storage space they have available in Englebright.

MR. COOK: And it doesn't take too much storage, does it, for a particular day of changes in the flows at Colgate, it doesn't take too much storage to modify the fluctuations below Englebright?

DR. HOUSE: I don't know that.

MR. COOK: Well, you do know that if -- at least, you say that if the flows, the instream flows which are, certainly below Englebright, are adopted according to the draft decision, that PG&E will lose all its money at Colgate; isn't that true?

DR. HOUSE: What I say is that the potential loss in revenues are the order of one million a year, because of hydroelectric generation and up to 7.3 million a year in ancillary services. The exact number I don't specify in there, but that's what the magnitude is, the potential magnitude is.

MR. COOK: And you base that on the fact that

instream flows below Englebright, according to the draft decision, would require a modification of fluctuating flows, or changes in flows at Colgate?

DR. HOUSE: Well, it can constrict the ability of the operators at Colgate to operate.

MR. COOK: And you didn't determine whether or not the operation of Englebright Dam would have an impact on that, did you?

DR. HOUSE: I did not determine whether the operation of Englebright Dam could be adjusted to allow unlimited operation of Colgate.

MR. COOK: Going on a slightly different tact, on the one hand -- and do you understand when I say, "fluctuating flows," the fact that I'm talking about changes in the amount of flows in the river over relatively short periods of time?

DR. HOUSE: Yes.

MR. COOK: And, therefore, on the one hand the price to PG&E depends upon minimizing -- or increasing fluctuating flows, does it not?

DR. HOUSE: I'm going to be a little bit nitpicky. The revenues to PG&E will depend upon the ability that they have to operate those facilities.

And the reason I'm being nitpicky is price is determined exogenous to this. It's determined by the

power exchange, or the independent system operating. That's a given, but the revenues are based upon the operation of the facility.

MR. COOK: You indicated at certain times the power is worth nothing?

DR. HOUSE: Yes.

MR. COOK: Other times it's worth a tremendous amount?

DR. HOUSE: Yes.

MR. COOK: And to get that, you have to -- to get the maximum value, or maximum revenue you would have to increase the flows at the time the price is the highest and decrease the flows when the price is the lowest; isn't that true?

DR. HOUSE: Out of Colgate.

MR. COOK: Out of Colgate.

DR. HOUSE: Out of Colgate.

MR. COOK: And so, on the other hand, you recognize -- I mean you assume -- you testified about the draft decision. I assume you understand it in that the draft decision provides for, I think you use the term additional flows for the benefit of fish life?

DR. HOUSE: Uh-huh.

MR. COOK: And so the additional flows and the fluctuating flows for the benefits of fish life, on the

one hand, requires certain non -- or certain -- let me say certain flows, and the price also requires certain flows which includes fluctuations?

MR. LILLY: I'm not clear whether there's a question or not at this point.

MR. COOK: Is that correct?

H.O. BROWN: You may want to restate that question. I think we know where you're headed here, but your question didn't quite get there.

MR. COOK: Well, what I'm trying to get at, Mr. House, is you have testified about the draft decision. And you understand that the draft decision requires certain flows, which include fluctuations for the benefit of fish life; is that correct?

DR. HOUSE: Correct.

MR. COOK: And, then, on the other hand, you testified that price to PG&E depends to a certain extent on flows and on fluctuation of flows; isn't that correct?

DR. HOUSE: Let me state this, what my testimony says is that the draft decision will cost money in lost revenues.

MR. COOK: And that's lost revenue to PG&E?

DR. HOUSE: PG&E, right now.

MR. COOK: And that would also relate to if PG&E sells --

DR. HOUSE: To the new owners.

MR. COOK: -- that right to generate electricity, if PG&E sells that right, it would have an impact on the value?

DR. HOUSE: Yes.

MR. COOK: The amount of money paid to PG&E?

DR. HOUSE: Yes, which is credited to CTC which is given to all the ratepayers in Northern California.

MR. COOK: There is a certain amount of profit, I assume, involved in that?

DR. HOUSE: No.

MR. COOK: No profit?

DR. HOUSE: Not in this transaction, but -- and we will bog the downstream extremely rapidly when we get into competitive transition charges in that particular discussion. But it doesn't have anything to do -- it's not germane to this proceeding.

MR. COOK: Well, I'll try to wind it up, if I can. On the one hand, we're talking about price for electricity that's generated at Colgate. And on the other hand, we're talking about instream flows for the benefit of fish.

DR. HOUSE: Yes.

MR. COOK: And neither -- and those two are not necessarily consistent with respect to the amount of flows and the time of the flows?

DR. HOUSE: That's correct.

MR. COOK: And so it's just, basically, a question between price and fish, is it not?

DR. HOUSE: It's -- it's a question that somebody here, other than me, is going to make, some policy maker. And -- but you could in a very crass way say it's either dollars or fish, or you could say this is how much it will cost us in lost revenues to increase the -- whatever your target is, how many fish you have in the river. And that is a policy decision that somebody is going to make.

MR. COOK: That's all I had, Mr. Brown.

H.O. BROWN: Thank you, Mr. Cook.

Mr. Minasian.

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CROSS-EXAMINATION OF YUBA COUNTY WATER AGENCY
BY SOUTH YUBA WATER AGENCY AND CORDUA IRRIGATION DISTRICT

BY MR. MINASIAN

MR. MINASIAN: Mr. House, your testimony is based upon determining an economic value of the effects of the implementation of the proposed decision, is it not?

DR. HOUSE: The potential impact, yes.

MR. MINASIAN: And I'm an attorney for the South Yuba Water District and the Cordua Irrigation District, and I'd like to ask you a series of questions relating to how the decision to take capacity away and move it to

other months will result in various steps being taken by society.

So first let's start, when the price goes up during the periods in which the agency has historically been generating electricity and it's now proposed to dislocate that generation to another period when the price is less, that indicates that the society values more in the periods when the price is higher, doesn't it?

DR. HOUSE: That's the premise behind the hourly price auction in the PX.

MR. MINASIAN: Okay. And you understand we don't have an Environmental Impact Report in this particular project to tell us where that power would be replaced. So I want you to deal with a hypothetical for me. And I'd like you to envision two periods.

Currently, where would somebody replace in excess, as you say on Page 3, 14,656 megawatts, megawatt hours of power, where would somebody place it today in August?

DR. HOUSE: In August, today, this is a -- there's a hearing that the Senate Utilities Committee is going through. And there's a report that's out by the Energy Commission on supply adequacy. And the reason I'm bringing those up is that both of those entities are saying that we are several 1,000 megawatts short of

capacity right now.

And we made it through the last summer with, I think, five stage one alerts, which means we were getting down to a very, very low operating level. The reason I'm prefacing this is, because if it's a very hot day in August, currently for the next several years until we get new generation that's being built, or under construction now available, it is unknown where new electricity will come from.

And what will probably happen is that demand will be curtailed if they're running short of electricity. Which means that those businesses and parties that are on interruptible rates will be shut off. And then they will go into whatever other fairly dramatic, or desperate needs.

But in the near term, the Energy Commission states, I think accurately, that there is not enough -- for the next two years, there's not enough sufficient generating capacity to get electricity during certain peaks in California. And we will be forced to rely upon curtailments if we run into trouble.

MR. MINASIAN: And is it a correct statement, without going into a lot of detail so that Member Brown will know who it is that gets curtailed, that's generally the minimum-wage worker factory, it's the low-economic

value to society factory, or plant, or activity, isn't it?

DR. HOUSE: It -- the initial curtailment is for those entities that have signed up for an interruptible tariff. And in response to certain price breaks, they agree to be curtailed when they run into system emergencies.

At least the initial phase of this curtailment is -- you can view that as being somewhat voluntary in that they've chosen to be a little riskier, or they've installed backup generation to make sure that they have their facilities taken care of, particularly, a lot of the computer industry.

So I can't answer -- I don't know what socioeconomic, economic strata it will fall on, because that they're not just going to go out -- they're not able to just go out and just curtail Burger King and those minimum-wage workers. They will curtail certain fairly large industries that have participated in this.

And I don't know what their value -- you know, what their revenues are. But in a lot of cases these industries have -- have installed backup generation.

MR. MINASIAN: Okay. So they have a diesel generator, or a natural gas turbine out in the back of the plant which they can turn on?

DR. HOUSE: Or they'll just shut down their process

line.

MR. MINASIAN: Okay. To your knowledge, has anyone looked at the impacts on air pollution of doing that in the month of August and could we not end up in a circumstance where this Board's decision leads to a circumstance where more people install those and now we have an air pollution problem instead of a fish problem?

MR. LILLY: Wait. Wait. I'm going to object.

MR. MINASIAN: Okay.

MR. LILLY: I have to object to Mr. Minasian's characterization that we now have a fish problem.

MR. MINASIAN: Okay.

H.O. BROWN: Maybe you may wish to restate that.

MR. MINASIAN: I, obviously, should bite my tongue on the fish issue. Can we, in this circumstance based on your expertise, can we trade one issue for another, because of relationships that are economic in nature, but they result in an environmental change?

DR. HOUSE: Let me answer your question this way: In the near term we're going to have problems; but in the far term what is going to be replacing any curtailment in the ability to operate these things, will be natural gas fire-combined cycle facilities, or existing utility generation.

MR. MINASIAN: Right. And that was the second part

of our question. That's the plan, isn't it?

DR. HOUSE: That is the plan.

MR. MINASIAN: And we have 13 submittals to the Energy Commission in regard to the natural gas plant in the area south of the Delta, don't we?

DR. HOUSE: That number, I think is correct. I don't know if 13 is the exact number. I don't have that, but it's about 800 megawatts --

MR. MINASIAN: Okay.

DR. HOUSE: -- of capacity.

MR. MINASIAN: And these types of plants require a reliable water supply, don't they?

DR. HOUSE: Yes. They're thermal plants, yes.

MR. MINASIAN: Okay. And they take water south of the Delta, put it through a plant and basically some part of it evaporates, does it not?

DR. HOUSE: Yes. It's used for cooling. Some of it evaporates, yes.

MR. MINASIAN: And if we were to examine the implications of the decision to take this capacity away from August, would it be logical to look at the effects upon the fish of building those cogeneration plants, those gas turbine plants south of the Delta?

DR. HOUSE: Yes, provided that the -- provided that they wouldn't be built anyway. I mean, if they're going

to be built anyway, then it is not something that this Board is not going to do -- does, doesn't make them build these plants.

But if this -- I mean if I was a smart guy and I realized that they were going to shut off Bullards Bar, and Bullards Bar is one of the primary stabilizing generators in Northern California, then it may -- I would have to really sharpen my pencil to say, well, you know, they're going to shut that off and they're going to need something to replace it, or curtail it, they'll need something to replace it, that, potentially, will change the economics of my new facility. Conjugality, it will make them better. And that may be enough to make me decide to build it or not build it, but I don't know.

MR. MINASIAN: Right. It would be better if the water supply and the ability to operate that plant on a reliable basis in August is more dependable than Bullards Bar, wouldn't it?

DR. HOUSE: Is more dependable than Bullards Bar -- if you mean more dependable, you mean less constrained than the operation of Bullards Bar?

MR. MINASIAN: Yes.

DR. HOUSE: Then, the determinate is the price that it costs the other guy to generate electricity versus the price it costs from Bullards Bar.

MR. MINASIAN: Okay. Now, I want you to imagine a hypothetical, because you deal in dollars, don't you?

DR. HOUSE: Yes.

MR. MINASIAN: And you deal in the financing of capital facilities to generate, or transmit energy, do you not?

DR. HOUSE: I advise people that are involved in that.

MR. MINASIAN: And bankers and investment counselors look at the reliability of the income stream from a plant, a gas turbine plant before they invest, don't they?

DR. HOUSE: Yes, they should.

MR. MINASIAN: I want you to take the example of the proposed decision of the Board, which would impair the capacity that was dependent upon by PG&E in this plant. And I want you to put that right next to a proposal to build a $750 million or billion gas turbine plant and I want to ask you:

How are we going to get the dependability to satisfy the financers of the gas generation plant that they're not going to have their capacity constrained in August, because of air, or some other species problem during the financing period?

MR. CUNNINGHAM: Mr. Brown, I'd like to object, please.

H.O. BROWN: Mr. Cunningham.

MR. CUNNINGHAM: I'm sorry. I've heard a friendly cross-examination, but this goes a little beyond the concept. I haven't heard this witness testify at all about any of these subjects on his direct.

And as I understood, that normally cross-examination is designed to elicit and elaborate testimony in direct, not to, essentially, treat this witness as a new witness for Mr. Minasian and talk about things like alternative power sources south of the Delta, the costs of generation, the risks of generation south of the Delta.

Mr. Brown, this goes far beyond the scope of any direct I ever heard and far beyond anything the witness' own curriculum vitae establishes, his credentials, to be even talked about. I understand what he is. What he is not an expert -- at least for this hearing, he's not been presented as an expert on alternative generation capabilities and costs.

H.O. BROWN: Thank you, Mr. Cunningham.

Mr. Minasian.

MR. MINASIAN: Obviously, I'm going to back off and make this much shorter. I have to represent to the Board that I did not talk with anybody, Mr. Lilly, or anybody about these questions, because this is a subject which is

very important to me in terms of trying to figure out what we're doing in society. So I'll back off.

I think, you know, I am beyond the scope of direct. The Board has given great liberality in the past and I'll make this real quick.

What does DFG suggest is the mechanism in this hearing that we balance the effects of taking away this constraint, which is a requirement of public trust? Perhaps, Mr. Cunningham can tell us how we're going to get evidence of how the balancing is going to take place.

H.O. BROWN: You may wish to ask that question to Dr. House. As all of you know, we offer a great deal of latitude on cross-examination. I think that the questions you asked are close enough to stay within that spirit of the debate here. And if you wish to continue you may do so.

MR. MINASIAN: Thank you, Mr. Brown. I'll make it very brief and, hopefully, not impose on DFG's concerns.

Mr. House, how are we going to be able to finance over 20 or 30 years a gas-fired plant in the Bakersfield area based upon the idea that it's going to be able to replace 14,656 megawatt hours -- actually, more than that -- in August of a year if we don't have certainty as to how the operating constraints from an environmental point of view are going to work during the whole financing

period?

H.O. BROWN: You're, obviously, asking for just an opinion --

MR. MINASIAN: Yes, I am.

H.O. BROWN: -- from a professional?

DR. HOUSE: The financers of these new facilities are looking at two things. One, is they are looking at replacing existing utility -- actually, it's non-utility generation, but what were existing generation plants.

The new facilities are, generally, a lot cleaner and cheaper than the existing facilities. But the introduction of these new facilities simply ends up pushing the older utility facilities higher in the loading order. So they will become used more inefficiently during shorter periods of time, they will be turned on and turned off more frequently, which is -- an end up result of various problems, air pollution problems in particular.

But I think that you can safely say that constraints on the operation of Colgate will result in the near term and probably the far term in increases in emissions from natural gas-fired generated plants.

MR. MINASIAN: Would you do something for us, put in magnitude an amount in excess of 14,600 megawatt hours in the terms of population use in August. Are we talking about a city of 15,000 people?

DR. HOUSE: I would have to get my calculator to, actually, figure this out.

MR. MINASIAN: Okay.

DR. HOUSE: But a general rule of thumb that you can use is that a typical suburban residence uses three kilowatts. So you can take that number and divide it by the hours in the month and by three kilowatts and figure out how many houses would be affected by this.

MR. MINASIAN: Okay. And in terms of a hypothetical which we develop a new winding for hydroelectric plants that could be installed in all hydroelectric plants, how would we finance a new winding without certainty about what the operating criteria will be for the life of the financing of the winding?

DR. HOUSE: The financiers would have to do due diligence to determine what the risks are associated with the uncertainty. And then they would make their decision of whether they would invest or not. But the increased risk, the higher the cost of the money.

MR. MINASIAN: And at some point money isn't available and the winding doesn't get put in, does it?

DR. HOUSE: At some point it gets too risky for entities to invest in and they will put their money someplace else.

MR. MINASIAN: And in your observation, are we

developing a state of uncertainty in the hydroelectric plants that does not allow the investment of reasonable amounts of money between now and the end of the PG&E contract?

MR. CUNNINGHAM: Mr. Brown, please, I'm going to object. I'm sorry, this goes so far beyond the scope. We're now asking the witness to testify as an economist. I do believe that is far beyond the scope of even the most lenient Board rulings.

MR. MINASIAN: Well, I think that's what he is.

H.O. BROWN: Mr. Minasian, you may answer the objection.

MR. MINASIAN: He is an economist. That's what he practices, but I'm done.

H.O. BROWN: All right. Thank you, Mr. Minasian.

MR. MINASIAN: Thank you.

H.O. BROWN: And thank you, Mr. Cunningham.

Mr. Gallery. Is he here? No.

Mr. Bezerra.

MR. BEZERRA: We have no questions for this witness.

H.O. BROWN: Mr. Morris.

MR. MORRIS: Thank you, Mr. Brown.

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CROSS-EXAMINATION OF YUBA COUNTY WATER AGENCY

BY WESTERN WATER COMPANY AND WESTERN AGGREGATES, INC.

BY MR. MORRIS

MR. MORRIS: Welcome, Dr. House. I only have a couple of very brief questions. I'm going to start out with some on Colgate. I think you testified, previously, that Colgate is a major resource in the day ahead clearing prices; is that correct? Did I characterize that properly?

DR. HOUSE: Colgate has, typically, been used by PG&E as a major stabilizing force in the northern part of the grid.

MR. MORRIS: If the reliability of the Colgate was seriously decreased, you might say, what would the effect of removing Colgate or impacting it be to the price of electricity on the day ahead, the closing price would be?

DR. HOUSE: The cost would, on the day ahead, PX price would go up. But that, I think, would really pale compared to the price impact on the ISO.

MR. MORRIS: On the ISO, okay. So either removing the reliability or even removing it completely from the ISO would significantly increase the price of electricity, is that --

DR. HOUSE: Would increase the price of ancillary

services, because bidders would know that that resource, which is a very valued resource is not there, particularly, in the ten-minute ramping category and they would adjust their offers to higher corresponding.

MR. MORRIS: Okay. You just mentioned "ramping." You weren't participating in the early parts of the hearing, I don't believe; is that right? You weren't here?

DR. HOUSE: I wasn't here.

MR. MORRIS: We heard some testimony, previously, that there are some parties that would like to increase the bypass flows out of New Bullards Bar. In other words, to release more water directly out of the reservoir to water, if you will, the river directly beneath New Bullards Bar, that water, of course, would not pass through Colgate at that point.

If that were to occur and additional ramping limits were to be put on Colgate to protect those resources, what would the impact of that be on the electric market, do you believe, or the flexibility?

DR. HOUSE: That would decrease the flexibility of that particular -- of the Colgate facility to respond to the needs. And any constraint on another generator in the market will result in the remaining generators increasing their bids for services, the dollar they bid for services,

because they know that they can get more.

MR. MORRIS: Do you think that would lower the value of these plants, too?

DR. HOUSE: It would lower the value of these plants, yes, from a hydroelectric perspective.

MR. MORRIS: I don't believe that your figures that you were talking about would have accounted for that scenario, would it, the one that I just described?

DR. HOUSE: If they were included in the information I got from Bookman-Edmonston.

MR. MORRIS: Okay. Fair enough. I just have one final question. I believe you may have answered this, but just to be clear, you were talking about natural gas plants as being a -- you know, coming online. Do natural gas plants have air-quality impacts?

DR. HOUSE: Yes.

MR. MORRIS: Describe those, quickly, what those might be.

DR. HOUSE: Because they burn natural gas, they have -- they have emissions, but they -- in order to get permitted, they are fairly stringent emissions. And I don't have the exact number off the top of my head, but the one that's in Sutter is pretty clean from a general generating -- thermal generation plant. It's a fairly clean plant.

MR. MORRIS: That's all the questions I have, Mr. Brown.

Thank you, Dr. House.

H.O. BROWN: Mr. Cunningham?

MR. CUNNINGHAM: I have just a few questions, Mr. Brown.

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CROSS-EXAMINATION OF YUBA COUNTY WATER AGENCY
BY CALIFORNIA DEPARTMENT OF FISH AND GAME
BY MR. CUNNINGHAM

MR. CUNNINGHAM: Dr. House, my name is Bill Cunningham. I'm the Deputy Attorney General. And I'm here representing Fish and Game. And I have just a couple brief questions for you, as soon as I get them. My apologies.

A follow-up question mostly to some of the questions that Mr. Minasian raised, or some of the others that you've been asked to address goes to potentialities of alternative generation to replace the generation that may be lost by changes to New Bullards Bar's operations.

Is it your understanding that all proposed new generation that is proposed for coming online within the reasonable foreseeable future is going to be nothing but thermal electricity generated through either diesel or turbine fire?

DR. HOUSE: Very little diesel. The majority -- and I don't know what the total number is, but I would say probably -- the capacity probably 95 to 98 percent on a megawatt basis will be -- that's being proposed as gas fire generation. They are building new solar facilities and windmills and things like that, but they are fairly small facilities compared to a 700 or 1,000 megawatt cogeneration facility.

MR. CUNNINGHAM: Isn't there currently before the Energy Commission discussions about a new pump storage facility in Southern California?

DR. HOUSE: There are discussions about a pump storage facility in Southern California.

MR. CUNNINGHAM: And pump storage is not thermal electricity, it's, essentially, the same thing as New Bullards Bar, it's hydroelectric, isn't it?

DR. HOUSE: No. It has -- something has to produce the energy to pump the water up the hill. So you're going to get the emissions from whatever the ultimate generation is.

MR. CUNNINGHAM: Well, Dr. House, isn't the normal theory with, like, pump storage is that you use cheap power, oftentimes, other hydroelectric power during off-hours, operate the pumps to put the water into the pump storage facility and then that facility is operated

online to generate during high demand times; isn't that how it works?

DR. HOUSE: If you have an excess of hydroelectricity 24 hours a day, that would be true. But the problem that you've got is even the most efficient pump storage facility is only about 75-percent efficient.

So you would not use hydroelectricity and lose 25 percent of it to generate from a pump storage facility the next day. You would simply take 100 percent of the hydroelectricity, use it the next afternoon, so you don't have to lose it at all.

So your characterization is correct, that you use low-cost energy to pump the facility, but you do pay about a 25-percent penalty. And so from a -- from an economic perspective, you need to make sure that there is the corresponding price.

The problem you run into is a lot of the base load electricity is coal or nuclear. And very rarely do you use natural gas-fired electricity to pump, because you're going to lose 25 percent. So that means that your -- the price the next day would have to be at least 25 percent higher than your cost of generating that evening to pump the facility in order to make it cost-effective for you to do it. And for gas fire generation, well, it could work for gas fire generation,

but, typically, you don't use gas fire generation to pump hydroelectricity.

MR. CUNNINGHAM: In fact, I agree. I'm sorry if I misled you, but my understanding of how these facilities work is you use inexpensive online power during off-hours, off-peak hours whether it be hydroelectric, nuclear, or coal fire.

And then the advantage of these facilities is you can operate them on an on-demand basis, for example, in August when power costs through an ISO are extremely high. So we're not talking about net loss, we're talking about a substantial profit gain, aren't we?

DR. HOUSE: Well, the owners of the existing hydroelectric facilities, Helms and Castaic Lake, have been very successful in the current market. The problem that you have with new facilities is they cost about a $1,000 a kilowatt, new pump storage facilities cost about $1,000 a kilowatt in order to construct them.

And they are -- I represented a major pump source facility called Arella up on the Northern California/Oregon border. It was not cost-effective to construct a $1,000 a kilowatt, because -- see, the problem you've got is it takes you about two-thirds of the time to pump and one-third of the time to generate, because you have reversible pump turbines. And they pump slower than

they generate.

So you have about 15 or 20 percent, maybe 25 percent of the year that you can generate electricity. So you've got about $1,000 a kilowatt costing you to pump this stuff. You've got a very short window of time that you can operate them and you've got the cost of the energy.

And so on our facility, the facility that I was working with, which was a 1,000 megawatt facility, it was not cost-effective to do. There wasn't enough of a spread between on and off peak, because the margin cost -- the marginal cost of most hours is natural gas. And so there was not enough of a spread and enough operating flexibility in that particular pump storage facility, and this was several years ago, to make it cost-effective. We couldn't get anybody to finance it.

MR. CUNNINGHAM: My last question about the pump storage, to the extent it uses coal fire, which I assume is out of state, for the most part --

DR. HOUSE: Yes.

MR. CUNNINGHAM: -- or nuclear, which may be in state or out of state, do pump storage facilities necessarily have any direct air emissions problems?

MR. LILLY: Mr. Brown, I'm going to have to object. I don't know whether Mr. Cunningham means air emission

problems in California or anywhere in the world. The question is vague in that regard.

H.O. BROWN: I understood the question. If you understood it, go ahead and answer it.

DR. HOUSE: Yes. In those cases we will be doing something that has made California very popular, which is exporting our pollution to other areas. If they're coal-fired plants that are running in the southwest, to pump hydroelectric -- to pump this pump-source facility, the emissions problems, which are significant in the southwest, the Grand Canyon and all the stuff they're going in Mojave and Navaho, those emissions, the southwest will be getting the emissions and we will be getting the electricity.

MR. LILLY: Don't be sarcastic.

MR. CUNNINGHAM: Well, one last question on that issue, then, Dr. House. Those coal-fire facilities run 24 hours a day, seven days a week, week after week, they don't come online to provide power for pump storage, do they? They operate all the time, don't they?

DR. HOUSE: If there is sufficient demand they will operate all the time, but if there's insufficient demand, then they will curtail those facilities. They're easier to curtail than the nuclear facilities.

MR. CUNNINGHAM: I agree, but you can't necessarily

say that the power generated by a four-corners coal-fire power plant for pump storage in California necessarily is going to increase any emissions load from that facility at all, can you?

DR. HOUSE: If the alternative -- if the demand was not there, other than the pump storage facility at night and they're responding to that, yes, you can.

If they're going to run anyway -- well, if that pump storage facility is not there and they're going to run anyway, they have to do something with that electricity, they can't store it. It's not like a fuel. So -- because the demand and the generation of electricity have to match, instantaneously.

So if the demand is not there at night, somebody has got to get shut down. And what the pump storage facility does is increases the demands by 500 to 1,000 megawatts. So all these guys can run even more efficiently or more often and there's someplace to put that electricity.

MR. CUNNINGHAM: Essentially, it's a hydroelectric storage battery?

DR. HOUSE: It's a hydroelectric storage battery, yes.

MR. CUNNINGHAM: Actually, going back to specifics, Dr. House, I notice you provided some numbers about

potential impacts, economic impacts for operation constraints on the New Bullards Bar.

Did you look at any of the possible costs for the operational constraints proposed by Yuba County Water Agency in their proposed fisheries flows that are being presented to this Board in this proceeding?

DR. HOUSE: I took -- of the eight scenarios that are in the Bookman-Edmonston --

MR. CUNNINGHAM: Uh-huh.

DR. HOUSE: -- I compared one and four, two and five, three and six, and four and eight. If Yuba -- and I don't know what went into the development of those. I didn't do those. And so if Yuba -- the proposal that Yuba County Water Agency has is included in one of those, then I did look at it. If it's not included in one of those, then I didn't look at it.

MR. CUNNINGHAM: I have no further questions.

Thank you, Mr. Brown. Thank you, Mr. House.

H.O. BROWN: Yes, Mr. Cunningham.

Staff?

MR. FRINK: Yes, we do have some questions.

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CROSS-EXAMINATION OF YUBA COUNTY WATER AGENCY

BY STAFF

MR. FRINK: Hello, Dr. House. I remember eight

years ago you were here --

DR. HOUSE: Seems like yesterday.

MR. FRINK: -- speaking on the estoeric subject on power pricing and so forth. And at that time, we invited over some of the staff of the Energy Commission to help us understand your testimony, give us a clearer record. And, unfortunately, we don't have that luxury today, so bear with us if our questions are very basic.

Is it your understanding that the PG&E power purchase contract calls for release of more water earlier in the year than has, actually, occurred in recent years?

DR. HOUSE: My understanding is there is some difference between the contract and the actual operations, but I don't know, exactly, what the difference is.

MR. FRINK: Okay.

DR. HOUSE: You could ask Mr. Wilson.

MR. FRINK: Okay. How did you account for the currently applicable FERC flow requirements at Englebright Reservoir?

DR. HOUSE: What I did is I assumed that the current FERC requirements were included in the work that Bookman-Edmonston did. And so, like I said, I just took the difference between those scenarios to develop this testimony. And like I say, I assumed that the FERC requirements were included in the hydroelectric data that

Bookman-Edmonston used.

MR. FRINK: Okay. The Colgate hydropower plant is frequently operated as a peaking facility; is that right?

DR. HOUSE: My understanding is, yes.

MR. FRINK: And is it your understanding that the Narrows 1 and 2 plants are normally operated more in a baseline mode?

DR. HOUSE: That's my understanding.

MR. FRINK: Have you independently reviewed the flow requirements that were specified in the draft decision?

DR. HOUSE: No.

MR. FRINK: Do you know if the draft decision proposes to alter the flow requirements between New Bullards Bar and Englebright Reservoir?

DR. HOUSE: I don't know.

MR. FRINK: Now, if you could operate at New Bullards Bar without changing the ability of operating the Colgate hydropower plant as a peaking facility, then that would be advantageous from an economic standpoint; is that correct?

DR. HOUSE: If you could operate Bullards Bar like you wanted, by using Colgate, putting certain parameters on Colgate, then that would be advantageous, yes. Because that's -- Bullards Bar is a much larger facility, it will hold a lot more storage.

MR. FRINK: Okay. Now, from a conceptual standpoint, am I right in assuming that there are two basic sorts of impacts that one might be concerned about in terms of hydropower revenue?

The first would be a possible seasonal shift in power production and the second would be any effects or limitations that flow requirements could have on one's ability to operate as a peaking facility; is that correct?

DR. HOUSE: Yes, but I would add a third thing. And the third thing is the ability to participate in the ancillary services market, which is water in storage behind Bullards Bar that can be used.

So you've got the monthly -- or the seasonal shift in water, you've got a daily shift in water, and then you've got the water in storage that would allow -- and the ability to use that water in storage to respond to the ancillary services market.

MR. FRINK: And what is the ancillary services market, could you briefly describe that for us?

DR. HOUSE: Because electricity -- the generation of electricity has to exactly match the demand for electricity on an instantaneous basis. The operators have certain rules in which they have excess generation available to them. And it's -- various operators -- there's a 12-percent operating reserve, there's a

7-percent spending reserve.

Let's talk about the spending reserve. What happens with it for any given level of demand, sort of as a rule, you have 107 percent of the capacity that's needed to meet that demand. So you're meeting the generation exactly, plus you have about 7 percent more capacity that's sitting there spinning, ready to go but it's not loaded.

And that's because you could lose a nuclear plant, you could have a fire and the transmission line could go down and because the generation has to exactly match, if you lose a transmission line into California, you're going to have frequency problems.

The frequency will drop. And that's where you start running into brownouts and you have all of these other problems. So what they have is this generation, the sitting capacity that's sitting in reserve to be called on in case something happens.

The other thing that the ISO uses is the PX, the power exchange, all of the schedulers put in a bid for the next day. They say -- not a bid, a schedule. They say we're going to use electricity like this. And the PX goes out and says -- adds them all up and puts it out there and everybody bids on it and they take the last guy. Well, what, actually, happens is --

MR. FRINK: Excuse me, I think we're getting into more -- a greater level of detail than I really needed. Is, basically, the value of the ancillary services revenue that you might get, could it be summed up as saying the standby ability to increase generation of power, if needed?

DR. HOUSE: That's right. It is the ability to increase generation when the system needs it for whatever reason.

MR. FRINK: Okay. Okay.

DR. HOUSE: Yes.

MR. FRINK: Okay. On Page 8 of your written statement, which is S-YCWA-12 you state in paragraph three,

(Reading):

"The ISO charges on an annual basis have averaged approximately 20 percent of the average PX prices for electricity. Given the size of the Colgate Powerhouse generation facilities its ability to participate in the ancillary services market is worth about $7.3 million per year."

And then reading on, you say.

(Reading):

"This value would be significantly reduced or

even eliminated by instream flow requirements that reduce the Colgate Powerhouse's ability to rapidly change its operations in response to rapid changes in electrical demand."

My reading of that is that the $7.3 million economic effect that you've identified is the potential impact one could have if the instream flow requirements completely eliminated the ability of Colgate to participate on an ancillary services basis; is that correct?

DR. HOUSE: That is correct.

MR. FRINK: Have you made any analysis of how the flow requirements in the draft decision might specifically affect the ability of Colgate Powerhouse facilities to participate in the ancillary services market?

DR. HOUSE: No. In order to do that you would need a hourly simulation of the operation of the Colgate facility. And I didn't have that.

MR. FRINK: Okay. So this shouldn't be read as predicting the implementation of the draft decision flows would result in a cost of $7.3 million as a result of the effect in the ancillary services market?

DR. HOUSE: It would be some portion of that amount.

MR. FRINK: And you haven't attempted to determine that portion?

DR. HOUSE: I don't know.

MR. FRINK: Okay. Thank you.

MR. MONA: Just a few questions, Dr. House. The potential losses of revenue described on Page 9 of your testimony are losses -- are potential losses to PG&E only, correct, based on your understanding of the PG&E/Yuba County Water Agency's power purchase contract?

DR. HOUSE: PG&E, or whoever gets the Colgate facility, or YWCA when they get the license in 2014.

MR. MONA: Or 2016, I thought?

DR. HOUSE: '16, excuse me.

MR. MONA: Okay. Other than the State Board's decisions, water releases from Yuba water reservoir for fish, what other operation factors can contribute to these potential losses of revenue under the new market structure?

DR. HOUSE: Any operating constraints such as changes in the minimal pool level, or flood storage requirements, those could be affected in the springtime. In the summertime, it would be -- I think the main change would be change in the minimum pool level would determine the ability of the operator to generate, or to not generate.

MR. MONA: So the Board's proposed fishery requirements would not be the only basis for effects on

those revenues. Other factors such as water being reserved in the reservoir for water transfers, would that have an effect on those revenue losses that you've --

DR. HOUSE: If that impacted the ability to generate electricity when it was needed, yes, it could.

MR. MONA: Thank you very much.

H.O. BROWN: Any questions, Alice?

MS. LOW: No questions. Thank you.

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CROSS-EXAMINATION OF YUBA COUNTY WATER AGENCY

BY THE BOARD

H.O. BROWN: Is there a daily differential power rate for peak and off peak?

DR. HOUSE: There's an hourly differential.

H.O. BROWN: What is that?

DR. HOUSE: That's one of the things I wanted to -- and, actually, my attorney's going to yell at me real soon, but I have another --

MR. LILLY: You can go ahead.

DR. HOUSE: -- thing that -- I guess you guys have been squabbling over this, so I didn't bring this up at the advice of my attorney. But what this does --

H.O. BROWN: Is this an exhibit?

MR. LILLY: Just so we're clear, I told him no new exhibits on summarizing his testimony. But my

understanding was in response to questions from you, Mr. Brown, if a new exhibit would help illustrate his answer, that that's your discretion. But there's, certainly, no blanket issue on that. So I just told him not for his summary.

H.O. BROWN: I think that's good counsel. Just give me an estimate of what the power differential is on a peak day, if there is one?

DR. HOUSE: Okay. What this table does, is this shows you for each month since the -- since we went to the new market, the minimum price for electricity for that month, the average price of electricity for that month from the PX and then the maximum price.

See, and then I graphed over here. So you can see in June of this year it went from zero to -- this is -- this is in dollars per megawatt hours, so 13 cents per kilowatt hour. And so that's --

H.O. BROWN: Okay.

DR. HOUSE: In answer to your question, this shows you the magnitude of prices that have been recorded out of the PX during the last year.

H.O. BROWN: All right. I think that would be helpful. Why don't you mark that as an exhibit and see that everybody -- we'll make some copies.

MR. LILLY: For the record, the figure that

Dr. House has been referring to, we will offer as Exhibit S-YCWA-28. And we will make sure to get copies for everyone and, of course, six for staff.

H.O. BROWN: Okay.

MR. LILLY: And we can probably do that during the break.

H.O. BROWN: All right. Do you have any redirect, Mr. Lilly?

MR. LILLY: No, but at this point I would like to offer the exhibits, if I may do so? We would like to offer --

H.O. BROWN: There are two exhibits now?

MR. LILLY: Well, I think we've got three. We've got the Exhibit S-YCWA-5, which was Dr. House's qualifications.

H.O. BROWN: Okay.

MR. LILLY: SYWCA 12, which is Dr. House's testimony, and then this new table, which you, Mr. Brown, just asked about, which would be S-YCWA-28. So we would offer those three at this time.

H.O. BROWN: Okay. Any objections to offering those exhibits into evidence? Okay. Seeing none, they're so accepted.

And no redirect?

MR. LILLY: No redirect.

H.O. BROWN: Okay. Then there's no recross. And we'll take a 12-minute break.

MR. LILLY: Before you hit the gavel, I just wanted to talk about the order of witnesses. Mr. Minasian, he called me over the weekend and asked if Steve Cramer, his witness, could testify now before Donn Wilson who's our last witness just because Mr. Cramer has a schedule problem with tomorrow. And I told him that was fine with me subject, of course, to your approval.

H.O. BROWN: All right.

MR. LILLY: But I want to let him go ahead with Mr. Wilson, if that's all right with you.

H.O. BROWN: And you're proposing that after the break?

MR. LILLY: Yeah, immediately after the break.

H.O. BROWN: All right. Any objections to that from anyone to accommodate Mr. Cramer? All right. You're not objecting, Mr. Minasian, are you?

MR. MINASIAN: No. But I have an addendum. On the theory that I always ask for something more, so let's hear it.

H.O. BROWN: Mr. Baiocchi?

MR. BAIOCCHI: Mr. Brown, I believe that Paul Minasian has two witnesses. So they're going to be piecemeal, so you understand that. So, fine, if

Mr. Cramer wants to put on his testimony, fine, but it's going to be piecemeal. So it will be Cramer and then it will be Wilson and then Paul's second witness.

H.O. BROWN: Is that what you're proposing?

MR. MINASIAN: No. I have a scheduling problem.

MR. BAIOCCHI: Well, it's Paul's --

H.O. BROWN: One at a time.

MR. MINASIAN: Fred Reid is the head of Ducks Unlimited for the Western United States. And he has to be in Washington tomorrow. So I asked Mr. Lilly and Mr. Wilson, if they could bear with us and let us do the testimony of Cramer and then Reid. And then we will come back to Donn Wilson.

MR. BAIOCCHI: So it will be Cramer and Reid?

MR. MINASIAN: If that is agreeable.

H.O. BROWN: Okay. All right. Now, I see no further objections. We'll do that after the break and we'll take a 12-minute break.

(Recess taken from 10:38 a.m. to 10:51 a.m.)

H.O. BROWN: Come back to order. I have an announcement that I would like to make for tomorrow's hearing. We'll conclude tomorrow's hearing at 3:00 p.m. in the afternoon, or just a few minutes before. So you should plan your calendars appropriately.

Mr. Minasian, you're up.

MR. MINASIAN: Mr. Hearing Officer, could I ask that Mr. Cramer be sworn?

H.O. BROWN: Mr. Cramer, do you promise to tell the truth in these proceedings? If so answer, I do.

MR. CRAMER: I do.

H.O. BROWN: Be seated.

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DIRECT EXAMINATION OF SOUTH YUBA WATER AGENCY AND CORDUA IRRIGATION DISTRICT

BY MR. MINASIAN

MR. MINASIAN: Is your name Steven P. Cramer?

MR. CRAMER: It is.

MR. MINASIAN: And is the testimony supplied by the South Yuba Water District the testimony you prepared in this proceeding?

MR. CRAMER: It is.

MR. MINASIAN: And is that testimony, actually, presented on both behalf of South Yuba and the Brophy Water Districts?

MR. CRAMER: Yes.

MR. MINASIAN: And would you describe your --

MR. CRAMER: This is not working.

MR. MINASIAN: -- your professional and work experience in regard to fish biology?

MR. CRAMER: I have been a practicing fisheries

biologist for 25 years. The first 12 years of my -- first 13 years of my career were with the Oregon Department of Fish and Wildlife, where I was a researcher. In 1987, I started my own consulting firm. And at that point, I began doing work in the Central Valley, in the past 12 years sampled juvenile migration of juvenile chinook in a variety of streams in the Central Valley including the Yuba River. And the focus of my career has been population dynamics of chinook salmon, steelhead, other anadromous species.

MR. MINASIAN: And did we supply an updated-version of your qualifications as Exhibit 2.1 of South Yuba Water District?

MR. CRAMER: Yes.

MR. MINASIAN: And you presently reside and work out of Portland, but work in the Western United States in regard to anadromous fish issues?

MR. CRAMER: I do. I have staff in the California area.

MR. MINASIAN: Would you like to summarize your testimony for us?

MR. CRAMER: Yes. First, I'll begin by talking a little bit about the past. I need to bring some updated information that we testified to previously in the 1992 hearings, they are pertinent to additional surveys we did

in 1993 at the site of the South Yuba/Brophy diversion. I'm going to use an overhead here, so I'll just stand up and talk.

This map, I apologize for its quality. It's right out of my testimony.

MR. MINASIAN: Is it Figure 1 of your testimony?

MR. CRAMER: It is. This will help give us a little orientation of where we did research in '93 and the site of research that had previously been done by others.

First of all, the Yuba River flows downstream of this direction. The South Yuba/Brophy diversion is, actually, on an oxbochannel that is right above the Daguerra Point Dam at this point on the diagram. The canal that this water wants to travel to and is used by the South Yuba and Brophy Irrigation Districts is substantially removed from the river and also has the unique situation that it is not adjacent to the actual diversion structure.

The rock levee that has been described is shown here. The water passes down this oxbochannel, it goes in front of about a 300-foot-long rock gabion, that has been referred to, variously, as a rock gabion fish screen, I've referred to it as a porous dike in the past.

Water filters through that gabion into this large diversion pond. Here's an important element of it. We

took a laser-measured distance, the distance from these pipes that take water out of that diversion pond is over 250 yards from where the water first strikes the upper end of the actual diversion structure.

So it's a substantial distance across this pond that creates a situation where as the water filters through this gabion, there is very little opportunity, in fact, there's no detectable point of velocity hot spot along that entire gabion. There's kind of a buffering hydrologic effect of having that large pond there that separates the actual focus diversion point from the filtration gallery that the levee creates.

Now, back to 1993 there was studies done by Cal Fish and Game -- or 1992 where they released juveniles at the head end of this diversion area, allowed them to swim all the way through. They had a trap that had fences or netting completely across the stream at the bypass channel at the lower end and recovered their marked fish there. They estimated the survival through here.

In my 1992 testimony, we went out and, actually, got their data sheets. Because I have done a number of these kinds of studies, there is always an element of insufficiency in the sample gear. And in that case, they had assumed their sample gear was 100-percent efficient.

The captures were exactly what they had reported

what the survival was. And in their estimates, they did four different experiments where they released marked fish at the upper end and allowed them to pass through. And then unreported in their report, but we did find and present the actual data sheets showing the data, they did release fish, marked fish directly in front of their traps at the lower end.

In that experiment, they recovered only 38.6 percent of the fish that they released four meters in front of the trap. That is a fairly expected and predictable kind of result from the studies that we've done in a variety of streams. You would expect a fair amount of inefficiency, even though they attempted to seal off the stream.

They're working with small juvenile chinook and they find gaps and they can pass through short distances of gravel. So they had 33.8 percent here, that was the lowest percentage they ever got in any experiment they did. The four released groups up here, more than 33.8 percent were recovered down here.

So in a simple scientific manner, you would treat any study -- if it was reviewed in the literature, it would have to be done that way. It's the way that we do wherever we do studies, be compared to the catch rate at the lower end, the survivals would all come out over a 100

percent.

They clearly don't make fish, so that's part of a sampling error, but simply stated there the conclusion is that there is no indication of mortality passing through that area. We went back to do further study, in 1993, to see if there was any evidence of fish going elsewhere.

Now, when we did that, we did sampling in a unique location. We went back to the diversion canal. If any fish were escaping through the porous dike, they'd be very difficult to detect in this very large pond. So the place that they would be aggregated, where you could get your hands on them would be in this diversion canal.

We placed fyke nets in that canal. Fish, the pipe -- there's two pipes that poured water out into the canal during 1993. Most of the season it was all one pipe. We had our fyke net fitted to the tail end of that pipe. When I say, "fitted," it was fitting right at the spill out of that pipe. This is the subject of a report which is attached to my testimony. And so it has been submitted.

The finding was that as we fished that -- from the very first day that any withdrawals were done, through mid July, we only captured 17 -- is it 17 or 19 chinook -- make sure I get that number right. 17 chinook and 2 steelhead fry. And our dates of fishing were May 7th

through July 22nd.

Now, we put 194 fish into our net at the mouth end of the net to see if any could escape. After a 24-hour period we had 194 chinook still in there. And these were larger, as large as the fish, they were, actually, gathered fish from in the Yuba, so they were the standard size of fish in the Yuba River at that time.

Another point, there was sampling going on out here in the Yuba River, so we could see what numbers of fish going by. And this sampling out here was done on the Hallwood-Cordua screen on the opposite bank of the river. And the Cal Fish and Game gathered those data. Here's the actual sampling results that we obtained.

The upper graph here shows what was going on as an index at the Hallwood-Cordua fish screen. This would be sampling out of the open river. And these would be fish that are captured in the bypass that returns them to the river.

You note that the peak -- these are numbers of fish along the vertical axis, this is the date along the horizontal axis. Sharp peak in numbers of fish in late May. It had declined to near zero by the very end of May and the sampling stopped thereafter.

The bottom graph, same time scale along the bottom is now the mean lengths of the fish. And the

triangles here show the lengths of fish that were represented in the upper graph. In fact, these triangles are the mean lengths of fish going by the Hallwood-Cordua screen. So they are actively migrating down the stream. You can see that they, generally, are under 80 millimeters.

Now, we captured 17 chinook during the course of our sampling in that canal that I have indicated on the diagram. Those 17 chinook were all substantially larger. It had no overlap with the size of any of the fish captured out here in the Hallwood-Cordua fish screens.

MR. MINASIAN: And are those represented by the black dots?

MR. CRAMER: Yes, those are the black dots on the diagram here.

MR. MINASIAN: What's the significance of the size difference?

MR. CRAMER: The key indication here is that the fish captured coming out of the -- and that is coming out of the diversion pond entering into the canal -- are from a different population, obviously, than the fish that are passing down the river.

By a, "different population," what we conclude as we look at the flow records there was a flood event back in January where the flows at Marysville exceeded 20,000

cfs, there was evidence of debris left on top of the porous dike, that constitutes the screen for fish, indicating it was overtopped back in January.

We can only surmise that there must have been fry, at that time, deposited in the canal -- into the pond, that now when the actual diversions began, those fish had grown substantially and emigrated when we -- when the diversion was initiated.

So there is no indication here of any fish swimming through the porous dike during the time of any of these diversions. The fish that we're sampling do not match. In fact, they were much larger. If there was any expectation they might swim through the dike, they should be much smaller.

They would be fish that could fit through tiny crevices. And these are substantially larger. In fact, you can see that there are individuals up to 160 millimeters, whereas, rarely are they over 80 back in the river. So that was the key finding, the fish that were there are very large.

Now, we did also catch two steelhead fry. And I say, "steelhead," simply that they were rainbow. They were Oncorhynchus mykss. We don't know their parentage. We know we caught two fry. They were under 35 millimeters in length. So they would be, substantially, smaller than

any chinook shown on this graph.

There's a variety of ways those could have gotten in. But the one that we would guess: Probably, those did get through the gravels. They're small enough to get through. It is conceivable that they could have been from fish that spawn in the pond. We saw none of that. So we really don't know, but we caught two.

Now, the next point that you have to surmise, then, when are the diversions and how does it compare to the size of fish that might be coming through? This shows -- this is Figure 3 from my testimony -- the average monthly diversion rates through that structure. And you can see that it's usually in late April and, certainly, strongly in May that the diversions begin.

By this time, the mean lengths out in the Yuba River are usually over 80 millimeters -- or not over, that's a misstatement, 60 to 80 millimeters. Again, that would be the size that we did all our testing. And it would be, substantially, larger than the two tiny steelhead fry that we found there.

So when there is water diversion, it is very unlikely that any fish are of a size that would allow them to escape to the gabion. There is no evidence gathered by any of the studies that would indicate that that is happening.

My testimony indicates that there is studies done by United States Fish and Wildlife Service, they sampled back -- there's also studies done by Cal Fish and Game, they sampled back in behind the gabion, in other words, in the diversion forebay pond.

And the fish they captured, also, were larger. They -- the U.S. Fish and Wildlife Service concluded those fish were probably deposited there by overtopping of a levee in the same way that we concluded from this data.

MR. MINASIAN: Would you now direct your attention to the predation work and the attempt to locate whether or not there were hot spots where the fish were being pulled into the rocks and impinged?

MR. CRAMER: Okay. Now, I need to go back to the map, and this is Figure 1. We had -- there's been sampling out here to look at predation in several places. The thought is that there may be a concentration of predators along the base of the gabion right here, but, in fact, we have conducted snorkle surveys, Cal Fish and Game conducted electrofishing through this whole side channel. And we conducted scuba and snorkel surveys behind in the diversion pond, so did U.S. Fish and Wildlife Service.

None of those surveys revealed any concentration of squawfish, although, squawfish were present. And those were the primary predator -- predatory fish identified.

The surveys by U.S. Fish and Wildlife Service -- yeah, U.S. Fish and Wildlife Service reported, I believe, from 1988, could be '89, but it was given in the 1992 hearings, found 12 adult squawfish along the face of this berm. In our surveys, in 1993, we found 19.

The Cal Fish and Game, Lower Yuba River Management Plan reports on data from sampling of squawfish in the main river. Their data shows that the average concentration of squawfish out here is 150 squawfish per 1,000 lineal feet of shallow pool, that's a deep pool; 250 per 1,000 lineal feet of shallow pool. In other words, more in shallow pools.

The range there was 150 to 250 squawfish per 1,000 lineal feet. In this case we have about 600 lineal feet in the sampling area. We had 12 adults by one study and we had 19 adults during our study. There were also juveniles in the area.

Cal Fish and Game conducted electro-fishing in this area. This is part of the 1992 testimony. They captured in the midrange of about 46, I think, squawfish. Few of those -- the largest squawfish they captured by electro-fishing in here was 24.8 centimeters. Squawfish, generally, become piscivorous, that is the time that they begin to prey on juvenile fish when they reach about 20 centimeters. The largest squawfish they caught was a

small adult. Squawfish get double that size easily.

And their rate of predation on juvenile salmon is related to their size. Larger ones prey at a higher rate. So all of the sampling shows -- no sampling shows high concentrations of squawfish in the back area. No sampling shows numbers of large squawfish in the area. And no sampling shows indications of escapement through -- into the diverting pond through the gabion.

MR. MINASIAN: Would you bring that to a conclusion? Is the mortality at the gabion, through the gabion any worse than if a stainless-steel modern, self-cleaning electrical-powered screen were installed?

MR. CRAMER: Within my testimony I have stated that this is -- there is no indication from any of these studies of mortality there. There's been suggestion, but all of the data, as I've explained here, do not show abnormal presence of predators, nor do they show high mortality in this reach.

So the answer, by default, has to be: No, it's not higher than with a screen, because there's no indication of any notable mortality in this reach.

MR. MINASIAN: Okay. Do you have an opinion to summarize it, as to whether or not this is a state-of-the-art method of protecting juvenile anadromous fish in the Yuba River?

MR. CRAMER: I would hesitate to use the word "state-of-the-art," but I would say this performs as effectively as any state-of-the-art device --

MR. MINASIAN: Okay.

MR. CRAMER: -- for preventing juveniles from entering the side channel. One thing I would note, and I did in my testimony, we have done testing on a variety of different screens throughout the West Coast. State-of-the-art screens, largely, prevent fish from passing into a water diversion, but they are not perfect.

Rarely ever does the testing after the installation of a state-of-the-art screen show that there are zero fish passing down that area. They captured the two steelhead fry we got there, those would be the most problematic for any screen to prevent -- any little crack, nook, or cranny anywhere would enable a few of those to get through. And most screens still show fish escaping through when you sample below them after their installation.

MR. MINASIAN: You understand that the proposed decision proposes that we go out and study this more. What would we study in regard to predators, in your view, effectively?

MR. CRAMER: First, I have to say, there's no scientific data suggesting that we need to study this any

further. All of the data suggests that there is no predator problem. However, there are, certainly, those who have said that they think that there is one.

If we need to supply more data, we'd have to first ask: How would that be any more satisfying than what we've done before? But the way I would do it -- and we have done predator studies, I directed those in the Columbia River for a number of years. We've done them on the Sacramento.

You need to estimate two things. You need to know how many predators are present and then you estimate the number of juvenile chinook, or the number of juvenile salmonids that they are consuming. So we would, actually, establish sampling sites in the main stem. We would establish sampling sites in the diversion channel.

With that we would, actually, do mark recapture. In other words, we would capture squawfish, we would evacuate their stomach contents by pumping to estimate how many fish they had taken. We would tag the squawfish and release them so that you could, then, from the marked to unmarked ratio estimate the abundance of squawfish.

So you would be looking at abundance in the channel, abundance in the river and comparing the two to see if you have any different rate of consumption of juvenile chinook, or if there is any different population

size in the two areas.

MR. MINASIAN: Let's assume for a moment that the evidence shows that there are predators in the main stem and that they are eating juvenile, has any policy decision been made in California to eliminate the squawfish as a predator to your knowledge?

MR. CRAMER: To my knowledge, there's no policy decision to use any form of predator control.

MR. MINASIAN: Would you direct your attention, now, to the elements of the proposed decision regarding temperature and your opinions in regard to the effects of attempting to maintain temperature and flow in the Yuba River in the springtime according to the recommendation?

MR. CRAMER: Okay. I'm going to address both temperature and flow together, because they are really interlinked. First of all, the proposed rule says that there would be a pulse, and it uses the word "pulse," flow in the spring to -- I'm not exactly sure of the language, but to enhance outmigration of juvenile chinook.

Here are key points about what happens when you have flow effects on juvenile chinook. And we've studied these in the Central Valley and in the Columbian Basin extensively. First, migratory responses of the chinook parr and smolts key on changes in flow, rather than the magnitudes of flow.

Secondly, sharp increases in flow will stimulate chinook parr and smolts to migrate, but the stimulus will last less than five days. Very important, it is a short-term effect. Increasing temperature will simulate migration of juvenile chinook. So if you have -- you have special warm events, you can cause fish to move just because temperatures are going up.

And then finally here, under stable flow and temperature, you have no special stimuli of either, then, juvenile chinook will delay outmigration evidently until physiological keys -- physiological keys signal the time to migrate. So they won't avoid migration if you don't give them any stimuli, they would just go on the physiological keys, signal the time to migrate.

And we'll show some examples of that in the Central Valley. We studied this for a number of years, in fact, since 1993 in the Stanislaus River. And this is a couple of points that are included in my testimony from the studies conducted there. We had opportunity to do fluctuating flows and look at specific examples of what happens and here are the points:

The number of outmigrates remain elevated for no more than five days following a jump in flow, repeated examples of that. And increase in flow from 310 to 560, so keep that in mind, that's been about a doubling, in

1995 had the same result on juvenile chinook than a larger magnitude pulse had in 1993.

In that case, it started at about the same, 390, but jumped all the way to 1360. And then in 1994, jumped from 340 to 1170 cfs. So the smaller increase had the same effect as the larger increase.

In the absence of any sharp changes in flow in 1996, the outmigration of chinook smolts still peaked about mid April and mid May, although the period of the high catches was more protracted. It was protracted over two to three weeks, rather than over two to three days. That would have been associated with pulses in flow.

MR. MINASIAN: Did you do work for Department of Water Resources in terms of judging mortality of smolts when they left the Yuba, the Feather, and the Sacramento and going through the Delta?

MR. CRAMER: Yes, I did. That work would have been done. I did extensive analysis of coded-wire tagged recoveries and used an analytical process called cohort analysis to estimate survival to age two. And we compared groups released in a variety of different places and also looked at strain rates.

And the one thing that those things showed was dramatic improvement in survival as you trucked fish and released them in the Delta rather than upstream. In

particular, there were events in 1980 where there's a very balanced design and so you could eliminate other factors. And in that year there was a fourfold benefit of releasing fish in the -- down in the estuary as compared to releasing in the Feather or the hatchery.

MR. MINASIAN: Since we're over our time, in fact, we're over our time, Mr. Cramer, would you briefly summarize for Member Brown what you think the affects of maintaining these cold-water temperatures through the period of February, March, April, May will be upon the timing and the mortality of juveniles in the Yuba River?

MR. CRAMER: Okay. Let me show you one figure to make that point. I'd like to have five or ten minutes to make that point, but this is very consistent up and down the West Coast, that when you -- that temperatures and flows are the queues that fish use to determine their migration timing.

Also, those same temperatures and flows are the conditions that determine their growth rate that spring. So as a result, what we find -- and here is a published study that has come out since the last hearing that confirms the testimony I gave then.

This is data from the South Umpqua River. What it shows is we have the median migration date on the vertical axis and the average spring temperature in the

river. They found as the temperatures were warmer, the median migration date was earlier. As temperatures were cooler, the median migration date was later.

What's noteworthy here is the difference between the warm and cool springs is almost two months in migration timing. We found that same effect on the Rogue. There is evidence of that same effect in the Yuba River from the history of data at the South Yuba -- or at the Hallwood-Cordua screens.

So what would happen is, if we -- I'm deeply concerned about the proposed rule, what it proposes for constant flows in the neighborhood of 1100 cfs and a reduced temperature at Marysville, so that's all the way at the bottom end, essentially, of the Yuba River. That in a low flow -- in naturally low-flow year will be out of synchrony with the conditions in the Delta.

What will happen is, if you keep the flows high and temperatures cool, cooler than the rest of the Central Valley system, then fish will linger in the Yuba River. They will survive just fine there, but then they have to swim through the Delta.

The rest of my testimony goes on to show there's major mortality problems in the Delta. With increasing temperature, you get increasing mortality. That's well established by work with the U.S. Fish and Wildlife

Service. And in low-flow years if we cause them to stay longer, everything we hoped to gain in the Yuba River would be more than depleted by what we would lose as they pass through the Delta headed to the sea.

MR. MINASIAN: Mr. Cramer, would you sit down for a moment. Would you invite cross-examination on the questions of whether or not dewatering of redds is, in fact, always fatal or detrimental to fish? And would you also invite questions in regard to the reasonableness of the flow rates and the temperatures in terms of growth rates? And with that we would conclude.

MR. CRAMER: I would invite those.

MR. MINASIAN: Good. Thank you.

H.O. BROWN: Okay. You ready for cross?

MR. MINASIAN: Yes.

H.O. BROWN: Mr. Edmundson hasn't shown up yet, has he?

MR. FRINK: No, sir.

H.O. BROWN: Mr. Gee, are you going to have cross?

MR. GEE: Thank you, Mr. Brown.

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CROSS-EXAMINATION OF SOUTH YUBA WATER AGENCY
AND CORDUA IRRIGATION DISTRICT
BY U.S. DEPARTMENT OF INTERIOR, FISH AND WILDLIFE SERVICE
BY MR. GEE

MR. GEE: Mr. Cramer, my name is Edmund Gee. I'm an attorney with the Department of the Interior. And I have some questions for you today.

I'll start off with a hypothetical, but -- unless Mr. Brown would prefer -- is it true that pikeminnows and other predatory fish are opportunistic, and when I say "opportunistic," I mean that they feed on fish near to them?

MR. CRAMER: I'm sorry, that they feed on fish that what?

MR. GEE: That are near to them.

MR. CRAMER: Yes.

MR. GEE: Okay. And there are pikeminnows in the Lower Yuba River, right?

MR. CRAMER: Yes, there are. Incidentally, the pikeminnows are the squawfish as I talked about. Squawfish, pikeminnows, same thing.

MR. GEE: I understand. Thank you. Isn't it true that there is a deep pool in front of the rock gabion --

MR. CRAMER: Yes.

MR. GEE: -- the levee fishery?

MR. CRAMER: Yes.

MR. GEE: And in your experience as a fishery biologist, would an adult pikeminnow consume a juvenile salmonid if it came into its holding area?

MR. CRAMER: If it's hungry, yes. And let me -- that needs to be answered a little bit further. A pikeminnow's ability to catch juvenile chinook is dependent on the size of the juvenile chinook. It can catch littler ones easier than it can catch bigger ones.

And, of course, if the pikeminnow is bigger, it can catch bigger ones. You've got a whole size-dependent relationship going on there. But it is true, if they are within their vicinity that they would seek to eat that juvenile chinook.

MR. GEE: If that salmon were, say, to measure 40 millimeters --

MR. CRAMER: 40 millimeters would be a size that would be highly vulnerable to predation by squawfish.

MR. GEE: Okay. And I would like to talk a little bit about diversion through the channel. Is it true, that in your professional opinion that when 400 cfs is diverted to a channel that there will be a particular amount of fish associated with that block of water?

MR. CRAMER: Yes, there would be.

MR. GEE: And let's just say for the sake of argument, there's ten fish in that block of water. Is it true, that if those ten fish in that 400 cfs of water would be concentrated into some smaller block of water, there is a diversion taking place through the gabion?

MR. CRAMER: Yeah. What you're saying is if they can't pass through the gabion so they can go through the bypass water, there would be less bypass water than there was incoming water.

MR. GEE: Okay.

MR. CRAMER: So they would be concentrated by that, yes.

MR. GEE: Okay. So hypothetically speaking, if you were diverting 360 cfs through the gabion, it would leave 40 cfs in the bypass?

MR. CRAMER: Correct. Yes.

MR. GEE: And is it likely that that ten fish that we were talking about, hypothetical ten fish, now would be concentrated into this 40 cfs block of water would be more susceptible to predation?

MR. CRAMER: Yes. If you had a fixed number of predators and a fixed opportunity that would increase the predators' opportunity to take those fish.

MR. GEE: If I could refer to your written testimony on Page 6. And I believe that's Exhibit SYWD-2. You

refer to a report by Smith?

MR. CRAMER: Yes, I did.

MR. GEE: And I believe it's the third sentence and it states,

(Reading):

"Smith (1990) did not observe any substantial predator activity in front of the rock levee in 1989, nor had Konnoff in the 1998 study."

Isn't that correct?

MR. CRAMER: Correct.

MR. MINASIAN: For clarification, Smith is U.S. Fish and Wildlife and Konnoff is California Department of Fish and Game.

MR. GEE: Mr. Cramer, did you read that report?

MR. CRAMER: I did.

MR. GEE: Where did Smith, he or she -- did she say this quote?

MR. CRAMER: I would have to pull that report back out. And I don't have it in front of me to do that for you, but we, certainly, could and resubmit the exact quote that I'm referring to there.

MR. GEE: In the next paragraph on Page 6 it stated -- this is the second sentence -- it says,

(Reading):

"Since other studies demonstrated that predator

abundance in the diversion in the channel was low, that predation to juvenile chinook was also low."

It continues. I'm wondering what are these other studies that you're referring to?

MR. CRAMER: Let me get to your spot, I'm not tracking you.

MR. MINASIAN: Yeah.

MR. GEE: I was on Page 6, bottom paragraph. And it's the sentence that begins with, "Since other studies demonstrated."

MR. CRAMER: Where's the sentence, "Since other studies demonstrated"? I'm not finding the sentence that begins, "Since others."

MR. GEE: Okay. Again, I'm referring to your written testimony. Do you have that in front of you?

MR. CRAMER: I do.

MR. GEE: Okay. It's the very last paragraph on Page 6 under the heading, Roman II, Experiments and Observations --

MR. CRAMER: Okay. I'm sorry. Let me look at what I said there.

MR. GEE: My question is: What are those other studies?

MR. CRAMER: What this -- the heading of this, you

have to read the first sentence.

(Reading):

"In 1993 SB Cramer and Associates undertook field studies."

Anything other than 1993 studies by us, which would have been after those previous studies, are the other studies. So they would be all under "cited."

MR. GEE: So these are studies that you undertook?

MR. CRAMER: We undertook studies in 1993.

MR. GEE: Okay.

MR. CRAMER: And this begins our description of those studies. The reference here is back to the Konnoff and the Smith study.

MR. GEE: Oh, so these other studies are the Smith and the Konnoff studies?

MR. CRAMER: Yes.

MR. GEE: And if you can flip to Page 16. You made some reference, at least, in this portion of your testimony, to Stanislaus studies; is that correct?

MR. CRAMER: Yes.

MR. GEE: I'm wondering if you could clarify. Are any of these studies complete and accurate estimates of the entire outmigration period?

MR. CRAMER: The studies performed -- the citations here discuss certain time periods and specific events.

They do not discuss an annual total number of migrants. And there is no reference to that. And, no, there was no complete estimate of the number of outmigrants.

MR. GEE: Thank you. And was there a study plan that included pulse flows that test your theory that pulse flows will facilitate outmigration?

MR. CRAMER: You're asking: Was there a test of that theory?

MR. GEE: Right.

MR. CRAMER: Yes, there was.

MR. GEE: Okay. By yourself, your company, or --

MR. CRAMER: Yes. In fact, I have it here to show. We did do that study.

MR. GEE: Can you reference the date?

MR. CRAMER: It was completed in 19- -- actually, we've been sampling almost all years in the Stanislaus River since 1993. This is the 1995 data and is referred to in my testimony. Here it is. Okay.

MR. GEE: That's Figure 6; is that correct?

MR. MINASIAN: This is not --

MR. CRAMER: This is Figure 6 of my -- I think this is Figure 6 of the -- no. This is not -- this is Figure 6 out of the report that I took it out of. This is not submitted.

MR. MINASIAN: We will mark this as a South Yuba

exhibit next in order. And I'll give you the number in a moment.

MR. GEE: That's fine. We'll go to the next question. I just wondered where you based -- did you do a study?

MR. MINASIAN: I think he wants to respond to your question.

MR. GEE: That's fine.

MR. CRAMER: Okay. Here's the way the study goes. In this year here, the line here shows the actual flow. The shaded areas are the estimated total passage of juvenile chinook at our site at Oakdale, which is about 40 on the Stanislaus River. And this is 1995 data.

What happened was the flows were running down here -- the flow is given on the right side Y axis, while the number of chinook is given over here on the left side Y axis. What you see is that flows were running down in the neighborhood of 300 cfs in early April.

We increased those flows in early April from 300 up to about 600 cfs. At the point of that increase, there was a sharp response of juvenile chinook migration seen by this peak in numbers of juvenile chinook passing. Five days later, the flow was bumped again, very little response.

There were three subsequent peaks, little minor

spikes in flows spaced at ten-day intervals to see what they could trigger. And there was very little response of juvenile chinook migration. So the conclusion was that -- as those bullet items that I stated previously, is that you get an initial response on a change in flow, it's not the magnitude, you get much higher flows much lesser response.

The first change in flow triggered the migration. And subsequent attempts to get it to trigger didn't accomplish anything. So -- and the response lasted less than five days.

MR. GEE: Thank you. Mr. Cramer, are there any other studies that would support your conclusion as to the base flows aside from the ones that you've done?

MR. CRAMER: Many, many. And I cited several in my testimony. On the chinook -- I'm sorry, on the Rogue River we did extensive studies, there I led studies for the Department of Fish and Wildlife for 12 years.

We had one very significant event that was probably the first time in my career that I was alerted to this, in fact, we had a record-breaking rainfall event in mid August caused by thunderstorms. Immediately following that event, there was a major outmigration of juvenile chinook. And we had those marked, we tracked them as they moved downstream.

And as we did that, the pulse in numbers of fish following that event lasted only a few days then tapered off for the rest of the season. There was few fish moving. And by the end of the season, a large number, again, moved in October.

So not all fish had been triggered, but there had been significant movement only for several days following that record-breaking event. That was a natural event. And here's a controlled one. And this was part of my testimony. There is on the Snake River. This was in 1994. So this follows after the testimony I gave in '92. Another real strong demonstration --

MR. MINASIAN: This is Figure 4 of your testimony.

MR. CRAMER: Yeah, this is Figure 4 of my testimony. This is on the Snake River. Where at Lower Granite Dam they, actually, sample the numbers of fish going by. The dotted line shows the flows. The solid line shows the number of fish.

The numbers of fish are given on the left Y axis, the flows given on the right Y axis. In early July, fisheries agencies asked for a sharp change in flow and asked it to be held at about 40,000 cfs on the Snake River. That was an increase that had been running in the neighborhood of 12- to 13,000 just prior to that.

There was a sharp response of subyearling

chinook, so these would be fall chinook -- these would be subyearling chinook like we have in the Stanislaus, or like we have in the Yuba, throughout the Central Valley, primarily, the fish migrate as subyearlings.

This triggered a sharp movement of fish right at that time and then no movement of fish, even though for one whole month we had these very high flows. As soon as that flow was dropped, now, the dropping flow/increasing temperature, as I had mentioned in my bullet points, triggered a follow-up movement out here in late August.

So the pulse flow didn't move the fish, it moved some fish in the first couple of days, as soon as you halted that, then the fish responded to natural environmental stimuli and you saw a later movement in August.

MR. GEE: Thank you, Mr. Cramer. I think you answered my question. I want to move to Page 19 of your testimony. You site to a report by Roper and Scarnecchia; is that correct?

MR. CRAMER: Yes, I do.

MR. GEE: And I believe the point you're making there is warmer temperatures stimulate earlier outmigration. Is that -- is that a fair summary?

MR. CRAMER: Yes. It's -- it's, generally, used -- it's talking about the response to temperature. There's a

couple of studies cited here where the correlation was to temperature. This is correlation to temperature. There's, also, a couple of studies where the correlation is twofold, but it's the combined effect of those low-flow years having high temperature are correlated with early outmigration.

MR. GEE: Okay. Do you have any information as to the success or survival of those fish?

MR. CRAMER: Yes. You can do that on several studies. In this particular study by Roper, no. The only thing you can say in regards to that is this is natural selection at work. If this strategy were a bad one, it would have been eliminated by natural selection.

You don't see natural responses done in a way that's damaging to the fish. If those fish survived poorly, then selection would have moved for the fish that did not respond to those stimuli in that way and would have waited and migrated at a different time. So this is a natural system and that's why natural fish are responding.

MR. GEE: So no with your explanation stated, is that --

MR. CRAMER: No specific data on this example.

MR. GEE: Okay. My following question is: In your opinion do fish need less water in a wet year than they

need in a wet year for habitat purposes?

MR. CRAMER: For -- it's a leading question. They have the same needs for temperature. They gain the same range of benefit from temperature and flow conditions. In any year, given that the supply of food is the same, which does vary between those years, given that other competing fish are the same, there's a whole lot things that are givens, you're congressing without a whole lot of other things that go along with a dry year.

But at any rate, the answer is: Temperature and the flow, they still have the same range of desired temperatures and flows that they would prefer.

MR. GEE: Okay.

MR. CRAMER: Even if it's a dry year.

MR. GEE: So are you saying that they need about the same amount of water?

MR. CRAMER: Need is a word that I would have to subtract from my statement. It's not need. They work with what they have. The key is how they respond to it. My point was, stimuli. They respond to these events as stimuli, which tells them when to migrate. If we change the stimuli so that there is asynchrony between what happens in the Yuba River and what happens in the Delta, the fish is in trouble. So it's not what happens in the Yuba River that I'm concerned about, it's about that fish

when he has to swim through the Delta.

MR. GEE: Okay. Given your explanation, was it a "yes," with your explanation, a "no" with your explanation? I just feel it is a "yes" or "no" question. I was just wondering.

MR. CRAMER: Okay. If you have the word "neither" -- I want to be careful that if I'm going to do "yes" or "no," you better state it clearly.

MR. GEE: Okay.

MR. CRAMER: Make sure I'm saying it to the right words.

MR. GEE: My question was: Do fish need less water in a dry year than they need in a wet year? And if you can answer "yes" or "no" without an explanation.

MR. CRAMER: I can't answer "yes" or "no." That's not a "yes" or "no" question, in my view.

MR. GEE: Okay. I've no further questions.

Thank you, Mr. Cramer.

H.O. BROWN: Mr. Baiocchi.

MR. BAIOCCHI: Mr. Brown, I want to turn my -- California Sportfishing Protection Alliance wants to turn their 20 minutes of cross-examination over to Mr. Bill Cunningham of the Attorney General's Office, Deputy Attorney General for the Department of Fish and Game concerning this witness.

H.O. BROWN: Okay.

MR. BAIOCCHI: Thank you.

H.O. BROWN: Mr. Sanders?

MR. FRINK: Excuse me, Mr. Brown, I believe earlier there was a question about assigning a period that a party has for cross-examination over to another party. And you ruled that, although, you were liberal in granting extensions of time, that one party to the hearing isn't able to assign their cross-examination period to another.

H.O. BROWN: That's right, Mr. Frink. Mr. Baiocchi asked for that, I didn't give it to him.

MR. FRINK: Okay. Okay. I wasn't clear.

H.O. BROWN: But I understand your request and we'll make considerations appropriately to Mr. Cunningham.

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CROSS-EXAMINATION OF SOUTH YUBA WATER AGENCY
AND CORDUA IRRIGATION DISTRICT
BY SOUTH YUBA RIVER CITIZEN'S LEAGUE
BY MR. SANDERS

MR. SANDERS: Good morning, Mr. Cramer.

MR. CRAMER: Good morning.

MR. SANDERS: Do you recommend using pulse flows on the Yuba River, is that your recommendation?

MR. CRAMER: I did not offer that in my testimony. I tried to redefine what pulse flows are. But as long as

you asked: Do I recommend them, what I -- a pulse flow of no more than five days, which being defined "pulse," meaning that flow increases by 50 percent or more from base flow, could be useful if there are other events downstream that you want to coordinate with. Other than that, pulse flow is not necessary to move fish out.

MR. SANDERS: Okay. You haven't been asked to make any specific recommendations for flows and temperatures in the Lower Yuba, have you?

MR. CRAMER: I have not.

MR. SANDERS: So you haven't done so?

MR. CRAMER: Correct.

MR. SANDERS: Are you familiar with the flow regime being recommended by Yuba County Water Agency's consultants?

MR. CRAMER: I'm sorry, I am not.

MR. SANDERS: Okay. So you're not in a position to speculate on whether those flows would maintain the fishery in good condition?

MR. CRAMER: I'm not.

MR. SANDERS: Okay. Are you familiar with the north -- or also known as Hallwood-Cordua diversion?

MR. CRAMER: I am familiar with it.

MR. SANDERS: Have you ever studied the efficiency of the north canal, or the north fish screen?

MR. CRAMER: I've never studied the efficiency, meaning I've never conducted fish releases over there, nor seen any data on releases of marked fish to estimate it's efficiency.

MR. SANDERS: Okay. I guess what I'm asking, I just want to make absolutely clear is: You performed a study on the south diversion?

MR. CRAMER: Right.

MR. SANDERS: You didn't perform an analogous study on the north diversion?

MR. CRAMER: No. I'm using data that was obtained by California Department of Fish and Game.

MR. SANDERS: Okay. Are you aware that DFG operates the fish screen, the north fish screen for only a limited period each year?

MR. CRAMER: Yes, I am.

MR. SANDERS: Okay. Now, I'm asking you to speculate as an expert witness, if Hallwood-Cordua is diverting through the north canal, and DFG is not operating the fish screen, will fish enter the diversion canal?

MR. CRAMER: So they are operating -- the water is going down the canal just nobody is sampling, yes, fish would use the canal.

MR. SANDERS: Right. Okay. Now, what happens --

again, speculate as an expert -- what happens when salmonid fry or smolts enter a diversion canal, what happens to those fish?

MR. CRAMER: Just depends on where the water -- it would depend on where the water is going.

MR. SANDERS: Okay. So if the diversion is being used to irrigate, say, rice fields, do the fish end up in the rice fields?

MR. MINASIAN: At what time of year, Larry?

MR. SANDERS: Well, again, I'm just --

MR. CRAMER: If the fish is in the water and it's going to a rice field, he'll end up in the rice field.

MR. SANDERS: Right. Okay.

MR. CRAMER: But the diversion has to happen when the fish is there.

MR. SANDERS: Okay.

MR. CRAMER: It goes back to that.

MR. SANDERS: Right. Okay. With your data on squawfish, does that include sampling the stomach contents to see if the fish are, in fact, preying on salmon and steelhead?

MR. CRAMER: In the Yuba River, no, it does not. We did not sample any stomachs.

MR. SANDERS: Okay. Are you familiar with the NMFS's and DFG fish-screening criteria?

MR. CRAMER: I'm familiar with older versions. I know that they have been updating those recently. I haven't seen their updated values.

MR. SANDERS: Okay. Well, is it true that even the older versions don't allow rock gabion fish screens as --

MR. CRAMER: That's a good point. And here NMFS has a policy. I think you'd have to ask them to express it clearly, but here's my understanding of it:

We've worked with them on several innovated methods of fish screening. Their policy has been, you live either by the criteria, or if you have an innovative idea, then the burden is on you to substantiate that you produced the desire result. So that they do make allowance for innovation. The proponent has to show that the system works.

MR. SANDERS: Okay. I think that's it. Thank you.

MR. CRAMER: Uh-huh.

H.O. BROWN: Mr. Cook?

MR. COOK: I have no questions, Mr. Brown.

H.O. BROWN: Okay. Thank you, sir.

Mr. Lilly?

MR. LILLY: No questions, Mr. Brown. Thank you.

H.O. BROWN: Mr. Gallery?

MR. GALLERY: No questions.

H.O. BROWN: Mr. Bezerra?

MR. BEZERRA: No questions, Mr. Brown.

H.O. BROWN: Mr. Morris?

MR. MORRIS: No questions, Mr. Brown.

H.O. BROWN: Mr. Cunningham?

MR. CUNNINGHAM: I have questions, Mr. Brown.

H.O. BROWN: I thought you might.

MR. CUNNINGHAM: I have more questions, Mr. Brown.

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CROSS-EXAMINATION OF SOUTH YUBA WATER AGENCY
AND CORDUA IRRIGATION DISTRICT
BY CALIFORNIA DEPARTMENT OF FISH AND GAME
BY MR. CUNNINGHAM

MR. CUNNINGHAM: Good morning, Mr. Cramer.

MR. CRAMER: Good morning.

MR. CUNNINGHAM: I'm Bill Cunningham with the Department of Fish and Game for today. You'll excuse me if some of these questions kind of bounce around. I haven't had a chance in the short time that I've been assembling them to put them in the correct order.

But, perhaps, we can start by just going through, first, I was provided your direct testimony. And I had a couple specific questions and then I'll come back to some more select questions as we go through it.

My first questions for you deal with some testimony that you provide on Page 10 of your direct

testimony, which I believe is the South Yuba Water District Exhibit 2.

And, specifically, I'm looking at the statement that's the last full sentence of the top paragraph. Where it starts,

(Reading):

"The fact that we caught no chinook within the size range."

Do you see that in your testimony?

MR. CRAMER: Yes.

MR. CUNNINGHAM: And I noticed that you underlined the word "no" chinook within the size range --

MR. CRAMER: Correct.

MR. CUNNINGHAM: -- outmigrants trapped at the Hallwood-Cordua trap during May. Could I draw your attention to your Exhibit 2. -- is it 2.2, Mr. Minasian?

MR. MINASIAN: Yes.

MR. CUNNINGHAM: I'm sorry, 2.2?

MR. MINASIAN: Yes, that's right, the 1993 study.

MR. CUNNINGHAM: Yes, please. And, specifically, could I call your attention to the Figure 10 on Page 17, which I believe is, actually, a comparison of lengths of fish found at the --

MR. CRAMER: Correct.

MR. CUNNINGHAM: -- two different sites,

essentially, Hallwood fish scene and the South Yuba Canal.

MR. CRAMER: Correct.

MR. CUNNINGHAM: Your conclusion is it has found no chinook within the size range trapped at the Hallwood-Cordua trap during May. But as I understand it from your testimony, on May 13th you found a chinook salmon fry at 106 millimeters; is that correct?

MR. CRAMER: Correct.

MR. CUNNINGHAM: And as I also understand it, on I believe it was May 4th, the Hallwood-Cordua fish screen trapped a 106-millimeter chinook salmon. Could you -- can you explain how those are not the same size range to me, please?

MR. CRAMER: I don't have those specific data in front of me, but if, indeed, that is true, then those are the same size range. I was making that statement based on this graph that you are referring to, Figure 10, and that has the dots representing the individual fish captured passing down the South Yuba-Brophy Canal, compares those to the range of lengths.

The plot here appears to show that the largest fish caught during the entire season was, perhaps, a millimeter less. If you say that it is 106, that largest fish is equal to the smallest fish we caught, yes.

MR. CUNNINGHAM: Okay. So assuming that that's

correct, you're absolute statement has a minor qualification on it?

MR. CRAMER: Yeah.

MR. CUNNINGHAM: Okay. My bigger questions go to, however, a question: Do you assume that fish seen at the Hallwood-Cordua fish screen are representative of the fish, actually, in the river at the Daguerra Dam?

MR. CRAMER: I would -- in my best judgment that the fish caught there are representative of the migrating fish. Now, there would be -- at any one time, there are fish that are not migrating. And those that are, the two groups do differ in size range, you can determine that by sampling.

So the assumption -- since we're worried about fish that would be exposed to passing at the levee, my assumption was those would be the same fish that have to migrate, to pass the levee, they would be comparable to ones migrating through the Hallwood-Cordua diversion.

MR. CUNNINGHAM: Okay. But to your knowledge, no studies have, actually, been done to correlate what's being seen at the Hallwood-Cordua fishery and what's, actually, out in the river at the Cordua Dam; is that a correct statement?

MR. CRAMER: I want to be careful to qualify it. There have been fish sampled by snorkeling, there's other

sampling going on. But the first sampling I am aware of where migrants were being sampled is the new rotary-screw trap right below Daguerra Point Dam that has started fishing this season.

MR. CUNNINGHAM: Okay. So at -- well, let me start again here.

To the extent that we're looking at 1993 results, I believe, on both of these elements of Page 17, at that point in time, to your knowledge, there was no study that had been used to correlate what was being sampled, or seen at the Hallwood-Cordua fish screen with what was, actually, in the river; is that an accurate statement?

MR. CRAMER: That is a -- let me qualify what I want to say. Insofar as you stated it that way, I find that okay. If I were to sample to determine how representative of what's in the river, I would do something like put in the Hallwood-Cordua fish screen and see how the fish migrate.

That is the sample. I would use it as the best way to determine what is in the river. I could do another one just like it to test if it is the same, but it is capturing a -- it samples a large share of the flow and does it very effectively.

MR. CUNNINGHAM: Okay. Well, if we're going to use the Hallwood-Cordua fish screen as an accurate means to

sample migrating fish, or resident fish in the Yuba River at the Daguerra Dam, doesn't flow through the screens play an important part?

MR. CRAMER: I think what you're getting to, the percentage of flow passing through that diversion would influence the percentage of fish that enter that diversion, the answer is, yes.

MR. CUNNINGHAM: And doesn't, also, the location of the screen play an important part as far as whether it's closer to the river, or farther away from the river?

MR. CRAMER: Yes. The orientation of the screen will influence the proportion of fish that would pass that way.

MR. CUNNINGHAM: And the actual timing of diversions so that there is a velocity differential through the screens makes a difference?

MR. CRAMER: Fish would be -- there is a relationship of the percentage of water diverted to the percentage of fish that would be contained within that water. It's not a one-to-one relationship, but as your percentage of water diverted increases, the percentage of the migrants that use that water would increase.

MR. CUNNINGHAM: And so, again, let me go back to my earlier question. Before you -- or -- part of my earlier question, before you could conclude that the

Hallwood-Cordua screen is an accurate sampling of salmonids in the Yuba River at the Daguerra Dam, don't you have to look at these other factors to make sure that they're accounted for?

MR. CRAMER: Yes, to make it an accurate depiction of the migration timing I would want a -- I would want a consistent sampling regime, or an estimate of the efficiency.

In the case of that screen, the best way to do it is percentage of flow diverted. Particular data that I show are simply -- in my testimony for the 1993 sampling we did -- are raw data. Simply, they reflect the raw catches from full-diversion rates that were going on at that time frame.

And all I refer to was the -- well, I did refer to the numbers, showing when the spike occurred and the size of fish. I would not think the size of fish would be influenced by that efficiency, rather that the total magnitude of the spike would be influenced.

MR. CUNNINGHAM: Now, going back to something you just said a couple minutes ago, I would like to ask an additional question. You indicated that at best you would, perhaps, use the Hallwood-Cordua screen as a way to sampling downstream migrating salmonids; is that right?

MR. CRAMER: Yes.

MR. CUNNINGHAM: Could you use it to accurately reflect nonmigrating salmonids in the Yuba River?

MR. CRAMER: No, you could not.

MR. CUNNINGHAM: Salmonid chinook that you sampled at the South Yuba-Brophy Canal, I believe, during 1993 you sampled a variety and found some sizable; any idea whether those were outmigrating fish, or nonmigrating fish?

MR. CRAMER: At the time we captured them, we captured them as they passed through our passively-fished gear and flowing water, they had to be migrating to enter our net. That doesn't mean that -- they clearly -- our conclusion was those fish had to be rearing in that pond since January.

To get that large, they must have been -- and the only way to get to the pond would have been the overtopping event in January. So they would have been rearing in that pond until the pond was opened, there's -- the pipes that draw water out of that are not always opened. So they have to wait until the pipes are opened to get out of there. And that's when we had our nets there.

MR. CUNNINGHAM: Now, I want to explore that just a little bit. You raised an interesting issue. Your explanation for those fish in that pond in 1993 were that they probably arrived through an earlier overtopping event

in January. Is that what you said?

MR. CRAMER: Correct.

MR. CUNNINGHAM: Now, in January those fish would have been much smaller, wouldn't they?

MR. CRAMER: Correct.

MR. CUNNINGHAM: How small?

MR. CRAMER: Typically, in January they would be new emerging fry in the neighborhood of 30 to 35 millimeters.

MR. CUNNINGHAM: Do you have any reason to believe that a fish of 30 to 35 millimeters could not go through that screen, that porous dike screen?

MR. CRAMER: Fish of that size probably could. That screen is not -- as I mentioned, the reason that they stayed in that pond is because there's no flow through that dike at that point. There's no water being diverted there until April.

MR. CUNNINGHAM: I'm sorry. Your answer was: They could have gone through the screen?

MR. CRAMER: If there was water passing through the screen, a fish of that size, conceivably, could get through there. Keep in mind, the screen at the elevation that they would pass through is about 30 feet of cobble with a fine-mesh barrier screen within it.

The only reason I say "could," is because we captured two fry that are -- these are two steelhead fry,

we don't know exactly where they came from. The best explanation is they probably got through that thing.

MR. CUNNINGHAM: Okay. And, now, you said chances are they might not have migrated through, because you would not assume that there would have been any velocity of water through the screens during January; is that correct?

MR. CRAMER: Correct. There's no water being withdrawn.

MR. CUNNINGHAM: Well, let me get this straight. If the river comes up three feet through some flood event or through some discharge event, you're not diverting on the other side. It's pre-diversion time. Does some water, then, flow through that porous gabion screen to bring the water to the pond level up to that of the surrounding surface flows on the other side?

MR. CRAMER: It does.

MR. CUNNINGHAM: Okay. So at any time that the river goes up in any kind of rising cycle, when the water on the other side of that gabion screen is lower, there would be some velocity of water through that screen?

MR. CRAMER: That's true.

MR. CUNNINGHAM: Okay. Do you have any idea whether or not something like that happened in 1993 other than the flood event in January that overtopped the screen?

MR. CRAMER: Fluctuating flows would cause fluctuating head. There's water moving back and forth through that. So that would go back to the point where we in our written testimony, actually -- while it was at maximum diversion had the scuba divers swim the entire face of that dam.

And similar to the findings that had been reported by United States Fish and Wildlife when they did it in '89, our divers remained suspended in the water column at points all along that gabion and found at no point could they drift. They could not detect any velocity anywhere on the back side of that gabion when it was at full diversion rate.

H.O. BROWN: Mr. Cunningham, at a time convenient to you, we'll take our break.

MR. CUNNINGHAM: Sir, why don't we go ahead and do it right now.

H.O. BROWN: All right. We'll be back here at 1:00.

MR. CUNNINGHAM: Thank you, sir.

(Luncheon recess.)

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MONDAY, MARCH 6, 2000, 1:00 P.M.

SACRAMENTO, CALIFORNIA

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H.O. BROWN: Come back to order. Mr. Cunningham.

MR. CUNNINGHAM: Thank you, Mr. Brown.

Mr. Cramer, if you'll bear with me, we'll try to get started, again, here. And I'd like to continue to talk to you a little again about the rock gabion screen on South Yuba-Brophy Canal.

I believe in your testimony you indicated that at least once in, I guess, it was 1993, the Yuba River had overtopped, I think that was your word, overtopped the gabion screen; is that right?

MR. CRAMER: Correct.

MR. CUNNINGHAM: That was that January event that you talked about?

MR. CRAMER: Yes.

MR. CUNNINGHAM: Do you know what level of water it took to overtop that screen as far as the flow?

MR. CRAMER: No one was out there to specifically observe it, but the flow measured at Marysville on peak day was 20,500 cfs.

MR. CUNNINGHAM: Do you know enough about the Yuba River system to say whether or not that kind of flow occurs once a year, or more than once a year on the Yuba

River?

MR. CRAMER: I haven't looked at the recurrent frequencies. I can only say that it, obviously, happened in the one year that U.S. Fish and Wildlife Service surveyed the pond. They found a few, a small number of juvenile chinook in that pond. And they concluded the exact same thing that the flow had come over the top in the peak flow event.

MR. CUNNINGHAM: It's your theory that may be the correct analysis of where those fish came. Is it possible that that happens every time that the flows get to a similar level, to overtop the gabion?

MR. CRAMER: I will expect that would happen any time they go over that level.

MR. CUNNINGHAM: Is it your understanding that that screen needs to only work when South Yuba-Brophy is, actually, diverting water?

MR. MINASIAN: Are you asking for a legal, or contractual conclusion?

MR. CUNNINGHAM: No, I'm sorry, just his personal opinion. When you evaluate fish screens, is it your understanding that the fish screens are only evaluated for their effectiveness during the actual periods of diversion?

MR. CRAMER: Well, just as a practical matter, I

would want a fish screen to prevent fish from entering -- keeping them from under any circumstances.

MR. CUNNINGHAM: Okay. That's a good lead in, because I guess my question is here as I understand it for the South Yuba-Brophy diversion, the pond, I think as people have been calling it, behind the gabion screen, actually, serves as part of the diversion works.

It's part of the way the system is designed to get water from the river, through that side channel, to the side gabion into the pond and then from there into the actual canal themselves; isn't that right?

MR. CRAMER: I don't know about design, but it is the way that it works. It is a forebay at the backside of that pond where the diversion, actually, takes place.

MR. CUNNINGHAM: Okay. So would it be safe to say that it's your personal understanding that the screen should function to keep fish out of the diversion waters?

MR. CRAMER: Correct.

MR. CUNNINGHAM: If I were to hypothesize that I had a diversion where once, or twice, or three times a year the screen didn't work and fish got into my diversion works, would you conclude that that is an effective fish screen?

MR. CRAMER: Well --

MR. MINASIAN: I think the question is ambiguous and

uncertain. Unless you ask whether or not the pond existed before the gabion was built across it.

H.O. BROWN: See --

MR. CUNNINGHAM: Well, that's not really the hypothetical that I --

H.O. BROWN: Mr. Minasian, you have an objection?

MR. MINASIAN: Yes.

H.O. BROWN: Please, state it for me.

MR. MINASIAN: The question is unclear for that reason, or the question is unclear because it doesn't indicate whether or not the witness is to compare the conditions before the gabion was built, where there was a pond with no exits, no entries; or after the gabion was built.

H.O. BROWN: All right. I understood the question.

If you understand it, go ahead and answer it.

MR. CRAMER: I think I understood it. I diverted my attention. Would you please reask it? I'm sorry.

MR. CUNNINGHAM: Well, the focus of my question is, and, perhaps, I can rephrase it to help, is when I put a fish screen in place to keep fish out of a diversion works, do I design it to keep fish out of the diversion works all of the time?

MR. CRAMER: Yes.

MR. CUNNINGHAM: And if I were to design a screen

that didn't work all of the time, for whatever reasons because of mechanical failure, a screen that was poorly designed mechanically, or because of a design problem, a location problem, that in each case led to failure of the screen to effectively keep fish out of the diversion works, would you consider that an effective screen?

MR. CRAMER: I think from a practical standpoint, we did a survey of different agencies, the answer would be, yes. They were all designed within certain tolerances. They can't cover 100 percent of the fish, 100 percent of the time. There will always be odd circumstances that they don't function 100 percent.

Like, for example, extreme floods. Another would be, for example, unusually small fish. Another would be you don't cause scuba divers to inspect the screen daily, because a crack might develop when the debris buildup causes a slight separation at some point. They're annual. They do usually some kind of a periodic maintenance where fyke nets behind those screens, almost 100 percent of functioning screens to state-of-the-art criteria still occasionally pass fish under some circumstances.

MR. CUNNINGHAM: Is it safe to say those circumstances are usually controlled, or minimized?

MR. CRAMER: Certainly, that would be the intent.

MR. CUNNINGHAM: Mr. Cramer, do you know has the

actual rock gabion screen for the Hallwood-Cordua -- I'm sorry, South, sorry, Mr. Minasian, the South Yuba-Brophy Canal, has it been approved by NMFS?

MR. CRAMER: No approvals have been received.

MR. CUNNINGHAM: Is there a procedure to obtain approval from NMFS of a fish screen, to your knowledge?

MR. CRAMER: I am uncertain of that. If you match their criteria for standards, that would be one way. For the -- I believe you have to go through -- probably if you want to have certification of sorts by them, you'd have to go through that process of testing and demonstrating the screens' effectiveness.

MR. CUNNINGHAM: Well, I think earlier you testified that there are some criteria for the designs of screens. And then there are the recognition of alternative kinds of screening technology.

Do you know, does NMFS put in place any kind of -- I guess for lack of a better word -- for criteria in designing those alternative screens to make sure that, somehow, they function the same?

MR. CRAMER: The criteria they offer in that policy statement, I can't quote you the numbers, but it is based upon result. So it is based upon achieving exclusion of fish to a, I think, percentage. It might be something like 98 percent. I don't know what it is, but that's the

way, you have to achieve a result.

MR. CUNNINGHAM: Are you aware of the proposed 4D take provisions that are being currently circulated as draft for -- by NMFS for steelhead?

MR. CRAMER: I am -- that is a 40-page plus -- 40-page plus set of draft provisions and I'm closely familiar with some parts of it. I didn't read the screening one -- there's several parts I haven't read carefully.

MR. CUNNINGHAM: Okay. Okay. I'll move on to something else, then. A last question for you, Mr. Cramer, I guess:

Do I understand that in your 1993 survey the fish behind the gabion, you found two fish that you identified as steelhead trout; is that correct?

MR. CRAMER: Yes.

MR. CUNNINGHAM: Any explanation for how those fish got there?

MR. CRAMER: As I said in my testimony, I thought they probably went through the rock. There is, also, the possibility that fish could have existed in that pond and spawned. That seems a low likelihood. So the most probable explanation is that they got through the gabion.

MR. CUNNINGHAM: And I noticed, I think in your testimony that you suggested that that was a minor

problem -- I'm sorry, I can't use your correct words, but I think you said it was a minor problem.

Did you make any kind of attempts to survey or study just how many steelhead fry of the same size could have interpenetrated that gabion screen?

MR. CRAMER: We did not.

MR. CUNNINGHAM: So to the extent that you found two, if you had looked at the river side of the screen and in a study -- a trapping study of some kind found a very small number of steelhead on the river side, would it be safe to say that two might be a significant number on the other side of the screen?

MR. CRAMER: For comparisons on one side of the screen versus the other, true. Certainly, not for the population of steelhead at large in the Yuba River.

MR. CUNNINGHAM: Yes, but only just on one side of the screen to the other. Because, again, before you can conclude that something is inconsequential, don't you have to balance it against the other side of the screen?

MR. CRAMER: You do. And so the only criteria that I would use at this point is the abundance of steelhead in the Yuba River.

MR. CUNNINGHAM: But at the exact time that you found those two steelhead juveniles, did you have any information to suggest what the abundance of steelhead

were on the other side of the screen?

MR. CRAMER: Not directly on the other side of the screen.

MR. CUNNINGHAM: Okay. Excuse me, bear with me for a second as I sort through lots of notes.

Mr. Cramer, can I have you look, again, at Page 19 of your testimony, which I believe was South Yuba Water District's Exhibit 2.

MR. CRAMER: I'm there.

MR. CUNNINGHAM: And Figure 5, the graphic that you put on that page. And I think you mentioned that that compares temperatures and median migration dates. Is that for -- what is that, for chinook salmon? Is that what it is?

MR. CRAMER: It is for chinook salmon, yes, subyearling chinook salmon.

MR. CUNNINGHAM: Now, my question for you: To the extent that we find the warmer temperatures suggest earlier outmigration, I believe that's what you testified to --

MR. CRAMER: Correct.

MR. CUNNINGHAM: -- when you look at that? Do warmer temperatures produce earlier outmigration, or force earlier outmigration?

MR. CRAMER: They stimulate, let's use that word.

It is fish that don't respond to environmental stimuli to survive, die. They don't pass their genes on to the next generation and then we don't have them anymore in the future. So the behaviors that we see today are the results of thousands of generations of selection and show you how fish respond to environmental stimuli.

MR. CUNNINGHAM: But I guess the question to me is: Is a stimulation, or stimuli that, essentially, is one of leave now or die, can, actually, also be considered a forcing of the outmigration. It's not an optimal choice. It's a leave-now-or-die choice; isn't it?

MR. CRAMER: Correct. And if they were swimming right into the ocean I think it would be better for them to stay. That's why they do on high-flow years. But since they're not, they have to survive wherever the next passageway is.

MR. CUNNINGHAM: Well, and I understood that you then talked about that when you talked about, perhaps, the asynchronicity, or asynchrony between the fish that are staying in a cooled flow to reach smoltification size, or, at least, large legal size, then arriving in the Delta which is out of synchrony with, perhaps, the Yuba River.

But I guess my question for you then is: To the extent that a fish were to stay -- a juvenile chinook salmon, let's be more specific on this one -- were to

choose to stay in the Yuba River, because the flows were cold, the fish was staying there, I assume, by choice. They can always outmigrate earlier, but if it stays there by choice and matures to an outmigrating size, a smoltification size in the Yuba River, do you have any information about whether or not its chances of survival through the Delta are higher or lower regardless of Delta conditions?

MR. CRAMER: Yes. Let me restate how I am interpreting your question. If all other conditions are equal, would a bigger fish have a better chance of survival than a smaller fish?

The answer is: The bigger fish has a better chance of survival consistently demonstrated by releasing hatchery fish at similar times of different sizes, a strong correlation for the better survival of a larger fish.

MR. CUNNINGHAM: A larger outmigrating chinook salmon would survive predation, in the Delta, for example, better?

MR. CRAMER: Yes, it would.

MR. CUNNINGHAM: Would it survive temperature, increased temperatures in the Delta better than a smaller fish?

MR. CRAMER: No, it wouldn't.

MR. CUNNINGHAM: So a larger chinook smolt does not survive temperatures as well as a smaller juvenile chinook?

MR. CRAMER: Temperature itself would have probably no different effect on the two. And temperature itself is unlikely to be the specific cause of mortality in the Delta. Disease goes up, predation goes up, a variety of things increase as fish pass through the Delta. We don't know all the causes of mortality, but there could be other ways that they die.

MR. CUNNINGHAM: Safe to say that a larger fish, again, a larger juvenile chinook of smolt size, a juvenile migrates through the Delta faster in time than a smaller fish?

MR. LILLY: I'm going to object. The question is ambiguous. Unless he's saying that all other factors being the same, because, obviously, the flow through the Delta and similar things could make a difference as well.

H.O. BROWN: Thank you, Mr. Lilly.

Mr. Cunningham.

MR. CUNNINGHAM: I assumed that that was the conditions that we were talking about. I was dealing with only one variable, Mr. Brown.

H.O. BROWN: I understood the question. If you understand it, answer it.

MR. CRAMER: Yeah. If all of the things are equal, the general time is that migration rate is related to fish size. Larger fish move faster.

MR. CUNNINGHAM: Okay. Okay. Thank you. I had to translate from the biological to the common sense for me. So, again, back to your Figure 5, when I'm looking at that --

MR. CRAMER: Uh-huh.

MR. CUNNINGHAM: -- I really cannot derive from that graphic any indication about actual survivability of outmigrating juveniles depending upon migration date and temperature, can I?

MR. CRAMER: What you can determine from this about survivability is that this behavior, not only expressed in this graphic, this is listed as an example of multiple ones that I cited, it's observed throughout the range of chinook salmon, it does relate to survival.

We need to understand what that mechanism is, because if this was maladaptive behavior, it would have been eliminated, but it is true across the full range of chinook salmon. It is adaptive -- the fish that do this survive better than the fish that don't do this.

MR. CUNNINGHAM: Is it safe to say, though, that when you're talking adaptive behavior, adaptive behavior over much longer periods of time than the 40 years since a

dam was put in place on the Yuba River, for example?

MR. CRAMER: Right.

MR. CUNNINGHAM: So to the extent that, perhaps, this is good behavior on behalf of outmigrating salmon, it reflects thousands of years of adaptation to an artificial system?

MR. CRAMER: Here's how you go about determining what this does. What you need to do is look at the actual outmigration time in the years that it went early and look at the kinds of circumstances that would have naturally occurred in that year.

Relate those circumstances to survival that you would expect in that year. And that, in fact, can be reconstructed from the data that the U.S. Fish and Wildlife has gathered over the years on survival of the fish through the Delta. And I can show you a couple of figures that would cover that.

MR. CUNNINGHAM: I don't need that. Thank you, Mr. Cramer. I, actually, wanted to explore another question, too. We're looking at temperature here -- I think you made reference in your direct testimony to a study done by Mr. Roper and Mr. Scarnecchia?

MR. CRAMER: Uh-huh.

MR. CUNNINGHAM: "Emigration of Age Zero Chinook Salmon Smolts from the Upper South, unquote, River Basin"?

MR. CRAMER: Right.

MR. CUNNINGHAM: And looking at a copy of that study, is it safe to say that the conclusion there reached was one that suggests not only stream temperatures may encourage or coerce outmigration, but phases of a lunar cycle can also do that?

MR. CRAMER: I cannot recall what they described about lunar cycle.

MR. CUNNINGHAM: Did you attach a copy of this study to your testimony, Mr. Cramer?

MR. CRAMER: Did not.

MR. CUNNINGHAM: Okay. Mr. Brown, if you'll bear with me, I do have a copy of this study with me. And at the -- I'd like to show it to the witness, but I do not have extra copies for either inclusion as an exhibit, or as even identification as an exhibit.

H.O. BROWN: Take a look at it, Mr. Cramer.

MR. LILLY: Mr. Brown, excuse me, can we turn off these spotlights, they're shining right in our eyes.

H.O. BROWN: Why don't you, they're right over there.

MR. LILLY: We weren't sure if you kind of wanted to keep the lights right in our eyes, or what.

H.O. BROWN: No, that's not part of the plan. All right.

MR. LILLY: If that's all right with you, we'll all appreciate it. Thanks.

H.O. BROWN: Mr. Lilly, we'll put you in charge of the lights from now on.

MR. LILLY: I'll add it to my list.

MR. MINASIAN: It's fine. It's cited by Steve.

MR. CUNNINGHAM: Well, I was going to have him read a portion of this, but I doubt that it will be much more productive. Thank you, Mr. Minasian.

MR. MINASIAN: Okay.

MR. CUNNINGHAM: Mr. Brown, I think it might just be more appropriate to just go ahead and include a copy of it in our rebuttal. It's more just because it does, perhaps, go further than Mr. Cramer's own memory does. And it might be useful for the Board.

H.O. BROWN: All right.

MR. MINASIAN: Now, we're talking --

MR. CUNNINGHAM: Mr. Minasian, whatever you wish.

MR. MINASIAN: Yeah, I think it would be better to deal with it right now, because otherwise nobody gets a chance to cross-examine with regard to the contents. And I'm sure that Mr. Lilly and I can look over Bill's shoulder and Steve's shoulder.

H.O. BROWN: It's all right with me, Mr. Cunningham.

MR. CUNNINGHAM: Okay.

H.O. BROWN: It's your call.

MR. CUNNINGHAM: Okay. Mr. Cramer, can I have you take a look at it. I think I have a complete copy of this. I think -- I won't redo the title again. It was published in the, I guess, is it the Canadian_Journal_of_Fishery_Aquatic_Science?

MR. CRAMER: Right.

MR. CUNNINGHAM: Volume 56, 1999.

MR. MINASIAN: And you want him to look at the lunar cycle?

MR. CUNNINGHAM: Mostly, could I just have him take a look at the abstract, which I think is best characterized as kind of the summation, or the conclusion of the report in the paragraph at the top.

MR. MINASIAN: Okay.

MR. CUNNINGHAM: And can I ask him to read that abstract, mostly to himself, if he chooses to; but to see if that refreshes his memory as to the conclusions of the study.

H.O. BROWN: If it's not very long, read it outloud.

MR. CRAMER: Sure. It's one sentence, so it will be easy.

MR. CUNNINGHAM: It's a long sentence, so be prepared.

MR. CRAMER: (Reading):

"Timing of emigration smolts was" -- let me caveat, smolts would mean fish that are probably in the neighborhood of 100-millimeter size range. We could look that up in the study, but smolts does refer to a size type. "Timing of emigration smolts found to be significantly related to stream temperature, probability less than 0.5; and phase of lunar cycle, probability less than .05, but not related to change in discharge. Emigration dates which varied over nine weeks were earlier when spring water temperatures were higher."

Do you want me to continue?

MR. CUNNINGHAM: Yeah, if you'd go ahead and finish.

MR. CRAMER: (Reading):.

"On average two-thirds of yearly smolt runs occurred when the moon was either waning or new. Even though these moon phases were present only about half of the time."

MR. CUNNINGHAM: That's enough if you reached a point where you want to stop, Mr. Cramer.

MR. CRAMER: Yeah.

MR. CUNNINGHAM: Mr. Cramer, does that refresh your memory at all about the conclusions of this study?

MR. CRAMER: Yes.

MR. CUNNINGHAM: Is it safe to say, then, that although the temperature may have some affect, lunar cycles might, also, have a similar affect upon outmigration of smolts?

MR. MINASIAN: Objection. Question is unclear. Are you talking about similar -- same probability correlation, because --

MR. CUNNINGHAM: Well --

H.O. BROWN: Okay. Wait a minute.

MR. CUNNINGHAM: I'm sorry, Mr. Brown.

H.O. BROWN: Your response.

MR. CUNNINGHAM: Yes. I'm sorry, Mr. Brown, that was inappropriate.

Yes. My question was in rereading that, Mr. Cramer, does that suggest that the phase of the lunar cycle has, essentially, the same impacts on outmigrating smolts as the instream temperature to the same level of impacts?

MR. CRAMER: No, it strongly does not. What the paper shows is that fish migrate earlier in years when water temperature is warmer. Within that whole season of migration, each time there is a change in lunar phase, you see a pulse of fish. You see more fish as the day length is increasing. But that occurs over a period of several months.

He's only giving you a value of median migration. You couldn't -- if it was all dependent on lunar phasing, you could not possibly have a correlation that says fish migrate earlier in warmer years.

MR. CUNNINGHAM: Well, I guess I was concerned, it said here the probability was less than --

MR. CRAMER: Right. That was statistical tests. That says the probability: Is it true? That would be a null hypothesis saying -- now, which lunar phase does it say? It says lunar phase, when it says -- right before 3. --

MR. CUNNINGHAM: I'm sorry?

MR. MINASIAN: It's "waning," isn't it?

MR. CRAMER: It's waning, but I would give you what the test would mean the way it's stated here. "Phase of the lunar cycle," the best it gives you, "Phase of the lunar cycle."

So what they have done is broken down their data into how many times did they sample under different phases of the cycle and then did a test. Was there significantly greater numbers of fish on a particular lunar cycle?

And so the answer is: Some phases, what they're calling the waning or the new, would have a different number of fish passing than on other cycles of the lunar phase.

That would be repeated as the moon goes through repeat phases during the course of the whole season of outmigration. If that were balanced from year to year to year, you'd have no correlation to stream temperature.

MR. CUNNINGHAM: I'm not sure I understand your answer, but that's fine. Thank you, Mr. Cramer.

Mr. Cramer, moving on to a slightly different question within the same area -- and Mr. Brown, thank you very much for your courtesy in letting me finish these questions. I appreciate your time.

I have some questions for you, you talked about, again, this question of warmer waters encouraging or almost biologically compelling earlier outmigration, it's a question of survival.

To the extent those fish may be less well-developed, less mature than warm water comes, that those fish in order to survive do choose to outmigrate, where do they go? Do they just get flushed out to sea? Do they not grow at all that year? What happens?

MR. CRAMER: As long as you've asked what happens, I need to clarify the total picture of what does happen. Because as you describe the situation, it's evident that a very critical piece of the puzzle is missing. And that is -- and I have modeled this. We did it extensively on the Rogue River, we had 12 years of data from which to

develop how fish respond to these different water years.

Juveniles grow faster in the warmer water. In a low-flow year fish achieve a larger size earlier in the year than they do in a high-flow year. So they are larger earlier, because the warm temperatures are not a stand-alone event.

See, this is averaged in this particular graph that we are now talking about from Roper and Scarnecchia. This is average temperature over the entire two months of April and May. So during that period, these fish have ample opportunity to grow in those temperatures.

And you can see the range in that plot is from 9 degrees to 15 degrees. Over the course of that -- that's 9 to 15 degrees centigrade, 15 being probably about -- let's see, 13 is 55 so that would put you close to 60 degrees at 15; 10 degrees is about 50 degrees Fahrenheit. So we're looking at a range of somewhere between 48 up to about 60 degrees.

Within that range, growth rate increases as temperature increases. Now, as water gets warmer than that, that turns around going around the other way. But within that range of temperatures, fish grow faster as it's warmer. So in these years where they're going earlier, they're also achieving a larger size earlier.

So what we have is the larger size earlier, we

have the fish migrating earlier, also, because the circumstances are stimulating them to get out before they get into severe circumstances.

They move directly out in the places that we're sampled them, that would be in the Rogue, in the Stanislaus, that happens on the Columbia where I have extensive monitoring of the outmigration. So when it's warmer and they move earlier they go all the way to the ocean.

MR. CUNNINGHAM: I guess, the problem I have is to the extent that you said that they grow faster as the water gets warmer. That predisposes a couple of specialized additional caveats, doesn't it?

That predisposes that the food supply expands at the same rate as growth does, it predisposes that other environmental conditions remain favorable, oxygen, for example, that available habitat, for example, all are commensurate with this growth rate.

It's not quite complete to say that fish grow faster as water gets warmer, is it, Mr. Cramer?

MR. CRAMER: The actual field data bear out -- what I'm reporting to you is what, actually, is observed from field sampling. While we're dwelling on this, it seems important that I show you a couple of actual field data here to demonstrate the point. Is that appropriate for me

to do that?

H.O. BROWN: It's up to Mr. Cunningham.

MR. CUNNINGHAM: I was looking kind of for more of a "yes" or "no." If they wish to explore that on redirect, that's fine with me.

H.O. BROWN: Try to answer "yes" or "no."

MR. CRAMER: Okay. I had in mind all the answer I was going to give you. So "yes" or "no," what -- I'm sorry. Restate the question so I can --

MR. CUNNINGHAM: Let me try to make it real short. Is it safe to say that the conclusion that fish grow faster in warmer water works only if several other variables are allowed for, or several other conditions are accounted for including such things as food supply, oxygen, and habitat?

MR. CRAMER: Those other conditions have to remain suitable. They do not all have to change, they just have to remain suitable.

MR. CUNNINGHAM: Okay.

MR. CRAMER: You don't have to have an increase in food supply to get them to grow faster.

MR. CUNNINGHAM: Now, you mentioned the warmer temperatures also hit a point in time of kind of declining affects on juvenile salmonids. In fact, can't warming temperatures also cause something called parr reversal in

the juvenile salmonids?

MR. CRAMER: When I talked about temperatures, you recall that I said there's increasing and decreasing range. You get those -- there is a whole range of temperatures at which -- this is really going to help the discussion if I could show a figure here.

MR. CUNNINGHAM: I'm sorry, I didn't mean to dwell on these questions. I was hoping -- if you can give me a quick "yes" or "no" answer, or --

H.O. BROWN: Mr. Cunningham is 45 minutes into his 20 minutes of allotted time. That's his problem.

MR. CRAMER: Yeah.

MR. MINASIAN: I have no objection to him extending time. I don't know about anybody else in the room, but we need to get to the bottom of this why the fish die or prosper.

H.O. BROWN: Thank you, Mr. Minasian.

MR. MINASIAN: Why don't we let him show it, I'll mark the exhibit. And you can examine him.

H.O. BROWN: I'll give you another 15 minutes. Is that enough?

MR. CUNNINGHAM: It's probably the best time to do this now, Mr. Brown. So let's go ahead and do it.

H.O. BROWN: All right.

MR. CUNNINGHAM: I appreciate it, Mr. Brown.

Mr. Cramer, you said that you have some overheads?

MR. CRAMER: Yes.

MR. CUNNINGHAM: Let's take a look at them.

MR. CRAMER: We need the screen. Okay. I'm going to give you some laboratory data and then actual field data that illustrate this.

First of all, this is an actual study --

MR. CUNNINGHAM: Mr. Cramer, I think Mr. Minasian would like you to hold the mic. Thank you.

MR. CRAMER: Okay. What I'm presenting here is the results from a published study done by the Canadian researcher, Brett. This shows you the influence -- these are chinook salmon. These are growth rates plotted on the vertical axis and temperatures on the horizontal axis.

Just to give you perspective on Fahrenheit, 10 degrees would be about 50 degrees Fahrenheit; 20 degrees is 68 degrees Fahrenheit. What this data shows is that the growth rate increases until you're somewhere -- you have -- all the different sample points that they have show from about 70 degrees Fahrenheit to, perhaps, somewhere in the mid 60s you have optimal growth if you have food available.

You get a little bit beyond the optimal for growth on the warm side, you have a rapid decline in

growth rate. If you get on the cool side then you have a fairly rapid, but not as rapid on the high side, decline. So there's an optimal and on either side there is a lot less of a growth rate.

Now, with the temperatures that we're talking about in the proposed operating schedule for the Yuba River are in the temperature range where in the spring, in April they are to be 55, which would be about 13 degrees C, at Marysville meaning there would be less above there. So you'd be all in this temperature range in the spring is what you're asking for.

Now, here's actual data from Rogue River. I led studies by RD Department of Fish and Wildlife 12 years on the Rogue River. These are data reports that I'm the prime author on. Actually, I take that back. These are going to be spread. This one is on sampling on the Applegate River.

I was not prime -- I was the program leader for this piece of research, but one of our staff prepared this report. In this case, I'll show you a couple different species. These are subyearling steelhead. And this is -- okay, I'm going to undo something that I just said.

This is one that I was the primary author on. This is in the Rogue Canyon, an area that does have high temperature. You see the temperature range here starts at

almost 20 degrees --

MR. CUNNINGHAM: Mr. Cramer, let me interrupt you. Mr. Brown, I'm going to -- unless you wish to continue this, I'm going to ask Mr. Cramer not to go any further in this, because all we're getting into is we're dealing with apples and oranges.

The earlier samples we looked at, Mr. Cramer, of your own slide reflects some Canadian studies. I think you told us was chinook salmon.

MR. CRAMER: Right.

MR. CUNNINGHAM: Now we're looking at steelhead and I'm afraid we're going to get more information here than I'll ever be able to deal with in cross-examination. I mean --

MR. CRAMER: I can stick with chinook.

MR. CUNNINGHAM: What I was hoping to discuss was one species in one environment and, hopefully, it was a California environment. And to the extent these studies might be useful, I'm sorry, the steelhead study we're starting to lose ground at, I believe, Mr. Cramer.

So, Mr. Brown, unless you want to pursue this I'd just like to go ahead and move on.

H.O. BROWN: Your call.

MR. MINASIAN: I will mark and make copies for everybody, the Brett study is 2.5, South Yuba Exhibit.

The Rogue River Study is 2.6. And 2.7, what was the one that you wanted to put up regarding temperature and chinook?

MR. CRAMER: There's still, yet, another. This one is fall chinook on the Applegate River.

MR. MINASIAN: Thank you.

MR. CUNNINGHAM: Thank you, Mr. Cramer. I didn't mean to interrupt you, but I think we're getting a little beyond what I can deal with in the time that I'm going to have available. I guess I'll leave it at that.

It's my understanding, however, though that your testimony already is that there are several other conditions that do affect juvenile salmonid growth, specifically, chinook growth, not just temperature; is that correct?

MR. CRAMER: It is correct. And it's extremely important to know exactly what all the limiting factors are and how they match up, but we want to look for mismatches.

MR. CUNNINGHAM: Okay. Now, one last area I wanted to explore here. In your direct testimony where you're talking about the synchrony or asynchrony of raising juvenile salmonid in the cool water environment and then forcing them into the Delta, or bringing them into the Delta in, perhaps, conditions that have changed --

MR. CRAMER: Right.

MR. CUNNINGHAM: -- do you have any information that you haven't already provided about how frequently such an asynchrony would occur between the Yuba River at flows and temperatures recommended by the Board's proposal and recorded Delta temperatures and environment, how many times we would, actually, be looking at asynchrony events?

MR. CRAMER: I can give you specific examples, and to get the total picture of probabilities, a simulation could be done to data that do exist to examine that question.

When I say they do exist, always that means that there's still assumptions that would have to be made within that simulation. But there's reasonable data to draw reasonable assumptions, put it all together and simulate, find out how often you have a mismatch.

I have said it would be on low-flow years. I want to look at the specific examples that I gave in my testimony. In 1976 and '77 the flows were low-flow years in the Yuba River. Peak migration in those two years showing them in the Hallwood-Cordua track from the -- it was in April, mid April.

'79 and '84, I'm quoting my years -- they're in my testimony, written testimony -- were moderate, or were not high-flow years. Those were flow years where the

flows in April and May were in the neighborhood of 1,000 cfs at Marysville. That is the proposed flow in the Yuba plan.

In that circumstance, over 50 percent of the outmigration of fish captured at Hallwood-Cordua occurred after May 15th. So there's a substantial departure on actual flows observed in the actual Yuba River.

We can take the actual data of temperatures and flows in the Delta to look at what happened in those years. Though we show clearly that temperatures increased through time in the Delta. I have that graph right here, I can show you that. And it shows that survival through the Delta decreases as temperatures increase. I have that graph right here.

MR. CUNNINGHAM: I was just interested in if you, actually, have looked at and done an analysis of which years such asynchrony would have occurred. And as I understand it, you have some ideas, but you have not, actually, examined --

MR. CRAMER: I haven't done the full analysis to know probabilities, but that would be a smart analysis to do.

MR. CUNNINGHAM: Okay. To the extent that we're looking at the outmigrating fish here and the questions of temperature, you're not recommending that we, actually,

encourage warmer temperatures in the Yuba River, are you, for the outmigration of chinook salmon?

MR. CRAMER: No. I am recommending that you be sure the patterns match up with what the fish will have to experience as they migrate down the river. So that if they need to go through early, they have the same clues where they live, that is in the Yuba River, to migrate early. In other words, you can't ever divorce a low-flow dry, warm year in the Yuba River unnaturally from what they will naturally experience as they go further.

MR. CUNNINGHAM: At the same time, I assume you would suggest that we should not ignore other salmonid species that choose to remain in the Yuba River while the fall-run chinook are outmigrating; is that correct?

MR. CRAMER: That's correct. You have to make some choices.

MR. CUNNINGHAM: Isn't it true, for example, that spring-run chinook salmon juveniles may, actually, remain in the system for up to a year? Are you familiar with that?

MR. CRAMER: I have -- I would guess that that is possible. I can tell you that the scales from fall chinook show that a percentage under ten percent do have yearling-like history. That is they remain in the stream. That even exists in the fall chinook. I never looked at

data on spring chinook scales, but I would not expect that to be a whole lot more frequent than the fall chinook.

MR. CUNNINGHAM: And what about steelhead, they stay in the system all summer, don't they?

MR. CRAMER: Correct. Correct. And they would be rearing, typically, in areas -- that's why you find their rearing distribution limited to the areas usually higher in the basin where the water remains cooler even though it's below 40. You wouldn't expect to find them rearing in great abundance at Marysville.

MR. CUNNINGHAM: Unless the waters were cool; isn't that true?

MR. CRAMER: On a cool water year you may find their distribution down there farther, but at that -- yeah, you may find some down. There they would tend to have distributions that corresponded to where they consistently survived, which means all kinds of flow years.

MR. CUNNINGHAM: Mr. Brown, if I can have just a second, I think I'm just about done, unless somebody hits me from behind.

Last question, squawfish. I think you testified in your testimony about squawfish as a predator and their existence in the river on the river side of the South Yuba screen.

I think you, also, testified that there was

little or no effort made to manage squawfish in California. And I wanted to ask if you were familiar with something called the squawfish derby at the Red Bluff diversion dam?

MR. CRAMER: My answer would be if that's in present time, no, I'm not. I know there was one done some -- there was talk of it some time ago. And to my knowledge, it never got implemented. If it has, that's news to me.

MR. CUNNINGHAM: And I, also, wanted to ask are you familiar with any efforts made by the Department of Fish and Game, or others to manage squawfish on the Eel River?

MR. CRAMER: No, I'm not informed about that.

MR. CUNNINGHAM: Mr. Brown, thank you.

Mr. Cramer, thank you for your time, Mr. Minasian as well.

H.O. BROWN: Thank you, Mr. Cunningham.

Staff?

MR. FRINK: Yes, Mr. Brown, we do have some.

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CROSS-EXAMINATION OF SOUTH YUBA WATER AGENCY AND CORDUA IRRIGATION DISTRICT BY STAFF

MR. FRINK: Good afternoon, Mr. Cramer.

MR. CRAMER: Good afternoon.

MR. FRINK: I have what I hope are a few short

questions and then Ms. Low may have some more extensive, detailed questions.

There was evidence presented at the prior Board hearing about problems -- excuse me. It would probably help on these questions if you could put up your slide showing the rock gabion diversion channel and the fish screen. Okay?

MR. MINASIAN: Figure 1.

MR. FRINK: All right, I appreciate that. At the prior hearing we heard evidence about problems of blockages in the return channel --

MR. CRAMER: Down here.

MR. FRINK: -- yes, into the Yuba River. I wonder if you have any familiarity with blockages occurring in that area before the diversion canal returns to the main portion of the Yuba River?

MR. CRAMER: I never observed any when there was water flowing through. And I guess -- yes, I can say that I recall discussion that there were occasions when there was a problem with that.

MR. FRINK: Would you believe that from the standpoint of survival of salmonids that it would be important to maintain a free flow of water through that return channel?

MR. CRAMER: Absolutely. Absolutely.

MR. FRINK: Have you done any evaluation of the percent of water which is diverted upstream at the intake channel that, actually, returns to the river down below at the return channel?

MR. CRAMER: Have not. I've done no measurement of the volume of water in that bypass channel.

MR. FRINK: Okay. Is there a method of measuring the pressure, or the suction effects that would occur at the gabion fish screen at the time that the water diversions are being made?

MR. CRAMER: Well --

MR. FRINK: Is there some sort of standard unit or method of measuring the fishery biologists use in determining the suction affect of a diversion on fish?

MR. CRAMER: The standard fish biologist would be a poor one, because we're not engineers, but I can tell you a rather simpleton one that we generally apply to screens.

MR. FRINK: Please.

MR. CRAMER: And that is surface area, total surface area and the volume of water that has to move through that surface area corrected for porosity. You have to figure how much open space there is, total possible open space water can pass through, how much water passes through.

MR. FRINK: Have you done any sort of analysis of the gabion fish screen that's shown on your slide, how it

would compare in that respect to the characteristics that exist at other fish screens with which you're familiar?

MR. CRAMER: I have not done the calculations, but the physical measurement of -- that's why we had the divers, we were, actually, expecting that we might find some hot spots.

So we had the divers float behind the fish screens, a diver would move with the current. In this case, we found no place anywhere on there where anybody moved at all. No -- could not detect -- we intended to measure velocity. We had probes, we had divers, we could find no velocity to measure it.

MR. FRINK: Okay.

MR. CRAMER: That is at the peak of the water withdraw season.

MR. FRINK: All right. I believe that's all the questions that I have. Thank you.

MS. LOW: Mr. Cramer, I have a few questions for you mainly on this Exhibit 2. On Pages 14 through 18 of Exhibit 2 your analysis focuses on the effects of spring flows on outmigration timing of juvenile chinook salmon.

MR. CRAMER: Yes.

MS. LOW: And I'm wondering if you, also, think -- do you think another consideration in setting spring flow releases should be the effects of spring flows on the

survival of juvenile chinook salmon during outmigration and not just the effects on outmigration timing?

MR. CRAMER: I strongly agree with that. And I will carry that survival all the way to the ocean. I would look for the total survival. That's really at the heart of my specific concern with low-flow years, that survival will not be good even though growth and survival inside the Yuba River might be fine.

MS. LOW: Okay. Although, all of your analysis focuses strictly on effects of outmigration timing?

MR. CRAMER: Right.

MS. LOW: When the fish leave the Yuba River and what these stimuli might be in the Lower Yuba River itself for outmigration --

MR. CRAMER: Right.

MS. LOW: -- is that correct?

MR. CRAMER: Right. And then -- well, let me extend that, greater -- in transition to address how that timing relates to survival later on. If you turn to pages -- Figure 7 on Page 25 it discusses how temperature is influenced to -- related to survival through the Delta.

Figure 6 on Page 23 shows how temperature increases up to about the 1st of July. So the later you are, the higher temperature you face going through the Delta. So that's where the tie is made to take that

migration timing to the survival that they would likely experience.

MS. LOW: Yes. That's true in the Delta.

MR. CRAMER: Okay.

MS. LOW: But the concern, also, in setting spring instream flows would, also, be within the Lower Yuba River what the survival may be during the outmigration of juvenile chinook salmon --

MR. CRAMER: Correct.

MS. LOW: -- is that correct?

MR. CRAMER: Yeah.

MS. LOW: Okay. I'd like to go, again, to the study that you cite on Page 19 of the testimony. We're going back again, I have a few questions on that relationship between average spring temperature and median migration date, the data from Roper and Scarnecchia.

Do you know in this study, was sampling conducted over consistent time periods in each of these years?

MR. CRAMER: It was. I can't quote the specific dates, but they were using a rotary-screw trap. And they were, basically, covering the outmigration season. And I can say this is published -- one of the reasons I put this in here and not many of the others that I have calculated on a variety of streams, this one went through the period used, generally, passed the peer review and published in

the Canadian Journal.

MS. LOW: Okay. But you're fairly sure, then, that the sampling was conducted over consistent time periods in each of these years on each of the streams?

MR. CRAMER: Consistent meaning within reason.

MS. LOW: Uh-huh.

MR. CRAMER: They had the same spring periods. You probably had some variations for logistical reasons, but, yes, it covered the full extent of the spring outmigration.

MS. LOW: Okay. And I notice here data from two separate streams are presented on this particular graph together.

MR. CRAMER: Right.

MS. LOW: With no particular -- no range in your outmigration dates. These are just the median dates of outmigration; is that correct?

MR. CRAMER: Correct, it is.

MS. LOW: Okay. Now, the statistically significant relationship that you talk about is that using data from both of these streams combined, or would that be for each of the streams individually, also?

MR. CRAMER: I am not sure. I'd have to look at the paper, again, to find out.

MS. LOW: Okay.

MR. CRAMER: I'm not sure if he used both or not. Jackson Creek is a tributary to the South Umpqua River.

MS. LOW: Okay. Yeah, that was another question.

MR. CRAMER: They're both there. And he was sampling both. I don't know if he combined the data for that analysis or not. I'm not sure.

MS. LOW: Okay. So you're not sure if the relationship was significant for each of the streams, or for the combined data set; is that correct?

MR. CRAMER: Correct, no.

MS. LOW: Do you think it's valid to combine data from a smaller tributary stream and the main stem river in one relationship such as this? Would you consider that a valid --

MR. CRAMER: You'd have to check a couple of things. With this -- final answer to that is the peer review panel of respected scientists had to say, yes, to that answer before this could be published.

But going back to my personal opinion, first thing I would test is: Are there differences -- my first test for combined data is always: Is there a statistical difference between the two things that you want to combine?

MS. LOW: Right.

MR. CRAMER: I didn't do that test on his data, but

as I look at them plotted they appeared to fit the same line pretty well. I doubt there was a statistically significant difference. And he should have, as a standard procedure, done that analysis before he combined them. So I assume that he did, but I'm not certain.

MS. LOW: You're not certain. Okay. So from what you could say from his relationship it's not necessarily that one stream or the other that there is a significant relationship between migration date and spring temperature, necessarily, for an individual stream.

You could say for the basin, in general, that there may be this relationship between spring temperature and timing of outmigration; is that right?

MR. CRAMER: I'm missing that distinction.

MS. LOW: That's fine. That's fine. I think I've gotten the information I need.

MR. CRAMER: Okay.

MS. LOW: The other point that came out just now was that this timing of outmigration was not related to flow in this particular study, it was related to spring temperature and phase of lunar cycle.

MR. CRAMER: Right.

MS. LOW: But not related to changes in flow. Do you know what these changes in spring temperatures were due to if not to flow differences?

MR. MINASIAN: Could we borrow the study, we could certainly answer that?

MR. CRAMER: Right. One of the things I would point out to you right away on this study, when you do a statistical test, there's two parts of it. Usually the one that gets reported is the probability of making a type-one error.

In this case, what he tested for is is there a difference between the lunar cycles, or is there a difference between the temperatures? And he said, yes. He doesn't ask the reverse question which says, what I've been able to detect if there was not.

He has only three years of data. This is 1991 through 1994. This was done for his doctoral dissertation.

MS. LOW: Okay.

MR. CRAMER: I have worked with other data sets, which I can show you that are 12 to 15 years long. A whole lot more information emerges out of longer ones. You can see effects of flow and temperature. He couldn't detect an effective flow, that doesn't mean there wasn't one.

He couldn't separate flow from temperature, they are highly correlated. So the problem always with flow and temperatures are correlated. So you need a lot of

years of data to begin to separate out which one is the causal factor. In his case, he had some warm years compared to cold years. So there was definite differences in temperatures that were atmospheric differences.

MS. LOW: Okay. So these differences were probably --

MR. CRAMER: Some of it.

MS. LOW: -- due to ambient air temperature differences rather than differences in flow?

MR. CRAMER: Some of it. There were differences in flow as well.

MS. LOW: Okay.

MR. CRAMER: But he had a short data set for flow. He could get multiple points here, but not enough to distinguish outflow affects and temperature affects.

MS. LOW: Okay. Okay. Thank you. Let's see, moving on, then, to Page 20 of your testimony. The last sentence on this page cites and uses information from a relationship developed by Jones & Stokes, 1992, that showed a relationship between the April/May flow in the Lower Yuba River and the timing of juvenile chinook salmon outmigration?

MR. CRAMER: Yes.

MS. LOW: This relationship was, also, presented in this phase of the hearing as Exhibit 24 of YCWA testimony.

Since your analysis, also, uses the information from this relationship, I wanted to know if you knew if the trap at the Hallwood-Cordua fish screen was operated over a consistent time period in each year?

MR. CRAMER: I do know that it is not.

MS. LOW: Okay.

MR. CRAMER: And in my -- in my testimony I cited several examples. I used the Yuba last. I knew everyone was interested in the Yuba, because that's what this hearing is about, chinook salmon -- chinook salmon whether they are in the Yuba, or in the Sacramento, or in the Rogue, so I cited several examples.

The Yuba are consistent with the other examples where we have better sampling. The example in the Yuba is troublesome on all of our parts, the one happened statistically accurate in that the sampling period is not always the same, nor is the percentage of the flow diverted always the same. It's got all these little problems in it that you have to overcome.

But the influence of temperature -- the influence of what I call -- whichever if it's flow or temperature, the influence of a low-flow high-temperature year is substantial enough that it shows up even in data that have all these oddities and when the sampling was done.

But, I guess, I put my last vote for depending on

data, on the Yuba data, because it is lacking in consistent sampling efforts between seasons.

MS. LOW: Okay. You said that you had other evidence presented here in your testimony of the relationship between flow and outmigration timing; is that correct?

MR. CRAMER: Right.

MS. LOW: Could you show me those relationships? I know that there are relationships with water temperature. I wasn't aware that you had presented other evidence of the flow outmigration timing relationships from other streams.

MR. CRAMER: Okay. I'm trying to get to my outline notes, so I can do this quickly without wandering. Okay. I have one here that is temperature. That's the Rogue River.

MS. LOW: Right.

MR. CRAMER: That one is driven -- and temperature and flow -- maybe I have -- within our Rogue reports, I'm not sure I have it cited exactly in here. I'll just tell you we had to do this analysis -- we had to do it on the Rogue River. We had to do it -- well, in fact, I do have some I think in here, maybe on Rogue.

I could show you pages of multiple regressions and all the outcomes of alternative regressions. And you

have to finally make a choice, the choice always is a subjective one.

Flow and temperature are so highly correlated that they both could be used very well to explain migration timing. The graph that I do have is temperature in the Rogue River. Let me show that real quickly to clarify what I'm talking about.

MS. LOW: Right. I think --

MR. CRAMER: This one --

H.O. BROWN: Do you have an exhibit number on that?

MR. CRAMER: That could be in my '92 testimony.

MR. MINASIAN: It's in your '92 testimony, but I don't have the exhibit number, I'm sorry.

H.O. BROWN: Can we mark it?

MR. MINASIAN: Yeah. Why don't we mark it --

MR. CRAMER: Just to explain real quick, in the Rogue River we ended up choosing this, because we used a variety of tests. The temperatures and flows came out, essentially, the same. They were highly correlated between years. This shows you, I think, about -- I'd have to count the dots, 10 or 12 years of data there. 1974 to 1983, 10 years of data.

And as the percentage of the outmigration that had passed Savage Rapids Dam -- Savage Rapids Dam has an irrigation diversion. And the fish are collected in the

bypass there. It is operable, generally, from about the 1st of April throughout the entirety of the summer and most of the fish pass midsummer, they are later than what you would experience in the Sacramento.

But at any rate, what you can see is through all of those years there was consistent sampling for, at least, five months of the year. And these were of fish passing during those five months. In low-flow years a much higher proportion that went out during that time occurred earlier in the season.

So we had the percentage migration by July 15th on the Y axis; river temperature on the X axis. So you can look around there you see that when it's up there around 12 and a half degrees C, that would be 55 in the upper basin. On those years you have a large percentage of the fish out by July 15th.

Now, on that very same year, that temperature in that river, when you get to the mouth of the river -- see, those fish didn't know the water was warm in the mouth. So the selection had to occur through who survived back through adulthood. The mouth of the river was over 70 degrees in those years, while it's running only 12 degrees up where the fish are. They have to have their triggers coincide with the surviving mode, otherwise, they don't know what is up ahead.

You asked about flow --

MS. LOW: Okay. Okay. Yeah, my question was concerning flow, but now that you have mentioned this, have you done any analysis on the Lower Yuba River between outmigration timing and river temperature? Have you done any analysis of that?

MR. CRAMER: Have not.

MS. LOW: Okay. You have not, okay.

MR. MINASIAN: Other than what he testified in '76 -- '75, '76, '79, '84? He's --

MR. CRAMER: I talked to you about what are low-flow years and high-flow years and some examples about what does the date indicate when they went, but you asked temperature versus survival.

MS. LOW: Yes. I was referring to the relationship, the potential relationship on the Lower Yuba River between temperature and outmigration timing, but you have not done that analysis --

MR. CRAMER: No.

MS. LOW: -- is that correct? Okay. Getting back to the flow outmigration relationship, you stated, then, that the trap, as far as you know, the trap at the Hallwood-Cordua fish screen was not operated over a consistent time period each year.

So could you say that the relationship between

average April/May flow and outmigration date could be biased by those differences and sampling period?

MR. CRAMER: Yes. So the challenge is always to figure out what the bias is and how do you correct for it and how --

MS. LOW: Right.

MR. CRAMER: -- you interpret the information.

MS. LOW: Right. Okay. I just wanted to make that clear, because you base some analysis on that relationship.

MR. CRAMER: Yeah.

MS. LOW: And, you know, to use that relationship to go on from there, you have to trust that that relationship was valid. But you're saying that there's potential bias in that relationship?

MR. CRAMER: Yeah. And here's how I would redo that analysis, if I had that data to work with. And we have done this in the Stanislaus and found this really to be meaningful.

As the juveniles outmigrate, there's really kind of three phases of their life stage they migrate out in. One is as fry, fairly newly emerged in the gravel. They respond differently to flow and temperature at that stage. That isn't even measured here at Hallwood-Cordua, because the screen is not operating. The diversion misses that

entirety of that outmigration. So what you have in April really -- that outmigration occurs in January.

MS. LOW: Right.

MR. CRAMER: So the whole issue is gone. Okay. So now we're still dealing with them out there in March/April. At that point you are dealing with -- I call them parr. They are under about 80 millimeters. Up to usually 80 millimeters and above where they are usually physiological queued in, about ready to migrate. And so it's about that size that you see temperature and flow stimuli kicking in.

What I would do is go back to the sampling and work only with smolt outmigration where they're over 80 millimeters, where the mean length is approaching 80 millimeters. And I would work with that sampling period when you've got fish qualifying as smolt and look at how does that smolt outmigration fit responses to temperature and flow.

So I'm not working with a mixture of some fry and some smolts. So that's the way I would overcome the problem that you have differential sampling.

MS. LOW: Uh-huh.

MR. CRAMER: I would start to bring them together by life stage.

MS. LOW: And would it be more valid to look at a

more consistent time period in each year to say anything about --

MR. CRAMER: It would be nice, but the most important thing is you have the same life stage. So what I would do is I would look for that smolt life stage to do the analysis by smolt life stage. And I think that would be very doable on the Yuba, because I think for the vast majority of the years the sampling covered the entirety of the smolt outmigration. It started while they were still smaller than 80 millimeters and then they got into that range by the time the sampling was already done.

MS. LOW: Okay. Okay. Moving on, then, on Page 24 of your analysis, you argue that contrary to the analysis in the draft decision that the recommended spring flows in the decision may delay outmigration of juvenile chinook salmon to a time of increased risk of mortality during passage through the Delta.

And are you attributing that risk primarily to increased water temperatures in the Delta; is that correct?

MR. CRAMER: It's all the things that go with -- that are associated with increasing water temperatures. As the water temperatures go up, predation rates go up, disease rates go up. So all the things -- just the one outcome we know is the mortality through the Delta is

highly correlated with temperature. The exact mechanism is to be debated.

MS. LOW: Right.

MR. CRAMER: And there probably is a whole bunch of things. The correlation is warmer temperature ends up resulting in lower survival.

MS. LOW: Okay. Okay. That's your hypothesis anyway?

MR. CRAMER: Well, that's an actual correlation.

MS. LOW: Right, in the Delta with survival?

MR. CRAMER: Right.

MS. LOW: Okay. And would you agree that the increasing water temperatures in the Delta throughout the spring and summer months would be due to changes in ambient air temperature that would cause the temperatures to be going up seasonally?

MR. CRAMER: They are related to that, but if that's all they are related to, then we sure don't need flow to create -- air temperatures do it. No, they are correlated to flow and to ambient air, both.

MS. LOW: In the Delta?

MR. CRAMER: Yeah.

MS. LOW: Okay. Is there any direct evidence in years of high spring outflow in the Lower Yuba River that survival and production of salmon is lower than in years

of low-spring outflow? Is there any direct evidence of that?

MR. CRAMER: I have not done that analysis. And it probably could be done based upon return rates using numbers of spawners, numbers of spawners. And you'd have to do a lot of other data, too, because you have variation in harvest rates, but I haven't done that specific analysis.

MS. LOW: Okay. You haven't looked at that?

MR. CRAMER: No. Let me go back to one -- no, I can't tell you specific years in the Yuba. What I was going to say is you could draw -- there is an analysis that I did a substantial report for the Department of Water Resources, 1990, looked at all the coded-wire tagged groups of the entirety of the Sacramento basin and correlated survival of all those coded-wire tagged groups back to factors that were physically occurring in the basin. And temperature was a very strong correlate to survival for hatchery-release groups.

MS. LOW: For hatchery-release groups?

MR. CRAMER: Warmer temperature years produced lower survival.

MS. LOW: Where were the release groups made, in the upstream areas, or within the Delta?

MR. CRAMER: They, certainly, were in the upstream

areas. Because of the very different survival, depending on release location, I did separate analyses for whether they were released in the Delta, whether they were released on station. Separate analysis for Coleman, for Feather. And I did it in 1990, so it's ten years ago. I would highly recommend the report for review to look at that issue, because it does have analysis for temperature. I don't have it all on the top of my mind to quote it accurately.

MS. LOW: Okay. But that has -- okay. But my question, again, was trying to relate higher spring outflows to subsequent production in the Lower Yuba River. You have not done that analysis with flow --

MR. CRAMER: No, it would have to be done directly through other data and I haven't.

MS. LOW: Okay. The spring outflows in the draft decision I think are in the order of 1200 cfs, something like that. Are you aware that the unimpaired flows in the Lower Yuba River in April and May, the average was between 6,000, 6500 cfs?

MR. CRAMER: Right.

MS. LOW: Would you expect under these spring flow rates under unimpaired conditions, which are approximately six times as high as the minimum flow recommendations in the draft decision, would you expect under those

conditions that outmigrating chinook salmon experience low survival through the Delta?

MR. CRAMER: With 6,000 cfs, unimpaired, the whole Delta would be unimpaired. So you would have had everything else unimpaired as well. And you would have much, much higher flows. No, I think that would be a great idea.

MS. LOW: I'm not recommending implementing --

MR. CRAMER: Yeah. Unimpaired conditions in a, what you call average, the key thing about averages is that's what I'm getting at on my whole point on this outmigration thing is that averages can hide within them your trouble spot. And the trouble spot is not the average.

In an average and above average year, I think you're great. You're going to have a serious problem in the low-flow years. That's where you're going to cause a mismatch.

MS. LOW: Yes.

MR. CRAMER: Under impaired conditions, because everything is impaired.

MS. LOW: Yes, but I mean your hypothesis is the higher the spring flows, the lower survival -- the lower the survival will be through the Delta, because you're delaying outmigration to a point where --

MR. CRAMER: No, only if it was a mismatch. And the

place that it would be a problem would be the low-flow years, because I doubt that you would have a mismatch of their migration timing, on average, in high-flow years.

They would probably go out at a time when it's still fine to get to the Delta. Those years you would not have the same high temperatures in the Delta. In other words, the temperatures in the Delta are not -- they are a function of flow of and of time of year.

MS. LOW: But ambient air temperatures in the Delta have a significant effect --

MR. CRAMER: Right.

MS. LOW: -- on the Delta --

MR. CRAMER: Yeah. What I'm saying is the conditions in the Delta in a low-flow year are different than a high-flow year on the same day, same air temperature.

MS. LOW: I won't argue with that, but my point is that you've made a relationship between -- you've made it your theory that outmigration may be delayed to a time of increased risk through the Delta due to the draft decision flows. And I'm just trying to fair it out a little bit better.

MR. CRAMER: Right.

MS. LOW: How far would you take that, the relationship between mean April/May flows and the

outmigration timing?

MR. CRAMER: I'd only take it to the low-flow years. And I would do some analysis to figure out what constitutes that. We have actual data on outmigration timing from the Yuba for smolts. You can look at how that varies between years. And you can look at conditions in the Delta, given those kind of flow conditions, but you have to work with real data and watch for the concern of causing fish to stay longer based upon real data that we observed in the Yuba compared to the expected conditions in the Delta.

MS. LOW: I would agree. I would agree with that, it would be good to have some real data.

Thank you very much, Mr. Cramer.

H.O. BROWN: You have some questions?

MR. FRINK: Yes, I do.

H.O. BROWN: Go ahead.

MR. FRINK: Yes, Mr. Cramer, I do have a couple follow-up questions. Before I was asking you about the effect on the fish on the diversions through the gabion fish screen. And you mentioned having snorkelers float in the diversion side of the gabion fish screen to see if there were any hot spots.

Do you know what the rate of pumping was on the day that you had the snorkelers there?

MR. CRAMER: Yes.

MR. FRINK: Okay.

MR. CRAMER: Now, you said the river side and we did both sides. There's the side that has --

MR. FRINK: If you want to put the transparency up, again, that's fine.

MR. CRAMER: Yeah. Okay --

MR. LILLY: Excuse me, Mr. Brown, I object. To the extent, I think it was inadvertent. Mr. Frink is referring to pumping. There's no pumping with this diversion. It's gravity feed.

H.O. BROWN: It's gravity feed.

MR. FRINK: I can rephrase the entire question.

MR. CRAMER: That's all right.

MR. FRINK: Okay. I do see that there is some diversion through underground diversion pipes from what is marked as the diversion pond into what is marked as the diversion canal.

MR. CRAMER: Right.

MR. FRINK: Do you know what the rate of the diversion through the pipes --

MR. CRAMER: Yeah.

MR. FRINK: -- was on the day that your snorkelers were along the face of the rock gabion fish screen?

MR. CRAMER: Yes. It would be on the backside of

that screen over here in the pond -- on the forebay, because they would experience drift along -- there is current coming down here from the side channel. So they would experience drift over here. On the back pond, no motion at all, just calm.

Maximum diversion that season was 150 cfs through the pipes. There's additional increase of flow in the canal that comes through just all the rocks and whatever. The actual diversion through the pipes was 150 cfs.

MR. FRINK: Okay. And that's all gravity flow?

MR. CRAMER: Yeah, all we do is open the pipe up here. See this point back here, I could only roughly quote you now, I should have brought a picture, but this is like 50 feet lower. There's another berm right here and you walk down a very steep hill to get down to where this starts.

MR. FRINK: Okay.

MR. CRAMER: So they just have openings in the pipe and you just open a little bit and it comes shooting out. And you have a lot of head on it.

MR. FRINK: Okay. I believe that there's been statements elsewhere, it may have been at the earlier hearing, about the percentage of the water that is diverted from the river into the intake channel that, eventually, goes through the gabion fish screen. And

there was some testimony that that can reach as high as 90 percent.

If that occurred, would that concern you that it might have an adverse effect on migrating salmonids? If 90 percent of the water that was diverted into the intake channel, flowed through the gabion fish screen into the diversion pond, would that concern you that it might adversely affect migrating fish?

MR. CRAMER: I guess I'd have to say, yes. I'm trying to think if that's even anywhere in the realm of possibility. The Hallwood-Cordua on the other side. You've got to have some water going over there.

MR. FRINK: No. No. I'm talking about: Of the water diverted into the intake channel for the rock gabion fish screen --

MR. CRAMER: Okay. Let me get this right. So you're talking about if 90 percent of this water.

MR. FRINK: Right.

MR. CRAMER: Is diverted, so you only have ten percent coming out.

MR. FRINK: Yes.

MR. CRAMER: Would I view that as a problem?

MR. FRINK: Yes.

MR. CRAMER: No. The reason being, you have to go look at this space here, but after the water comes out,

there's a small road here. And then it is a small canal, it runs like a creek. It's got like little ripples, looks like a little natural creek in there. But it doesn't have a lot of flow in it.

But a whole lot of fish didn't go there to start with. No, I don't see that as a major problem. What I was envisioning your picture, you were saying what if I have all the Yuba River fish --

MR. FRINK: No. The way you described it, my question is correct. I was just referring to 90 percent of the flow into the intake channel.

MR. CRAMER: Yeah. No, I think having that ten-percent bypass flow is sufficient to carry those fish the remainder of the distance back to the river. And there's no big, deep holes, no great place for accumulation of predators, or anything.

There's no -- the key thing that bypass criteria would have for fish screens is an adequate flow to sweep -- would, actually, create a sweeping flow and have size and velocity and things relative to screen flow as to what is adequate for bypass.

MR. FRINK: But you would want to be certain that the channel is not obstructed?

MR. CRAMER: Correct.

MR. FRINK: So it flows freely to the river?

MR. CRAMER: Right.

MR. FRINK: Ernie?

MR. MONA: Just one question, Mr. Cramer. Do you have any recommendations today regarding what additional studies may be needed to better define the proposed fishery requirements on the Lower Yuba River?

MR. CRAMER: For the entirety of the Lower Yuba?

MR. MONA: Correct.

MR. CRAMER: Well, the one that I hear discussed here, could be resolved real well. I mentioned a need for a kind of simulation analysis, putting together the data on how we would have the expected timing of outmigration and how that would match up with the expected conditions in the Delta.

Rather than all theorizing on it, we could construct based on the best data what that, actually, would be. And I would really recommend that get done. To improve the data at Hallwood-Cordua, there are great opportunities to use that as a monitoring site.

Now, there's been a rotary-screw trap installed out there. And, perhaps, that's going to be sufficient if they're going to use that year after year to get the outmigration timing. Then, we could get rid of the concern over inconsistent sampling at Hallwood-Cordua.

The other way would be is we would typically do

code-released marked fish upstream and determine the proportion, periodically, throughout the season that are brought into the Hallwood-Cordua Canal.

So you could, now, retrospectively, go back and identify what the actual sampling frequency was at Hallwood-Cordua. If you follow me, it's usually related to percentage of flow diverted. We could go now and over several different flow ranges, figure out, by releasing marked fish above that site, what percentage are going to the Hallwood-Cordua trap.

And then we go back to the past years' data and establish that relationship between the efficiency of the trap versus flow. And do a better job of cleaning up some of our old data, so it's more confident in its use. Those are a couple of things. There's a whole lot more I could think of, if you gave me a while to think about it. Anyway, those are a couple off the top of my mind.

MR. MONA: Sure. We have a couple more minutes.

MR. CRAMER: Yeah.

MR. MINASIAN: So let's go through it. Growth rates?

MR. CRAMER: Growth rates, I presented data in my 1992 testimony from sampling that had been done at Parks Bar on growth rates. What that indicated was the fish were growing slower in years of high abundance.

You could do an analysis on growth rates at Hallwood-Cordua by looking at mean size by given date. We did that on the Rogue River and found it quite meaningful. So you could do that with existing data. You could look at size on a given date at Hallwood-Cordua versus environmental variables, which would have to include fish abundance. You have to have a measure of fish abundance, because fish abundance and temperature are going to be the two variables that will come out.

Scale analysis, most of the information after 12 years of study in the Rogue Basin that we were able to tell about what effect did the survival and the growth rate was premised very much on data we gained off reading the scales to determine the age of return and the growth of -- growth rate of juveniles based on scale spacing and size at migration based on scale radius at ocean entry determined from the scale.

So those are kind of additional pieces of work that could be done probably with existing information. I don't know if there are good scale collections or not, but I think that there are. So those would help resolve a lot of the questions about growth, what factors related to growth within the Yuba River.

MR. MINASIAN: So there also seems to be an assumption that if you fluctuate flows from October 15 to

March 1, you kill fish, you dewater redds. Would you like to comment upon the evidence and testimony?

MR. CRAMER: Yeah. There is a strong link that could really benefit from some study. Studies -- and I put this in my direct testimony. Studies that have been done on the effect of fluctuating flows on redds consistently show that survival -- now you're sorry that you asked this, aren't you?

MR. MONA: Well, I just thought, you know, one more recommended study.

MR. MINASIAN: Yeah.

MR. CRAMER: The studies that have been done on that consistently show that survival is a lot higher than some might expect it to be, because the eggs are still wet in the gravel, that they are already hatched as alevins in the gravel, that they swam away from the problem, so survival is much higher than you think just by thinking, gee, we've got our redds dewatered.

You determine how to efficiently use that flow by doing some actual instream sampling of those redds. And conduct some flow fluctuation studies. I think that would be wise, given the value of water these days so that you don't unnecessarily keep a lot of water out there that didn't really have to be there to protect redds. In a natural system, flows fluctuate and redds are periodically

dewatered in pristine environments.

MR. MONA: Thank you very much.

MR. MINASIAN: Mr. Brown, I have just one question for redirect.

H.O. BROWN: I have a question.

MR. MINASIAN: Good.

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CROSS-EXAMINATION OF SOUTH YUBA WATER AGENCY AND CORDUA IRRIGATION DISTRICT BY THE BOARD

H.O. BROWN: Mr. Cramer, in your opinion, you were talking about the gabions, is that a major problem, a minor problem? How often does that happen? And what's your opinion of it how it effects the outmigrating smolt?

MR. CRAMER: My -- I would have to base it on only two years of sampling. I haven't looked at the flow frequencies. 20,000 cfs flow at the Marysville gauge overtops that. And as I mentioned, that has happened in the two years that there was sampling done in the forebay pond. That pond behind the gabion that leads into the canal.

In both of those years, the number of fish observed in that pond were very few. I have forgotten how many it was that were observed by Cal Fish and Game when they were back there. It was either Smith's study in '89

or Konnoff's in '88. They did sampling in that pond and it seems they caught four juveniles, but that would need to be checked. It was very few.

We estimate that a total of no more than 25 were in that pond in the year that we sampled. That's based upon we sampled until all of them were done moving out and expanding for the few days that water, actually, went through another pipe that we didn't sample. So expanding for the unsampled volume, we expect about 25.

In other words, I think it is negligible. I cannot imagine a beautiful state-of-the-art screen out there that could do a better job. And there would be environmental occurrences that would cause it to fail. There always are. When I say, "fail," meaning a momentary problem.

H.O. BROWN: When you had 150 cfs into the south canal, were you able to measure any head differential between the supply water and the intake canal and the diversion ponds across the gabion?

MR. CRAMER: So you're talking about measure on either side of this?

H.O. BROWN: Right.

MR. CRAMER: We didn't, specifically, measure for head, because you have waves and you have a flowing water running across this side. And you have total calm

water -- I'm sorry, calm water in this pond.

And so our intent was to measure velocity in the backside to see where it was coming through. And we couldn't detect it anywhere. I assume that means if I could get a nice balance of head differential, I wouldn't be able to measure that either, but we didn't do those measurements.

H.O. BROWN: So there is, at least, nothing obvious?

MR. CRAMER: Nothing obvious. We spent a lot of time trying to find it.

H.O. BROWN: I was out there once, but I can't remember, can those gabions be raised if they have to?

MR. CRAMER: I'm not an engineer, but it sure looks like they could to me. You can, in essence, drive a truck out on them. It's a road width on top of the thing. And, yes, I think it could be raised.

H.O. BROWN: Is there any history as to the size of rock, or gravel that's in those gabions?

MR. MINASIAN: Uh-huh.

MR. CRAMER: Yes. I wouldn't be the best expert on it, but I can tell you that on the exterior side that I can see and what's reported to have gone in it, it's, basically, built out of river cobbles. It's -- you can see it in photographs when you look at it. I'd say it's probably four or eight-inch diameter cobbles, something in

that range. It is not riprap.

H.O. BROWN: Is there a set of specifications for it?

MR. CRAMER: Yes.

H.O. BROWN: All right. And you had redirect, Mr. Minasian?

MR. MINASIAN: Yes, I've got two now.

H.O. BROWN: All right. On cross-examination we are pretty liberal on what the questions can be. But on direct and recross, recross is limited to the questions that are asked.

With that spirit in mind, Mr. Minasian, please, proceed.

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REDIRECT EXAMINATION OF SOUTH YUBA WATER AGENCY AND CORDUA IRRIGATION DISTRICT

BY MR. MINASIAN

MR. MINASIAN: Right. Mr. Mona asked you a question in regard to -- strike that. Let me not ask that.

Mr. Cramer, when your divers were out there and trying to detect velocity, did he have a thing called a probe which will mechanically measure and electronically record velocity through the face of that gabion?

MR. CRAMER: They had it in their possession.

MR. MINASIAN: Right. But it will not work in low

velocities, will it?

MR. CRAMER: Correct, it won't. It won't work in velocities where you can't even -- by the naked eye, or by flowing material, if everything is holding still in the water, you can't see anything moving, the probe won't move either.

MR. MINASIAN: And would you describe those fish that were not able to find refuge in the diversion pond, in the January storm, of 20,500 at Marysville, where did those juveniles go?

MR. CRAMER: Juveniles that came -- now, wherever there are floodwaters the fish go.

MR. MINASIAN: Okay.

MR. CRAMER: So they're out on the edge of the flood wherever it goes to. They would have passed into that pond. I understand that there can be releases of water out of that pond that can be routed back to the river.

MR. MINASIAN: Right. Do you understand that's the normal operating criteria for the pond, first releases go back to the river?

MR. CRAMER: No, I didn't. I didn't, no.

MR. MINASIAN: Okay.

MR. CRAMER: I think, then -- now, if that's true, what that would mean is the year that we sampled that was, specifically, not done, because we wanted to sample every

day that any water came out of that pond.

MR. MINASIAN: Okay. You provided testimony with regard to results in Oregon and Canada. As we go south along the coast, is there any trends, or tendency in regard to anadromous fish in regard to temperature? That is as we move south, does the temperature tolerance of chinook and steelhead rise?

MR. CRAMER: There are indications that it does. That is poorly documented. We know that warmer temperatures exist as you go south. There's been a few studies on a few specific stock suggesting that they may be more tolerant to high temperatures. But for the most part, the answer is: We have not demonstrated substantial differences as you move south.

MR. MINASIAN: Okay. Thank you.

Thank you, Mr. Brown.

H.O. BROWN: Thank you, Mr. Minasian.

Let's see a show of hands on who would like to redirect.

All right, Mr. Cunningham, you're up. I'm sorry, recross. Would you like to take a break and you can think about it over the break?

MR. CUNNINGHAM: I think I can do it in about two questions, Mr. Brown.

H.O. BROWN: All right.

MR. CUNNINGHAM: I just have to hurry and get them.

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RECROSS-EXAMINATION OF SOUTH YUBA WATER DISTRICT AND CORDUA IRRIGATION DISTRICT BY CALIFORNIA DEPARTMENT OF FISH AND GAME

BY MR. CUNNINGHAM

MR. CUNNINGHAM: Mr. Cramer, again -- and, Mr. Brown, with your understanding of the scope of recross, I'll ask my first question with the understanding that it may or may not be within the scope, but I think it is. And I think Mr. Minasian was talking, again, about velocities through the gabion at the time you were there snorkeling.

Did you earlier testify what the actual release from that pond into the diversion works was, was that 150 cubic feet per second?

MR. CRAMER: Yes.

MR. CUNNINGHAM: And do you know if that is the maximum that the South Yuba-Brophy people can divert and release through that facility?

MR. CRAMER: I do not know that. I do know that it was surprising to me to understand the amount of water going down their canal was substantially more than the amount of water coming down that pipe.

So you can't determine their diversion out of

that pipe based on the canal flow, because they get a substantial amount of accretion into their canal through the gravel flow across the Yuba-Brophy. So all I know is the 150 cfs is all they had. And you have to ask if that's -- yeah, it's 150. I just don't know if that's -- that was the maximum that year and it was in August. I don't know if it's possible for them to divert higher volumes through those pipes or not.

MR. CUNNINGHAM: Okay. Then the other question I had for you: You just mentioned something in your redirect about the potentiality of flows that overtop the gabion being released back into the river during certain times of the year.

MR. CRAMER: Right.

MR. CUNNINGHAM: And do you have any information about whether or not when that happens the fish that have come in with the overtopping then go back out?

MR. CRAMER: Yeah. The only way we would be able -- that is a good question. And the way you would have to look at that would be based on exactly what we did. We set the net down there and turned on the flow and looked at the time the fish come out. Some come out right away, some don't come out right away. You rescue a few of them, others you wouldn't.

MR. CUNNINGHAM: Okay.

MR. CRAMER: Given that that would be a short-term operation, you pour some fish down, let them bypass out to the river and say you did it for a week or something, you'd -- you would get some portion of them, you wouldn't get them all.

MR. CUNNINGHAM: And I assume you would also be looking for effects of predation within the pond during that period of time?

MR. CRAMER: You would have to assess that. Within my testimony, I pointed out that we did, with that very thought in mind, do a complete circuit of snorkeling all the way around the pond. It is another one of those gravel ponds that is deep, sharp drop-offs.

So it's not a great opportunity for holding fish, but I don't have the numbers in my mind. We observed low numbers. There was very low densities of predatory fish in that pond.

MR. CUNNINGHAM: But you would have to examine that question as well to determine --

MR. CRAMER: How many got lost, yes.

MR. CUNNINGHAM: That's all the questions I have.

Thank you, Mr. Brown.

H.O. BROWN: Okay.

MR. MINASIAN: I would offer the testimony of Steve Cramer, which is Exhibit 2; qualifications of Steve

Cramer, Exhibit 2.1; the study, 1993 study, which is 2.2; the Use of Managed Pulses and Flow to Simulate Outmigration of Juvenile Salmon, which is 2.3, Figure 6, which is an overhead, which will be supplied to everybody, entitled, "Comparison of Daily Chinook Catch and Abundance Index at Oakdale-Stanislaus River, 1995; 2.5, which is the Brett,

B-r-e-t-t, figure; 2.6, which the Rogue River figure; 2.7, which is the Applegate figure; 2.8, which is the 1974/'83 Savage Rapid Dam-Rogue River figure; and 2.9, which would be the Roper-Scarnecchia Study, which Mr. Cunningham if you'll be good enough to give me a copy of I'll supply to everybody.

H.O. BROWN: Okay. Are there any objections to those exhibits being offered into evidence?

MR. CUNNINGHAM: Mr. Brown, if I might have a second?

H.O. BROWN: Mr. Minasian, you have one more witness?

MR. MINASIAN: I do. Thank you.

H.O. BROWN: We'll take these into evidence, if there's no objections, pending Mr. Cunningham's.

MR. CUNNINGHAM: Working backwards, to the extent multiple questions were asked about the Roper study, we only have one copy and we'll provide it to Mr. Minasian.

And we'll make copies for everybody because there were a lot of questions asked about it not only by myself in a limited style, but the staff also had some significant questions about the contents of that stuff.

Mr. Brown, I do have some objections to several of the other proposed exhibits. However, to the extent that several of those were proposed and presented -- or, at least, initially offered during my cross-examination, Mr. Brown, I never chose to follow up and ask questions.

Specifically, for example, on such things on, I believe it was 2.7, which was the Applegate information. And I don't believe anybody else ever asked anything. And I don't believe Mr. Minasian asked anything in redirect. So to the extent that that's there, but there wasn't any direct testimony, I'm not sure there's a foundation laid for admitting that. And I'll object to that exhibit on those grounds.

H.O. BROWN: All right.

MR. MINASIAN: I will withdraw 2.7, then. I think that is a correct description.

H.O. BROWN: All right.

MR. CUNNINGHAM: And, Mr. Minasian, tell me what was 2.6, again, please.

MR. MINASIAN: That is the Rogue River study.

MR. CRAMER: You talking about the one that I

showed?

MR. MINASIAN: Yeah.

MR. CUNNINGHAM: So questions were asked. So my references were specifically to 2.7.

H.O. BROWN: Okay. With the exception of 2.7, are there any other objections?

MR. COOK: Mr. Brown?

H.O. BROWN: Mr. Cook.

MR. COOK: I'm not objecting. I have a question.

H.O. BROWN: Sure.

MR. COOK: I didn't hear what you said with respect to the next witness. Who will be the next witness?

H.O. BROWN: I was just reaffirming with Mr. Minasian that he had one more witness. We have taken his exhibits. We normally wait until all of the direct is through and the cross, and then offer the exhibits into evidence.

MR. COOK: But we will go back, now, to the Yuba County Water Agency?

H.O. BROWN: No. We'll go back to Mr. Minasian. These exhibits are being offered a little out of sequence here, but if nobody objects, I'm going to allow that. If there were objections to it, then we'll hear those.

MR. COOK: But Mr. Rue will be on next?

MR. MINASIAN: No, Mr. Cook, Frederic Reid, who is

the coordinator for Ducks Unlimited, will be a Cordua witness. And you'll find his testimony in the Cordua index.

H.O. BROWN: Will he be making reference to any of these exhibits?

MR. MINASIAN: No, none.

H.O. BROWN: Okay. Is that all right, Mr. Cook?

MR. COOK: The only problem is I spent substantial time last time preparing for other witnesses. And I did not anticipate these witnesses coming up. I guess I can handle that.

H.O. BROWN: All right. That's understandable and that's a reasonable concern. If you're comfortable with that, we'll go with that decision; if you're not, we'll figure it out when we come back after the break.

MR. COOK: Yeah.

MR. MINASIAN: I understand. I believe Mr. Cook is making a valid point. Mr. Reid has to be in Washington to do some testimony or meetings, I believe, tomorrow. And he won't be available Thursday. So if we end up with another day and you've got some questions, I'm sure that I can lean on Mr. Reid if he's back from the chaos of Washington to come back in and answer.

MR. COOK: In the interest of proceeding, it's fine with me.

H.O. BROWN: All right. Thank you. Thank you, Mr. Cook.

Are there any other objections or concerns with the offer of those exhibits into evidence? Seeing none, they're so offered with the exception of 2.7.

We'll take a 12-minute break.

(Recess taken 2:42 p.m. to 2:54 p.m.)

H.O. BROWN: Come back to order.

MR. MINASIAN: Mr. Brown, we'll need to swear Mr. Reid, who was not present at the opening day.

H.O. BROWN: Mr. Reid, do you promise to tell the truth during these proceedings; if so, answer I do?

MR. REID: I do.

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DIRECT EXAMINATION OF CORDUA IRRIGATION DISTRICT

OF FREDERIC REID

BY MR. MINASIAN

MR. MINASIAN: Mr. Reid, would you tell us something about your academic and work background?

DR. REID: Yes. My name is Frederic A. Reid. I am currently the director of conservation planning for Ducks Unlimited in Western North America. I've worked for Ducks Unlimited since 1990. I had a chance to speak to the State Water Board related to these issues in 1992, but the greatest time I spent in this room was over the Mono Lake

water right issues where I was a chief witness related to water and related to wetlands and waterbirds for Fish and Game, Audubon, and the Mono Lake committee.

I hold a Master's degree and Ph.D. in fisheries and wildlife ecology and I have over 20 years of experience in wetland ecology across North America.

MR. MINASIAN: Would you like to summarize your testimony in this case?

DR. REID: Sure. I'd like to start by saying that I am very well-aware of the critical nature of water in the fall and winter for anadromous fish, but the reason I am here is I am also concerned as to the importance of the floodplain habitat that exists in the District 10 region.

And, whereas, historically, many of these areas were a landscape, seasonal wetlands, today much of this area has been impacted through the construction of main stem levees. Although, natural inundation does not occur in these areas, artificial flooding of rice in wetlands does occur and provides some critical habitat for the 70-some species of waterbirds that use these areas.

I discuss a number of studies in my written testimony, I'd just like to summarize a couple of those, because I think they're fairly important. Dr. Chris Elphick, who was at the University of Nevada, Reno, demonstrated that in flooded rice that there was a

preference of flooded rice over non-flooded rice throughout the Sacramento Valley by a wide variety of waterbirds. It includes waterfowl, shorebirds, and colonial waterbirds.

He further demonstrated that that preferred water depth is fairly shallow. It's generally under 25 centimeters of water, which is about 10 inches. And while some of the acreage of flooded rice is critical to these waterbirds, the amount of water within any single field can be relatively shallow.

He further demonstrated that the District 10 area was extremely important for a number of the waterbirds that he investigated. Dr. Jim Hill, who was the chairman of agronomy at the University of California, Davis, has led a team of agronomists since about 1992 with a number of research projects related to rice practices.

Related to this discussion today, his investigations have shown that by keeping the rice stubble moist, or very shallowly flooded yields the best level of decomposition of rice straw. And so it's not that you have to have the rice fields flooded three feet, but rather at a very, very moist level, or a shallowly flooded level is extremely important.

Now, why I bring these up is that we know from other recent studies that the District 10 area is a very

important area in the early fall and mid-fall period for a number of waterbirds. That's been recently demonstrated by Dr. Joe Fleskes. And Dr. Fleskes is trying to replicate studies that were done in the 1980s when we used radiotelemetry to look at pathways that Northern Pintail used habitat in the Central Valley.

What Dr. Fleskes is doing is replicating those studies and looking to see what changes are there in the distribution of pintails and how have either restoration of wetlands or change in water practice is changing the distribution of Northern Pintails.

And what we see from his current investigations are that the District 10 area remain extremely important during the early fall and mid-fall period for Northern Pintails both in diurnal and nocturnal use. As the winter rains occur in median to wet winters, then the birds move out into the rest of the American basin. But that District 10 area, which is that area north of Marysville bordered by Highway 70 on the west, remains a very critical habitat.

The final study I wanted to mention was that of Dr. Glenn Wiley, who we co-funded. And Dr. Wiley has been investigating habitat use of the endangered giant garter snake. And his data suggests that the snakes prefer a mix of semipermanent wetlands, seasonal wetlands, and flooded

rice.

And he has looked in the District 10 area and, certainly, having a mix of those habitats flooded in the early fall and mid fall pre to their dormancy will be extremely important.

And Ducks Unlimited has been working on restoration of wetland habitat, specifically, in regards to the giant garter snake. The most recent effort was in the Colusa Basin. And those efforts have focused on trying to provide a mix of both flooded wetlands and of flooded rice.

And my point that I'd just like to make to the staff and to the Board is that, certainly, the flood -- the historic floodplain habitat has been artificially flooded in the District 10 region over the last 40 or 50 years. And it does maintain some critical habitat for waterbirds.

Those that are of special status such as the white-faced ibis, sandhill crane, as well as the giant garter snake, which is endangered. And I would just like the staff and the Board to consider the fact that some water, even under the most critically dry years, is really important in this region.

Now, there are two discussion points of how to deal with such an aspect, one of which is that birds can

fly away and that they have alternative habitat. And we know based on efforts by some of the members that I've already discussed, that the alternative habitats under extremely dry conditions are very, very limited. We have the federal refuges, the State areas, but they represent -- especially as you move into mid fall -- a very small amount of habitat as for the birds that, potentially, use those areas.

Likewise, there is a potential of using well water in these areas. And well water has both some benefits and some negative aspects to it. Certainly, one of the negative aspects to it is it's very expensive. And when you're looking at private landowners, such as rice farmers, or you're looking at state, federal wildlife areas, those extra-incurred costs may allow a situation where it doesn't become feasible to do it. And, therefore, by forcing water strictly on -- as a mechanism coming from wells, you may eliminate that as a real viable source.

Second thing is that, typically, well water is colder and it tends to be lower in nutrients. Many of these birds are responding to vertebrae prey. We know that as you release cold water out of the sites, cold water is going to delay growth. It's going to delay hatching. And so it would impact the type -- impact the

abundance and the food resources that would be available for these waterbirds.

And, basically, just in conclusion, I just would like to bring forward to the staff and to the Board the fact that we are very concerned about this habitat given very dry conditions.

MR. MINASIAN: Doctor, would you focus and summarize your level of concern? Are you slightly concerned, moderately concerned, seriously concerned if District 10, in fact, is delayed in its ability to flood? And if so, why?

DR. REID: Yeah. As I said before, that we know that District 10 for pintails, for species such as tundra swans are extremely important for early and mid winter. And so if you do not have viable habitat in the District 10 area during those periods, it's going to impact those species. So in terms of your criteria, I would say that we're very concerned that given dry conditions there would not be enough viable habitat out in the area.

MR. MINASIAN: And if the water is delayed into a colder temperature period, is there an effect upon the production of the invertebrates as a result of flooding the field, whether it's well water or surface water, if there is a delay in application, is there an affect?

DR. REID: Yeah. We do know that the chironomids,

which are the major food source, do respond in terms of growth and numbers. And as you provide colder water the growth rates are reduced.

MR. MINASIAN: When a species is a special status species, does that mean that there is a concern that it may become either threatened or endangered under either the California, or the State law?

DR. REID: Right.

MR. MINASIAN: Okay. And do you have advice for the Board in regard to what process they should undertake being a person trained as both a fish biologist and with a job now related to waterfowl?

DR. REID: Well, let me say I have degrees in fishery and wildlife ecology. I would not classify myself as a fisheries biologist. However, I will say that I am somewhat embarrassed in that I don't come forward with a prescription. It's easy to come forward and say, hey, you need to be concerned about this, but if you don't offer a prescription I recognize that it's tough for the staff and the Board.

However, my recommendations are that there be some considerations for allowing surface flooding to some degree on both the natural, seasonally flooded and semipermanent wetlands that in the core of District 10 are about 3,000 acres now and rice that provides some really

critical habitat for both the waterbirds and, apparently, for the giant garter snake.

MR. MINASIAN: Thank you.

H.O. BROWN: All right. Mr. Gee?

MR. GEE: Thank you, Mr. Brown.

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CROSS-EXAMINATION OF CORDUA IRRIGATION DISTRICT
BY U.S. DEPARTMENT OF INTERIOR, FISH AND WILDLIFE SERVICE
BY MR. GEE

MR. GEE: Mr. Reid, I just have a few questions for you. If you could -- you made a number of references to studies conducted by a Dr. Chris Elphick.

DR. REID: Uh-huh.

MR. GEE: Could you give me the name of his study that you relied on there?

DR. REID: Sure.

MR. GEE: I didn't see a list of references in there.

DR. REID: Sure. I have a publication, it's in the Journal_of_Applied_Ecology. The title of that manuscript is, "Winter Management of California Rice Fields for Waterbirds."

MR. GEE: Can you run that by me again, slowly?

DR. REID: Yeah, I'm sorry. It's in the Journal_of_Applied_Ecology. It's Volume 35, Pages 95 through 108.

And it was 1998 that it was published. He also has published several other manuscripts, but this is core.

MR. GEE: Okay.

DR. REID: And Orring was his coauthor.

MR. GEE: Secondly, there's another reference you made to a Dr. Jim Hill?

DR. REID: Uh-huh.

MR. GEE: Is there a particular article or study that you refer to?

DR. REID: Actually, yeah, there's a number of them. Probably a good summary one would be -- there's one -- probably a good summary one would be the principal author was Silvi Brouder, B-r-o-u-d-e-r, Hill was the second author, published in 1995. It was in California Agriculture, Volume 49, Pages 58 through 64. And that title of the manuscript is, "Winter Flooding of Rice Lands Provides Waterfowl Habitat."

MR. GEE: Okay.

DR. REID: They've got a more recent manuscript that's in press in an international rice symposium that really provides the most current information, same coauthors.

MR. GEE: You mentioned some ongoing research by Joe Fleskes.

DR. REID: Yes, F-l-e-s-k-e-s.

MR. GEE: So that is still in progress?

DR. REID: Yes.

MR. GEE: And Dr. Glenn Wiley.

DR. REID: Yes.

MR. GEE: Can you give me the name of his work that you relied on?

DR. REID: That's still in progress as well. Both Dr. Wiley and Dr. Fleskes are with the USGS at the Dixon field station, Biological Research Division.

MR. GEE: Thank you, Dr. Reid. That's all I have.

H.O. BROWN: Mr. Baiocchi?

MR. BAIOCCHI: Thank you.

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CROSS-EXAMINATION OF CORDUA IRRIGATION DISTRICT

BY CALIFORNIA SPORTFISHING PROTECTION ALLIANCE

BY MR. BAIOCCHI

MR. BAIOCCHI: Good afternoon, Doctor. I just have two questions. Are you speaking on behalf of Ducks Unlimited today?

DR. REID: I am, yes.

MR. BAIOCCHI: Okay. Is Ducks Unlimited against the protection and restoration and enhancement of federally threatened steelhead and spring-run salmon of the Yuba River?

DR. REID: No. I think that's why I began my

statement by saying that we are well-aware of the critical nature of this water. And we applaud the Board for listening and realizing that that's important.

MR. BAIOCCHI: Okay. Thank you very much.

H.O. BROWN: Mr. Sanders?

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CROSS-EXAMINATION OF CORDUA IRRIGATION DISTRICT

BY CALIFORNIA SPORTFISHING PROTECTION ALLIANCE

BY MR. SANDERS

MR. SANDERS: Good afternoon, Dr. Reid.

DR. REID: Hi.

MR. SANDERS: I want to start by just asking you what's District 10? That's a terminology that we haven't used, yet, in these hearings.

DR. REID: District 10 is a term that applies to a broad area. It's -- I guess in its broadest sense about 20,000 acres of core. It is about 10- to 11,000 acres. And it's an area of historic wetlands north of Marysville. It's a broad circle. It's, basically, east of Highway 70 north of Marysville.

MR. SANDERS: Okay. So is it contiguous with the Cordua Irrigation District?

DR. REID: I can't -- I can't tell you how that fits.

MR. SANDERS: Okay. That's fine. Now, referring to

paragraph two of your testimony and also just kind of throughout your testimony you use the term, "critical." I'm looking at, I think, the fifth sentence of paragraph two.

(Reading):

"These habitats remain critical for a number of wetlands species."

Then further on, two sentences down,

(Reading):

"We know that these wet habitats are critical to some 70 species of waterbirds as well as other species."

And then, finally, the final sentence,

(Reading):

"The surveys revealed or demonstrated that on the landscape level, flooded rice and wetlands in District 10 are critical for species such as Dunlin, Short-Billed Dowitcher, and Western Sandpiper."

I guess my first question is: What do you mean by "critical"?

DR. REID: I'm supplying emphasis there. It's not a designation that represents any federal or state type of information. It rather designates the fact that I was showing emphasis.

MR. SANDERS: Okay.

DR. REID: The fact that I listed critical three times in the same paragraph, it's fairly redundant.

MR. SANDERS: You're anticipating my next question. I'm going to refer you to previously used exhibit SNW -- or NMFS-13, which was submitted by National Marine Fishery Service. And, conveniently enough, it's got a definition of, "critical habitat." I'm just going to give you this and ask you to read the highlighted section. The pink highlighted section.

DR. REID: Right. Before I read this, what you've given me is a designation on the Endangered Species Act. Nowhere did I state in my testimony --

MR. SANDERS: Right, I understand that.

DR. REID: But I'd be happy to read this to you. This is from the Federal Register, definition of critical habitat. Critical habitat is defined in Section 35(A) of the Endangered Species Act as,

(Reading):

> "(I), The specific areas within the geographic area occupied by the species on which we have found those physical or biological features, one, essential to the conservation of the species; and, two, which may require special management considerations and protection."

MR. SANDERS: Okay. Thank you very much. In your opinion, are the rice fields in Yuba County essential to the conservation of any species of waterfowl, essential to the conservation?

DR. REID: On what basis, on a continental basis?

MR. SANDERS: Well, I'm going to leave it up to you. Are they essential to the conservation? You can answer "yes" or "no," or "I can't answer based on that question."

DR. REID: Okay. So for waterfowl we're looking right now at 31 species that regularly used California habitats. So I'm going to have to go, you know, to the major groups. But let me just say that:

First of all, we know that the Northern Pintail, typically, has somewhere between 50 to 75 percent of their wintering population of the continent that winter in the Central Valley of California. And we know that District 10 is an essential habitat for Northern Pintail. So I'd say for the Northern Pintail --

MR. SANDERS: Hold on a second. My question is: Are the rice fields essential to the conservation of any waterfowl species, the rice fields?

MR. MINASIAN: You mean the flooded rice fields?

MR. SANDERS: The flooded rice fields within Cordua Irrigation District, I'll make it that specific, are they essential to the conservation of the species?

DR. REID: Well, again, given a dry fall, we have done energetic models for waterfowl in the Central Valley. And we know that virtually all of the existing flooded habitat is needed early fall and mid fall.

And so if you say, is it essential, then can we dry it up, I would say you would have to have alternative habitat that currently does not exist out there.

MR. SANDERS: Okay. I'm going to move on. To your knowledge, are the rice fields in Yuba County designated by the U.S. Fish and Wildlife Service as critical habitat for any species?

DR. REID: Not to my knowledge.

MR. SANDERS: Do you know if NMFS has designated the Lower Yuba River as critical habitat for steelhead and spring-run chinook?

DR. REID: It's my understanding that they have.

MR. SANDERS: Okay. What listed endangered species of waterfowl are known to use the irrigated rice fields in Yuba County, listed as endangered under the Endangered Species Act?

MR. MINASIAN: You mean endangered or threatened?

MR. SANDERS: No. I mean endangered.

DR. REID: None.

MR. SANDERS: What listed threatened species of waterfowl are known to use the rice fields in Yuba County?

DR. REID: The last listed threatened species that was in California, the Delouse Canadian goose was delisted this last fall. So there are none.

MR. SANDERS: Okay. In your position with Ducks Unlimited, you have occasion to interact with farmers on a regular basis?

DR. REID: I regularly did. I'd say irregularly now.

MR. SANDERS: Okay. Well, based on your experience, how would the rice farmers in Yuba County react if the United States government proposed to designate their fields, their private property, as critical habitat for waterfowl?

MR. LILLY: I object on the grounds that that question calls for speculation.

MR. SANDERS: He's an expert. He's allowed to speculate.

H.O. BROWN: Wait a minute.

MR. SANDERS: I'm sorry.

H.O. BROWN: Thank you, Mr. Lilly.

Mr. Baiocchi?

MR. BAIOCCHI: Mr. Brown, that was a great question. I think it should be answered. Thank you.

H.O. BROWN: Thank you, Mr. Baiocchi.

DR. REID: Can I respond?

MR. MINASIAN: No. It's my estimation that we didn't put him forth as a mind reader, or a political census taker. He's not appearing here, nor is he offered as an expert in that particular field.

MR. SANDERS: May I speak?

H.O. BROWN: If he has an opinion --

MR. SANDERS: Okay.

H.O. BROWN: -- I'd like to hear it.

MR. MINASIAN: Okay.

H.O. BROWN: If he doesn't have an opinion, he may say so.

DR. REID: Sure. The example comes up in relation to the giant garter snake. When the giant garter snake was proposed for listing, the rice farmers were extremely concerned and very, very worried that there would be critical habitat listed for this species.

As it turns out, rice happens to be a very important component in what the giant garter snake needs. So I would say that if it was to be proposed for waterfowl that initially they would be very concerned.

MR. SANDERS: Concern as in opposed?

DR. REID: I think most would be opposed. I think all would be concerned.

MR. SANDERS: Okay. Thank you. Have any farmers in Yuba County given Ducks Unlimited conservation easement

which guarantees the fields will be flooded in the future?

DR. REID: No. We're currently working -- our only agricultural conservation easements are in the Sutter Basin, to date. There are easements that exist in the District 10 area that are both federal and state. The federal easements include U.S. Fish and Wildlife Service and NRCS.

MR. SANDERS: Okay. I guess -- let's see, where are we? I guess at the very end of your paragraph two, what is AUK?

DR. REID: That's a journal.

MR. SANDERS: Okay. And do you happen to know the name of the study that you refer to? When it was published, et cetera?

DR. REID: I think it should be cited in one of these two. Well, it was, I believe, Dave Shuford. Yeah, here it is. It's Dave Shuford is the first author. It's Shuford, et al. It was published in -- this is just one of the interim reports. The interim report was 1994. I believe the final manuscript was published in '96 or '97. But Dave Shuford was the first author, S-h-u-f-o-r-d.

MR. SANDERS: Okay. And does that study specifically discuss Yuba County rice fields, irrigated rice fields?

DR. REID: Yes, it does.

MR. SANDERS: Okay. Going on to paragraph --

DR. REID: It discusses the basin.

MR. SANDERS: Okay. Going on to paragraph three and four of your testimony, which is about studies about irrigated rice fields and their use by wetlands species.

DR. REID: Uh-huh.

MR. SANDERS: Do you happen to know what the application rate of water was in these studies? By "application rate" I mean the amount of water per acre applied to the land?

DR. REID: Well, as I mentioned Elphick is talking about preferred water depths of under 25 centimeters. So assuming some water loss, probably an acre-foot per acre.

MR. SANDERS: An acre-foot per acre. Okay.

DR. REID: That would be for preferred use. When you put more on it, it tends to have less usage.

MR. SANDERS: Okay. Do you happen to know if either study makes a recommendation on the application rate to maximize benefits for waterfowl?

DR. REID: Good question. I've got two -- two of the manuscripts right here. Let me just make -- just a minute. No, it just talks about the fact that the flooded rice fields are preferred over non-flooded.

MR. SANDERS: You know, I'm going to go on. I don't need to belabor this.

MR. MINASIAN: You know, you can ask him about his personal knowledge of that, he knows.

MR. SANDERS: Well, I think he testified what he just -- what -- in his previous answer, he testified what he knew and made an estimate of an acre -- or an acre-foot per acre.

MR. MINASIAN: Uh-huh.

MR. SANDERS: Okay. Yeah, so I'm going to go on. About paragraph five, Dr. Fleskes' study, is the Northern Pintail listed, or proposed for listing under the Endangered Species Act?

DR. REID: No. It's under special status. It's one of the two species that -- actually, three species that have -- of the common waterfowl species that have shown a downward trend in continental populations.

MR. SANDERS: Okay. But they haven't been listed?

DR. REID: Absolutely not.

MR. SANDERS: Okay. And I'll go on to paragraph six, Dr. Wiley's studies on the giant garter snake. Does this study conclude that rice fields in Yuba County are used as habitat for the garter snake?

DR. REID: He has study sites all over the Sac Valley. I know he has some work in District 10. So, I mean, it does provide habitat in District 10 and his investigation would show that.

MR. SANDERS: Okay. The rice fields are not designated critical habitat for the giant garter snake, are they?

DR. REID: No.

MR. SANDERS: Okay. To your knowledge, do the farmers in Yuba County take any special measures to protect giant garter snakes?

DR. REID: By not running them over, they take --

MR. SANDERS: Well, do they take special measures to avoid running them over?

DR. REID: I know some that do.

MR. SANDERS: Okay.

DR. REID: When we built the Yolo Wildlife Basin area, we had to have all of our equipment operators do an hour training on what the giant garter snake was, how they could identify it. And when they saw one, they were to immediately stop operation. And we had to give it in both English and Spanish so that everybody understood.

MR. SANDERS: Okay. Fair enough. Are you familiar with vernal pools?

DR. REID: I am.

MR. SANDERS: And to your knowledge, are there vernal pools within the District 10 Region?

DR. REID: There are.

MR. SANDERS: And do waterfowl use vernal pools in

any way?

DR. REID: Yes, principally in two ways. The term vernal means spring. They use them when they're flooded. And drying in the late spring. So that the time period that I'm talking about in terms of critical time from October to March, it's really at the back end of that.

There are pairs of waterfowl that will use vernal pools, as -- most generally, Mallard, cinnamon teal, and gadwall. And the other usage of vernal pools is by the small geese, Ross geese tends to forage on vernal pool plants when it's in a dry condition.

MR. SANDERS: Okay. And vernal pools are habitat for endangered species of fairy shrimp, are they not?

DR. REID: That's true.

MR. SANDERS: Okay. To your knowledge, do the rice farmers in Yuba County take special steps to preserve vernal pools?

DR. REID: Well, insomuch it is critical habitat for those shrimp, they're not going to destroy them.

MR. SANDERS: Well, again, I was asking to your knowledge, if they are, actually, preserving them?

DR. REID: Preserving the vernal pools?

MR. SANDERS: Yes.

DR. REID: Those that exist, yes, they preserve them.

MR. SANDERS: Okay. Okay. You testified back in '92, didn't you?

DR. REID: Yes, I did.

MR. SANDERS: Okay. And back then you testified that rice fields were important habitat for waterfowl; is that correct?

DR. REID: Correct.

MR. SANDERS: And you testified that the Board should consider waterfowl needs; is that correct?

DR. REID: Correct.

MR. SANDERS: So your testimony today more or less is identical to what you were offering back then; isn't it?

DR. REID: Except that there's been a great deal more studies. And that's what the breadth of my written testimony is.

MR. SANDERS: Okay. So leaving aside these studies -- your reports of studies that other people have conducted, are you testifying about any recent developments affecting the Yuba River, or the waterfowl?

DR. REID: Well, yes. I mean, we recognize now that the District 10 area is extremely important in the early fall and mid winter. And I don't think we had the breadth of knowledge in 1992 of that. I think Fleskes' work clearly shows that.

MR. SANDERS: Okay. But Fleskes' work has not been published, yet?

DR. REID: Well, that doesn't mean that it's not true.

MR. SANDERS: Has it been peer reviewed?

DR. REID: It has been reviewed by a number of waterfowl ecologists, yes.

MR. SANDERS: But he's not here to testify, is he?

DR. REID: No, he is not. However, I have co-funded his work. And as a coinvestigator, I feel fairly reasonable talking about this.

MR. SANDERS: Okay. That's fine. Thank you.

H.O. BROWN: Mr. Cook?

MR. COOK: Thank you, Mr. Brown.

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CROSS-EXAMINATION OF CORDUA IRRIGATION DISTRICT

BY CALIFORNIA SPORTFISHING PROTECTION ALLIANCE

BY MR. COOK

MR. COOK: Just a couple of questions, Dr. Reid. What is the period of time, period of the year that water is helpful to migratory birds?

MR. MINASIAN: In District 10?

MR. COOK: In District 10, yes.

DR. REID: Well, migrations differ among species. So, now, you're talking, you know, a large number of

species. But, basically, a fall migration for shorebirds is initiated for nonbreeders in July and moving through Sac Valley many of them on their way to Latin-America. And peak out in September for fall migration for most of the shorebirds.

Then we have wintering populations of shorebirds that are using the habitat from that time period through March. For waterfowl, the majority of migrants that are coming from intermount west, Canada or Alaska are arriving into the Valley late September/October with peak numbers in the Sac Valley occurring late November/December.

MR. COOK: You indicated that shorebirds, I think, need the water supply from the period July to September. Was that correct?

DR. REID: That's true. But, again, the -- I think the District 10 area is not as critical during that time period for shorebirds.

MR. COOK: Well, during the period of July through September, are the rice fields flooded?

DR. REID: The harvest occurs in September/October. So, typically, what's happening is there's a growing of rice. There may be a last flush of water in July and August. And then the water is allowed to go down. They're actually pulling the water off.

Then the harvest occurs. And then in

post-harvest techniques, they're putting water back on if they're going to flood, it's doable, beginning anywhere from beginning to like mid October.

MR. COOK: During the harvest period, of course, the rice fields are dry, are they not?

DR. REID: That's correct.

MR. COOK: And so where would the shorebirds and any other birds that you use the rice fields go at that time?

DR. REID: They're going to collapse on seasonal wetlands and semipermanent wetlands that exist in the Honcut Creek area and other areas in District 10 and areas of the valley.

MR. COOK: They go to alternative areas that you mentioned previously did not exist?

DR. REID: They go to alternative areas, yes. But these -- the numbers of birds that you see in this time period nowhere near reflects the birds that are present in November and December.

MR. COOK: So, in other words, shorebirds have alternatives during that period of time, alternative places to go in the wetlands, is that what you're saying?

DR. REID: Well alternatives in that since it's not flooded, it's not available. So it's not really an alternative. They're in other areas.

MR. COOK: But there are other areas where they can

go to live in wetlands, you're saying?

DR. REID: Right. In the fall migration what we typically see is that shorebirds are using coastal areas as the major corridor in their southern migration. And they use inland areas in winter and in spring. That's the general trend that we see in most recent shorebirds.

MR. COOK: Now, what about the garter snake, what period of year does the garter snake need the wetlands?

DR. REID: Well, they shift in terms of the type of water system they're using. So they're using, you know, semipermanent wetlands, waterways during the summer and early fall period. And they're shifting to seasonally flooded wetlands and rice fields during the fall period.

MR. COOK: In other words, there are alternative areas they can go to when the rice fields are not available?

DR. REID: During the summer period. During the early fall and mid-fall period, Dr. Wiley has shown that they're moving into seasonal wetlands and into the flooded rice during those time periods.

MR. COOK: Now, if the rice fields were not flooded I assume after September, would there be alternative places the garter snake could go to for wetlands?

DR. REID: Certainly, they can go into canals and permanent wetlands, but I would, also, say that probably

exposes them to greater predation.

MR. COOK: But how badly does the garter snake need -- how important are the rice fields as wetlands to the garter snake with the alternatives available?

DR. REID: I don't know how I could answer that question. I know that Dr. Wiley has shown during certain months of the year as much as 80 percent of time budgets in radio tracking snakes are out in rice versus seasonal wetlands or semipermanent wetlands, which is quite different than what we expected.

When we got involved in restoring wetlands for giant garter snakes, we didn't think the rice was going to be anywhere near as important.

MR. COOK: When you say the garter snake has alternative places to go during the period of time that the wetlands are not flooded, are they subject to that predation you're talking about at that time?

DR. REID: You really have to talk to Dr. Wiley, that's not my expertise.

MR. COOK: So you don't really know about the alternative areas for the garter snake, is that what you're saying?

DR. REID: That's not what I said, no. What I'm saying is addressing the question that you asked me which was: Do I know if they're susceptible to more predation?

MR. COOK: Well, you say that during periods of time when the rice fields are flooded --

DR. REID: Uh-huh.

MR. COOK: -- that it's necessary for the garter snake to go to the rice fields to avoid predation in the alternative areas; is that what you said?

DR. REID: No, that's not what I said. What I said was that if you force snakes into canals and into areas where you concentrate the animals, they're most likely to be susceptible to the predation.

MR. COOK: So concentrating the animals does subject them to predation; is that true?

DR. REID: As a trend, yes.

MR. COOK: And wouldn't that apply in the summertime as well as later on when the rice fields are flooded?

DR. REID: Yes -- not necessarily, because the predator base is going to be different under those different scenarios. And you have a whole host of aiding predators that are not present during the summer period here and are present during fall and in the winter.

MR. COOK: And you, personally, have studied that --

DR. REID: No, Dr. Wiley has. And I have been one of the program officers for that research with the Bureau of Reclamation and Fish and Wildlife Service and Ducks Unlimited.

MR. COOK: I think you indicated on predation, I should talk to Dr. Wiley rather than you?

DR. REID: On your specific question related to predation, yes.

MR. COOK: Well, let me go, then, to something else. When you say that the garter snakes and migratory birds should be considered when determining the use of water, you realize that there's a finite supply of water. And, therefore, when the water is used for one purpose, it's likely to take it away from another purpose.

Have you considered the comparative benefits of the different uses of water?

DR. REID: If you're asking me have I -- and I'm trying to rephrase your question.

MR. COOK: Sure.

DR. REID: So I can understand it. Are you asking me what prescription I'm recommending? I told the Board that I'm not recommending prescription. I'm trying to say that they should recognize that these are critical habitats.

Am I saying that the water for the chinook salmon is more valuable than water for 70 species of waterbirds and the endangered giant garter snake, absolutely not. I do not believe that we should manage habitat solely under the considerations of the Endangered Species Act. That is

a major mistake and one that you wouldn't find the agencies do.

They're trying to manage for a variety of species. And if we try and correct systems and habitats as a whole, we'll tend to have the greatest results. And that's what Ducks Unlimited is involved in doing.

Unfortunately, with main stem levees you're precluding the flooding of floodplains. And so these habitats have to be artificially flooded.

Likewise, there's been tremendous change on the landscape from when they were natural grasslands and wetlands and so agriculture becomes a very real component that we deal with. And are you asking me am I going to close my eyes and say put water only where endangered species exist? That would be a real travesty in the management of wetlands and wildlife.

MR. COOK: I don't think that was the question. But in any event, do you feel, therefore, that one method for flooding wetlands -- flooding rice fields or other areas to avoid taking water from the river would be to remove some levees?

DR. REID: Absolutely. Absolutely. That's -- in the whole breadth of different scenarios that you can put together, that's one methodology.

MR. COOK: Do you feel that water for migratory

birds and snakes is more beneficial than water for life?

DR. REID: I think you're comparing apples and oranges.

MR. COOK: Well, I'm asking the question. If you know --

DR. REID: I mean I don't work for the rice industry. I work for Ducks Unlimited. So in my personal interest, I think that water for the waterbirds is extremely important. Where water is provided that grows rice and provides an alternative habitat for waterbirds for the 96 percent of wetlands that have been lost in the valley, that's a very viable use of water for wildlife habitat.

MR. COOK: I think I'll let the questions go at this point. Thank you.

H.O. BROWN: Thank you, Mr. Cook.

Mr. Gallery?

MR. GALLERY: No questions.

H.O. BROWN: Mr. Bezerra?

MR. BEZERRA: First, Mr. Brown, I think Mr. Lilly has a point.

MR. LILLY: I don't know when you're going to get to me, Mr. Brown, but I usually come somewhere in the order.

H.O. BROWN: I did that to see if you were paying attention, Mr. Lilly.

MR. LILLY: I was going to make the point known at some point in the afternoon.

H.O. BROWN: You're up, Mr. Lilly. I'm sorry.

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CROSS-EXAMINATION OF CORDUA IRRIGATION DISTRICT

BY YUBA COUNTY WATER AGENCY

BY MR. LILLY

MR. LILLY: Dr. Reid, my name is Alan Lilly. And I'm the lawyer for the Yuba County Water Agency.

I think I just have one question and that is: Are the reports by Dr. Elphick, Dr. Hill, Dr. Fleskes and Dr. Wiley the types of information that expert witnesses in your field normally rely on in the course of developing their opinions?

DR. REID: In the expert opinions that I've given, yes. And that's why I bring them on.

MR. LILLY: I have no further questions. Thank you.

H.O. BROWN: Thank you, Mr. Lilly.

Mr. Gallery, I'm going to give you another chance. Do you have any?

MR. GALLERY: No questions.

H.O. BROWN: Okay. Mr. Bezerra?

MR. BEZERRA: I have no questions, Mr. Brown.

H.O. BROWN: Mr. Morris.

MR. MORRIS: No questions, Mr. Brown.

H.O. BROWN: Mr. Cunningham?

MR. CUNNINGHAM: Just a few, Mr. Brown.

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CROSS-EXAMINATION OF CORDUA IRRIGATION DISTRICT
BY U.S. DEPARTMENT OF INTERIOR, FISH AND WILDLIFE SERVICE
BY MR. CUNNINGHAM

MR. CUNNINGHAM: Good afternoon, Dr. Reid. My name is Bill Cunningham. I'm representing the Department of Fish and Wildlife today. I have just a couple of brief questions for you.

I'd like to talk a little bit about habitat for giant garter snakes in rice fields. I think you identified that the rice fields provide good habitat for giant garter snakes. Aren't there some problems with rice fields as habitat for garter snakes?

DR. REID: I'm referring to habitat fall post-harvest. The only problems that I'm aware of in regards to problems with rice fields would be in any herbicide or pesticide that was applied during the growing season. That's all that I'm aware of.

MR. CUNNINGHAM: Okay. Well, can you, perhaps, help me understand just how migratory is the giant garter snake. I mean, does it travel miles as factors dictate?

DR. REID: I can't remember the longest distance that a giant garter snake was recorded by Dr. Wiley's

information, but they're, obviously, not as migratory as either the anadromous fish, or the migratory birds that we're talking about. But, surprisingly, they do move a quarter to a half mile along different habitat sites.

MR. CUNNINGHAM: So to the extent they would use a rice field, then, as desirable habitat, would they be prone to suffer, for example, from those fields that are still burned come fall time?

DR. REID: Well, in terms of burning application, I would think so.

MR. CUNNINGHAM: And what about springtime during plowing, wouldn't the young of the year have problems, then, in escaping the rice fields before they were plowed under?

DR. REID: I don't know that. I don't know that.

MR. CUNNINGHAM: In the grand scheme of things, I guess -- and I'll try to describe "grand scheme" -- but, at least, for Northern California that tends to provide habitat for the giant garter snake, rice fields do come with some risk; isn't that true?

DR. REID: That's true. But the State of California's Fish and Game is currently involved in a project with U.S Fish and Wildlife Service, Ducks Unlimited, and some others where we are restoring the Zumwalt property next to Colusa and it's now a part of

Colusa National Wildlife Refuge.

And as part of that restoration the site was selected, because it's surrounded by rice fields with the idea being that that would be put to use for other habitat usage.

MR. CUNNINGHAM: The hope being that the snake migrates out of field before the field becomes undesirable and retreats to this refuge?

DR. REID: Well, we don't enter into management strategies with hope. A number of these snakes have radio transmitters on them and we will monitor what the effects are.

MR. CUNNINGHAM: Okay. Well, backing up a ways. In some of your earlier testimony you talked about District 10, and you referred to the term more as a generic area more than anything. We now understand it as an irrigation district, or a flood control district. Do you know how far north District 10, actually, extends?

DR. REID: You know, I was going to bring my map, GIS map showing the extent of flooding, because we have it all delineated. I'm sorry I didn't bring that now. I can't tell you the description, but I've seen it. I mean you can see from outer space where this thing floods. It's a very, very defined area.

MR. CUNNINGHAM: And let's talk a little bit about

this flooding. The flooding that you would consider most desirable is the fall time flooding for rice decomposition; is that what I understand?

DR. REID: We're talking about rice only, right?

MR. CUNNINGHAM: Let's talk only about rice.

DR. REID: Right. The flooding that I'm talking about is a flooding that is done sequentially in different fields. So you can begin flooding as soon as harvest is done in some fields. And you are flooding at later times during the winter period in other fields.

And there's a scenario that's developed whereby under wet winters you don't have to artificially flood very much habitat, because as rainfall takes over all you have to do is put the stop logs in and you don't have to flood. So we're not looking at every year you're going to have to artificially flood 200,000 acres across the Sac Valley.

The question becomes, under dry conditions, what's the minimal level that's acceptable habitat. And to my knowledge, there hasn't been an identified number associated there. We can look at energetic models of waterfowl and shorebirds in the valley. And that work is currently going on.

And we're putting it under the worse scenario, really high populations coming out of Arctic, Canada, and

Alaska coming into a valley that's very low in water and what, then, is the minimum amount of water and what is the distribution of that water, because we know where current populations exist. And we don't have that information.

MR. CUNNINGHAM: Okay. Another area that, perhaps, I need to find some information out about is part of your concern, part of Ducks Unlimited concern's directly related to proposed Yuba River fisheries flows that we're currently discussing in this hearing?

DR. REID: We're concerned that the floodplain habitat of District 10 is also considered, because if, in fact, you look solely at water within the corridor of the river and look at minimum acceptable temperatures, you can avoid looking at the other side of the levee, so to speak, and not come into consideration that that habitat is important at all.

And so in regards to water issues of flow and of water temperatures of the river under very dry conditions in the valley, we just want it to be recognized that there are other concerns in terms of wildlife habitat.

MR. CUNNINGHAM: Okay.

DR. REID: And we, absolutely -- I tried to reiterate this both in my written testimony and in my oral testimony -- we are not saying that chinook salmon habitat is not important, nor in providing viable temperatures for

them. But we are saying that it would be a simplified version of fisheries and wildlife ecology to simply look at the fisheries issue.

MR. CUNNINGHAM: You could paraphrase it as, "Give geese a chance"?

DR. REID: That would be fine. That would be fine.

MR. CUNNINGHAM: Sorry, I had to -- so you're not focused on any specific flow regimens as being presented to this Board. And your concerns, if I can get them correct, then, are for those times of the year when because of a lack of other waters in other places to provide flooded habitat, this waterfowl needs someplace to go and District 10 can provide that "someplace"?

DR. REID: Right. And, again, reiterating the fact that, you know, we've lost 96 percent of the historical wetlands that exist in the Central Valley, this state has the greatest loss of historic wetlands of all 50 states.

And given that scenario and given that unlike many of the other flyways, we still have viable populations. And that in many cases, the chink in the chain, potentially, is this wintering ground and we remain vigilant on that.

MR. CUNNINGHAM: I appreciate that. But I guess what I was trying to get at is that if you had to pick the most critical times you're concerned about, it's those dry

years when, otherwise, viable wetlands do not exist --

DR. REID: Correct.

MR. CUNNINGHAM: -- so that there's a very limited available habitat?

DR. REID: Absolutely. And as I mentioned, we're most concerned is where conditions on northern breeding grounds are highly favorable. And so you have big populations coming from the north.

MR. CUNNINGHAM: Lots of birds, no place to go?

DR. REID: Right.

MR. CUNNINGHAM: Okay. You haven't gotten any idea, to your knowledge, about whether or not those years of dry fall conditions when flooded wetlands in California are minimal, coincide at all with those years when water flows through the Yuba system are limited, because of a previous dry winter. So, to your knowledge, there's no real connection between those two at this point in time for you?

DR. REID: I don't have that information.

MR. CUNNINGHAM: Okay. I'll explain, perhaps, why I was going there. One of the questions that's pertinent here is whether or not under operations proposed by both the Board and others, the District would have available for its -- or the agency, Yuba County Water Agency and also Cordua Irrigation District would have available at

the end of the year enough water to provide rice and flooding flows.

But as I understand it, it really isn't -- that isn't critical if, for example, it is a wet fall and those birds are finding another habitat; is that right?

DR. REID: And if it's a wet fall, the farmers can put stop logs in and capture rainfall. And as I mentioned the preferred depths are very, very shallow for a lot of these waterbirds. You don't have to have a lot of water out there.

MR. CUNNINGHAM: The last questions for you, Dr. Reid, have you or Ducks Unlimited looked at other means for providing flooded areas for waterfowl? And let me give you two examples -- well, it's a subset of one example.

The example that comes to mind is there is a way to provide groundwater recharge, if you're going to use groundwater, for example, as a water source which can be made by overirrigating, or deep flooding the fields. And has Ducks Unlimited or you given consideration to that kind of activity as a way to provide waterfowl habitat in this part of the Sacramento-San Joaquin Valley?

DR. REID: You answered your own question. When you said you are overflooding areas, because in most of those recharged basins you, then, provide too much water for

viable forging for many of those waterbirds.

However, if you're looking at a scenario where you have recharge occurring in the summer, such as would exist in the Tulare Basin when you get excess water coming in snowmelt, that that is an area that, then, has some real opportunities.

Where you recharge in the summer and, in fact, what you then provide in the fall and winter is declining water levels. And under dry conditions, you can provide excellent habitat in the Tulare Basin in that fashion. Yes, we've been involved in some smaller projects, but we're currently looking at some very large landscapes down there.

MR. CUNNINGHAM: So if I were to qualify the concept of recharge to the limit to depth, the use for recharge and, essentially, deal with amounts of water by continuous recharge rather than deep pool of recharge, that would, actually, provide reasonable habitat for overwintering waterfowl?

DR. REID: Yeah, that is a potential.

MR. CUNNINGHAM: I have no further questions. Thank you very much.

H.O. BROWN: Thank you, Mr. Cunningham.

Staff?

MR. FRINK: Yes, we do.

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CROSS-EXAMINATION OF CORDUA IRRIGATION DISTRICT

BY STAFF

MR. FRINK: Hello, Mr. Reid.

DR. REID: How you doing?

MR. FRINK: It's good to see you.

DR. REID: Good to see you.

MR. FRINK: I haven't seen you since '94, '93?

DR. REID: I think so.

MR. FRINK: The Mono Lake hearings. Has there been an increase in the population of waterfowl in California in recent years?

DR. REID: There has. We were extremely concerned during the drought period of the early '90s, which coincided with a drought that existed on the prairies of Canada. And populations were very much on a decline.

MR. FRINK: How are the waterfowl populations now compared to what they were in the 1990's, for instance?

DR. REID: In the early 1990's?

MR. FRINK: Yeah, early 1990's.

DR. REID: We're probably looking at increases for several species two to three times, the gadwall, a number of species have really had some large increases. The exception to that, as I mentioned earlier, are the scaup, which is more of a marine species and the Northern

Pintail. The Northern Pintail is the species of greatest concern here.

MR. FRINK: Okay. Have you or Ducks Unlimited identified a target acreage of rice fields that you would like to see flooded in the Yuba County area?

MR. MINASIAN: And you're speaking both north of the river and south of the river.

MR. FRINK: I'm speaking with regard to anything that he's looked at in the general area. And he can define it accordingly.

DR. REID: Yeah. I'm a coauthor on a manuscript that looks at flooded rice in the '80s and mid '90s. And that information is in that manuscript, but for the life of me, I couldn't give it to you off the top of my head.

MR. FRINK: You don't have any idea as to what the overall acreage would be?

DR. REID: I don't have that. I could supply the manuscript. Ruth Spell is the chief author of that. It's an interesting manuscript, because what it does is it looks at two scenarios. '88 -- the growing season of '88 and then January of '89 and then the growing season of '93 and January of '94 and the amount of flooded rice and changes in flooded rice that occurred.

And it's fairly interesting, because what you see is you see an increase in Butte and the Colusa Basins in

the amount of rice that's flooded. And a decrease in the Yolo Basin. And I could provide that if the Board would be interested.

MR. FRINK: Well, if Mr. Minasian brings you back on another day and is so inclined, I, certainly, would be interested.

DR. REID: We also do have digital satellite images of the winter period that shows the District 10 area flooded. And that might be useful.

MR. FRINK: And how much of Yuba County is included in that area, District 10?

DR. REID: Yeah, of the valley portion of Yuba County, it's a very significant portion of Yuba County. The foothill mountain area, of course, is out, but it's a fairly significant portion of Yuba County.

MR. FRINK: Are most of the wetland areas or rice fields that are in Yuba County that you would like to see flooded located within District 10?

DR. REID: Yes. That's -- that's the real core area.

MR. FRINK: And you identify I believe in your testimony approximately 7,000 acres of rice that you would like to see flooded for wildlife habitat?

DR. REID: That's the core area. There's as much as 18- -- 18- to 20,000 acres that make up District 10 that

have a potential of flooding. The 7,000 acres of rice and 3,000 seasonally and semipermanent wetlands are the core, the core basis.

MR. FRINK: Okay. In terms of doing the balancing you were referring to, if you flood that 7,000 acre-foot of rice -- excuse me, 7,000 acres of rice and 3,000 acres of other wetlands, would you be relatively satisfied from a waterfowl habitat standpoint?

DR. REID: Yeah. For early-fall and mid-fall periods that would be fairly substantial. I think that would be significant enough to take -- you know, we could run -- we have this model set up for looking at the energetics and how waterfowl would use that. So we could run those numbers and run that out for you.

MR. FRINK: If you could flood the entire 18,000 acres that you referred to earlier, you believe that would be satisfactory for waterfowl habitat?

DR. REID: Actually, I would do that scenario only across the entire winter period, because you want to sequentially flood some areas. So that total acreage you wouldn't want to have flooded, necessarily, all at one time.

It will flood during wet periods, but that's not the scenario that you put together -- especially, on a dry year, I would not recommend that. On a dry year you would

want to sequentially flood, make new habitat available. So the 7,000- and 3,000-arce figures are probably more realistic.

MR. FRINK: In a dry year that's the realistic number that you would use, then?

DR. REID: Yes.

MR. FRINK: You testified that a preferred depth of flooding rice fields or waterfowl habitat is ten inches or less. How long do you believe that the rice fields normally should remain flooded when they're being used for waterfowl habitat?

DR. REID: Any individual field in order to deal with the rice double, if it's chopped or if it's rolled, most of the decomposition can occur if it's during the early fall period in about an eight- to ten-week period.

MR. FRINK: Would that be a sufficiently long period of time to provide waterfowl habitat that you desire?

DR. REID: For any individual field, that would be true. What you'd want to do is then roll that water into another field that had not been flooded, previously. And, then, therefore, provide a newer habitat that is more recently flooded.

MR. FRINK: Okay. Do you have an estimate on the amount of evaporation that would occur during the two-month, or eight- to ten-week period that you're

interested in keeping a rice field flooded for?

DR. REID: Jim Hill has published in that manuscript that I mentioned and other manuscripts they have really, very solid evaporation numbers on that.

MR. FRINK: Okay.

DR. REID: And it's my understanding that it's only about the first month that you have any real loss.

MR. FRINK: Okay. Earlier I believe you referred to a total number of about one acre-foot per acre as needed for waterfowl habitat.

DR. REID: Uh-huh.

MR. FRINK: Would that include your estimated need for evaporation?

DR. REID: Right.

MR. FRINK: Okay. And I assume if you move the water from one field onto another field that the net quantity of water needed is not in excess of two acre-feet --

DR. REID: Right.

MR. FRINK: -- for the two acres that are done sequentially; is that correct?

DR. REID: There's some loss because of canal movement, et cetera, but --

MR. FRINK: Okay. If Ducks Unlimited were -- I'll move back a minute. It's my understanding that Ducks

Unlimited has worked with farmers in the Central Valley to create waterfowl habitat; is that correct?

DR. REID: That's correct.

MR. FRINK: Okay. And when you make a proposal to a farmer for flooding rice fields to provide waterfowl habitat, would approximately one acre-foot per acre of water be the amount that you would be discussing as needed?

MR. MINASIAN: Are you talking about applied water, or converted water?

MR. FRINK: Let's discuss both.

DR. REID: When we discuss it, we're talking about water that's entering the field. So from the point of the delivery structure into the field it's one acre-feet per acre.

MR. FRINK: So if there were a ten-percent conveyance loss needed to get the water there, you would be talking --

DR. REID: 1.1 acre-feet.

MR. FRINK: 1.1 acre-feet, okay. Do you know approximately how many acres of rice were planted in the Cordua Irrigation District in 1998?

DR. REID: I don't.

MR. FRINK: Do you know how much were planted in 1999?

DR. REID: No.

MR. FRINK: Okay. Exhibit S-YCWA-15 identifies 6930 acres of rice fields in Cordua Irrigation District as suitable for flooding as waterfowl habitat each year. Does that number seem about right to you?

DR. REID: I don't know.

MR. FRINK: Okay. But if we were to use your number of one acre-foot per acre, if we were to flood all 6900 acres, it would take about 6900 acre-feet of water; is that correct?

DR. REID: A little more because of loss.

MR. FRINK: Because of conveyance losses?

DR. REID: Yeah.

MR. FRINK: Okay. Do you know how many acres of rice were flooded in the Hallwood Irrigation District in 1998 or 1999?

DR. REID: No.

MR. FRINK: Okay.

DR. REID: The areas that we use when you were looking at waterfowl habitat are, typically, the hydroelectric basins, or when we identify broad areas of, you know, like District 10, it's a waterfowl term. So we don't usually use it in terms of the irrigation districts.

MR. FRINK: Okay. But I believe you stated that if you apply extra water in excess of ten inches, or a foot

in depth, that it can have some adverse affects on waterfowl habitat; is that correct?

DR. REID: That's correct. Because you tend to -- you can tend to make forging efficiency drop out. Now, what we do know is that when we have very, very severe dry years and evapotranspiration could be high during the early months, that it may be, just in terms of field practice, you may need to give the field, you know, another four-inch shot.

But, typically, you don't apply the one acre-foot. You apply like eight inches and then you give it another shot later on. That's, typically, the way a lot of the farmers apply.

MR. FRINK: And about how much would that other shot be for?

DR. REID: So it would be a total of one foot.

MR. FRINK: Okay. So even if your only concern was waterfowl habitat, you wouldn't want to apply in excess of one acre-foot per acre; is that correct?

DR. REID: You wouldn't want to apply much more than that. You know there are examples where people were trying to really maximize waterfowl benefits and were able to get one-and-a-half to two feet of water out there. And they had no birds, or the only birds they had was the American coot, which is a species that tends to be in

deeper water. And those people that bought duck club memberships, they were pretty disappointed.

MR. FRINK: If there were 7200 acres of rice identified as being suitable for flooding for waterfowl habitat in Cordua Irrigation District, do you have an estimate on the overall amount of water that might be needed to do that, taking into account that there may well be some sequential use of that water?

DR. REID: No.

MR. FRINK: Do you believe that using 21,930 acre-feet of water would be a reasonable estimate of the amount needed for the 7200 acres?

MR. MINASIAN: Is this a hypothetical?

MR. FRINK: Right now it's a hypothetical, yes.

MR. MINASIAN: You're assuming that that 21,000 was used on 7200 acres?

MR. FRINK: I'd be interested in clarifying information, if Mr. Reid has it.

MR. MINASIAN: Mr. Mathews will be here. And I'm sure he will be able to talk to you about it.

MR. FRINK: Great.

DR. REID: I think Mr. Mathews could provide a better example of that. But to use the example, which you did, of one-third, that one-third of the habitat, say, was flooded at any time and then you were reusing that water,

is not totally unreasonable, I mean, in terms of trying to develop a model.

MR. FRINK: Excuse me. If there were a total of 72000 acres, hypothetically, could you imagine any scenario on which you would want to use nearly 22,000 acre-feet of water?

DR. REID: I'm sorry. I misunderstood your question. That's -- no. In my experience, that's a lot of water.

MR. MINASIAN: But you're talking about water depth now, you're not worried about cholera, or botulism, or anything like that?

MR. FRINK: I would be interested in the amount of water that Dr. Reid believes is reasonable for providing waterfowl habitat on an area of approximately 7200 acres.

DR. REID: As I said, given that -- we're talking strictly now --

MR. FRINK: At this point, it is hypothetical.

DR. REID: Post-harvest?

MR. FRINK: Sure.

DR. REID: Post-harvest, then, as I said our recommendation is typically one acre-foot per acre of habitat. And, then, considering all the losses and the amount of water necessary for conveyance.

MR. FRINK: Okay. And if you account for sequential

reuse of that water, the net acre-feet of water per acre could be reduced by approximately how much?

DR. REID: Anywhere from 30 percent to more, because you're talking about sequential flooding.

MR. FRINK: Okay. Do you know if the acreage of rice fields in Yuba County that is flooded for waterfowl habitat has increased in recent years?

DR. REID: As I remember, in Yuba it has increased, but not as substantially as has occurred in Butte, or the Colusa Basin.

MR. FRINK: Has Ducks Unlimited been promoting an increase in Yuba County, an increase in the amount of rice fields that are flooded for waterfowl habitat?

DR. REID: I don't know if "promoting" is the right terminology. If you're asking have we provided technical assistance to rice farmers so that as an alternative to burning, which they're forced to, rather than drying manipulation of the rice doubled that they use some form of water, yes, absolutely. We have two ag specialists that work specifically with rice farmers. And they have worked in District 10.

MR. FRINK: So is it a situation of: If they're going to be flooding the fields in order to promote decomposition of rice straw, Ducks Unlimited would like to see them do that in a way that is beneficial to waterfowl?

DR. REID: That's very true. The other part of that is that given that many of them have to use other techniques other than burning, the technique that we oftentimes suggest is one that they will manipulate the straw and burn -- and flood.

MR. FRINK: Okay. I think that's all my questions. Thank you.

DR. REID: Thank you.

MS. LOW: Hi, Dr. Reid. I just have a few questions for you. I was just looking at one of the exhibits that Yuba County Water Agency submitted to us just today. It's Yuba County Water Agency Exhibit 27. And it lists water deliveries for recent water years to the various districts within Yuba County Water Agency.

And the footnote here says that, (Reading):

"Water after October 15th is considered waterfowl habitat."

Would that be a valid representation of those water deliveries, that anything after -- I suppose any water delivered after October 15th in any particular year would be considered waterfowl habitat?

DR. REID: It's a funny designation that the irrigation districts have, because some of them charge differently for ag water versus waterfowl habitat water.

And so depending on the district, it may have a different meaning.

I would suggest that you're correct in saying that any water delivered after October 15th is going to have benefits to waterfowl, provided that it's -- it's not too deep where that water is put. You know, if you're putting it in a reservoir situation, that's not benefiting waterfowl.

MS. LOW: Okay. But it would be valid -- you probably haven't even looked at these tables, so you probably don't know what I'm talking about. But anyway it could be considered to have waterfowl benefits if delivered after October 15?

DR. REID: I think that's true.

MS. LOW: Okay. Thanks. Under the recent historic conditions in the past 10 to 20 years, has the extent and timing of the flooding of rice fields for waterfowl habitat varied from year to year?

DR. REID: It not only has varied from year to year, but there's been a big change over the last 20 years where to the best estimates there were somewhere between 70- to 90,000 acres flooded in the entire Sac Valley. That number has changed to probably 180- to probably 200,000 acres of rice in the Sac Valley in the recent past.

The timing of rice flooding has changed because

growing rates of hybrids has changed. There used to be huge wars between the rice farmers and the waterfowl hunters. And, quite frankly, the reason that the National Wildlife Refuge in the Sac Valley exists there is for rice deprivation.

Because it used to be that there were long varieties of rice. And in November and December when the farmers are still trying to grow the rice, the large numbers of waterfowl would arrive and the farmers would send kids out with shotguns to get rid of them.

Today they've developed a shorter hybrid of rice so that you can, actually, complete growth, get the complete full grains of rice by September and then harvest at that time period. And so the option of flooding rice fields in the harvested aspect is probably a fairly recent situation.

However, remember that when there were longer growing rates of rice, they were flooded in the growing aspect. So in terms of: Is there less water or more water now early, it's going to be apples and oranges.

MS. LOW: Okay. Yeah, part of my question was the variation from year to year, let's say under current conditions, under current practices, is there quite a bit of variation between years in the amount of rice fields flooded for waterfowl habitat?

DR. REID: We only have satellite information for real wet winters. So, you know, we're basing it all on kind of wet-winter situations. And we do not know the extent of flooding and what that will be under dry conditions, because across big periods we haven't had that.

Now, we had initially phases of that this fall where we had reduced amounts of rice flooded this fall. We had areas that were flooded and then went dry, because they put small amounts of water on one time. And then the water either seeped out or it evaporated. So that occurred this last fall.

MS. LOW: Okay. So there may be some variation -- there may be some factors that influence the extent and timing of flooding. And that could vary from year to year under current practices?

DR. REID: Absolutely. And given the scenario of a very dry year, we would not expect the same amount of rice to be flooded that are flooded in wet years. That area, that amount of rice is not absolutely needed to maintain the energetic requirements of populations that use the Central Valley, but there is some minimum. And what that is we don't know yet.

MS. LOW: Okay. So you would expect in a dry or a critical water year that you would have -- under continued

practices, you would have less acreage flooded in a particular year?

DR. REID: And you do it more in a sequential fashion where you'd flood some and then use that water again and flood again.

And there, again, you have the option of putting in the board. So you take advantage of storms that come through. So if you get a strong November or December storm, even though it may be one event, it may take care of a lot of your problems.

MS. LOW: Okay. And you stated before that you have not conducted any analysis of the effects of the proposed instream flow water releases on the timing, or extent of flooding of the rice fields in Yuba County; is that correct?

DR. REID: That's correct.

MS. LOW: So compared to the target levels of flooding that you've identified for the county, you don't -- you don't have any idea as far as the degree of impact of the various flow recommendations; is that correct?

DR. REID: That is correct.

MS. LOW: Okay. Thank you very much.

MR. MONA: Dr. Reid, just a few questions. I'd like to refer to your paragraph seven of your testimony. Are

you suggesting with that paragraph that under no circumstances will -- can groundwater be used for waterfowl habitat?

DR. REID: No, absolutely not. I think that there's a role for groundwater. It's just -- the reason for my paragraph there is that we shouldn't look to groundwater as the absolute savior and end all of an alternative water source for the District to run surface water.

MR. MONA: When you say that, are you thinking about during periods of dry to critically dry years, under one scenario offered to this Board, fisheries are taking an impact of almost 50 percent to limit the deficiencies to water users?

MR. LILLY: I object. Misstates prior testimony. There's no testimony whatsoever of fisheries taking an impact of 50 percent. That's outrageous for that to be said. The proposal was for flows to be lower in a certain year. There's no evidence, whatsoever, of 50-percent impact on fisheries.

H.O. BROWN: Thank you, Mr. Lilly.

I would like to hear that question restated.

MR. MONA: During critically dry years when proposals are made where fishery resources below the Yuba River are taking an impact of water availability in order to limit the amount of deficiencies to water users, would

it be feasible to use a groundwater source to maintain waterfowl habitat as opposed to diverting water from the Lower Yuba River?

MR. LILLY: I'm still going to object. I think what Mr. Mona is trying to say is that the flows would be lower. But if he says fishery resources taking an impact, I object on the grounds that there's no evidence of that.

H.O. BROWN: Mr. Frink?

MR. FRINK: I think Mr. Mona could rephrase the question in a way that would satisfy Mr. Lilly's objection.

H.O. BROWN: Try again.

MR. MONA: All right. During very critically dry years, where flows below the Yuba River are reduced to the extent for fishery maintenance in order to reduce, limit delivery deficiencies to --

MR. FRINK: Do you want me to try it? The only reason I'm going to try this is I think maybe I understand Mr. Lilly's objection. I'll give it right back.

If the rate of release of water for instream flow purposes were released by half, regardless of what impact that might have on the fish, would you believe that it's reasonable under those conditions to rely, in part, on groundwater for water needed for waterfowl habitat?

DR. REID: I think one should consider all the

different alternatives. And well water is clearly an alternative. And it does provide water that can be used for waterbird habitat.

My reason for putting in this paragraph is to show that it -- that there are some negative aspects associated with groundwater as well related to the expense, related to the temperature, related to its impacts on decomposition. And it's just a caveat that -- I think it would be detrimental if you relied solely on groundwater. I think it's an alternative that absolutely should be considered.

MR. MONA: Would it be detrimental to rely on a combination of groundwater and surface water?

DR. REID: I think that's what I'm suggesting.

MR. MONA: Thank you very much.

H.O. BROWN: Any redirect?

MR. MINASIAN: Yes.

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REDIRECT EXAMINATION OF CORDUA IRRIGATION DISTRICT

BY MR. MINASIAN

MR. MINASIAN: Dr. Reid, I want you to take the hypothetical that somebody ties to put one foot of water on a rice field that's been harvested, will you imagine that for a moment?

DR. REID: Yes.

MR. MINASIAN: Okay. We talked about invertebrate production. Is invertebrate production increased by tilling the soil before the water is applied?

DR. REID: The data suggests -- and this relates to a couple of studies -- the data suggests that if you manipulate the rice straw, whether by a disk or whether by flailing, cutting and flailing the rice straw, that invertebrate production tends to be higher than if the rice straw is not manipulated.

MR. MINASIAN: And invertebrate production is what the ducks eat, is it not?

DR. REID: Right, that's what I'm referring to here. Here the dominant organisms are aquatic oligochaetes and chironomids that appear to make up most of the diet of the shorebirds.

MR. MINASIAN: So I want you to imagine a rice field that a farmer has gone through with a disk. And I want you to imagine putting one foot of water on that. Now, the field has been disked. You want one foot above the top of the disked furrows; do you not?

DR. REID: That's correct.

MR. MINASIAN: Okay. So we're talking about more than one acre-foot of water in that circumstance, aren't we?

DR. REID: Yeah, potentially.

MR. MINASIAN: Okay. Now, if we do flood that field in October and it's 95 degrees and we're able to get the water on the field, there's more evaporation than there will be in November and December; isn't there?

DR. REID: Absolutely. The data from Hill suggest that first month is really critical. But that first month is also really important, because the decomposition of the straw is greatest during that period. So that's one of the reasons that the rice farmers want to put it on at that stage.

MR. MINASIAN: Okay. The invertebrate production is greater, the evaporation and water use is greater because of the combined effects of trying to get more food and more decomposition; is that correct?

DR. REID: More or less, yes.

MR. MINASIAN: Okay. We also have a problem called avian botulism, or avian cholera in regards to waterfowl, if we simply block up the fields with one inch -- one foot of water over a tilled field, which would make it about four-inches deep to five-inches deep, don't we?

DR. REID: Those are very -- those are two very different diseases that waterbirds are susceptible from. Avian botulism is a toxin that's in the soil. And what happens in this particular case -- and it's common in the fall -- when you have anoxic water that heats up --

MR. MINASIAN: Okay. So that's water that isn't allowed to flow, the oxygen dissipates and the toxin comes out of the soil; does it not?

DR. REID: Correct.

MR. MINASIAN: Okay. What about botulism?

DR. REID: That's botulism.

MR. MINASIAN: What about the cholera?

DR. REID: Cholera is a disease that is far more common, during a colder period during the winter. And cholera is not associated with a particular locale, but it's a disease which is acquired through respiratory aspects of other birds.

And so you run into cholera when you tend to concentrate birds. And it's during dry years that we're most worried about cholera in that you get concentrated numbers of waterbirds. And, therefore, you potentially are exposing birds to that disease.

MR. MINASIAN: Okay. What role does circulating water, keeping it moving and oxygenating it have in regard to cholera?

DR. REID: Cholera, in that if you're providing new habitats and moving the birds around, you're not concentrating them in any one particular local. So the advantage of spreading water out over more areas for cholera, is you're reducing those large concentrations.

MR. MINASIAN: Okay. And this is why you kept saying "sequential flooding" --

DR. REID: Right.

MR. MINASIAN: -- did you not? You dry up one piece, go to the next, come back to the next; is that right?

DR. REID: That can be potentially done. What you're more apt to do is to flood dry pieces that have not yet been flooded.

MR. MINASIAN: Okay. Now, you've not focused upon your testimony upon the acreage that is now being flooded in Southern Yuba County, because of the construction and the operation of the South Yuba Water Project. Is that because it's of no significance?

DR. REID: No. That area is less important, but that area is used as late-winter habitat. And, typically, that habitat is flooded by winter rains and by surface flooding.

MR. MINASIAN: Okay. And we have 50 years of history in regard to District 10. And we have approximately ten years of history in the Southern Yuba County; isn't that correct?

DR. REID: That's true.

MR. MINASIAN: Nothing further.

H.O. BROWN: Thank you. Who would like to recross?

Mr. Gallery.

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RECROSS-EXAMINATION OF CORDUA IRRIGATION DISTRICT

BY BROPHY WATER DISTRICT

BY MR. GALLERY

MR. GALLERY: Dr. Reid, I'm the attorney for Brophy Water District, which is up south of the Yuba River. I don't know if you're familiar with the district, but there's some rice grown in the Brophy District.

You were asked wasn't it true that putting water on the rice fields for flooding for ducks could have a recharge benefit into the groundwater supply; is that correct?

DR. REID: I remember that question.

MR. GALLERY: Isn't it also true, that in many of these rice growing areas the ground is really hardpan, and that's what makes it usable for rice?

DR. REID: That's true.

MR. GALLERY: So that --

MR. SANDERS: Mr. Brown, I'm going to object. This goes beyond the scope of the recross. You set the rules out earlier. Mr. Gallery had his chance to cross-examine, he waived it, or he didn't ask any questions. There's no reason to allow him to do it now.

H.O. BROWN: The hardpan and the water application

go hand in hand. I'll allow the question.

MR. GALLERY: So it would be true in those cases where you have hardpan underneath the rice fields, there would be minimal recharge of groundwater; is that true?

DR. REID: That's true.

MR. GALLERY: Thank you.

H.O. BROWN: Anyone else wish to recross?

MR. FRINK: I do have one question, Mr. Brown.

H.O. BROWN: Okay.

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RECROSS-EXAMINATION OF CORDUA IRRIGATION DISTRICT

BY STAFF

MR. FRINK: Mr. Reid, Mr. Minasian was asking you about manipulation of rice straw in order to promote invertebrate production. Would manipulation of rice straw by flailing and cutting the rice straw have the same benefits for invertebrate production as would plowing, or disking that the rice straw would have?

DR. REID: Yeah. There appears to be no significant difference between those two forms physical manipulation.

MR. FRINK: Okay. Thank you.

H.O. BROWN: Mr. Minasian, do you have any more exhibits?

MR. MINASIAN: No. And we would offer Dr. Reid's qualifications, his testimony which are Cordua Exhibits 1,

1.1.

H.O. BROWN: Any objections? So accepted.

MR. MINASIAN: Thank you.

H.O. BROWN: Dr. Reid, thank you.

DR. REID: Thank you for the opportunity to speak.

H.O. BROWN: You're quite welcome. Good seeing you again.

Tomorrow morning we start with Mr. Lilly.

MR. LILLY: Our last witness, who has been patiently waiting is Donn Wilson, but our plan would be to start with him at 9:00 tomorrow morning.

H.O. BROWN: Yes.

Mr. Cook?

MR. COOK: Mr. Brown, I noticed today from the record that apparently my written testimony and the written testimony of William Calbert were not introduced into evidence at the time we presented our case. And I'm requesting that they be introduced into evidence at this time.

H.O. BROWN: All right. Do you have that exhibit number, staff, for Mr. Calbert.

MR. MONA: They would be numbered as S Cook-3 and S Cook-4.

H.O. BROWN: Three and four. And you're offering those into evidence now, Mr. Cook?

MR. COOK: Yes, sir.

H.O. BROWN: Are there any objections?

MR. LILLY: Could I have just one moment, please. Since we don't have these in front of us, I just want to check the list.

H.O. BROWN: Sure. Off the record for a moment.

(Off the record from 4:31 p.m. to 4:32 p.m.)

H.O. BROWN: On the record.

MR. LILLY: Thank you. I'm a little confused, because the master exhibit identification index we got from staff does not list those exhibits. It's just lists Cook A, Q, M, O, and I. So I propose if we could just at least go back and maybe address this tomorrow morning, I would like to, at least, get the exhibits so I know what we're talking about, because I don't have any reference to them.

H.O. BROWN: Mr. Cook, will you be here in the morning?

MR. COOK: Yes, I will be here in the morning. I would like to point out that all this material was transmitted to every party here. And every party should know what it was -- it was a written testimony of myself and written testimony of Mr. Calbert. And I don't know what the problem is.

H.O. BROWN: I'm sure that it will be properly

considered in the morning. If that's all right with you, Mr. Cook.

MR. COOK: Thank you.

H.O. BROWN: Any other business? 9:00, remember tomorrow afternoon we were going to adjourn at 3:00. Plan your day accordingly, 3:00 p.m.

(The proceedings concluded at 4:35 p.m.)

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REPORTER'S_CERTIFICATE

STATE OF CALIFORNIA)
) ss.
COUNTY OF SACRAMENTO)

I, MARY R. GALLAGHER, certify that I was the Official Court Reporter for the proceedings named herein, and that as such reporter I reported in verbatim shorthand writing those proceedings; that I thereafter caused my shorthand writing to be reduced to typewriting, and the pages numbered 1062 through 1339 herein constitute a complete, true and correct record of the proceedings.

IN WITNESS WHEREOF, I have subscribed this certificate at Sacramento, California, on this 16th day of March, 2000.

MARY R. GALLAGHER, CSR #10749