BEFORE THE

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

CALIFORNIA WATERFIX WATER RIGHT CHANGE PETITION HEARING	)))

JOE SERNA, JR. BUILDING

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

COASTAL HEARING ROOM

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SACRAMENTO, CALIFORNIA

PART 1B

Thursday, November 17, 2016

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APPEARANCES

CALIFORNIA WATER RESOURCES BOARD

Division of Water Rights

Board Members Present:

Tam Doduc, Co-Hearing Officer
Felicia Marcus, Chair & Co-Hearing Officer
Dorene D'Adamo, Board Member

Staff Present:

Diane Riddle, Environmental Program Manager
Dana Heinrich, Senior Staff Attorney
Michael Buckman

PART IB

For Petitioners:

California Department of Water Resources:

James (Tripp) Mizell
Thomas M. Berliner
Jolie-Anne Ansley

The U.S. Department of the Interior:

Amy L. Aufdemberge, Esq.

INTERESTED PARTIES:

For County of San Joaquin, San Joaquin County Flood Control and Water Conservation District, and Mokelumne River Water and Power Authority:

Thomas H. Keeling
Osha Meserve

For State Water Contractors:

Stefanie Morris

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APPEARANCES (Continued)

For Central Delta Water Agency, South Delta Water Agency (Delta Agencies), Lafayette Ranch, Heritage Lands Inc., Mark Bachetti Farms and Rudy Mussi Investments L.P.:

John Herrick, Esq.
Dean Ruiz, Esq.

For California Water Research:

Deirdre Des Jardins

For California Sportfishing Protection Alliance (CSPA), California Water Impact Network (C-WIN), and AquAlliance:

Michael Jackson

I N D E X

Thursday, November 17, 2016 9:00 a.m.

PROCEEDINGS

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CO-HEARING OFFICER DODUC: (Banging gavel.)

Good morning, everyone. It is 9 o'clock.

Welcome back to the public hearing regarding the California WaterFix Project Water Right Petition.

I am Tam Doduc. Joining me shortly will be Board Chair Felicia Marcus and Board Member Dee Dee D'Adamo. To my left are Diana -- Dana Heinrich, Diane Riddle, and Kyle will be joining us today?

MS. RIDDLE: Not today.

CO-HEARING OFFICER DODUC: Okay. We are also being assisted by Mr. Baker and Mr. Long.

The usual announcements: Please take a minute right now and locate the exit closest to you. In the event of an alarm, we will evacuate this room. We will take the stairs down to the first floor, exit to the park where we will stay until we receive the all-clear signal to return.

If you're not able to use the stairs, please flag down one of us or anyone wearing an ugly orange vest or cap and they will direct you to a protected area.

The second announcement is, this is being recorded and Webcasted, so, as always, when you are

recognized by me to speak, please provide your comments into the microphone and begin by stating your name and affiliation for the record.

Our court reporter is back with us. Thank you. Please make arrangements with her if you would like to have a copy of the transcript prior to our posting it on our website, which will be at the conclusion of Part 1B.

And, finally, and as always, most importantly, please take a moment and make sure that all your noise-making devices, also known as Hearing Officer Irritant Devices, are on silent, vibrate, do not disturb. All right?

With that, are there any housekeeping items that we need to address?

Not seeing any taker, and seeing Mr. Herrick is here ready for, hopefully, his performance this afternoon, we will now turn back to Mr. Keeling and Ms. Meserve for their third panel.

MR. KEELING: Good morning. Tom Keeling for the San Joaquin County Protestants.

OPENING STATEMENT BY

MR. KEELING: San Joaquin County's population is projected to grow to almost 1.1 million by 2025.

The Delta supports a $5.2 billion annual agricultural industry and some 40 percent of those farms

are in San Joaquin County.

The gross value of San Joaquin County's agricultural production in 2014 exceeded $3.23 billion.

A large portion of the Delta's $750 million recreational economy is also centered in San Joaquin County.

San Joaquin County is Ground Zero for the adverse impacts of the State and Federal Water Export Projects and the proposed WaterFix.

Rather than fix the Delta's salinity and harmful algal bloom problems, the WaterFix Project proposes to remove even more fresh water from the already-choked and -suffering Delta channels.

The County Protestants' witnesses who have yet to testify will explain some of the reasons why removing more fresh water from the Delta will harm legal users of Delta water.

It was all summed up last week when Mr. Van Loben Sels used the phrase "common sense."

One of our witnesses, Mr. Josef Tootle, has already explained how impervious slurry cutoff walls and the two 40-foot-wide 30-mile-long tunnels themselves will obstruct groundwater flows in San Joaquin County in the Delta.

Even though the proposed WaterFix Project would

dramatically reduce fresh water flows from the Sacramento River into the largest and most important estuary on the West Coast of the Americas, Petitioners' witnesses admitted that they have not analyzed any other project anywhere else in the world which resulted in substantial reductions of fresh water flows into a large estuary.

You may recall that cross-examination from the Construction Panel early in this proceeding.

Petitioners have portrayed the Fix as allowing only slightly higher water exports with a similar level of compliance with water quality standards.

They have consistently evaded the questions about injury to legal users by invoking their projected compliance with D-1641 and the all-too-convenient and always-available escape hatch, adaptive management.

As for the unknowns and threats inherent in such a project, their operations witnesses repeatedly assured you to the following effect: "Trust us. We'll continue to operate the Projects to achieve the same great results that the Projects have achieved in recent years."

Before we get to my brief -- and I mean very brief -- overview of the witnesses' testimony, we think it important at this point to reiterate some of the fundamental aspects of the legal context in which their

testimony is being presented.

Petitioners have done their utmost to suggest that the Protestants have a burden of proof they must meet under the Water Code. Wrong.

It is not our clients' burden to show that the WaterFix will injure legal users of water in San Joaquin County. Petitioners bear the burden of proof here, not the Protestants.

Under the Water Code, Petitioners must establish with evidence such that this Board can find that the change will not operate to the injury of any legal user of the water involved.

Petitioners failed to meet that burden. Rather than identifying each category of each legal user of water that could be adversely impacted by the Project and explaining how they would not be injured, Petitioners presented testimony claiming no adverse effect to legal users because the State and Federal Projects could still meet existing water quality objectives about as often as they currently do.

That is not good enough.

Merely predicting that one can meet a water quality objective most of the time is not the same as proving that the Proposed Project will not result in injury to legal users of water. And establishing no

injury requires much more than compliance with water quality standards.

Petitioners' vague Project Description evades proper evaluation. Instead of presenting a Proposed Project Operation and Conditions of Approval, Petitioners' case in chief relied on multiple vague scenarios and options for their project definition. Petitioners refused to agree or even suggest any limited -- limiting Conditions of Approval.

This lack of specificity has allowed Petitioners to blur the Project Description and effectively shift the burden of proving no injury off to the Protestants.

The Petitioners' proposed use of adaptive management to address future conditions is indicative of this problem.

The Delta Science Board has already discredited this facile use of adaptive management as little more than an agency excuse to avoid timely and responsible assessment of impacts, alternatives, mitigation, governance and financing before commitment to the project becomes a fait accompli.

Indispensable elements of a genuine Adaptive Management Program which are missing from this Petitioners' Project include reliable funding and

monitoring, an independence of data review from institutional tilting.

We strongly agree with the National Research Council's sharp criticism in 2011 of what was then the draft BDCP's use of science and adaptive management.

The council observed that the draft failed to provide a quantitative assessment of specific hydrological and biological consequences, including consequent changes in tributary watersheds, aquifers, demands, risks of levee failure, and ecology of what was then called the BDCP Plan Area. Nothing has changed.

The council also pointed to research showing that more than a hundred adaptive management efforts have failed due to institutional problems, ranging from lack of funding to lack of leadership and implementation.

It highlighted a problem others have also noticed: That the aims of adaptive management often conflict with institutional and political preferences.

On that point, any Adaptive Management Plan that lacks robust and independent, enforceable safeguards becomes an easy target for regulatory capture. That's the same fox-guarding-the-henhouse problem that often afflicts agencies charged with managing valuable public resources, such as California's water.

Petitioners' made no effort to perform a water

availability analysis to confirm that the water supply they seek to divert is available and not already relied on by appropriators, riparians, or public trust uses.

As proposed, the WaterFix runs afoul of statutory and policy protections for the Delta. We will have a great deal to say about that later in this proceeding.

For now, though, touching upon some of the key legal obstacles facing this project as it has been proposed should suffice.

Reducing fresh water supplies to the already-imperiled Delta violates the Delta Protection Act. For example, Water Code 12204 mandates that (reading):

> "In determining the availability of water for export from the . . . Delta, no water shall be exported which is necessary to meet the requirements of Sections 12202 and '203."

Those sections assure Delta water users that the State and Federal Projects will provide for salinity control and an adequate supply of water in the Delta.

In 1960, when DWR embarked on the State Water Project, its own interpretation of key provisions of the Delta Protection Act confirmed not only that the State Water Project had an obligation to provide water supply

and salinity control to the Delta but also that the diversion of water upstream of the Delta, as now proposed with the WaterFix, would make this obligation more difficult, quote -- And this is DWR speaking in the December 1960 Bulletin 76, quote (reading):

> "Further increase in water use in areas tributary to the Delta will worsen the salinity incursion problem and complicate the already complex water rights situation. To maintain and expand the economy of the Delta, it will be necessary to provide an adequate supply of good quality water and protect the lands from the effects of salinity intrusion (sic). In 1959, the State Legislature directed that water shall not be diverted from the Delta for use elsewhere unless adequate supplies for the Delta are first provided," end of quote.

Petitioners admit, as they must, that the Proposed Project will reduce the amount of fresher Sacramento river water that flows through the Delta.

The hydrodynamics of the Delta will force this reduction in fresh flow to be replaced, of course, with lower quality water from other tributaries and the Bay, brought in with the tide.

The Delta Protection Act does not allow the Projects to increase the export of water from the Delta,

as proposed, at the expense of the Delta.

And, as proposed, the WaterFix conflicts with other area-of-origin protections. Those protections ensure that protected areas are not deprived of adequate supplies of water, directly or indirectly, by a water supplier exporting or intending to export water for use outside a protected area.

The Watershed Protection Act and Water Code Section 11460 applies this mandate to the operation of the State and Federal Projects.

The protections assured by Section 11460 extend to all the beneficial needs of the watershed area, its inhabitants, and property owners.

The legislature reaffirmed the area-of-origin and Delta protections in the 2009 Delta Reform Act. That aspect of the Act comports with Section 85021 of that Act in which the legislature recognized the damage inflicted by excessive water diversions and -- and exports, and the critical need to reduce reliance on the Delta.

The legislature declared, quote (reading):

"The policy of the State of California is to reduce reliance on the Delta in meeting California's future water supply needs through a statewide strategy of investing in improved regional supplies, conservation, and water use efficiency," end of

quote.

That's the policy of the State of California.

Finally, the WaterFix Project, as proposed, violates the State Board's antidegradation policy, which is resolution 68-16.

The project proposes to export more fresh water out of the Delta before it flows through the estuary. These increased diversions will obviously reduce the assimilative capacity of the remaining fresh water flows in the Delta.

Instead of addressing the degradation of water quality in the Delta that will result from the WaterFix, the Petitioners focused on whether the degradation would be so severe that it will violate water quality standards. This approach misses the point of the antidegradation policy. All degradation of high-quality water needs to be considered, even if it does not rise to the level of a water quality objective violation.

Again, the standard governing this proceeding is the no-injury standard, which entails far more than simply promising future compliance with D-1641 or any other water quality standard.

I will turn now to the County Protestants' witnesses. With today's panel, we will present the expert testimony of Erik Ringelberg and the percipient

testimony of Linda Turkatte, San Joaquin County's Director of Environmental Health.

These witnesses will explain the challenges the county faces due to harmful algal blooms, sometimes referred to as HABs, and the proposed Project's increased threat to injury to legal users of water from HABs and the resulting neurotoxin microsystem.

That HABs and the resulting neurotoxins are harmful to humans, pets and wildlife is beyond dispute. Mr. Ringelberg will explain the nexus between this form of injury to legal users of water in the Delta and the proposed WaterFix Project.

Residents and visitors in San Joaquin County use the Delta for a variety of recreational activities in addition to diversion of water for agricultural and municipal and industrial uses.

HABs -- harmful algal blooms -- directly impact the continued use of the waters of the Delta channels for these purposes.

The proposed increase in diversions of fresher Sacramento River flows from the Delta will significantly exacerbate the conditions that cause HABs to form and thrive, substantially increasing the injury to legal users of water in the county.

Another component of the County Protestants'

case in chief focuses on the proposed slurry walls and the tunnels themselves which are likely to interfere with groundwater flows in San Joaquin County.

Last week, you heard Mr. Tootle testify that, as proposed, the project will likely impede the flow -- the flow of natural groundwater in the area.

He also testified that the Petitioners failed to perform an adequate analysis of the impacts to legal users of groundwater located near the proposed forebay and tunnel sites.

You may recall that, last week, some of the witnesses on that panel -- the Physical Injury Panel -- were asked on cross-examination whether they had commissioned an independent subsurface soil studies to show injury resulting from the proposed WaterFix.

Those questions were plainly calculated to suggest to you that the Protestants have some burden of proof they must meet in this matter to -- and to -- and to divert -- they were intended also to divert attention away from the fact that the burden of proof here lies with the Petitioners, not with the Protestants.

The Petitioners must come forth with evidence sufficient to establish that there will be no injury to legal users of water as a result of the Proposed Project.

The Protestants have no corresponding burden of

proof. It is enough to show what they -- what the Petitioners did not look at, what they did not analyze, what they did not study, and what they did not consider.

Finally, the WaterFix Project is likely to inflict significant injury to Delta agriculture and related economies.

On this issue, the county has joined with other Protestants in presenting the testimony of University of the Pacific economist Dr. Jeffrey Michael on the economic impacts of the Proposed Project.

Professor Michael will explain the economic injury to agriculture in the Delta as a result of reduced water quality caused by the proposed diversions, even if the State and Federal Projects are able to operate to meet the D-1641 standards.

He will explain how a modest increase in average salinity of 1.1 percent is estimated to result in a $1.8 million decrease in Delta crop revenue due to the need to shift the lower value but more salt-tolerant crops over time. Larger increases in salinity are predicted to have even larger crop revenue impacts.

Professor Michael will explain how reductions in Delta crop revenue will have significant rippling effects throughout the Delta economy.

He will also testify regarding his work on the

Delta Protection Commission's Economic Stability Plan for the Delta.

And, with that, my -- that concludes my opening statement. We are ready to move on to the witnesses on our Harmful Algal Blooms Panel once they are sworn in.

Thank you.

CO-HEARING OFFICER DODUC: Thank you.

Mr. Ringelberg, you have taken the oath and I will remind you, you are still under oath.

CO-HEARING OFFICER DODUC: Miss Turkatte --

THE WITNESS: Yes.

CO-HEARING OFFICER DODUC: -- if you could please stand and raise your right hand.

ERIK RINGELBERG and LINDA TURKATTE, called as witnesses for the San Joaquin County Protestants, having been first duly sworn, were examined and testified as follows:

CO-HEARING OFFICER DODUC: Thank you.

You may begin, Mr. Keeling.

MR. KEELING: Thank you.

DIRECT EXAMINATION BY

MR. KEELING: Good morning, Miss Turkatte.

WITNESS TURKATTE: Good morning.

MR. KEELING: Could you please state your

name -- state and spell your name for the record.

WITNESS TURKATTE: Linda Turkatte, spelled T-U-R-K-A-T-T-E.

CO-HEARING OFFICER DODUC: Closer to the microphone, please.

WITNESS TURKATTE: (Pulling microphone closer.)

CO-HEARING OFFICER DODUC: Real close.

WITNESS TURKATTE: (Pulling microphone closer.)

CO-HEARING OFFICER MARCUS: You can pull it towards you.

WITNESS TURKATTE: (Pulling microphone closer.)

How's this?

MR. KEELING: Could you please briefly summarize your educational background.

WITNESS TURKATTE: Sure.

I -- I went to school at UOP. I majored in biological sciences and I graduated with a Bachelor's degree in biological sciences.

MR. KEELING: Who -- Who's your employer?

WITNESS TURKATTE: (Speaking.)

THE REPORTER: Sorry?

WITNESS TURKATTE: San Joaquin --

CO-HEARING OFFICER DODUC: I think.

WITNESS TURKATTE: -- County.

CO-HEARING OFFICER DODUC: You really need to

pull the microphone closer to you, please.

WITNESS TURKATTE: San Joaquin County.

CO-HEARING OFFICER DODUC: Very close.

WITNESS TURKATTE: San Joaquin County.

CO-HEARING OFFICER DODUC: Better.

MR. KEELING: All right. Your current position with San Joaquin County?

WITNESS TURKATTE: I'm the Director of the Environmental Health Department.

MR. KEELING: How long have you worked for the county?

WITNESS TURKATTE: I've worked for the county for around 30 years.

MR. KEELING: And in those 30 years, what -- what positions have you held?

WITNESS TURKATTE: I -- I started out in the San Joaquin General Hospital, and then after about four and a half years there, I transferred to the Environmental Health Department in 1991. And I held a variety of positions there, starting with -- as a trainee and worked my way up through the levels as a -- as a Registered Environmental Health Specialist, the lead Senior Environmental Health Specialist, the Program Coordinator, and now the Director.

MR. KEELING: Could you briefly describe your

duties and responsibilities as the Director of San Joaquin County's Environmental Health Department.

WITNESS TURKATTE: Sure.

I'm responsible for leading, managing, administering the programs' functions and budgets and activities of the Department.

I'm also responsible for making sure the Department complies with all the applicable laws and regulations, and also with the policies established by the Board of Supervisors and the County Administrator.

MR. KEELING: Miss Turkatte, have you reviewed Exhibit SJC-001?

WITNESS TURKATTE: Yes.

MR. KEELING: Did you provide the information set forth in that exhibit, which is your Statement of Qualifications?

WITNESS TURKATTE: Yes.

MR. KEELING: Is Exhibit SJC-1 an accurate statement of your qualifications?

WITNESS TURKATTE: Yes.

MR. KEELING: Have you reviewed Exhibit SJC-2, which is your written testimony?

WITNESS TURKATTE: Yes.

MR. KEELING: Did you provide the information set forth in Exhibit 2?

WITNESS TURKATTE: Yes.

MR. KEELING: Does Exhibit 2 accurately summarize your testimony as of August -- or accurately summarize the activities in the -- in the county that you are testifying to as of August 31, 2016, when you signed it?

WITNESS TURKATTE: Yes.

MR. KEELING: Have you reviewed Exhibits SJC-16 through 39?

WITNESS TURKATTE: Yes.

MR. KEELING: Are all of those exhibits from the files and records of your Department, the County's Environmental Health Department?

WITNESS TURKATTE: Yes.

MR. KEELING: Did your Department obtain all of those documents in the ordinary course of its business?

WITNESS TURKATTE: Yes.

MR. KEELING: Are these exhibits true and correct copies of the documents you provided from your Department's files?

WITNESS TURKATTE: Yes.

MR. KEELING: Miss Turkatte, could you please summarize your testimony that you also outlined in Exhibit 2 and skip past the summary of your education and position about which you've already testified.

WITNESS TURKATTE: Okay. As mentioned, I'm the Director of the San Joaquin County Environmental Health Department.

Very simply, our mission is to protect public health. We do this through prevention. We prevent unsafe and unhealthy conditions in the environment where we eat, work, live and play. We achieve this through inspections and educational services in over 20 different environmental programs including Recreational Health Program.

This past summer, we experienced significant cyanobacteria blooms in the Delta surface waters. The risk of exposure to people out in the Delta during these cyanobacteria blooms was very high. The microsystem produced by these blooms is documented to cause serious health effects to exposed people and animals increasing the risk of illness and impact public health.

The Delta's a place where many people come to have fun and play year-round but especially during the warmer months. The Delta supports boating, sailing, paddle boarding, kayaking, rowing, water skiing, camping, hiking, and RV.

Many people enjoy the Delta with their pets, especially their dogs. Many people enjoy fishing in the Delta waters with regular fishing tournaments commonly

being held in the area. In addition, many people in and around the Stockton area, including areas identified as disadvantaged communities, fish and depend on their catch to provide a portion of the food they eat. These are sustenance fishers.

Currently, there is no local regulatory program or funding in place to monitor the water of the Delta for water quality issues that may affect public health.

We typically receive information from various State agencies that do collect water quality data from the Delta as part of their normal processes. The State then forwards the data to us when levels harmful to health are found.

The exhibits provided in my testimony include detailed models showing the dissemination of information to my Department during the summer's blooms. The State provides the data but the response to protect public health is typically local.

Local environmental health response is to educate the public on risks so that they can make informed decisions to protect their health. We do this through press releases, media interviews and followup, information dissemination (sic) to affected groups and by posting warning signs.

As a small local agency with limited resources,

we rely on State and Federal agencies for information on harmful algal blooms.

Exhibits SJC-16 through SJC-18 show three web locations we used to obtain information this past summer.

If we can have SJC-16, Page 4.

(Document displayed on screen.)

WITNESS TURKATTE: This is an example of what we received and where we go to get information. This shows the Water Quality Monitoring Council's website that includes fact sheets, guidance about harmful algal blooms, guidance for recreational water users, posting and signage criteria, and the trigger levels for protection of human health.

If we could move to Exhibit SJC-17, Page 1.

(Document displayed on screen.)

WITNESS TURKATTE: This shows the State Water Resources Control Board's Surface Water Ambient Monitoring Program's website.

This website provides forms for the reporting of blooms, analysis, or exposures and provides a document on Freshwater Harmful Algal Blooms Assessment and Support Strategy.

Exhibit SJC-18, go to Page 2.

(Document displayed on screen.)

WITNESS TURKATTE: This website provides

information on the health effects related to blooms. It includes animal poisoning information and information on risk reduction actions, including avoiding the water and removing the guts from fish and washing the fish.

The next series of exhibits are meant to provide a summary of the harmful algal blooms that we experienced in this past summer.

Exhibit SJC-19, Page 1.

I think that it would be easier to show the exhibits from the -- from that thumb drive that we provided. We could -- I think it will just speed it up a lot quicker.

(Document displayed on screen.)

WITNESS TURKATTE: This initial e-mail dated June 6 was from Christine Joab. She's an environmental scientist with the Central Valley Regional Water Control Board, and it provided the first information on the harmful algal blooms to our Department.

Miss Joab was our main contact at the State for information throughout bloom events.

Miss Joab communicated with Jeff Carruesco, Registered Environmental Health Specialist and Program Coordinator of our Recreational Health Program, with Lisa Medina --

MR. KEELING: Miss Turkatte --

WITNESS TURKATTE: -- Registered Environmental Health Specialist --

MR. KEELING: Miss Turkatte, you're going to have to slow down a little for the court reporter.

WITNESS TURKATTE: I'm sorry.

CO-HEARING OFFICER DODUC: And I would suggest, Mr. Long, that since most of the exhibits that she's referencing are e-mails and correspondence, which we are not going to have time to read, anyway, you don't need to put it up on the screen and she's going to be summarizing them.

WITNESS TURKATTE: Right. They're -- The ones that I had chosen were actually some maps --

CO-HEARING OFFICER DODUC: Okay.

WITNESS TURKATTE: -- that would -- the graphic parts of some of these e-mails --

CO-HEARING OFFICER DODUC: Yeah. The graphics is good, but like this.

WITNESS TURKATTE: Right. This is just -- Yeah.

And I'll try to move as quickly as I possibly can, in light of our having to get recorded.

Okay. Basically, in this first e-mail, Miss Joab provided information on the Department of Water Resources Visual Observation Number 1, which was

conducted on June 2nd, and the finding -- their finding of widely scattered colonies of microcystis in the San Joaquin River.

The e-mail also provided web links for the reporting and sharing of information and links to information to assist local agencies.

Based on this information, we requested additional information from Miss Joab and began preparation of a press release to warn the public of the harmful effects of exposure to blue-green algae.

So Exhibit San Joaquin County 21, Page 2, this is -- shows the information that we requested from Miss Joab.

This exhibit shows the monitoring sites that Department of Water Resources used throughout -- to monitor throughout the season from Stations 1 through 14. They have 14 monitoring sites, from Christmas Point near Venice Island along the San Joaquin River to the Turning Basin near downtown Stockton. And it shows the visual observation scale used to record concentrations of colonies from absent to very high.

MR. KEELING: I think we need the map to show what you're talking about.

CO-HEARING OFFICER MARCUS: 22?

WITNESS TURKATTE: So it's Exhibit 21, Page 2.

(Document displayed on screen.)

WITNESS TURKATTE: Yes. This is the graph that shows the -- the graphic that shows the -- the monitoring the Department of Water Resources conducted throughout the season.

Okay. So moving on to . . .

Miss Joab responded to our request for assistance on signage, and especially in Spanish, which was not available at the time.

Signage is very important for multiple languages in San Joaquin County. We have a large population of non-English-speaking, and including those that rely on fish for their food.

So, sign -- signage in the past of events, we've had up to seven different languages on a sign. And many of these people are from underserved disadvantaged communities in the Delta area.

So if we can go to Exhibit SJC-25, Page 2.

(Document displayed on screen.)

WITNESS TURKATTE: This e-mail provides information on dog exposures and deaths that we had requested. We use this information to respond to community concerns and to assist in outreach to veterinary providers.

Exhibit San Joaquin County 26, Page 3, is an

e-mail from Miss Joab. This shows Department of Water Resources Visual Observation Number 2 conducted on June 17th, and finding mostly high and medium levels of colonies in the San Joaquin River.

Exhibit 2 -- San Joaquin County 28, on Page 3. These are e-mails from Miss Joab. They're an example of a constituent concern. In this case, it was a concern about people swimming in the Smith Canal and the algal bloom that was observed there.

Over the summer, we responded to over 12 similar constituents' concerns, very similar to this one.

And, also, in this e-mail Miss Joab provided the signage we requested in Spanish.

MR. KEELING: Can you move to that slide.

WITNESS TURKATTE: Yes. If I could have -- Page 3 is the page.

(Document displayed on screen.)

MR. KEELING: The next page.

(Document displayed on screen.)

WITNESS TURKATTE: That signage was provided for us.

If we can go to San Joaquin County 29, Page 2.

(Document displayed on screen.)

WITNESS TURKATTE: This e-mail provided results of the Department of Water Resources Visual Observation

Number 3 conducted on July 5th, finding mostly high and medium levels of colonies in the San Joaquin River.

If we can go to Exhibit 30, Page 2.

(Document displayed on screen.)

WITNESS TURKATTE: This e-mail provided the results of the Department of Water Resources to Visual Observation Number 4. Unfortunately, it's in black and white. This was conducted on July 20th but it showed mostly high and medium concentrations of colonies in the river.

This e-mail also provided information on new blooms identified in downtown Stockton at McCloud Lake and Weber Point areas.

If we can go to SJC-32, Page 1.

(Document displayed on screen.)

WITNESS TURKATTE: This e-mail provided results of Department of Water Resources Visual Observation Number 5 conducted on August 1st, in black and white unfortunately, but it found mostly medium concentrations of colonies in San Joaquin River.

If we can go to SJC-33, Page 11.

(Document displayed on screen.)

WITNESS TURKATTE: This -- This e-mail is from Miss Wood, an Environmental Scientist at the Regional Water Quality Control Board.

And this was sent by her in response to a citizen's complaint about harmful algal blooms in Stockton's waterfront area and his concerns for public safety while swimming and fishing in the area.

Also attached to this e-mail was the joint press release issued by my Department and the Public Health Department on June 8th.

Our press release was issued to get the message out to the public in line with our mission to protect public health. The release provided the health effects from exposure to blue-green algae for adults, children and pets, and provided recommendations issued from the Stated designed to protect public health from exposures.

The release also advised that we were planning on posting caution signs out at local marinas cautioning recreational water users to avoid contact with blue-green algae.

If we can go to Exhibit SJC-35, Page 3.

(Document displayed on screen.)

WITNESS TURKATTE: This e-mail provided a media release from California Water Quality Monitoring Council presenting information on a newly created harmful algal blooms portal.

The media release stated the portal was created because harmful algal blooms are increasing due to warm

temperatures, increased nutrients and low water flows; and further provides that these conditions are causing persistent blooms in the Delta, and other places; and that toxic blooms are threatening drinking water supplies and causing wildlife and domestic animal deaths.

The release provides that the blooms may cause illness in humans ranging from rashes and allergic reactions to liver damage and even death.

The portal provides a mechanism for people to report observed blooms, and a fact sheet was also released called "Are harmful algal blooms affecting our waters?" A link was also provided for the public to use to access a map showing the locations of the reported blooms.

Another Exhibit, 36, is another e-mail. That e-mail provided some information about August 16th positive field test for microcystin toxin at the Big Break Shoreline in Contra Costa County at or above the 20 parts per billion test strip threshold.

20 parts per billion is the Tier 2 trigger threshold for danger health advisory.

Miss Joab stated in the e-mail that she wanted to discuss potential -- the potential for similar monitoring in San Joaquin County.

We requested more information on testing but

also related to Miss Joab at that time that the Delta's a very large place and water contact is made all over the Delta, and that there would probably be similar events at similar locations all over the Delta, and that monitoring and testing, in addition to our outreach activities we all need to conduct, would require additional resources at the local level and additional funding to support the activities.

If we can go to SJC-37, the first page.

(Document displayed on screen.)

WITNESS TURKATTE: This e-mail shows the results of Department of Water Resources Visual Observation Number 6 conducted on August 15th and finding mostly medium concentrations of colonies in the San Joaquin River.

This e-mail also reported that blooms were still being observed in Discovery Bay in Contra Costa County and McCloud Lake and Weber Point in downtown Stockton.

If we can go to Exhibit SJC-38, Page 2.

(Document displayed on screen.)

WITNESS TURKATTE: This e-mail's from the California Health Alert Network, or CAHAN, and it came with a news release from the California Department of Public Health and the State Public Health Officer.

CAHAN is a mechanism for the California Department of Public Health to share health-related news alerts with public health and environmental health agencies.

This news release warned of health risks associated with infected water being touched or swallowed, provided the health effects of exposure, including "eye irritation, skin rashes, mouth ulcers, vomiting, diarrhea and cold- and flu-like symptoms."

It stated that symptoms can be more severe for livestock and pets, including death, and that exposure may cause serious injury to the liver, kidney and nervous systems in children and adults, if swallowed, with immediate medical attention warranted, and urges recreational water users to avoid close contact with water containing blue-green algae.

This news release provided a link to California harmful algal blooms map showing voluntary-reported bloom locations.

And the last exhibit is the final exhibit from Miss Joab -- the final e-mail from Miss Joab. This e-mail showed that microcystin toxin levels reported at Big Break Shoreline continued to be elevated, and this one showed above 50 parts per billion.

The e-mail provided information that additional

testing would be conducted and that signage was going to be posted prohibiting contact with the water and to keep pets out of the water.

This last exhibit completes the summary of my written testimony.

Thank you.

MR. KEELING: Thank you, Miss Turkatte.

I believe that concludes the direct examination of Miss Turkatte. And we have another witness. We have an expert witness, Mr. Ringelberg.

If you'll give me a minute to shift papers. Thank you.

MS. MESERVE: Excuse me. For the record, Osha Meserve.

We've asked for 45 minutes for this witness. I don't know that we'll need all that time but I just wanted to make that clear because I see 20 minutes up on the timer.

CO-HEARING OFFICER DODUC: All right. We'll go ahead and start you off at 30. I know his testimony has quite a bit to say, and we'll see how -- how it goes.

MS. MESERVE: (Nodding head.)

MR. KEELING: Good morning, Mr. Ringelberg.

WITNESS RINGELBERG: Good morning.

MR. KEELING: I believe you are already sworn

in and you've already given and spelled your name, so we'll skip that.

Have you reviewed Exhibit SJC-3, which is your Statement of Qualifications?

WITNESS RINGELBERG: I have.

MR. KEELING: Did you prepare that?

WITNESS RINGELBERG: I did.

MR. KEELING: Does SJC-3 accurately state your qualifications?

WITNESS RINGELBERG: It does.

MR. KEELING: Have you reviewed SJC-4?

WITNESS RINGELBERG: I have.

MR. KEELING: And that's the summary of your testimony.

WITNESS RINGELBERG: (Nodding head.)

MR. KEELING: Did you prepare that exhibit?

WITNESS RINGELBERG: I did.

MR. KEELING: Does SJC-4 accurately summarize your testimony?

WITNESS RINGELBERG: It does.

MR. KEELING: Is there anything in SJC-4 that you think should be corrected or supplemented at this point?

WITNESS RINGELBERG: Not at this point.

MR. KEELING: Have you reviewed the San Joaquin

County exhibits submitted in connection with your testimony, by which I mean Exhibits SJC-45 through 68, excluding Exhibit 62? There is no Exhibit 62.

Have you read those?

WITNESS RINGELBERG: I have.

MR. KEELING: Are all of those exhibits true and correct copies of documents you used or relied upon in framing -- in forming your opinions in this matter?

WITNESS RINGELBERG: They are.

MR. KEELING: Mr. Ringelberg, could you please summarize your testimony in this matter.

WITNESS RINGELBERG: Yes.

I did have one correction, typo, in the slide that I wanted to identify.

MR. KEELING: Why don't you do that now, or is that something you can do in the course --

WITNESS RINGELBERG: I can do that. It's Slide Number 10, for the record.

MR. KEELING: Okay.

CO-HEARING OFFICER DODUC: I assume you want 68 up.

WITNESS RINGELBERG: Yes, please, SJC-68.

CO-HEARING OFFICER DODUC: It's SJC-68.

WITNESS RINGELBERG: I can get started while that's being put up.

So, I wanted to start out with the comment that the Petitioners simply made no statements of any kind that I could find regarding cyanobacteria and harmful algal blooms in their Petition, in it's errata SWRCB-1 and 2.

The only identification of this critical ecological issue is found in fragments in the DSEIR and EIS which are SWRCB-3, 4 and 5.

So, to -- to better understand why these blooms are so critically important and why I believe that the Proposed Project has the potential to create or exacerbate those HABs in certain flows, I've developed the following presentation which you're about to see.

But before we get into that, I wanted to describe a little bit about cyanobacteria, harmful algal blooms, or what we'll be calling HABs.

They create concentrations and toxic chemicals which you've already heard from Miss Turkatte's testimony. And these toxic chemicals and HABs essentially form in just a couple days, peaking in about six days, which I will demonstrate for you just in a general sense.

We have heard earlier that it can kill and harm wildlife, pets, and cause acute but also chronic impacts on people. It's been associated with Parkinson's

Complex, neurological impacts, and ALS.

You've also heard that they, in SACCITY-6 (sic) and 7, that they cause incredible expense to drinking water treatment plant costs.

All of these impacts are significant impacts to beneficial users of water.

Now, let's take a step back. Cyanobacteria, broad class of organisms, are naturally found throughout the Delta already but typically at very low densities. When Miss Turkatte was talking about, when you look at the colonies, colonies aren't individual organisms, they're masses of organisms. And those massive organisms conglomerate, get bigger and bigger, until you can see them as colonies. And that's what she was referring to when you're looking at HABs in the water, is those colonies.

Whenever there are drought or low flow conditions -- and so we're essentially in our fourth year of drought -- these natural microscopic members of the community are able to outcompete a whole host of other alga that are in this system.

There are many, many different alga. But HABs have certain unique biological characteristics which I'll describe -- well, cyanobacteria have certain unique characteristics that I'll describe that explains why they

dominate in these low-flow periods, the critical, ecological portion of that.

So what does it take for these algae to dominate the nutrients in the system? This system is essentially saturated in nutrients from algal perspective. There are lots of nutrients at the bottom of the watershed. There's no substantive limitation on nutrients in the system and essentially -- and given the time that the algae are able to grow.

We have lots of sunlight. We have a Mediterranean climate. There's hardly any clouds in the summertime. That means that we have nutrients and then we have the energy, the sun, to be able to allow them to use those nutrients. And cyanobacteria have special features that allow them to take advantages of our particular nutrient colony.

And then, finally, the change in Point of Diversion has a couple different factors that are critical for the final step in the growth of these cyanobacteria.

One is, the proposed Point of Diversion has massive sediment diversion ponds. And the purpose of those ponds is, when you take that water out of the Sacramento River, it's loaded with sediment, and you have to remove that sediment out for drinking water purposes.

Also, sediment causes erosion in the piping and pumps and the following, so it's a real advantage to them to take that out.

But once they've taken that sediment out of that system downstream of those intakes is now -- had that sediment removed, and that sediment is a key part of the turbidity that is in the river.

Turbidity blocks out light. And so the more turbidity that is in the system, the less light there is and the less that cyanobacteria can compete. And that's a critical function. This is why we don't see cyanobacteria in the river during high flow, early spring/mid-summer conditions, because there's essentially light in there.

Okay. And then the final issue is warmer temperatures. Cyanobacteria have an essentially sort of a rough threshold in temperature. They need a certain temperature to grow. This is why we don't see cyanobacteria blooms in the winter, even in ones that are surviving.

Okay. So let's -- Let's talk about current conditions.

Slide 2.

(Document displayed on screen.)

WITNESS RINGELBERG: Okay. So, first, I want

to set the foundation for this.

In my prior testimony, I talked about how the Delta at low flows is less of a riverine system, much more of a tidally dominated system.

There's one more element to that, which is, already, there are large areas within the Delta, such as Big Break, Cache Slough Complex, Franks Tract, that actually function as lakes. So within the existing hydrology of the -- of the Delta, we have areas that were historically leveed, they flooded, now they're big shallow lakes and they function like lakes.

And, so, when you look at research done in other places, you can compare portions of the Delta today to those lakes and then, when you reduce the flow, the whole system tends to act in a much more lake-like fashion.

And so these are ideal conditions for hazardous algal bloom formation. The edges of rivers, the slow spots, the -- the . . . the back water areas, the cuts, portions of the sloughs and these lake-like areas, are really the farms for these algal blooms.

Next slide, please.

(Document displayed on screen.)

WITNESS RINGELBERG: Okay. There's a lot on this slide and, unfortunately --

Do we have the laser again?

MR. BAKER: It doesn't work.

WITNESS RINGELBERG: So, what -- what is cyanobacterial algal bloom look like? And it -- it looks like green scum, looks like floating green particles. If it's been around a while, they're incredibly smelly, so there's that impact. And, eventually, if they've been allowed to dominate for a significant period of time, they form these very large green mats attached to the rocks or wherever the wind has blown. And so that -- that's what you're going to see when you see an algal bloom.

But probably the challenge that people have when we talk about algal bloom formation is that the algae produce the toxicity as part of chemicals within their cell. And so when the algae is blooming, that doesn't necessarily mean you're going to have the cyanotoxins floating around in the water system. A little bit of leakage, some cells leak, some cells die early, so you might have 20 percent of the actual concentration of the microcystins, the toxic chemicals, when the bloom is going on.

It's when the bloom dies and the cells rupture and they attack the cyanobacterial food from a number of other microorganisms in the system. When they get

ruptured, that's when we see this spike in the microcystins.

And the microcystin chemicals are quite robust. They're able to travel through the system and extend as far out as to San Francisco Bay, according to one study.

And so the specific algal green mat, the bloom that you see, is not necessarily associated with the cyanobacterial -- cyanotoxins. And so they might be significantly different in terms of their locations when they actually occur. And so they -- That's apparently the main focus.

Okay. So one of the unique things about cyanobacteria, they're actually a predecessor to plants, so they're very, very ancient. The -- Part of the geologic record is that cyanobacteria helped create the oxygen of the earth face.

And so they -- they initiated -- they became dominant in a period that is unlike anything that we understand here today. They predate plants. They predate anything that uses oxygen, essentially.

And so they're very, very hard -- It is almost impossible to -- to wipe them out. And so once they're in the system, they're in that system essentially in perpetuity. And they have resting stages so they can drop out of the water column and then come right back up

when conditions are ready. So this is something that, once you get, there's no management or treatment scheme to get rid of them.

And they have some unique features. In particular, some of the cyanobacteria have the ability to move within the water column, which is very unique for bacteria in the sense that they can actually create air pockets within them and flow to the surface. And that allows them to flow past other algae and get to the surface to where they can get to that sun.

And so that's critical. They can compete really effectively even when the water is filled with other competitors. As long as they have the right nutrient and light conditions, it can survive and rise to the surface.

So, let me talk briefly about the kinds of toxins. You hear a lot with microcystin. Microcystin's just one of a host of toxins. And so when you focus just looking at microcystis aeruginosa -- I'm happy to spell these for the court reporter later.

But when you have -- When you focus your -- your interest on one of the HAB formers, you're only also looking at one or a couple of the microcystin, the toxic chemicals, and you have to be very careful that you're not looking at -- You need to look at the whole of the algal community, the whole of the toxic suite of

chemicals that are created. You can't just focus on microcystin. In particular, in the Delta, microcystis aeruginosa appears to be pushed out by another microcystin.

And so if you want to monomaniacally focus in a complex system on one of the issues, you're not going to have the answer when those species shift around just naturally or because of many reductions.

Okay. So, to the slide.

All right. So I'll try not to make this too much of a science lecture here.

I wanted to show you what happens in the standard algal ecological study when you -- when you hold nutrients fixed but vary the light; okay?

And so this axis, we have the cell count, that's in millions. So there's the starting -- Let me talk a little bit about how this gets started.

So, you have a lab. Your lab techs go create nutrients, and the nutrients are all essentially stabilized and matched so that no one bottle gets more or less of the nutrients.

You then add a certain fixed amount of algal cells to those nutrients, and that's the zero point, zero hour. And then you expose, in this particular case, different intensities of light. So "lux" is just a way

of looking at light over a meter. And I'll explain what those different lux lines mean.

And by exposing those algal cells to different amounts of light, you can see different responses, but they have the same nutrients in each and every case.

And so let me describe this a little bit.

So, these are in millions.

So you use an Aqua-Lator with a quarter million. And then I'm just going to use one of these as an illustration.

As it goes up, you go from 1 million, 2 million, 3.5 million, just below 4 million. So, in a period of five days, that population skyrocketed. And this is why looking at a 14-day period is not really particularly meaningful in terms of algal growth cycles, is, because these things take off and really move quickly in a very short period of time.

So we've gone from a quarter million to 3.5 million in essentially five days. And six days now, under any of these conditions, we have massive populations.

So, the bottom line here is the control. So this is an algal bottle that was put in with no light and that helps tell you if you did something wrong with your study.

And then at the various light levels here. So 100, which is in this interval between this blue diamond and the red, that's a typical overcast day. So right in there's an overcast day.

But when it's a sunny day, it's 10,000 lux, so right off here. And so this is all happening in what we would normally as people consider fairly shady conditions. So this is what can happen to algae under full light conditions.

Now, I pointed out here that 2500 is much lower than even the sunny days. On a sunny day, it would be 10,000. And so what you actually see here is the kind of orange with balls on them is what an ecologist would say is, essentially, that's light inhibition. You have so much light at 2500, it's actually reducing the way of growth for this particular organism.

All right. So a microorganism has an ideal window of sunlight, but this is not a cyanobacteria. Cyano -- Cyanobacteria start cracking off at 2500. That's why the next number in the community, and they start taking off until we start to get over 32,000 lumens. So they're able to compete and maintain that growth rate at very, very high low light levels which is one of the things that makes them a unique competitor in this case.

And since we have essentially full sunlight most of the year, during -- certainly during the growing period for algae, they are not light limited.

Okay. Next slide, please.

(Document displayed on screen.)

WITNESS RINGELBERG: Next slide, please.

Slide 4.

(Document displayed on screen.)

WITNESS RINGELBERG: Thank you.

Okay. So you what -- you saw what happened with one alga at different light levels, and this is what's happening -- and this is what happens when you take the same basic nutrients -- I'm sorry -- the same light. You fix the light and then you change the nutrients.

And so you hear a lot of talk about different nutrient levels, a lot of the technical stuff. This is actually a little bit different. We're actually using nitrogen, phosphorus and potassium. So these are ag ratios of chemicals, so this is what we apply on the land and it essentially washes into the stream. So it provides a little bit better context with that.

But what you can see by varying the different nutrients for the microorganisms here is that all's varying the nutrient ratio does in this particular case

is either allow them to peak earlier if the nutrients are really available and they're able to crank away, or allow them to peak later, the nutrients are less available but still good ratios for them, or have a little bit of sort of inhibition. It's harder for the cells to take advantage of those nutrients in that particular ratio and they were inefficient.

Okay. And so -- But what you -- what I want to point out to is, regardless of how you play around with the ratios, you still get that same basic peak in D6 essentially, that under fixed light conditions, you change the nutrients, they still have logarithmic growth, they still go from, you know, a quarter million to the three or $4 million (sic) in six days.

And one of the challenges here is -- I've talked with you a little bit about the algal community -- there are many members of the algal community -- is, you can have cyanic tox -- cyanotoxic bacteria that take advantage of certain nutrient concentrations because that one particular genus was able to do that and then immediately followed on by another cyanobacteria.

So within 14 days, you have two massively -- two different organisms. And if there's not a scientist out there sampling, you just have no idea what happened.

And at some point some doctors could say,

essentially, that's what's happening in the current conditions.

All right. So, we talked a little bit about the basic ecology here. It's not light limited. It's not particularly nutrient limited, no matter how you play around with the ratios.

But here's the flow portion of this. And so there are lots of different models, many, many, many different models of algal ecology, algal growth, including a couple models in the Delta itself, in terms of relationship with the algae and the nutrients and the light.

But this is a really good illustration of the Potomac River. So they have a flow index. So they know with a .62 R-squared -- so, you know, a reasonable degree of confidence from a natural system -- that differing amounts of flow lead to different bloom severity.

And that knowledge is -- That's a simple mechanistic relationship. If you have -- In this case, it's a unique case, when you have more flow, you actually have more blooms. And the reason why that -- and that's very different from here in California -- is, this is not a snowpack or a largely diomanaged (phonetic) system. This is a system -- it's in the East Coast, the Potomac, in Virginia areas -- that is dependent on rainfall. And

that rainfall washes the nutrients out of this relatively urbanized system and washes those nutrients into the river, and that's when the blooms form. And that's different here.

So this is why there's actually a correlation to increasing flow rather than decreasing flow which is the argument I'm making, so just so you know.

So, flow as a mechanical variable is really easy to look at. You can develop these. You can develop the X squares. This is not rocket science. This is something that can and should be done as a simple mechanistic equation.

There are other elements to algal growth that I talked about, lights and different nutrient ratios. That's a more sophisticated modeling exercise. That can also readily be done with the information we have today. The USGS is doing that.

But that's -- that's the information necessary to understand the relationship of project flow or relation of project sediment management or project temperature of the algal community is through the development of these sorts of models, none of which were provided.

MR. KEELING: I'm sorry. I missed that last point. You're moving a little fast.

WITNESS RINGELBERG: I'm sorry.

None of which were provided in the Petition.

Okay. And I apologize if I'm going too quickly.

So, recent conditions -- and I want to be clear. Operations are not responsible for drought conditions. It's one of the -- It's been used as a straw mat.

Operations due influence flows and they influence the distribution of flows within the watershed and, in particular, the Delta Cross Channel.

The Delta Cross Channel acts in parallel to Georgiana Slough, and that's how operationally fresh water is moved from the Sacramento River today into the Central Delta. And that's one of the controlling functions for why we don't have the degree of bloom formation you could have if the DCC was, frankly, closed.

So DCC helps control salinity, but it also helps control freshening of the interior, and that freshening helps control algal bloom formation.

Okay. There is an impact -- an influence by the rim dams in that they do hold back water. They change the timing of the water for releases. They change temperature control which you folks are quite well aware of.

And the variation of releases from the dams, as Sac City identified, changes the temperature profile and the clarity profile from the American River down. And so that's something that, you know, whether or not it's been modeled, I certainly have not seen the evidence of the modeling for that.

But I think the testimony's compelling because I believe now two years ago, we actually had a dog death in the park right at -- right where the American River connects.

And I would have guessed -- I would have bet that that would not have happened, but the conditions were that with all the early water releases out of Folsom had lowered that system down. There was hardly any turbulence in the water. You could see well through it.

And the temperature, because now it's a much shallower, narrower system, had an influence on that. And so that's my hypothesis as to why we did see that dog death quite far up the Sacramento River system, which is very unusual, at the park.

And that is also identified in my references with identification that was -- The Public Health Officer identified that it was flows that was the contributing factor for that formation at the park.

So, I've spoken a little bit about this. When

you take significant fractions of the coldest, highest quality of water out of the system, Sacramento River water, you're reducing the dilution effect and ultimately the assimilation capacity of this particular watershed.

And it's been a project benefit, frankly, to have that water removed from the DCC for the purposes of water quality. But if that water is removed at the Point of Diversion, that dilution effect is missing. And that dilution effect is just one part of the puzzle.

So we have the dilution. We have the reduction in flows. So the flows are a mechanical force that break up those algal blooms. And then flows also correlated to the turbidity, to the sediment that gets maintained in the water column during those higher flows.

And so it's essentially a triple whammy. We lose the mechanisms that break up algal formation and then we exacerbate them over a very, very large area when we withdraw the water from the growing Sacramento River area.

I won't go over this since we spoke about this in detail in the past, but it is my contention the proposed operations lower flow conditions that essentially mimic the drought flows.

And, in particular, there was some commentary about the periodicity or how short that interval of those

low flows are. And I think quite clearly the algal ecology doesn't care if you have a 14-day run. On average it can grow very, very quickly as we've seen under lab conditions, within six days. And the 14-day limit is more than one interval for HAB formation.

So, according to the Petition, compliance of D-1641 is essentially, in what I've been hearing, the -- the -- the -- the criterion by which they're saying that no injury can occur.

1641 has no influence on HAB formation. It does not drive it. It is not responsive to it. If there is HAB formation with microcystis aeruginosa, which in particular of all the species is in the system, D-1641 is not sensitive to or controlling for that.

And so D-1641 in no manner can affect the . . . the relationship of hazardous algal bloom formation and the impacts to beneficial uses.

Furthermore, when you look at the interoperation of the Delta Cross Channel -- I think that got mentioned twice already -- it's likely to have a really profound effect. And we -- As a scientist, I really want to see, one, a model of the relationship between flows in the Proposed Project and hazardous algal bloom formation. But, two, in particular, the timing, because there's a variable window for the D-16 operations, that could

ultimately be the biggest driver for algal bloom formation within the Central and South Delta.

And this is Slide 10. And the typo is, I should have typed, instead of "Petition" in the first sentence, "the Petition," it should state "the DSEIR/DSEIS," because indeed the Petition didn't identify the potential for HAB influence.

So, the DSEIR did identify that microcystis aeruginosa, single species as identified, had the potential for forming in here as a result of the project change of Point of Diversion.

But in one instance said it was a significant CEQA effect and in another instance it said it was not a significant CEQA effect.

And, frankly, I don't feel it relies on any sort of substantive scientific evidence, now CEQA, so it doesn't have to rely on substantive CEQA -- scientific evidence.

But the evidence that they did bring forward in the DSEIR/EIS is clear that there is a, from their perspective even, in terms of a potential to have formations relative to Project operations, as I've described them.

So, I don't want people to get lost in the mechanics or, as the scientists say, the beauty of the

individual mechanics of the individual alga.

What's important is that the biological responses are very straightforward: Food, light, water, they're going to grow. And under more food, more light, less disruption of the colonies, they grow fantastically and they can and do have produced microcystins and other toxins in the Delta.

So, when we look at the Proposed Project and its relationship to flow and the other associated factors, there's -- there's not scientific uncertainty about the Project's impact on algal formation. It's just, there isn't one.

There is a lack of substantiation as to why the project won't do that because it seems self-evident to me as a scientist that it would cause the hazardous algal blooms by maintaining that system in that way, to drop flows, which, today, we have the organisms, we have the water flows in the drought, and we have the nutrients at more than ample enough growth conditions. We have all the factors necessary to maintain their growth.

The thing that changes as a result of this project is the flows. And what we've seen in the drought is, the flows are the driver for algal bloom formations. You heard from Miss Turkatte's testimony, that's the big difference.

(Timer rings.)

WITNESS RINGELBERG: One last slide.

CO-HEARING OFFICER DODUC: Yeah. You have one slide, so go ahead and finish up.

WITNESS RINGELBERG: So, in conclusion, the Petition fails to identify -- I won't say adequately -- identify the potential for Northern Delta diversions in their operations to promote or influence.

And I haven't spoken much about the influence thing.

So, you can promote algae. We've talked about how algal -- algae are promoted. Algae.

But they can influence HAB formations. So if you change flows in such a way that the -- the ordinary condition in the drought would be that the algal bloom formed for three days and was broken up and never really formed microcystis, more, that allowed another species to dominate in that system, the project wouldn't cause that bloom, but the problem -- the potential project operations have the ability to influence that bloom, make that bloom longer, allow microcystins to fully develop and the algae then be released.

And so it's not just yes or no, we're going to have algal blooms or not have algal blooms. We know we have algal blooms already. It's whether or not those

algal blooms will be extended or exacerbated when you look at year after year after year of relatively even project operations, is that you are able to, then, have faster and faster, to some biological limits, the ability that algal communities explode and expand the following years.

So, I've spoken a great deal already about the ultimate conditions here. I believe it has a high likelihood to injure beneficial uses as a result of the HABs themselves in the micro -- or in the various toxic chemicals.

The operational range provided by the Petitioners is very similar to the flows and the potential that in drought years we've seen already.

And as -- You know, as a conclusion, I'd like to say: There are cut -- The Delta is behind in terms of its focused scientific effort despite hundreds of millions of dollars at looking at dynamic problems. We often look at fixed problems.

Algae dynamics are literally dynamic. They change spatially; they change temporally; there's lots of moving parts in terms of the actual variables on that.

We need to spend a lot more time, a lot more energy, setting up monitoring, looking at a couple factors, developing models, testing those models, working

those models out so we can catch up with places like the Potomac, because we have the ability to do it.

We do not have the institutional or administrative focus on doing that. And I think it's critical, whether this project goes forward or not, that we have a much, much better understanding of what's happening in terms of algal dynamics in the Delta.

Thank you.

MR. KEELING: Mr. Ringelberg, before we leave your direct testimony, do you have your written direct testimony in front of you?

WITNESS RINGELBERG: I do.

MR. KEELING: I'd like you to comment on your direct testimony at Pages 12 and 13.

My -- And, first -- the page is actually 11 and 12 -- comment on what the USGS found or concluded.

And then on Page 13 and following, I'd like you to comment for the benefit of the Hearing Officers on the potential impacts of climate change -- change on HABs in the Delta, some of which you touched upon obliquely already.

WITNESS RINGELBERG: (Nodding head.) Absolutely.

Well, the USGS did an excellent job of deconstructing the physical mechanics of the Delta and

looking at some of the particulars, and I'll wait for you to catch up here.

(Document displayed on screen.)

WITNESS RINGELBERG: So bottom of Page 11, in quotations, Line 24.

(Document displayed on screen.)

WITNESS RINGELBERG: Great. Thank you.

So . . .

So, what we're looking at here is essentially USGS looking at the potential for large-scale restoration, changes in water conveyance, as a result of projects similar to the Proposed Project, and identifying specifically the Stewardship Council's co-equal goals.

But the important part related to what we're talking about here is that it's critical that we document these changes. And we are going to affect flows in the Delta through a variety of different things, including project operations.

How does that affect issues like transport process?

And, so, transport process, here they're talking about salinity intrusion, also affects microbial transfer process. You're moving the microorganisms around so you're talking about . . .

So when you -- So -- And this is their

statement, I'll quote directly from them (reading):

"Withdrawing water from the system into an isolated water-conveyance facility, such as the currently proposed twin tunnels, would also alter transport throughout the Delta."

And dropping down to Line 10 (reading):

"If the conveyance facility is built, the north-to-south draw of water across the Delta that has existed for decades would likely be reduced as a result of compensatory reductions in pumping from the South Delta, creating much longer average residence times."

And here's the focal point (reading):

"Longer residence times are associated with higher rates of algal growth, which could fuel eutrophication in some regions, including increased blooms of nuisance algae, such as microcystis, which is toxic to humans and others."

Mr. Keeling, I lost your second question.

MR. KEELING: The second question had to do with the section of your written direct summary at Page 13, potential impacts of climate change on HABs in the Delta.

When I said you commented on this obliquely, I was referring to your comments about the effect of flows

on the development of HABs.

But I wondered if you -- if you wanted to say something more directly about climate change in HABs.

CO-HEARING OFFICER DODUC: If you could summarize and not read it to me --

WITNESS RINGELBERG: Oh, fair enough.

CO-HEARING OFFICER DODUC: -- since I have it right here.

WITNESS RINGELBERG: Thank you.

I think the issue of climate change is often used as a red herring for coming up with the particular answer that you want to get.

When we look at a climate change modeling in the Sierras, actually we have a range of possibilities, and so I cited Dr. Cohen on this. Some of the range of possibilities includes higher flows.

And so if you have -- you increase precip and those flows run out of the system faster, it has the possibility of, one, lower -- well, three different parts: Increased sediment transport, lowering temperatures, and creating the mechanics that disrupt hazardous algal bloom formation. And so it's not that there is a climate change.

And even within the climate change scenario, in given back-to-back years, which we don't understand, we

could have a series of very wet springs that dampen the ability for HAB formation, even with significantly reduced snowpack and warmer overall temperatures.

And so you can't just simply say climate change means X or Y to an algal community.

And I want to point out, on my focus of microcystis, microcystis has really unique physical features. It dominates the conditions we see today.

You change climate significantly, temperature, timing of flows, amount of water in the system, you can actually get another genus of hazardous algal bloom-forming bacteria to replace that, and they have the same basic suite of toxic chemicals that are a result of that.

So, we can't just focus on what we see today as the likely outcome. We can use that to inform our understanding.

But I think climate change in particular, for this project, we're looking at -- I'm looking at -- I was tasked to look at the impacts of the Projects today, and the impacts of the Projects today don't have some fantastical future scenario for climate change. They have today's conditions, and that wasn't analyzed, either.

MR. KEELING: Thank you.

I believe that concludes the direct testimony from this panel.

CO-HEARING OFFICER DODUC: Thank you.

We will take a 15-minute break for the court reporter.

And during the break, I assume the Department will have cross-examination, so please set up for your cross-examination.

We will return at 10:40.

(Recess taken at 10:25 a.m.)

(Proceedings resumed at 10:40 a.m.)

CO-HEARING OFFICER DODUC: (Banging gavel.)

All right. It is 10:40. We are resuming.

And before we get to the Department, let me do just a quick check:

Who all anticipate conducting cross-examination of this panel?

MS. MORRIS: (Raising hand.)

CO-HEARING OFFICER DODUC: Miss Morris.

MR. HERRICK: (Raising hand.)

CO-HEARING OFFICER DODUC: Mr. Herrick.

MS. DES JARDINS: (Raising hand.)

CO-HEARING OFFICER DODUC: Miss Des Jardins.

All right. How much time do you anticipate needing, Mr. Berliner? About half an hour? An hour?

MR. BERLINER: An hour.

CO-HEARING OFFICER DODUC: An hour? Okay.

Looks like -- Miss Morris, how much time?

MS. MORRIS: About 30 minutes probably.

CO-HEARING OFFICER DODUC: Okay. So Mr. Herrick?

MR. HERRICK: No more than 10, 15 minutes at the most.

CO-HEARING OFFICER DODUC: All right. And Miss Des Jardins?

MS. DES JARDINS: 10 to 20 minutes.

CO-HEARING OFFICER DODUC: Okay. So, Mr. Herrick, it looks like we will definitely get to your team, if not around 1:00, then 1:30 or so; all right?

Thank you.

With that, Mr. Berliner, your topic areas that you will be exploring.

MR. BERLINER: I'm going to be deferring to Miss Ansley this morning.

CO-HEARING OFFICER DODUC: Miss Ansley, you're in the hot seat.

MS. ANSLEY: We will be exploring microcystis occurrences in the Delta. We will be exploring -- And this is all keyed directly to his testimony, obviously.

We will be exploring factors contributing to

microcystis blooms, some of the studies of microcystis in the Delta, in particular ones that he references in his testimony, and then his conclusions regarding the same.

And we've only added a couple questions based on things that he said today.

CO-HEARING OFFICER DODUC: So your cross will be of Mr. Ringelberg, not of Miss Turkatte?

MS. ANSLEY: That's right.

CO-HEARING OFFICER DODUC: Is there any planned cross-examination of Miss Turkatte?

All right. You may leave or just sit there and enjoy seeing Mr. Ringelberg get grilled.

Actually, do you have any redirect, I should ask, for Miss Turkatte?

MR. KEELING: I think she should stay.

CO-HEARING OFFICER DODUC: Yes. Not if there's no -- Counsel has reminded me.

MR. KEELING: It's hard to do redirect before you have cross.

CO-HEARING OFFICER DODUC: Well, there's no cross of Miss Turkatte, so, in that case, Miss Turkatte, you may stay or leave.

All right. With that --

Oh, Mr. Herrick.

MR. HERRICK: There's no cross from this

party --

CO-HEARING OFFICER DODUC: I'm sorry? There's no cross --

MR. HERRICK: There's no cross from this party, but I had a couple questions for her.

CO-HEARING OFFICER DODUC: Oh, you have -- That was -- That was my question to everyone in general.

MR. HERRICK: Oh, I'm sorry.

CO-HEARING OFFICER DODUC: That you have questions for Miss Turkatte.

So you do not get to leave. I'm sorry.

All right, Miss Ansley.

MS. ANSLEY: I do have a quick question to what Mr. Herrick just said.

It's a little confusing, but Miss Turkatte was also identified as a South Delta Water Agency witness. I don't understand quite if he's withdrawing that testimony on behalf of South Delta Water Agency so that she's not going to be testifying again, or if he is sort of, in a sense, joining in this testimony, in which case he'd be sort of cross-examining on the same testimony that he submitted, her testimony.

CO-HEARING OFFICER DODUC: Let's wait until we get to Mr. Herrick. We've been down this line before in terms of --

MS. ANSLEY: Sure.

CO-HEARING OFFICER DODUC: -- parties cross-examining witnesses that are also on their direct list, and we'll get to it when Mr. Herrick comes up.

MS. ANSLEY: Okay.

CROSS-EXAMINATION BY

MS. ANSLEY: Good morning. My name is Jolie-Anne Ansley. I represent the Department of Water Resources.

And, as I said before, my questions are for Mr. Ringelberg.

Your Statement of Qualifications has been submitted here today as SJC-3; is that correct?

WITNESS RINGELBERG: I believe so. One second.

Yes, that's the case.

MS. ANSLEY: Is that Statement of Qualifications identical to the exhibits submitted by other parties, which would be Islands, Inc. 23, Save the California Delta Alliance 32, and South Delta Water Agency 73? Are those all identical?

WITNESS RINGELBERG: No, I don't believe they're identical. I tailored each one to refer more to the specific impact.

MS. ANSLEY: Okay.

WITNESS RINGELBERG: To be clear, my CV is well

over 10 pages, so . . .

MS. ANSLEY: Do you recall how your Statement of Qualifications for this testimony is different from your Statement of Qualifications for Islands, Inc., which we heard last?

WITNESS RINGELBERG: No. I don't recall if there are differences. Sorry.

MS. ANSLEY: Have you ever published a pier review on the subject of microcystis in the Delta?

WITNESS RINGELBERG: No, I have not.

MS. ANSLEY: Have you ever developed a food web model for the Delta?

WITNESS RINGELBERG: No, I have not.

MS. ANSLEY: In reaching the opinions that you present here in SJC -- I should ask first:

Your testimony is submitted here as SJC-004; is that correct?

WITNESS RINGELBERG: It is.

MS. ANSLEY: And you have no corrections to your actual testimony here today; did you?

WITNESS RINGELBERG: Not to SJC-004 but to the PowerPoint.

MS. ANSLEY: Thank you.

In reaching the opinions that you present in SJC-004, you yourself performed no independent analysis

or modeling of impacts of the proposed changes on microcystis or harmful algal blooms in the Delta; did you?

WITNESS RINGELBERG: No, I did not.

MS. ANSLEY: This morning, you testified to a number of factors that contribute to harmful algal blooms in the Delta.

What generally -- if you can provide me with a list -- are the environmental factors that do contribute to harmful algal blooms in the Delta?

WITNESS RINGELBERG: In various permutations, I described it about five different times, so I'd be happy to restate that if you like.

There's a minimum temperature.

There is light availability, and the factors that influence light availability.

There are nutrients.

And, finally, there are the presence of the organisms themselves.

Oh, and the most important one, the influence of flow and mechanical disruption of the algal blooms.

MS. ANSLEY: How about pH?

WITNESS RINGELBERG: I do not describe pH as a factor in this system for a number of different reasons.

So, in certain riverine systems, there's a pH

essentially loop where a certification created by algal blooms causes fosters to come out of sediment by dropping the pH, and -- But that's not something that we've seen much of -- I'm not aware of any evidence of that in the Delta.

MS. ANSLEY: How about the various ratios of different nutrients?

WITNESS RINGELBERG: I spoke at length about those.

MS. ANSLEY: Turbidity. Would you consider that a light -- a factor related to light irradiance, turbidity, or water clarity?

WITNESS RINGELBERG: Yes. I spoke about light availability. And turbidity is a factor that influences the light available to the microorganisms.

And I explained that the microorganisms have the ability to move within the water column vertically to adjust for variances in light.

MS. ANSLEY: At the end of your testimony, you have a figure, Figure 1. If we could look at it. It was both in your testimony and I believe it's also in your PowerPoint, which is SJC-68.

Either one, Mr. Baker.

(Document displayed on screen.)

MS. ANSLEY: Okay. Stopping right there.

This is Figure 1 from your testimony; is that correct?

WITNESS RINGELBERG: Yes, it is.

MS. ANSLEY: And this shows a basic relationship between light or light air surface of radiance and cell counts; is that correct?

WITNESS RINGELBERG: I wouldn't call it surface radiance. I'd say it's available light in lux.

MS. ANSLEY: Okay. Thank you for the clarification.

This figure is for marine diatoms; is that correct? This is not a figure specific to microcystis?

WITNESS RINGELBERG: That is correct, yes.

MS. ANSLEY: Can we look at the next figure, please.

(Document displayed on screen.)

MS. ANSLEY: A similar question.

This -- This relationship between cell growth and NPK ratios is not specifically for microcystis; is it?

WITNESS RINGELBERG: I used both of these figures to show the relative response under controlled laboratory conditions for similar algal organisms.

MS. ANSLEY: This is, in fact, a marine unicellular green algae?

WITNESS RINGELBERG: Actually, I'm not certain that this one is a marine unicellular green algae. I could check.

MS. ANSLEY: Are you familiar with chlorella vulgaris?

WITNESS RINGELBERG: Yeah. I wasn't certain if this was actually chlorella.

Yeah. I'm not certain if this is the marine cultivar for chlorella but . . . it is indeed chlorella vulgaris.

MS. ANSLEY: And that is a marine cellular green algae; is that correct?

WITNESS RINGELBERG: Yes. It is a single-cell organism.

MS. ANSLEY: So, you use these slides to talk about the adequacy or, as you testified earlier, lack of adequacy of looking at a 14-day time period; is that correct?

WITNESS RINGELBERG: I used it as an illustration as to why a 14-day time period would not be suitable for understanding algal dynamics.

MS. ANSLEY: Can you identify for me in your testimony where you discuss the adequacy of a 14-day time period, please.

WITNESS RINGELBERG: It was not in my written

testimony. It was in response to questioning in my prior testimony.

MS. ANSLEY: I'm sorry. You're saying that this isn't -- that that line of testimony is not in your direct testimony presented here today as SJC-004?

WITNESS RINGELBERG: That is correct.

MS. ANSLEY: Madam Hearing Officer, I'd like to move to strike his testimony concerning the adequacy of 14-day time period in response to these graphics presented as part of SJC-004.

MR. KEELING: I believe Mr. Ringelberg just explained that the 14-day period came from examination prior to today.

WITNESS RINGELBERG: That's correct.

CO-HEARING OFFICER DODUC: That was in response to a cross-examination from an earlier panel?

MR. KEELING: Yeah.

CO-HEARING OFFICER DODUC: Which you should have addressed in redirect.

MS. MORRIS: Stefanie Morris for the State Water Contractors.

I'd like to join in the objection and just note this is part of the issue with a witness presenting on three or possibly four different times.

He's adding to his direct testimony,

essentially surprise testimony, in response to cross-examination questions. He did that several times throughout his direct testimony today.

CO-HEARING OFFICER DODUC: Thank you, Miss Morris.

If it's not in your direct as submitted for this panel, then it is strick -- it is struck.

The objection is sustained.

Please move on.

MS. ANSLEY: Thank you.

MS. MESERVE: Madam Hearing Officer, just to clarify. Sorry.

We have submitted these as a group, so, I mean, I think there -- we were trying to -- I think we've been struck by some slightly unfair, possibly, rulings because of the fact that we grouped together testimony.

And so, I mean, I guess we will address this when we submit our evidence, but I don't necessarily think it's true that we have to stay within the tiny boxes of the specific panels with respect to some of these overarching topics that we've been addressing.

I think we've been quite clear in our entire cases in chief that we have a big problem with the using of 14-day average.

So, it seems to me that it's within the scope

of what Mr. Ringelberg and others within the multiple panels were presenting -- are saying, and I can address that further in briefing.

CO-HEARING OFFICER DODUC: You may do so, but my response right now stands because the witness has said that this is not part of his direct for this particular panel, that this is in response to cross-examination from a previous panel, and his counsel, Mr. Keeling, has also affirmed that.

So my ruling stands.

MS. MESERVE: Just to clarify, however: The 14-day average was in his direct testimony on salinity as well. It's not just on cross.

CO-HEARING OFFICER DODUC: All right. But the 14 with respect to this HAB is not in his direct.

Please proceed.

MS. ANSLEY: Thank you.

I have a somewhat similar question.

Earlier today, I believe you testified as to -- And please correct me for your exact wording. You testified to lake-like conditions in areas such as Cache Slough; is that correct?

WITNESS RINGELBERG: I identified in my testimony that, during certain flows, there are features within the Delta, including the Cache Slough complex,

that are -- respond more lake-like than riverine.

MS. ANSLEY: Can you point me to where that is in your testimony.

WITNESS RINGELBERG: It's not in my direct testimony.

Let me clarify that: The reference to Cache Slough is not in my direct testimony. My reference to lake-like versus riverine conditions is.

MS. ANSLEY: So you identified no specific locations as you did this morning; is that correct?

WITNESS RINGELBERG: I believe that's correct.

MS. ANSLEY: Can we have a similar objection that we'd like to move to strike testimony concerning lake-like conditions in specific locations in the Delta?

CO-HEARING OFFICER DODUC: Do you have others?

MS. ANSLEY: I -- You know, I was struggling. I know he mentioned Cache Slough. I know that he's familiar with Cache Slough so it caught my attention.

I -- He did mention one other place and I did not catch the reference. I believe there were only two specific locations he identified this morning in the same sentence or paragraph.

CO-HEARING OFFICER DODUC: All right.

WITNESS RINGELBERG: You know --

CO-HEARING OFFICER DODUC: Miss Morris, are you

joining in the objection?

MS. MORRIS: Yes, but there's a clarification.

CO-HEARING OFFICER DODUC: Hold on. Come up to the microphone.

MS. MORRIS: Thank you.

Just one quick clarification.

I don't believe that the testimony talked about lake-like conditions anywhere in the Delta and certainly in those specific conditions.

It did reference a study done in Lake Erie, but I don't think a reference to lake-like conditions in the Delta.

CO-HEARING OFFICER DODUC: Mr. Keeling.

MR. KEELING: If we are to cross consists of a computerized word search through the written testimony, and a "gotcha aha" whenever a phrase comes up or a word comes up in the spoken testimony that is not in the written testimony, then that makes a mockery and a circus of this hearing.

The concepts and the basic precepts we've been talking about, flow, residence time, and the other concepts that are controlling here were indeed part of his direct.

CO-HEARING OFFICER DODUC: All right.

Miss Morris. Do you have something productive

and constructive to add?

MS. MORRIS: No.

CO-HEARING OFFICER DODUC: Thank you.

All right. Miss Ansley.

MS. ANSLEY: Thank you.

CO-HEARING OFFICER DODUC: Let's move on and let's -- let's focus on some substance now, please.

MS. ANSLEY: Sure. I -- I was just trying to tailor my questions that I do have to whatever he said this morning as well so I'm aware.

Finally, you mentioned microcystis blooms in -- you mentioned microcystis in San Francisco Bay. And I just wanted to clarify that I knew where we were talking about.

Are you aware of any microcystis blooms in the actual San Francisco Bay as opposed to the Delta?

WITNESS RINGELBERG: I believe I -- Excuse me.

I believe my comments related to the ability of microcystins and other toxins to be migrated or . . . drift essentially out of the Delta into the San Francisco Bay.

MS. ANSLEY: Okay. Thank you that the clarification.

So, Mr. Ringelberg, microcystis blooms have been identified as a concern in the Delta since 1999; is

that correct?

WITNESS RINGELBERG: That's what the literature states, yes.

MS. ANSLEY: Looking at Page 2 of your testimony.

Oh, we'll wait till it comes up.

(Document displayed on screen.)

MS. ANSLEY: Thank you, Mr. Baker.

Looking at Page 2, Lines 19 to 22 of your testimony, you state that Molecular Biologists have identified the microcystic genre as being less dominant in the Delta, potentially being replaced by another species of toxic algae; is that correct?

Do you see that?

WITNESS RINGELBERG: Yes, I do.

MS. ANSLEY: Is your support for this statement the article by Kurobe, et al., in 2013?

WITNESS RINGELBERG: I believe that was my primary citation, but there are other citations related to that.

MS. ANSLEY: Does your testimony provide any other citations for that statement?

WITNESS RINGELBERG: No, my testimony does not identify other citations for that sentence.

MS. ANSLEY: Turning to this specific

publication, Kurobe, et al., 2013, are you aware of when the sampling was done for that study?

WITNESS RINGELBERG: I'd have to see the study.

MS. ANSLEY: I believe that's SJC-045.

(Document displayed on screen.)

CO-HEARING OFFICER DODUC: I assume that you do know when it was done and that you're leading to a point?

MS. ANSLEY: I am. I am leading to a point.

CO-HEARING OFFICER DODUC: Let's get there.

MS. ANSLEY: Okay.

WITNESS RINGELBERG: The answer to your question is 2011.

MS. ANSLEY: Okay. So, are you aware of what the year type was in terms of hydrologic year points in 2011?

WITNESS RINGELBERG: Yeah, I don't recollect.

MS. ANSLEY: So you're not aware that that was designated as a wet year hydrologically?

WITNESS RINGELBERG: I don't know that to be the case. I'd have to take a look at the study again with that particular information in mind.

MS. ANSLEY: Based on your knowledge of microbial or algal ecologies, is it possible that conditions during that sampling period, assuming that it was a wet year, could have affected the abundance and

distribution of species of phytoplankton?

WITNESS RINGELBERG: And I think I testified at length about the -- some of the key influences and drivers on the system, including during high flows, as related to . . .

Excuse me. The Potomac River.

CO-HEARING OFFICER DODUC: So your answer to her question is "yes"?

WITNESS RINGELBERG: Yes.

MS. ANSLEY: Okay. And aside from the Kurobe 2013 study, do you have -- do you present any evidence here today that microcystis is becoming less dominant, you know, after 2011 perhaps in the Delta?

WITNESS RINGELBERG: I think I wrote and meant something different than what you're drawing my attention to. So I don't disagree with your statement.

CO-HEARING OFFICER DODUC: What did you mean, then? Because that's what you wrote.

WITNESS RINGELBERG: Yes. Well, so, identifying the genus as being less dominant in the Delta potentially being replaced by the toxic AFA, as I explained in my testimony, the individual genus isn't as particularly relevant, and that was one of the points of this section, as the overall potential to influence flows and result in algal blooms.

The particular genus or species of the alga is not critical to the question that I was asking.

The point is illustrative of -- that there are multiple community level dynamics in the system and you can't rest on the understanding or the conclusions drafted on microcystis.

MS. ANSLEY: Let me -- Let me ask one clarifying question.

But isn't the species of concern of all phytoplankton species, those species, in particular microcystis, that actually produce microcystin toxins and you're concerned with toxic algae here, not other flora of phytoplanktons?

WITNESS RINGELBERG: Yeah. I would not say that specifically.

Microcystin and microcystis are related because one is the dominant toxin created by microcystis. There are multiple other cyanobacteria that produce toxins, some of which include microcystin, but some of which include other blue-green algal toxins.

MS. ANSLEY: Okay. I think that I -- I think I'm good with that.

I just wanted to know whether you have any evidence that microcystis is not the dominant algal species of concern -- or it's not an algae, I'm sorry --

a cyanobacteria species of concern or genre of concern in the Delta other than this Kurobe, et al., 2013 in your testimony?

WITNESS RINGELBERG: Yes. There are -- There are -- Let me clarify.

So, there are no other citations in my testimony that relate to the dominance of a particular genus.

MS. ANSLEY: Okay. Thank you. I can move on.

So, on Page 3 -- the next page of your testimony --

(Document displayed on screen.)

MS. ANSLEY: -- you reference several models, one of which is a food web model for the Delta known as the DRERIP; is that correct?

WITNESS RINGELBERG: That's correct.

MS. ANSLEY: Which is the Duran-Sacramento-San Joaquin Delta Regional Ecosystem Restoration Implementation Plan; correct?

WITNESS RINGELBERG: Could you restate that? I wasn't quite clear.

MS. ANSLEY: I'm not sure I can.

The DRERIP stands for Duran Sacramento San Joaquin Delta Regional Ecosystem Restoration Implementation Plan; is that correct?

WITNESS RINGELBERG: Yes, and I referred to it as a conceptual model.

MS. ANSLEY: Right. And you submit that as SJC-48; correct?

WITNESS RINGELBERG: I believe it's SJC-46.

MS. ANSLEY: Oh, I'm sorry, I stand corrected. It is 46.

And I think you just stated it, but isn't it true that the DRERIP is a conceptual model?

WITNESS RINGELBERG: I think DRERIP falls within the class models that are considered conceptual models. That's a term of art.

MS. ANSLEY: Can we look at SJC-46, please.

(Document displayed on screen.)

MS. ANSLEY: The second page.

(Document displayed on screen.)

MS. ANSLEY: Thank you.

So, do you see here where it refers to itself as a conceptual model?

WITNESS RINGELBERG: That's right.

MS. ANSLEY: It's not a mathematical model; is that correct?

WITNESS RINGELBERG: It is not a mathematical -- a mathematical model in the traditional sense, no.

MS. ANSLEY: And it is a suite -- it is a part of a suite of conceptual models designed to aid in the identification and evaluation of restoration actions in the Delta; is that correct?

WITNESS RINGELBERG: I believe it's been used for that.

MS. ANSLEY: Do you see the second paragraph and the first paragraph of the Preface.

Would you agree that that's what that says?

WITNESS RINGELBERG: Excuse me. Give me one second. I'm . . .

(Examining document.)

Could you ask your question again? Is it the third paragraph?

MS. ANSLEY: I was just asking you to confirm that the question I asked is actually stated on the second sentence of the first paragraph there, that these (reading):

". . . Conceptual models are designed to aid in the identification and evaluation of ecosystem restoration actions in the Delta."

Do you see that?

WITNESS RINGELBERG: I see that sentence. I think the operative sentence is the one following that (reading):

"These models are designed to structure scientific information such that it can be used to inform sound public policy."

MS. ANSLEY: Okay. I see that.

But this is not a predictive model; is that correct?

WITNESS RINGELBERG: Oh. It is not intended to be a predictive model.

MS. ANSLEY: In looking at the third paragraph, to the point you just said, the third sentence of the third paragraph, it says, these are not -- or (reading):

"They are not quantitative, numeric computer models that can be 'run' to determine the effects of" an action -- or "of actions." Excuse me.

Do you see that?

WITNESS RINGELBERG: Yes.

MS. ANSLEY: Isn't it true that the information used to derive this conceptual model is at least eight years old?

WITNESS RINGELBERG: I believe actually some of the information used to populate this model is older than that --

MS. ANSLEY: Is older than that.

WITNESS RINGELBERG: -- so the answer's "yes."

MS. ANSLEY: This model is dated 2008; isn't

it?

WITNESS RINGELBERG: Right.

MS. ANSLEY: Based on your knowledge of the development of literature, there's been further publications on the -- on issues relative to the food web productivity in the Delta, is that correct, since that time?

WITNESS RINGELBERG: That is correct.

MS. ANSLEY: And the DRERIP model does not specifically address cyanobacteria or microcystis in specific; does it?

WITNESS RINGELBERG: Yeah. The purpose of my illustration of this model was to show that there was an existing Delta model that allowed you to understand the relationship between residence, time, water velocity, nutrients and turbidity, which this model does quite well, and scale whether our knowledge or understanding of those forces was essentially strong or weak.

And in each of these cases, that was the -- The purpose of this illustration was that it has a phytoplankton function that articulates that.

So, in answer to your question, it was not used to define a particular genus or species, but that the interaction between various phytoplankton and the drivers for their growth in the Delta is identified here.

MS. ANSLEY: So it's a conceptual model that applies sort of coarsely to all phytoplankton and factors that contribute to primary productivity and phytoplankton in the Delta; is that correct?

WITNESS RINGELBERG: Well, it actually breaks out phytoplankton to finer scales, but it does not, I think to your next question, identify specific blue-green algae.

MS. ANSLEY: Correct. It focuses on diatoms and microflagellates?

WITNESS RINGELBERG: That's correct.

MS. ANSLEY: Okay.

WITNESS RINGELBERG: But I wouldn't say focus. It includes a breakdown for those particular organisms, classes of organisms.

MS. ANSLEY: Okay. So, would you agree that different conditions favor differing species or genre of phytoplankton, including in the Delta?

WITNESS RINGELBERG: Yes, I believe that different conditions favor different species.

MS. ANSLEY: So this model doesn't specifically provide any information regarding the level of flows that were initiated or maintain a microcystis bloom in the Delta.

WITNESS RINGELBERG: To the best of my

knowledge, those data don't exist.

What this model's intended to do is to show the ecosystem drivers that would promote the growth of phytoplankton, of which the blue-green alga are considered in this model.

MS. ANSLEY: Your testimony also references the models used, and these are models used for Lake Erie and the Potomac River, on Page 3; is that correct?

WITNESS RINGELBERG: That's correct.

MS. ANSLEY: Has the Potomac model ever been validated for use in the San Joaquin-Sacramento Delta?

WITNESS RINGELBERG: Not to the best of my knowledge.

MS. ANSLEY: The same question: Has the Lake Erie model ever been validated for use in the Sacramento-San Joaquin Delta?

WITNESS RINGELBERG: Again, not to the best of my knowledge.

MS. ANSLEY: So there's been no study that the conditions that drive those models or those relationships for those -- for Lake Erie or the Potomac River are applicable here in the Delta; is that correct?

WITNESS RINGELBERG: I believe in my direct testimony, I gave illustrations as to the differences between those models and the Delta specifically.

MS. ANSLEY: I'm sorry. I kind of lost my train of thought.

Did you actually answer my question? So --

WITNESS RINGELBERG: I believe I did.

Please ask it again. Maybe you can help me on it.

(Counsel confer.)

MS. ANSLEY: Can I have my question repeated, please.

(Record read.)

WITNESS RINGELBERG: That -- That's a compound question.

MS. ANSLEY: Okay.

WITNESS RINGELBERG: So, I illustrated how the mechanisms applied in those models, including the two models that were -- a few models that were described in here, would apply to the Delta.

Has there been a separate study that identified that those models could be used as is for the Delta?

MS. ANSLEY: For example, your -- I believe your Potomac model was a relationship -- a simple linear regression between flow and . . . I'm sorry. I'm trying to remember the other axis. It was . . .

WITNESS RINGELBERG: Percentage blooms.

MS. ANSLEY: For percentage blooms. Okay. And

so percentage blooms.

Has there been any studies of the same or sort or relationship found that -- in the Potomac that fit that linear regression applies to the Delta?

CO-HEARING OFFICER DODUC: If you're -- If you're talking about Slide 5 of his presentation --

Is that what you're talking about?

MS. ANSLEY: Sure. That was the graph he put up for the Potomac model, and that shows simple linear regression between flows --

CO-HEARING OFFICER DODUC: And he acknowledged that that is not applicable here.

MS. ANSLEY: Okay. I mean, I'm -- I'm --

CO-HEARING OFFICER DODUC: The point of his testimony was that there was no modeling, no studies done, applicable here, and his suggestion was that Petitioners should do that kind of analysis.

Did I catch that correctly, Mr. Ringelberg?

WITNESS RINGELBERG: That is correct.

CO-HEARING OFFICER DODUC: All right. Let's move on.

MS. ANSLEY: I apologize. On Page 3, I was trying to get clarification that the Project failed to apply any of those models to this Project. So I'm happy on that point.

CO-HEARING OFFICER DODUC: Thank you so much.

MS. ANSLEY: (Laughing.)

On Page 14 of your testimony --

(Document displayed on screen.)

MS. ANSLEY: -- Lines 19 through 21 --

Oh, I'm sorry.

(Document displayed on screen.)

MS. ANSLEY: -- you testified that (reading):

"Removing significant fractions of the . . . Sacramento River and concentrating that effect in a river corridor profoundly changes the downstream channel flow" or velocity.

Correct?

WITNESS RINGELBERG: Yes. The reduction of flow changes velocity.

MS. ANSLEY: Isn't it true that the DWR study of velocity in the areas of the Delta where microcystis is a concern?

WITNESS RINGELBERG: Could you ask that question more specifically?

MS. ANSLEY: Are you aware that as part of its studies the DWR did study velocity in areas of the Delta where microcystis is a concern?

MR. KEELING: Objection: Vague and ambiguous as to location, as to areas where it's a concern.

MS. ANSLEY: Okay. I'll back that out.

Are you aware that DWR did indeed study velocity in the Delta?

WITNESS RINGELBERG: I believe the DWR has modeled velocity in the Delta.

MS. ANSLEY: Okay.

WITNESS RINGELBERG: Is that what you mean by "study"?

MS. ANSLEY: Sure.

Are you aware that earlier in this proceeding that DWR witnesses testified that the Project will not have a significant impact in velocity in areas of the Delta of concern regarding microcystis?

Do you recall that testimony?

WITNESS RINGELBERG: Actually, could you give me a second? I believe I have that here.

(Examining document.)

MS. MESERVE: May DWR clarify whether they're talking about direct testimony or on cross or what they're talking about?

MS. ANSLEY: I believe . . .

(Counsel confer.)

MS. ANSLEY: I believe it was -- I do not recall direct or cross. I believe it was live during the earlier Petitioners' case in chief put on by Petitioners

and DWR. If he's not aware, he can say.

WITNESS RINGELBERG: Well, I'm aware of some testimony. I'm not sure if it's the testimony you're referring to.

Could you provide an illustration of it?

CO-HEARING OFFICER DODUC: Is there a particular question about -- I assume it was the Water Quality Panel expert witness that you wanted to ask Mr. Ringelberg?

MS. ANSLEY: I merely wanted to know whether he was aware that the DWR had actually provided testimony in this proceeding that -- that the DWR studies show no significant impacts on velocity as it relates to microcystis.

If he's -- If he's not aware, I'm happy just to move on.

CO-HEARING OFFICER DODUC: I believe he's aware some analysis was done. His opinion was inadequate.

Did I capture that correctly?

WITNESS RINGELBERG: (Laughing.)

Let me clarify where I think we're headed with this.

So, the one-dimensional DSM-2 model is not a relevant model for the assessment of microcystis because microcystis functions throughout the water column in

three dimensions and the -- the model itself doesn't have the ability to show that.

To the degree that the model represents residence times under fixed scenarios, that's the useful application of that model.

But I want to be clear: Residence time does not -- does not directly -- residence time as described by DSM-2, there is no evidence that I'm aware of that relates to HAB formation.

MS. ANSLEY: But you will agree that DSM-2 does indeed model velocity.

WITNESS RINGELBERG: DSM-2 models velocity for the purposes of comparative studies, not for the purposes of understanding HAB formation.

MS. ANSLEY: Going back to Page 4 of your testimony.

(Document displayed on screen.)

MS. ANSLEY: Mr. Ringelberg, on Page 4, you again lay out your assertion that the proposed operational rules of the Projects would produce drought equivalent conditions. Is this correct?

WITNESS RINGELBERG: Yes, I testified to that before. The operative -- With the caveat, and I made this caveat before, that not all operations -- operations determine certain flows.

MS. ANSLEY: And this is just a limited question because I know that we've done testimony on cross on this.

Are you aware of the proposed middle bypass flow for the Proposed Project under the -- under the example that you cite, DWR-5 Errata, Slide 25?

WITNESS RINGELBERG: Yes, I'm familiar with that figure.

MS. ANSLEY: And that middle bypass flow is 5,000 cfs; is that correct?

WITNESS RINGELBERG: Minimum bypass flow has a variety of stairsteps, so I'd like to take a look at DWR Errata 5.

(Document displayed on screen.)

MS. ANSLEY: So while we're putting that up, you're not aware there's a minimum flow by which there are no diversions under this proposed example?

WITNESS RINGELBERG: It's Page 4 of ours. I'm not sure which slide we're actually talking about here.

Which slide are you interested in?

MS. ANSLEY: You -- Pardon me.

You cite to DWR-5 Errata, Page 20 -- Slide 25.

(Document displayed on screen.)

WITNESS RINGELBERG: This is not --

(Document displayed on screen.)

WITNESS RINGELBERG: Yeah. There we go. Is it 25?

CO-HEARING OFFICER DODUC: No, it's five.

MS. RIDDLE: 25.

CO-HEARING OFFICER MARCUS: 25.

WITNESS RINGELBERG: Exhibit 5, Page 25.

(Document displayed on screen.)

WITNESS RINGELBERG: This figure shows the minimum pumping beginning at 5,000 cfs.

MS. ANSLEY: Okay. And my simple point is, then, your testimony on Line 14 of Page 4, where you state that, under the proposed rules, that, "at 5,000 cfs, 9,000 (sic) cfs would be diverted, leaving 4100 cfs in the river" is incorrect; is that true?

WITNESS RINGELBERG: My testimony is not incorrect. I believe that was illustrated and covered under cross-examination in my prior testimony in terms of the following figure, which is on the next page.

MS. MESERVE: Tell them where it is.

WITNESS RINGELBERG: Sorry. My apologies. The next page of the Errata 5.

(Document displayed on screen.)

MS. ANSLEY: And you're looking at which line on this graph?

WITNESS RINGELBERG: So, the North Delta bypass

flow requirements are the red line.

MS. ANSLEY: Does that go below 5,000 cfs?

WITNESS RINGELBERG: The North Delta Diversion, period, is the green line.

MS. ANSLEY: So it's your understanding that flows can go below 5,000 cfs under the proposed example operational rules that you cite?

WITNESS RINGELBERG: (Examining documents.)

I think we're conflating what I testified and your question.

I -- The way that I wrote my testimony in this was the amount of flow being left in the river, and I think that's been used as the surrogate for the actual amount diverted.

Thresholds for diversion are identified with the red line and then the amount being diverted is identified by the green line in that figure.

The threshold for diversion is 5,000 cfs during certain periods according to this proposed dry-year example.

MS. ANSLEY: So your testimony on Page 4 at Line 14 is not correct, that there would be diversions below a flow of 5,000 cfs? I'm simply trying to get clarification on that one line.

Under the example on which you rely.

WITNESS RINGELBERG: Can you give me the line number?

MS. ANSLEY: Oh, sure. It's Line 14 on Page 4 of your testimony, where you state (reading):

". . . Flows . . . would be altered in the following manner, at 5,000 cfs, 900 cfs would be diverted, leaving 3,100 (sic) cfs in the river."

WITNESS RINGELBERG: Yeah. That's a reflection -- The point of inflection at 5,000 cfs allows, then, the so-called low-level pumping.

That threshold exists at 5,000 cfs. I was not talking about a threshold existing below 5,000 cfs.

MS. ANSLEY: So it's your -- So it's your understanding that, in the example, there would be pumping at 5,000 cfs?

WITNESS RINGELBERG: Pumping is initiated at 5,000 cfs.

MS. ANSLEY: Okay. On -- On Page 4, you also state that -- At Lines 9 through 10, you also make the point that (reading):

". . . Because of the current drought conditions, spring is now an important period for bloom formation."

Do you see that assertion?

WITNESS RINGELBERG: Yes, I do.

MS. ANSLEY: And is your -- Is it your understanding that, currently, microcystis blooms occur primarily in the summer and the fall?

WITNESS RINGELBERG: Well, we're talking about two different kinds of blooms.

Microcystis blooms, from the literature, in the Delta appear -- that appears to be correct.

Glibert's analysis was an identification of the potential -- not potential -- that spring was now an important period because of modifications to the system.

MS. ANSLEY: Well, because of modifications to the system? What modifications?

WITNESS RINGELBERG: Give me a second and I'll pull that citation.

MS. ANSLEY: Is Giblet -- Is Glibert, et al., your cite -- your only cite for this assertion?

WITNESS RINGELBERG: (Examining document.)

Glibert is my only cite for this conclusion. And, if I could, let me state the title of that citation (reading):

"Major -- but rare -- spring blooms in 2014 in San Francisco Bay Delta, California, a result of the long-term drought, increased residence time, and alternate nutrient loads and forms."

MS. ANSLEY: Yes. That's SJC-48, for the

record.

So, as you just stated, didn't this study characterize the observed bloom in 2014 as rare?

WITNESS RINGELBERG: Yes.

MS. ANSLEY: And isn't it true that the bloom observed in 2014 was, depending on location, dominated by chlorophytes and diatoms but not microcystis; is that correct?

WITNESS RINGELBERG: (Nodding head.)

(Examining documents.)

CO-HEARING OFFICER DODUC: Is anybody still awake?

(Laughter.)

WITNESS RINGELBERG: The reason why I'm delaying here is because there's a methodological difference that Glibert used, and so I want to make sure I'm talking specifically about the approach.

(Examining documents.)

CO-HEARING OFFICER DODUC: While Mr. Ringelberg is re-reading the study, where are you going with this, Ms. Ansley?

MS. ANSLEY: I'm sorry. What was the question?

CO-HEARING OFFICER DODUC: Where are you going and how quickly can we get there?

MS. ANSLEY: All I was trying to do is point

out that this study, in fact, does not -- does not -- is not an observation or a study of a microcystis bloom and that this study is not -- and I guess the end point is, the study is not evidence that spring is now an important period for bloom formation for microcystis, but I wasn't expecting to be . . .

CO-HEARING OFFICER DODUC: Okay. So, you've said it; it's noted.

Do you disagree, Mr. Ringelberg?

WITNESS RINGELBERG: The intent of the study was not a synoptic study to identify algal blooms, it was to look at algal blooms that they were able to identify in the field recon and provide samples of those.

And so it would not be statistically -- It was not statistically designed to identify which mixtures of which alga are found where in the Delta.

And so I think the reason why I used that illustration is, because it was an important period for bloom formation that was novel and pointing towards, one, the lack of understanding of algal ecology in the Central Delta, but also, more importantly, that under the conditions that they looked at, that nutrients were not a limiting factor, and temperature was not a limiting factor for algal blooms.

CO-HEARING OFFICER DODUC: Okay. Fine. We'll

consider that in weighing the evidence.

Move on, Miss Ansley.

MS. ANSLEY: Okay.

Is it your conclusion in your testimony here today that the Proposed Project will increase Delta water temperatures or have an impact on Delta water temperatures?

WITNESS RINGELBERG: Yes. I included testimony that it appears that it would have increased local temperatures as related to the testimony provided by SACCITY, I believe, 5 and 6.

MS. ANSLEY: Do you cite SACCITY-5 and 6 in your testimony?

MR. KEELING: Madam Hearing Officer, you yourself indicated early in this proceeding that witnesses may rely on other submissions in this hearing.

CO-HEARING OFFICER DODUC: Move on, please.

MS. ANSLEY: Okay. And what specifically are you relying to in SACCITY-5 and 6?

WITNESS RINGELBERG: The quite extensive illustrations of the effects of operational changes and priorities to Folsom Dam and the consequential effects of temperature and clarity on what they believed to be significant impacts on their beneficial uses of water.

We could go line by line through that, if you'd

like.

MS. ANSLEY: And would this be -- Just for my knowledge, would this be the testimony of Pravani Vandeyar and Bonny Starr?

WITNESS RINGELBERG: That's correct.

MS. ANSLEY: And would it rely on Miss Starr's correlation of -- and I believe she had some graphs of water releases from reservoirs and water temperature?

WITNESS RINGELBERG: It --

MS. ANSLEY: Is that what you're relying on?

WITNESS RINGELBERG: It includes that testimony, yes.

MS. ANSLEY: Do you cite any other evidence in your testimony for an impact on water temperatures?

WITNESS RINGELBERG: I do not.

MS. ANSLEY: Isn't it true, as noted in the Draft EIR/EIS that ambient meteorological conditions are the primary driver of water temperatures in the Delta?

WITNESS RINGELBERG: Are you talking about the Kimmerer cite?

MS. ANSLEY: Well, I asked you just are you aware that ambient meteorological conditions are the primary driver of water temperatures in the Delta?

WITNESS RINGELBERG: I recollect that citation and I strenuously disagree with it on a technical

foundation that I'd be happy to establish now.

MS. ANSLEY: Can you pull up DW --

CO-HEARING OFFICER DODUC: No.

MS. ANSLEY: Oh, sorry. I didn't mean to interrupt you.

CO-HEARING OFFICER DODUC: I'm sorry?

MS. ANSLEY: I didn't mean to interrupt you.

CO-HEARING OFFICER DODUC: No, go ahead.

MS. ANSLEY: Can you pull in DWR-575, please.

(Document displayed on screen.)

MS. ANSLEY: And so you strenuously disagree that ambient air temperatures are a driving factor of water temperature in the Delta; is that true?

MR. KEELING: Objection: Mischaracterizes the witness' prior testimony.

MS. ANSLEY: He can say that if he likes.

CO-HEARING OFFICER DODUC: Never mind. Just get to your question, Miss Ansley, about this document we just pulled up.

MS. ANSLEY: I'm actually going to move this document. That's fine. I'm happy to move on to a different topic.

CO-HEARING OFFICER DODUC: Okay.

MS. ANSLEY: Looking at your testimony and your reference list, SJC-004, I believe the last few pages

before the two figures are your reference list; is that correct?

CO-HEARING OFFICER DODUC: I'm sorry. What was that? The last?

MS. ANSLEY: It's the last pages of his testimony, but I believe the two figures follow it, so it would be the third and fourth to last.

WITNESS RINGELBERG: Do you mean Pages 16 and 17?

MS. ANSLEY: I mean -- Yes, starting on Page 16, 17, and 18.

(Document displayed on screen.)

WITNESS RINGELBERG: What is your question again?

MS. ANSLEY: My question is, you're here testifying today as an expert on microcystis; correct?

WITNESS RINGELBERG: That's correct.

MS. ANSLEY: And you're familiar with the literature on microcystis in the Delta; is that correct?

WITNESS RINGELBERG: Yes.

MS. ANSLEY: Are you familiar with the work of Dr. P.W. Lehman's on microcystis in the Delta?

WITNESS RINGELBERG: I'm aware of Dr. Lehman's work.

MS. ANSLEY: Your testimony, indeed, cites

three studies by Dr. Lehman; is that correct?

WITNESS RINGELBERG: It does.

MS. ANSLEY: And these are from 2005 and 2008?

WITNESS RINGELBERG: Yes, two from 2005 and one from 2008.

MS. ANSLEY: Are you aware that Dr. Lehman has published additional studies in the Delta in 2010, 2013 & 2015 specifically on microcystis?

WITNESS RINGELBERG: I'm not aware of that fact.

MS. ANSLEY: Let's pull up DWR-576.

(Document displayed on screen.)

MS. ANSLEY: Your testimony provides discussion on the topic of climate change at Page 13-14; is that correct?

WITNESS RINGELBERG: One moment, please.

(Examining document.)

WITNESS RINGELBERG: That is correct. I have comments on Page 13 and Page 14.

MS. ANSLEY: Okay. And looking at the study we called up, DWR-576, which is a study from 2013 by Dr. Lehman that discusses climate change, you're not familiar with this study?

WITNESS RINGELBERG: I have not read that particular study, no.

MS. ANSLEY: And, similarly, you said that you were not familiar with DWR -- or you're not familiar with Dr. Lehman's publications in 2010?

If you'd like, I can show you the paper, but --

WITNESS RINGELBERG: Sure, show me the paper.

MS. ANSLEY: It's 577.

MR. KEELING: Is this -- Is this on the website and how do we find it?

MS. ANSLEY: Oh, I'm sorry. I have copies. I'm sorry. I apologize. Let me --

MR. KEELING: Well --

MS. ANSLEY: -- give you copies.

MR. KEELING: -- we have never seen these documents.

MS. ANSLEY: Sure. These are studies --

MS. MESERVE: Yeah, it's not an existing exhibit.

CO-HEARING OFFICER DODUC: Hold on. Hold on.

MS. ANSLEY: I apologize. I was crossing questions off, so I'd be happy to pass these out.

The first one was -- 576 was Dr. Lehman's 2013 study. I have that right here.

CO-HEARING OFFICER DODUC: Miss Ansley, if your point is that Mr. Ringelberg has not read these documents -- and I think he has confirmed that --

WITNESS RINGELBERG: (Nodding head.)

CO-HEARING OFFICER DODUC: -- then you should --

MS. ANSLEY: He asked to look at the copy. That's fine.

My point -- My only point is just to make sure -- or to see if he is familiar with the most recent research on microcystis climate change, causal factors in the Delta.

CO-HEARING OFFICER DODUC: I understand.

MS. ANSLEY: And I'm happy to pass out the other one, since we have the copy here, if you'd like to look at the cover page. And I have copies for . . .

MR. KEELING: Madam Hearing Officer, I have no objection to showing the witness a document and asking him if he's seen it, but I do object to the characterization of this document by counsel.

This is a document of -- a fairly technical document that will take a little time to absorb in order to acquiesce, agree with, or disagree with even the characterization.

CO-HEARING OFFICER DODUC: The only thing we want on record right now is whether Mr. Ringelberg is familiar with these documents.

I will now allow Miss Ansley to ask him about

documents that he's not familiar with.

So let's just establish now, Mr. Ringelberg: Have you seen, are you aware of, are you familiar with these documents?

WITNESS RINGELBERG: I'm not personally familiar with these specific documents.

I want to be clear: There's an exhaustive literature on microcystis. These relate predominantly to the San Francisco Bay, which is where the focus has been for water quality -- drinking water quality concerns.

And I guess in my brief perusal of this, I didn't see anything that changed the conclusions of her prior work, so . . .

MS. ANSLEY: Moving on from those two papers, obviously.

Are you aware of Dr. Lehman's 2015 work regarding uses of forms of nitrogen by microcystis in the Delta?

WITNESS RINGELBERG: I'm not.

MS. ANSLEY: Madam Hearing Officer, I've gone through most of my questions.

I'd like a couple minutes just to make sure I don't have any followup questions, if that would be okay --

CO-HEARING OFFICER DODUC: Okay.

MS. ANSLEY: -- and cross out whatever we don't need to ask.

(Counsel confer.)

MS. ANSLEY: Madam Hearing Officer, I think that concludes our cross.

Thank you.

CO-HEARING OFFICER DODUC: Thank you.

Miss Morris.

MS. MORRIS: Good afternoon. Good morning, I guess, still.

My only question is for Mr. Ringelberg and they're related to bypass flow requirements, and I think it will be less than 10 minutes.

I did have questions on 2013 but I'm taking the suggestion and I'll skip those for now.

CROSS-EXAMINATION BY

MS. MORRIS: You testified last week that the bypass flows for the North Delta -- It might have been two Fridays ago.

Two Fridays ago, you testified that the bypass flows for the North Delta Diversion only applied from December to April.

Do you remember or recall that testimony?

WITNESS RINGELBERG: Yeah. I don't recall the specifics of the testimony. I've been focused on HABs.

MS. MORRIS: Is it your understanding that there are only bypass flows for the North Delta Diversion during that time period from December to April?

WITNESS RINGELBERG: If we could go back to that reference, I'd be happy to talk about it specifically.

MS. MORRIS: Okay. Well, it's not a reference. It was your testimony.

If you want to just pull it DWR-515, Page 5.

Is it -- Is it your understanding that there is bypass flows year-round for the North Delta Diversion?

Or do you not have any understanding of the North Delta Diversion bypass flows?

WITNESS RINGELBERG: I would like to speak directly from the bypass flows themselves so that I don't mischaracterize something by accident.

MS. MORRIS: So are you asking for DWR Errata 5, Slide 25, that has the example?

(Document displayed on screen.)

MS. MORRIS: I believe the witness is asking for DWR Errata 5. And I would still like to leave this document up.

MS. MESERVE: For the record, I have handed him a copy of DWR-515.

WITNESS RINGELBERG: Right. Thank you.

So, your question relates to the periodicity of the bypass flows?

MS. MORRIS: Yes.

Do you want me to restate it?

WITNESS RINGELBERG: And your question is from a period of December to April?

MS. MORRIS: My question is, isn't it true that there are bypass flows for the North Delta Diversion year-round?

WITNESS RINGELBERG: (Examining document.)

MR. BAKER: Pardon me. You wanted me to pull up DWR-515; is that correct?

MS. MORRIS: (Nodding head.)

MR. BAKER: And then you mentioned DWR-515 errata? Is that also?

MS. MORRIS: The witness has a copy of it.

WITNESS RINGELBERG: And the reason I'm struggling with your question is, there are periods where there are no upper limits.

MS. MORRIS: But there's always a minimum bypass flow of 5,000 cfs, correct, in every single month throughout the entire year?

WITNESS RINGELBERG: And the reason why I'm struggling with that specific question is because, in Errata 5 -- If you could bring Errata 5 up, please,

DWR-5, or actually --

CO-HEARING OFFICER DODUC: Okay. So now we want DWR-5 Errata.

MS. MESERVE: Page 25 is the reference, I believe.

CO-HEARING OFFICER DODUC: Page 25, please.

(Document displayed on screen.)

MS. MORRIS: I don't think this is going to tell you anything because this is --

CO-HEARING OFFICER DODUC: Hold on.

MS. MORRIS: -- a different example.

CO-HEARING OFFICER DODUC: Mr. Ringelberg, why did you ask for this to come up in response to Miss Morris' question?

WITNESS RINGELBERG: Because it showed that the bypass flow rules are from December to April.

MS. MORRIS: So that's your testimony, that the -- the bypass flows only are from December to April?

WITNESS RINGELBERG: The illustration only shows that the bypass flows are from December to April.

MS. MORRIS: Okay. Can you please pull up DWR-515, Page 5?

(Document displayed on screen.)

MS. MORRIS: Do you see DWR-515 on the screen? And do you see --

I'm sorry, Mr. Baker or Mr. -- Yeah, Mr. -- Whoever's controlling, Mr. -- Sorry.

Now I know why everyone calls you the projectionist.

If you could just scroll up one page so that it's clear what we're looking at.

(Document displayed on screen.)

MS. MORRIS: Okay. Mr. Ringelberg, do you see the top left corner on Page 4 of DWR-515 where it's talking about the bypass flows, and it has the December into April that you were referencing, and it shows that there can be no diversion from December to April if there's less than 5,000 cfs in the river?

Do you see that?

WITNESS RINGELBERG: (Examining document.)

Yes, I do.

MS. MORRIS: Okay.

WITNESS RINGELBERG: Under Level -- Under Level II pumping operations, I do.

MS. MORRIS: Which is the minimum. But if you look all the way across, just so the record's clear, under Level 1, Level II and Level III, doesn't it state the exact same thing?

WITNESS RINGELBERG: Yes, it does.

MS. MORRIS: Okay. Great.

Could you please scroll down to the next page.

(Document displayed on screen.)

MS. MORRIS: And, then, now we're on Page 5 and we see for May similar, where there is a 5,000 cfs minimum bypass flow; correct?

WITNESS RINGELBERG: Yes, that's correct.

MS. MORRIS: And under each level.

Correct?

WITNESS RINGELBERG: That's correct.

MS. MORRIS: Okay. And for June, same thing? There's a minimum 5,000 cfs bypass flow.

WITNESS RINGELBERG: That's correct.

MS. MORRIS: Okay. And then looking at Page 6 of DWR-515 from July to September, it shows under Level I the first column, which is on the left-hand side, that there's a minimum 5,000 cfs bypass flow; correct?

WITNESS RINGELBERG: 5,000 and 7,000.

MS. MORRIS: Well, the 7,000 is for the month of October-November; correct?

WITNESS RINGELBERG: That's correct.

MS. MORRIS: So, in fact, we've just stepped through the entire Calendar Year, and for each month, there is at least a 5,000 cfs bypass.

WITNESS RINGELBERG: We did that.

MS. MORRIS: You agree.

WITNESS RINGELBERG: Yes.

MS. MORRIS: Thank you.

I have no further questions.

CO-HEARING OFFICER DODUC: Thank you, Miss Morris.

Mr. Herrick.

How much time do you anticipate needing, Mr. Herrick? And what topics will you be exploring?

MR. HERRICK: Brief -- For Miss Turkatte, I have a couple questions on the extent of the algal bloom microcystis in the Delta, and then a couple questions for -- just a couple questions for Mr. Ringelberg regarding other fact -- other conditions in the proposed Petition -- Petition's operations that might affect the conditions.

CO-HEARING OFFICER DODUC: And these are not questions that you have consulted with Mr. Ringelberg ahead of time.

MR. HERRICK: No. And I don't mean to waste the Board's time, but I feel I need to explain this.

I have never met Miss Turkatte before, except when I picked up the pointer there. I didn't consult -- We didn't consult with either of them for their testimony.

We originally, in our NOI, noticed microcystis

as one of the topics we would do -- listing some experts.

Then, as we progressed, the county said, "yeah, we can help." The county decided to do that.

The very last minutish, there was an issue of the county being able to list new witnesses, amongst our own, you know, discussion. So we just included their testimony in case the county was told they couldn't put them on.

We've had nothing to do with the production of their testimony. I haven't coordinated with somebody to do something clever, stupid or something. I -- You know if the -- If you don't want me to ask questions, I won't. I have just a couple basic ones that are kind of related but not what they've been covered, so . . .

CO-HEARING OFFICER DODUC: Go ahead, Mr. Herrick.

MR. HERRICK: Thank you very much.

CROSS-EXAMINATION BY

MR. HERRICK: Miss Turkatte, your testimony didn't include any mention of algal blooms in the South Delta.

Are you aware of any of those that occurred in the 2015 -- 2016?

WITNESS TURKATTE: I am aware of some algal blooms that were identified, after I submitted my

testimony, in the Fabian Tract in the Tracy area, and as well as some continued with the Big Break Shoreline.

MR. HERRICK: And was the Regional Board involved in investigating those conditions also?

WITNESS TURKATTE: Yes, the Regional Board and the Department of Water Resources did some additional sampling.

MR. HERRICK: Were there any -- To your knowledge, were there any reports of adverse impacts to humans or animals from those algal blooms in the South Delta?

WITNESS TURKATTE: Yes. The investigation started with a complaint from an area landowner that was concerned about the effect of the algal bloom on his tomato crop, as well as he was concerned about the effect to area dogs that might be, you know, in the water or come in contact with the water.

MR. HERRICK: Has the county or the Regional Board made any definitive findings about those alleged incidences -- incidents?

WITNESS TURKATTE: Yes. The Regional Board provided us with the information from those, and I have -- I keep track of those, because we follow up -- you know, we follow that. And I do have results.

They did find microcystis in that area of

Fabian Tract in about four different places and including Tracy Marina Oasis -- Oasis Marina at Tracy -- Oasis Marina, as well as visual scum you can -- It was very thick.

So then they arranged for Department of Water Resources to do some sampling of microcystin toxin, and they did that, and they did find elevated levels over the danger -- I believe it was the danger -- I have to look, but -- threshold for microcystin.

MR. HERRICK: Do -- Do you know, like, a distance, the extent of any microcystis problem as in, like, two-mile stretch or one-mile stretch or 10-foot stretch or something? Do you have any idea of the magnitude of the microcystis in Old River?

WITNESS TURKATTE: I'm not really sure what the length of that stretch of water is. But, yeah, it was pretty much the whole length of that.

MR. HERRICK: Thank you.

Mr. Ringelberg, I believe you're generally aware of the previous testimony that's gone on here.

Are you aware that part of the Petitioners' proposal is to have a Permanent Head of Old River Barrier installed and being operated from February through June?

WITNESS RINGELBERG: A permanent or an operable barrier? So a permanent operable barrier?

MR. HERRICK: Yes.

WITNESS RINGELBERG: Yes.

MR. HERRICK: And, just generally, do you understand that the purpose of that barrier is to shut off some level of flow from San Joaquin River into Old River in order to shunt fish down the San Joaquin River; is that correct?

WITNESS RINGELBERG: Yes. It's the latest in a series of actions including temporary barriers and other proposals for gates in the area.

MR. HERRICK: Now, we don't know from the Petitioners -- I'm just asserting, you can disagree -- we don't know the extent of when and how long it'll be shut off -- the flow will be shut off during that time period.

But do you have an opinion as to whether or not blocking the flow into Old River would affect the conditions you have identified that lead to the growth of algal blooms?

WITNESS RINGELBERG: I have no understanding of the proposed operational conditions for that structure. But I think what we found in the temporary barriers process is that visible algal blooms and aquatic leads collected at the upstream ends of those structures and, to some degree, possibly downstream into those structures, and those would be the features that I would

look for for hazardous algal blooms.

MR. HERRICK: And if the head of Old River Barrier actually shut off all flow into Old River, as it would be capable of doing, would that exacerbate even further problems that you have identified?

In other words, there's no flow going out of Old River.

WITNESS RINGELBERG: Is this a slightly more complicated question?

So when you shut off the flow, the algal and bacterial communities can actually use up all the nutrients or mineralize the nutrients there such that it's not subject to a future algal bloom so there might be a near term algal bloom after it's shut off and then no significant blooms after that shutoff because of lack of mixing in the dead-end structure.

MR. HERRICK: And would you agree that, with a new North Delta intake, then it's likely at some times less water will be diverted from the South Delta than was previously before the new Delta -- new North Delta intake.

WITNESS RINGELBERG: Yes, I believe that to be the case.

MR. HERRICK: And does that mean that there's less water flowing across the Delta and entering the

various channels on the tides?

Let me -- Let me restate that. That wasn't clear.

Does that mean the proportion of Sacramento river water in the Central and South Delta might then change?

WITNESS RINGELBERG: Yes, it would. And this is why I testified about the critical role the Delta Cross Channel plays in maintaining or changing that struc -- flow pattern.

MR. HERRICK: And so you believe that the WaterFix, by operating the North Delta Intakes, then might exacerbate conditions which lead to algal blooms in the Central and South Delta.

WITNESS RINGELBERG: Absolutely. That was the foundation of my testimony.

MR. HERRICK: That's all I have. Thank you very much.

CO-HEARING OFFICER DODUC: Thank you for that concise cross-examination, Mr. Herrick.

Miss Des Jardins, I believe, is our last cross-examiner.

Is there anyone else?

Okay.

MS. DES JARDINS: My name is Dierdre

Des Jardins with California Water Research.

Can we go to Mr. Ringelberg's testimony, please.

CO-HEARING OFFICER DODUC: And you had estimated about 20 minutes.

What are your topic areas?

MS. DES JARDINS: There's two topics. One is -- and both are -- are related to -- One is the conditions in which the harmful algal blooms emerged and --

CO-HEARING OFFICER DODUC: Um-hmm.

MS. DES JARDINS: -- what was Dr. Lehman's paper that he does cite, I have some questions about that.

CO-HEARING OFFICER DODUC: The paper that he did cite. Okay.

MS. DES JARDINS: Yes.

CO-HEARING OFFICER DODUC: Proceed, please.

CROSS-EXAMINATION BY

MS. DES JARDINS: Okay. So I'd like to go to your testimony on Page 6, Line 18 to 20.

(Document displayed on screen.)

MS. DES JARDINS: And you say (reading):

"As was first documented in the Sacramento-San Joaquin . . . Delta in 1999, blooms

of cyanobacteria have spread through miles throughout the Delta . . ."

You recall that the first widespread bloom occurred in 1999?

WITNESS RINGELBERG: I do not have personal knowledge of that. I assume the algal blooms existed --

MS. DES JARDINS: Yeah.

WITNESS RINGELBERG: -- precontact.

MS. DES JARDINS: Can we go to DDJ-135, please.

Oh, it's on the stick I gave you. Apologize. Yeah.

(Document displayed on screen.)

MS. DES JARDINS: And this is the IEP newsletter from '99. Page 11, please.

(Reading):

"An extensive patchy bloom detected in the Delta."

The article's by the Department of Water Resources.

Can we go to Page 12.

(Document displayed on screen.)

MS. DES JARDINS: I just wanted to ask you:

The -- They noted . . . On the right side of the page, it says (reading):

"Water quality in the Central and Southern

Delta is typically influenced by low summer and fall stream inflow. The Southern Delta in particular has longer water residence times than regions adjoining the Sacramento and San Joaquin Rivers since blooms of microcystis aeruginosa in fresh water lakes, stock ponds and lagoons have been associated with low flows, warm water temperatures, increased water clarity and high nutrient temperatures. It may be that the stimulus" --

CO-HEARING OFFICER DODUC: Are you testifying or is there a question?

MS. DES JARDINS: Well, what I want -- Just, if he can read this passage.

CO-HEARING OFFICER DODUC: Are you familiar with this document, Mr. Ringelberg?

WITNESS RINGELBERG: (Nodding head.)

MS. DES JARDINS: Yeah. I was just --

CO-HEARING OFFICER DODUC: Hold on. What -- Hold on.

Mr. Ringelberg.

WITNESS RINGELBERG: Yes, I am familiar with this document.

CO-HEARING OFFICER DODUC: Okay. He is familiar with this document.

MS. DES JARDINS: Great.

CO-HEARING OFFICER DODUC: Now, ask your question, please.

MS. DES JARDINS: Yeah. So my question is just: I was reading about the conditions.

CO-HEARING OFFICER DODUC: Ask your question.

MS. DES JARDINS: What they ask is that -- They had these conditions within the Central and Southern Delta during the exceptionally warm and dry fall of 1999.

Is -- Is that consistent with the kind of conditions that you're testifying --

WITNESS RINGELBERG: Yes.

MS. DES JARDINS: -- that the -- The low flows, warm water temperatures. Are -- Are those consistent with what you're testifying as to when this bloom was first observed?

WITNESS RINGELBERG: Yes, it is.

MS. DES JARDINS: And the increased water clarity.

Is that also consistent with what you're testifying?

Are you --

WITNESS RINGELBERG: It is.

MS. DES JARDINS: Okay. That -- That was all I wanted to ask, Miss Doduc. Thank you.

CO-HEARING OFFICER DODUC: All right.

MS. DES JARDINS: Okay. The next thing I'd like to go to is . . . DDJ-136, please.

(Document displayed on screen.)

CO-HEARING OFFICER DODUC: Please don't read the document.

MS. DES JARDINS: Apologies.

CO-HEARING OFFICER DODUC: Mr. Ringelberg, are you familiar with this research paper?

WITNESS RINGELBERG: Yes. I believe it's the 2007 one that I cite.

CO-HEARING OFFICER DODUC: That you reference. All right.

What is your question?

MS. DES JARDINS: Can we go to Page 14, please.

(Document displayed on screen.)

MS. DES JARDINS: Yeah. So just where it says "Environmental factors," it mentions stream flow.

Are -- Are you familiar with -- Is this why you -- partly why you cited this, these findings by Dr. Lehman?

WITNESS RINGELBERG: That's correct.

MS. DES JARDINS: So she states (reading):

"Stream flow was a major factor controlling density. It has a relatively slow growth wait. Long residence time is needed for biomass to

accumulate."

So is that partly what you're basing your conclusion on? I mean, you did cite this.

WITNESS RINGELBERG: So, to be clear, the -- the issues that I spoke about that these are related to are all the fundamentals of algal ecology. You have food, you have light, and at the appropriate temperatures you're able to convert that into carbohydrates and nutrients.

MS. DES JARDINS: Okay.

WITNESS RINGELBERG: And so --

MS. DES JARDINS: But your conclusions are similar to Dr. Lehman's in this paper?

WITNESS RINGELBERG: So, that's the fundamental ecology. And so Dr. Lehman's paper helped illustrate how within the Delta that these factors interrelate.

MS. DES JARDINS: Okay.

WITNESS RINGELBERG: As well as drawing from other similar locations.

MS. DES JARDINS: Okay. Thank you very much.

And then I just had . . .

If we could bring up SVWU-107, please.

(Document displayed on screen.)

MS. DES JARDINS: And I just wanted to look -- There's a figure on Page 16 which shows North Delta

Diversions.

Page 16 of the document.

(Document displayed on screen.)

MS. DES JARDINS: This was prepared by Walter Bourez. It shows monthly average diversions in the North Delta, and the diversions in different year types.

If the -- Looking at this, is this -- would your conclusions be the same as your conclusions about bypass flow, looking at the bypass flow information?

CO-HEARING OFFICER DODUC: Hold on.

MS. DES JARDINS: Yeah.

CO-HEARING OFFICER DODUC: Miss Morris.

MS. MORRIS: I'm going to object to this line of questioning and any answer that this witness gives would be speculative. He hasn't read this study. He hasn't looked at this modeling.

MS. DES JARDINS: There's a --

MS. MORRIS: He --

CO-HEARING OFFICER DODUC: Hold on. Hold on.

Mr. Ringelberg, are you familiar with the study that Mr. Bourez conducted?

WITNESS RINGELBERG: I have not seen this document.

MS. DES JARDINS: Okay. Never mind. Thank you.

CO-HEARING OFFICER DODUC: Actually, I was going the ask him:

Just based on reading this, do you have any opinion to offer without that knowledge about the study?

MS. DES JARDINS: It's just a graph.

CO-HEARING OFFICER DODUC: That's what I'm trying -- Do you have an opinion to offer, Mr. Ringelberg? If not, you do not.

WITNESS RINGELBERG: I do have an opinion on the basis of the monthly average issue, is that the way that this model runs, it provides the monthly averages, and that's why it's intended to show the differences between the Water Yeah classes.

But ecologically, how things respond on the ground, this type of modeling would not be sufficient to show that.

CO-HEARING OFFICER DODUC: Would not be sufficient.

WITNESS RINGELBERG: (Nodding head.)

CO-HEARING OFFICER DODUC: Okay. Thank you.

MS. DES JARDINS: That concludes my cross-examination.

CO-HEARING OFFICER DODUC: Thank you.

Redirect, Mr. Mr. Keeling, Miss Meserve?

MR. KEELING: Miss Meserve is going to handle

redirect.

Could you give us a couple of minutes, Madam Hearing Officer, to --

CO-HEARING OFFICER DODUC: A couple minutes?

One minute.

MR. KEELING: One minute.

CO-HEARING OFFICER DODUC: All right.

Mr. Herrick.

MR. HERRICK: John Herrick, South Delta.

I was just trying to get a time frame here. We're ready with our expert panel. Dante's the fill-in for after then, but I'm -- it looks like --

CO-HEARING OFFICER DODUC: We won't get to you until after lunch.

MR. HERRICK: Yeah. Should we assume that our expert panel is the all the rest of the day or do you want to have Dante come?

CO-HEARING OFFICER DODUC: How much time -- You have three panels proposed, I believe; right?

MR. HERRICK: Yeah.

CO-HEARING OFFICER DODUC: And the last one being of just Mr. Nomellini.

MR. HERRICK: Yeah. We're going to put him second --

CO-HEARING OFFICER DODUC: Okay.

MR. HERRICK: -- and then two farmers, the third one maybe. But -- So I'm just-- I'm just kind of thinking, it looks like with cross, if we start at 1:30 up, you know, with them, that I shouldn't have the next panel here.

CO-HEARING OFFICER DODUC: How much time do you anticipate needing for your direct?

MR. HERRICK: Our direct is about an hour and 40 minutes.

CO-HEARING OFFICER DODUC: And then cross?

How much time do you anticipate needing for across? The Department I'm asking.

Come on up, Mr. Mizell.

MR. HERRICK: Sorry to delay.

CO-HEARING OFFICER DODUC: No.

MR. MIZELL: Tripp Mizell, Department of Water Resources.

We would anticipate two hours for his expert panel.

CO-HEARING OFFICER DODUC: Okay. And then seeing other people lining up to cross-examine, I think we will focus on just that first panel for today.

MR. HERRICK: Thank you very much.

CO-HEARING OFFICER DODUC: And you'll have all day tomorrow for the remainder of your case in chief.

CO-HEARING OFFICER MARCUS: You have a whole half day tomorrow, just to remind you.

MR. HERRICK: I'll bring cookies.

CO-HEARING OFFICER DODUC: And so, Mr. Herrick, since tomorrow is your day, you'll be expected to provide the general announcements.

MR. HERRICK: I will.

CO-HEARING OFFICER DODUC: All right.

MR. HERRICK: Should I wear a suit also on Friday?

MR. KEELING: Our one minute has expired.

CO-HEARING OFFICER DODUC: Okay.

(Laughter.)

MS. MESERVE: All right. Thank you. Just a couple of clarifying questions.

REDIRECT EXAMINATION BY

MS. MESERVE: So, in your testimony, Mr. Ringelberg, which is SJC-68, Slides 3 and 4 -- I think it's actually your PowerPoint. Yeah.

You were asked about the reference at the bottom of these to being related to marine algae growth.

And I was wondering if you could explain just briefly why you thought that these Slides 3 and 4, which come from a marine environment, would be relevant to the question of the impact on HAB formation of removing

significant volumes of fresh water from the Sacramento River?

WITNESS RINGELBERG: I was hoping you were going to ask that question.

CO-HEARING OFFICER DODUC: Very good question, Miss Meserve.

WITNESS RINGELBERG: So, there's a fundamental challenge with looking at algal ecology is funding for the kind of research that supports really high detailed studies such as these.

And we typically use organisms that are well cultured, that don't have any crazy what we call wild types, forms that act differentially, as you might expect them to do. And so it's much like when you use a hybrid corn. You know exactly how it's going to perform under those conditions. And that's what we use now in ecology. We don't use typically -- There's some exceptional studies that have, but we don't use wild where we go out and take a graft sample of a water column, we don't try to isolate and get a wild type and then run these kinds of studies because there's so many different environmental factors and very subtle genetic factors that we just don't completely understand with these.

And so we use these ecological surrogates, as we call them, to illustrate the basic physical forms.

The direction -- No . . . It's . . .

It's common practice -- In fact, you know, the -- one of these is actually what we used to call Soylent Green in the good old days for what was thought to be a great human food to supplement the, you know, growing population, and agriculture was able to do some fantastic things and be able to meet the human food supply.

But it was actually cultured specifically in the lab and then this isolate has been used for many, many years because it's so easy to work would and we understand the dimensions of how it grows and under what conditions it doesn't grow.

MS. MESERVE: You were also asked, with respect to your testimony, which is SJC-4 on Page 2, Line 20, to your citation to Kurobe for the proposition that there may be multiple forms of harmful algal blooms that would be of concern.

(Document displayed on screen.)

MS. MESERVE: And in coming up with this point in your testimony, was the Delta Independent Science Board discussion of this in their comments on the Draft BDCP EIR something that you have looked at?

WITNESS RINGELBERG: Yes. I had looked at those draft comments before, that's correct.

MS. MESERVE: And do you recall what the Delta Independent Science Board had to say about the singling out of cyanobacterium without -- by the proponents of this Petition as opposed to looking at a fuller array of genus?

WITNESS RINGELBERG: My recollection is that they argued against that point.

MS. MESERVE: What do you mean by "against that point"? If you could describe that, please.

WITNESS RINGELBERG: I used the unfortunate term monomaniacal focus before.

CO-HEARING OFFICER DODUC: Hold on. Hold on.

Mr. Berliner?

MR. BERLINER: Tom Berliner for the Department of Water Resources.

I'm going to object to this redirect. This is eliciting actual new direct testimony. This is not in response to the cross. We didn't ask about the Delta Science Panel. They're using redirect as an effort to enhance the witnesses' direct testifying.

I have no objection to redirecting questions on cross in order to shape those up or correct or whatever a misstatement. But this is introducing new evidence that was not asked about.

CO-HEARING OFFICER DODUC: You did ask about

this particular --

MR. BERLINER: We asked about --

CO-HEARING OFFICER DODUC: -- claim and testimony was made by Mr. Ringelberg, and she's following up on the premise or the foundations upon which he made the statement in his testimony.

MR. BERLINER: We asked about whether the Kurobe study was the only one that he cited.

CO-HEARING OFFICER DODUC: You did.

MR. BERLINER: He said "yes."

And now Ms. Meserve is asking about the Delta Science Panel study, which is an entirely different study that we never asked.

CO-HEARING OFFICER DODUC: You did ask whether he considered other studies.

And, Mr. Ringelberg, is it your testimony now that you now recollect additional studies that you depend on for this testimony?

WITNESS RINGELBERG: Madam Hearing Officer, I tried to respond to their very specific question, which was whether I cited other sources, and I did not cite other sources for that.

CO-HEARING OFFICER DODUC: But you did say you considered other sources.

WITNESS RINGELBERG: I considered numerous

other sources.

CO-HEARING OFFICER DODUC: All right. I'm going to allow the direct -- redirect to proceed.

Go ahead, Ms. Meserve.

MS. MESERVE: Just to clarify: Since I believe that DWR's cross was going to the issue of whether it would be appropriate to look at anything else.

And can you just explain why multiple genus would be of concern, just to be clear for the record.

WITNESS RINGELBERG: You'd have to look at the full suite of organisms that are in the system and the potential Project impacts on those organisms.

So I think, as I described earlier, certain organisms have very high-temperature requirements and critical-clarity requirements but they are able to move within the water column to adjust for those.

Other organisms are attached, so they're stuck on rocks or weed, or whatever, and they don't have the ability to move and, therefore, they would predominate under other physical conditions.

And so you can't just look at one particular toxic organism. You have to look at the full suite in their standard nature and impact of Project operations in that full suite of species.

If you look at just one species, you will be in

the slot.

MS. MESERVE: And, so, to clarify your testimony on Page 2 that we're referring to:

If it was, in fact, true that one genus, microcystis, was being edged out by, say, another toxic algae, would you still be concerned about the impact of the proposed diversions?

WITNESS RINGELBERG: Absolutely. I think much has been made about this illustration. It's a very simple illustration in my mind.

We can't just look at one species. There are many toxic species in the system, and without modeling the responses of those different species under different conditions, this to me as an ecologist is a red flag. We don't understand the dynamics and my focusing on microcystis is one of those flags.

MS. MESERVE: Now, related to that, you were asked about whether you conducted any of your own studies or modeling in order to support your testimony.

I believe you clarified that you looked at the materials that were provided, and others. But did you find anything in your review of the case in chief that showed Petitioners had conducted such modeling or studies specific to this Project?

WITNESS RINGELBERG: That's a compound

question.

So, in -- in my background, I've done a number of studies for the production of various microorganisms, including alga. That was not part of this work and is not related to work that happened in the Delta.

In response to your second question, the -- I saw nothing in the information provided to me in the Petition that related to microcystis or HAB formation at all.

And then within the DSEIR (sic) and EIR, there were no models or explanations of models that would be useful to understand the Project's impacts on toxic algae and their by-products in the Delta.

MS. MESERVE: Now, you were also asked about your citation -- I'm sorry -- about -- With respect to water temperatures, you were asked about whether you are aware that the EIR/EIS concluded that air temperature is the most -- I don't want to misstate -- that that would be the most important factor with respect to formation of harmful algal blooms.

You said you disagreed with the Kimmerer study. Can you explain why?

WITNESS RINGELBERG: I want to clarify. I don't disagree with the Kimmerer study. I disagree with the use of the Kimmerer study in support of that

conclusion for the entirety of the Delta as they relate to the Project or as it relates to current conditions in the Delta.

So, the Delta receives source waters from a variety of different areas, including groundwater, and each of those has a characteristic temperature depending on the time of the year.

And, so, if you looked at the Delta as a giant mixing zone, as some scientists do, the Delta is very effective in terms of bringing those mixed waters together and homogenizing those signals and leading to fairly simplistic mean temperatures as a result of all of that.

But we -- I have not seen -- And I'm aware of models that can link to this for this kind of system but has not been presented before us.

When you manipulate the various source, signal, streams and include groundwater and return flows, it's actually a fairly complex system.

So, you can't draw a straight line from something in the geometric center of the Delta and then to the San Joaquin Delta as it enters the legal Delta, or the Sacramento River as it enters the legal Delta, or any of the many, many sloughs and other features that have each different characteristics depending on the source

waters and the time of year and Water Year.

And so each of those changes that puzzle in terms of what the actual temperature is.

So, glibly, scientists will say, yeah, it homogenizes everything. And if you point to some part of the Delta, that's not incorrect. But in terms of ecological differences between each of the source waters, they're significantly different.

MS. MESERVE: Thank you.

That's all.

CO-HEARING OFFICER DODUC: Recross?

MS. ANSLEY: (Shaking head.)

CO-HEARING OFFICER DODUC: Is that a "no" by the Department?

MS. ANSLEY: That's no.

CO-HEARING OFFICER DODUC: All right. Miss Morris.

MS. MORRIS: Five minutes.

CO-HEARING OFFICER DODUC: All right.

Mr. Herrick, any recross?

MR. HERRICK: (Shaking head.)

CO-HEARING OFFICER DODUC: Miss Des Jardins, any recross?

MS. DES JARDINS: (Shaking head.)

CO-HEARING OFFICER DODUC: All right.

Miss Morris, you're standing between us and lunch.

MS. MORRIS: Thank you.

RECROSS-EXAMINATION BY

MS. MORRIS: Mr. Ringelberg, I'd like to ask you a followup:

You were asked about SJC-68, Slide 3 and 4, and about marine algae.

And you said in response that there wasn't this type of work because there was no funding for it, the specialized work; correct?

WITNESS RINGELBERG: I said the reason that we don't typically see these high-end detailed studies is because typically there is a lack of funding for those kinds of research programs.

But the critical point of all that was that these are highly cultured alga that we have a good understanding of their reactions rather than wild alga which we don't understand.

MS. MORRIS: Okay. Are you aware that there are studies in the -- in the Delta that look at the relationship between microcystis and light?

WITNESS RINGELBERG: I'm certain there are.

MS. MORRIS: And did you look at any of those studies in coming to your conclusions today, your opinions?

WITNESS RINGELBERG: I did not feel it was necessary to. We have a pretty good understanding of cyanobacteria, in particular microcystins, and their physical mechanisms for converting light. There's no ambiguity about their ability to do that. There's even the mechanism of the light-capturing system is well understood.

MS. MORRIS: So you're -- you're -- you're testifying that there was a study that's on point that looks at the relationship between microcystis in the Delta and the relationship between light and microcystis, but you didn't think it was important to look at as an expert?

MR. KEELING: Objection.

CO-HEARING OFFICER DODUC: Yes, I can hear the objection now.

Rephrase your question, Miss Morris.

MS. MORRIS: I'll move on.

Are you aware that there are studies in the Delta that look at the relationship between microcystis and nutrients?

WITNESS RINGELBERG: I'm certain there are.

MS. MORRIS: But you didn't look at those today for your opinions, either; correct?

WITNESS RINGELBERG: They weren't necessary for

the illustration because there's no scientific debate about the potential differentiation between light availability, given our climate, and although we understand within the Delta and microcystins for the light trapping, or for the nutrients because this system is not considered to be limiting in terms of nutrients; ergo, there's not a need to bring forward a bunch of additional studies to defend that.

MS. MORRIS: I have no further questions.

CO-HEARING OFFICER DODUC: Thank you, Miss Morris.

That should conclude your case in chief. You have until noon next Thursday to submit your entire list of exhibits.

MS. MESERVE: Thursday is Thanksgiving.

CO-HEARING OFFICER DODUC: Oh, it is.

(Laughter.)

MS. MESERVE: I would ask, pursuant to the Code of Civil Procedure, that we either go -- I mean, I think we have joined with the South Delta and Central Delta, at least San Joaquin County has, so, ideally, we would go one week out from their completion of their direct testimony.

CO-HEARING OFFICER DODUC: Any objection to that?

Mr. Mizell?

MR. MIZELL: Tripp Mizell for DWR.

As we heard from Mr. Herrick earlier, he does not intend to submit the testimony or call these witnesses back for his panels, and it was done out of a mode of convenience at the time.

So given their presenting as an independent party from South Delta Water Agency, I do not believe it's appropriate to give them additional time to present their testimony -- submit their exhibits into evidence.

CO-HEARING OFFICER DODUC: Mr. Herrick, is that understanding correct, that you do not intend to call these witnesses?

MR. HERRICK: John Herrick, South Delta.

We are not calling these witnesses.

I believe the -- I believe Dr. Jeff Michael is sort of a co-witness with San Joaquin County, if that changes anything.

We have nothing to do and will not be submitting their testimony or exhibits.

CO-HEARING OFFICER DODUC: All right.

MR. KEELING: If I might clarify.

The question -- Normally your one-week date comes from when the panel stands down because that's the end of the case in chief.

In this case, of course, the County's case in chief includes Mr. Jeffrey Michael and began a week ago with Mr. Tootle. So the question is a week from when? A week from the end of the panel? Or a week from the end of the party's case in chief?

I think -- And whatever, obviously -- I just need clarification on when.

CO-HEARING OFFICER DODUC: Understood. And since in your opening/Policy Statement, you didn't mention Mr. Michael -- I believe that was his name?

MR. KEELING: I did.

CO-HEARING OFFICER DODUC: You did.

MR. KEELING: I did indeed.

CO-HEARING OFFICER DODUC: As part of your --

MR. KEELING: As part of interest.

CO-HEARING OFFICER DODUC: Yes, you did mention that.

I will go ahead and grant your request to submit your list of exhibits at the same time that Mr. Herrick does.

MS. MESERVE: Thank you.

CO-HEARING OFFICER DODUC: I don't believe it delays matters all that much.

So the Department and others should save your objections to when it really counts, guys.

With that, we will take our lunch break. We will resume at 1:30 with Mr. Herrick's panel.

MR. KEELING: Thank you.

CO-HEARING OFFICER DODUC: Thank you very much.

(Luncheon recess was taken at 12:27 p.m.)

Thursday, November 17, 2016 1:30 p.m.

PROCEEDINGS

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CO-HEARING OFFICER DODUC: (Banging gravel.)

Welcome back, everyone. It is 1:30. We are back in session.

And I will now turn over to Mr. Herrick and Mr. Ruiz for your opening statement.

OPENING STATEMENT BY

MR. HERRICK: Thank you, Madam Chair.

John Herrick for South Delta and other parties.

I would say that, at the beginning of the proceedings, I think I took two minutes or three minutes that is part of mine, but with that I'll proceed. I'm here with Mr. Dean Ruiz.

We're here for a Change Petition, but that's normally used for, you know, somebody moving their diversion 40 yards downstream, or combining with somebody else a little ways down, or even sometimes in the Delta where they move from one side of the island to another and it's a different -- it's a different waterway, actually. That's the normal proceeding.

But here we are in a proceeding that fundamentally replumbs the Delta. And it not only adds facilities but it includes the reoperation of the

existing facilities not necessarily outside the bounds of their current possible operations, but we see that reservoirs might be operated differently. Certainly with a new diversion there's different operations. The South Delta pumps will be operated differently. And that makes a very strange situation which, in our view, simply cannot be found to not cause adverse effects.

Now, the degree of the adverse effects, of course, is important. But if one replumbs the system and reoperates it so that you intentionally have less fresh water flowing through the estuary, then there can be only adverse impacts.

So the question is, what is the degree of those impacts? We don't know the degree of those impacts because the Petitioners haven't told us that. What they've done is given us averages of some impacts. We've seen from other parties that there are impacts that haven't even been examined.

But with regard to the South Delta and Central Delta's interest, we have been presented with evidence that says, here are at bars -- you know, showing the different types of years -- here are bar charts that show very little difference. The bars are not very different.

The problem with that is, the bars are averages, and an average impact is not the same thing as any

specific impact. And so when we have a bar chart that shows us, you know, a tiny bit of difference, the question really is, well, what is the difference in different scenarios?

And the Petitioners took 16 years and then, for EC, for example, they averaged the EC for each month, and then they averaged all those months over a 16-year period to show the impacts of the project.

Well, of course, that doesn't tell you what the range is or how long an impact might occur.

Of course, there are times when the impacts might be beneficial, but until you break that out and show what the impact is, how long it -- how long it persists, and then tie that to a legal user or a beneficial user, we simply don't know what the Project's impacts are.

And that's another key thing. We heard from previous testimony that, you know, reservoir might have 14 percent less water on average in some year types. Or exports might be certain percent difference. Or EC at various locations might be certain amount different.

That's the beginning of the analysis. Even ignoring the averaging part, unless one says, for example, for reservoirs, a 14 percent decrease equals this impact to the users of that, you can't tell whether

or not it's a harm to a legal user.

So whether or not a 14 percent decrease in reservoir storage is distributed over 30 users or a hundred users or decreases water for fish the next year, until you have somebody connect that difference with the impacts, you don't know whether somebody's been harmed or not.

And that's especially important with regard to the salinity issue that we're focusing on, or most of our focus is on. And that is, an average impact doesn't tell us anything, but if perchance we have a 200, 100, 300 EC impact, then we have to take that and apply it to the situation.

One can't simply say, well, a hundred EC doesn't look like much. One has to provide an expert that says, 100 EC either does or doesn't impact an agricultural user. And that's what's missing from the Petitioners' presentation and from their Petition.

So, we have done that instead. So, we have taken the modeling that they did and we've broken it out to show those impacts.

The presumption, it appears, in this proceeding is that the Petitioners will mitigate adaptively management, alter their operations in order to avoid impacts.

It is even assumed, I think, that the Board will -- might place restrictions on the Petition if it's approved and that will guide actions to avoid impacts.

In -- In our view, that eviscerates this process because what we're trying to do is determine exactly what will be done under the Petition and then will that -- will those actions that are being done harm somebody?

So simply saying, I will adaptively manage and avoid that impact doesn't tell us what they'll do. It's the specifics of what one will do that determines whether there's an impact.

So if one wants to avoid the impact to, say, South Delta diverters, doing that might adversely affect someone else. So that's why we have to examine things up front.

Then, when you add to this whole thing with the notion that the Petitioners intentionally and -- and plan on relying on Temporary Urgency Change Petitions when necessary, the whole house of cards falls down. Excuse me for using bad metaphors.

The notion that you would plan to use emergency procedures that deal with unexpected events doesn't work. Not only does it preclude us from examining what the effects of those operations would be under the TUCP, but it actually means that we're -- we're expecting that dry

periods of one, two or three years are unexpected emergency unanticipatable events and, of course, that's not true.

We've been for -- A couple years here through the drought, we've heard constant admonitions that the Petitioners need to plan ahead.

Now, I don't know if planning ahead makes the Projects unable to perform their duties or not. But planning ahead tells us what will happen and then we can examine those effects.

And so the bottom line, I guess, is that the Petition simply doesn't tell us how operations will affect the various legal users and whether or not those effects constitute harm to those legal users.

So, with that said, we will present our case in chief beginning with our expert panel. And first we'll have Mr. Tom Burke. And he has taken the DWR modeling and he has broken it out.

From their averages, he has broken out on the 15-minute time-step that DSM-2 uses and presented that information?

Now, he'll describe various -- various ways that the information -- what the information shows.

But that will give us a better idea of whether or not there are increases in EC, how long that will

persist, and the degree to which that higher EC might be sustained. Excuse me.

Mr. Burke also has a couple of other things. He deals with residence time to see how that may have -- other people may analyze that with respect to other legal users, and he also deals with impacts on water levels, or stage, around the new intakes, or because of the new intakes.

Now, from Mr. Burke's information, then we have Mr. Prichard, who's going to testify that, in light of this EC changes that the model predicts -- or it shows, I'll say, the model shows -- this will or will not cause harm to agricultural users in the South Delta.

I need to interject there that, in order to -- in order to evaluate with any specificity the impacts to any particular piece of land, one would literally have to do hundreds of sampling tests because of changes of soil type and all sorts of things. So all we can do is do samples and measure -- and determine whether or not the salt that's additionally supplied reaches the level that will harm a particular plant. Because just because it's salt doesn't mean it causes harm.

So Mr. Prichard does that. He describes how he does it, and gives the information on the specifics of the South Delta for -- for us to -- for one to make a

conclusion.

Now, he also presented -- produced information to deliver to Dr. Jeff Michaels -- Dr. Jeff Michael. And he analyzes that data in order to give an area-wide impact, put an number on it financially.

Mr. Prichard does the, this is what it will do to crop or to a percentage of crop production. Then Mr. Michael, then, translates that into the impacts on ag in the area.

But, just as importantly, Mr. -- Dr. Michael also discusses how changes in salt not only may lead to this economic impact but it leads to the economic impact by pushing agricultural practices in different directions.

And, as his testimony will show, farmers react over time to levels of salt. Whether the level of salt is toxic to the plant or adversely affects the -- the total crop production, people still move away from crops that will be affected by increases in salt.

And, lastly, Dr. Michael discusses the -- the development of the analysis of the project -- that's not the right way to say it, sorry -- to show that the Petitioners have chosen a method of addressing their issues that increases the risk to the Delta, so that when you do an analysis that shows that it's more cost

effective to protect levees in the Delta, you then choose an opposite preferred alternative; in other words, tunnels. You now have increased the risk by not concentrating on protecting the levees.

And that was a very horrible description of what he says. But the point is, the Petitioners have chosen and are pursuing a project that will increase the risk to Delta users. And we assert -- we will assert in our conclusions that that is a harm or a potential harm that is worthy of preventing the approval of the Petition.

So, again, I apologize for getting tongue-tied there at the very end.

With that, I'll turn it over to Mr. Ruiz who will begin the direct examination of Mr. Burke.

Thank you very much.

CO-HEARING OFFICER DODUC: Not before I administer the oath.

Please stand, all of you, raise your right hand.

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THOMAS BURKE, TERRY PRICHARD and JEFFREY MICHAEL, called as witnesses for the Central Delta Water Agency, South Delta Water Agency (Delta Agencies), Lafayette Ranch, Heritage Lands Inc., Mark Bachetti Farms and Rudy Mussi Investments L.P., having been first duly sworn, were examined and testified as follows:

CO-HEARING OFFICER DODUC: Thank you. You may be seated.

Mr. Ruiz, you may begin.

And, Mr. Herrick, that was very well done. Thank you.

MR. HERRICK: Thank you very much.

MR. RUIZ: Good afternoon. Dean Ruiz for the South Delta Water Agency parties.

DIRECT EXAMINATION BY

MR. RUIZ: Mr. Burke, can you please state and spell your name for the record.

WITNESS BURKE: Thomas Burke, B-U-R-K-E.

MR. RUIZ: Turn your microphone on, please.

WITNESS BURKE: Thomas Burke, B-U-R-K-E.

MR. RUIZ: Mr. Burke, have you been retained as an expert witness for the SDWA parties in this matter?

WITNESS BURKE: Yes, I have.

MR. RUIZ: Is SDWA-75 a true and correct copy

of your Statement of Qualifications?

WITNESS BURKE: Yes, it is.

MR. RUIZ: And did you prepare that document?

WITNESS BURKE: Yes, I did.

MR. RUIZ: Mr. Burke, did you prepare a technical report in connection with your work on this matter?

WITNESS BURKE: Yes, I did.

MR. RUIZ: And does SDWA-78 Errata contain the details of your work and your opinions in this matter?

WITNESS BURKE: It is.

MR. RUIZ: Mr. Burke, did you also prepare a summary of your written testimony in this matter.

WITNESS BURKE: Yes, I did.

MR. RUIZ: And is SDWA-76 Errata a true and correct copy of that summary?

WITNESS BURKE: It is.

MR. RUIZ: Mr. Burke, did you also prepare a PowerPoint presentation in connection with your work in this matter?

WITNESS BURKE: Yes, I did.

MR. RUIZ: And is SDWA-78 Errata a true and correct copy of that PowerPoint presentation?

WITNESS BURKE: I believe it's SDWA-77.

MR. RUIZ: I'm sorry. SDWA-77 Errata.

WITNESS BURKE: That's correct.

MR. RUIZ: You prepared that document as well.

WITNESS BURKE: Yes, I did.

MR. RUIZ: And is the purpose of SDWA-77 Errata the presentation -- Is the purpose of that document to help facilitate your testimony in this matter?

WITNESS BURKE: Yes. It's to summarize what was included in my written report and to provide a presentation to describe the details of the analysis that we conducted.

MR. RUIZ: So that document is going to be the basis of your testimony this afternoon.

WITNESS BURKE: That's correct.

MR. RUIZ: Mr. Burke, beginning with a brief description of your professional and educational background, can you provide that now and then begin to present your testimony relative to your PowerPoint presentation.

WITNESS BURKE: Yes, I will.

Good afternoon, Co-Chairs Doduc and Marcus, member D'Adamo and staff.

My name is Tom Burke, and I've been hired by the Delta Agencies to evaluate the California WaterFix Project and determine potential impacts on the Delta.

I'm a Civil Engineer. I've got a Master's of

Science in Civil Engineering with a specialty in Water Resources Engineering. I am a Licensed Civil Engineer in the State of California. I have over 35 years of experience in hydraulic -- in hydrologic modeling and analysis.

In the course of my work, I probably worked on over a hundred different river systems across the country, starting out with the Corps of Engineers as a Hydraulic Engineer.

I worked for several different Environmental Engineers performing hydrologic analyses of fisheries and aquatic systems and, for the last 17 years, I've been running my own water resources engineering firm, Hydrologic Systems.

Over the last 25 years, my experience has been in California working on a variety of streams that are tributary to the Delta and within the Delta channels itself.

Next slide, please.

MR. RUIZ: Would you like to have your PowerPoint presentation put up now?

WITNESS BURKE: Yes. Could you put up my PowerPoint?

MR. RUIZ: Please put it up. That's SDWA-77 Errata.

(Document displayed on screen.)

WITNESS BURKE: Could you go to the next slide, please.

(Document displayed on screen.)

WITNESS BURKE: As a bit of background, the Central and Southern Delta presently is a very stressed system. Agricultural and municipal water users are constantly attempting to combat a variety of this use. Those issues include water quality primarily dealing with salinity, water temperature, which is one of the primary factors in algal growth, and water stage, which affects the ability of diverters to remove water from the Delta channels.

It's because of the existing water issues and the already stressed and degraded condition of the Delta that the Delta Agencies are very concerned that the California WaterFix Project may already exacerbate problematic conditions and make things worse.

In order to evaluate the impacts that may be generated by the project, I looked at the hydrodynamic flow conditions throughout the Delta for each of the WaterFix scenarios.

We used a DSM-2 hydrodynamic model that was provided by DWR to evaluate these conditions. This allowed us to be able to run the model under different

scenarios without making any changes so that we can evaluate our results to theirs directly without looking at several different models or competing models.

Along with the changes to the hydrodynamics of the Delta, we evaluated changes to salinity, river stage, and residence time that would be generated by those changes in flow.

The changes were evaluated by comparing the results of each of the different scenarios to the No-Action Alternative to determine the change in conditions that existed.

As proposed by the Petitioners, there are several different physical components to the WaterFix Project. And I'm sure we've gone over this many times before, but as a brief summary, I'd like to go through the different components as a basis for describing my analysis.

Basically, there are three different diversions that are on the Sacramento River located in the north end of the Delta. These diversions feed water down to an Intermediate Forebay. From the Intermediate Forebay, there's two 40-foot-diameter parallel tunnels that convey the water approximately 9 miles down to the modified Clifton Court Forebay.

For the physical characteristics of the

Project, Petitioners have proposed four different scenarios to encompass the range of operations that may exist for the project.

These scenarios range from B1, which is the low Delta outflow scenario, to B2, which is a high Delta outflow scenario, with Scenarios H3 and H4 as intermediate conditions for the Project. Finally, a scenario was presented by DWR for the No-Action Alternative, which basically represents the existing conditions without the Project features in place.

It should be noted also that the B1 and B2 form a boundary of scenarios for the potential operations of the Project, but they don't necessarily represent the boundary, the impacts that may be resulting from the different scenarios because Delta outflow is not the only component that creates these different scenarios.

I'm sure everybody's familiar with the basic budget components of the Delta but, as a brief overview, I'd like to go through the major components that create the water flow into and through the Delta.

We've got inflow coming into the Delta from the north and the Sacramento River. We've got tributary inflows coming in from the east. We've got the San Joaquin River inflow coming in from the south.

Basically, the Sacramento River and the

tributary inflows provided the primary source of fresh water coming into the Delta.

We've got a tidal flow boundary on the west side of the Project -- or the west side of the Delta which allows water to come into and out of the Delta. There's basically two different tidal cycles each way bringing water in and taking water out of the Delta.

It should be noted also, though, that water that leaves the Delta in an outgoing tide isn't necessarily lost to the Delta. That water -- Much of that water, anyway, comes back in in the next incoming tide. This water sloshes back and forth through the tidal cycle and the incoming flows.

Down in the southern end of the Delta, we have the primary exports, the State Water Project exports and the Central Valley exports, bringing -- taking water out of the Delta.

All of these inflows and outflows to the Delta result in the Delta becoming a giant estuary, which is essentially a mixing pot for all of this fresh and saline water that moves through the system.

The relative volume of the different components and the resulting flow through the system has a direct impact on the water quality in the Delta.

You can see, independent of any real modeling,

a simple mass balance of the Delta would show you that a change in any one of these components would have an effect on the water -- resulting water quality throughout the Delta. And that's especially true of the Sacramento River because it's the primary source of fresh water that's entering the Delta.

From the different physical components of the WaterFix Project that I previously discussed, here's a layout of their location within the Delta.

The Delta's located in the center of this map. On this map, north is going up. So at the northern end of the Delta, you can see the three intakes that are on the Sacramento River. They're pulling the water off, as mentioned earlier, to the Intermediate Forebay which then conveys the water down below the Delta through the two tunnels down to the Clifton Court Forebay.

The end result of this system is the diversion of a significant portion of the Sacramento River. Instead of going through the Delta, it's now going around the Delta, depriving the Delta of a large amount of fresh water.

The end result of this whole diversion of this fresh water from the Sacramento River is a reduction in the Delta mixing of fresh water and saline water.

The resulting question is, will the removal of

this much fresh water from the Delta have any effect on Delta water quality? And that's what we set off to look at by evaluating the different WaterFix scenarios that were presented by DWR, or the Petitioners.

To answer that question, we went ahead and looked at the two -- the existing DSM-2 models that were uploaded by the Petitioners to evaluate the impact of each of the scenarios as compared to the No-Action Alternative.

DSM-2 is a one-dimensional unsteady flow model that can evaluate flow and water characteristics of that flow as it moves into, through and out of the Delta. It's typically run on a 15-minute time-step and has computational nodes at hundreds of locations across the Delta, allowing for a very fine-tune evaluation of the change in hydrodynamics and water quality at many locations.

Almost any location that you want to look at in the Delta, you can use some of the existing nodes or you can use request output at other locations between these nodes so you can get very exact information at specific locations.

It's not a perfect model but it's been around for a long time. It's gone through multiple generations and evolutions of improvements to try to help the ability

to predict water quality at hydrodynamics through the Delta.

This particular version of the model is fairly accurate, mimicking or predicting the hydrodynamics of the system in terms of stage and flow, but it's not very good at predicting water quality at certain locations in the Delta, especially the Southern Delta.

One of the first things that we noticed when we started to evaluate the model is that there's two different time scales being used in this modeling analysis.

The -- Each scenario is really composed of two components. You've got the CalSim II model, which is a reservoir operations model, which evaluates the inflow and outflow from the reservoirs and then demands down below the reservoirs, and feeds the boundary conditions to the Delta. These boundary conditions are then taken by DSM-2 and evaluate the detailed hydrodynamics of the water movement and water quality through the system.

CalSim II is incapable of directly predicting water quality or flow within the Delta. It relies on neuronetworks between CalSim II and DSM-2 to develop a type of estimate of what those relationships may be.

But in order to know the exact details of what's going to happen for any particular CalSim II

scenario, you have to look at the DSM-2 model to get that detail.

From a statistical viewpoint, if you want to take -- make exceedance analyses or extrapolations from the data you get from these models, you want to try to use the longest period of record that's available.

And, so, looking at the 82-year period of CalSim II and the 16-year period that's being used in DSM-2, it made a discontinuity between the two systems. Why -- Since Cal II -- CalSim II feeds the data that DSM-2 needs, why wasn't DSM-2 run over the full 82-year period?

Now, it may be that the shorter 16-year period that DSM-2 is using is hydrologically equivalent to the 82-year period. And if that's the case, then you can do extrapolations and exceedance analyses based on the results of the DSM-2 model.

And so we set off to try to look at that to determine, are these two periods hydrologically similar? To do that, you develop a probability analysis for the flow for each period using the Eight-River Flow Index as a proxy for the hydrologic characteristics for each year.

The Eight-River Flow Index represents the unimpaired flow from the eight major rivers which contributing flow to the Delta.

The plot that we have up now is a plot of those two probability plots. The X-Axis is the probability of occurrence. That's the probability that the eight-river flow value will be less than or equal to the value you read off of the curve. Now, the Y-Axis, we have the actual flow in million acre-feet.

There's two plots that we have on the curve. We've got a blue line with red dots. That represents the probability curve for the 82-year period of record for the Eight-River Flow Index.

For the 16-year period, we have the red line. This represents the probability curve for that shorter period.

The first thing we notice is that the two lines don't necessarily overlap. They're following a general trend, which you'd expect for almost any set of curves. But for developing exceedance analyses and extrapolations, you want to be able to amass the extreme through low-flow periods and high-flow periods.

For the probability of occurrence, the lower number is from zero to 30 to 40 percent. Those represent the dry periods. The 80, 90 and 100 percent would represent what would happen during high wet periods.

And as an example for how well they match up, you can look at the 90 percent occurrence line. And if

you follow that up, you can follow it up to the first curve that it hits, which is the curve that represents the 82-year flow period. You could read across to your Y-Axis and you see it generally would tell that the 90 percent occurrence value will be about 38.9 million acre-feet.

If you continue up till you hit the curve that was generated by the 16-year period of record, you see that you're getting about 47.2 million acre-feet.

So the shorter period is overpredicting on the high-flow events by about 20 percent. The difference between those two values is about 8 million acre-feet, which is two Lake Shastas completely full. So that's a significant amount of water.

If you look at the curve down on the left side, which are the lower probability of occurrences, you'll see that the orientation of the two lines have now flipped. Now the 82-year period record is providing a higher flow estimate than the 16-year period of record.

So, in this area, for low-flow events, the 16-year period record would underpredict the flow characteristics for those years.

This is a table that we put together that is just data read off of those two plots that we just looked at. And it provides -- And this is actually a typo that

we have on here. For that first column, that percentage exceedance should be the percent occurrence.

And, basically, to present this, exceedance and event occurrence are just two sides of the same coin. They're just the universe of each other.

The 90 percent exceedance value is equivalent to the 10 percent occurrence value. It all depends on which way you want to look at the data. So this (indicating) should be percent occurrence and this is down from 10 percent on down to 95 percent occurrence.

The second column shows the Eight-River Flow Index that you get for the 82-year period of record, 1922 to 2003.

The third column shows the Eight-River Flow Index that you get for the 1976 to 199116-year period that was used for the DSM-2 analysis.

The last column shows the percent difference. And that percent difference was calculated by taking the 82-year period of record and subtracting the 16-year period of record estimates.

And as we saw from the plots but is maybe a little clearer here, for the low-flow periods of 10, 20 or 30 percentage occurrence, you're getting about a 20 percent underprediction of your flows using the 16-year period of record versus the longer and more

accurate 82-year period of record.

And if you move down to the 89-95 percent occurrence, you'll see that now you're underpredicting -- or overpredicting, rather, the value compared to the longer 82-year period.

And when you get up to the 90-95 percent, now you're overpredicting by about 20 percent.

So the estimates you make in exceedance analyses based on a shorter period of record is questionable and may not be as accurate as we'd like to have when you're trying to evaluate different hydrologic characteristics or water quality characteristics in the Delta.

This last plot, I guess, is a bit repetitive but basically is the plot of the table that we just saw. It makes it a little clearer perhaps that you can see how the values are -- the 80-year -- 82-year period of record is giving you 20 percent more flow for the lower percent occurrences, and about 20 percent less flow for the higher percent occurrences.

And, again, that typo extended on to this sheet, too -- I'm sorry about that -- where the X-Axis should be percent occurrence rather than percent exceedance.

So, given the fact that the 82-year period of

record is available, the output of CalSim II can be used to drive the DSM-2 model. We're not really sure exactly why only the 16-year period of record was a value used for the analysis of the CalSim II -- of the WaterFix models.

To evaluate the effects of the different WaterFix scenarios in the Delta, we selected several different locations throughout the Delta. We selected some locations that were already problematic areas that we wanted to determine whether or not conditions got worse, and we selected other areas that weren't necessarily problematic but gave us a better distribution of what the water quality characteristics would look like across the Delta.

This first map is the first of three, just showing the location of the sites that we selected to perform our analysis. This map, north is pointing up. And to orient you a little better, on the right side of the map, you can see the San Joaquin River running north and south. Along the bottom of the map, you can see Old River running east to west. And in the middle of the map you've got Middle River coming up and then curving off to the left with Grant Line Canal going across the center of the map.

There was two locations that we selected on Old

River. We selected Old River at Tracy Road. We selected Old River 1, or a designation we called Old River 1.

We looked at Tom Paine Slough, Grant Line Canal, two sites on Middle River, Middle River at Head and Middle River near Howard Road Bridge, and two sites on San Joaquin River, San Joaquin River 1 and San Joaquin at Brant Bridge.

Moving up in the Delta, we also evaluated several locations on Old River. Again, north is up on this map. We've got North Victoria Canal running across the center of the map, and Old River running north to south through the center.

We selected two locations on Old River, three locations on Indian Slough, another location on Warner Dredger Cut, and on the upper right side of the map, you can see the Middle River and we selected a site called Middle River at Post Office.

Moving further north in the Delta, this is near the confluence of San Joaquin and Sacramento Rivers, we also evaluated the Emmanton (sic) site.

As I mentioned earlier, the analysis that we conducted was used -- was developed using the WaterFix scenarios for DSM-2 model that were uploaded by the -- by DWR. These models run on a 15-minute time-step. And for this analysis, we looked at the data from each of those

15-minute time-steps as well as a daily average for those sites.

This differs from the Petitioners' analysis where typically the monthly value averaged over all 16 years of the DSM-2 model run was used as an indication of impact.

The type of averaging that Petitioners used tends to eliminate the high and low values. You're washing everything out by averaging over a longer period of record that incorporates wet years as well as dry years.

But given the dependence of -- on -- of irrigation on the quality of water at the time the water's diverted, we felt that averaging over multiple years would not accurately reflect the impact in any real water quality change.

And the following two plots kind of illustrate the difference in the two approaches.

This first plot is a plot from Exhibit DWR-513, and it shows that change for the different WaterFix scenarios for each month of the year but based on the mean monthly average.

So, as you can see, that for most months, except for March, April, May, there's very little change in water quality between all the different scenarios,

including for the No-Action Alternative.

And the Y-Axis on this plot is the electrical conductivity in microsiemens per centimeter going from zero on up to 800.

It's important to know how these numbers were calculated. They take -- They started out with a basic 15-minute data the DSM-2 model produces, then it came up with monthly averages from those DSM-2 data, and then took the month for each of those months and averaged those altogether. So the October data we have here is the average October data for all Octobers of the 16-year period.

If you could look closely at some of these graphs, except for those three months where there isn't a fair difference, in March, April, May, there's very little more than maybe 20 microsiemens per centimeter difference between all the different scenarios.

If you look at the actual data, though, you'll see there's a quite different story going on behind these averages.

This is a plot showing the difference between the salinity for Scenario B1 and B2 as compared to the No-Action Alternative.

This data is the 15-minute data that's been plotted from October '75 through October '91 on the

X-Axis, and the Y-Axis is showing the change in salinity going from negative 400 on out to positive 800.

If you look carefully, you can see, for the scenario for B2, which is the orange line, the difference between that scenario and the No-Action Alternative can go as high as 400, 500 or even 600 microsiemens per centimeter difference. And that's quite a big difference as compared to the 20 microsiemen per centimeter from the Petitioners' analysis.

Not only are we seeing these large increases in salinity for these periods, but if you look at the thickness of some of these bands as that salinity starts to rise, this is not a momentary spike that occurs during low tide or any particular day. These bands last for several weeks, sometimes even several months. Some of these actually look to be two to three months in thickness.

So these are not momentary spikes resulting from a change in conditions on a particularly low tide or something like that. These are systematic problems that are occurring between the B1 scenario and the water quality characteristics that we're evaluating.

We could actually take this data and even average it over a year. As long as you didn't cross boundaries where you started averaging wet years and dry

years. You can take the data for any particular year and average it for that particular year and see what you get.

Now, this is a plot doing exactly that where we've taken the salinity difference between each of the four WaterFix scenarios, B1, B2, H3 and H4, and subtracted that salinity from the No-Action Alternative after we've averaged it over that whole year.

And we plotted this up from 1976 through 1991, and we can see on the Y-Axis we've got the change in salinity going from negative 40 on up to about positive 80.

As you can see through all of the different scenarios -- and this is for the site Old River at Tracy -- all these scenarios, except for 1989 to 1990, are resulting in a positive increase in salinity at this location.

Now, it's not the 600 microsiemens per centimeter we saw when we looked at the individual data but it still, at some years like 1987, we can see that there's a 70 microsiemens per centimeter increase which is still much larger than the 20 or 30 that we saw from the Petitioners' analysis.

So this is showing that there's a lot more going on. And, as you can see, the more you average it, the more you lose that data, the more it looks like

nothing's really happening.

Another way of looking at the change in salinity is to actually look at the amount of time that the salinity has increased for any particular scenario as compared to the No-Action Alternative. And that's what we've done here in this plot.

This is the plot showing bar charts for each of the four different scenarios, B1, B2, H3 and H4, for three different time periods. The first brown bar that you see there is for all 16 years, the blue bar is for April to September 1977, and the orange bar is for April to September 1991.

The Y-Axis shows the percent of time that the -- the electroconductivity, or salinity, at this site has increased over the No-Action Alternative.

As you can see for each of these different scenarios, over 50 percent of the time the salinity is increased due to the changes from each of these different scenarios.

For certain periods during drought years when salinity is a critical issue, you can see that salinity for Scenario B1 is about 85 percent of the time it's going to be worse; and for Scenario H3, about 92 percent of the time it's going to be worse, at a time during a drought period when this -- any increase in salinity at

all can be catastrophic.

One of the things that should be noted in this analysis, or when analyzing the results from the DSM-2 model, is that the model's not necessarily predicting water quality characteristics or salinity correctly in the South Delta. And this is one example showing the ability of the model to predict at the Old River at Tracy site.

What I've done here is, I've plotted up the prediction of the model for the No-Action Alternative over the 1976 through '91 Water Years, and I plotted that against the actual measured salinity at this site.

The blue line is the measured salinity at the site, and the red line is the predicted salinity at the site. As you can see, it's almost consistently underpredicting the actual value that exists there.

So, the model's not only predicting low, but it's not able to match the fluctuations and changes in salinity that were seen at this site. The actual different between the mean for the two is about 150 microsiemens per centimeter.

So, it should be noted, specifically when you try to evaluate whether or not we're exceeding D-1641 more often with the results in the model because the model's not predicting the salinity correctly in the

first place, so when you tried to compare that to the D-1641 criteria, it's not a true comparison because it's not predicting accurately.

Another analysis that we performed from the WaterFix scenarios was to evaluate the change in stage due to the diversions on the Sacramento River. To do that, we looked at the output from the DSM-2 model at three different locations. We looked at it immediately downstream of the North Delta Diversions, we looked at another site 3 miles downstream of the diversions, and we looked at a third site that's 9 miles downstream of the diversions.

Now, Petitioners have proposed that there's very little change in the stage that would occur in the river, and that change is more a function of low tide and would be reversed in a single day.

Well, we found out that, in looking at this data, is that not only is that not accurately portraying what we see from the data but that we have a significant decrease in stage at just below the North Delta Diversion, commonly getting down to one foot below, and at one point in time during the 16-year period actually having a 4-foot drop in water surface elevation down just below the diversions.

What should be noticed, too, in this is that

these are not momentarily -- momentary spikes where water drops, and it comes -- the stage drops and comes back up due to a low tide, or changing fluctuations in the tidal cycle.

But in October '84, the water level came down below 2 feet and stayed between 2 and 4 feet -- stayed depressed between 2 and 4 feet for over 20 days and didn't come back up until the 22nd day. So these are long periods of depressed water levels at these locations.

And it's not due solely to the conversion itself but it's due to the configuration of the whole scenario. Each of these scenarios consists of the diversions occurring on Sacramento River as well as the changes to inflow in the Sacramento River due to the output from CalSim II.

Each scenario changes the amount of exports from the different reservoirs, so there's a different flow in the Sacramento River for each different scenario.

And so the drop in water level that we see here is a result of all the different factors that come into play for the scenario that has been developed for the WaterFix. And, in this case, it's showing us that we're getting a significant decrease in stage that kind of lasts for a significant period of time.

Here's the results of that same type of analysis but this is 3 miles downstream of the North Delta Diversion.

Again, here, you can see that we have a drop-down -- a lowering of the stage down to negative one fairly regularly, and with extreme events sometimes occurring down to two and a half to three and a half feet below the No-Action Alternative.

And, again, these same periods when it does drop, it's not something that drops and comes back up. It can drop and stay there for weeks at a time.

The last site that we evaluated was a site that's 9 miles downstream of the Delta Diversion. This is just below Georgiana Slough.

And, as you can see, here, we're still 9 miles further downstream, we're still seeing a significant decrease in stage at this location, frequently getting a foot drop and still the maximum drop is around 2.8 feet.

Now, if you're diverting from this location, a 2.8-foot drop in water over an extended period of time could have potential impacts on your ability to divert water from the river or at least in the volume of water you can divert given that change in head.

The Petitioners, when they evaluated the water level change in these locations, did a very similar type

of averaging that they did when they looked at salinity. And by looking at an average change below for the 16-year period of record, you come out with about a .3-foot drop in water level on average. And we were able to verify that.

When we average everything over 16 years, we show it's .3. That may be generally insignificant to most people, but when you see the actual changes for something that drops down below a foot or two for weeks at a time, that may be significant, much more significant than a .3-foot average change would be.

Another way of looking at this is looking at the change in the stage at -- from a probability of exceedance perspective.

This is a plot where we have the probability of exceedance on the X-Axis and we've got the difference in stage between B1 and the No-Action Alternative on the Y-Axis.

As you can see here, when the stage for B1 is lower than the No-Action Alternative, we colored that area in red. When it was higher than the No-Action Alternative, we colored it in blue.

And so the general areas that you see, red and blue, would give you a relative feel for the amount of time that the stage would spend either depressed or

raised above the No-Action Alternative.

And as you can see from this particular plot, there's a significant amount of time that the stage is going to be depressed below the No-Action Alternative for this scenario.

If you look at the 90 percent exceedance value, you'll see that 10 percent of the time, it will be more than one foot below the No-Action Alternative. Given 365 days a year, you're looking at 36 days a year that you're going to have a depression of at least one foot.

If you look at the 70 percent exceedance line, you move on up until it hits the chart, and you see that 30 percent of the time, the water level will be depressed more than .5 feet, which can be significant depending on how the diverters -- irrigation diverters are set up along the river.

The last analysis we looked at was to try a way of evaluating residence time in the South Delta.

One of the ways that you could look at residence time is looking at the flushing flow, the ability of water to move positively through the system and out of this area.

So we looked at flushing flow as a proxy for the residence time of water within the Middle River and Old River. And we evaluated that for a drier scenario

when conditions are critical to see if it's going to be making things worse.

And what we found was, for the 1977 period, that, for Middle River for the Scenarios B1, -2, H3 and H4, there was a decrease in the flushing flow, which means residence will increase for these -- for that location for each of the different scenarios.

And the reason why residence time is important is because residence -- the longer the water sits in this particular area, the longer it has time to absorb nutrients from the discharging flows that are coming in at this location, and the longer it has time to heat up and more likely has a chance to contribute to algal growth. So residence time is a direct driver indicator in the ability to grow algae in these areas.

If you look at Old River under Scenario B1, the residence -- the flushing flow actually increased. So, for that particular scenario, we had more water moving through Old River and a reduction in residence time. But for B2, H3 and H4, the flushing flow decreased, thus increasing the residence time.

So, for those scenarios, there will be a longer period of time where the water is sitting in these locations providing the time for algae to grow.

To summarize the analysis that we did,

basically the WaterFix will result in increase in salinity in the Central and South Delta. Some of these increases in salinity can be hundreds of microsiemens per centimeter versus the lower value that you get when you only average things on a mean monthly or monthly average.

And I think it's important to be able to look at the actual data that you're going to be getting rather than averaging it, because when you average it, you lose the ability to look at what's happening in any particular year.

As far as the amount of time that the salinity will be elevated over the No-Action Alternative, we found out, in almost every scenario, you have elevated scenario levels -- elevated salinity levels at least 50 percent of the time, sometimes in dry years up to 80 or 90 percent of the time.

We also found the stage in the Sacramento River will decrease significantly downstream of the North Delta Diversions up to 4 feet immediately downstream of the diversions. As far as 3 miles down from the diversions, you're still getting 3.7-foot drop in water stage at that location. And up to 9 miles downstream of the diversion, you're still getting a 2.9-foot drop in stage which can be a significant drop for diverters.

And, finally, the residence time is going to

increase in the Central and South Delta for almost all the scenarios except for B1 for Old River.

And we did the analysis for residence time looking at not only the dry year of 1977 but we looked at it as an average over all 16 years as well and found fairly similar results, although not as dramatic as we found for the 1977 period.

And that's all.

MR. RUIZ: Mr. Burke, that concludes your direct testimony today?

WITNESS BURKE: Yes, it does.

MR. RUIZ: All right. We'll next move to Terry Prichard and John Herrick will lead that examination.

DIRECT EXAMINATION BY

MR. HERRICK: Mr. Prichard, would you give your full name and spell it for the court reporter, please.

WITNESS PRICHARD: My name is Terry Prichard, T-E-R-R-Y --

MR. HERRICK: First, you have to turn on the microphone.

WITNESS PRICHARD: Yeah.

My name is Terry Prichard, T-E-R-R-Y, P-R-I-C-H-A-R-D.

MR. HERRICK: And you've appeared before this Board on previous occasions as an expert with regard to

agriculture and soil salinity issues?

WITNESS PRICHARD: Yes, I have.

MR. HERRICK: Mr. Prichard, is South Delta SDWA-91 your Statement of Qualifications?

WITNESS PRICHARD: Yes, it is.

MR. HERRICK: And is SDWA-92 the written testimony you prepared for this proceeding?

WITNESS PRICHARD: Yes.

MR. HERRICK: And, with that, I'll just have Mr. Prichard summarize his testimony.

If we could bring it up, I believe he'll want to refer to one or two of the figures in there as he goes, but he'll start to summarize his testimony.

Thank you.

WITNESS PRICHARD: Good afternoon. As I mentioned, my name is Terry Prichard. I reside in Stockton, California.

I'm a soil scientist, an agronomist and agriculture consultant with over 40 years of experience in analyzing, testing -- and testing the effects of water supply and quality on crop production.

Over the years, much of my work dealt with the effects of salts on plants and crop production, especially in regards to the Southern Delta salinity issues, as I was a Water Management Specialist at U.C.

Davis for 35 years.

I was retained by the South Delta Group for this proceeding to analyze data provided by Tom Burke to determine if any changes in Southern Delta channel water resulting from the WaterFix Project would affect users of water in the Southern and Central Delta.

However, such difference -- differences between model runs should not be understood to indicate what conditions will actually result, as was just presented by Tom Burke.

The Petitioners' Modeling Panel highlights this, as the Modelers agreed that the salinity, or EC, numbers given in their testimony and evidence were for comparative purposes only and did not assert that those numbers would reflect what actually would occur.

In fact, in Exhibit South Delta 27, it included graphs which were produced by DWR for the Old River near Middle River, and that was listed on that exhibit as the predicted EC from approximately July 12th to August 1st, and that would be, from my estimates of the lines on the graph, to be from 680 to 450 EC.

However, Exhibit South Delta 35 included the actual ECs for the same period, and those ECs were 770 to 680, because the model numbers were substantially lower than the actual numbers.

And the worst case instance was on August 1st where the difference was, 380 microsiemens per centimeter.

But regardless -- regardless of the underlying reason for this large difference, it illustrates that the model outputs can only be used as a guide in comparing the differences. They're not reliable for predicting the actual conditions. This becomes extremely relevant with regards to my analysis.

To highlight this, let me say that, let's say that the analysis deals with modeling numbers in the range of 300 to 600 microsiemens per centimeter.

My results will then indicate the impacts, if any associated with those numbers. However, if the actual ECs resulting from the Project are, say, two to 300 higher, the impacts would be much greater.

The long-term impacts of a -- to a crop result when the soil of the root zone accumulates salt to the point where it exceeds the particular crop's salt tolerance threshold. That threshold is at the beginning of when yield decline would increase as the soil salinity increases.

When model numbers do not result in any soil salinity reaching this threshold, the impacts can be small or, in fact, nonexistent.

When the actual numbers reach or exceed the threshold, impacts begin to rise rapidly, as shown in my figures.

The best method for determining the impacts to users of water in the Delta is to examine how salinity might affect crop production. This entails certain necessary steps, selecting and calculating the necessary inputs.

Because the Delta has so many varying conditions relating to soils, general water quality, leaching ability of the soil, and scores of different crops, I decided to limit my analysis to two crops, beans and almonds and limited my comparison between two scenarios discussed previously by Tom Burke. That was the H3 scenario and the No-Action Alternative.

Additionally, I did this for a single location, which was Tracy Boulevard Bridge at Old River, designated on Mr. Burke's testimony and exhibits as SDN-1.

Before relating the results of my analysis, I need to explain leaching fractions. The leaching fraction is the fraction of the crop water used which should pass through the root zone to control salts at a specific level.

Dr. Michelle Leinfelder-Miles of U.C. Davis Cooperative Extension recently conducted a leaching study

in the Southern Delta which was previously presented.

In that study, she measured soil salinity at the beginning of the season, she measured the salinity of all of the applied water during the season, and then measured the salinity of the soil at the end of the season. In this way, she was able to determine how much salt built up in the root zone, how much made its way out of the root zone. This then allowed her to calculate the leaching fraction for each site.

Her results indicated about 50 percent of the sites, a leaching fraction of less than 5 percent was accomplished.

I'm familiar with this study as I consulted with her on the design, implementation and analysis of the study.

The procedure for evaluating the effects of model water qualities at the locations stated are as follows:

One, I selected a crop, beans and almonds, one a short-season crop and one a long-season crop, determined the crop water used for each of those crops from the Brentwood CIMIS station, a California irrigation management information system run by the Department of Water Resources, and used a 10-year average from that station for the evapotranspiration reference number and

also utilized crop coefficients for each of those crops.

Thirdly, I determined the irrigation date and the irrigation volume to meet the crop's water use throughout the season, and I utilized the modeled five-day average water salinities to calculate the average seasonal irrigation water salinity. And I got those from -- the information from Thomas Burke.

Then I calculated the resultant root zone soil water salinity, often called the ECsw, using inputs of the average ECi, the crop water used, and the leaching fractions from a variety of leaching fractions from five to 20 percent.

This was done using a water use uptake pattern model, commonly called a 40-30-20-10 method described by Ayers and Westcot in FAO 29, then converted those projected water -- soil water salinities to the soil salinity extract to calculate the relative yield, or yield reduction.

The results for bean, which appears in Figure 1.

If we could go to Figure -- Figure 1 of my testimony.

(Document displayed on screen.)

WITNESS PRICHARD: That's not it.

CO-HEARING OFFICER DODUC: Page 5.

(Document displayed on screen.)

WITNESS PRICHARD: This figure shows the data for crop yield productions for the 16 years of data at four different leaching fractions for the H3 and No-Action Alternative.

The leaching fraction, again, I must say, is a fraction of water -- crop water use which should pass through the root zones to control the salts at a specific level.

The higher irrigation water salinity, the higher of the leach fraction required to maintain productivity. That's why this was done with a number of different fractions.

As we can see from this chart, yield reductions are predicted -- those are the ones that are not blanked, those are yield reductions -- are predicted at the 5 through 15 percent leaching fraction for both the H3 and the No-Action Alternative scenarios.

The average crop production of the 5 percent leaching fraction over this time frame was about 24 percent under both scenarios. However, in years like 1977, 1979, 1985 and 1987, we see that the H3 scenario results in significant crop reductions beyond those of the No-Action Alternative.

The yield for the 10 percent leaching fractions

are similar but somewhat lower. Average in reductions for the H3 and No-Action Alternative are very similar but they are significant additional reductions in the years for H3 in years '77, '79, '85 and '87.

For almonds, let's go to the next -- the next, Figure 2, which is just below that somewhat.

(Document displayed on screen.)

MR. RUIZ: Slide 7.

WITNESS PRICHARD: My analysis for almond shows that yield reductions are predicted only at the 5 percent leaching fraction in most years. That's 73 percent of the period '76 through '90. That averaged 13 percent in the H3 and the No Alt -- No-Action alternatives, pretty much equal. Although the average reductions were similar, there were significant additional reductions in H3 in the years '77, '87 and '88.

And I must note that the H3 yield reduction calculated for '87 is nearly double the yield reduction for the No-Action Alternative.

So, in conclusion of this portion, substantial yield reductions in bean production are predicted to occur in most years below a 10 percent leaching fraction under the H3 and the No-Action Alternative.

And that is especially true for the 5 percent leaching fraction that shows -- of the 16-year model

period, shows that four years were significant -- additional crop reduction was found with the H3 scenario.

In almond, at the 5 percent leaching fraction, the 16-year model period shows three years of significant additional crop reduction resulting from the H3 scenario.

I will note here that these results predict results for each of the 16 years and they're not cumulative. Thus, in reality, unless and until some other condition actually leeches salt from the root zone, the previous year's salt buildup remains. This means that the following year, added salt is -- at the starting point of a crop's threshold may be reached sooner or exceed it to a higher degree.

My conclusion must also reiterate the fact that, not knowing what the actual ECs are from the WaterFix Project, my numbers can only be described as conservative. The actual impacts may be very much worse.

Given these predicted crop reductions at specific leaching fractions, it's imperative that growers be able to attain or exceed leaching fraction -- the leaching fraction to maintain productivity.

Attaining an adequate leaching fraction with these two crops may be difficult in the Delta region.

First, beans are sensitive to overwatering, causing saturated soils and encouraging root diseases,

and the lack of oxygen in the root zone can also be reduced cause -- which both can potentially cause crop production decreases.

Beans use about 21 and a half inches of water per average season while almond uses about 50. Given the many Delta -- Given the many Delta soils that are low in permeability, and that it may be difficult to infiltrate that extra 10 percent, or about five or five and a half inches of water, which would be required for almond to achieve that 10 percent leaching fraction.

Additionally, the shallow water table does not provide a typical leaching scenario whereby the salts would simply be washed down below the root zone.

The salts move down by leaching to the water table where the net movement is not downward, causing the waters -- the salts to pool in a shallow water table waiting to move upward by capillary forces when no net downward water is present.

There's one additional analysis which should be done but for which there's no acceptable scientific tools to accurately calculate that. That analysis deals with the effects of crops from any particular irrigation or irrigations rather than the yearly average irrigation salinity.

A scientifically acceptable method for modeling

this has not been developed but the issue needs to be discussed.

If a particular irrigation uses water quality that is significantly worse than the average water quality over the season, and that is applied during the seedling or more sensitive stage, it may adversely affect the crop even if the yearly average shows no effect.

Whether or not this occurs is dependent upon soil conditions at the time of the irrigation. If the soil is at or near the salt-tolerance threshold for the crop, the application of poor quality water might push the salinity above the threshold in that shallow root zone and impair crop growth at that time, which would be magnified by harvest.

We see from the data provided by Mr. Burke that the different locations . . . that different locations can be relatively short, for example, five to 15 days, times when the water quality predicted by the model for H3 is up to 100 EC above that under the No-Action Alternative.

Depending on conditions at that particular site, that increase of 100 EC may stress the plant. Such stresses will adversely affect the eventual crop production to some degree.

So, given the complexity of measuring scores of

crops at numerous locations under four WaterFix scenarios, again, using the 16 years of model data, I prepared Figure 4.

Can we move to Figure 4?

(Document displayed on screen.)

WITNESS PRICHARD: I don't think that's Figure 4.

MR. HERRICK: Page 11.

(Document displayed on screen.)

WITNESS PRICHARD: There we go.

I prepared Figure 4 by use -- for use by Dr. Jeff Michael for his analysis on behalf of the South Delta Group.

The generally accepted method of calculating relative yield or yield reduction of agricultural crops is based on the use of two salinity coefficients.

And if we could move back up about a page.

(Document displayed on screen.)

WITNESS PRICHARD: A little bit more.

(Document displayed on screen.)

MR. HERRICK: So -- Let's go a little bit farther.

(Document displayed on screen.)

WITNESS PRICHARD: Okay. There's two salinity coefficients. These coefficients consist of a slope -- a

threshold and a slope.

The salinity threshold is the maximum average soil salinity that a crop can tolerate in its root zone without yield decline. The slope, or the B coefficient, is the percent of loss and relative yield that will be experienced for every unit of increased EC above the threshold.

Using these coefficients and -- the yield potential can be estimated from the following expression. That expression is listed on Line 21 of Page 9.

Further, the B slope can be -- The B, or the slope, can be calculated from -- I think that's Line 24-25 -- by taking the soil salinity at zero yield reduction minus the EC at 100 percent yield reduction. One line's the other dividing that into 100 which gives you the slope when it exceeds the threshold.

Figure 3, shown at the bottom -- if we could move that up a little bit -- are the salinity coefficients for six common Delta crops, which included bean, corn, alfalfa, tomato, almond and grape.

The important component needed in the above calculation is to determine -- to determine the relative yield in the average seasonal root zone salinity. That value was estimated using the method that I previously referred to as the 40-30-20-10 water uptake function

described in FAO 29.

The ECe, or the soil salinity, for each corresponding ECi, or irrigation water salinity, ranged from 0.2 to 1.0 decisiemens per meter, and the leaching fractions were estimated from 5 to 20 percent.

There were no yield reductions at the 15-20 percent leaching fraction.

Figure 4 -- Let's move back to Figure 4 now. It's --

(Timer rings.)

MR. RUIZ: Page 11.

(Document displayed on screen.)

WITNESS PRICHARD: Figure 4 indicated that -- the yield reductions of the six crops at the 10 and 5 percent leaching fractions using waters from zero to one. From this figure, Dr. Michael calculated the economic impacts from the possible reductions.

So, in conclusion, using DWR-produced data from its DS2M (sic) modeling for the WaterFix, we see that, although slight to no significant impacts due to EC changes, or channel water qualities, occurred at or above the 10 percent leaching fraction, however, even using just that data, we see that there are years when the WaterFix changes in salinity result in additional crop reductions above that of the No-Action Alternative.

For beans, the H3 scenario, there are four years of significant impacts to crop production out of the 16 years modeled at the 5 percent leaching fraction.

For almond, there were three years of the 16 modeled years that significant impacts occurred at the -- at that same 5 percent leaching fraction.

All of these numbers are likely to be very conservative for a number of reasons.

First, the DSM-2 model is not normally used as predictive matter but only for comparison. The modeled results can be hundreds of EC units off from reality, and using numbers hundreds of EC larger would greatly increase the calculated impacts.

Second, current information indicates that leaching fractions of less than 5 percent occur in many parts of the Southern Delta, as per Michelle Leinfelder-Miles' report.

The lower leaching fractions, the more additional salt in the applied water will adversely affect crop production.

From all of this, I concluded that the Delta clearly -- that the data clearly shows salinity impact resulting from the WaterFix Petition will significantly injure Delta farmers.

MR. HERRICK: Mr. Prichard, just one last item

there.

In your testimony, you referenced Dr. Michelle Leinfelder's -- Leinfelder-Miles' report, and that's -- a true and correct copy of that is South Del -- SDWA-140; correct?

WITNESS PRICHARD: Yes, it is.

MR. HERRICK: Thank you.

Mr. Ruiz.

CO-HEARING OFFICER DODUC: Are you done with this witness?

MR. HERRICK: Yes.

CO-HEARING OFFICER DODUC:

Okay. Before moving on, though.

First of all, do you wish to make a slight correction on Page 11?

Shouldn't that be percent "reduction"?

Go back to Page 11.

(Document displayed on screen.)

CO-HEARING OFFICER DODUC: Percent "reduction"?

MR. HERRICK: Yes.

WITNESS PRICHARD: Yes, that's correct.

CO-HEARING OFFICER DODUC: And the other table, percent "reduction"?

WITNESS PRICHARD: That's correct.

MR. HERRICK: She's noting that the "D" is

missing.

WITNESS PRICHARD: Oh.

MR. HERRICK: It's a typo.

WITNESS PRICHARD: Typo and a copy --

CO-HEARING OFFICER DODUC: It's a new word I'm not familiar with.

(Laughter.)

WITNESS PRICHARD: It's a typo and a copy of a typo.

MR. HERRICK: Yeah.

CO-HEARING OFFICER DODUC: And let me interrupt you, and let's -- We should take our break right now for the court reporter.

We will resume at 3 o'clock.

MR. RUIZ: Thank you.

(Recess taken at 2:46 p.m.)

(Proceedings resumed at 3:00 p.m.)

CO-HEARING OFFICER DODUC: (Banging gavel.)

All right. It is 3 o'clock. We are back in session.

Mr. Ruiz, Mr. Not Herrick.

MR. KEELING: Back to Mr. Not Herrick.

CO-HEARING OFFICER DODUC: Mr. Keeling.

You may continue with Dr. Michael.

MR. RUIZ: Thank you. Thank you.

Mr. Keeling is here with us because Dr. Michael is also a witness for the county in this proceeding.

DIRECT EXAMINATION BY

MR. RUIZ: Good afternoon, Dr. Michael.

Could you please state your -- state and spell your name for the record.

WITNESS MICHAEL: Sure. Jeffrey Michael, J-E-F-F-R-E-Y, M-I-C-H-A-E-L.

MR. RUIZ: Thank you.

And have you been retained as an expert witness in this matter by the attorneys for the SDWA parties and also for the county?

WITNESS MICHAEL: Yes.

MR. RUIZ: And is SDWA-133 a true and correct copy of your Statement of Qualifications?

WITNESS MICHAEL: Yes, it is.

MR. RUIZ: And did you prepare that Statement of Qualifications?

WITNESS MICHAEL: Yes.

MR. RUIZ: Can you provide a brief background and a summary of your education, professional background at this time.

WITNESS MICHAEL: Sure.

My -- I received my Ph.D. in economics in 1999. It's worth noting that my dissertation was on regional

economic impacts of the Endangered Species Act. The setting was in North Carolina, not California, but it was one of the first economic studies of the Endangered Species Act and its effect on the economy.

In 2008, I was hired by the University of the Pacific and came to this region for a job to run their Center for Business and Economic Research that studies California regional economy.

And naturally, in my background working on the ESA environmental issues, I started researching the Delta issues as part of our research agenda at that time.

For the center that I manage as a full-time staff of four, we study a lot of aspects of the State and regional economy. One of our particular areas of expertise is -- is -- has become transportation and water infrastructure, including studies of the Delta.

You know, in that capacity, I've worked as a -- as an expert consulting with a bunch of different State agencies, ranging from the Department of Finance to Caltrans and the Delta Protection Commission.

The Delta Protection Commission is particularly relevant here because I was the principal consultant on the Economic Stability Plan for the Sacramento-San Joaquin Delta that the Commission produced in 2011 and approved in 2012, and a lot of my testimony

is drawn from that.

MR. RUIZ: Thank you.

And did you prepare a written summary of your testimony in connection with this matter?

WITNESS MICHAEL: Yes.

MR. RUIZ: And is that testimony identified as SDWA-134-R?

WITNESS MICHAEL: Yes.

MR. RUIZ: And did you also prepare a PowerPoint presentation in connection with your work on this matter?

WITNESS MICHAEL: Yes, I did.

MR. RUIZ: And is that PowerPoint presentation marked as SDWA-135-R?

WITNESS MICHAEL: Yes, it is.

MR. RUIZ: And is the PowerPoint presentation based on your written summary?

WITNESS MICHAEL: Yes, it is.

MR. RUIZ: Are you prepared to provide your written summary at this time, Dr. Michael?

WITNESS MICHAEL: Yes, or to -- yes -- testify through the PowerPoint, yes.

MR. RUIZ: Yes. Are you prepared to do that at this time?

WITNESS MICHAEL: Yes.

MR. RUIZ: Can you please bring up SDWA-135, please.

(Document displayed on screen.)

MR. RUIZ: Actually, it's 135-R on the Exhibit List.

WITNESS MICHAEL: Should I begin?

MR. RUIZ: You can begin, please.

WITNESS MICHAEL: This is just an outline of the testimony that I prepared. It had three main pieces to it.

The first is to look at the economic harm to Delta agriculture. And partly what I'll show is that losses to Delta agriculture are likely even with compliance with the D-1641 performance standards that Petitioners have put forward in this Petition.

I'll also discuss how economic losses to farm production can spill over and have ripple effects on the surrounding counties.

The next part of my testimony will draw from the Economic Sustainability Plan and talk about some other aspects of the -- of the Delta economy and how it affects employment and the people who live in and around the Delta.

Specifically, I'm going to talk about a group of industries that I refer to sort of as

infrastructure-dependent, a catch-all for groups, and talk about the importance of the levee system to the Delta economy and the Delta region beyond agriculture.

The third part of my testimony was about the feasibility of WaterFix, but I was told that that testimony is moved to Part 2.

This slide shows agricultural land cover in 2010 in the Delta that we -- a map that we had assembled for the Economic Sustainability Plan in 2011, a field level map. It shows crop type across the Delta.

The first thing I'd like to draw your attention to is -- Actually, I wish -- I wish this map had some of the areas right outside the Delta boundary. Because one of the important things to note is, agriculture in San Joaquin County outside the Delta boundary is characterized by tree crops and grapes. They dominate agricultural production in San Joaquin County. Those are typically the most profitable crops in San Joaquin County.

Within the boundaries of the Delta, you see a lot less of that. And, in fact, this map, you can sort of see by the colors a bit of a spatial pattern for -- you know, across the Delta for crop type as -- as environmental conditions are different through the Delta. And that's some of what underlies some of the data

analysis I'll be talking about.

CO-HEARING OFFICER DODUC: Actually, before you move off.

WITNESS MICHAEL: Yeah.

CO-HEARING OFFICER DODUC: What is "truck"?

WITNESS MICHAEL: Yeah. Truck crops is primary -- Tomatoes are in there. So the major crop in there would be processing tomatoes, but basically produce melons, beets, things of that nature. But most of -- most of that red area would be processing tomatoes, which are an important crop.

So, some of the evidence -- Basically, I have two pieces of evidence to show that salinity changes can reduce Delta ag revenue even within the bounds of D-1641 compliance.

The first thing I'm going to do is discuss a model that was developed in the Economic Sustainability Plan. It's a model that I developed collaboratively with Dr. Dave Sunding and the -- and he moved to the Brattle Group at that time.

And so we worked together to develop this model, so it was used in the DPC. It was also used when Dr. Sunding went on to work for the Bay-Delta Conservation Plan, DWR, and the Statewide Economic Impact Report.

So most of the findings I'm going to talk about today actually don't -- It's the same model we did in the ESP but they actually come from the DWR report that they published.

I will mention, though, in the Economic Sustainability Plan, this particular model, it was peer reviewed. There was a panel of five experts that came and were convened by the Independent Science Board. This was positively peer reviewed.

A Peer Review Panel said the modeling work was, quote, "state of the art," and it's been deemed reliable by that review panel and subsequently used by DWR and BDCP impact -- Economic Impact Report.

And what that report shows is statistically significant salinity impacts on crop choice during the 2000s, a period that's been described as high compliance with D-1641.

It's an econometric model, and what it is, it's a -- it's what's known as a multinomial logit model, which is a type of regression model when you're choosing -- when you're trying to estimate a choice between options like what kind of crop to grow.

And the important thing in this slide is just to note that the data was across 6,000 fields, eight years. It was a large dataset. And the model controlled

for a number of issues -- a number of issues that could determine crop choice.

The size of the field, the acreage could affect agricultural practices and what crop type. It looked at the electroconductivity conditions in the summer. In each year, at each point, it estimated soil conditions, elevation, temperature, fixed effects for each year to control for potential changes in the market that might affect employment choices.

And we also had a spatial variable in there for conservation zones that were part of the BDCP at that time, but these are different environmental conditions.

And just to sort of summarize some of the results: This particular slide shows what are commonly called elasticities, or the sensitivity, of the crop categories to changes in salinity.

And there's basically -- you know, basically just one or two things to pick up from this slide.

You notice that there are negative values in front of the categories of deciduous, or tree crops, truck crops and vineyard crops. Those are the high-value crops in the Delta.

The model shows a strong -- a significant relationship that those crops are less likely to be grown in places that have higher salinity, whereas field green

and pasture crops are positively related. Pasture crops are the most positively related with salinity, and that's the lowest crop value in the Delta.

All these things are significant at the -- at the 99 percent competence level for a statistical model. So there's strong evidence that water quality's affecting -- was affecting crop patterns in the Delta during this period of time that we looked at, in the 2000s.

So I'm going to talk about the BDCP Economic Impact Report that utilized this model, looked at -- They took modeling estimates for the BDCP, not for the WaterFix, but the results were very similar to what we're seeing today, and took -- I believe it was the DSM-2 models, and you show the changes at some points in the Delta and fed it into the model to see what the impact is on crop losses.

So, the DWR statewide Economic Impact Report estimated a $1.8 million decrease in ag revenue in the Delta because of water quality from implementing the BDCP. And this was just from crop shifts that they predicted for relatively small change in average salinities like we've seen in the -- in the testimony here.

Now, obviously, the scale, the impact, depends

on the amount of the salinity change. So, if we saw a much larger salinity change, we'd see much larger impacts.

But this is very similar to the kind of modeling that we saw today and establishes that DWR's own report shows loss in ag revenue for implementing the tunnels.

I'll point out that this particular analysis only looks at crop shifts. It doesn't consider losses in yield. If a farmer grows a crop and receives lower quality water and sees a yield reduction, like could happen, that's not reflected here. This is just when conditions changed to which they choose to grow a different crop like, say, instead of growing grapes, growing corn.

So, shifting to the -- to -- The second way of looking at it looks at yield reductions that might happen in a given year if water quality deteriorates as a result of the -- of the WaterFix.

So this is the same table that Mr. Prichard showed in his testimony. He said he gave this one to me. And this shows the percentage reduction in yield when there's a leaching fraction of 5 percent.

And there's a few things that I'd like the point out here in terms of sensitivity. One is on the

far right column, the two columns on the far right, almond and grape.

As I pointed out earlier, these are the most lucrative crops in the region in San Joaquin County. They're grown in huge abundance in the Delta. And you'll see that they are salt-sensitive relative to some of the crops that are grown in more abundance. You can see a percentage decrease in yield gets pretty large as the electroconductivity increases here.

Corn, alfalfa and tomato, which are grown in a lot more acreage in the Delta, are more salt -- more salt-tolerant.

So, the table also shows that the -- the current D-1641 standard is .7 in the growing season, or 700 -- I always mess this up, so forgive me if I get it wrong -- but 700 is microsiemens per centimeter, .7 per meter.

So, the table goes all the way to one because I think, as the -- as the Board knows, there's a -- I don't know whether you call it a petition or request or proposal to move this standard to -- to one, in which case the yield reductions would be even larger.

So, on the next slide, I just went through -- through an exercise. It's . . .

And so this is not predictive. It's sort of an

illustrative exercise from the table of yield loss to show what's a plausible loss in revenue for a change that would be within the D-1641 standards.

You know, in some of the testimony that you've heard, it's hard to tell exactly what the changes would be in any one place. And so, you know, this is a -- this is a sort of a stylized example to give us an idea of what could happen.

And in that, basically, we -- I looked at the 2009 crop distribution. That's the data I had from our DPC work across San Joaquin County, across crop types, looking at almond, corn, alfalfa and grape. These would be the ones that are most sensitive.

I looked for -- I wanted to know what is -- what are the leaching fractions out there in the Delta. I was told the most recent and best-available data was from the study of Dr. Leinfelder-Miles that people have pointed to, and I believe that's 50 percent of the sample points in that study had a 5 percent leaching fraction.

And so I took the crop distribution and I cut it in half, assuming that that -- assuming half of it would be in areas of leaching well enough that there wouldn't be any significant change here, and we just looked at half. I distributed those uniformly over a baseline of electroconductivity levels ranging from 400

to 600 and said what -- you know, what would happen if we just moved it by a hundred, which is plausible given -- plausible in some years given Mr. Burke's testimony.

And so the table just shows the change -- the decrease in revenue by taking the decrease in yield in this scenario, multiplying it by the value of the crops, and summing it up.

And, so, the total loss is down in the bottom right-hand corner, which is $4.8 million in this scenario, which is illustrative of plausible impacts.

So, to look at what the potential broader impacts are on Delta counties, we have to look a little bit beyond just the water quality impacts on agricultural production, that there's a loss of land through the construction of the Project.

If -- You know, it may be that the fields that are taken out of production are purchased by the State and so that landowner may receive compensation through eminent domain, but you still have the impacts on the county and the broader economy from taking that production in revenue and crops out of the county economy.

So for this, thinking about the ripple effects, I also thought about land loss. The EIR/EIS is a little bit more than 3900 acres permanently taken out of

production. I believe it's up to 2,000 more temporarily. I heard some testimony a week or two ago suggesting that this number was too low and more acreage might be permanently removed.

But I used basically the EIR/EIS number. I did use the EIR/EIS number, calculated revenue loss from that, in the range of eight to 10 million, added a few more million for the water quality losses I discussed before, and just thought about what would be the economic impact of a $12 million reduction in ag revenue as a result of the WaterFix.

So, using the economic impact models that we developed for the Economic Sustainability Plan, that kind of loss of $12 million in revenue in -- in 2009 dollars here would result in a loss of 146 jobs and $11.6 million in lost income or value added throughout the Delta counties. So there would be a broader economic loss, not just farm jobs but transportation and related type employment.

These impacts are, in my view, a low estimate. The likely impacts are worse for a variety of reasons.

Mr. Burke's testimony talked about how, you know, it was plausible that there'd be -- actual salinity levels would be -- changes could be higher and result in higher impacts.

I've heard testimony about how the standards could be relaxed in drought years and the impacts could be larger in drought years. Those haven't been modeled.

There's a Petition to raise the standard by 41 percent from 700 microsiemens per centimeter to 1,000. If that change were made, that presumably could allow for larger losses.

And, also, noting that, in my view, Petitioners haven't provided any evidence that operations they modeled are feasible, and that's part of my Part 2 testimony, but it is an important reason why I think this is conservative.

The next part of testimony is to go and talk about some of the other sectors and issues, drawing largely from the Economic Sustainability Plan that I helped develop for the -- for the Delta Protection Commission.

That particular -- The ESP, as we refer to it, identified three critical areas to the Delta economy, three primary drivers: Agriculture and recreation people are pretty aware of in the Delta. One thing we drew attention to and realized is somewhat underappreciated and, actually, I think in the long run, is going -- will be the most important of the three, has to do with -- with infrastructure in the Delta.

It's popular to call the Delta the hub of the State water system, which it is the hub of the State Water Project and the CVP, so that's fine.

I always refer to it as an infrastructure hub for the State of California, particularly Northern California, because there's a lot more in there.

Particularly when you look at the Delta economy, some of these key infrastructure sectors, transportation and energy, these are actually the highest-paying, best jobs in -- in the Delta, and local water infrastructure. So they're critically important to the -- to the Delta economy.

The recreation piece --

(Timer rings.)

WITNESS MICHAEL: -- I'm told, is a -- is a Part 2 issue as well, so I'm just going to talk a little bit about these other infrastructure services.

And also point out that another finding from the ESP about the levee system is that our findings said the levee system is the foundation on which the entire Delta economy is built.

So we can discuss the levee system, because it -- I mean, without it, there is no -- there's no Delta as we know it and particularly as it relates to some of these other economic sectors, like transportation, energy

and water.

And I'm going to try to be brief here. I'm not going to go into, you know, an hour-long discussion about -- unless you want me to -- about, you know, the broader economy.

But I think it's important for people that are in the water world to sometimes step back and see the broader context of the economy and where it fits in.

CO-HEARING OFFICER DODUC: All right. Dr. Michael, let's -- You only have about seven slides or so, so let's give you another 10 minutes to sort of wrap up.

WITNESS MICHAEL: Okay.

CO-HEARING OFFICER DODUC: All right.

WITNESS MICHAEL: Okay. The -- So, all I'm pointing out here is that San Joaquin County is increasingly part of the Bay Area, so much so that, in 2013, the Federal government Office of Management Budget (sic) added San Joaquin County as the next county in the -- in its combined statistical area for the Bay Area.

That's because the flows of economic resources, peoples and goods have become so large that it's part of the Bay Area now more so than it is part of the Central Valley.

And that relates to our findings about

transportation and warehousing is the fastest growing industry in the Delta. And WaterFix construction will impede transportation between the region so its impacts go beyond just these agricultural areas.

Critical State highways, rail, Port of Stockton, all these things are growing in traffic and more and more important to the economy all the time.

In fact, if you look to the future, you know, the State is going to reduce reliance on the Delta for water, but these particular areas are going to grow in importance to the economy, and it's important to realize that when looking forward. And all those -- those economies depend critically on the -- on the levee.

So I'm just going to talk a little bit, at the last part of my testimony, about WaterFix and the risk to levee failures. And this is not engineering analysis at all. Basically, it's about resources, money and policy, and the effect on the Delta. I don't know if there may be other testimony about engineering and levee stability.

But I'll just point out that Petitioners cite the risk of failure in the Delta levee system as an important reason for approving the WaterFix.

And my comment on that is, it's critically important to recognize and note that the risk of the failure of the levee system are broad and much, much more

severe than just impacts on the water system. The catastrophic -- most catastrophic impacts are in the Delta itself.

The DRMS Study that looked at this and is often cited as -- for justification for the WaterFix, the scenario -- you know, the scenario that is frequently reported with tens of billions of dollars of damage also estimated 700 fatalities in the Delta, which would be the largest mass fatality event in California since the 1906 San Francisco earthquake.

And, then, when we looked into the details of those estimates for the ESP, we found that, actually, 80 percent of the economic losses had nothing to do with water exports and were actually losses associated with the transportation system property in the Delta, and the economy of the Delta, and repairing the damage.

These consequences are catastrophic. And so the reason it's important to consider the Delta levee system is that if WaterFix even makes a very small change in the risk, because the consequences are catastrophic for the Delta region, it's critically important to ensure that WaterFix does not increase flood risks, but I think their evidence that it potentially does.

And there's two channels from which it can.

Okay. One is direct funding. So, there's talk

in -- in the Governor's Water Plan, in the Delta Stewardship Council, the DPC, has all recommended going towards more of a beneficiary fee system for funding Delta levees. It may or may not be part of a Levee Assessment District, but the concept of a beneficiary fee is there.

If the WaterFix goes in, the basis of assessment for the Water Projects will be lower and their contribution and the resources that flow to maintaining and improving Delta levees will be lower as a result of the WaterFix by formula, if that's the way that we go for funding levees.

The second channel through which it can impact is just sort of a general approach toward State policies and resources.

And to illustrate that, I was just going to discuss the DRMS Phase 2 Study because I think it's a great illustration of how the policy emphasis can -- can change away from improving Delta levees as a result of the -- of the WaterFix.

So, most people are familiar with the DRMS Phase 1 Study, as I pointed out before. The DRMS Phase 2 study was an analysis of alternatives and there was supposed to be -- or there was a -- the Agency was directed to report to the legislature in 2008 about

alternatives for reducing risk in the Delta. And they did produce that report in 2008. That's on -- what I talk about on the next slide.

But for the Economic Sustainability Plan, the next -- the 2008 report was sort of qualitative, and I wrote to them and I asked them, can I see the modeling that supports the qualitative results? And I was sent the Phase 2 draft from fall 2007 from a few months beforehand.

And the thing I'll point out about that 2007 report is that it compared the effectiveness of a seismic levee upgrade strategy in the Delta to an isolated conveyance strategy. At that time, it was a canal, not a tunnel.

And the results of that draft analysis actually show that the seismic improved levee scenario had the highest risk reduction benefits in the aggregate and the lowest costs.

Now, that's not surprising to me as an economist because levee improvements protect against all 100 percent of the catastrophic effects of the flood while the canal is only focused on that 20 percent slice that's related to the -- to the Water Projects.

Now, I mention that because this is the report that went to the legislature in 2008. In the report to

the legislature, it said, DRMS is the primary process to provide technical information requested by AB 1200, which was this ranking -- requested ranking of risk reduction strategies.

The report to the legislature said that they found three building blocks with the highest risk reduction potential. Included in those was seismic, improved levees, and an isolated conveyance scenario.

Page 24 of the report gave the ranking to the legislature of the -- of the DRMS scenarios. I quote from the report. It said (reading):

"The ranking of preliminary DRMS scenarios is shown in the following table. These rankings were developed by DWR and DFG staff based on the DRMS analysis with adjustments based on the BDCP analysis."

Now, the bold is added by me.

And if you look at the table of the preliminary results that they showed the legislature, I'd like to point out a few things.

One is, the goals on the -- on the side there, just water goals -- And it was pretty surprising to me that it left out public safety when the DRMS Report estimated such catastrophic public safety impacts.

And the other thing that I'll point out is just

to look at the last two lines with a -- and this dot rating they provided.

First is overall risk reduction in which the improved levee scenario, which included the seismic-improved levees, received two dots, where the isolated conveyance received four dots.

I told you that the draft report actually said overall risk reduction was highest for the improved levee scenario, higher than the improved isolated conveyance.

So the adjustment based on the BDCP analysis was to switch this ranking to match the BDCP.

On lower long-term costs, it shows them tied, whereas the DRMS Report supporting that shows that levees were cheaper.

Now, the final DRMS Phase 2 Report came out a few years later. And one of the things I noted in 2011 is the building block for seismic levee improvements was actually deleted from the scenarios. It didn't exist when they presented the quantitative results.

And I present this as just an example of how the focus on the WaterFix and the BDCP has actually resulted in what I would characterize as inaccurate information about the levee system and the importance of investing in it to policy process.

This is what went to the legislature in 2008

right before the 2009 Delta Reform Act. I think that's carried over into the EIR, which doesn't discuss levee improvements as an alternative, even though it's sort of the most obvious alternative to protecting the Delta from the -- from the flood risk.

And so this is another channel through which I believe the focus on WaterFix increases risk to the Delta.

So that concludes my testimony.

Thank you.

MR. RUIZ: That concludes our direct testimony --

CO-HEARING OFFICER DODUC: All right.

MR. RUIZ: -- for this panel.

CO-HEARING OFFICER DODUC: Thank you.

Let's go ahead and get the Department up here.

I believe you had anticipated a couple hours of information.

Let me see an indication who else.

Miss Morris, how much time?

In any case, I don't think we'll get to you today because it's about 3:30.

MS. MORRIS: I think about 30 minutes. It depends on what the parties cover, but I will cross it off.

CO-HEARING OFFICER DODUC: And just for my information, who else?

MS. DES JARDINS: (Raising hand.)

CO-HEARING OFFICER DODUC: Cross-examination, Miss Des Jardins. How much time?

MS. DES JARDINS: I would estimate 40 minutes. It could be longer.

CO-HEARING OFFICER DODUC: I'm sorry. I can't hear you.

CO-HEARING OFFICER MARCUS: 20 minutes.

CO-HEARING OFFICER DODUC: 20 minutes? Okay.

Mr. Jackson.

MR. JACKSON: 20 minutes.

CO-HEARING OFFICER DODUC: 20.

And Miss Meserve?

MS. MESERVE: 15. It may be less.

CO-HEARING OFFICER DODUC: Yeah. In any case, I don't think we'll get to you today, but it's good for me to get a layout.

MR. MIZELL: Tripp Mizell with the Department of Water Resources.

Our cross-examination will be split between both Mr. Berliner and myself. Mr. Berliner will be cross-examining Mr. Burke and I will be cross-examining Mr. Prichard and Dr. Michael.

CO-HEARING OFFICER DODUC: Okay. And topic areas?

MR. BERLINER: My examination of Mr. Burke will be on three subjects: Modeling adequacy, kind of my interpretation of the first part of his testimony; water levels; and algae growth.

CO-HEARING OFFICER DODUC: All right. And, Mr. Mizell, for your witnesses -- your cross?

MR. MIZELL: Yes. For Mr. Prichard, we'll be delving into his method of analysis; and for Dr. Michael, we will be discussing his economic models versus what we see in the report to the San Joaquin County.

CO-HEARING OFFICER DODUC: Versus what?

MR. MIZELL: What we've seen actually reported to San Joaquin County.

CO-HEARING OFFICER DODUC: Thank you.

Please begin.

MR. BERLINER: Thank you.

CROSS-EXAMINATION BY

MR. BERLINER: My name's Tom Berliner. I'm one of the attorneys for the Department of Water Resources.

Good afternoon, Mr. Burke.

WITNESS BURKE: Good afternoon.

MR. BERLINER: My questions will be exclusively for you.

Mr. Burke, do you participate in any of the modeling forums that are conducted in the State regarding CalSim and DSM-2?

WITNESS BURKE: Yes, I do.

MR. BERLINER: And which ones is that?

WITNESS BURKE: California Environmental Water Modeling Forum.

MR. BERLINER: Any -- Any others.

WITNESS BURKE: No. That's the only one I've participated in.

MR. BERLINER: That's the only one.

And how long have you been working with CalSim?

WITNESS BURKE: I worked with CalSim and DSM-2 for about two years now, maybe three years actually.

MR. BERLINER: Two to three years.

And are you familiar with DWR staff that routinely works on CalSim and DSM-2.

WITNESS BURKE: I've contacted some of the staff. I'm not familiar with all of the staff that are working on the project.

MR. BERLINER: But do you -- When you participate in the forum that you mentioned, does DWR participate in that forum?

WITNESS BURKE: Yes, they have.

MR. BERLINER: And have you worked with

Dr. Nader-Tehrani on modeling issues?

WITNESS BURKE: No, I haven't.

MR. BERLINER: Are you familiar with his testimony in this proceeding?

WITNESS BURKE: Yes, I am.

MR. BERLINER: And have you reviewed various DWR exhibits that have been submitted in this proceeding?

WITNESS BURKE: Yes, I have.

MR. BERLINER: And have they informed the testimony that you've given today?

WITNESS BURKE: Yes, they have.

MR. BERLINER: Thank you.

I'd like to refer you first to South Delta Exhibit 78, Page 8, please, .pdf Page 10.

MR. BAKER: Would you like South Delta 78 or 78 Errata?

MR. BERLINER: Errata. All references will be to the errata.

(Document displayed on screen.)

MR. BERLINER: You know, before we get to that, let's scroll through that slowly because I have a question about one of your -- one of your previous slides.

Could you go to the slide -- the map of the Delta that has the bracket on it.

(Scrolling through document.)

MR. BERLINER: Oh, it may not be in here. All right. We'll have to get to it in a minute, then. I apologize.

Let's go back to the graph.

(Document displayed on screen.)

MR. BERLINER: And can you flip that?

Or we'll all just turn our heads sideways.

It won't flip?

MR. BAKER: Hmm-um.

MR. BERLINER: No?

All right. We'll just have to use it as is. I'm assuming everybody's seen this.

MR. KEELING: If I may interrupt, it's in the PowerPoint.

MR. BERLINER: We can use that. Yeah, we might do that. That'll be easier.

(Document displayed on screen.)

MR. BERLINER: There we go. Great.

(Scrolling through document.)

MR. BERLINER: No, you got it.

MR. BAKER: You got it.

MR. BERLINER: Just go back.

(Document displayed on screen.)

CO-HEARING OFFICER DODUC: Uh-oh.

MR. BERLINER: I think it was just taking its time.

CO-HEARING OFFICER DODUC: It's also the PowerPoint, Page 23.

(Document displayed on screen.)

MR. BERLINER: No, it's the earlier one. Let's scroll up.

WITNESS BURKE: Slide 23 in the PowerPoint presentation.

(Staff confer.)

MS. McCUE: Was it 78 Errata, just an earlier graph? Is that what you're saying?

Is that right?

MR. BERLINER: Whatever works out well for you.

CO-HEARING OFFICER DODUC: Mr. Berliner, what do we need to put up on the screen?

MR. BERLINER: Pardon me?

CO-HEARING OFFICER DODUC: What do we need to put up on the screen?

MR. BERLINER: The Figure 2-2, whether from the report or in the PowerPoint, either one.

MR. BAKER: What is the identification for the PowerPoint?

WITNESS BURKE: Slide 23 of the PowerPoint.

CO-HEARING OFFICER DODUC: 77 --

WITNESS BURKE: 77 Errata.

CO-HEARING OFFICER DODUC: -- Errata. It is a slightly different graph, though.

WITNESS BURKE: That's correct.

MR. BERLINER: Okay. So we'll use this for purposes of this discussion.

CO-HEARING OFFICER DODUC: No.

MR. BERLINER: We'll focus on --

CO-HEARING OFFICER DODUC: 23.

(Document displayed on screen.)

MR. BERLINER: There we go.

So, this is --

(Exhibit displayed on screen.)

(Laughter.)

(Exhibit displayed on screen.)

MR. BERLINER: There we go.

Okay. So we'll ignore the red line for now and we'll come back -- We're going to come back to this slide, anyway. So, Mr. Baker, if you could keep this handy, we'll come back to it again.

All right. Regarding the blue line only, let's ignore the red line.

You stated that the blue line indicates that salinity exceeds D-1641 for a significant period of time.

Is this figure on Page 23 of Exhibit 77 Errata

as well as Figure 2-point -- 2-2 in your testimony the basis for that statement?

WITNESS BURKE: Yes, it is.

MR. BERLINER: And are you aware that, during this time frame of 1975 to 1991, D-1641 had not yet been adopted?

WITNESS BURKE: When I made that declaration, it wasn't assuming whether D-1641 was in place at the time. It was, rather, what the salinities were being viewed at the location of that site.

MR. BERLINER: Well, weren't you comparing the salinities against D-1641? That's what the title of your figure says.

WITNESS BURKE: That's correct. I was comparing these salinities that were measured during that period against the criteria from D-1641 --

MR. BERLINER: Okay. So you were --

WITNESS BURKE: -- but --

MR. BERLINER: Sorry. Didn't mean to interrupt you.

So you were comparing exist -- actual salinities during this 15-year period at a time when the regulation was not in place; correct?

WITNESS BURKE: That's correct.

MR. BERLINER: So the Department would not have

been making any effort to comply with 1641 at that time; right? There was no regulation.

WITNESS BURKE: I have to think about that for a second. I want to make sure that my thought process is -- is correct on that.

The primary objective of this particular plot was to show the difference between the measured values for salinity at this site and the modeled values for salinity from the DSM-2 model.

And the DSM-2 model is being compared to the ability to meet D-1641, and I'm trying to show in this particular plot that it can't necessarily be compared to what would have to be observed in the field because it's not able to accurately model the salinities observed at this location.

MR. BERLINER: Well, but if we wanted to look at -- And we might as well jump to it now.

If we wanted to look at modeling and compliance with 1641, isn't that what the red line essentially does?

WITNESS BURKE: The red line is the modeled salinity data from the No-Action Alternative for this location.

MR. BERLINER: Which has 1641 in it; right?

WITNESS BURKE: That's correct.

MR. BERLINER: So aren't we really comparing

apples and oranges here? Aren't we really comparing a non -- a no requirement-for-compliance against a compliance data that wasn't in existence at the time on the blue line?

WITNESS BURKE: I don't know if I can answer that directly. I don't -- Because what we're trying to compare here is the ability for the model to match the measured data at this location. Whether 1641 was in effect at this time or not, it's just the ability to be able to match what the model -- what was measured given the model's ability to predict this location.

MR. BERLINER: You know, I notice you used the word "predict." You're aware that we don't use the model in a predictive manner; correct?

WITNESS BURKE: Sometimes you say it's not but often you -- and sometimes you actually do use it in a predictive fashion.

So it should be used as just a comparative fashion to compare one scenario against another. But when you start try to actually predict whether or not you're going to match D-1641, you've now transitioned into a predictive mode.

MR. BERLINER: Well, if -- if I go with your -- your suggestion here, then I would be looking at the red line, wouldn't I?

WITNESS BURKE: I'm not --
MR. BERLINER: I mean --
WITNESS BURKE: -- sure --
MR. BERLINER: -- that has 1641 in it.
WITNESS BURKE: -- exactly what your question is.
Pardon?
MR. BERLINER: Wouldn't I be looking at the red line, then, instead of the blue line because that has 1641 in it? If I want to see how the Department is complying, doesn't the red line tell me a lot more than the blue line?
WITNESS BURKE: The red line would tell you what the model prediction at that location during those period -- that time period would be.
MR. BERLINER: So your answer is yes.
WITNESS BURKE: Repeat the question, please.
MR. BERLINER: Okay. If -- If -- If I was to go with your suggestion that we could use it in a predictive fashion -- and I'm only doing that for your -- in your response because you used the word "predictive" -- isn't the red line the predictive line?
WITNESS BURKE: I'm not saying that it should be used in a predictive fashion. I'm just saying that it has been used in a predictive fashion in the documents

developed for the WaterFix Project.

MR. BERLINER: All right. Let's go to -- Try it again, Mr. Baker, because my references are to your Exhibit 78.

I'm going at the Figure 3-1 which is the plot of the 16 years versus the 82 years. I know you had that in your PowerPoint.

So, Mr. Baker, whichever is easier for you.

MR. BAKER: Do you have a page number?

If you have the video page number.

MR. BERLINER: .pdf Page 13 in the exhibit. And if you can't flip it, I believe it's in the PowerPoint as well.

MR. BAKER: This is it, but we can flip it now.

(Document displayed on screen.)

MR. BERLINER: Now, I don't want to misstate what you said when you were introducing this chart, but -- and please correct me if I don't characterize -- I'm not going to try to complete what you said.

But I believe that your statement was something to the effect that it would be appropriate to use the 16-year comparison against the 82-year comparison if you had done an analysis to demonstrate that they were compatible or appropriate to use those different sequences of years.

Is that roughly what you said? Or maybe you could --

WITNESS BURKE: Maybe I could restate it.

It would be appropriate to use the 16-year period of time to make extrapolations or exceedance -- exceedance analyses on the data if the 16-year period was hydrologically similar to the 82-year period that -- that we have data for.

And these two plots would determine whether or not that similarity was sufficient for the 16-year period to be used in that fashion.

MR. BERLINER: Thank you. I appreciate that.

So let's -- Let's start with some -- some somewhat simple observations.

I assume that, as you are aware, that there's somewhat of a difference in values between the 16-year and the 82-year. DWR's well aware of those differences.

Is that -- Is that reasonable to assume?

WITNESS BURKE: What values are you referring to?

MR. BERLINER: The -- The difference in the -- the exceedances that you're showing in terms of millions of acre-feet of available or required water supply. As you're showing here on the chart, you have a probability of occurrence of various volumes of water.

WITNESS BURKE: It's showing the probability of occurrence from the two different probability analyses, each of those probability analyses based on a different period of record.

MR. BERLINER: Yes.

Isn't it reasonable to assume DWR is as aware of this as are you?

WITNESS BURKE: I would hope so.

MR. RUIZ: I was going to object that it calls for speculation as to what's reasonable for him to assume what the DWR knows.

CO-HEARING OFFICER DODUC: I'm not sure what the point of that question was, Mr. Berliner.

MR. BERLINER: The point of the question is that if, in fact, there's a difference between the number values that he gets from using a 16-year period versus a -- an 82-year period, DWR's aware of those differences.

CO-HEARING OFFICER DODUC: Okay. So let's move on.

MR. RUIZ: Is that a question or --

MR. BERLINER: It's just a statement. I was just responding to the Hearing Officer's question.

CO-HEARING OFFICER DODUC: He's going to move on.

MR. BERLINER: And isn't it also true that, as

a Modeler, you have to have some expertise in running these models and understanding the inputs and outputs; correct?

WITNESS BURKE: That's correct.

MR. BERLINER: And DWR has that expertise; correct?

MR. RUIZ: Again, I'm going to object that it calls for speculation as to what he believes that DWR has in terms of expertise.

CO-HEARING OFFICER DODUC: He may offer his opinion, Mr. Ruiz. And if he does not know, he may say so.

WITNESS BURKE: Yeah, I'm not familiar with all the staff that DWR has, so I couldn't -- I'd have to assume that they do.

MR. BERLINER: Okay. That's fine.

Now, looking at the 82-year curve, doesn't the 82-year curve fall within the range of the 16-year curve?

WITNESS BURKE: I'm not sure what you mean by "fall within the range."

MR. BERLINER: So, if you look at the maximum and minimums for the 16-year curve, don't the flows fall within the flows for the 82 years?

In other words, if you go down to the zero to 10 percent, you can see that the 16-year curve is to the

right of the 82-year curve. In other words, those values have been captured there.

And the same -- same thing on the high-end, where the top of the 16-year curve is within the -- the probability of occurrence of the 82-year curve?

WITNESS BURKE: I think you're getting to an important point as to why the -- the error was made in using the 16-year period as the period of record for the DSM-2 model.

If you do a cursory analysis of the -- of the data available, you'll find that the mean of the 16-year period and the mean of the 82-year period are almost identical. If you look at the max and the min, you find that those are almost identical as well.

So if you didn't look deeply into the data, you might think these are hydrologically similar because the mean, the max and the min are nearly identical; therefore they must have been the same period, but it isn't until you look at a probabilistic analysis of the two datasets that you see that they are not actually similar.

MR. BERLINER: So did you have a chance to take a look at DWR Exhibit 511?

WITNESS BURKE: I believe I have, yes.

MR. BERLINER: And you're aware that that's a memo that was prepared by Dr. Nader-Tehrani explaining

the differences between the 16 versus 82 years and explaining why it would be appropriate to use the 16-year comparison against the 82-year comparison?

WITNESS BURKE: I don't recall exact details of that letter, but I remember reading through that.

But I also remember in that letter, he says that the 16-year period should not be used for any predictive fashion, only as a comparative fashion.

MR. BERLINER: Correct. And that -- And that has been our theme throughout these -- these proceedings.

Do you know that the WaterFix hydrologic analysis was performed using the 82-year modeling results?

WITNESS BURKE: Which hydrologic analysis are you referring to?

MR. BERLINER: Now you're asking me a good question.

(Laughter.)

MR. BERLINER: Let me get back to you on that, and I'll be very specific.

(Laughter.)

CO-HEARING OFFICER DODUC: That was well done, Mr. Burke.

MR. BERLINER: Well, it's a fair -- it's a fair question.

Are you aware that the 16-year period was only used for hydrodynamic and water quality modeling for the Delta?

WITNESS BURKE: I've seen the results of the 16-year period used for those two items, yes.

MR. BERLINER: That's a "yes"?

WITNESS BURKE: Could you repeat the question? I want to make sure I'm completely answering it.

MR. BERLINER: Sure.

Are you aware that the -- that it was only the hydrodynamic and water quality modeling in the Delta that was performed using the 16-year period?

WITNESS BURKE: Yes. The 16-year period was used for the hydrodynamic and water quality modeling.

MR. BERLINER: All right. And for hydrodynamic modeling in the Delta, will you agree that it's sufficient to consider representative years such as the Delta inflow/export boundary conditions in the selected years that encompass a full range of inflow/export conditions in the 82 years?

WITNESS BURKE: I'm going to ask you to repeat --

MR. BERLINER: Sure.

WITNESS BURKE: -- that question.

MR. BERLINER: It's a long -- It had been a

long introduction, so let me -- let me try that again.

For hydrodynamic modeling in the Delta, would you agree that it's sufficient to consider representative years such that the Delta inflow/export boundary --

You're familiar with that; correct?

WITNESS BURKE: That's correct.

MR. BERLINER: -- such that the Delta inflow/export boundary conditions in the selected years encompass the full range of inflow/export conditions in the 82 years?

WITNESS BURKE: I would have to have a problem with the use of the word "sufficient" but I'm not even sure that I fully understand the question.

Maybe one more time if --

MR. BERLINER: Okay. Let me try it once more. I'm going to try to use the exact words that I used.

WITNESS BURKE: Okay.

MR. BERLINER: For the hydrodynamic modeling in the Delta, would you agree that it is sufficient to consider representative years and -- and we should -- I'll try to define "sufficient" for purpose of this question as being an in -- equivalent to an industry standard in modeling of a degree of accuracy.

Would you agree that it is sufficient to consider representative years that the Delta

inflow/export boundary conditions in the selected years encompass the full range of inflow/export conditions in the 82 years? In other words, wet years versus above normal years versus below normal years, et cetera.

WITNESS BURKE: If you put together a hydrodynamic analysis that incorporates different Water Year types in your analysis, that would help you be able to capture the range of response that the model will have for those particular Water Year types, but it's not necessarily sufficient to be able to define how the model -- or how scenarios will respond to those Water Year types just by incorporating a wet, a normal water or dry year within that analysis. It all depends on what you want to say about the results of that model and what you're trying to determine.

MR. BERLINER: I appreciate what you -- you just answered.

If you reflect back on the memo that Dr. Nader-Tehrani had prepared, Exhibit 511, with -- which you're familiar with, one of the points he made in there was, they went to an effort to find a time period that captured all of the different year types in different amounts, so many wet years, dry years, it varied during that time, but they got a -- a variety of wet and dry years through that time period.

Do you agree that that approach to finding a surrogate for the 82 years is -- and I'm not asking specifically for the approach but just that approach in general -- of finding a time period that mimics the kinds of years that you would find in the 82-year period is an appropriate approach?

WITNESS BURKE: I would have to agree that the approach is correct, but whether or not you capture a sufficient number of wet, normal and dry years, that is questionable.

MR. BERLINER: Understand that. But the -- But you're agreeing the approach itself is a reasonable approach.

WITNESS BURKE: I agree the approach is correct --

MR. BERLINER: And --

WITNESS BURKE: -- yes.

MR. BERLINER: And you may have a professional difference with DWR's Modelers as to whether that particular time period is appropriate; correct?

WITNESS BURKE: It's more than a professional difference. I actually evaluated the error incorporated in the limited timeframe used for the DSM-2 model and compared it to the longer 82-year period.

So it goes beyond just professional opinion of

whether that should be used. Now you have to determine whether or not the errors resulting from that choice are sufficient and adequate for the purposes of that model.

MR. BERLINER: And yet, based on Dr. Nader-Tehrani's memo where he justifies it, his conclusion is different than yours; correct?

WITNESS BURKE: That's correct.

MR. BERLINER: Okay. So, then, isn't that a professional difference of opinion?

WITNESS BURKE: No, because he also says in that memo that he's not going to use the results of that model for any kind of predictive values but, yet, then he goes and uses them for predicting exceedance analyses of state and salinity.

MR. BERLINER: I'm sorry. I missed the end of your -- He used them to predict . . .

WITNESS BURKE: The results of the 16-year period of modeling for the DSM-2 model was used in the salinity analysis. In that salinity analysis, exceedance curves were developed for different locations in the Delta. Those exceedance curves are predictive curves based on using the model in a predictive fashion.

So they would be incorrect because of the short period of record used and the analysis does not match the true hydrologic characteristics that have been used in

the 82-year period of record.

MR. BERLINER: I think we're going to have to agree to disagree on this one.

All right. Let's try this again, Mr. Baker. Let's go to Page -- .pdf Page 21 of the exhibit.

(Document displayed on screen.)

MR. BERLINER: As Mr. Baker's flipping that, just to kind of keep the ball going:

On -- On this chart, you're showing the daily differences between . . . a WaterFix scenario and the No-Action Alternative; correct?

WITNESS BURKE: That's correct.

MR. BERLINER: In reaching -- In -- You prepared this chart; right?

WITNESS BURKE: Yes, I did.

MR. BERLINER: And you based this on information that was provided by DWR; correct?

WITNESS BURKE: This is based on the DWR models for the scenario -- WaterFix scenarios.

MR. BERLINER: And you used the data -- You changed it to averaging over a month; correct?

WITNESS BURKE: No. This is direct model data from the DSM-2 model.

MR. BERLINER: Okay. You just prepared the graph.

WITNESS BURKE: That's correct.

MR. BERLINER: Okay. And this graph was not in the DWR exhibit; correct?

WITNESS BURKE: No, it wasn't.

MR. BERLINER: Okay. And this graph show -- If I understand this correctly, you are showing these values averaging them over a month; is that right?

WITNESS BURKE: No, this is not averaged over a month.

MR. BERLINER: So is this actual?

WITNESS BURKE: It is the actual data from the DSM-2 model.

MR. BERLINER: Okay. So . . . when you look at the . . . at the peaks that you have on -- on these charts, do you have an opinion as to what caused those peaks?

WITNESS BURKE: No. We didn't actually decompose the model to determine what -- which of the components were contributing or how much each component would be contributing to the increase in salinity.

MR. BERLINER: So you're aware that the CalSim II model determines the amount of flow that goes into the DSM-2; right?

WITNESS BURKE: I understand that the output from CalSim II is used as the inflow to the DSM-2 model.

MR. BERLINER: Okay. And then you're aware that CalSim II modeling figures out what's necessary to meet the standards for a month; correct?

WITNESS BURKE: The CalSim II has a built-in Artificial Neural Network which tries to determine or predict what the resulting salinity may be for a select -- set of discharges that supplies to the Delta.

But this is just an approximate relationship that was developed from previous model runs that was then built into CalSim II. CalSim II cannot directly calculate what the salinity would be to meet D-1641 or any other objective. It makes a estimate, its best-guess estimate.

Then you have to take the inflows from the CalSim II model, put them into DSM-2 and run the model to see if -- how close that guess was to the actual salinities in meeting D-1641.

MR. BERLINER: And CalSim is on a -- on a monthly time-step; correct?

WITNESS BURKE: That's correct.

MR. BERLINER: Okay. Are you aware that, at least as far as DWR's concerned, that it's inappropriate to look at the daily differences in DSM-2 when it's run using CalSim II outputs?

WITNESS BURKE: I would say that it's probably

not the most accurate way of looking at the data on a daily basis, but it is the data that we -- the best data we have given the best model available for this type of analysis in the Delta.

MR. BERLINER: Are you aware that DWR looks at dailies only for flow but not for water quality?

WITNESS BURKE: The water quality is directly related to the flow component, so I can't say how you could say one is good while the other is bad.

MR. BERLINER: All right. Looking again at the -- at the spikes, are you aware that those spikes correspond to the Head of Old River Gate operation?

WITNESS BURKE: That's possible.

MR. BERLINER: And are you aware that -- that Boundary 2 has increased the Head of Old River Gate operations compared to the No-Action Alternative?

WITNESS BURKE: Yes, I am.

MR. BERLINER: And you're aware that Boundary 2 is not the Department's proposal; correct?

WITNESS BURKE: Boundary 2 was part of the Petitioners' Petition for Water Rights Change, so it encompasses a range of operations that could exist, so it must be evaluated until that particular scenario is removed from potential operations.

MR. BERLINER: Okay. That wasn't actually

my -- my question.

My question was, are you aware that Boundary 2 is not the Department's proposal for the terms of the Permit?

WITNESS BURKE: It's not the preferred alternative, but it is a potential operating range.

MR. BERLINER: Yes, we agree it's a potential operating range.

But you understand it's not what DWR is proposing to be the -- the Project Alternative; correct?

WITNESS BURKE: I don't believe the Project Alternative has actually been defined or definitively established yet.

MR. BERLINER: No. That's why we're here.

(Laughter.)

MR. BERLINER: If we could go to the next page, please.

(Document displayed on screen.)

MR. BERLINER: So, this shows the annual salinity changes for the WaterFix scenarios as compared to the No-Action Alternative; correct?

WITNESS BURKE: That's correct.

MR. BERLINER: And you understand that D-1641 standards are not the same year-round; correct?

WITNESS BURKE: That's correct.

MR. BERLINER: So, in terms of meeting water quality requirements, or DWR's operations, looking at it on an annual basis doesn't really inform us about meeting 1641; does it?

WITNESS BURKE: It wasn't -- It's correct. It wasn't developed to evaluate the ability of D-1641. It was developed to evaluate the change in salinity that might exist from one scenario to the No-Auction -- No-Action Alternative.

MR. BERLINER: Okay. And -- And the gray bars are the Boundary 2 bars; right?

WITNESS BURKE: It looks like it from here, yes, I agree.

MR. BERLINER: All right. Mr. Baker, if we could go to the next page, please.

(Document displayed on screen.)

MR. BERLINER: This is Page 21, .pdf Page 23, Figure 4-6b for the record.

Now, just to confirm, this chart doesn't say anything about what the No-Action Alternative salinity would be; does it?

WITNESS BURKE: It doesn't state what the Action -- No-Action Alternatey -- No-Action Alternative salinity would be. It just shows the percent of time that each of the WaterFix scenarios would be greater than

the salinity of the No-Action Alternative.

So you could theoretically look at the No-Action Alternative as being the zero line on the Y-Axis.

MR. BERLINER: Okay. And -- And all it does is tell us a percentage of time; correct?

WITNESS BURKE: That's correct.

MR. BERLINER: It doesn't tell us actual values; right? It's just percentage of time.

WITNESS BURKE: That's correct. It doesn't --

MR. BERLINER: So --

WITNESS BURKE: -- show actual boundaries.

MR. BERLINER: So, if it was a .1 or 1 percent or 2 percent difference, it would be reflected in these values; correct?

WITNESS BURKE: That's correct, it would be.

MR. BERLINER: Okay. Mr. Baker, if we could go to .pdf Page 24, please.

(Document displayed on screen.)

MR. BERLINER: And just to confirm that this Table 4-2, that's the same table that reflects the prior figure; correct? It's just capturing that in table format?

WITNESS BURKE: That's correct.

MR. BERLINER: And in your testimony on

Page 26, .pdf Page 28, do you indicate that in the South Delta (reading):

"The model sometimes overpredicts the salinity and sometimes underpredicts the salinity."

Correct?

(Document displayed on screen.)

WITNESS BURKE: That's correct.

MR. BERLINER: And do you know why?

WITNESS BURKE: Because the model can't accurately predict salinity in the South Delta very well.

MR. BERLINER: And do you know why it can't?

WITNESS BURKE: No. That's something that everybody's been kind of working at for awhile now, to determine what it is that's creating that discontinuity between the ability in the model for the model to predict in the data.

MR. BERLINER: Might you suspect it would be lack of data?

WITNESS BURKE: I wouldn't necessarily venture to say that, because there's a lot of data that's being collected in the South Delta.

MR. BERLINER: Well, are you aware that DWR has asked the -- the farmers down there for their salinity data and they haven't gotten them?

WITNESS BURKE: I'm not aware of those

conversations.

MR. BERLINER: Okay. If we could go to Page 27, .pdf Page 29, please.

(Document displayed on screen.)

MR. BERLINER: The same chart that we saw earlier.

Looking at the blue line again, you're aware that this does not include climate change or sea-level rise; correct?

WITNESS BURKE: That's true. The blue line does not encompass climate change or sea-level rise.

MR. BERLINER: And you're aware that the No-Action Alternative includes climate change and sea-level rise?

WITNESS BURKE: That's correct, it does.

MR. BERLINER: So when you're comparing these measured salinities against the No-Action Alternative, the circumstances are dramatically different; aren't they?

WITNESS BURKE: They are -- They are different because the No-Action Alternative incorporates the climate change and sea-level rise. But the results of climate change and sea-level rise I would expect to end up increasing the salinity at this location.

So even with those components of sea-level rise

and climate change built into the No-Action Alternative, it's still not able to match the measured data at this location.

MR. BERLINER: But it will also include D-1641 or its successor as well as Biological Opinions and any other regulatory requirements; correct?

WITNESS BURKE: What is the -- What is the "it" you're referring to?

MR. BERLINER: The red line, the No-Action Alternative.

WITNESS BURKE: The No-Action Alternative reflects -- it does not reflect any changes to D-1641 or the gate operations.

MR. BERLINER: No, but it includes them; correct?

WITNESS BURKE: No, it doesn't.

MR. BERLINER: It does not include 1641?

WITNESS BURKE: No, it does include 1641 but it does not include climate change or -- I'm sorry. I'm getting confused.

MR. BERLINER: Yeah. Let's take it one at a -- Let's take it one at a time so we get the record clear.

WITNESS BURKE: Sure.

MR. BERLINER: So 16 -- So the No-Action Alternative includes climate change and sea-level rise;

right?

WITNESS BURKE: That's correct, it does.

MR. BERLINER: And includes current regulatory requirements, State and Federal regulatory requirements; correct?

WITNESS BURKE: It includes current State and Federal regulatory requirements.

MR. BERLINER: And the blue line doesn't include any of those; correct?

WITNESS BURKE: The blue line includes those State and Federal regulatory requirements that were in place during the 16-year period, from '76 to '91.

MR. BERLINER: And -- And are -- Are you familiar with the regulatory requirements that existed at that time?

WITNESS BURKE: No, I'm not.

MR. BERLINER: All right. Let's -- Let's move on to a different subject.

Regarding water levels, you testified about water levels. You're aware, are you not, that the North Delta Diversion will -- will have to be in excess of the proposed Sacramento River bypass -- minimum bypass flows because of regulatory requirements; correct?

WITNESS BURKE: That's correct.

MR. BERLINER: I'll compliment you, by the way.

I thought you laid it out very well in your testimony. We've had some earlier controversy about what applies and what didn't, and I thought, well, everybody should have read your paragraph on regulatory requirements because it made it quite clear that there were those obligations.

WITNESS BURKE: Thank you.

MR. BERLINER: Referring to .pdf Page 31, please.

(Document displayed on screen.)

MR. BERLINER: I believe that this displays your analysis of the annual changes in water level comparing Boundary 1 to the No-Action Alternative; correct?

WITNESS BURKE BURKE: It's not the annual changes but the DSM-2 output 15-minute time-step between B1 and the No-Action Alternative.

MR. BERLINER: Over the -- Over the 16-year period.

WITNESS BURKE: That's correct.

MR. BERLINER: Now, are the -- You're testifying today on behalf of -- of interests in the South Delta and Central Delta; correct?

WITNESS BURKE: The Delta Agencies, that's correct.

MR. BERLINER: And -- And, to your knowledge,

are they concerned that the WaterFix would cause water levels in their area where they irrigate to be so low that their irrigation diversions would not be fully functionable -- functional?

WITNESS BURKE: Yes, that is a concern that they have.

MR. BERLINER: Do you know what the different -- the distance is between the proposed North Delta Points of Diversion and the Delta Agencies' Points of Diversion, just generally?

WITNESS BURKE: Well, I might say -- I would have to just guess, but 35 miles, 40 miles. I may be off by a hundred percent. I don't know.

MR. BERLINER: And you looked at what -- And you looked at changes in water levels from three to 9 miles downstream from the proposed diversion points; right?

WITNESS BURKE: That's correct.

MR. BERLINER: Do you have any evidence that the -- that -- that you submitted that would indicate that there's going to be adverse impacts to water levels in the area of the Delta Agencies?

MR. HERRICK: If I may, I don't want to interrupt the questioning a little bit.

I think you might want to ask him if the

analysis of the -- that he's done for the locations during the North Delta intake apply to any argument or concern about the South Delta diversions. We're not presenting this data to extrapolate that impact in South Delta water levels.

CO-HEARING OFFICER DODUC: You're helping him with his cross-examination, Mr. Herrick?

MR. HERRICK: I don't want to get --

MR. BERLINER: I might use it for one of my future questions.

CO-HEARING OFFICER DODUC: All right. Let's settle down.

Mr. Berliner, what is your question again to Mr. Burke?

MR. BERLINER: Have you presented any evidence that water levels in the area where the Delta Agencies divert would be adversely impacted by the diversions of the North Delta Points of Diversion?

WITNESS BURKE: First, I should make clear that the impact analysis that we did downstream of the North Delta Diversions were solely a function of the North Delta Diversions. They were the result of the full whole scenario.

So when we analyze Scenario B1 or H2 or H3, it incorporates the diversions that were occurring from the

three North Delta diversions as well as gate operations, revised input flow from CalSim II with the Delta.

So, what we wanted to do was to evaluate those three locations because that's what the Petitioners put forward to see whether or not that makes sense.

But we did evaluate change in elevation in other locations but that was not presented. So, there are changes in the South Delta that occur from these scenarios, but they are not a function of the diversion that North Delta -- for the North Delta Diversions. They are a function other changes in Head of Old River Gate structure or other operations that are being input to the model by CalSim II for the specific scenario that we're evaluating.

MR. BERLINER: And where did you provide that analysis?

WITNESS BURKE: Actually, that wasn't provided.

MR. BERLINER: So that evidence is not before us.

WITNESS BURKE: That evidence isn't before us.

MR. BERLINER: So, referring to . . . the -- this -- this graph -- No, I'm sorry.

Let's go to Page 28 of the testimony, back one page.

(Document displayed on screen.)

MR. BERLINER: In that bottom paragraph, you have a sentence that says (reading):

"As can be seen in the plot, there is a 10 percent probability in any year that the water surface elevation will be one foot or more below the water level in the No-Action Alternative."

Do you see that sentence?

WITNESS BURKE: Yes, I do.

MR. BERLINER: And the plot that you're referring to is --

We have to scroll up for that.

(Document displayed on screen.)

MR. BERLINER: -- Table 4-5. Is that what you're referring to by that?

WITNESS BURKE: I think I'm referring to a figure in that statement.

MR. BERLINER: Earlier.

WITNESS BURKE: I think if you scroll down, let's take a look at that sentence again.

MR. BERLINER: Yeah.

(Document displayed on screen.)

WITNESS BURKE: So, as can be seen in the plot, there's a 10 percent probability. So I'm referring to the probability plot.

CO-HEARING OFFICER DODUC: Figure 4-11.

MR. BERLINER: Figure 4-11, which I believe is up.

(Scrolling up document.)

MR. BERLINER: No, sorry, it's down.

(Scrolling down document.)

MR. BERLINER: One more.

(Document displayed on screen.)

MR. BERLINER: Now, does this plot say anything about whether the 10 percent occurs during high-flow or low-flow periods.

WITNESS BURKE: No. This would just be the percentage of time over the 16-year period.

MR. BERLINER: But it would make a tremendous difference to an irrigator if it was during a high-flow or low-flow period; couldn't it?

WITNESS BURKE: It could.

MR. BERLINER: You're familiar with -- with irrigation practices?

WITNESS BURKE: I have a vague sense. I'm not an expert in irrigation practices, but I do understand the concept of diverting water.

MR. BERLINER: And, generally speaking, a farmer would want to put the -- the intake end of the diversion as low as possible in order to be able to divert during maximum changes in -- in stage; is that

correct?

WITNESS BURKE: That's correct.

MR. BERLINER: You also stated in your testimony that the analysis differs from the stage analysis provided by DWR in its Exhibit 5 because, in the data in that exhibit, it was averaged over -- they average a stage over a day which filters out the changes in the highs and lows; correct?

WITNESS BURKE: That's correct.

MR. BERLINER: Do you recall DWR Exhibit 66?

WITNESS BURKE: Yes, I do.

MR. BERLINER: And are you aware that, in DWR-66, it states that DWR used daily minimum water levels and showed it -- and showed as a probability of -- showed -- Sorry. Try that again.

Are you aware that DWR used daily minimum water levels and showed it as a probability exceedance graph?

WITNESS BURKE: That's correct.

MR. BERLINER: And there -- And they didn't do any averaging; correct?

WITNESS BURKE: If they used the daily minimum, their values should actually exceed ours because we're taking in all of the values, high and low, in our analysis. If they filtered out and just used the lowest values, then their data should have exceeded what we show

in ours, and since it didn't, I don't think that's what they actually did.

MR. BERLINER: You just disagree that's what they did.

WITNESS BURKE: It doesn't match the data from their own modeling, no.

MR. BERLINER: And, as a matter of practicality, isn't the period of time that we're concerned about the irrigation season? In other words, if we're outside the irrigation season, this stage of discussion is really academic.

WITNESS BURKE: I want to understand: There is a -- an intensive irrigation season but, yet, through the Delta, people irrigate all year long.

But there's more irrigating going on between, say, April and September but, yet, people will still be growing crops through the winter as well, just not as intensively as they do during the summer period.

And in reference to the question you asked previously, I'm not sure if I throwed this in.

But you're wanting to know whether or not, when I looked at the 10 percent exceedance of when the values would be greater than one foot, you could actually go back to the plot that we showed with the individual data point from the DSM-2 model to determine when those low

points were occurring. That would give you the time of year that you could see those drops.

MR. BERLINER: Yes, I understood.

Maybe we could go back to .pdf Page 31.

(Document displayed on screen.)

MR. BERLINER: And here we're looking roughly at the October timeframe; correct?

WITNESS BURKE: It looks like from September to October.

MR. BERLINER: And this includes both high- and low-flow periods on the Sacramento River; correct?

WITNESS BURKE: The 16-year periods covers both high -- wet and dry years.

MR. BERLINER: And would you agree that, really, during the wet and above-normal year types, stage is really not an issue. River flows are substantial.

WITNESS BURKE: I would have to see the exact scenario, but under high flow conditions, it's less likely to be substantial or significant, but you'd have to look at the exact conditions for any particular year to see if that's true.

MR. BERLINER: Now, are you aware that -- This is comparing Scenario B1 and the No-Action Alternative.

Are you aware that the No-Action Alternative includes a Fall X2 requirement?

WITNESS BURKE: That's correct.

MR. BERLINER: And that would occur in the September-to-November timeframe?

WITNESS BURKE: I'm not sure exactly when the Fall X2 requirement is implemented.

MR. BERLINER: And are you aware that it would occur in both normal and wet years only?

WITNESS BURKE: I'm not familiar with the criteria.

MR. BERLINER: Do you have any knowledge of any Sacramento River agricultural diversion that was unable to operate due to low water levels in September or October of any wet or above-normal year historically.

WITNESS BURKE: I haven't been involved with any of the agriculture users along there in any form or fashion, so I wouldn't know whether they had problems or not.

MR. BERLINER: You're familiar with annual hydrologies; are you not? Wet years, dry years?

WITNESS BURKE: Yes, I am.

MR. MIZELL: And are you aware that, for the years that you're showing these highest reductions, which would be roughly September, October '82, '84 and '86, that those were all wet years?

WITNESS BURKE: I'd have to go back and review

the data. I don't have that committed to memory, so I couldn't say.

And whether the wet years continued all the way to the September period is questionable as well.

MR. BERLINER: Did you do any other water level analysis besides B1?

WITNESS BURKE: I believe we just looked at B1.

MR. BERLINER: Just B1.

Do you know how often the Fall X2 outflow action's been implemented since the 2008 Biological Opinion?

WITNESS BURKE: No, I'm not familiar with that data.

MR. BERLINER: And is it correct that your analysis -- your analysis doesn't consider water levels that would exist if the State and Federal Projects were not making releases to meet regulatory requirements?

WITNESS BURKE: We only evaluated the scenarios that the State put forward as part of the WaterFix Project.

MR. BERLINER: You didn't take a look at a with-or-without Project scenario; did you?

WITNESS BURKE: We looked at the No-Action Alternative and that's what we considered the without Project.

MR. BERLINER: I should define, then. I'm using kind of a vernacular.

"With Project" means the existence of the State and Federal Projects in my question, and "without Project" means without the existence of those Projects.

Did you look at what water levels would have been under with-and-without Project -- under with-and-without Project conditions as I'm defining that?

WITNESS BURKE: No, we didn't evaluate the without Project condition.

MR. BERLINER: Let me switch to my last topic. If I can get it done in a minute and 56 seconds, I'm in business.

You offered some opinions on algal growth.

Do you have any expertise in biology?

WITNESS BURKE: No.

MR. BERLINER: Ecology?

WITNESS BURKE: I'm familiar with the hydrologic characteristics necessary for fisheries and aquatic resources to some extent, but primarily from the hydrologic perspective, not the biologic perspective.

MR. BERLINER: Have you done any peer-reviewed writing on microcystis?

WITNESS BURKE: No, I haven't.

MR. BERLINER: Have you read any studies,

peer-reviewed studies, on -- on factors contributing to the formation of microcystis?

MS. DES JARDINS: Yes, I have.

MR. BERLINER: And what papers are you familiar with?

WITNESS BURKE: This was a USGS report produced on Klamath Lake that I was working on, and I don't remember the same of that particular paper.

Then a second paper was produced by Jacob Kann and Eugene Welch looking at the production of growth of microcystis. These were involved with a Project where I was developing a model of the growth factors that are driving microcystis and algal growth on Klamath Lake.

MR. BERLINER: Have you reviewed any papers on the algal growth in the Delta?

WITNESS BURKE: No, I haven't.

MR. BERLINER: Are you aware that the factors associated with the development and distribution of microcystis in the Delta is not well understood?

WITNESS BURKE: That's true.

Actually, I have to take it back. I don't really know. I'm not a -- I'm not a biologist and I haven't studied the factors well enough in the Delta to know whether that's true or not.

MR. BERLINER: I was actually going to follow

up and ask you the basis for your agreement or disagreement with my question, so I appreciate you offering that.

Are you aware that water temperature is a factor in the development of microcystis?

WITNESS BURKE: Yes, I am.

MR. BERLINER: And are you aware the water temperatures in the South and Central Delta are mostly dictated by the ambient air temperatures?

WITNESS BURKE: Ambient air temperature and time. If they're not --

MR. BERLINER: And time.

WITNESS BURKE: And time.

The temperature from the air doesn't instantaneously penetrate into the water column. It takes some time and length of exposure in order to permeate down into the water column.

MR. BERLINER: Just to confirm:

You've not read any reports by Dr. Peggy Lehman; have you?

WITNESS BURKE: That name doesn't ring a bell, no.

MR. BERLINER: I have no further questions.

CO-HEARING OFFICER DODUC: All right. Good, because you ran out of time a while back.

How is the court reporter doing? Do you need a --

THE REPORTER: I'm fine.

CO-HEARING OFFICER DODUC: -- short five-minute -- You're okay?

THE REPORTER: No, I'm fine.

CO-HEARING OFFICER DODUC: Witnesses okay?

Okay. Mr. Mizell.

We do have a hard stop at 5 o'clock, so find a good place in your cross-exam nearby that time.

MR. MIZELL: Will do.

And I'll try to start in with Dr. Michael. I believe his questions will be a little bit shorter. Maybe I can get through them today if --

CO-HEARING OFFICER DODUC: Okay.

MR. MIZELL: -- I'm efficient.

CROSS-EXAMINATION BY

MR. MIZELL: Hello, Dr. Michael.

WITNESS MICHAEL: Hi.

MR. MIZELL: Just a couple of preliminary questions here.

Did you draft what's been marked as SDWA-134-R?

WITNESS MICHAEL: Is that my testimony? Yes, I did draft that.

MR. MIZELL: Okay. Did anyone assist you with

drafting that exhibit?

WITNESS MICHAEL: Can you repeat that? I didn't quite get it.

MR. MIZELL: Did anyone assist you drafting that?

WITNESS MICHAEL: Oh, no.

MR. MIZELL: Okay. So, just to confirm what I thought I heard earlier:

Is it correct that you relied upon testimony of Mr. Prichard that's contained in SDWA-92 to calculate your yield reductions, specifically his Figure 4?

WITNESS MICHAEL: Yes.

MR. MIZELL: When assessing changes in crop revenue, are there factors besides salinity that affect crop revenue?

WITNESS MICHAEL: Absolutely.

MR. MIZELL: Would these factors include things such as commodity prices, pests, weather and irrigation practices, like drainage and crop rotation?

WITNESS MICHAEL: Yes, but particularly prices. Most changes in crop revenue we see are a result of price changes.

MR. MIZELL: Very good.

So it is -- it is true that there's a connection, then, between crop yield and commodity prices

in the resulting crop revenue.

WITNESS MICHAEL: There's a connection between crop yield and commodity prices?

MR. MIZELL: And their resulting revenue.

WITNESS MICHAEL: There's a connection between commodity prices and resulting revenue. There's a connection between crop yield and resulting revenue.

I don't know that crop yield in the Delta would affect the price of corn in the United States if that's what you're suggesting.

MR. MIZELL: No. I said the inverse, but I think we're on the same page.

So, just to be clear: Crop yield and the price of the commodity combine to generate what is revenue.

WITNESS MICHAEL: Yes.

MR. MIZELL: Okay. So, just to reiterate what I believe you stated earlier.

Is it true that you relied on Dr. Leinfelder-Miles' study to apply a 5 percent leaching fraction to your analysis?

WITNESS MICHAEL: Yes. I requested what portion of the Delta, how it was characterized by leaching fractions.

I was informed that there actually isn't real good data across the Delta and the most recent data came

from the Leinfelder-Miles study, and I believe it was about half the data points in that were about 5 percent.

MR. MIZELL: Okay. But isn't it true that Leinfelder-Miles' study indicated a median 5.5 leaching fraction?

WITNESS MICHAEL: I don't recall.

MR. MIZELL: Okay. You split your economic analysis into three components; is that correct?

Three geographic components.

WITNESS MICHAEL: Three geographic components? I'm not quite sure what you're asking.

MR. MIZELL: It's my understanding that your economic analysis broke the Delta into three geographic regions based upon the Delta Protection Commission's Economic Sustainability Report.

Is that a correct understanding?

WITNESS MICHAEL: There are times when we looked at the Primary Zone of the Delta, at times the Secondary Zone, different counties.

If you'd be more specific, then I can answer "yes" or "no."

What three regions are you referring to?

(Counsel confer.)

MR. MIZELL: Give me one second. I'll find the table that I'm actually --

WITNESS MICHAEL: Okay.

MR. MIZELL: All right. I'm going to -- In the interest of time, I'm going to move on to a separate section. Maybe we can come back after we find the table we're -- we're thinking about.

So, going back to the leaching fraction testimony.

It is true leaching fractions vary across the Delta; correct?

WITNESS MICHAEL: That's my understanding, yes.

MR. MIZELL: And do you know if Leinfelder-Miles' study establishing the leaching fraction that you've used considered geographic locations outside of the Southern Delta?

WITNESS MICHAEL: I don't -- I don't know the answer to that.

And I'll just point out, too, in relying on it, that it was an illustrative analysis and, you know, I don't necessarily believe that that's -- that's the best-available data that I was given about leaching fractions.

MR. MIZELL: Okay. If we could pull up -- pull up Dr. Michael's testimony -- that's SDWA-134-R -- and look at Page 6.

(Document displayed on screen.)

MR. MIZELL: Maybe you can help educate me on -- on the various columns in this table because I think I'm confused as to what they stand for.

On this chart, you have a column marked .4, one marked .5 and one marked .6.

What do these breakouts -- What do these delineations represent?

WITNESS MICHAEL: That -- So, what the calculation did -- And, again, it assumed a uniform distribution of the crops across places that had the EC drainage. So basically, you know, a similar fraction of the crops would start at each of those levels of EC. That would be sort of the baseline level of EC.

MR. MIZELL: And the various levels of EC, would those be based upon a geographic distinction or some other distinction?

WITNESS MICHAEL: The assumption is a uniform distribution.

MR. MIZELL: Sorry for being dense. I'm an attorney.

(Laughter.)

CO-HEARING OFFICER MARCUS: Don't say that in front of her. She's an attorney.

CO-HEARING OFFICER DODUC: What was that you just said, Mr. Mizell?

WITNESS MICHAEL: I mean, if you're asking if the crop yields match the specific location, I think the answer is no. It's very, very conceptual in assuming that, you know, the corn and alfalfa that's grown in the Delta is distributed evenly over these baseline sets, so . . .

MR. MIZELL: Okay. So, if I -- if I'm finally getting it: The .4 is one-third of the geographic area but it's distributed evenly, .5 is one-third of the area but distributed evenly, and .6 is one-third distributed --

WITNESS MICHAEL: Yeah. It's actually 1/6th of the area just because I -- I reduced everything by 50 percent because of the leaching fraction issue, yeah.

MR. MIZELL: Okay. So each of these columns could represent anyplace in the Delta; correct?

WITNESS MICHAEL: I'm not -- I'm not sure if that's correct. There is variation across the Delta. It's not meant to correspond to a specific location.

MR. MIZELL: Okay. Well, I guess we'll have to have someone smarter than me examine this another time.

Thank you for humoring me on that one.

WITNESS MICHAEL: (Laughing.)

It's actually -- I mean, it is a very simplified analysis. It just illustrates conceptually,

if you have some changes of the level that they showed were plausible and you applied the -- the yield functions, that period produced this example of the kind of revenue changes that could occur.

It certainly is -- It's not meant to be predictive. It's illustrative, to use the words that I've heard in other testimony here.

MR. MIZELL: Okay. Thank you.

If we could move up to Page 2 of this exhibit.

(Document displayed on screen.)

MR. MIZELL: I guess it's Page 3.

(Document displayed on screen.)

MR. MIZELL: I'm look for Lines 13 and 14.

(Document displayed on screen.)

MR. MIZELL: This is 134-R.

CO-HEARING OFFICER DODUC: What page do we want, Mr. Mizell?

MR. MIZELL: Let's look at the next page. Maybe . . .

(Document displayed on screen.)

MR. MIZELL: Thank you.

All right. Looking at Line 15, you mention a small change in salinity there.

Do you see that?

WITNESS MICHAEL: Yes.

MR. MIZELL: And it's your estimate that a small change in salinity could result in 1.8 million in crop -- or in economic loss?

WITNESS MICHAEL: Actually, that was taken from the BDCP Statewide Economic Impact Report so I'm citing DWR's report.

MR. MIZELL: Okay. Do you have an opinion as to what "small change" means?

CO-HEARING OFFICER DODUC: 1.1 percent increase.

WITNESS MICHAEL: That's -- Yeah. Thank you.

CO-HEARING OFFICER DODUC: You're welcome. I can read.

MR. MIZELL: That might be one example.

How -- How large an increase or how small an increase would you consider to be a small change?

WITNESS MICHAEL: I don't -- I don't have an opinion of when the -- I would change my adjective there.

MR. MIZELL: Do you have any opinion as to how often the last 10 years salinity in the South Delta has experienced a small change?

WITNESS MICHAEL: These are, you know -- Based on some of the slides that Mr. Burke showed us, these are changes that occur from year to year.

MR. MIZELL: Okay.

WITNESS MICHAEL: Even more than this. A variation from year to year can be quite a bit larger than that.

MR. MIZELL: Okay. If we could bring up DWR-579 from the flash drive this morning.

(Document displayed on screen.)

MR. MIZELL: I'll give you a minute to read this chart, and we're passing out hard copies as well.

WITNESS MICHAEL: (Examining document.)

MR. MIZELL: So I'll just assert that this is a graph that represents data available on CDEC, and we can -- we can do the basis of that in our -- in our rebuttal.

Would you characterize the changes you see on this chart as small changes?

WITNESS MICHAEL: No, I don't think so.

MR. MIZELL: Would you characterize them as large changes?

MR. KEELING: I would just ask for clarification.

We -- We can see the graft -- graph has various lines that do different things, but when you ask a question about changes, it presupposes changes from something.

WITNESS MICHAEL: There's -- I mean, there's

significant changes from -- from month to month and year to year.

I mean, there's -- The model that you're referring to, where I used the adjective "small," it was a growing season average EC. That's not the graph that we're looking at here, but . . . you know.

MR. MIZELL: I guess where I'm driving is, you incorporated a statement in your testimony that said small changes are significant to economic progress, economic development.

And I'm -- I'm asking if the variability you see on this chart would --

WITNESS MICHAEL: I did not say that small changes -- What I said is, DWR studies showed, and their estimate showed, that -- that 1.1 percent change in average growing season salinity predicted a $1.8 million decrease in revenue.

MR. MIZELL: Okay. In your professional opinion, would changes similar to what you see on this graph result in an economic loss?

MR. KEELING: Again, I have to -- I have to object as to -- I'm not clear.

The graph shows various salinities, but when you ask a question about, do changes indicate an economic impact, changes from what to what?

So you might compare two lines or something, but these don't show changes. They show a -- actual data, I think.

CO-HEARING OFFICER DODUC: Dr. Michael, are you able to answer? If you're not, just please say "no" so we can move on.

WITNESS MICHAEL: Yeah. This -- This data isn't very closely related to what we looked at.

I mean, all other things being equal, crop prices being a critical one, as you mentioned before, and a given field, a given farm, if it were to see changes in its average salinity levels, typical salinity levels, of this scale here -- Now, this graph does not show average salinity levels. But if it were to show changes along the lines of a couple hundred microsiemens per centimeter, then, yeah, we'd expect to see significant economic effects and cropping shifting.

MR. MIZELL: If we could bring up -- quickly here -- DWR-586 and go to .pdf 15.

(Document displayed on screen.)

MR. MIZELL: At the bottom of that page, please.

(Document displayed on screen.)

CO-HEARING OFFICER DODUC: And, Mr. Mizell, for the record, this is?

MR. MIZELL: This is the San Joaquin County Agricultural Commissioner's Report for 2014.

CO-HEARING OFFICER DODUC: All right. And --

MR. MIZELL: We're looking at the total of the -- a total of ag revenue on field crops for the past decade.

CO-HEARING OFFICER DODUC: And ask your question quickly because we are about to shut down.

MR. MIZELL: Does this show an upward trend in agriculture revenue over the same period as the chart -- the water quality we just looked at?

WITNESS MICHAEL: It does in the recent 2000s. You know, 20 of these correspond to record crop prices for field crops.

In fact, there was a devastating drought in the midwest in 2012 that, among other things, pushed prices for corn and commodities up to -- to record levels, and it's reflected there. They've come down quite a bit recently.

MR. MIZELL: I think that would probably be the best place to stop here.

CO-HEARING OFFICER DODUC: All right. Thank you.

We'll reconvene at 9 o'clock tomorrow.

(Proceedings adjourned at 4:58 p.m.)

State of California)
)
County of Sacramento)

I, Candace L. Yount, Certified Shorthand Reporter for the State of California, County of Sacramento, do hereby certify:

That I was present at the time of the above proceedings;

That I took down in machine shorthand notes all proceedings had and testimony given;

That I thereafter transcribed said shorthand notes with the aid of a computer;

That the above and foregoing is a full, true, and correct transcription of said shorthand notes, and a full, true and correct transcript of all proceedings had and testimony taken;

That I am not a party to the action or related to a party or counsel;

That I have no financial or other interest in the outcome of the action.

Dated: December 3, 2016

_____
Candace L. Yount, CSR No. 2737