Case No. 84739

IN THE SUPREME COURT OF THE STATE OF NEVADA

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ADAM SULLIVAN, P.E., NEVADA STATE ENGINEER, et al.

Appellants,

vs.

LINCOLN COUNTY WATER DISTRICT, et al.

JOINT APPENDIX

VOLUME 44 OF 49

In The Matter Of:

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES

Vol. I
September 23, 2019

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STATE OF NEVADA
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
BEFORE MICHELINE N. FAIRBANK, HEARING OFFICER

IN THE MATTER OF THE ADMINISTRATION AND MANAGEMENT OF THE LOWER WHITE RIVER FLOW SYSTEM WITHIN COYOTE SPRING VALLEY HYDROGRAPHIC BASIN (210), A PORTION OF BLACK MOUNTAINS AREA HYDROGRAPHIC BASIN (215), GARNET VALLEY HYDROGRAPHIC BASIN (216), HIDDEN VALLEY HYDROGRAPHIC BASIN (217), CALIFORNIA WASH HYDROGRAPHIC BASIN (218), AND MUDDY RIVER SPRINGS AREA (AKA UPPER MOAPA VALLEY HYDROGRAPHIC BASIN (219).
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TRANSCRIPT OF PROCEEDINGS

PUBLIC HEARING

HEARING ON ORDER 1303

VOLUME I

MONDAY, SEPTEMBER 23, 2019

Reported by: Michel Loomis, RPR

APPEARANCES:

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Tim Wilson, Acting State Engineer

Adam Sullivan, Deputy State Engineer

Melissa Flatley, Chief of the Hearing Officer Section

Michelle Barnes, Supervising Professional Engineer

Levi Kryder, Chief of the Hydrology Section

Jon Benedict, Hydrologist

Christi Cooper, Geologist

Bridget Bliss, Basin Engineer

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For NV Energy: Justina Caviglia, Esq.

APPEARANCES:

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For Moapa Band of Paiutes: Beth Baldwin, Esq.

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For Moapa Valley Water District: Greg Morrison, Esq.

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By: Laura Schroeder, Esq.

For National Park Service: Karen Glasgow

For Center for Biologic Diversity: Patrick Donnelly

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CARSON CITY, NEVADA, MONDAY, SEPTEMBER 23, 2019, A.M. SESSION

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HEARING OFFICER FAIRBANK: Let's go ahead and go on the record. Good morning. So this is the time and place set for the hearing in the matter of Lower White River Flow System in the Order 1303 proceedings.

My name is Micheline Fairbank, I will be the hearing officer today. And with me is the staff from the Division of Water Resources. We have Tim Wilson, acting State Engineer. We have Adam Sullivan, Deputy State Engineer. Levi Kryder who is our chief of our hydrology section. Jon Benedict who is one of our hydrologists. Christi Cooper who's staffed out of our Las Vegas office who's a geologist and familiar with and works quite extensively in the Lower White River Flow System area.

With me also is Melissa Flatly who is the chief of our hearing section. Michelle Barnes, the supervising professional engineer of our hearing section. And Bridget Bliss who is the basin engineer for the Lower White River Flow System basins.

Just as a couple preliminary remarks. I wish to go ahead and remind everyone that this proceeding is for the express purpose of providing the State Engineer a concise

summary of the salient conclusions set forth in the Order 1303 reports and rebuttal reports and to direct our office to the evidence and analysis that is supportive of that testimony.

I want to just reiterate, and we've been trying to make this clear, that this is not a contested or adversarial proceeding. The scope of this proceeding is for the limited purpose of addressing those four issues plus the fifth.

And while that fifth issue is we're on it is not intended to expand the scope of this hearing into making policy determinations with respect to management of the Lower White River Flow System basin's individual water rights, those different types of things, because those are going to be decisions that would have to be made in subsequent proceedings should they be necessary.

Additionally, just to go ahead and provide some procedural matters. This morning we'll be starting with Coyote Springs Investments, they were going to have half of the time today and today we have a total of about seven hours.

So they're going to have approximately three and a half hours today to go through all of the presentation of the conclusions and reports and evidence on behalf of CSI as well as for cross-examination.

And again the opportunity for cross-examination

is not for an adversarial or contested proceeding, it's to provide the State Engineer a robust record in which to analyze all of the data and conclusions that are being provided to our office.

Cross-examination this afternoon will be limited to 14 minutes for the participants and we will have an audible alarm at the end of that time period. We're going to go ahead and take two breaks today, the first one will be about two hours in around 10:30 and then we'll take another ten-minute break this afternoon.

Additionally, time left this afternoon after those -- the participants are provided their time for questioning will be reserved for the State Engineer and his staff to ask questions.

And if there's additional time remaining at the end of the day before we have to conclude at 4:30, then we may open that up for additional questions by participants and cross-examination. But we do have to conclude at 4:30. We have to be -- everyone has to be out of the legislative building no later than 5:00 today and that's pursuant to LCB's requirements.

Additionally, if you plan on leaving documents or materials in the office at the conclusion of -- excuse me, in the hearing room the conclusion today, if there's anything

that you -- is confidential or is something that you don't want to have publicly accessible you will need to take that with you. While the room is locked up there's no guarantee of security or anything of that nature.

Let's see, finally, when it comes to the cross-examination of the witnesses, I just want to go ahead and just make it very clear, the expectation on behalf of the State Engineer and staff is that the witnesses are being responsive and courteous to the time during those that are cross-examining.

We understand that this is a limited time period and so we want to have -- we are going to conduct this hearing in a manner to allow a fair opportunity for individuals to ask questions of witnesses.

And if there's any perceived effort to stall or to draw out the time of a cross-examining party, then we're going to go ahead and address those matters. Because those -- this is intended to be a fair opportunity and really the focus of this is to provide the State Engineer with the most comprehensive evaluation of the data.

Also as a reminder, the proceedings are available to be viewed on the internet via the legislative website. And we also have it being cast down to the Las Vegas legislative offices as well.

And so with that being said, we'll probably go a little bit about maybe five minutes into the lunch hour so we may take a little less than 60 minutes for lunch today just because I want to make sure CSI has their full time. And I'm going to go ahead and open up to Coyote Springs Investments for the presentation of their case. Thank you.

MR. HERREMA: Good morning, my name is Brad Herrema, I'm counsel for Coyote Springs Investment. As a logistical -- in terms of logistics, to begin with, we'd like to reserve 30 minutes for redirect and so we'll plan to make our presentation this morning in three hours.

In terms of the presentation, we have two different pieces, the first is a presentation on the conclusions that were in the initial CSI report filed in July and the second is the presentation on the conclusions in the rebuttal report that was filed in August.

We think that the first part should take about two hours and the second part one hour. And maybe that will align with our break schedule as well.

So I want to first thank the State Engineer for the opportunity to have the authors of CSI's reports here today to be able to highlight the salient conclusions of their responses to the Order 1303 questions.

The panel will explain the conceptual model of

the Lower White River Flow System and the work that's been done this year to assist the State Engineer in understanding the system, including new study regarding geology creating flow paths within the system and focused analysis of recharge in the Coyote Springs area.

The panel will highlight those salient conclusions of their answers to the State Engineer's four 1303 questions, including that the State Engineer's Order 1303 boundary for the flow system may be used so long as there is accounting for resources in the Lower Moapa Valley.

That in reviewing the Order 1169 test data, that data demonstrates the climatic conditions dominate the water level signature and carbonate wells and geologic structures control the occurrence of movement of water within the system.

That there's roughly 12,000-acre-feet per year of evapotranspiration and 19,700-acre-feet per year of subsurface outflow from the Lower White River Flow System.

That new calculations estimate 5,280-acre-feet per year of local recharge from the sheep range within the Coyote Springs Valley. That the impacts of pumping within the flow system are dependent on their location.

That the faults identified in 2017 and confirmed by work done in April of this year define a structural block that creates western and eastern compartments in the Coyote

Springs Valley. And that local recharge from the sheep range is contained west of the carbonate block which limits its contribution to the Muddy River Springs area.

The panel members will also summarize their observations regarding the reports and information submitted by other stakeholders.

And finally, the panel members are here to answer all of your questions to ensure that you fully understand their findings and observations.

So with that, I'd like to have our panelists please introduce themselves by stating and spelling their names for the record.

MR. REICH: Good morning, my name is Stephen Reich, last name is R-E-I-C-H. I'm a principal with Stetson Engineers and I'm a registered engineer and professional geologist in the state of California.

MS. MORAN: Good morning, my name is Jean Moran, J-E-A-N, last name M-O-R-A-N. I am a hydrogeologist with Stetson Engineers, a senior hydrogeologist with many years of experience. I'm here to test -- to support the testimony today.

MR. CARLSON: Yes. My name is Norman Carlson, spelled C-A-R-L-S-O-N. And I'm chief geophysicist at Zonge International. We have offices down in Tucson and up here in

Reno. Or in Reno further up. And I'm here to testify on the geophysical survey that was done in April of 2019.

MS. PALMER: My name is Molly Palmer, M-O-L-L-Y, P-A-L-M-E-R. I'm a registered civil engineer and I'm a senior engineer with Stetson Engineers.

DIRECT EXAMINATION

MR. HERREMA: Thank you. Mr. Reich, just as a matter of housekeeping, are you familiar with the document labeled as CSI Exhibit Number 1, which has been in shorthand labeled CSI July 3, 2019 Order 1303 report?

ANSWERS BY MR. REICH:

A. Yes, I am.

Q. Did you prepare that report or was that report prepared at your direction?

A. The report was repaired at my direction with members from my team Stetson Engineers and working with Zonge International.

Q. And is that report a true and correct summary of your conclusions regarding the State Engineer's five questions for this hearing?

A. Yes, it is.

Q. Are you familiar with the document that's been marked as CSI Exhibit 2 and the shorthand reference to that document as August 16, 2019 rebuttal report?

A. Yes, I am.
Q. Did you prepare that report or was that report prepared at your direction?
A. The report was prepared at my direction with members of the same team.
MR. TAGGART: Madam Hearing Officer, Paul Taggart, Southern Nevada Water Authority. Have the witnesses been sworn in?
HEARING OFFICER FAIRBANK: They have not. We should probably do that. Thank you, Mr. Taggart.
(Witness panel sworn.)
MR. HERREMA: Does that cover the questions we've already answered or do we need to go back?
HEARING OFFICER FAIRBANK: I think we're good. Thank you.
MR. HERREMA: Okay. Thank you.
I think you were indicating, Mr. Reich, that you did prepare the rebuttal report or it was prepared at your direction?
ANSWERS BY MR. REICH:
A. Yes, I did. It was -- it was -- we prepared it as a team, so we prepared it together with the same members of the July 3rd report.
Q. And is the rebuttal report a true and correct

summary of the team's conclusions regarding the -- the report submitted by the other parties and their conclusions to the State Engineer's five questions for this hearing?
A. Yes, it is.
Q. All right. Thank you.
Turning your attention to slide number 1, which is shown up on the screen. Mr. Reich, can you please explain what you were tasked to do in this case?
A. Yes. Stetson was originally hired in early 2018 to look at the results from the Order 6255 and the Order 1169 pumping tests and then to assess the results of that and then investigate more into the geology and the occurrence of movement of groundwater in the Lower White River Flow System.
We then proceeded to participate in some of the public meetings that took place in 2018 and I believe early 2019 and as well as perform geologic investigations in the field itself.
We went out and we visited -- we visited, we did some geologic mapping along some of the faults and formations that exist out there. We visited monitoring wells and production wells throughout the area. And -- and also drove through many of the different basins that comprise of the Order 1303 administrative basin.
One of the field trips we met earlier this year

was actually in the wildlife refuge with also members of the Fish and Wildlife Service. So we've been able to perform field investigations of the area to help form some of our opinions.
Q. And following that -- that work you prepared the reports, Exhibits 1 and 2; is that correct?
A. Yes. In -- we then prepared our July 3rd report which was in response to the -- the four questions issued in Order 1303 in order to help provide information to the State Engineer and his staff that -- that provides understanding of a conceptual model, you know, really one of our -- our goals was to -- to be able to provide scientific and technical information to help -- help others really form an opinion on how water occurs and moves through the basin.
So that was presented in our July 3rd report. And then continuing we then prepared the August 16th report as a rebuttal report to the other -- other reports that were issued by the other parties in the July 3rd report.
Q. Mr. Reich, did you also prepare a document that was submitted to the -- it's labeled as CSI Exhibit Number 4, June 13, 2019 submittal of May 31, 2019 technical report and large lot, Village A map?
A. Yes. We prepared that report in May of 2019 in order to -- that was kind of the beginning -- our initial

presentation of our conceptual model. So to look at the availability of water in the Coyote Spring Valley, you know, that was -- that was the initial report that where we introduced a lot of the understanding that we have of the scientific information that we've assessed over the years -- over the -- over the last couple of years.
So that -- that report was -- is -- I believe that was May 31st; correct, of this year?
Q. Yes, May of this year.
A. May of this year, yes.
Q. If you could switch to slide 2. Mr. Reich, could you please describe what the panelists are going to present to us today?
A. Yeah, you know, we're also very appreciative of the opportunity to present the findings to the panel. We've really been able to, you know, get together I think with a lot of great resources that -- that have been able to form these opinions.
And so we're going to kind of walk through in a step wise fashion kind of the logic which has helped develop our opinion, we want to present that to you today.
You know, some of the issues -- and not necessarily issues, but some of the factors that we really come to understand is presented in this outline. And that's

really -- you know, starting with the basic understanding of the geology and the geologic structure of the area and how that affects the occurrence of movement of water.

You know, we -- we really took the order very seriously and -- and we went out and looked for new data. So that's when we worked with Zonge International to go out and do geophysical investigation. That geophysical investigation that we'll discuss is -- is -- has really provided a lot of information that allows us to confirm some of the other data that's been presented by others.

So, you know, I think a lot of the folks that are more technically based have heard about Page and other geologists who have really been working in the area over the last 20 or 30 years that have formed geologic maps or cross sections.

So -- so as we talk about how structure controls the occurrence of movement and water, it's really important for us to go out there and to perform this geophysical analysis. So we're going to talk about that. And then how that moves into the movement of water.

Again, some of the things that we're going to talk about are the heterogeneity of the aquifer, how the structures affect that aquifer and then move into climate and a little bit about how the climatic signature is seen and how

that's a common feature in a lot of the groundwater levels. So we're going to go through. And I know a lot of the staff, a lot of us have all looked at these groundwater levels for many years.

But, you know -- and I think germane to this hearing today is what -- what have we learned since the end of the Order 1169 tests? What have we learned since -- since the reports were submitted in June of 2013?

So we're going to talk about that. And then we want to wrap that up into a conceptual model. So in order to -- to really provide the -- the State Engineer with the information he needs to make decisions.

We want to wrap that into the conceptual models and the groundwater budget and then -- and then summarize our conclusions. So that's kind of a short overview of what we'd like to talk about today.

Q. If we could turn to slide 3. Mr. Reich, can you describe what we're looking at in slide 3, please?

A. Yeah, slide 3, and hopefully it comes out better on your screen than it does on the projector, but, you know, what this is, a lot of the work that we based was -- was from a rally in 2017.

And we talk about that a lot in our report, but what I really wanted to do was to -- to use this slide to show

the geologic units and the extent of the -- of the regional aquifer, carbonate aquifer in eastern Nevada and for -- for, you know, for purposes of today I've identified where Ely is up in the north. And you can see the boundary starting from Ely coming down towards Lake Mead and the area.

That's the -- we call that the modified Colorado River Basin. We -- we relied on the State Engineer's description and list of basins and his basin identification map. And those would have been concluded, Cave and Dry Lake in that -- in that lower -- or in that Colorado River basin as defined by the State Engineer.

We also wanted to show you where -- where the White River Flow System is. So again, you know, we're today talking about Order 1303 administrative basin. And what we're looking at here, you can see the boundary within the screen a little bit better.

What that boundary is of the entire Lower White River -- of the White River Flow System. And then finally, on top of this we want to show you of course where we are today and what we're going to really focus our discussion on.

You know, it's important for me to show you this because these are the -- these are the units, this is the area. And every -- I think that we need to look at the large conceptual picture of the entire carbonate aquifer so that we

can talk specifically about what we're going to address today, and that's that flow in the middle of the White River Flow System.

So together we can see that, you know, that we have different boundaries and different extents that we're going to talk about. We're also going to focus in too on -- as you can see I've identified this cross section EE.

So as we go through today the cross section EE, which was -- or EE prime, I should be more exact, is -- is information that was published by Rowley again in 2017, which also sets up some of the understanding and ideas of structure in the area.

Q. Mr. Reich, you've been talking about a series of slides labelled slides 3, 4, 5 and 6; is that correct?

A. That's correct. I -- 6 is the summary of all the different basin boundaries -- or slide 6 is a summary of all the different basin boundaries that we put together.

Q. If you could advance to slide 7?

A. So slide 7 is a blowup of the Lower White River Flow System. And if you look on your -- if you look on your screen you can see that I've really -- we've generalized it, there's different units and there's different ages of formations.

And what's important in here that we wanted to point out was the -- the carbonate aquifer and the carbonate where it outcrops. So this is a surface map. So, you know, when we look -- if you look across that cross section EE you can see on the left that blue section along the top, that's -- that's a sheep range, and we're going to talk a little bit more about that today.

So the sheep range is a -- is a carbonate aquifer. The basin fill material is that yellow. There's volcanic formations that we talk about that are located further in the north, that's represented by the pink.

And then, you know, there's some older sedimentary, you know, plastic rocks that are shown in brown, which are down closer towards the -- the downgradient portion of the Lower White River System Flow System down towards the Lower Moapa.

Q. If you could advance to slide 8. Mr. Reich, what are we looking at here?

A. Well, slide 8, I -- I mentioned earlier before there was that cross section of E -- of EE prime that was presented by Rowley. So the purpose of presenting this cross section is to -- is to give an understanding of some of the different both faults and structure that exist within the Lower White River Flow System, specifically associated with that EE prime cross section.

So if you start on the left near EE you can see the sheep range up top. And then as you go across later on this morning we're going to talk about thrust faults, the faults that have the -- it's identified there right near the elbow range, there's a gas peak thrust, we want to talk about that.

And then as we move across there's more types of normal -- normal faulting which is associated with extensional tectonics. So each of these different ideas we're going to -- we're going to touch on how today in terms of how they affect the occurrence of movement of water.

What was important to slow on this slide is really -- I mentioned in our introduction about doing the geophysics, so where it's labeled as CSAMT, that's a control source geophysics method that we use to identify some of these faults that were introduced by Rowley. So -- so -- and others, but they're summarized by Rowley in his report.

But again, it's really -- what we wanted to do was to go out and use these geophysical techniques in order to identify, you know, A, that they exist and where they existed. So -- so again, that's -- those two arrows kind of point to the extent of our survey.

Also, we put on this the location of the Muddy River Springs area to give you an understanding of, you know,

how you move across cross section EE prime, the relationship between the different geologic lithologic units and the faulting, so...

Q. If we could advance to slide 9, what does this show us, Mr. Reich?

A. Well, you know, I keep talking about this idea of a -- of a conceptual model. And -- and when -- when we do in-house -- and every basin that we worked on we always tend to put -- we always put together a conceptual model.

A conceptual model is important for us to understand, you know, where the water occurs, how does a recharge occur, where may there be evapotranspiration, groundwater outflow. So -- so this is -- this is just a conceptual model, it's our general understanding of where we're going to start from in order to talk about, you know, how we can account for the different flow.

So -- so as you see in this we have -- we have these different layers, these lithologic units as you go from the bottom to the top. And -- and what those are are really different sequences of carbonates.

In general, they're older -- older carbonates on the bottom, you know, and they -- and they move up to younger carbonates on the surface.

And they're -- they're -- you know, I always like

to go back. I try -- I don't want to get too longwinded on the historical geology section, but I think in terms of why we're here today, it's important to understand, you know, those older formations on the bottom are 500 million years old, they started 500 millions years ago and a lot of those carbonates were deposited during the Paleozoic period.

And then -- and then after they were deposited we had different forms of tectonics that affected those. So we had -- we had compressional tectonics that happened, you know, 140 million years ago, those compressional tectonics formed thrust faults and thrusts -- we were -- we were pushing -- and, you know, in the basic form we're literally pushing some rocks on top of the other and that's where we get some of these thrusts faults.

And that's depicted by the gas peak thrust fault on the left. So -- so that fault itself was more than -- was approximately 140 million years ago.

And then as the system -- or as time went on, what we see today is really a -- a result of the basin and range extensional tectonics. And so the extensional tectonics is really what pulled some of these formations apart. And that pull apart of that extensional tectonics created what we call normal faulting.

And then normal faulting is identified in this

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figure. So we have older compressional faults, which is a thrust fault. We have newer normal faults, which is an extensional environment. And then approximately about 10 million. So those started about 20 million years ago, those -- those extensional and normal faultings.
And then about 10 million years ago, you know, is really -- really the beginning of the formation of the mountains that we see today where they were up -- or they were -- they were turned and erosion occurred and the basin flow started to occur.
So -- so that's kind of a, you know, a short, very short history of -- of some of the geologic processes that have occurred since about 500 million years ago.
Q. Mr. Reich, you mentioned thrust faults and normal faults. Why are these faults important?
A. Well, you know, we largely relied on a description by Rowley, you know, who went through and, you know, did kind of a comprehensive analysis on the relationship of how these faults are with the occurrence of water.
So in a -- in a compressional fault or in a thrust fault there's a lot of forces that really push -- push these different formations together and then they tend to be tighter and less permeable.
In extensional faulting we tend to have a little

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bit more of a pull apart and it creates different zones. We create a core zone, and that's depicted by the red here and that's a -- kind of a fault. We would get deposits of gouge and so forth that's in the center of the fault. And then we also get damage zones along the side. So you can imagine, you know, we have these extensional forces, things are turning and twisting and pulling apart. And then along the sides you can get this -- this kind of damage area. And that's depicted by the green.
And according to Rowley what we see is where the damage zones are and carbonated records the -- it provides for kind of preferred pathways, higher permeabilities along those damage areas. And -- and in essence also the -- the flow in a perpendicular manner across the fault, that tends to be impeded because of the fault gouge that exists along that fault.
So we have both, you know, this kind of preferred pathways through this damage zone which tend to see some -- we see some of the higher transmissivities and higher values of productivities of the wells in these damage zones.
And then -- and then a perpendicular direction we see more of a -- they can act as barriers or they're -- or they're, you know, some -- some type of barrier to that flow.
So it's important to understand, you know, really

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how these faults can help us determine that direction of flow and the occurrence of flow in the area.
Q. Mr. Reich, you've been just now describing a slide marked number 10 labeled preferred flow paths along exceptional faults; is that correct?
A. Yes, it is.
Q. Did you see evidence of preferred flow paths within -- in wells within the Coyote Springs Valley?
A. Yeah, we investigated the -- the pump test of different wells in Coyote Springs Valley and you can see faults -- wells that are located, you know, close to faults have a very high production rates where faults by some -- by some other wells have lower production rates.
We also looked at, you know, changes in water levels across those faults and how there may or may not be impact, you know, as -- from pumping on one site compared to water levels on the other site.
So there's -- so there's different evidence that we've used to, you know, we can -- that we've used to observe the impact of those faults.
Q. You've mentioned a few times that your analysis started with the faults that were described by Rowley. What did you do to -- to further analyze those faults?
A. Well, again, it was -- it was important for us in

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order to provide the information to the State Engineer of how we view the conceptual model, the location of these faults becomes very important. Not only the location but just the existence themselves.
So in order to verify their extension and their location we -- we employed Zonge International to perform a geophysical investigation of the area to identify and locate those faults. And -- and here today Mr. Norm Carlson who's our chief geophysicist has come to help explain that -- the survey that was performed.
Q. Good morning, Mr. Carlson.
ANSWERS BY MR. CARLSON:
A. Morning.
Q. If you could advance to slide 11. Mr. Carlson, could you please describe for us the geophysical survey that you were engaged to run?
A. Yes, we were -- we were contracted to run a resistivity survey called CSAMT. Resistivity information is very useful because different materials conduct electricity differently.
So core spaces in a material in a rock affect the resistivity. The fluid that's in the core spaces affects it, the TDS of the fluid affects it, temperature, these all affect the resistivity of the subsurface. By making measurements of

the resistivity it helps us understand what's down there. Is there water present, is it absent, is it high TDS, and so on.

The -- there are a lot of methods you can use to measure resistivity in the subsurface. And the one you choose to use depends on the -- what the surface environment is, how deep you want to see, the background resistivities you might encounter, how much culture there is, are there pipelines, are there power lines?

So all of those affect which resistivity method you use. There are of course other geophysical methods like seismic and gravity, those -- those are measuring different physical properties of the subsurface.

But since groundwater affects the resistivity so much, that's one of the reasons why we use resistivity methods in both the vast majority of our groundwater work.

The CSAMT stands for controlled source audiofrequency megnetotellurics, which is why you never see that written out. You see CSAMT. The CS -- well, CSAMT is kind of a subset of -- of a method called magnetotellurics.

And the idea there is that you measure an electric field on the ground and you measure the magnetic field on the ground at the same location. And if you do this at different frequencies you can calculate a resistivity at different depths.

The CS in CSAMT means controlled source. And that -- that means that we actually transmitted the signal that we were measuring. Put out the motor generator set and the transmitter equipment and transmitted the signal. Sometimes you'll see it labeled as just AMT, audiofrequency magnetotellurics. That implies that you're only measuring a certain frequency range.

You can also forget about the use of a transmitter and you just measure the naturally occurring electromagnetic signals that are generated by lightning on the other side of the planet literally and by the solar storms that are affecting the upper stratosphere, there's these EM fields going on all the time.

So you can either measure those, make that your source or you can put out your own source which you have control of. And that's what we did for this survey.

The CSAMT method was first developed theoretically back in the mid-'70s and became commercially available as a tool back in the early '80s.

Since that time, it's -- it's used most commonly in minerals exploration because it has very good lateral resolution. And then the last 20 years or so more and more in the groundwater and geothermal fields.

The bottom part of this slide is a sketch just to

give you a kind of a physical layout of everything. In the upper right is -- it's labeled transmitter source. What we do is lay out a long insulated wire on the ground. It might be 4,000 or 5,000 feet long, just -- just literally laying on the ground. And then it's grounded HN with a bunch of metal stakes or metal plates so it has good electrical contact with the ground.

We transmit an alternating current into that. To get deep data we transmit it at a lower frequency, say about one hertz so it's changing polarity once every second. And for the shallow information we go to high frequency. And that -- for these surveys it was 8,192 hertz. So it's alternating polarity 8,192 times per second.

So we measure a whole suite of frequencies and then use that to calculate a resistivity at all these different depths.

Q. If we could advance to slide 12. Mr. Carlson, is this type of geophysical survey accepted by the scientific community as a valid tool to map the subsurface?

A. Yes. Actually the -- for example, the Rowley report, the 2017 report and the map and such that everybody relies on so much, that report includes more than 20 lines of AMT data, the -- the audiofrequency magnetotellurics, which is exactly what we did from at least five different valleys.

Most of that is work done by the USGS.

They happen to use a different equipment system than we did. So they transmitted some signal and then they also measured the naturally occurring signals.

Our -- our own experience with geo -- well, geophysics in general, we've been in business for 47 years, you know, I looked back at the records, in the past ten years we've done about 1600 different geophysical surveys, gravity, seismic, CSAMT, MT magnetics. Out of those 1600 surveys about 350, 360 of them were CSAMT or MT, this magnetotellurics. So it's a -- as I say, commonly used method, particularly in the minerals.

And we've been doing this specific kind of survey for about -- about 38 years since we started building equipment for it.

On the next slide, slide 13, this is a list of some of the other groups in most cases national agencies that use our equipment and do CSAMT and things like that. So the USGS has several surveys, several systems. Sandia, Idaho, Lawrence Livermore, all the national laboratories.

We sell the equipment to government agent -- foreign government agencies, they use them in their -- their equivalent of the USGS in their countries. And then many private mining companies and groundwater companies and

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environmental firms use the equipment as well, so...
So it is indeed a well-established tool, very well-accepted peer -- peer-reviewed results, everything. So it's -- it's not a -- it's not a black box kind of secret proprietary thing that gives you wonderful results.
Unfortunately, because of the money involved and the oil and minerals, you get a lot of black box geophysics. But this is -- this is definitely not black box, well reviewed, peer reviewed, plus we paint our boxes white, so...
Q. If you could advance to slide 14. Mr. Carlson, what did you do in the Coyote Spring Valley?
A. Yes. In Coyote Spring, in 2019 specifically, we ran three survey lines. The station spacing along the lines was 200 feet. So every 200 feet we were making measurements of those electric and magnetic fields at a variety of frequencies.
So that -- and we covered 13.8 miles on those three lines. So it works out to about 369 specific individual measurement points to give us resistivity at different depths.
Q. Could we advance to slide 15? Does this slide show those three survey lines?
A. Yes, this is -- this shows the three survey lines we did for Coyote Spring and sort of zero in -- sort of in the center of Coyote Spring Valley. The very northern nose of the

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Arrow Canyon Range is just about dead center in this slide. We did lines A and B, those were east/west lines running at -- running through there.
We've labeled only every fifth station on these lines because you can't pack all the labels in there, it's very tight spacing. Because one of our targets were faults. Sometimes faults or fault zones can be very narrow. So we needed good lateral resolution.
We had -- we couldn't put a station out once every mile or once every half a mile because we may jump right over a fault and never see it.
Lines A and B were the east/west lines. As you see there B is almost right in the middle. And line C is oriented -- more of a different orientation. And that's crossing the Pahranagat Wash where it sort of takes a bend towards the southeast and goes on towards Moapa.
In this next slide, which is slide 16, what we've done is just overlay the line locations onto the Rowley map for this area. And colors kind of fade out a little bit, but basically the bulk of the survey, most of lines A and B and all of line C are over basin fill.
So everything is hidden, all the bedrock is invisible. And that's -- that's the reason you do geophysics is you're trying to see something that you can't see at the

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surface.
Up on line A, A ran across a small kind of isolated sort of island of limestone, that's that blue, it's labeled MD. And then line B right at the very nose of the Arrow -- Arrow Canyon Range ran over a little bit of limestone, same -- same unit.
And then line C is in -- as I said is entirely over basin fill. The dotted lines that you see there are faults as shown on the Rowley map. So we have on -- on the west running right through the labeled line B there you can see a dotted line fault.
Parallel to that is a blue line on the Rowley map that indicates a -- sort of a secondary, a less important fault right up against the limestone. As we move further east we see another fault parallel to the first one right -- right on the eastern edge of the limestone.
Then we see what's probably part of a basin bounding fault as we go further -- further, sort of about -- first the east end of line B about a third of the way in.
Then on line C we crossed two faults that are oriented north, call it north 60 east. But all of those are shown as dashed lines indicating that they're -- that's where the geologists have placed them based on what they can see on the surface someplace else, but by dashing them they're

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basically admitting okay, this is a good guess, but we -- we don't know. Those are all concealed faults.
Q. Could we advance to slide 17? What does this show, Mr. Carlson?
A. These are the results in cross section form for the CSAMT survey. This is the final result.
So what we're looking at is along the top of the plot is the surface of the ground. And you can see it's basic -- mostly flat. And the station numbers, again, this every fifth one or tenth one is shown for clarity.
And then down the side we're looking at elevations. We're looking downward through the earth. If you can see it on your screens, the elevation in feet is down on the left side and in meters is down the right side.
And then the color shading is the resistivity, that's what the final computer model came up with for all of these measurements we made. We shade high resistivity material towards blue and we shade low resistivity, meaning it conducts electricity better, towards red.
Though the first thing you notice on this particular slide is that big block of blue sort of towards the center of the line. That's where this line A crossed over that little isolated -- little island of limestone. And limestone is often very high resistivity. It's -- so that's

perfectly normal.

As we go further towards the east you can see some high resistivities, that dark blue on the very far end, that's where this line crossed over a small outcrop dolomite. Good correlation what we do know at the surface at least. But the rest of the line of course is just basin fill.

If we could go to slide 18. All we've done here is sort of tilted the world for you. We have the Rowley map draped on top of the US digital -- USGS digital elevation map. So you get kind of a perspective. You can see how the data, how the results line up with the map.

And we can see the -- the blue high -- high resistivity feature right in the middle lined up nicely crossed over that little island of limestone. And the blue on the east end where it crosses a little tiny nose of the dolomite sort of crossing over in high resistivity ground.

And then out in the basin we see some more low resistivity values, the yellows and reds. And what we've also put on here is the -- what's -- what's on here is where Rowley put those faults, these dotted lines. The solid line farthest to the west is the highway, so don't -- don't interpret that as a fault.

And we see good agreement with what we see on the ground. We see interesting things in the data. For example,

in that basin fill you can see that -- we see a lot of low resistivity material, which would -- you know, if you were interpreting this brine we'd say that's -- okay, that's basin fill or that's some of the volcanics, some water present, things like that.

You can see that -- if we look on the west side versus the east side of that central limestone island the two sides are different. We see two -- two distinct layers on the east side and then those low resistivities, all that conductive material kind of thickens and plunges as you get towards that basin valley fault.

On the west side we see weakly two layers. And one of them drops off fairly deep and the other stays horizontal. It's a little hard to see on this screen but probably easier on here, but towards the end of the west line around stations 1900 to 2500 or so there's some construction going on for -- for Coyote Springs and the data was -- was affected by what we call cultural effects. Anything out there that conducts electricity or radiates noise causes us problems.

So there's a -- there's kind of a little tiller feature out there that looks unrealistic and that's because it is unrealistic, it's -- it's the effects of culture.

The last 1,000 -- 1500 feet to 2,000 feet the

west end of line 1 does look like good data when we look at all the stations individually. So we have faith on that end of it.

Out there on that very end around 1500 to 2,000 we do see a fault that's not shown on the Rowley map. And here I think we can go to line B, which would be slide 19.

So this is line B, this is the one that crosses the nose of the Arrow Canyon Range. And they're -- as we would expect nice high resistivities, dark blue right there in the center as we go over that -- that little nose of the range. It looks very similar to the -- to line A. We see low resistivities on either side of it. That's -- that's all quite good.

One thing to notice though is on this map the eastern concealed -- the fault that was east of the -- of the blue, the high resistivity stuff on line A, it was quite a ways away from it on this line, it is actually right up against it. Which made sense and looks like a fault to us.

There's also a fault shown on the western edge of that blue nob. And that makes sense to us, that looks like a fault too, there's big change in resistivity as you go from west to east. The Rowley map also has a concealed fault about a quarter of the way from the western end of the line kind of out there in the middle of nowhere.

We don't see a fault there. We think -- we think that fault is -- is misplaced and should be further west. Actually around station 2000 on this in the deep data you'll see a change from -- from sort of medium to dark blue towards green. That indicates to us a fault out on this west end of line B.

Rowley's map, if we jump to the eastern side of the -- of the nob Rowley's map shows a concealed fault there right about halfway between the nob and the east end of the line. And we would put that fault based on the changes in resistivity as you go from west to east about 500 to 1,000 feet further west. Otherwise it's well placed. You can see where the -- the resistivities change from fairly dark blues to light blues and then to greens, that's where we see that.

Q. If we could advance to slide 20. What does this show, Mr. Carlson?

A. Yes. This is similar to the line A, that line A plot that just draped the Rowley map onto the digital elevation file. So it gives you kind of a 3D perspective. So we're looking -- looking to the north looking kind of downward as if we're a couple thousand feet in the air.

And you can see that the western fault on the Rowley map, that western dotted line running along the surface in the middle there, doesn't really line up with a change in resistivity. But the change in resistivity further to the west around station 2000 or so is definitely there.

The -- the black dotted line on the Rowley on the east side of that little nob does indeed line up exactly where we would put it as a very significant fault.

And then further to the east, that basin bounding fault that we saw just -- just saw a little bit of on line A, we can see that kind of in the middle of the eastern half of line B and very well-defined change in resistivity there. So that fault is in good agreement.

So what -- what we're seeing is three faults on the Rowley map, two of which agree well with the CSAMT data and the western line should be moved further out to the west to about station 1500 to 2000.

Q. Advancing to slide 21. Does this show the results of your work on line C?

A. Then -- yes, on line C, that's the one that runs in a different direction, it's kind of southwest up to northeast, crosses Pahranagat Wash. And after it makes the bend there by the nose of the Arrow Canyon Range.

This is interesting in that it shows concealed faults very well defined as we go from the west end of the line towards the east down in the deep data we see the dark blues showing high resistivity and changes to light blues and

then into greens.

The whole central section of this line is lower resistivities, not as dark blue, not as -- more green.

And then where Rowley puts a concealed fault as we move further east we see a big change to the darker blues.

So the -- the agreement on this line between CSAMT and Rowley are very good. Plus we see that the whole central section of this line, which is actually a couple of miles is lower resistivity than the ends of the line.

Basically what we see often in large fault zones and we've seen this type of thing in the Horst and Graben-type structures. So the western third of this line and the eastern third are the Horst -- part of the Horst and Graben in your geology. And the central section is the down dropped lower resistivity. Or it's a very broad fault zone.

HEARING OFFICER FAIRBANK: Ms. Caviglia?

MS. CAVIGLIA: Hearing Officer, Justina Caviglia from NV Energy. Do we have a pointer or something that's easier to follow the map section? It's hard --

MR. CARLSON: I forgot mine today. I'm sorry.

MR. ROBISON: I have two and four dead batteries.

HEARING OFFICER FAIRBANK: I will take that as a no. But thank you.

BY MR. HERREMA:

Q. If we could advance to slide 22?

A. Slide 22 shows the line, seeing data with the perspective again. This time we're looking west, so north is to your right. We have the CSAMT cross section there and you can see the dotted lines coming -- extending away from it in good agreement with those big changes from lighter blue to darker blue. And then the Arrow Canyon Range, you can see that just above the cross section.

But really the key point here is very -- very good agreement with the Rowley interpretation of the area. Again, this line crossed it off at all -- this is all. All of the structure in geology is -- very good. Thank you.

HEARING OFFICER FAIRBANK: Thank you, Mr. Carlson.

BY MR. HERREMA:

Q. Okay. Advancing to slide 23, what does this show, Mr. Carlson?

A. Yes. This -- this sort of summarizes our view of the faults after the CSAMT. Down here, this is the nose of the Arrow Canyon Range that we've been talking -- talking about, barely even visible and it doesn't really even show up on much of the topographic maps, is the little limestone island that Rowley drew there. So this is line A crossing

that little limestone island.

And then extending on out, that's -- that's probably the extension of the Basin Valley fault. Line B and the nose of the Arrow Canyon Range.

Rowley had faults extending from this side on up and out and then another fault extending up here. And then that secondary fault, the one shown in blue extended up to about here and stopped.

What we see is a very narrow band of high resistivities between these -- from here to here with the faults right up against the high resistivity line.

So don't see a fault out here. But as you recall, on line B and the little more weakly on line A you saw a fault out here on the west end.

This orientation when you line up the fault we see here and the one you see here is almost identical to the orientation of these two, which is about north 30th west, north 30 west. And then the other fault that we saw in Rowley intersected line A up here where we crossed a little bit of dolomite and intersected line B down here. There's no outcrop, but a very nice change in resistivity.

Q. Mr. Carlson, if there's anyone who might wish to read the transcript of this proceeding later, could you please --

A. Oh.
Q. -- when you're using the pointer just describe on the figure what you're pointing out?
A. Right. Sorry. So, the -- and we've shown our faults where we place them as dashed lines. We know -- we know where they are next to the -- next to the limestone, we can see them in the data in between the lines. We dashed them because we're assuming they go there.
And on line C in the lower right of the slide you can see line C crossing two Rowley faults, those faults are shown as dashed black lines. And again, those occurred right where we see them.
Also on the map we see well locations. We have MX-5, which is -- you can see in aerial photos and it's almost exactly on top of one of the faults, the eastern fault. CSI-2, which is very, very close to the same fault. And then CS-1 -- CSI-1 is in between two -- two faults out in the middle sort of near the golf course on this slide.
MR. TAGGART: Madam Hearing Officer, is there an exhibit to reference for this slide?
MR. HERREMA: Mr. Taggart, if I can direct your attention to the upper right-hand corner of the slide it's got a reference. And each of the slides have references from where this information is taken from.

MR. TAGGART: We can't find this in Exhibit 2, so...
HEARING OFFICER FAIRBANK: Mr. Taggart, I believe it's also maybe at CSI, Exhibit 13.
MR. TAGGART: Thank you.
MR. HERREMA: Thank you, Ms. Fairbank.
BY MR. HERREMA:
Q. Mr. Carlson, moving to slide 24, what does slide 24 show us?
A. Yes, slide -- slide 24 is a list of the summarized results of the CSAMT survey. First of all, the CSAMT data did show good valid realistic results.
During the course of the survey the equipment does -- does its own internal checks every time it sets up at a station. The field critique can see the data coming in so he knows if a wire is suddenly broken and things like that.
We didn't experience any equipment problems. No unusual weather conditions, thunderstorms of course with all the lightning really -- really drive us crazy.
We had no weather problems, no equipment problems. So we look at this dataset as -- as a good realistic valid dataset. And the data seemed to be providing us with specific locations for faults that were identified as concealed on Rowley. It also indicates that at least one of

those faults has shifted significantly west of where Rowley put it.
We see other weakly -- weakly apparent faults, but the main ones that we're worried about would cross line A and B, in particular the far western fault is the Rowley fault that shifted quite a ways west.
And line C was in very good agreement with the Rowley map. Those were our summarized results for CSI.
Q. Thank you, Mr. Carlson.
Mr. Reich, as part of your team's work, did you review the climate and precipitation in the Lower White River Flow System?
ANSWERS BY MR. REICH:
A. Yes, we did. One of the -- one of the things that I mentioned earlier before was the impact of climate.
So one of the -- one of the things that I asked Ms. Molly Palmer to do was to review the available data that we used to characterize the climactic conditions in the Lower White River Flow System. So maybe -- maybe Ms. Palmer could help explain a little bit about what we -- what we found.
Q. Okay. Advancing to slide 25. Ms. Palmer, can you tell us what data you looked at to characterize climate in the Lower White River Flow System?

ANSWERS BY MS. PALMER:
A. Yes. There are two maps on this slide, the small map in the upper right corner is showing the climate divisions for the state of Nevada. There are four divisions as defined by the National Oceanic and Atmospheric Administration which defines climate divisions in the United States.
So the Lower White River Flow System is shown on both maps. And you can see that it's located mostly within division 4, which is the southern extreme climate division. NOAA maintains climate records for the climate divisions that date back to 1895.
They're also showing a single point station in Pahranagat Valley for -- which we're showing that one because it's upgradient of the Lower White River Flow System. It has data going back to 1964.
In general, for each climate division, the records in that division are based upon records at individual stations in that division throughout history.
And as I said, for the division before goes back to 1895. In general, the precipitation stations that are located in the Lower White River Flow System are at lower elevations, typically less than 5,000, more like 2,000 and 3,000 feet on the valley basin floor, not up in the mountainous areas.

And we reviewed all of the precipitation stations from the Lower White River Flow System. There are no long-term stations that are located at high altitude in the basin.
Q. Ms. Palmer, could you speak up just a little bit so the reporter can hear you?
A. Yeah, um-hum.
Q. And I believe you used an acronym in your -- in your summary, NOAA, could you describe for the reporter what that stands for?
A. Yes. That's National Oceanic and Atmospheric Administration.
Q. Thank you. Advancing to slide 26, Ms. Palmer, what -- can you describe the data that's displayed on this slide?
A. These are two graphs that show cumulative departure for the two climate records that I discussed on the previous slide. Both graphs show in blue bars the annual precipitation, the top is showing you the annual precipitation on a calendar year basis for the division 4 climate division.
The lower graph is showing you the annual precipitation on the calendar year basis for the Pahranagat Wildlife Refuge Station. And the blue bars as I said are total precipitation per year.

The straight line should be sort of like a red or pink color is showing you the average annual precipitation on a calendar year basis for the period of record for each respective record. So the top one is the average for the division 4, the lower bar -- the lower average is for the Pahranagat Wildlife Refuge Station.
And the black curves that you see are what we refer to as cumulative departure from mean. And those lines track the deviation from average over the period of record for each respective record or station.
And the black lines, the cumulative departure or CDM curves are extremely helpful for characterizing trends in the basin. Trends in precipitation as we look --
MR. TAGGART: We're going to lodge an objection to the expert conclusions by this witness. We think it's improper for her to describe facts and data without any interpretation of this would require an expert opinion and --
HEARING OFFICER FAIRBANK: Your objection is noted and we'll go ahead and allow the testimony and the State Engineer will assign the value based upon the decisions that were made at the hearing on the voir dire of witnesses and it's recognized that Ms. Palmer's not -- has not been admitted as an expert in these particular matters.

BY MR. HERREMA:
Q. Please continue, Ms. Palmer.
A. Thank you. So the black lines are cumulative departure from mean. What they show are that when there is an increasing slope that indicates a wetting trend and when there is a decreasing slope there is a drying trend.
So we can point out a few features of the climatic trends on the top graph. You can see that there is approximately a 30-year drying trend that starts in about 1945 to 1975, you can see that the line declines on the top graph.
You can also see some shorter increasing wetting trends where the vine has an upward slope. That occurs for about a ten-year period in the early part of the graph and then again from about a 20-year period from 1967 to about 1985 -- sorry, that's a ten-year period there.
And so that tells us how the precipitation changes over time.
Q. Okay. If we could advance to slide 27, Ms. Palmer, could you describe the data shown on this slide?
A. Yes. The top graph is a repeated graphic from the previous slide 26 and just a cumulative departure from mean curve for the climate division 4.
The arrows show you the period of record that has been blown up and shown on the bottom graph. The bottom graph

is showing you monthly precipitation records for the extreme southern climate division 4.
So it starts in January 1998 and goes through December of 2018. And it's showing you the monthly total precipitation for that climate division.
You can see that there are some months that have significant amounts of precipitation. For example, in early 1998 there's one month that has more than four inches per month. You also see months with bottom precipitation in 1998, 2004, 2005 and 2010.
HEARING OFFICER FAIRBANK: Mr. Donnelly?
MR. DONNELLY: Thank you.
HEARING OFFICER FAIRBANK: Please state your name for the record, please.
MR. DONNELLY: Patrick Donnelly, Center for Biological Diversity for the record. The previous slide's data is quite different from what's in the filed report. On the second chart displayed in the previous line. That's a different chart that's not in the filed report.
HEARING OFFICER FAIRBANK: Thank you. We'll note that.
BY MR. HERREMA:
Q. Turning to slide 28, Ms. Palmer, does this slide accurately summarize the data being collected?

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A. Yes. The data that we collected was for -- we used this -- the division 4 climate data to characterize precipitation in the Lower White River Flow System.

We showed two cumulative departure from mean graphs to show the trends, wetting and drying and normal over the period of record at those stations. We showed that there were wetter than normal conditions occurring in 1998, 2004, 2005 and 2010.

And we also note that there was a downward trend in 2006 to 2014. And the monthly data showed us that precipitation primarily occurs during the winter months.

Q. Thank you, Ms. Palmer.

Mr. Reich, in your introduction you talked about the movement of groundwater and the carbonate aquifer. Would you elaborate on some of the hydrogeologic principles that you relied on?

ANSWERS BY MR. REICH:

A. Yeah. In order to understand some of the hydrogeologic parameters that we talk about and that really control that occurrence of movement of water, Ms. Moran from our office reviewed some of the available information that -- that describes the -- the flow occurring.

So, for instance, we looked at a Theis analysis just to understand what we might expect from impacts in -- in

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a sample case of something similar to the carbonate rock aquifer.

So I'm going to let Ms. Moran describe her findings.

Q. Ms. Moran, we have slide 29 in front of us. Could you please describe for us what this shows?

ANSWERS BY MS. MORAN:

A. Yes. So I was asked to look at the Theis solution and look at probably drawdowns from a pumping well within the Coyote Springs area and the -- the -- the -- close to -- sorry, I got a little sidetracked. Close to Pederson Springs.

So what the Theis solution is, it's a nonequilibrium well equation. It was -- when it came on the scene for hydrogeology in 1935 it finally answered some of the major concerns that were at that time is how do you correlate drawdown in a well to the pumping rate? What does that mean and how does that characterize the hydraulic properties of the aquifer around it?

But it is a very simple equation, there's a lot of more complex equations that have grown out of it from then. But this is also the equation of the SeriesSEE used by the Fish and Wildlife Service, so we decided to stay with the Theis equation looking simply at two wells pumping and what

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would be the effect at a spring located the distance of Pederson Spring from those two pumping centers.

The relationship that the equation gives us is drawdown, pumping rate, what's also needed is the transmissivity and the storage and time.

If one piece of that is missing you can solve for the other pieces in the equation. The assumptions though make in very, very simple, it needs to be a homogeneous aquifer, infinite, no boundaries, uniform thickness and no recharge from any source, that the well is fully penetrating, that the screen interval is open to that full saturated thickness.

And that the well is a hundred percent efficient. It doesn't lose anything in the well drawer storage. And that the potential metric surface is flat.

This is a very idealized system in that all water pumped is from storage. And what it will give us is what the shape of that cone of depression is that goes out into the aquifer from a well pumping. So that's the beauty of this equation, though it's very simplified in its method.

It helps us -- it conceptually see -- okay, well, what would happen if I don't know really how those faults are behaving and if I don't really know what the recharge is and everything else is the same, what is happening there?

What the map shows is we took the average, a

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two-year average pumping rate for MX-5 location, which you'll see over here. And it is pumping 5,217-acre-feet per year, it's 11.5 miles away from the observation point, which is around Pederson Springs or VH-4.

The other pumping well we're going to talk about is at Arrow Canyon, and it will be pumping 3,000-acre-feet per year at over two years. And it is 2.5 miles away from an observation point.

So with the Theis equation again we're just looking at a simplified how that cone of depression propagates over time from that kind of pumping in an aquifer that's homogeneous across it.

The next slide, please. So the first well pumping, it's pumping the 5,217-acre-feet per year two years, 11.5 miles away. It causes a drawdown, its cone of depression, you're only see half of that cone in this graphic. But that cone of depression is -- causes a .289 feet drawdown at that observation point.

The next slide.

Q. Could you please -- sorry, for the record, just identify slide you were just speaking about?

A. Oh, thank you. So that was slide 30 that looked at the well 11.5 miles from the observation point.

The next slide, 31, looks at a well that is only

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2.5 miles from an observation point pumping less, but it has a greater impact because of where it is in the cone of depression. So it's just 2.5 miles away. It's causing a .46 feet drawdown at that observation point.

The next slide. What's nice with the Theis equation is you can add different cones of depression together. You can also put in image wells that could simulate recharge or could simulate a boundary, but in this case we did not simulate any -- anything that would affect the cone of depression.

So this has two wells pumping. You can see that the cone of depressions coalesce somewhere around the 20,000 feet or the 30,000 feet. But the -- the full drop at the Pederson Spring observation point would be 0.74 feet. So it sums the two together if it has no other influences.

Q. Here you're referring to which slide?
A. I'm referring to slide 32.
Q. Thank you.
A. The next slide. So in summary of this simple equation, it shows the relative impact of pumping wells located at different distances from an observation point.

And it's based on that the aquifer's homogeneous, so it has the same value of transmissivity in storage that a well pumping about 1800 gallons per minute but only located

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2.5 miles would have a greater impact at the observation point than a well that was located 11.5 miles but pumping a lot more in the 3200 gallons per minute.

The two components that describe how the aquifer -- how groundwater occurs and moves within the aquifer of the storage and transmissivity, the occurrence is storativity, it's the storage of water in the pour space and how much water from that pour space will yield to a well. That's what storage -- that storativity coefficient is.

What transmissivity is is the movement of water. It's the saturated thickness times the hydraulic conductivity. So it describes how quickly water will move through the subsurface.

When there's a higher T there will be a larger aerial extent but a shallower cone of depression because its pulse can move out through the aquifer to retrieve water from storage to supply it to the well.

When there's a lower T, it draws a -- a deeper cone of depression and the cone of depression doesn't go out as far. It's still the same amount of water coming out of storage, but the shape of the cone of depression is different.

Similarly with the storage coefficient, if you have a higher storage there will be a shallower cone of depression because the water will be released from storage.

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It doesn't have to go as deep to retrieve that water to -- to pump it from a well. And with a lower storage you would get a deeper cone of depression.

Again, it's all about how the water has to come from somewhere to come out of the well. And it's coming from that generation of a cone of depression.

So basically what I put together for this Theis equation is to explain how it works and then how different wells, different pumping rates, how that would affect at an observation point.

Q. Thank you, Ms. Moran.

Mr. Reich, turning your attention to slide 34, can you describe what slide 34 includes?

ANSWERS BY MR. REICH:

A. Yeah, slide 34 is kind of a summary of the observations we've made of -- of the groundwater levels. I think we spent the last hour or so, you know, talking about, you know, some of the basic geology and the location of the faults and the occurrence of movement and the hydrology.

So now that we've created that foundation we wanted to move forward and apply that to the observations that we've seen in the water levels.

So -- so really, you know, if -- if -- and we're going to go through this in a second, but it's really kind of

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looking at different segments. We want to look what would occur prior to Order 1169, what did we see during 1169, what we have seen since.

So -- so before I do this I was wondering if I could present a demonstrative aid that might help everybody kind of locate where they are with respect to each of the wells, because it gets -- it gets complicated with referring to different well locations.

MR. HERREMA: Ms. Fairbank?

HEARING OFFICER FAIRBANK: That will be fine.

MR. HERREMA: We've prepared a figure that shows the well locations.

ANSWERS BY MR. REICH:

A. Well, I think the one in your right hand would be better for this conversation.

MR. ROBISON: Okay.

MR. REICH: I wonder if it would be better -- maybe a little bit closer over here. Because I don't want to block anybody's view.

MR. ROBISON: This better?

MR. REICH: Maybe in just lean it up against -- without the easel maybe we could just lean it up against the tray towards the State Engineer.

HEARING OFFICER FAIRBANK: Actually, I think if we could put it there, that way then it can also be viewed on the camera so individuals who are viewing from Las Vegas as well as on the internet can see.

MR. REICH: Okay. If we just move it. The only problem is it blocks the -- so let me just -- let me do this. What --

MR. ROBISON: This way. Towards you.

MR. WILSON: Like this of. Perfect.

MR. REICH: That's fine. So what I wanted to do is summarize how we bring things together. So maybe I can show that in the next slide.

HEARING OFFICER FAIRBANK: If I may just ask a quick clarifying, this is a demonstrative of the different well locations within Coyote Spring Valley?

MR. REICH: Coyote Spring and Muddy River area and part of Garnet Valley in the southern portion. So it's really -- it's a -- it's a -- it's just an accumulation or a presentation of the location as we talk about it.

Because, you know, I realize, you know, our staff and our group is -- we get so involved in understanding where these wells are, but it's important as we go through this discussion that we can see exactly where they're located. So that's -- this is really just a demonstrative to -- to allow us to go back and reference exactly where wells are with

respect to other well locations.

So what -- what we're looking at on the screen on slide 35 is MX-4. So MX-4 is located about 300 feet away from MX-5 pumping well. And you can see it on the demonstrative, but it's in Coyote Spring Valley. So one of the things that we see in MX-4 water levels is its relationship to precipitation.

So you can see Ms. Palmer described -- characterized what the precipitation events have been in the past. And what's remarkable here is when we see the 1998 event, over four inches of rainfall.

So on the left we have precipitation axis and measured in inches. On the right we have elevation. And that right axis relates to the hydrograph that we'll be discussing. We're going to go through a lot of these hydrographs today. And so the theme is always going to be the elevation and/or pumping in some cases or precipitation in other cases on the left axis.

But for right now the black line on the top is associated with the black axis on the right and the blue bars are associated with the precipitation axis on the left.

Again, 1998, we don't have data prior -- we don't have groundwater level data prior to 1998, but we see the 1998 was a wet event. We have a decline in stream flow. We've all

talked about '04, '05 rainfall event. We can see that there's a reaction or a response in the groundwater level. In '05 there's a jump up. And then again, there's a further decline.

There's a -- there is a decline in the groundwater level until 2010. There's a small bump in the water level due to the rainfall event in 2010. And then average conditions -- what appear to be average conditions from say 2015 to the present.

If we overlay that with the CDM curve that Ms. Palmer introduced, again, we see that same formation, that same characterization.

This particular graph, which is slide 36, shows again the -- the -- kind of the dotted groundwater level line on the top is -- is the water level at MX-4, the solid black line is the CDM curve that we introduced earlier.

The gray bars are annual precipitation. The blue bars are monthly precipitation. And the -- the pink line going across horizontal is the average of the period of record for -- for the precipitation at southern extreme division 4.

So, you know, we see the same characterizations, we see -- again, back to '98 a response in the water level, a decline down to '04, '05 rainfall event response. And so there's a lot similarities between these two curves.

So we don't only see this in Coyote Spring

Valley, but we also see this in the Muddy River Spring area. So we can do the same for EH-4. If you -- if you can see the chart, EH-4 is down near the -- near Muddy River Springs area and you can see that this also is showing the carbonate water level, the black line along the top, the hydrograph measured in elevation on the right axis and then monthly precip.

So -- so we see almost an identical similarity in EH-4 that we just saw in the MX-4 well. And again, when we overlay that with the cumulative departure from mean and we add annual precipitation, it's the same general, you know, trend that we see going on.

We have a high rainfall again in '98, some decline, a response in '04 and '05 to a wet event decline, you know, basically from '06 down to 2013, that's punctuated by a high rainfall event in 2010 and then average conditions from '15 to '17 -- or '15 to -- '15 to the present.

So --

Q. And, Mr. Reich, in regard to well EH-4 you've been referring to slides 37 and 38; is that correct?

A. That's correct. 38 meaning EH-4.

MR. TAGGART: For the record, we object. I don't think this in their report. And unless it's offered for demonstrative purposes, that's fine, unless they can point to where this diagram is in the report.

MR. HERREMA: So these slides are a summary of a compilation, it's different pieces of reports and exhibits that have either been presented or admitted. We intend at the end of the day to ask that the State Engineer accept the slides as a part of the record, but we weren't intending to offer them as evidence themselves.

HEARING OFFICER FAIRBANK: And for the purposes as being offered as demonstrative exhibits in the summary compilation of data, we will accept them.

Mr. Herrema, is there -- are there copies of your presentations available and where are they located?

MR. ROBISON: On the table on the other side of the room.

HEARING OFFICER FAIRBANK: Okay. So there's copies of the presentation on the table over there? Thank you very much.

MR. TAGGART: If I can just for the record, and I understand your ruling, we will abide by it, I just want to clarify whether this is in their exhibits or not, just for the record so we know whether this is something different. If it is we object to it being admitted as evidence and obviously counsel said they will not offer it in evidence. But if it's in their exhibits we would just like to know where it is.

HEARING OFFICER FAIRBANK: And if I understand

correctly, it's a summarization or a compilation of documents which is reflected in the upper corner of their slides, which is -- if I understand correctly from prior statements from counsel, is that's the -- where the source data is located and if I understand it's a demonstrative exhibit?

MR. HERREMA: Yes.

HEARING OFFICER FAIRBANK: So that's -- that's what it is at this point and it's not being offered as evidence or as an exhibit, it's being offered for demonstrative purposes?

MR. HERREMA: Yes. So we would like it made part of the record so that it can be referred to in the transcripts being reviewed.

MR. TAGGART: Those are two different things. It can't be part of the record if it's not an exhibit.

MR. HERREMA: It's a demonstrative exhibit.

MR. TAGGART: It can't be part of the record if it's not offered and accepted --

HEARING OFFICER FAIRBANK: So, Mr. Taggart, we will go ahead, it's being presented, all the participants have it available as a copy of it. It's being proffered for demonstrative purposes.

And as the State Engineer stated previously, the State Engineer will assign what, if any, weight to provide to

this.

However, it is being provided as a source of the presentation today. And so to the extent it gets included in the State Engineer's record, it may be included in the State Engineer's record to the discretion of the State Engineer. However, it is not being offer -- it's not going to be accepted as an exhibit by CSI in these particular matters.

MR. TAGGART: I understand --

HEARING OFFICER FAIRBANK: Mr. Taggart, your objection is noted, but we're on a tight time frame and that's the ruling of the State Engineer right now. Thank you.

BY MR. HERREMA:

Q. Could we please advance to slide 39? Mr. Reich, what does slide 39 show?

A. 39 are some -- are wells that I use for observation of data prior to the beginning of the Order 1169 aquifer test.

So one of the -- one of the steps that we went through was as I explained before, was to really truly understand the data and see what -- what -- what those data prior to the tests showed.

I think unfortunately -- I wish I could sit here in front and say we have a very long period of record that -- that would characterize this area. I think what we'll see

today is that there is somewhat of a limited amount of data, but I wanted to present that today and show you how we came to our conclusions regarding what we see prior to the order of 1169 aquifer test.

So, maybe I can jump to slide 40. And what slide 40 shows is a groundwater level of response in the MR -- in the Muddy River Springs and EH-4. So there's a lot going on in this graph. And I think I've introduced each one kind of on a step wise fashion.

But I've -- I've shaded out the blue area. And the purpose of that blue and what it represents is the period that pumping was occurring in Coyote Springs Valley.

And so what I want to do today with you is explain what I see prior to the beginning of pumping in Coyote Springs Valley. So what I'm going to do is focus on the information that's located on the left side of the graph.

And as we look at the information on the left side of the graph, I -- I want to repeat what I said before, and that is we've seen that that trend, that groundwater trend reflects climactic conditions.

And we see that, we used EH-4 as an example before, but we see it again in this graph 2, that solid line is that CDM curve, that black solid line. And in this case what the green lines are, the green bars is pumping in -- it's carbonate pumping in the Muddy River Springs area.

So what that green is showing is monthly pumping from 1998 I believe up into 2019, it's showing that that pumping was in the Coyote Spring -- in the Muddy River Spring area.

And what we're looking at in this is the seasonal response. So now instead of looking at the climatic response over periods of five or seven years, what I want to kind of focus in on is that annual response.

And you can see that annual variation in that hydrograph at the top. It -- it -- it's high in the wintertime and early spring and then it's low in the late summer and early fall.

And you can see how that kind of follows the peak pumping, so the top green bar would be the peak pumping. And what I've shown on this slide is that period.

So there's two vertical lines. There's two vertical lines, and they kind of represent the time between the peak pumping, which is the green. That would be the first vertical line you see on the left and then the minimum groundwater level, which would be the second vertical line or the parallel vertical line just to the right of the first.

So really, all that is doing is demarking kind of a time delay between when peak pumping occurs in the Muddy

River Springs area and when we see minimum groundwater levels.

So, again, you know, it's this annual variation that we relate to pumping. Pumping goes up, groundwater levels go down. Pumping reduces, and you see a response in that groundwater level.

So this is -- I think it's pretty standard. We all have seen the signature before. But what -- what it allows us to do is to see what does it mean in the area that we're -- we're discussing today.

So if I move further upgradient, if I move from EH-4 and now I'm looking at UMVM-1. UMVM-1 monitoring well is located at the northwestern end of the Muddy River Springs area right before you go into Coyote Spring Valley.

Again, you know, we see that same trend in the long-term kind of climatic conditions of drying and wetting. And unfortunately, because of lack of data -- or I should say lack of period of record, we're really missing that early time just because of when these wells were built. But we see the same thing. We see this annual variation.

And that annual variation is, again, due -- if we look to the left, if we look to prior to when pumping occurred in the Coyote Spring Valley, we see that that annual variation is occurring in -- in the -- in the UMVM-1.

And, again, what I've done is I've demarked that

period by two vertical lines between when peak pumping occurs, which is the top of that green bar, and when minimum groundwater levels are observed, which is the vertical bar on the right.

And if you remember a little bit, it's gotten a little bit wider, so that gap is getting a little bit longer. You know, it kind of makes sense. You're getting further away. The impacts take longer. There is a time delay between peak pumping and draw-down.

So this is fitting our conceptual model, and it supports the idea that pumping in the -- in Muddy River Springs area is impacting groundwater levels at UMVM-1 as shown in Slide 41.

If we go a little bit further upstream as shown -- or upgradient. I should be careful. Upgradient in Slide 42. Slide 42 is CSVM-6. CSVM-6 is now located north of MX-5 in the Coyote Springs Valley. And the green bars represent, again, pumping in the Muddy River Springs area.

The blue area, again, is when pumping was occurring in the Coyote Springs Valley.

So we looked at this, and we tried to ask ourselves why are we seeing a seasonal response to early time groundwater levels in the Coyote Spring Valley, especially in CSVM-6.

And so we saw what happened in VH-4, and we saw how that -- and also as shown in UMVM-1 and now, in CSVM-6 with the available data, we see the same thing. We see that there's a seasonal variation prior to when pumping was initiated.

So it really got us understanding that, you know, this -- that this pumping center in the Muddy River Springs area has impact as far north into this -- the area of CSVM-6, which is the -- kind of the eastern portion of Coyote Springs Valley just north of MX-5 as shown on the demonstrative aid.

So we kept going further upgradient. And this is CDVF-2. And CDVF-2 is even that much -- it's further upgradient in Coyote Spring Valley. And, again, if we can look on the demonstrative aid, and what we see again is -- is -- is the same -- is what's actually missing in this, and that is that seasonal variation.

So one of the reasons that I hesitate is because one of the things I want to point out here is that there was a screen failure or a hole in the casing, and so the data after October -- I believe it was October 2011 in Figure 4- -- was it 43? -- for CEVF2, we're not really looking at that data.

Again, we're just focusing on that early time data prior to pumping in the Coyote Springs Valley. So this kind of raised a question: Why are we seeing that seasonal response on the eastern side of Coyote Springs Valley but not necessarily seeing that seasonal response on this further well, CEVF-2.

So with that, that went to help us understand, you know, what the impact of these of these faults and barriers may be along the -- along -- within the Coyote Springs Valley.

Q. Okay. Advancing to Slide 44.
A. So as I mentioned before -- we looked at kind of before, that was before the 1169. That's what we observed and when we observed declining water levels during and somewhat after the 1169 tests.

So what I want to do today is kind of want to focus again on some of these monitoring wells, and I'm going to be specific in looking at MX-4, UMVM-1, EH-4 as we go kind of down gradient from MX-5 down towards the Muddy River Springs area. So, again, the red lines that are showing the location of some of the monitoring wells I want to discuss.

For instance, if we look at the next slide, which is Slide 45, Slide 45 is MX-4. As I mentioned before, MX-4 is located about 300 feet or so from MX-5. The yellow represents the period of the Order 1169 tests.

The blue bars represent pumping in Coyote Spring

Valley. So now -- I kind changed a little bit. Now we're on those bars and those -- the bars themselves represent Coyote Spring Valley pumping, not Muddy River.

So you can see during the aquifer test how much that increased in 2011 and 2012, that big increase. And you can see how MX-5 continued to pump all the way out through April of 2013. So even beyond the Order 1169 aquifer test, and what was reported, you know, that MX-5 still had pumping going on.

One of the observations we see in MX-4 is that, you know, during -- during that early part of 2013 when MX-5 was -- was continuing to pump, the groundwater levels remained fairly constant.

And then after -- after that MX-5 was shut down, you can see how MX-4 reacts immediately to that shutdown. There's a jump in the hydrograph. It jumps straight up.

You also see in 2011 and 2012 when MX-5 was shut down for repair for different purposes, you can see that there's an immediate response in the groundwater level. So we feel good that MX-4 is really -- is responsive to what's being seen at MX-5.

So -- so now, we went further down-gradient, and as shown on Slide 46, which is CSVM-1. Now, CSVM-1 is also very nearby. We can see on the graph here CSVM-1 is almost

immediately down-gradient of the MX-5 pumping well. We see a lot of the same characteristics that I just talked about at MX-4.

Besides the fact that, you know, we have that seasonal response that we see that we talked about earlier, we have the long-term climatic response, but we also have that response due to MX-5. So in MX-5, you can see in 2011 and 2012 when it shuts down, there's a response by that hydrograph, you know, kind of jumping up. The early part of 2013, you see a flat hydrograph. At the end of 2013 at the end of those blue bars, there's a jump up in the groundwater level.

So, you know, again, we can -- we can see that CSVM-1 is tied together with what we see in the other areas.

So -- so we kept moving further down-gradient as shown in Slide 47.

And when we go down 47, this is UMVM-1, and UMVM-1 is, again, a lot of the same characteristics. And I don't want to, you know, keep saying the same thing but, you know, the -- the drawdown in early 2013, you know, that still continues. But, you know, it's not as flat as it was.

You know, recovery -- there seems to be some of type of recovery response in UMVM-1 that's different than what you see in MX-4 and CSVM-1. But you still can see the

seasonal pumping signature and can see -- and you see the drawdown recovery.

So there's no question that, you know, we see impacts from MX-5 into -- into Muddy River Springs area, which is where -- where UMVM-1 is located.

HEARING OFFICER FAIRBANK: Mr. Donnelly.

MR. DONNELLY: Thank you.

Patrick Donnelly, Center for Biological Diversity. For the record, we'd like to object to all these charts being included. All these charts are citing CSI Exhibit 1. They're not in CSI Exhibit 1. This certainly feels like evidence, and we have not had a chance to review this before.

HEARING OFFICER FAIRBANK: Your objection is noted. Thank you.

MR. HERREMA: Miss Fairbank, if I may, there was an e-mail that you sent out on August the 29th which talked about PowerPoints and what they might include and when they should be produced.

There's a Question Number 5 that talks about PowerPoints that are a summarization of the expert report taking data or analysis of hydrographs of other data in the reports, and that's what we have put together in our PowerPoint.

It talks about those -- that particular question talks about those as demonstrative exhibits and that they can be produced and provided to everyone at the time that they're being presented.

MR. TAGGART: And just for the record, I would like to add that we've done this for decades, and absolutely, a demonstrative can summarize expert conclusions. A demonstrative should not make new experts, and that's the basis for our objection.

HEARING OFFICER FAIRBANK: And that objection is noted, Mr. Taggart.

MR. TAGGART: Thanks.

HEARING OFFICER FAIRBANK: Thank you.

BY MR. HERREMA:

Q. Mr. Reich, you were last speaking about Slide 47, which is relating to Well UMVM-1.

A. Yeah. So I think I explained UMVM-1 that this is at -- located at the kind of the northwestern portion of the Muddy River Springs area, and you see the same type of response.

And then we go further down-gradient in Slide 48, we show EH-4. So EH-4, again, is -- you know, it's a longer period of record. You can see that longer hydrograph. But, you know, we start to see that even at the end of -- of the

pumping, of the MX-5 pumping in 20 13, you know, you start to see a recovery. You start to see an uptick in the groundwater level.

So, you know, why we've submitted that, you know, there's a relationship in the hydrologic connection between Coyote Spring Valley and Muddy River Springs area, you know, as we get further away, we start to see the impacts of other issues, whether they be recharge or groundwater flow. But, you know, there's -- there's -- there's different characteristics that help us understand and explain, you know, that movement of water.

So, you know, this is just important to see how, you know, we can relate pumping in Coyote Springs Valley to impacts in the Muddy River Springs area.

So, you know, if we -- if we move on, this was the area that we looked at down-gradient. We also looked upgradient. So, now, what I would like to do is walk you through some of those wells, observation wells that we looked at moving upgradient in Coyote Spring Valley.

So in this particular case, in 49, I'm just kind of showing you -- if we start at the bottom and work our way north, that's going to be the order of my presentation for water level graphs.

So on page 50, I'm showing CSVM-6. And CSVM-6,

again, I think, is very much tied to the pumping we see in MS-5. There's a -- there's a flat level in the early 2013. There is an immediate response in -- in May of 2013 after MX-5's pumping is shut down. We see the seasonal variability that we talked about before.

And also in -- in 2011 and 2012, you see the response in the groundwater level due to the -- the shutdown of the MX-5 pumping.

So, you know, CSVM-6, we go further north from that and -- or upgradient. And as we look at Figure 51, we look at CEVF-2. And, you know, I got to -- CEVF-2 is it's just unfortunate that the well doesn't show us -- doesn't have data later on up to present due to the failure of the well itself.

But, you know, what's interesting about this is, you know, what we -- what we don't see. And we don't -- we don't see an immediate response in 2011.

And as I mentioned before, we -- and this is supported by the fact that we don't really see that seasonal response due to the pumping in the Muddy River Springs area, but we do see a seasonal response to the pumping in the Coyote Spring Valley area.

As we'll get on to later today or right now in Slide 52, you know, we look at other pumping that occurred,

say, on the west side of the -- of the structural block that we pointed out before.

So, you know, groundwater pumping on the west side, we talk about CSI-1 and we talk about CSI-3, and we include CSI-4. You can see how there's a responsiveness to the water level graph at CEVF-2 and seasonal variation pumping from these other wells.

So as we then continue to move further north, you know, we want to look at CSVM-4. So CSVM-4, which is at the outflow area of -- or the top part of the Coyote Spring Valley near the King Spring Valley, again, what's really interesting here is we don't really see any seasonal response.

But we do see the climatic response, and the climatic response is -- you know, when we plot that with the cumulative departure for mean curve, you can see that there's an increase, you know, following the '04-'05 wet period.

There's an upward trend in the groundwater levels, and then there's a decline down to 2013, 2014, and then groundwater levels have remained fairly stable from 2015 to the present.

So, you know, this -- this, you know, helped form and support our conceptual model. This model that allows us to understand what -- you know, what the impact of some of these barriers are; where is the flow is occurring; how flow may or may not occur across those barriers. But, you know, these data and the other data in -- in the Coyote Spring Valley were used to assess that.

And so moving on to Slide 54, in the upper left, we're looking at CSVM-4, which we just talked about; the lower left, which is CSVM-5 -- 3. Sorry. And that's right at the base of the Pahranagat wash or the northern end of the Coyote Springs Valley.

Again, it's very similar to the CSVM-4 in the sense that you see a recovery and you see a decline, and what is happening in that area, CSVM-5 is located south of the MX-5 pumping on the west side of the valley. It's located below the sheep range in an area that is also controlled by faults, and we see something completely different.

We see something that's in a -- in a different characterization of increase in groundwater level going -- going up, which we haven't seen -- you know, today, we've looked at a lot of water levels, and so we have to ask ourselves: Why is this different. Why do we have some different characterization of CSVM-5 that we don't see in the other wells?

And that's -- and that's a question where it can be explained by, you know, either a purge stone, a fault barrier, crossed areas, and it really elicits the need to find

out more about this area because this is -- this is unique to what we've looked at in this basin.

So we're -- you know, as we are today, we're still -- we're still looking at that and explaining why that -- that change is occurring.

But then again, CSVM-2, as we move down towards Hidden Valley, we see the same characterization of seasonal water levels, but we don't see the response from the MX-5 pumping.

So to summarize all this, and I've done that in the next slide, again, we -- we've seen this trend. Long-term climatic conditions impact the groundwater levels. I think we've seen that in all these different groundwater hydrographs that we've looked at today.

And I -- what's most interesting to us in our investigation was -- is really how the pumping in the Muddy River Springs area affects the eastern portion of Coyote Springs Valley.

So, again, how is that -- why is that something that -- you know, how does that occur and why is it contained in that eastern portion? And that's -- you know, and why, similarly, do we not see that seasonal impact on the western side of the Coyote Springs Valley.

So -- so, you know, that helps and support our

conceptual model that these barriers, these faults, these normal faults that were described by Rowley that we identified in our geophysical survey really impact and control that occurrence and movement of water throughout the area.

And so, you know, we come to the conclusion based on these data that basically, you know, that the barrier to flow or that the faults and the structural block and the geology that exist, you know, act to -- to isolate the western and eastern portions of Coyote Spring Valley.

Q. Mr. Reich, you're referring right now to Slide 55; is that correct?

A. 55, yes.

HEARING OFFICER FAIRBANK: Mr. Herrema, we're almost at 10:30. Is this a good time to take a ten-minute break?

MR. HERREMA: We've got about ten more slides, so I think we can.

HEARING OFFICER FAIRBANK: Let's go ahead and take a ten-minute break, and we'll start back promptly in ten minutes.

(Recess.)

HEARING OFFICER FAIRBANK: We're going to go ahead and go back on the record.

So, Mr. Herrema, you may proceed.

BY MR. HERREMA:

Q. Mr. Reich, we have Slide Number 56 projected on the screen here. Would you please tell us what Slide 56 shows us?

A. Yeah, we kind of ended before the break talking a little bit about a summary of our observations on the water levels, so I just want to continue about some of those, just summarizing what our observations were, you know, after -- during and after the aquifer test.

So some of the points that -- that I want to push out is really that during the -- during the aquifer test, you know, we could really see that -- that CSVM-2 -- CSVM-2, CSVM-3, CSVM-4, CSVM-5 -- and I know we jumped back into these numbers again, but they're really -- they really show a different environment.

You know, it's really a different hydrogeologic and geologic environment. And characterization of water levels from those wells are different than what we saw on the eastern side is what we saw on MX-5 and the CSVM-1 and, you know, the CSVM-6 in the northern Muddy River area and the UMVM-1.

You know, we're really looking at -- at something, a characterization. And when we look at those water levels, we can see that there's different environments

and a different geologic framework that's affecting those.
So as we move on this morning, you know, that's something that's important to us to convey to your office to -- to think about as you put together your own conceptual model, how these really affect that occurrence of movement of water throughout the system.
So, you know, moving on, I think is -- what I really wanted to kind of end with is that -- that same point is just we really see this long-term variability in water level that's connected to the climate.
I think it's -- it's -- it's obvious throughout all the wells, you know, that we've talked about today, except that CSVM-5 which I indicated we're still looking at. But the other water levels' response where we see an increase from '98, an increase in '04-'05 and a long-term decline in average conditions, it's really evident as we look throughout those hydrographs and we see how climate plays a role. You know, pumping plays a role. Climate plays a role. There's all these different things that we have to consider when we start to describe and characterize this.
So it's just something to think about and -- for your consideration as -- as you think about managing the resources in this basin.
Q. Mr. Reich, you're referring right now to

Slide 57; is that correct?
A. Yes. Slide 57.
Q. Moving to Slide 58, Mr. Reich, how did you address answering the State Engineer's Question 3 regarding the long-term annual quantity of groundwater that may be pumped from the Lower White River Flow System?
A. You know, we took an approach of -- of developing a groundwater budget for the Lower White River Flow System. We think -- or we know that budgets are important planning tools that we use for understanding, you know, all the different fluxes that affect the available resources.
When I talk about fluxes, you know, we talk about groundwater inflow. We talk about local recharge, evapotranspiration, spring flow, surface flow. Each one of these fluxes, each one of these terms, you know, is what we use to quantify what the resources are.
So as we make changes in the future, we go back and we look at those different items, and we say: How are we affecting those? How may we be affecting evapotranspiration? How may we be affecting groundwater discharge? How we may affecting surface flow because, you know, pumping -- pumping and groundwater development is going to affect something.
It's -- it has -- there's no -- there's no free lunch there. So if you take water out in one place, you know,

how do -- how do we have enough information to be able to describe and understand where those impacts are going to be?
And we -- we suggest that a groundwater budget is a tool that allows us to begin to be able to inventory those resources, to be able to figure out, you know, where those impacts are going to occur. How much can we give up? And so -- so what we did was -- was we outlined each one of those types of fluxes or inflows, and we did that for the Lower White River Flow System.
So in Figure 59, what we're showing here is -- is the budget is some of the flux terms that we have for the groundwater flow budget for the Lower White River Flow System. I -- you know, I have another demonstrative that just might help.
I know a lot of us are pretty comfortable with all the basins, and maybe we can just change that one out for that one. Just so everybody -- as we talk about names and we talk about places, I think it's important for everybody here to understand where those places are and where those valleys are.
And so, you know, as I talk, what I'm showing in the -- in the PowerPoint presentation is a summary of the geology. I use this figure to demonstrate where that budget and how those budget terms occur.

As I talk about names, you can reference the demonstrative here to make sure when I -- that you can associate those with physical places and locations.
But, you know, in terms of the flux terms that we have, we talk about groundwater inflow and regional groundwater inflow.
And so what our office did was we kind of performed a literature research. We didn't go out and develop new data for groundwater -- regional groundwater flow. Rather, we went out and relied on studies done by others. And we reviewed a lot of those studies.
We reviewed studies that looked at deterring mass balancing, carbon-14 dating, recharge analysis, precip runoff, and Maxey-Eaken from the 60's, and we really went to a great extent to see the kind of information that was out there.
And in order to get something that we could present to you, present to the State Engineer for their use in planning, we ended up relying on an SNWA 2007 report that also used those data.
And we chose that report because it was fairly comprehensive. It was fairly comprehensive, and we felt that we could use that as a good budget that would be, you know, somewhat balanced because it was all from the same report.
So we didn't feel like, you know, it -- it would

have to -- you know, there's no mixing and matching from different reports.

And so in short, what that report identified and you can see in these -- in these dark blue lines, there was regional groundwater inflow from Pahranagat Valley. There was regional groundwater inflow from Delamar area and regional groundwater inflow from Kane Springs, regional groundwater inflow from the Lower Meadow Wash.

And the regional groundwater inflow from the Lower Meadow Wash was identified to occur into both -- into both the Muddy River Springs area and the California Wash.

And so when we talk about the groundwater recharge or the groundwater regional flow, we talk about those as being sources of -- of that groundwater flow.

We also -- we also looked at values from groundwater outflow from the area. So, you know, in the same report, we looked at groundwater outflow from the California Wash area into lower Moapa, and we looked from -- and also identified groundwater outflow from -- into the Black Mountains area.

So there was specific areas that identified where there was reasonable inflow into the system and regional outflow into the system. So you can see on this map -- and we also summarized it in a budget.

So you can see in Slide 60 -- Slide 60 kind of is the old classic groundwater budget that a lot of us have been using and looking at for our whole lives. So you can see that all the places in the -- and the terms that I just mentioned are outlined with the addition of local recharge.

So not only do you have this regional groundwater inflow into the Lower White River Flow System, you also have local recharge, local recharge occurring on the Coyote Spring Valley -- I mean, on the Sheep Range in the Lower Meadow Mountains, you know.

Now, we didn't make an estimate because the -- because published estimates from recharge from the Lower Meadow Mountains and from Arrow Canyon and other areas were not available.

So we didn't add anything, but what we really focused on was using those values from that 2007 report to put together this balanced budget.

For instance, in the outflow terms, we also used their estimates of evapotranspiration: How much evapotranspiration is in California Wash, how much may be in the Muddy River Springs area.

And it's important to remember these were presented as predevelopment, so it might not be what's there today but certainly, from a predevelopment groundwater budget

perspective, what was existing overall.

So when we summarize this and we look at this together in this budget, you can see the total outflow is about 62,200-acre-feet, and the total -- I'm sorry. Total inflow, excuse me, is 62,210-acre-feet, and the total outflow is 63,630.

So when I use this budget to say to -- in our conclusions that there's upwards of 30,000-acre-feet of available groundwater in the Lower White River Flow System, this is the basis for that presentation or this is the basis for that conclusion.

And where that number comes from is looking at the total amount of evapotranspiration and groundwater outflow out of the basin, so we can talk about this later. But I wanted to provide with -- you where those values are coming from.

Q. Advancing to Slide 61, Mr. Reich, what is the importance of local recharge from the Sheep Range?

A. Well, the local sheep -- the local recharge from the Sheep Range is an important component in our conceptual model and what we've been talking about today because the local -- the local recharge is -- is really occurring off of the Sheep Range. And what we've done today is -- is we decided that, you know, it would be good to provide an

independent analysis.

The independent analysis would allow us to use the most up-to-date and modern techniques. And if I may be allowed, I'd like to have Miss Palmer talk about the analysis that she did with regards to precipitation and recharge from the Sheep Range.

MS. PALMER: Right. Thank you.

We reviewed the literature, as Steve said. We selected several empirical precipitation recharge models from the literature, and we applied those using the most recent spatial data for the State of Nevada.

We used something that's called PRISM, a gridded raster data, which is a spatial dataset for outer general precipitation. And the PRISM stands for precipitation elevation regressions on independent slopes model.

It's developed -- the PRISM dataset has published in literature since about 1994, and it's been developed by research from Oregon State University. They produce a variety of spatial climate datasets for use in the western -- well, all the over the United States.

So we used this spatial information on precipitation in our geographic information system or GIS software to look at each of these areas that you see in the figure on the slide. And each of those areas, we broke them up into recharge zones, and we used the spatial data to compute the average annual precipitation in each zone.

And then we applied the coefficients and parameters from the literature -- from the models that are in the literature, and we came up with a range that's 5280 to 7380-acre-feet per year.

Again, we also went back through the literature to put those numbers in context, and that's in one of the appendix to our July 3rd report. There is a table that shows that we reviewed more than a dozen numbers. They ranged from 1900 acre per year to 14,000-acre-feet per year.

MR. REICH: Thank you.

So that was an independent analysis of the local recharge in the Sheep Range that was prepared for this area. And what we did next was we used that to focus in on a groundwater budget just for the Coyote Springs Valley.

So now what you're looking at is just a -- a new budget different than what we looked at before. But, you know, what would be the budget for just the Coyote Spring Valley?

And, again, we look at the same terms, which is groundwater inflow and local recharge. We now have an independent number for local recharge, and then outflow, of course, would be the groundwater outflow out of the Coyote

Spring Valley, evapotranspiration, and any surface water out.

So we -- we used this updated precipitation runoff analysis. We tightened up our boundary just for the purposes of discussing the Coyote Spring Valley today in order to develop the groundwater budget that's shown in Slide 64.

So Slide 64 is slightly different. It's just for a description of -- to support our conceptual model, but you can see that the inflow -- very similar terms, if not identical, from Pahranagat, Delamar and Kane for 22,400, 24,100-acre-feet. 4200-acre-feet from Kane.

And then local recharge, because we had an estimate, we now have an independent estimate of local recharge for the Coyote Spring Valley of 5280.

And then in terms of outflow, we have outflow into the Muddy River Springs area which is 37,800, which is identical to what we had in the previous budget or -- as based on -- it's based on the same information that we used for the previous budget. And then outflow out towards Hidden and Garnet Valley.

Now, that number is based on -- on the 2007 SNWA study, but we've adjusted it in order to provide you with a balanced budget for the Coyote Spring Valley.

You can see under predevelopment conditions and the previous -- the previous -- it was interesting. The

previous studies had also identified up to a thousand acre-feet of evapotranspiration. So the total inflow and total outflow based on our analysis for the Coyote Springs Valley is 55,980-acre-feet as shown in Slide 64.

BY MR. HERREMA:

Q. Sir, I -- again, in summary, could you please summarize the responses to the State Engineer's Order 1303 questions, and could we bring up Slide 65, please.

A. So Slide 65 is really just a summary of a lot of things that we've talked about today. But our -- specifically directed to answering your question, and, you know, we really looked at this as an opportunity to provide you with as much information and observations and new data that we have.

So -- so, through that process, you know, we believe that the Order 1303 boundary that was identified can be used, but resources will need to be accounted for.

And those resources are not just as I've shown on my slide here in the Lower Moapa Valley how much outflow is there from the basin, you know, because of what's going on downstream but also to be able to determine, you know, and account for the inflow, the regional groundwater flow, that flow that's coming in through Pahranagat and Delamar and Kane and Lower Meadow Valley Wash. All of those need to be considered as -- as kind of, you know, impacts to the flow

system.

But using the flow system boundary as defined in Order 1303 is -- is a plausible way to -- that we recommend that the State Engineer can do that.

The information from the Order 1169 aquifer test, you know, there's -- there's two big things that we provide with you today, and that is that the climatic conditions play a large role, a signature in the water levels that we look at today. And that needs to be considered, and it's something that -- something that we've learned since -- since that Order 1169 pump test.

And also, it's the structure. It's the -- it's the -- it's the geologic structures that are defined by normal faults that support, you know, and support preferred pathways and flow ways for water and also help to create barriers through development of -- of those faults as well as structural blocks.

And so, you know, keeping those in mind, those are -- those are some of the -- the new information or information that, you know, need to be considered when looking at pumping in the Lower White River Flow System.

The long-term quantity of water that can be pumped, I just -- I just recently finished with you on Slides 62 -- I mean, excuse me, 64 and the previous budget

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slide.
But, you know, 11- -- there's 11,900-acre-feet of predevelopment evapotranspiration and 19,700-acre-feet of subsurface outflow in the Lower White River Flow System, and we also identified 52- -- 5,280-acre-feet of local recharge in the Sheep Range.
So, you know, these are values that can be used for -- for you to determine on managing pumping in the Lower White River Flow System in the future.
The effects of moving water rights between aquifers, we didn't address necessarily water rights that -- and I apologize if we missed that, but we -- we instead, you know, addressed the physical relationships between pumping in alluvial wells and pumping in the carbonate aquifer.
And what we really found was, you know, pumping from the carbonate wells in the Muddy River Springs area really -- and pumping from the alluvial wells really have almost a direct impact on the surface flow and spring levels in the Muddy River system area.
But what I also want to conclude from this is that -- you know, and this is reason why we brought forward today the groundwater budget is that, you know, pumping -- pumping is -- anywhere within the Lower White River Flow System is going to affect something, and it's going to affect

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groundwater outflow. It's going to affect evapotranspiration. It's going to affect surface flows.
But really, what needs to be considered is -- is where the location of that pumping is and where those effects will occur when that pumping takes place.
So -- so I hope that we presented that information for your consideration today to see how that pumping can be managed based on the impacts that you're looking at.
Q. Turning your attention to Slide 66. What do we have here?
A. Well, the -- this question in Order 1303 was specific to other matters relevant to the State Engineer. And a lot of that, I've kind of addressed just in my last slide presentation.
But, you know, I really wanted to point out again that going out and getting new information, going out and getting the -- performing the geophysical survey, identifying the faults, locating these pathways and barriers and developing a structural understanding of the amount of water or the currents and that movement of water really supports the conceptual model that we've been talking about all day that we've presented to you and, you know, how -- how that can be used to support, you know, pumping in Coyote Spring Valley, a

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total pumping in Coyote Spring Valley of up to 5,280-acre-feet.
So, you know, it's really -- using the available information and the new information that we provided you with today, that will allow you to look at that -- those stresses and those -- those physical properties of the rock and the movement of water to help form your decisions about total pumping in the Lower White River Flow System.
MR. HERREMA: Miss Fairbank, this concludes the first part of our presentation regarding the direct -- or the report. We're going to change who it is that's going to be questioning to do the next part of our presentation.
Could I have a time check?
HEARING OFFICER FAIRBANK: Yes. You are about two hours and 26 minutes into your presentation thus far.
MR. HERREMA: Thank you.
MR. ROBISON: Miss Fairbank, I think I did not leave the State Engineer's office with the slides for the rebuttal presentation. May I?
HEARING OFFICER FAIRBANK: Thank you. So you have provided us the slides for the rebuttal presentations. Thank you.
MR. ROBISON: And they were on the table for distribution.

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HEARING OFFICER FAIRBANK: And those two are available on the table?
MR. ROBISON: They were. I think they've been taken up by other participants.
HEARING OFFICER FAIRBANK: Okay. Just one quick matter if I may, Mr. Herrema. It didn't appear that you actually sought to have the -- Exhibit 1 and 2, the report and rebuttal report, admitted.
The State Engineer's prehearing notice or the hearing notice stated that -- it identified the all the exhibits the State Engineer was admitting as well as the order, with respect.
But the State Engineer has not admitted any of the reports, and so I just wanted to ask if that's something that you wanted to have admitted in this matter.
MR. HERREMA: Yes, Brad Herrema for CSI. I read the report as saying it to needed to be verified or the order saying it needed to be verified and submitted to cross before they were admitted, so I was planning to move that they be admitted at the end of the day.
HEARING OFFICER FAIRBANK: Okay. Thank you.
MR. HERREMA: We do certainly want them admitted, yes.
MR. ROBISON: Thank you.

DIRECT EXAMINATION
BY MR. ROBISON:
Q. Good morning, all. My name is Kent Robison. I'm counsel -- co-counsel for Coyote Springs, and I am going to ask our panel backwards questions with regard to the CSI rebuttal report and some of the findings and analysis you did in that respect.
Start with you, Mr. Reich. Would you please summarize for us all what you reviewed with respect to this part of your assignment?
ANSWERS BY MR. REICH:
A. As part of our assignment, we reviewed the reports that were submitted by other parties to the Order 1303 July submittal.
So -- so we -- we limited that review to the information that was provided in those reports.
Q. Are you prepared to give your analysis and observations with respect to those other reports, sir?
A. Yes, I am.
Q. Because of the limitation of time, I'd like you to first give us a summary of your findings overall if you would, please.
A. You know, I'm going to -- I'm going to spare the State Engineer to repeat what I just said to him for the last

two hours because hopefully, most of that got through -- or we as a group were able to present that to you.
I do want to -- I do want to emphasize the fact, you know, that we used the available data that we could find to present those findings with you.
So what we found in the rebuttal reports was we not only looked to see what information was provided in those that would represent and support or change our minds or change views. So we were looking for new information.
We looked at those reports and determined, you know, how do they -- how do they support or how do they provide information that would say, hey, listen, you know, there is a different view that needs to be looked at.
So in short, in summary, you know, we disagreed with the findings of -- of, you know, A, how much water can be pumped and for what reasons. And that goes back, really, to the idea that we want to get across and that we found as evidence in our information that the aquifer is heterogeneous; that there are barriers that exist; that climate affects streamflow -- affects groundwater levels. And -- and putting that all together, you know, how -- how -- how do all these fit together?
So that was -- that was kind of our -- you know, the basis for our review. And then that led us to determine

whether we agreed with all the different aspects or disagreed with some of the aspects of those rebuttal reports.
Q. That overview is reflected on Rebuttal Slide Number 3, sir?
A. That's correct.
Q. Would you then direct your attention to Rebuttal Slide Number 4.
Can you tell us how you believe that your findings may differ from previous conceptual considerations to which the State Engineer has been submitted or subjected?
A. Yeah. You know, in summary, it's the impact of the hydrologic conditions on the available water resources and the climatic variability.
And -- and more importantly, I just mentioned the word heterogeneity, but it's really the differences in the past is how -- how homogenous the aquifer may or may not be. How much does it affect pumping in one location versus observations in another location.
You know, we need to consider that the Lower White River Flow System administrative boundary is on the order of a thousand square miles. So we have a thousand-square-mile basin that we're looking at and, you know, what -- what are some of those differences? And I think it's a fundamental difference on how we view that -- that

basin.
You know, is it homogenous or are there heterogeneities in there that cause different changes and different issues or difference fluxes to occur. Is there spring flow here? Is there outflow into the Black Mountains area? Is there flow on the western side and, you know, can pumping in one area affect or not affect pumping in another?
And that gets to the, you know, impact of faults and structural components: How important are those components? You know, how important are those faults? You know, how are they barriers to flow or conduits to -- and to create preferred pathways.
So it's really -- it's really that which -- which formulates our opinion on the amount of water that can be pumped from the Lower White River Flow System.
Q. Would you, with regard to Rebuttal Slide Number 4, focus on the third bullet point and elaborate on that, sir.
A. The impacts of -- on Slide 4, I'm reading about the impacts of faults and structural components on groundwater flow.
So, you know, when I'm talking -- I -- faults are the normal faults. We went back and in the beginning of our direct presentation, we -- we brought up the idea that

extensional faults, extensional tectonics create these normal faults that create preferred pathways. We clearly showed, you know, the support for that -- that opinion and where that came from.

And then looking at our observations of -- of different transmissivities and well properties and information from the -- from the wells and the pumping wells we have in the Coyote Springs area, we could see that.

And then in the geophysics, it's really the geophysics that we did to confirm what Rowley had suggested in 2017: That these -- these faults exist and that -- you know, the continuation of that Arrow Canyon Range, that structural block.

So how do we define -- how do we really know that those are there and now, how do we really feel confident that that supports our conceptual model? So it's really a combination of that, which is different, I think, than what the State Engineer has considered in the past.

Q. These are differences since the 1169 aquifer test, sir?

A. Yes.

Q. The four bullet points on this particular slide?

A. Yes. The 1169 aquifer test, which completed at the end of 2012, and the reports were written in June of '13,

certainly, you know, we relied a lot on recent data as well as the data that we performed ourselves in the form of a geophysical investigation.

Q. Did you review the initial reports submitted to the State Engineer's office by the Southern Nevada Water Authority?

A. Yes, we did.

Q. All right. And if we could look at Rebuttal Slide Number 5, please. Could you just describe the structure of that summary with your columns going from left to right.

A. So from left to right on Slide 5, what I tried to do was to organize our rebuttal in the sense of, you know, what were the questions being asked in Order 1303 -- you know, how each of the different parties responded to that and then just comments or remarks regarding that, which is the last column.

So as we -- as we look at this slide, you know, I've organized it into geographic boundary status as from top to bottom on the left column; status of aquifer recovery; annual quantity of groundwater that may be pumped; you know, impact of pumping on the Muddy River Flow and the movement of water rights between aquifers.

So -- so this is -- this is -- this particular slide is a summary of what we found and -- and I think the

most important thing that -- that we saw that we really disagree with is the amount of groundwater that can be pumped from the -- from the groundwater system.

And so it's really that disagreement which is based on some of our differences in the understanding of how climatic conditions and how structural barriers and -- and faults are characterized.

Q. No dispute with respect to SNWA's findings on the geographic boundaries?

A. You know, we agree with SNWA with regard to those boundaries. The SNWA report identified the no change from the State Engineer boundary and that, you know, the only -- and so -- so we -- we don't disagree with that.

Q. Is it a disagreement with respect to the status of aquifer recovery, the second item on your summary?

A. You know, I -- I -- I think that the -- what's really important is that they -- they identify the fact that, you know, recovery occurs during extraordinary events similar to '04 and '05.

And so my -- my remark to that -- and so we -- so SNWA is providing and acknowledging that those hydrologic events have an impact on the resources that we see in the Lower White River Flow System, and the only comment I make to that is that, you know, the wet hydrologic condition is part

of any boundary. I mean, it's part of any hydrologic balance to hydrologic cycle.

So when you consider management in this area, such things as, you know, wet years, you know, wet years like '98, wet years like '04 and '05 and wet years like 2010 all need to be considered when -- when determining the status of the aquifer recovery.

Q. The Water Authority determines in its report that the annual quantity of groundwater that can be pumped is between 4- and 6,000-acre-feet per year.

Do you agree with that?

A. No, I do not.

Q. Please explain why.

A. You know, I really -- I really believe that the evidence provided by -- in their report did not support pumping that's occurring -- that -- the amount of pumping that can occur from the carbonated rock.

Q. For what reasons?

A. Well, the best way to show this would be to look at Slide 8.

Q. Rebuttal Slide 8, please.

A. Right. So Rebuttal Slide 8, which is -- you know, I kind of quote that the -- the -- the summary, which says that "if the conflicts with senior water right holders are adequately addressed, the total annual groundwater production should be managed between 4,000 and 6,000-acre-feet over the long run."

And the basis for that is presented in the report in Section 6.2.4 which -- which compares the contribution of Warm Springs West Flow to the Muddy River Flow.

So it's a -- it's an analysis where they identify that approximately seven percent of the flow at the Muddy -- and I should be careful. It's not the Muddy River Flow but the discharge from the Muddy River Springs area.

So, really, what -- what their analysis looked at was a flow from the Warm Springs West compared to the discharge from the Muddy River Springs area.

And in that -- in that analysis, they assume that approximately seven percent of the discharge from the Muddy River Springs area is due to contributions from the Warm Springs West Gauge.

Q. Does the Water Authority explain why it does not include the alluvial pumping?

A. No, they do not.

Q. Do you think that should be considered in this analysis?

A. I think that the State Engineer asked to understand how much -- the quantity of water that can be

pumped from the Lower White River Flow System, and the analysis presented in 6.2.4 addressed pumping from the carbonate aquifer.

So -- so I think that, yes, the alluvial pumping should be considered, maybe not in this analysis but in a response to the State Engineer. Alluvial pumping should be addressed.

Q. In the third bullet point on the bottom of Rebuttal Slide 8, you refer to the Water Authority's use of linear relationship.

Could you explain, please.

A. Yeah. I think the best way to show that would be on Slide 9.

So what Slide 9 shows is a graphical representation of a table that they presented in the July report. So the table in the July report related decreases in flow at Warm Springs West to decreases in flow or discharge from the Muddy River Springs area.

So -- so we've chosen to -- for this analysis to use the Moapa gauge as kind of a de facto discharge from the Muddy River Springs area. But what we've shown on this graph is the axis on the left is the flow at the Warm Springs West. And the blue line is the Warm Springs West flow.

So, for instance, if you -- if you look on the

left axis at approximately 3.82 -- I guess that's pretty precise, but 3.82 is the estimated predevelopment flow in the Warm Springs West Gauge.

And as that flow decreases down to zero -- you can -- you can see zero on the bottom. If you go over on the right axis, that also equates to 3.82. So that's a relationship between, you know, flow on the left axis and decrease in flow on the X axis. So the X axis is really how much does the flow decrease.

So on the upper axis or on the upper line, we see that -- we see that that red line or orange line, that's actually discharge from the Muddy River at the Moapa gauge. And it, too, but you read it off the right axis.

So at the top, it's 50.2. So you can see that basically, it correlates with 50 CFS, which is predevelopment flow in the Muddy River.

And so then, as we as look at the table that was presented, you can see that what it -- basically, what it shows is that when there's a 1.12 drop in CFS drop in flow at Warm Springs West, which is -- you know, you can read it off the X axis.

If you go over to 1.12 and then up, you can see that that's that 1.12 CFS decrease from 3.82 down to 2.7; that it results in a flow reduction in the Muddy River Springs -- I

mean, from the discharge from the Muddy River Springs area from 15 CFS.

And that's read by looking at the 50.2 down to the approximately 35 CFS. So that's the data that's presented in -- in their report. And as discussed in that report, then that 15 CFS drop would be a decrease of approximately 10,000-acre-feet.

The numbers that they present to get to the 4,000 to 6,000 is -- is basically addressing the amount of flow decrease when Warm Springs West would decrease from 3.82 down to 3.2.

So I think it's important to understand that the analysis that they presented for the 4,000 to 6,000 range is based on this linear relationship. If you were to continue this linear relationship down to the right, you can see that when there's more and more flow decrease, that there's a direct decrease in the flow at the Muddy River.

And -- and that's the part that I think is -- is flawed in their analysis in the sense that it doesn't account for a non-linear relationship of contributions that would occur from the alluvial aquifer.

Q. And is there contributions from the alluvial aquifer to the Muddy River?

A. Yes.

Q. Accounted for by SNWA?
A. Not in this analysis, no.
Q. With respect to SNWA's report that CSI did not ignore groundwater levels in CSV production wells, do you recall that area of the report?
A. Yes, I do.
Q. Do you agree with that?
A. No, I do not.
Q. I'm referring to Rebuttal Slide Number 10. Would you please explain.
A. So there's a statement in the report that the hydrographs of the three CSI wells and CSVM-1 exhibit the same shape and general decline occurring during the two-year aquifer test and the responsive MX-5 shutdown and restart in the middle of the stake. And so they're staking, it was unmistakable, and we ignored that.
And, you know, my response to that is, no, we did not ignore that but, in fact, that SNWA ignored the specific temporal distribution of pumping from the different CSI wells.
So, in fact, when you look at those wells, you have to take into account the pumping that's occurring on the west side and the pumping that's occurring on the east side of that block in order to understand why those production wells support -- support our analysis.

CSI-1, -3, and -4, those -- those wells that are located on the west side, they do behave differently than those wells that are located on the east. I'm going to show you that in a second.
But also, I wanted to point out that, you know, we're not alone in this. Others have also identified that there is a lack of information or lack of data that really supports any type of hydraulic connection between -- between the west and the east side.
But if you look on 11, on Slide 11 -- you know, the purpose of Slide 11, again, is to remind everybody where all these wells are.
So we look at the carbonate production wells, and those are in blue: CSI-4, CSI- -- CSI-3. I'm kind of going down and CSI-3, CSI-1, CSI- -- and MX- -- MX-5. So we look at those wells and we also look at those monitoring wells which is UMVM-1, which is the upper part of the Muddy River Springs area. CSVM-1 or -- and also CSVM-6 -- no, I'm sorry, MX-4 and CSVM-6. Those are the monitoring wells that I want to show you in the next slide.
So when we look at Slide 12 --
Q. Let's refer to these as rebuttal slides so they're different than the ones that you previously -- so this is Rebuttal Slide Number 12, please.

A. Right.
Q. Go ahead and explain.
A. So Rebuttal Slide Number 12 shows you how we viewed those similarities. You can see -- again, I don't want to -- and, you know, so there's some of this information on this graph.
But as you look at it, the bars on the bottom are individual pumping in the Coyote Springs. Gray is pumping from CSI-1. Yellow is pumping from CSI-2. Blue is pumping from CSI-4, and green is pumping from CSI-5. And -- and then kind of orange-pink is CSI-3.
So we can see -- and I believe that we've all looked at this hydrograph many times today. And what the -- what we -- what we're presenting here is the fact that MX-4, CSVM-6, and UMVM-1 are all responding identically.
What I've done here for presentation purposes is I want to make sure that we're not showing the true elevation. It's important for everybody to understand what these are is these are hydrographs that are all shown on -- based on the same scale, but they've been offset so that we can show you exactly how they compare.
It's just an important -- the right axis -- it's important to understand that we're not trying to say that these are the actual evaluations but rather, they're relative

change in elevations from one to another.
So I think, you know, this really shows that.
And then we go ahead and we look at CSI-2, so when we throw on the available data from CSI-2, we can see that it too also behaves quite similarly to CSI-1 -- I mean MX-4, CSVM-1, CSVM-6 and UMVM-1.
It's the same things that we talked about today. It's -- it's the recharge in '05 event that you see the rise in groundwater levels. It's a decline over the -- over the long period down to 2013 at the end of the test.
It's a -- you know, it's a slight pump up in 2010 due to the recharge event in 2010 and then flat conditions kind of over the last four or five years. But what's really important that we look at is -- is also that -- that response that occurred in 2011.
So -- so, you know, the data, I think, are pretty remarkable that, you know, we have these observation wells and monitoring wells, and we can compare, you know, nearby production wells. They're all -- they're all pretty much behaving the same.
And --
Q. Can I interrupt because I think we have approximately ten minutes left, and I want to cover some ground with you.

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What you have now displayed is Rebuttal Slide 13; correct, sir?
A. Right.
Q. And that's slide from which you were just testifying?
A. That's correct.
Q. And the significance of Rebuttal Slide 14 to this hearing is what, sir?
A. The significance is is that the characterization of the other production wells: CSI-1, CSI-3, and CSI-4 are different than what we see when we compare CSI-2, MX-4, CSVM-1, and CSVM-6.
Q. Does that reflect the significance of the block that you referred to?
A. The block?
Q. The fault.
A. Oh, the fault. I'm sorry. Yes, it reflects the importance of the structural block that exists between the west and eastern sides of the Coyote Spring Valley.
Q. How so?
A. Because it works to isolate the hydraulic connection between the two.
Again, we go back to this idea that these nominal faults -- not just those along the block, but other normal

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faults that we've identified -- create these preferred flow -- flow ways and pathways.
And that in a perpendicular direction, we see that not only the faults but also the structural blocks can act as barriers to groundwater flow in a perpendicular direction.
Q. Did you analyze the reports submitted to the State Engineer's office by the United States Fish and Wildlife Service?
A. Yes, we did.
Q. And would you take a look at Rebuttal Slide 15 and explain your analysis and findings, please.
A. We looked at the Fish and Wildlife report, and, again, we disagreed with the assessment of the amount of groundwater that can be pumped from the Lower White River Flow System.
And I think that, you know, a lot of the basis for our disagreement really comes down to the importance of the hydraulic variability that we see in the system and how groundwater levels are driven by that hydraulic variability.
Q. With respect to Rebuttal Slide 16, does that show the analysis that you just referred to with respect to FWS's estimate of groundwater availability?
A. Yeah. I think it does. And I -- I think one of

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the -- one of the things that we want to point out here is that they identified that steady-state conditions were not reached in EH-4 until late 2015, and spring flow and streamflow were relatively constant.
And I apologize for that typo where it says 2017 to 2017. It should be 2015 to 2017. So that's -- that's an error I made.
Q. In the first bullet point?
A. In the first bullet point.
Q. Thank you.
A. So one of the things that -- that really kind of struck us was that it doesn't really account for local pumping. And so this is, again, you know, what -- what is the impact of local pumping on nearby spring flow and nearby observation wells and how does that get taken into account when you're trying to assess, you know, what -- what the -- what the resources are and how those resources react along with that and climatic conditions. I think that's best described in Slide 17.
Q. Rebuttal Slide 17, please.
A. I'm sorry. Rebuttal Slide 17.
And in Rebuttal Slide 17, you can see that, you know, we -- we -- the green bars along the bottom are pumping in carbonate wells in the Muddy River Springs area, and the

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squiggly line on the top with the hydrograph with the annual variability, that's something that we've looked at for the EH-4 before. And then, of course, the straight solid black line is the cumulative departure from mean.
But what really struck out from us on this is the fact that from 2013 to 2014, average pumping from those carbonate wells in the Muddy River Springs area is about 1442-acre-feet. But when we get to 2015 and 2017, that average pumping has increased to about 2700.
So you can see that when you look at the hydrograph, if anything, there's been a slight recovery with increased pumping rate in that, but in that near vicinity of the Muddy River Springs area.
But, again, while pumping plays a big role in describing, you know, the characteristics of a hydrograph, it's also the -- the climate that can't be ignored on how that also affects it.
Q. This might be a question better suited for one of your colleagues, but was the Series C's analysis reliable in your opinion?
A. You know, I -- Miss Jean Moran reviewed the hydrogeologic aspects of both the Theis and the SeriesSEE, so I'm going to defer to her to answer that question.
MS. MORAN: The SeriesSEE is a spreadsheet

adaptation of handling the Theis curve, and it is developed by the USGS. And it calls upon a Fortran code to solve for the distribution of drawdown based on pumping.

And I did not do SeriesSEE. I mean, I do numerical modeling and fairly complex models, but I do not do this particular analytical tool.

So I did do the simplified Theis equation, as I presented earlier, and I showed that as a cross-check, looking at the SeriesSEE, if you had two wells pumping and their distances and their two-year average pumping that was during that pumping test, what effect would be at roughly VH-4.

How the report goes with SeriesSEE, it's an appendix, and it's Appendix A. It is a really -- it's a good analysis of things other than we do not have all of the data to cross-check it.

But when I cross-checked it with my very simple model, it showed that it had more influence from a well pumping further away than a well that was closer.

So the -- the simple cross-check that I did didn't check out with the SeriesSEE. I have no way of knowing what the -- the -- the assumptions were that were used. Clearly, we probably used different T's and different S's, which were the hydraulic properties. But we would have used the same, and it should have been relatively the same for

those values.

The figure I'm referring to is in the 2013 July report from Fish and Wildlife Service, and it's Page A.4-2. What it shows is Arrow Canyon's contribution to EH-4's drawdown would have been 0.7, and then MX-5 was 1.2.

So that's opposite just doing a cross-check. So though I don't know SeriesSEE inside out, it's still the simplified Theis equation, and to my knowledge, it didn't have any recharge in it and it didn't have any boundaries in it that could have been handled with image wells.

To my knowledge, that wasn't done. So I don't have the full answer, but it put in question how this works.

Q. Would you please put up Rebuttal Slide Number 19 and let's turn our attention to the National Park Service.

Mr. Reich, did you analyze their initial report and find flaws in it?

ANSWERS BY MR. REICH:

A. Yeah, I reviewed the National Park Service report, and one of the comments that they make in their report is that gravity data should not be ignored when defining the geometry of some of these basins.

Q. Do you agree with their suggestion that there's less than 14,500-acre-feet per year available for the administrative unit?

A. Yes, I disagree with that value because, again, it's these hydraulic barriers and flow paths that, you know, that support pumping in different parts of the Lower White River Flow System, as I've shown in my previous water budget, upwards of 30,000-acre-feet per year.

HEARING OFFICER FAIRBANK: Mr. Robison, just to let you know that you're at your three hours if you wanted to reserve your 30 minutes for rebuttal.

MR. ROBISON: I'm going to intrude on the redirect time for three minutes or less.

HEARING OFFICER FAIRBANK: Sounds good.

MR. ROBISON: Mr. Reich, would you please turn your attention to Rebuttal Slide 25 and tell us what your analysis is concerning the report of the Moapa Valley Water District.

ANSWERS BY MR. REICH:

A. I'm sorry. We reviewed the -- the Moapa Valley Water District report. And for the most part, what we found was that we disagreed that the carbonate aquifer is in somewhat of a steady-state condition.

So if you turn to Slide -- Rebuttal Slide 26, they're stating that the aquifer is in a somewhat steady-state condition, and while they don't specify an amount of groundwater that may be pumped, they do state that, you know,

based on the -- Order 1303 that the current amount of pumping corresponds to a period of time in which spring flows have remained relatively constant and have not demonstrated a continuing decline.

So, again, I wanted to stress the fact that carbonate -- carbonate levels and spring flow in the Muddy River system are driven by climatic conditions -- we've seen that signature throughout today -- and that structural features and heterogeneities also affect this -- affect understanding and decisions that can be made regarding whether we're in -- whether we're in steady-state conditions.

And also, importantly, we have seen similar rates of decline in -- in spring flow at the -- at the Muddy River Springs.

I think it's -- if you go back and you look at the record, you can see that, you know, following wet periods in '99 and 2000, we saw rates of decline. While -- while the minimum levels did not reach what we've seen, certainly the rates themselves, we do see those rates of decline.

So understanding that hydrologic condition with respect to how pumping -- pumping and recharge affect spring flow -- and spring flow, I think, is really fundamental to understanding the system.

Q. Mr. Reich, we have had an estimate of 4- to

6,000-acre-feet per year given by the Water Authority, 9318 by Fish and Wildlife, something less than 14,5 from the Park Service, and year similar, estimating that up to 30,000-acre-feet of availability for groundwater pumping in the administrative unit.
Please explain why these -- your number is a better number to be used by the State Engineer's office?
A. Well, I believe we brought forward today a set of data and information that the State Engineer can use to assess and develop his own conceptual model and water budget.
So what we've done today is we've provided that information that provides a complete picture. I believe that others have not provided that understanding of how the system works, where groundwater flows, how -- what it affects.
You know, and that's something different, and I think -- you know, we hope that the State Engineer will consider the data that we presented today and understand why we think that that information can be used to assess a pumping number that can be used for the area.
MR. ROBISON: Thank you, sir.
We'll submit this part of our case.
HEARING OFFICER FAIRBANK: Thank you. So we have about 15 minutes until we're going to go ahead and break for lunch. So if we want to go ahead and we can start -- the

first participant for asking questions of the panel for cross-examination purposes is the United States Fish and Wildlife Service.
And so if they have any questions, I'm going to go ahead and give you guys 14 minutes to go ahead and make that presentation.
And before you start asking questions, if you'll just go ahead and state your name and make an appearance for the record. And just for the purposes of making appearances today, I'm going to ask each of the attorneys to do so when they speak.
We're also going to go ahead and, for purposes of identifying all the parties that are here, mark as an exhibit the sign-in sheet. So if there's participants who have not signed in on the sign-in sheet, please make sure you do so before the close of business today.
Go ahead.
MR. MILLER: Okay. My name is Luke Miller. I'm with the Department of the Interior's Office of the Solicitor on behalf of the Fish and Wildlife service.
SPEAKER FROM THE AUDIENCE: Madam Chair, are you going to swear the witness?
HEARING OFFICER FAIRBANK: I'm sorry?
SPEAKER FROM THE AUDIENCE: Are you going to

swear in the witness?
HEARING OFFICER FAIRBANK: He's not a witness. He's an attorney asking questions.
SPEAKER FROM THE AUDIENCE: Okay.
CROSS-EXAMINATION
MR. MILLER: Thank you.
I think we were trying to prioritize some of our questions here, so I want to skip to the chase here.
I believe it's Ms. Moran did the SeriesSEE analysis?
MS. MORAN: I did not do the SeriesSEE analysis. I did a Theis equation checking the SeriesSEE analysis.
BY MR. MILLER:
Q. Okay. Well, in relation to the SeriesSEE analysis by the Fish and Wildlife Service?
A. Yes. That's correct.
Q. Okay. Would you agree or are you aware that the data interpreted using SeriesSEE Curve-fitting by DOI in 2013 like monthly pumping at major wells within the -- within the study area, groundwater level data collected and reported in that study area is available on the Nevada Division of Water Resources' online and publicly accessible website?
A. Yes. I'm aware of that.
Q. Would you also agree that the -- the USGS

SeriesSEE Excel add-in code is a public domain that has been publicly available from I believe it's 2012 to present on the USGS publications warehouse?
A. That's correct. 2012.
Q. Okay. And it sounded like you had familiarized yourself somewhat with the SeriesSEE instructions, I guess we want to call it, from the -- let's see if I found it here. USGS Techniques and Methods, Halford, et al?
A. That's correct. It's available from the website. I downloaded it.
Q. Okay. Well, do you agree with the USGS authors of that SeriesSEE regarding their characterization of the purpose methodology employed and intended application of SeriesSEE?
A. I -- I guess I'd like you to restate it.
Q. Yes. How about this.
A. Okay.
Q. Would you agree that it's essentially a Curve-fitting tool as opposed to a distributed groundwater flow model?
A. That's correct.
Q. Okay. Would you also agree with the authors of SeriesSEE that the parameters of, say, the Theis transforms as applied in that SeriesSEE Curve-fitting analysis are neither

intended to represent or serve as estimates of aquifer parameters like such as transmissivity and storage coefficients?
A. Well, I guess I'm not aware. Could you explain what your statement means.
Q. Well, let's see here. Probably not, but give me a second.
A. It seems a little twisted. If you state it again, maybe I can --
Q. Okay.
A. -- figure it out.
Q. Well, we're trying to see if you agree with what the authors of the SeriesSEE outlined as the use of parameters or Theis transforms as applied in SeriesSEE in a Curve-fitting analysis.
Are they neither intended to represent or serve as estimates aquifer parameters?
A. They're not aquifer parameters. It's a Curve-fitting. Yeah, it's still a little -- it sort of misses.
Q. Okay. Well, I might just move on from that one.
A. Okay.
Q. So it sounds like you are knowledgeable about the DOI's 2013 application of SeriesSEE to the analysis of the

Order 1169 pumping tests?
A. Yes, I am.
Q. And the DOI's 2013 interpretation of those reports?
A. Yes. They presented a series of graphs. It was -- I could follow what they said, yes.
Q. And would you say that your approach to your effort -- I believe you said it was a Theis -- central Theis?
A. Non-equilibrium well equation.
Q. And that was an effort to evaluate the SeriesSEE analysis?
A. It was sort of independent. It was independent. But it did come from having the 2013 report available and that they did use the Theis equation.
And though I typically do numerical flow models that handle a lot more pieces in it and this is more analytical, I decided to do something similar but not -- it's not identical because it doesn't move those curves. But it does solve for what would be a drawdown.
And it helped while I was reviewing a report to see the relative impacts from the different pumping. I suppose I should have showed something, but it's in your report.
What's nice about these graphs -- I mean, I could

do to solve this other than I didn't agree with the results. And I -- it shows the different pumping in the basin and then it -- it puts the relative impact to that particular observation well from those wells.
So it's pretty straightforward that way other than I didn't know what the assumptions were that went in. Because some kind of knob is in there that has to be adjusted to weight the different wells, and that -- it got weighted such that a well closer that, in my estimation, should have had more impact had less.
It just sort of raised a red flag that I can't resolve without more background data here.
Q. So did I understand earlier when you were testifying that it's not necessarily that the Fish and Wildlife Service's SeriesSEE analysis is completely or necessarily unreliable but that you're potentially missing some data in your perspective and to reproduce it?
A. That's correct with the caveat that just a simple cross-check analytical model should be able to be cross-checked. So do numerical models. You want to have a cross-check in them so they don't become a black box.
And when I did my analysis, though simple, it should have ran as a cross-check to it -- relative cross-check, not absolute. And, yes, it -- it is a SeriesSEE.

I have no problem with the program. I just don't have the background information. So, yes, maybe background information would resolve that, but I don't know.
Q. Okay.
MR. MILLER: No further questions.
HEARING OFFICER FAIRBANK: Okay. Thank you.
Next will be National Park Service.
CROSS-EXAMINATION
MS. GLASGOW: Good morning. I'm Karen Glasgow with the Office of the Solicitor, Department of Interior, and I represent the National Park Service. Hi. I just have a couple of questions. Just sort of making sure I understood what you testified to earlier.
BY MS. GLASGOW:
Q. So I understood that you testified that you believe an appropriate estimate for recharge to the Coyote Spring Valley from the Sheep Range was 5,280-acre-feet per year?
ANSWERS BY MR. REICH:
A. Yes. That's correct.
Q. Okay. And is it not true, then, at 520-acre-feet per year that that's greater than the mean value of 34,348-acre-feet per year that is contained in Appendix C for the recharge to -- why do I want to not say that right? -- to

Coyote Spring Valley from the Sheep Range?
A. Yeah, I can -- I'll be happy to answer that. I think it's a good point that you look at. So what we did -- and the appendix that you're referring to is the literature review that we did for other -- other reports that were out there.
And as Ms. Palmer mentioned, there were more than 12 different reports that we looked at to come up with that -- with that average, and there is different techniques used for each one of those.
What we did was we provided that information, so I think people can ask a great question like that. But we -- we developed an independent analysis, and so our analysis was independent. And while it might be greater, I don't know. I am -- I guess they are responsive to yes, it's greater than the average, yes.
Q. Thank you.
You talked about barriers from both natural faults that were mapped by CSANT and structural blocks that were mapped by CSANT that coincide with geological mapping from I think you quoted Rowley.
A. Yes.
Q. Okay. How permeable is this structural block?
A. Oh, so how -- we -- we -- we assume that the

structural block is not permeable.
Q. Is it true that MX-5 actually is within the structural block?
A. It's drilled right on the edge of the -- in the structural block, which I would consider to be in the damage zone of that structural block.
Q. Lastly, so you talked about the SNWA 2000 -- I think --7 report?
A. Correct.
Q. Okay. And in that report, SNWA states that there's 4,190-acre-feet in a tributary that contributes to the Lower White River Flow System and to the local recharge; correct?
A. I would have to look to review which tributary is that.
Q. Kane Springs.
A. Kane Springs. Yeah, I can look. It will take me two seconds --
Q. Okay.
A. -- and I can confirm that.
Yes. We've summarized that in Table 9 as 4,200-acre-feet per year from Kane Springs based on the 2007 report.
Q. But -- okay. So -- so yes, the report does.

Do you agree with that, I guess, is a better question? Do you agree that the Kane Springs contributes any acre feet of whatever amount to the local recharge?
A. You know, so I think -- could you rephrase the sentence -- or question because I think there's two questions there. I'm not sure which --
Q. Well, my question was: The report says that Kane Springs contributes 4,200 -- I'm rounding up, as you did -- acre feet of water to the tributaries to the Lower Water -- Lower White River Flow System and contributes to the local recharge; correct?
A. That's correct.
Q. Okay. But now -- and so -- and so my question, I guess, is do you agree with that statement, that the Kane Springs contributes acre feet to this -- to the Lower White River Flow System and to recharge?
A. Yes, I agree that the Kane Springs Valley contributes regional recharge to the Lower White River Flow System similar to the other tributary basins that I discussed in my testimony.
Q. Okay. And so then I guess my question is: How -- you indicated on page 55 of your July 3rd report that you did not believe that the Kane Springs should be included in the Lower White River Flow System because of geologic

characteristics.
A. Correct.
Q. Okay. So tell me -- explain how those two go together. How is it if it's contributing to this recharge that we're talking about, why is it not -- why is it, in your opinion, not to be included?
A. Right. And the best way to describe that is if we go back to my budget and I show that, you know, there is inflow from Pahranagat Wash and there's inflow from Delamar and there's inflow from Kane and there's inflow from Lower White River Flow System, you know, we've stated before and I stated during our direct testimony that we agree with the State Engineer's boundary for 1303, but we also state that these other resources need to be accounted for.
So -- so we can -- we can isolate and manage the Lower White River Flow System as per Order 1303, but in order to understand how those resources occur and move through that system, then it's important to understand what that regional flow into the aquifer is.
So -- so I treat Kane Springs the same way I treat Delamar and Pahranagat and the other basins, and that is as a source of regional groundwater inflow into -- into the basin.
Q. But ones that should not be included as part of

the flow system that we're talking about here?
A. It -- the answer --
Q. For management.
MS. GLASGOW: Okay. Thank you very much.
THE WITNESS: Thank you.
HEARING OFFICER FAIRBANK: All right. It is noon, so we will go ahead and take a break for lunch.
And then we get back, next up for cross-examination will be the Moapa Band of Paiute Tribe, and we'll continue on down the list.
Thank you very much, and we will be back and start promptly at 1:00 p.m.
(Lunch recess at 11:59 a.m.)

CARSON CITY, NEVADA, MONDAY, SEPTEMBER 23, 2019, P.M. SESSION
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HEARING OFFICER FAIRBANK: And I -- just as a real quick preliminary matter, just to address some questions and concerns that had been raised via an objection with regards to the introduction of the PowerPoints or the use of the PowerPoints, just to go ahead and clarify to make sure that the record and the parties are abundantly clear that the PowerPoints will be maintained in the hearing -- in the hearing record as demonstrative exhibits. But they are not the substitute for the reports or the exhibits submitted by the parties timely.
So just as -- they'll be maintained in the hearing file, but they are not going to be relied upon or, you know, for the purposes and substitute that for the reports in evidence that was submitted by the parties pursuant to the scheduling order.
With that being said, we'll go ahead and move on and next up will be the Moapa Band of Paiute Indians.
MS. BALDWIN: I am Beth Baldwin for the Moapa Band of Paiute Indians, and with me is Debbie Leonard, local counsel. I just have a few questions.

CROSS-EXAMINATION
BY MS. BALDWIN:
Q. Mr. Carlson, you testified that fault zones can be narrow and may not correspond to surface features; is that correct?
A. Yes, that's true.
Q. And, Mr. Reich, is it accurate to say that known faults depicted on geologic maps may be located differently than assumed?
ANSWERS BY MR. REICH:
A. Yes, it is. We used geophysics to redirect where those faults were going to be located.
Q. And the C -- I'm going to get this wrong. The CSAMT survey was only in Coyote Springs Valley; correct?
A. Yes, it was only in Coyote and -- yes, Coyote Springs Valley. I'd have to overlay it. They're -- yes, it was. I was concerned -- the reason I hesitated was because it might have been in the northern part of Muddy River Springs area, but no, it was all in Coyote Springs Valley.
Q. Would -- could undetected or mislocated faults exist elsewhere in the Lower White River Flow System?
A. Yes.
Q. And would you agree that accurate description of groundwater flow depends upon knowing fault locations?

A. Yes.
Q. And just to confirm, the panel concluded that the carbonate aquifer is heterogenous throughout its entire extent?
A. We identified the heterogenotes in Coyote Spring Valley Muddy River Spring area based on the work that we presented today. My -- we did not present evidence today about heterogenotes outside of that area, but based on review of Rowley's map and my review of reports by others, there are both thrust faults and normal faults that exist throughout the rest of the Lower White River Flow System.
MS. BALDWIN: Thank you. That's all.
HEARING OFFICER FAIRBANK: Thank you. Next will be Southern Nevada Water Authority and Las Vegas Valley Water District.
MR. TAGGART: Is it possible to have the PowerPoint up on the screen? I'm going to have a few questions for him.
MR. HERREMA: Which PowerPoint?
MR. TAGGART: Both. Starting though with the --
HEARING OFFICER FAIRBANK: Mr. Taggart, will you make sure your mic is on?
MR. TAGGART: Yes. If it's possible, I may have some questions about each one of the PowerPoints.

HEARING OFFICER FAIRBANK: Okay. Looks like it's up.
MR. TAGGART: Thank you. I want to make sure we have a clock going.
HEARING OFFICER FAIRBANK: I have one, too, so don't worry about that.
MR. TAGGART: All right.
CROSS-EXAMINATION
BY MR. TAGGART:
Q. Good afternoon, panel. My name is Paul Taggart. I represent the Southern Nevada Water Authority and the Las Vegas Valley Water District, and I have a few questions for you.
First, to Mr. Reich, from your testimony, do you agree that alluvial pumping in the Muddy River Springs area affects the Muddy River?
ANSWERS BY MR. REICH:
A. Yes.
Q. Okay. And I think in your report, you indicated immediately it affects the Muddy River; right?
A. I'd have to get the exact wording, but my intent would be that immediately, yes.
Q. Okay. Would it be fair to characterize that as a one-to-one effect from pumping versus capture of river flow at

alluvial pumping in the Muddy River Springs area?
A. I'm sorry. Could you repeat that because -- is it the -- just one section at a time. I'm sorry.
Q. That's fine. I'll move on.
A. And also -- no, I --
Q. I have very short time, so I'll just move on.
Do you also agree that carbonate pumping in the Muddy River Springs area affects the Muddy River Springs?
A. Yes, I do.
Q. Okay. And you also agree that pumping in the Coyote Spring Valley at MX-5 does impact the Muddy River Springs; is that correct?
A. Yes, I do.
Q. Okay. Now, I have a couple questions for you from Figure 10 in your report. And maybe I'll just use your PowerPoint, but I didn't see this one.
A. Oh, my report. I'm sorry.
Q. Yes, Figure 10 is on page 26 of your report?
A. Yes, I'm looking at it now.
Q. Great. So is it fair to say that this figure represents your modification of the Rowley geologic understanding from 2017?
A. Yes, it's a close proximity.
Q. So let's go through. What changes did you make

to the geologic map from Rowley and that are reflected on this? And let me -- what I'll ask you first is, there's a dotted line that runs along the highway. I'm going to refer to that as the Highway Fault. Do you see the one I'm talking about?
A. Are you suggesting there's CSM-5? CSM-5 -- or no, CSI-4?
Q. Well, there's a Highway 93. Do you see that?
A. Oh, no, I'm just saying there's two parallel dotted lines along Highway 93. There's one on the left and one on the right.
Q. Okay. So you see the Highway 93 there?
A. Yes.
Q. And you see where CSI-4 is located right on the highway?
A. Yep.
Q. And just to the right of that is a dashed line that runs parallel to the highway. Do you see that?
A. Correct.
Q. And I'm going to be referring to that as the Highway Fault. And is that new in your analysis to any prior geologic understanding of the area?
A. That is a fault that Mr. Carlson's identified earlier in his testimony that we would use Rowley's fault and

move that to the west.
Q. Okay. So is that fault located in any other geologic literature prior to your report?
A. Yeah, I believe that's -- it's located and I have a -- located in Rowley, that we would take that and move it to the west.
Q. Okay. Now, what other modifications have you made to the Rowley map?
A. The boundary fault that's running through CSI-3 and just to the right of CSI-1, that was the fault that would be on the west side of the structural block.
Q. Okay. Now, I have a question for Mr. Carlson.
So, Mr. Carlson, you see the -- good afternoon, sir.
ANSWERS BY MR. CARLSON:
A. Yes, hello.
Q. Do you see the figure that we're talking about?
A. Yes.
Q. Okay. And do you see where the A-A prime cross-section is located on that map?
A. Right.
Q. Okay. Now, I want to ask you about that cross-section. And in your PowerPoint at slide number 17, could we put that up, please?

Okay. Now, you see we're on Figure 10 from the CSI number one, the expert report from Mr. Reich and others, do you see where the A-A prime cross-section crosses this Highway Fault we've been talking about?
A. Right.
Q. Do you see that?
A. (Nodded head.)
Q. Okay. Now, I want to read from your report, which is an appendix to CSI number two. Are you familiar with that document?
A. Yes.
Q. All right. And on page 7 of that document, it says -- it describes some man-made culture, some noise in that area on the west end of that cross-section. And when I'm looking up at the screen, I'm asking you specifically about the area between site 1500 and site 3300. Do you see that?
A. Yes.
Q. And is that -- that's the area Mr. Reich is relying upon for the location of the Highway Fault; correct?
A. No. The Highway Fault is just to the west of that. That -- the label on there, that's the zone of cultural effects I mentioned, man-made conductive features.
They were doing some construction of some sort there, but there's man-made conductive features, pipelines, a

lot of electrical noise. So that area there, I can't quite see the label, but that area you just named is the cultural effects.
Q. Okay. So in your report, you state "the very unusual resistivity data near the west end of the line, line A, and the upper thousand feet of this section centered at station 2100 is likely the result of noise and is not likely a valid geologic structure," right?
A. Right.
Q. And east of approximately station 3300, the data appear reasonable, right?
A. Right.
Q. So isn't it -- is it fair to say that the resistivity data west of the 3300 section should not be considered because of the noise or the data?
A. No. I say that the infrastructure that's being built and causing the noise is in the vicinity of stations 2,000 to 3,000, approximately 2,000, depending on exactly where the -- where you land on the GPS. West of approximately station 2,000 appears to be valid data.
Q. Okay. Even though, in your report, it says east of approximately 3300, the data appear reasonable?
A. Right.
Q. Now you're saying the data east of 2,000 appear

reasonable?
A. No, west of 2,000. The data in between the cultural noisy things that were causing us problems and to the west end of the line, that was good data.
Q. Okay.
A. From approximately 2,000 to 3,000 roughly is noisy data that we consider invalid.
Q. All right. Now, Mr. Carlson, are you confident that 5,000-acre-feet of water can be pumped to the west side of the Highway Fault based on your resistivity data alone without causing impacts to the Muddy River or the Muddy River Springs?
A. I'm not a hydrologist, so I cannot answer that. I can answer questions about the data, the resistivity, and the measurements made. But I'm not a hydrologist, so I don't know what can be pumped.
Q. But in -- given your expertise, do you consider the resistivity data, itself, and alone to be sufficient to make a conclusion I just asked you?
A. No, I can't draw that conclusion myself, A, because I'm not a hydrologist, and B, because we have two lines of data that show a fault. But, hydrologically, what's happening from one side to the other is for the geologists and the hydrogeologists to work out.

Q. Okay. Now, Mr. Reich, back to Exhibit 10 -- I'm sorry, Figure 10 from your report, so the Highway Fault I asked about, that was moved and modified from where Rowley had it; is that correct?
ANSWERS BY MR. REICH:
A. That's correct.
Q. Any other changes based upon your analysis to what Rowley found in 2011?
A. Can I pull Rowley out real quick and I'll tell you?
Q. Well, I don't really have time for that. So --
A. Yeah, that was the major change, yes.
Q. Okay. I want to ask you about the water budget analysis that you did. Do you know how much water the State Engineer indicated in ruling 6255?
And first of all, are you familiar with ruling 6255 that established the joint hydrologic area for considering pending applications for groundwater rights?
A. Yes, I'm familiar with it.
Q. And are you -- do you know how much water the State Engineer indicated was available as perennial yield in the Lower White River Flow System in that order?
A. Available for perennial yield? I'd have to -- I'd have to go back and review the order. My understanding

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was that the order was looking at additional water rights applications for appropriation and that the order decided that there was none available.
Q. All right. Let me ask you to assume for the purpose of my question that he indicated that 50,000-acre-feet is the perennial yield available in the Lower White River Flow System. Do you know how much of that perennial yield is allocated to the Muddy River itself?
How many acre feet of perennial yield to the Lower White River Flow System should be reserved for the flow of the Muddy River?
A. Based on what was stated in 6255?
Q. Yes.
A. No, I do not know with 6255. I would have to go back and review that document.
Q. Okay. Would you disagree that 37,000-acre-feet was the predevelopment flow of the Muddy River on average?
A. No, I would not disagree with that.
Q. So if those numbers are correct and the State Engineer indicated that 50,000-acre-feet was the perennial yield and 37,000-acre-feet needed to be reserved for the river, that only would leave 13,000-acre-feet of perennial yield for the Lower White River Flow System, right?
A. Yes.

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Q. Okay. And your opinion is there's 30,000-acre-feet of perennial yield in the Lower White River Flow System, right?
A. Yes.
Q. Okay. And that calculation is based, in part, on your calculation of recharge; right?
A. Yes.
Q. You have a water budget that uses recharge as one part of the equation to balance for the water budget, right?
A. Yes.
Q. And you calculate recharge using precipitation data from PRISM and the Maxi Eakin coefficients; is that correct?
A. No, let's clarify this because what we -- we used estimates from SNWA on the entire Lower White River Flow System for the available water that's available from sustainable yield in the Lower White River Flow System.
When we changed our methodology to look to see what was available in Coyote Springs Valley, we then performed our own recharge analysis. So only in Coyote Springs Valley did we identify the 5280 of local recharge from sheep ranch. In our analysis --
Q. I understand, sir. So -- and I'm sorry if I asked the question inaccurately. I just want to ask about the

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recharge that you calculated in Coyote Spring Valley?
A. Yes.
Q. Okay. So for that recharge, you used the PRISM data set for precipitation and you used the Maxi Eakin coefficients to generate a recharge value; is that correct?
A. Ms. Palmer can respond to that question.
Q. Go ahead.
ANSWERS BY MS. PALMER:
A. No, we looked at four different empirical recharge models. We did do the analysis with the Maxi Eakin method, but those have been shown to not be valid for use with the more modern precipitation data sets. They are married to the Hardman precipitation map, which is based on older data.
So our analysis is based on two citations, which are in our July 3rd report that come from one from the USGS and one from -- sorry, the other reference is XD -- we have those citations.
Q. Well, then do you have an independent calculation of recharge in this analysis?
A. Yeah, it's --
MR. REICH: Recharge from the sheep range.
Q. Yes, recharge in the sheep range. Do you have an independent calculation of that value in this report?
A. Yes.

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Q. And what precipitation data did you use?
A. The PRISM precipitation data, which is based on 1981 to 2010 data.
Q. And what coefficients did you use?
A. I'd have to look in the report to tell you that.
HEARING OFFICER FAIRBANK: Mr. Taggart, your time is up. If there's time remaining at the end, we can go ahead and open it back up for further questions.
MR. TAGGART: Thank you.
HEARING OFFICER FAIRBANK: Next up is Moapa Valley Water District.
CROSS-EXAMINATION
MR. MORRISON: Good afternoon. I'm Greg Morrison and I represent Moapa Valley Water District. Let me get my timer going.
Okay. Just a few questions here for you, a couple of things that I thought might be inconsistencies or maybe I didn't understand in the report.
First, I know we've talked about Kane Springs already. I don't think too much needs to be asked about that. But I just wanted to ask, are you aware if there were any measurements taken in Kane Springs Valley pursuant to the 1169 pump testing?
ANSWERS BY MR. REICH:

A. Are you specific about groundwater levels, or --
Q. Yeah, I'm sorry. I think it's the KSV-1, alternately known as --
A. Yeah, actually I saw the water level. We didn't review those as part of our July 3rd report. We saw those water levels. We didn't address it. But I'm saying we reviewed it, we didn't address it in our July 3rd report.
Q. Levels were monitored, though, pursuant to the 1169 pump testing?
A. Yeah, there was -- yes.
Q. Okay. Quick question about the Theis analysis, I believe it was Ms. Moran, you completed that?
ANSWERS BY MS. MORAN:
A. That's correct.
Q. Okay. Now, you stated, I believe, that faults affect and/or disturb groundwater flows within a basin?
A. They can.
Q. Or have the capacity to?
A. They have the capacity to, yes.
Q. All right. And those faults and/or features, those aren't represented in any Theis analysis; is that accurate?
A. Not in the one I did. You have to use image wells to account for them.

Q. So this Theis analysis, it's a pretty simple tool when you're evaluating complex fragmented groundwater system?
A. It -- could you rephrase that? It's -- I think what I said was that it has some very simplifying assumptions to it and it doesn't represent what's happening here. And if you're saying that this is a very fragmented system, and therefore, it shouldn't be applied -- I don't understand your question.
Q. I guess what I'm saying is, I believe your expert reports, collectively viewed does say that this system is a very fragmented and complex system. With that being the case, is a Theis analysis not a somewhat limited utility?
A. That's correct.
Q. Okay. Let's see here. A couple things I wasn't real sure on within your reports. I think this is all for Mr. Reich. I want to ask about the effects on a couple of the wells or at least one of the wells from the 1169 pump testing.
Page 49 of your initial report, I think you stated that CSVM-4 did not show response to Coyote Springs Valley carbonate pumping. So that being the case -- and I'm looking at this -- this statement sites Appendix E, but the statement's on page 49.
A. So are you referring to the rebuttal report or the --

Q. I have it in the report.
A. I have 49 as a figure.
Q. All right. Let me see. I could have left a typo in there.
HEARING OFFICER FAIRBANK: Mr. Morrison, is it page 48?
MR. MORRISON: Could be. It is, it's page 48 and it is the first full paragraph, first sentence on that CSVM-4, does not show a response to pumping, Muddy River Springs area or eastern Coyote Springs Valley.
So I'm looking at -- the data that supports that on page 5 of appendix E. And I'm looking at your hydrograph of CSVM-4, and it looks to me like it reflects about a half a foot of drawdown at CSVM-4 during the 1169 pump testing. Is that accurate?
ANSWERS BY MR. REICH:
A. Yeah, I just want to make sure that we're looking at the same graph. It's CSVM-4, page 5 of the appendix; correct?
Q. Yep.
A. Okay. Yeah, and we addressed this issue before and I think that what our -- what we see here is a response to the hydrologic and climatic conditions.
Q. Yeah, I understand that your conclusions were

different. I just want to make sure that you do agree that there was a half a foot of drawdown show in that hydrograph from the course of the 1169 pump testing?
A. Okay. Let's see. So basically from 1874.5 to -- yeah, a half a foot, maybe even more, but a half a foot.
Q. Okay. And there's a steady downward trend throughout the 1169 pump testing?
A. There is a trend consistent with -- yes.
Q. All right. Now, Coyote Springs pumping began in 2005, I believe. And looking at this same hydrograph, I see about a foot of drawdown since CSI began its pumping. Does that look right to you?
A. A foot of drawdown since -- so what I -- I'm not quite sure of the time frame that you're referencing. I see that --
Q. '05 to the present.
A. From '05 to the present? Oh, so over the entire --
Q. Since Coyote Springs began.
A. So over the entire period of record, yeah, I would agree with you that there would be, yeah, a -- what was the number you stated?
Q. About a foot?
A. About a foot.

Q. Give or take?
A. I would agree with a foot.
Q. Okay. Thank you. I want to ask real quickly about page 32 of your rebuttal report. And while you're looking that up, at page 32, you state that from 2006 through 2009, carbonate pumping throughout the Lower White River Flow System averaged about 7,000-acre-feet annually. From 2010 through 2013, carbonate pumping averaged about 9,000-acre-feet annually.
So that 2,000-acre foot increase, you refer to it, page 32 of your rebuttal report, it does refer to those time frames in that 2,000-acre foot increase?
A. 2006 to 2009, range from 6500, averaging 7,000. By 2010 to 2013, range 7500, averaging nine. So you -- what's your question? I'm sorry.
Q. Well, I haven't asked a question yet. I was making sure we were on the same page.
A. Oh, okay. I'm just getting caught up with you.
Q. All right. Great. So I want to talk about Pederson Springs and Pederson East.
A. Okay.
Q. Your footnote 58 and 59, I believe, is on that same page. You talk about the spring measurements at Pederson Springs and Pederson East. And October 2006, which is the

start of the time frame we're discussing here, Pederson East flows were about .23 CFS?
A. Pederson East.
Q. This is in footnote 58.
A. Right. Yes.
Q. And the Pederson was .24 CFS?
A. Correct.
Q. All right. So at the end of that time frame, which would be starting in 2006 and ending in 2013, October 2013, Pederson East was flowing at .1 CFS. Is that what your footnote 59 says or it might still be in 58?
A. No, you're good. No, you're on the 59. Pederson Springs East spring flow was .1 in October 2013.
Q. All right. And Pederson Springs was 0.7 CFS that same time?
A. Correct.
Q. All right. So you agree, then, that from 2006 to 2013, Pederson Springs East flowed -- flows reduced from 0.23 CFS to .01 CFS?
A. Yes, I do.
Q. And the same time frame, Pederson Springs declined from 0.24 to 0.07; is that correct?
A. Yes.
Q. All right. And would you consider those declines

in spring flows measurable?
A. Yes.
Q. Okay. That's all I have for you. Thanks a lot for your time.
MR. REICH: Thank you.
HEARING OFFICER FAIRBANK: Next will be Lincoln County and Vidler Water Company.
CROSS-EXAMINATION
BY MS. PETERSON:
Q. Hello, panel. Karen Peterson from Allison MacKenzie law firm, representing the County water district and Vidler Water Company. So I did have a copy follow-up questions. Slide 15 on your rebuttal presentation, I don't know if you can bring that up.
Mr. Reich, one of the items I think you discussed was questions regarding, including Kane Springs Valley into the Lower White River Flow System boundaries, and you indicated in your rebuttal comments that Kane Springs Valley should not be included. Do you see that?
ANSWERS BY MR. REICH:
A. Yes, I do.
Q. And did you have an opportunity, during the course of all these proceedings, to review all the CSAMT information performed by Zonge?

A. Yes, I did.
Q. And what data supports your rebuttal conclusion on this slide regarding, including Kane Springs Valley and the boundaries?
A. My understanding -- or my review of the data indicates that there's a series of en echelon faults that help to create a -- some type of a hydraulic barrier or a barrier to groundwater flow in this area that isolates the Kane Springs Valley area from the -- from the Coyote Spring Valley.
And a lot of the data I looked at was also based on water level data that shows that there is a very large, a very steep hydraulic gradient between the two valleys.
Q. And is the CSAMT information new data for the State Engineer to consider since the 1169 pump test?
A. Yes. My understanding is that the data was performed or the survey was performed in March of this year.
Q. And to your knowledge, have you seen any other data provided by Southern Nevada Water Authority, the Moapa band of Paiute Indians, the U.S. Fish and Wildlife Service, or the National Park Service? Any new information regarding locations of faults or geologic structures in this whole area?
A. I believe the Moapa band presented a conductive model -- or effective model, excuse me, a heat transfer using finite difference in the Colorado -- in this lower region.

So I believe that to be -- I first heard about that at a hydrologic review team meeting that we had at SNWA three or four months ago, and then looked at the presentation or the reports submitted by them.

But besides that and the geophysical data, you know, without going back and reviewing all the reports, that's my only understanding of the new data.

Q. And you were just asked some questions by Mr. Morrison regarding the hydrograph in Appendix -- I believe it's Appendix E for CSVM-4?
A. Yes.
Q. Do you recall those questions?
A. Yes, I do.
Q. And what's -- do you have the hydrograph in front of you?
A. Yeah, I'm looking at it right now.
Q. All right. What's occurring in the hydrograph to cause the overall pattern?
A. The impact of the hydrologic conditions that we've talked about, the wetting and drying and the average where we see the response to the '04 and '05 rainfall events, the long-term decline. Over that 2006 to 2013, '14 period and then recent average conditions since that.

So this hydrograph, to me, reflects a lot of --

it's driven a lot by the climate and the precip.

MS. PETERSON: That's all the questions I have.

HEARING OFFICER FAIRBANK: Next will be the City of North Las Vegas.

MS. SCHROEDER: I'm representing the City of North Las Vegas, Laura Schroeder. We have no questions.

HEARING OFFICER FAIRBANK: Thank you. Centers for Biologic Diversity.

CROSS-EXAMINATION

MR. DONNELLY: Thank you. For the record, Patrick Donnelly, representing the Center for Biological Diversity. For the record, I am not an attorney. I play one on television sometimes, so I'm going to do my best and I am sure people in this room will let me know if I wander astray.

So I'm going to direct my questions to Mr. Reich and perhaps the appropriate person can jump in if they are better suited for someone else.

I'd like to start with the topic of evapotranspiration capture. Is it true that evapotranspiration capture would result from the lowering of the water table?

ANSWERS BY MR. REICH:
A. Yes, it is.
Q. Are you aware of the elevation of well MX-5?

A. I can look it up. I have it stated in my report. But, no, not off the top of my head.
Q. That's fine. The well of MX-5 elevation is 1813.
A. Oh, the groundwater level.
Q. Yes, I'm sorry.
A. Oh, I'm sorry. I thought you were asking about the surface level, so that's why I was -- no, yeah, 1813 is appropriate for that.
Q. And does a groundwater elevation of 1811 at Pederson Springs sound about right to you?
A. Yeah. Yes.
Q. So because groundwater elevations are so similar, how would one draw down the water table to capture ET without also impacting spring discharge? Are we . . .
A. Well, there's a question that I think we have to talk about, and that is one of the themes that we've really promoted today is the idea that location of pumping has a great deal to do with how much pumping can be -- occur in the Lower White River Flow System.

So when we talk about that and we talk about the structural control, so again, it's that normal faulting. It's the structural control that -- where we see flow paths that come through Coyote Springs down into Hidden Valley and Garnet and California wash or flow paths that go through Coyote

Spring Valley into Muddy River Springs area, California wash. I -- and we have to look at that as a whole. It's important that we see the whole picture.

So why there are wells, and I've stated in my earlier testimony, that pumping on the east side of Coyote Spring Valley would absolutely impact groundwater levels and result in spring flow. There's also other locations where you can pump that necessarily do not go directly through Muddy River Springs area.
Q. Thank you. Are you aware of what environmental impacts might results from capturing of evapotranspiration and the die off of phreatophytic vegetation?
A. I am -- I'm not a biologist, so I'm not going to opine on the impact of that. But I am aware that the groundwater level has a direct relationship on the health or the habitat that it supports.
Q. Thank you. You state that there is 30,000-acre-feet of water available for pumping in the Lower White River Flow System per year; is that correct?
A. Yes.
Q. How would -- sorry, are you aware of the significance of 3.2 cubic feet per second of discharge at the Warm Springs west?
A. Yes, I am.

Q. Would removing 30,000-acre-feet of water per year from the ground in the Lower White River Flow System maintain levels at the spring above 3.2 CFS?
A. It's a multi faceted response, and so I'm trying to figure out the best way to respond to give you the answer, because again, I just talked earlier about the location of pumping and the importance that the location of pumping has on the resources.
And so when we talk about, you know, what is sustainable and -- or what kind of pumping can occur, we really have to focus in on what is actually causing that and controlling that -- those water levels.
So if we're talking about pumping in, say, Garnet Valley or pumping in certain parts of California wash, how does that affect Warm Springs west flow? How does that affect, you know, sub flow that might be captured as evapotranspiration in the bottom part of the Moapa Valley?
So it's really -- the answer I want to provide to you is that, yes, we can pump up to 30,000-acre-feet based on how we distribute that pumping and how we use our conceptual model to do that.
Q. Thank you. You stated that -- in your report that your model is at least partially based on the Maxi Eakin model; correct?

A. I'm going to let Ms. Palmer respond to the -- you're talking about local recharge from the sheep range.
Q. Thank you.
ANSWERS BY MS. PALMER:
A. Yeah, that's what you mean when you say "model"?
Q. Yes?
A. No, it's -- the numbers that we presented are not based on the Maxi Eakin coefficients.
Q. Without using the coefficients, was the methodology based on the framework of Maxi Eakin, different coefficients granted?
A. It's based on the same type of empirical model.
Q. Yes.
A. That relates precipitation to recharge. But it is not the coefficients that were established by Maxi Eakin, but by papers and literature that established other methods and other coefficients.
Q. Given that it's a different set of coefficients with the same framework, was that framework designed to be evaluating entire basins or -- I'll leave the question at that.
A. Can you clarify what you mean by --
Q. The question is: Was the framework designed to evaluate recharge on an entire basin scale or is it meant to

be slicing up a basin and evaluating pieces of it in that fashion that you did?
A. I would say that, generally, the method is applied to regional areas, but I think that there are some applications that have been done for the scope of the size of the sheep range is within the bounds of what's been done.
Q. Taking a broader look at the overall conceptual model for the basin, do you assert that discharge equals recharge?
ANSWERS BY MR. REICH:
A. In predevelopment conditions or --
Q. Yes, yes. Thank you.
A. Well, our budget shows that there's a difference of approximately 1200-acre-feet. I'd have to do the exact math. But there's an imbalance in our budget of some -- I don't know, 1 or 2 percent or something.
Q. Do you have ideas as to where that 1 or 2 percent comes from?
A. Oh, yeah. You know, the values could easily be -- you know, could be connected to evapotranspiration because we got to remember, we're using different methods to establish different fluxes in this budget.
So while we might be using, you know, mass balance, deterrent mass balance to look at recharge rates and

fluxes of groundwater coming in, you know, we might be looking at historical photographs or different precip or other records to measure ET.
So there can be variations in those estimates, which would explain why the budgets don't necessarily equal out. You know, the goal of our budget was really to provide the State Engineer what we felt was the best available data for describing the 1303 administrative units. So we chose consistency among data sets to provide that.
Q. Is the water being discharged generally from recent origin and provenance or is water discharged from past epics, for instance, Pleistocene?
A. Yeah. So there's a -- you know, this is a great question because I really enjoy this part of the geology and hydrogeology because, you know, we got to remember, you know, what has happened over the last 12,000 years compared to what might have happened over the last 40,000 years or 50,000 years.
So, you know, as we've had the last ice age melt off and, you know, you have this vision of this basin and range area with these lakes and very, you know, paleo areas.
And then what has happened to that -- you know, what I want to say recent water, you know, that's kind of recent water, that last, you know, 12 to 15,000 years,

whatever you want to call that last ice age, then compared to, you know, some of the dating that we've seen in the recharge estimates that we use. So I guess that's a very long way of saying that there is older water in the system.
Q. Granted that, isn't it entirely possible that there is more waters -- appreciably more water discharging from the system than is coming in in new recharge, given that the -- given that the knowledge of interbasin flow and recharge is entirely speculative?
A. Sure.
Q. Isn't it entirely possible that this is fossil water discharging that will not be replaced?
A. Yeah. So there's two components to the discharge. There's local recharge that we've identified, and so every year, there's a local amount of recharge that's being mixed in. And then there's the old -- you know, the groundwater flow system that we suggest starts as high up as in the Ely range where that flow has been drained through.
So you -- if you -- if I understand your question correctly, is -- are you asking me if discharge is greater than recharge?
Q. Potentially. Isn't that possible?
A. Well, two things are going on. So I look at it as a -- the potential metric head, right? So let's say

further upstream as the head drops, you know, the rate of flow is going to decrease, right? So everything has to be in balance.
And so something has to be -- something has to give, like one of the -- when we look at that -- when that budget, if recharge is going to go down, then discharge is going to go down also, right, because that -- those budgets have to balance out.
So maybe not only does discharge go down, but also ET would go down and spring flow would go down. It would be a combination of all those different factors if you were to -- if you were to suggest that recharge was going down also.
MS. MORAN: I'd like to look at it just a little bit differently, and that is if your question is if recharge is changing over time, it can be out of balance with discharge until the new steady state is reached.
And that occurs all the time because if a change in pumping occurs, there has to be a new steady state and that can take 50 years or it could take ten years or it could take 100 years.
But if what you're asking is if recharge is changed over historical -- not even historical, you're asking for something prehistorical.

Q. Well, let me clarify. Is there any reason to believe that a predevelopment state in the Lower White River Flow System was a steady state? Why do we assume that it was a steady state?
ANSWERS BY MS. MORAN:
A. Right, because even our budget shows that it's slightly not steady state with there being a difference in what's an inflow and an outflow. It was the best numbers that we have at the time. So we're going to start with the best numbers that we have. I don't think we know to the nearest foot, notice we round them at least somewhat.
Q. Right. Sure.
A. But yes.
Q. One final line of questioning to build on the Moapa Valley Water District. We had talked about Kane Springs Valley. Isn't it true that well KSV-1 declined slightly during the pump test?
ANSWERS BY MR. REICH:
A. Could you -- I didn't present any information on it. Could you provide me a view of an exhibit?
Q. I cannot. So I will withdraw that. I will withdraw that question. I cannot provide an exhibit.
A. We never presented in our reports, so --
Q. Okay. No more questions. Thank you.

HEARING OFFICER FAIRBANK: Next will be Georgia Pacific Republic Industries Dry Lake.
MS. HARRISON: Good afternoon, panel. Sylvia Harrison from McDonald Carano appearing for Georgia Pacific and Republic Environmental Technologies.
Also appearing with me for Georgia Pacific is Paulina Williams from Baker Botts in Austin, Texas, and Sarah Ferguson from McDonald Carano for Georgia Pacific Republic?
Just to clarify the record, Broadbent prepared its report for three entities, including Dry Lakes Water, LLC.
Dry Lakes is not participating in these hearings and we do not represent them. So with all of that being said, we have no questions for these witnesses.
HEARING OFFICER FAIRBANK: Thank you, Ms. Harrison. Next is Nevada Cogen Associates 1 and 2.
CROSS-EXAMINATION
BY MR. FLANGAS:
Q. Hello, my name is Alex Flangas. I'll present this to the panel. I'm not really sure if it would be best.
Referring to your CSI Exhibit 1, your initial report, you show in Table 8, a predevelopment water budget for the LWRFS based on SNWA's 2007 report. This is on page 41.
ANSWERS BY MR. REICH:
A. Yes, I'm looking at it.

Q. You essentially accepted that table and said that table was essentially a valid water budget; isn't that accurate?
A. Where do I state that? I'm just curious.
Q. Page 43. This third -- beginning of the third full paragraph, the water budget provided in Table 8 and shown in Figure 16 presents an initial budget that may be used for groundwater sustainability in the LWRFS?
A. Yes, that's an accurate statement.
Q. And so essentially the water table you're showing for inflows and outflows in Table 8, that's something you accepted as valid; correct?
A. We accepted the Table 8 as an initial budget for the State Engineer to start his planning process. So I -- you know, we presented this budget because no other party, up to this point, had put together a comprehensive budget that we were able to review.
So we went and used the best data available to provide an initial budget and we fully believe that initial budget will be improved upon over the years as more information is learned.
Q. But the budget you used drew from these various valleys that you have contained in the inflow; correct?
A. Yes.

Q. And Kane Springs Valley, you show 4200-acre-feet coming in; correct?
A. That's correct.
Q. And then in Figure 16, which is on page 42 of that report, you actually show the 4200-acre-feet coming in from Kane Springs Valley; right?
A. That's correct.
Q. Didn't you just testify a little while ago about a boundary condition, a fault that would prevent or a block that would prevent that water from coming in from Kane Springs?
A. No, I did not.
Q. I thought that's what you just said a little while ago, that there was not water coming in from Kane Springs, that it was blocked?
A. No, I did not. I never said that.
Q. Okay. Isn't it consistent with your report on page 9 -- just so that I'm clear then, is it consistent with your Figure 9 -- not page 9, I'm sorry, Figure 9 that the faults in that area run lateral to Kane Springs Valley?
A. No, we identify in our write-up, and are we on -- we're on the July 3rd report. Yeah, there's a series of these northwest/southeast trending faults and subparallel faults to those.

So I don't want to get confused with you on what you're calling lateral or axes or whatever. But there -- I think a great example, and we see this just southeast of MX-5 are these subparallel faults that are connecting -- that are connecting the Coyote Springs Valley with the Muddy River Springs area.
So, no, there's other -- you know, not all faults run northwest/southeast. There are a series of subparallel faults that have been developed over different geologic episodes.
Q. I'm not worried about all faults, sir. I'm focused on the ones running from Kane Springs Valley into Coyote Springs Valley. What does your -- what does your mapping show?
A. Which map are you referring to?
Q. I'm looking at Figure 9.
A. It reflects the Rowley map. So this figure was based on Rowley and others from 2017. So the purpose of this was to show the general geology.
Q. And what does it show, sir?
A. It shows a -- kind of a north -- so after -- I'll go back to Mr. Taggart's Highway Fault. If you start down towards the Highway Fault and work your way directly north, there is a fault that's running approximately north, northeast

direction that runs along the northern part of Kane Springs Valley. It also shows a fault system that runs along the southern side of Kane Springs Valley.
Q. And the faulting system on the southern side of Kane Springs Valley runs what direction towards Coyote Spring?
A. It runs in a northeast/southwest direction.
Q. Toward -- essentially, when I say "laterally," I'm talking this way, not crossways as a block towards Coyote Spring; correct?
A. Laterally would be along the long axis of the Kane Springs Valley.
Q. Along -- okay. Thank you, sir. So is it your contention, then, that the tables shown in Table 8 that shows the 4200-acre-feet flowing in is accurate?
A. Not -- it's a best available data that was -- that we could use in order to provide the State Engineer. I think another example might be to look at some of the literature review that we did for that.
So there's a literature review, I believe appendix C, that might be -- that might be helpful to look at. But again --
Q. To answer that question, sir, do I need to go to Appendix 3 to answer a question as to whether you find the 4200-acre-feet shown on Table 8 flowing into Kane Springs

accurate or inaccurate? Do we need to look at Appendix 3?
A. No. I find it -- no, I find it's based on the 2007 SNWA report, we think it's a valid estimate for an initial budget for the Lower White River Flow System.
Q. Thank you.
MR. FLANGAS: That's all the questions I have. Thank you.
HEARING OFFICER FAIRBANK: Next would be Muddy Valley Irrigation Company.
THE STATE ENGINEER: Good afternoon, Steve King from Muddy Valley Irrigation Company and we have no questions for this panel.
HEARING OFFICER FAIRBANK: And just so -- for those individuals watching on the internet, that was Mr. Steve King making his appearance and not having any questions.
Next would be Bedroc.
MS. SCHROEDER: Laura Schroeder, representing Bedroc. I just have a couple of questions. Thank you.
CROSS-EXAMINATION
BY MS. SCHROEDER:
Q. You -- CSI estimated that there was about 5,280-acre-feet of recharge in the Coyote Spring Valley that originated in the sheep range.
My question is whether -- where CSI suggests that

that flow -- where is that flow going?
ANSWERS BY MR. REICH:
A. So the recharge that falls on the eastern side of the sheep range, it contributes to multiple different drainages along the base of the sheep range itself, or I believe is it Steptoe, the Steptoe Range. The water comes down and then drains into the -- what we would call the western side of the Coyote Spring Valley. So that local recharge is contributing with regional groundwater flow that comes in from the north.
Q. Okay. And is that local flow, that flow on the western side then, is that something that can be pumped in that alluvial fill without impacting the carbonate aquifer?
A. So I'm also hearing two questions. I want to make sure I answer accurately.
Q. Um-hum?
A. So is your question whether the recharge occurs -- what is your question because I hear a couple different questions.
Q. All right. So we -- you've testified that we have this flow from the sheep range that goes into the west side. And my question is whether that is contained by -- in that area such that it's not contributing to the carbonate flow?

A. Oh. So the mechanisms for recharge, I think, are very -- it's very common what we see throughout eastern Nevada. So there's a rainfall that occurs and, you know, there's direct precipitation in the carbonate rock and there's runoff that comes down. And that runoff also contributes to and supports recharge directly into the carbonate and there's also runoff into the basin fill.
So one of the things that we looked at also was, you know, what happens to that basin fill water in that area and what are the water level differences. So we were -- we went through and we looked at some of the alluvial water levels and saw that they were higher actually than that of the carbonate aquifer.
So our conceptual model, if we were to continue to describe it, would indicates that areas along the west contribute -- the basin fill contributes into the carbonate rock in that area.
Q. So is the flow on the west side of the Coyote Spring Valley, is it at all hydrologically isolated from the Muddy River Springs aquifer?
A. Is it all isolated?
Q. Is it isolated by a fault or other structural impediment?
A. Yes. So I think now we're talking specific

elevations, right?
Q. Right.
A. So you -- you're -- and I don't mean to read into your question, but you're asking, is there a mechanism or there is a mechanism for water to flow from the west to the east, is that what you --
Q. Yes. Is there or isn't there, yes?
A. No, it's a great question, and I think that's why if we were to look at the very northern portion of Coyote Spring up towards bedrock, for instance.
Q. Um-hum?
A. Or even closer up towards -- I believe it's CSM-3, you know, we've shown through our geology and geophysics that that's a northern part of the Arrow Canyon Range that's coming through and diving down.
And so as that dives down, it's plunging, going for northward. And so recharge that occurs in the very northern end of the sheep range, does it have an opportunity to mix with basin fill material and end up contributing to the west side is kind of --
Q. Um-hum?
A. Is kind of a good, you know, way to look at this conceptual model, and my answer would be, yes, there could be.
Q. Okay.

MS. SCHROEDER: I think that's it. Thank you very much.
HEARING OFFICER FAIRBANK: Next will be NV Energy.
MS. CAVIGLIA: Hi, my name is Justina Caviglia and I represent NV Energy and I just have a couple of questions for you.
CROSS-EXAMINATION
BY MS. CAVIGLIA:
Q. So, Mr. Reich, you stated towards the end of your testimony this morning that you interpret the structural blocks to be impermeable; is that correct?
A. Yes, it is.
Q. What evidence do you have that they are impermeable?
A. Groundwater level data.
Q. Okay. Can you please change the slide to rebuttal testimony on page 14.
So in your reports, CSI -- I want to understand, CSI-1 is on the west side of the fault zone; is that correct?
A. That's correct.
Q. Can you focus your attention on the -- during the pumping inventory testing? When you look at, I would say quarter three in 2011, and you look at CSI-1, is there an

increase in water level at that time?
A. No, there's not.
Q. There's no increase right there?
A. I'm --
MS. MORAN: I'm looking at the same thing.
MR. REICH: Yeah, what are we looking at?
BY MS. CAVIGLIA:
Q. CSI-1?
A. Right.
Q. During the pumpage time, so probably the third quarter of 2011?
A. Yes.
Q. Is there an increase in the groundwater?
A. Third quarter of 2011, no.
Q. Is it the second quarter? It's hard to tell exactly. Does there look like there's a small increase in 2000 --
A. Oh, a small -- oh, you mean -- you're talking about that very slight little bump up?
Q. Correct.
A. Yeah, it appears that there's a small bump up in the --
Q. Okay. And can we go to 2012 for the same one? Is there also a small bump up?

A. Yes, small bump up.
Q. Right in here?
A. Yes.
Q. Now, that CSI-1 is on the west side of defaults; is that correct?
A. That's correct.
Q. So let's go down to, say, MX-4, and that is on the east side of the faults; is that correct?
A. That's correct.
Q. So around the same time in 2011, is there also a slight bump up?
A. Yes, there is.
Q. And then you go to 2012, is there also a slight bump up?
A. Yes, there is.
Q. So would those lines be somewhat consistent during or around the same time period?
A. They seem to look a little bit different. The 2012 appears to occur later in CSI-1. But, yeah, that -- I'd have to take a look at that. And I think, again, you know, this is where we go back and talk about the impact of hydrologic events and rainfall events. So seeing something similar like that, yeah.
Q. And then I have another question for you. Can we

go to slide 25?
So when you go up to the rebuttal comments, you state there is no hydrologic -- or hydraulic connection between north Coyote Springs Valley and south Coyote Spring Valley; is that correct? Is that what that states?
A. Northern Coyote Spring Valley and southern Kane Spring Valley.
Q. Yes, with MX-5?
A. Yeah.
Q. So MX-5 is in southern Coyote Spring Valley?
A. MX-5 is -- there's -- well, okay, MX-5 is -- I would consider it to be kind of central or south central Coyote Spring.
Q. Okay.
A. And so I chose that as the pumping well to describe that.
Q. So is that saying that for the northern Kane Springs, Coyote Springs Valley and southern Coyote Springs Valley, there's no connection? Is that what you're stating there?
A. I just -- I'm going to help you. The northern Coyote Spring Valley.
Q. Yes.
A. Southern Kane Spring Valley.

Q. Yes, and southern Coyote Springs Valley?
A. Right. So is there a hydraulic -- is there a connection there? My review of the data showed that there was no response from pumping MX-5 in the CSVM-4 well.
Q. Okay. So does that mean that your testimony today is that you can pump as much water as you want from that northern area without affecting the Muddy River Springs?
A. Pump as much area as you want? So what areas specifically? Let's -- if we're going to go down this, let's make sure that we're going to identify the right area.
Q. Okay. So what I read when I read your comment is that there is a line basically in the middle of the Coyote Springs; is that correct?
That there is no connection between northern Coyote Springs, southern Kane Springs Valley and where MX-5 is in southern Coyote Springs. Is that what you're stating right there?
A. No, I'm saying there's a hydraulic barrier. So that's a -- yeah, there's a hydraulic -- there's a hydraulic barrier in the sense that from -- there's no hydraulic connection from MX-5 pumping in Kane Spring Valley, yet there still is flow out of the Kane Springs Valley are into the Coyote Spring Valley area.
Q. Okay.

A. So there's a downward vertical gradient into the Coyote Spring Valley area. So as I've showed in the water budget, there would absolutely be an impact if there was unlimited pumping upstream.
MS. CAVIGLIA: I think that's all the questions I have.
HEARING OFFICER FAIRBANK: Thank you. Now we'll go ahead and open it up to staff. Do we have any questions?
MS. COOPER: Hi, thank you.
HEARING OFFICER FAIRBANK: Please state your name.
MS. COOPER: Christi Cooper, DWR. I'll start with -- I think anyone on the panel could ask -- answer this question.
EXAMINATION
BY MS. COOPER:
Q. I'm looking in your initial submittal report, Figure 10, specifically at the location of MX-6 and slide 23 of your presentation today, your very first presentation.
Could you verify which location of MX-6 is correct?
ANSWERS BY MR. REICH:
A. Yeah, that's -- I believe that's --
HEARING OFFICER FAIRBANK: Can you turn on your

microphone?
MR. REICH: Yeah, I apologize. That exhibit, I believe, has MX-6 in the wrong location. So slide 21.
MS. MORAN: 23.
MR. REICH: Oh, slide 23, sorry.
BY MS. COOPER:
Q. Your report is the correct location then?
A. Yes.
Q. Thank you. I have a few more questions, please.
Ms. Moran, you did the Theis analysis?
ANSWERS BY MS. MORAN:
A. That's correct.
Q. Could you explain what the reason for using solely MX-5 pumping and not total Coyote Spring Valley carbonate pumpage was?
A. The way the Theis equation works, I wanted pumping in a center versus in multiple locations. And I was only looking at four being an example, the pumping that occurs at two places.
And given MX-6 was the largest pumping volume, I took that average pumping of the pumping test to look at what its effect would be at the spring, just using the simple Theis equation.
Q. MX-5?

A. MX-5, right. That was the greatest pumping in those two years, representative two years.
Q. But you used both Arrow Canyon wells and the Muddy River Springs area?
A. Right. They're fairly close together as a pumping center.
Q. Okay. Do you think that if you would have used -- combined Coyote Spring Valley pumpage, that would have made any difference in your analysis?
A. I would have to do it to know if it would.
Q. Okay.
A. Thanks.
Q. Thank you. Can I have one more question? I can go to slide 14 in your initial presentation. Oh, maybe the rebuttal, I'm sorry.
Mr. Reich, do you believe that CSI differs from -- number two differs from wells 1, 3 and 4? And in what ways again, please?
ANSWERS BY MR. REICH:
A. Sorry. I was reading the previous slides you had for well. Does well -- does well one?
Q. Two, did you say previously two differed from 1, 3 and 4?
A. Yes, I did. So there's a couple -- there's a

couple of characteristics I would like to point out here. The CSI-3, the -- you see the large decline during the Order 1169 aquifer test. And, you know, we have to then go and compare that to the pumping that was going on on the west side.

So if you look at CSI-3, the data, you know, shows the red bars at the bottom. But we also have to remember that the transmissivity of that well tested out at about 13,000 feet squared per day.

And so, you know, when you think of a lower transmissivity as compared to CSI-4, which had 130,000 feet per day, then we start to think about how these different wells will react to different stresses.

So, for instance, I believe we're all in agreement that CSI-2 mimics MX-4 or CSVM-6, UMVM-1 water levels. But CSI -- and so CSI-2, so when you look at CSI-3 and the CSI-4, and we look at the pumping that's occurring on the west side at the same time, I see that as an explanation of -- that explains why those are behaving during that time.

When I look previously, or afterwards, I also see a change in the recovery. If you look at -- if you look at kind of the long slope from 2014 to the present of CSI-3, that -- it's kind of generally trending, I don't know about upwards, but it has a different type of trend during those last 5 or 6 years than it does before.

So when I look at this together and I look at those different periods, I really feel strongly that there's different geologic kind of environments that control the water levels that we're looking at in each of these different periods.

Q. So would you say, to follow up that pre-1169 tests and post tests, that all four CSI wells do have a decline in water levels?

A. Oh, yes, they all have a decline in water levels. If -- starting from the beginning of their period of record to today, yes, they all have a decline.

MS. COOPER: Thank you.

HEARING OFFICER FAIRBANK: So given that we have some additional time, I guess I'll say thank you to everyone for being concise and honoring the spirit of what the purpose of a hearing is. We're going to go ahead and open it back up for questions, and so I'm going to just kind of go back down in the order.

Does United States Fish and Wildlife Service have any additional questions that they'd like to ask? And I'm going to limit the parties to approximately three minutes for any follow-up questions.

MR. MILLER: No further questions.

HEARING OFFICER FAIRBANK: And then National Park

Service?

MS. GLASGOW: No questions. Thank you.

HEARING OFFICER FAIRBANK: Okay. So I've gotten declined from Fish and Wildlife Service and Park Service.

The Moapa Tribe, do they have any follow-up questions at this time? Seeing none.

Mr. Taggart, does Southern Nevada Water Authority and Las Vegas Valley Water District have some follow-up questions?

MR. TAGGART: We do.

HEARING OFFICER FAIRBANK: And given the fact that the prior parties have not asked any follow-up questions, I'll go ahead and extend that time to -- I'll give you seven minutes.

MR. TAGGART: Okay. Thank you.

BY MR. TAGGART:

Q. Okay.

HEARING OFFICER FAIRBANK: Make sure you use the mic. Thank you.

MR. TAGGART: Thank you. For the record, Paul Taggart for the Southern Nevada Water Authority and Las Vegas Valley Water District.

FURTHER CROSS-EXAMINATION

BY MR. TAGGART:

Q. Mr. Reich, I'm going to ask you, if you could, to use the demonstrative that you guys prepared. And I have a couple questions that I'm going -- I'd like to walk over there and ask you, but I'll be off the mic temporarily. Is that okay? Folks in the internet won't hear me?

HEARING OFFICER FAIRBANK: Mr. Taggart, we can probably share one of our mics with you.

MR. TAGGART: Okay. Great.

BY MR. TAGGART:

Q. Okay. We'll see how this works. All right. So where on this map can this pumping happen, this 5288 feet of pumping happen on the west side of Coyote Spring Valley without impacting the Muddy River or the Muddy River Springs? Can you show me?

HEARING OFFICER FAIRBANK: And, Mr. Taggart, will you put the demonstrative on the easel so that those that are watching from afar can see.

BY MR. TAGGART:

Q. And I don't want to offend my colleagues, but do you mind if he writes -- if he draws this on there so we can see where it is, Mr. --

A. See, which one is it? It's the direct --

HEARING OFFICER FAIRBANK: And, Mr. Reich, when you go -- and if you'll also provide a verbal description of where you're putting that so that it's clear on the record, and you can use the mic that Mr. Taggart is using to do that.
MR. REICH: Great.
BY MR. TAGGART:
Q. And I can help you along there a little bit because -- so you see where CSVM-6 is?
A. Yeah.
Q. So you've acknowledged that that is impacted by the MX-4 pumping; is that right?
A. That's correct.
Q. So that would be on the right side of the structure you talked about?
A. So let me --
Q. But CSI-1 is not impacted, right? So that would be on the other side --
HEARING OFFICER FAIRBANK: Mr. Taggart, if you'll let him just make his answer so that we can have a clear record as well.
MR. TAGGART: Okay.
HEARING OFFICER FAIRBANK: And so that it can be heard both here and on the internet and in our southern Nevada location.

MR. REICH: So which question? I just want to make sure I answer the question correct.
BY MR. TAGGART:
Q. I'll ask you a specific question. Where does the line of no impacts run north/south between CSVM-6 and CSI-1?
A. CSI. Okay. So as we've seen with Rowley and, you know, we have this -- I'm going to not do dashes and dots and other things that we would normally do with geologists. But it's -- what we've done is we've used the CSAMT in order to map what the boundary of this fault is.
So we got -- sorry. It goes something like this and something like this. We already had all this up here and then we talked about the fault running through A and B here.
So we have these series of down-drop blocks. This is the horse that we've talked about, the structural block that's in the center.
BY MR. TAGGART:
Q. Okay. Can I just stop you there? So is it west of the structural --
HEARING OFFICER FAIRBANK: Mr. Taggart, if you'll please use the microphone.
BY MR. TAGGART:
Q. Is it west of that structural block or is it within the structural block that --

A. That's west of the structural block.
Q. Okay. So a well west of the structural block pumped will not impact the river. Is that your testimony?
A. That is my testimony, correct.
Q. Okay. And you've dashed that or you've hashed that structural block, right?
A. So, yes, and I want to be clear that when we talk about, you know -- so now we're going to look at a cross section.
And when we look at a cross section and we have some type of horse structure and we have a series of faults that move these boundaries up and down, and then we have -- this area has Rowley described the different structural components of whether it's a damage zone or a core zone that's creating some type of barrier in this direction --
Q. Okay. That's not really my question, but --
A. No, wait --
Q. -- so what's the southern boundary of the quadrant that you've identified where pumping can occur without impacting the river? What's the southern boundary of that area?
A. Well, so now -- what's the southern boundary of this quadrant? Is that what you're asking?
Q. Is there a southern boundary running from east to

west of the quadrant you believe can be developed without impacting the river?
A. It's the -- so what we've talked about before and what we've presented is where the flow goes through the Coyote Springs Valley, and we have flow on the western side, I've shown in my budget and in my conceptual model that there's another either 11 or 17,000-acre-feet of flow that comes down into this area. And as we come down into this area, now the question is, where does the water go.
Q. Okay. So where is the southern -- okay. Let me just -- I don't have a lot of time.
A. No, I --
Q. So your testimony is the State Engineer can authorize 5280-acre-feet of pumping in Coyote Spring Valley, west of this fault structure.
And I'm asking you: Is there a southern boundary to that area where this water can be developed? Is it the Coyote Spring Valley hydrographic basin boundary?
A. No, it's beyond that.
Q. Okay.
A. I'm sorry. Is there 5280 -- you're asking if the 5280 is within Coyote Spring Valley or if we're pumping 5280 within this area, are you saying -- are you asking, is there a southern boundary to that?

Q. No, you saying there's an area that can be pumped 5280-acre-feet without impact. I want to know where it is. So what's the northern -- I mean, is there a box that you can put around it?
A. So let's talk about -- let's talk about the recharge because where did the 5280 come from?
Q. Well, sir, either there's a box or there's not. Can you tell me what the box is from which this 5280-acre-feet could be pumped without impacting the river?
A. The 5280 comes from the amount of water --
Q. I know where it comes from. Is there a box?
A. -- so as that -- so the question is always where is the water going.
MR. TAGGART: I withdraw the question.
MR. REICH: No, no --
BY MR. TAGGART:
Q. If you can't show the State Engineer where it is, how is it --
A. -- it is going out into the California -- into the Hidden Valley, Garnet, Black Mountain and the Black Mountain area. And it's going to be -- like I said before, the pumping is going to impact subsurface, outflow, ET. Those kind of issues.
Q. Okay.

A. So I'm not the only one --
Q. So there's no southern boundary?
A. Southern boundary of -- so -- and that's why --
Q. Just as --
A. I just want to tell you why I'm confused.
MR. TAGGART: I withdraw the question.
MR. REICH: You're asking --
HEARING OFFICER FAIRBANK: -- Mr. --
MR. TAGGART: -- can I -- 5280 --
HEARING OFFICER FAIRBANK: Mr. Taggart, if -- you can intervene just to have -- so that we can have a clear record, because the court reporter cannot record multiple people, excuse me, multiple people at the same time.
MR. TAGGART: And I think I can just clarify it.
BY MR. TAGGART:
Q. Is it a fair statement that your testimony is as long as you stay to the west of that structure, that the 5280 can be developed?
A. Yes, in the Coyote Springs Valley.
Q. All right.
HEARING OFFICER FAIRBANK: Okay. I'm -- Mr. Taggart, do you have any additional questions?
MR. TAGGART: I do, but I don't want to get in trouble.

HEARING OFFICER FAIRBANK: Well, let's see if there's addition people that have questions.
MR. TAGGART: All right.
HEARING OFFICER FAIRBANK: And then if there's still time, we'll allow you a little bit more time.
Moapa Valley Water District, do you have any further questions?
MR. MORRISON: Just one.
HEARING OFFICER FAIRBANK: Okay.
FURTHER CROSS-EXAMINATION
MR. MORRISON: All right. Once again, Greg Morrison, Moapa Valley Water District. I just -- I really want to nail down what your position is on the Kane Springs Valley.
After me, Ms. Peterson, on behalf of Lincoln County Vidler, asked you about Kane Springs and its exclusion. And you stated that your exclusion of Kane Springs Valley from the management unit was supported by en echelon faults that isolate Kane Springs Valley from Coyote Springs Valley.
And then shortly thereafter, Mr. Flangas asked you about Kane Springs and faulting, and you stated that you didn't testify about impediments to flow from Kane Springs Valley.
So I guess I really want to nail down CSI's

position on: Are there strict impediments to flow from Kane Springs Valley into Coyote Springs Valley or is there a substantial amount or say 4200-acre-feet of interbasin flow from Kane Springs into Coyote Springs Valley?
ANSWERS BY MR. REICH:
A. So question one would be -- and I don't mean to -- or I will summarize is, is there impediments between -- maybe you can just state -- if you can just give me one question at a time, I really would look forward to answering this.
Q. Do en echelon faults justify the exclusion of Kane Springs Valley from the management area?
A. Yes, they do.
Q. Are there interbasin flows between Kane Springs Valley and Coyote Springs Valley?
A. Yes, in a similar manner that there is -- and that there is flows and faulting between Delamar and Coyote Springs Valley and Pahranagat and Kane Spring Valley -- Coyote Spring Valley.
Q. Okay. And the 4200-acre-feet that you have in your report, is that a fair estimate of that flow, do you believe?
A. It is an initial estimate that I -- as the best information I can provide today to the Nevada State Engineer.

Q. That's the best estimate of interbasin flow that you're aware of?
A. That I am aware of.
Q. Thank you.
HEARING OFFICER FAIRBANK: Okay. So next would be Vidler Lincoln County, no additional questions? Okay. Thank you, Ms. Peterson? City of North Las Vegas?
MS. SCHROEDER: No.
HEARING OFFICER FAIRBANK: No? Okay. Mr. Donnelly for Centers for Biological Diversity?
MR. DONNELLY: It's actually singular, Center.
FURTHER CROSS-EXAMINATION
BY MR. DONNELLY:
Q. Thank you. Patrick Donnelly from the Center for Biological Diversity. I want to follow up on a couple things I hit on in my first round that I wasn't able to follow through on.
I'd like to refer you to page 54 of SNWA's July 3rd report. So that is page 54 of the PDF file of SNWA's July 3rd report, Figure 5-6 is what I'm referencing. I'll give you a minute to find it?
A. 5-6, yes, we're looking at it.
Q. Yes. So there is a figure for well KMW-1, the monitoring well in Kane Springs Valley. Do you see any

declines of that well -- monitoring well during the pump test?
A. Yes, I do.
Q. Approximately how much?
A. On this scale, half a foot.
Q. And is there further decline subsequent to the pump test?
A. There appears to be a decline in 2014 at which point the -- there's fairly average conditions or level groundwater levels.
Q. In a generic hypothetical groundwater model, would decline signals take longer to spread through a system the further away from the point of diversion you are? I can rephrase.
A. Yes.
Q. Is there a lag -- is there a lag time between a pumping and the signal being picked up far away from the point of diversion?
A. Yes, there is. I testified to that this morning when I was talking about our observations of groundwater levels and Coyote Spring Valley.
Q. Do you observe here that the Kane Springs well is declining in -- declined during that period in parallel to other wells and Coyote Spring Valley?
A. The Coyote -- Kane Spring well has a similar

hydrologic response as other wells, yes.
Q. And are you aware of the elevation --
A. I'm sorry.
Q. Sorry.
A. Earlier I testified about the seasonality of that, and that is something that I do not see in this well, is the annual type of variability. But I do see the other characteristics, which are observed of in the wells.
Q. Understood, yes. Thank you. Are you aware of elevation difference -- groundwater elevation difference between Kane Springs Valley and northern Coyote Springs?
A. Yes, I am.
Q. And how much is that difference?
A. Well, I know in the groundwater elevations, we're looking at approximately 40 -- I believe if we look at CSVM-4, which is right down -- it's what, 40 feet.
And then if we go down all the way to -- into the main part, CSM-4 -- so it appears to be about a seven-foot decline to CSVM-4.
Q. A seven-foot difference in groundwater elevation?
A. Yeah, and then from CSVM-4 down towards CSVM-6, there's approximately another 40 or 50 feet of decline.
Q. Okay. Thank you. To shift gears completely to evapotranspiration, you say the location of pumping makes a

difference as far as -- well, you assert that the location of pumping makes all the difference.
Is there a location in Coyote Springs Valley where they can -- where one could pump the 5,280-acre-feet of water while also capturing ET?
A. ET and --
Q. Yeah, okay. I'm sorry. Do you -- are you aware as to which side of that north/south fault the ET is occurring on in Coyote Springs Valley?
A. Oh. Right now, there -- our initial budget says there's only 1,000-acre-feet of ET in Coyote Spring Valley and I would guess that that's even overestimated today.
So under predevelopment conditions, there might have been 1,000-acre-feet. I think today there's probably much less, if any, phreatophytic ET that's occurring.
Q. And which side of the fault would that have occurred on or be occurring on? Where is that locus of ET?
A. As I stated today, I don't believe it exists in Coyote Spring Valley, so --
Q. Okay. So the thousand-acre-feet is predevelopment only?
A. Yes.
Q. And there's none now?
A. Yes.

Q. Okay. I guess my question is: Is there a place one could place a well to pump such that ET within the LWRFS is captured that doesn't affect the springs? Where is that pumping location?
A. That would be located on the western side of the fault.
Q. That accounts for 5,200-acre-feet. What about the other 25,000-acre-feet? Where can that be pumped where it affects ET, but not spring discharge?
A. So let's go back to identify a little bit more about -- I think where you're headed on this because I want to read my exact statement if that's okay.
So total -- so my documents states that after accounting for 32000-acre-feet of surface flow of the Muddy River, total evapotranspiration and groundwater outflow from the Lower White River Flow System would be 30000. So that's why I'm asking you exactly what your question is.
Q. Okay. My question is: You've stated 30,000-acre-feet can come out of the ground sustainably in the Lower White River Flow System and that 5280-acre-feet of that would be on the west side of the fault in Coyote Springs Valley.
So my question is: Where can the other 25,000-acre-feet be pumped such that it is capturing ET, but

it is not affecting spring discharge?
A. So my response, sir, is I didn't -- I think that they're the -- the important response here is that it's total evapotranspiration and subsurface outflow.
So when we -- if we're talking about designing a system where we want to capture a certain amount of evapotranspiration and a certain amount of groundwater outflow, you can't assign all 3,000-acre-feet just to ET.
You have to determine how much of the outflow are you going to capture, because I've stated clearly throughout my testimony today that, you know, all the pumping that's going to go on, something's going to happen.
There's no -- you know, something has to -- something has to be measured. There has to be a reduction in ET. There has to be a reduction in outflow. There has to be, you know, some type of impact that occurs from that.
So what I've suggested in my report is that, you know, that can be captured from, as I state here, total evapotranspiration and groundwater outflow. So I'm not saying that there's 30,000-acre-feet of ET. In fact, I'm suggesting there's 11,900-acre-feet of ET.
Q. Well, again, my question would be then: Where can you pump such that you can accomplish 11,000-acre-feet of ET without affecting any surface discharge of springs?

HEARING OFFICER FAIRBANK: And that will be your last question.
BY MR. TAGGART:
Q. Yeah, yeah. It's been one question.
A. Well, no, it's important that I answer. I want to provide information to you and to the State Engineer on how that can be managed, and I think that's where we have to go and look to see where that evapotranspiration is. How much is -- how much does the State want to capture, you know? How much is there willing to put up?
I mean, I've always said there is a trade-off for the imbalance of groundwater pumping and what is it going to capture? Is it going to capture ET? Is it going to capture groundwater outflow? Let's map those areas and go find out where those areas are.
MR. TAGGART: Thank you.
HEARING OFFICER FAIRBANK: Mr. Reich, and I guess I -- the question, though, and -- was: Have you identified where?
MR. REICH: Oh.
HEARING OFFICER FAIRBANK: I think that was the question that was being asked of you. And so I guess that's the answer that we're waiting for is: Have you identified where that pumping could occur?

MR. REICH: Oh, no, I have not. I -- if it was that easy in the beginning, I'm sorry, I would have answered that way. But did I miss --
HEARING OFFICER FAIRBANK: All right. Next, Georgia Pacific, do you have any additional questions or follow-up questions?
MS. HARRISON: No further questions.
HEARING OFFICER FAIRBANK: Seeing none. Nevada Cogen, do you have any follow-up questions?
MR. FLANGAS: I have no further questions.
HEARING OFFICER FAIRBANK: No additional questions. Okay. Thank you, Mr. Flangas.
Muddy Valley Irrigation Company?
MR. KING: No questions. Thank you.
HEARING OFFICER FAIRBANK: Seeing no other questions. Bedroc, any further questions?
MS. SCHROEDER: Nope.
HEARING OFFICER FAIRBANK: Okay. Seeing none. And then Nevada Energy, any further questions?
MS. CAVIGLIA: (Shakes head.)
HEARING OFFICER FAIRBANK: Okay. Just one moment. All right.

EXAMINATION
MR. BENEDICT: For the record, John Benedict.
My question goes to hydrograph for CSVM-5, and I know it's one that you said you haven't spent as much time researching, but it is kind of an interesting area with respect to the Coyote Springs area and it's on the west side of the basin.
And so I think this is in your July report, there's a -- oh, do you have one up there.
ANSWERS BY MR. REICH:
A. Yeah.
Q. Yeah, okay. You have it up there. So I was curious about the climate relationship that you've been talking about and what this hydrograph tells you. I know there's a bump in 2005, '6, it's relatively small and water levels continue to increase.
Would you like to speculate on what you think or what your opinion is on how the recharge that you're defining in sheep mountains is impacting that hydrograph?
A. Yeah, no, we'd love to.
We find this is a real challenge to understanding and developing our conceptual model in the area, and so we've asked ourselves a couple of different questions.
One of the first questions we've talked about

amongst ourselves is just a different in elevation. You know, why are we looking at -- now I'm going off of memory, was it 20.
MS. MORAN: About 60 feet.
MR. REICH: About 60 feet. So we have about a 60-foot difference in elevation in this well than we do in the other wells in the main part of Coyote Spring Valley.
So what's causing that? Is it a -- is it a perched, an area perched water? And we've seen in this other mountainous areas. So we could have an area of perched area water, we could have a boundary, we could have -- you know, we didn't get into technicalities today. But when we talk about boundaries, we often talk about leaking boundaries and what the permeability across those boundaries could be, whether they be faults. And so this is something special.
We went up and actually visited this well. This well is -- it really -- it peaked our interest on why this was going on.
So we drove up the -- it's an old rocky road that goes up the side of this hill out to where drainage is through the Steptoe Range there. And not only is the well there, but there's also -- Clark County flood control also runs a precip station at that location.
Unfortunately, the data period is not real long

for that precip station because that's where we want to go with this. We want to -- we really want to develop higher elevation rainfall. We think that's an important factor of understanding how this recharge system is working.
So with that recharge and with that rainfall runoff relationship, we start to try to better understand that. As we stand here today, you know, right now, we can hypothesize on what's causing that.
As I mentioned before, there's either perched water supply, a barrier. There could be a couple different fault structures that are going on there that could cause this. But, no, we're looking forward to actually addressing this issue.
Jean, you were with me, too. Do you have anything additional?
MS. MORAN: Given where the well is located way up on the side of the valley, I -- obviously it's not connected with what's happening on the valley floor, and either it is a pocket that is seeing the recharge and the collective recharge coming up.
We haven't seen a spring nearby to say that maybe it reaches a certain level and then it becomes a spring. You know, why did it go flat. We haven't fully determined why this well is behaving this way. But it is in the recharge

zone, so it is an area that does receive more precip.
HEARING OFFICER FAIRBANK: All right. Mr. Taggart. And we'll go until 3:00, when we'll take a break, and that's when we're going to go ahead and call it good for opportunities for cross-examination.
FURTHER CROSS-EXAMINATION
BY MR. TAGGART:
Q. Hello, again, Paul Taggart for the record. I have a question about that line that you just talked about. Is that CSVM-3 we're talking about, up on the -- up north in Coyote Spring Valley along the --
A. It is CSVM-5.
Q. Okay. And that's up in the right panel, upper right panel?
A. That's correct.
Q. So it does not reflect an increasing trend in water levels in that area?
A. Yes, it does.
Q. And doesn't that reflect the increased precipitation regionally?
A. I think as I stated in my direct testimony, this is an area that we have not been able to answer as thoroughly as we have others. This is the one well that doesn't fit the same characteristics as all the other wells that we've looked

at in the area.
As we just testified to, there's different reasons for it. One of them being it could be a purge supply. Another reason being that it could be a pocket of some area that is causing that faulting, and then lastly, it just -- it could actually be reflecting of some type of regional increase in recharge.
And so, no, you know, we've stated clearly today that we intend to continue to investigate this well to be able to answer that question.
Q. You're familiar with the reports that were submitted by the Park Service and the Fish and Wildlife Service?
A. Yes, I am.
Q. And you're familiar with their analysis of regional precip in areas surrounding Coyote Spring Valley, are you not?
A. Yes, I am.
Q. And you're familiar with their conclusions that regionally around Coyote Spring Valley to the north, east and west, precipitation and climate has actually been trending up?
A. Yes, I am.
Q. All right. And so it's possible that this well is reflecting that, right?

A. Yes.
Q. And I want to ask you -- I have one other quick question about this in your PowerPoint on page 17, and I already asked Mr. Carlson a little bit about this.
This is the resistivity data from cross-section A-A paren. And where -- Mr. Reich, where on this do you see a fault on the west side? What exact resistivity data do you see there that you believe is a fault?
A. We lost our pointer. So I -- oh, is this one? Can I use this? Oh, we need paper. It's not showing up.
MS. MORAN: It is. There it is --
MR. REICH: So I -- you see where my arrow is there, and I wish I could read those numbers for you, but I believe that number is 700. And you see that high resistivity blue layer and then you see the low resistivity, red, and then you get into this area of cultural noise that Mr. Carlson testified to.
Well, then when you go across that, I mean, you're above that 3,000 as we talked about the data that was east of 3,000 and you see, again, this lower high conductive area. So what I'm looking at here and what I'd like to point out about this fault is this vertical offset.
So you can see kind of this level here where there's this main elevation of the low velocity, low

conductivity layer, and a different elevation on this side.
Q. Well, what is it that shows your vertical offset?
A. Right in this section. The difference between --
Q. This being located where?
A. Between 700 and 11,000. If you look at that resistivity layer, you can see that there's a difference in that resistivity in those layers up there.
Q. In colors? You see -- do you see -- I mean, this is the -- this is the primary basis for your determination of the Highway Fault, this evidence, right?
A. Yeah. Well, do you see -- excuse me, do you see the blue?
Q. But am I right about that?
A. Do you --
Q. This is the primary evidence you're relying upon for the existence of this Highway Fault along this A-A prime, right? I object to you guys -- if, Mr. Carlson, you want to answer the question, you can answer it.
But I mean, it's a bit of a privilege that we do this in panels. But I think folks talking among each other during the answer isn't proper. If you want to answer the question, go ahead and answer it. But if it -- I don't want him giving me your answer.
MR. CARLSON: Okay. Sure, I'll answer.

BY MR. TAGGART:
Q. Well, the standing question to Mr. Reich was: Is this the primary evidence that you're relying upon for the existence of that Highway Fault, Mr. Reich?
MR. CARLSON: Yes, and line B. And as I said earlier, line B, it is better defined on the disk. But, yes, this line does show a fault near the western end of the line. It also shows the cultural noise that we talked about earlier.
BY MR. TAGGART:
Q. Well, because when I look at your Figure 13, forgive me, but this line that -- this Highway Fault, I don't know if we have that handy.
MR. REICH: Which figure is 13? In the report or --
MR. TAGGART: Your Exhibit 13, it's page 23 of your slideshow. Do you see that? I mean, forgive me, but I see that -- I see the fault, the Highway Fault cutting through the 2000 number on A-A prime, not where you just identified it at 700.
MR. CARLSON: 700 to 1,000 is where we put it.
MR. TAGGART: But it's not -- that's not where it's shown on --
MR. CARLSON: On this -- you're right, it does look like it's drawn closer to 2,000. The culture starts at

about 1900. We can't put an exact edge on it with a culture sitting there.
MR. TAGGART: So Exhibit 13, which is shown on page 23, that's inaccurate showing you where the fault is? It shouldn't be going through that location on line A, right?
MR. CARLSON: I would say that's approximate, but it's not inaccurate, no.
MR. TAGGART: Now, because -- well, forget that.
Where is -- so now you have Exhibit -- so I'm looking at Figure -- the figure up on the screen, Exhibit 13, I think.
When I look at Figure 10 in your report, and I wish I could have them both up on the screen at the same time, but Figure 10 in your report, can you get a copy of that in front of you?
ANSWERS BY MR. CARLSON:
A. Yes, I've got that.
Q. Okay. And this Highway Fault that I'm calling it, it doesn't cross line B at all on this figure, right?
A. Right. I think that's a typographical error.
Q. Oh, so this one doesn't -- this one's not depicted properly either on this figure?
MR. REICH: I'd like to clarify. You know, because of the -- because of the rush that we went through to

get Mr. Carlson and his company out there in April, it really was a lot to do in a very short period of time.
So unfortunately, when the July report came out, we had not received the final results. That's why, as you see in our August 16th submittal, we had attached Zonge Engineering, Zonge International's final results.
So why there might have been, you know, different changes in between when we submitted the preliminary results from the Zonge Engineering and the final, you know, there are going to be discrepancies and changes in our understanding of what constitutes that change.
BY MR. TAGGART:
Q. But when you completed your report in July, CSI number one, you did not basis your conclusion about this Highway Fault and its location on the resistivity evidence, did you, because you didn't have it yet?
ANSWERS BY MR. REICH:
A. If you look at Figure 11, I think a good picture would be to look at 11 and that is the April 29th, these are the preliminary results.
So if you're looking at the same report, it's literally the next page. You can see, you know, a good example would be as Mr. Carlson previously testified to, and this is in July, we knew the same thing. There was a

construction area of unknown cultural effects.
Q. Right. And I guess my point just is that you didn't draw your line through the cross-section of BB prime on Figure 10, even though you had the BB prime resistivity data because it was also submitted as part of the same report.
But now you're testifying that the resistivity data in BB prime is actually support for your position. But you didn't make that support in your report when you filed it; is that true?
A. Is that a question?
Q. It is.
A. Oh, we didn't submit it. Why wasn't that --
Q. Well, maybe I'll make it easier. Strike the question.
Is Figure 10 -- you would draw it differently if you could draw it today, right?
A. Yes, I would.
Q. Okay. And let's look at BB prime, and where on there do you see this evidence of fault? That's at about the 200 -- I'm sorry, 2,000 site; is that the same?
MR. CARLSON: Yes, the faults, it's -- when I'm looking at them, I'm primarily looking in the deep data down there where the shades are dark blue. On the actual printed plot, if you have those, you can see some contour lines.

They're roughly horizontal in the middle of the line and then they take a sudden downward plunge. That happens to be right about station 2500.
As you move further, you go into lower resistivities than that. This suggested to me that the fault is someplace in that zone, a different geophysicist could draw that at 1500, somebody else might draw it as 2300, and then we can also argue about what direction the fault goes. My impression is it dips to the west.
BY MR. TAGGART:
Q. All right. But aren't you interpreting there to be carbonate rocks on top of basin fill rocks?
A. No.
Q. Okay. So the dark blue is, in your opinion, carbonate; right?
A. The dark blue in the -- at the bottom of the cross-section is carbonates, right, most likely.
Q. Um-hum.
A. The dark blue up near the surface is probably very dry alluvial cover.
Q. So just -- Mr. Reich, on the 30,000-acre-feet that you were asked by Mr. Donnelly about, I have a similar question. Of the 30,000 feet, 30,000-acre-feet, why didn't you do two water budgets, one on each side of the fault?

A. You have to -- my goal was to respond to the State Engineer for the Lower White River Flow System. So, you know, I really looked at this as an exercise to be able to provide that information.
So I wasn't focused on just necessarily where the individual flowed paths throughout, you know, as they go into -- from MX-5 area down to the Muddy River area or the flow pass around through Garden and Hidden or into Black Mountains area. I think that's all very important stuff, but no, I didn't break it down to that level of detail.
Q. How much water does CSI own?
A. I'm not familiar with their water rights. I believe it's over 4,000-acre-feet.
Q. Okay. And of the 30,000 that you opined as a water budget, 5,000 is what you believe can be developed on the west side; right?
A. Um-hum.
Q. And that's -- that would be enough for CSI's water rights; right?
A. Yes.
Q. Okay. And what about the other 25,000? I think the question to you was: Could it be developed without capturing ET or capturing ET without affecting spring discharge. I mean, do you have an opinion on whether the

remaining 25,000-acre-feet in your water budget can be developed at all?
A. Yes, I do.
Q. Can it be developed without impacting the Muddy River?
A. Yeah, there's going to be impact. I want to state this really clearly and I've stated all day today is that as water withdrawn and is used and put under production, there is going to be an impact. And the goal here that we're here today is to be able to identify, you know, how that water moves through the system.
I'm not here to say what are an acceptable impact, you know, what was an acceptable reduction in groundwater outflow or what is an acceptable reduction in evapotranspiration. Rather, we've really taken this as an opportunity to provide the information that we see.
So, no, I have not identified exactly where the 30,000-acre-feet would occur, nor have I identified what would be the resulting impacts from that 30,000-acre-feet.
Q. So, hypothetically, if the standard was no impacts to senior rights, where could that water be developed?
A. So no -- so what senior could -- so maybe you could just tell me exactly what those senior rights are.
Q. Let's say no impact to the senior surface water

rights in the Muddy River?
A. Right. And then I would ask the question, you know, do you look at the point of measurement and the point of impact at different locations throughout the Muddy River? Are you measuring it at one location or are you measuring that at multiple locations or what would be your metric? And this is a --
Q. Sir, sir, the metric would be capturing senior water rights. That's the metric.
A. Right.
Q. Capturing river flow. Can 25,000-acre-feet be captured somewhere else outside of the compartment you've identified without impacting senior rights, without depleting, in any quantity, the Muddy River?
A. Yes, I believe that, sir.
Q. Where?
A. I did not identify where that would occur.
HEARING OFFICER FAIRBANK: It's 3:00 p.m. We're going to go ahead and take a break. We'll go off the record for about ten minutes and we'll come back, and then we can go ahead and proceed with Coyote Springs rebuttal.
(Recess.)
HEARING OFFICER FAIRBANK: All right. Let's go ahead and go back on the record.

And before we get started, I just have one question for counsel. It looks as though there's a missing page in your original presentation. The copy that we received did not have a slide number 62, so we jumped from page 61 to page 62. So I didn't know if that was intentional or an accidental omission.
MR. ROBISON: Intentional.
HEARING OFFICER FAIRBANK: Okay. Thank you. Go ahead and proceed.
MR. HERREMA: I just have three questions on redirect. I hope to be very brief.
REDIRECT EXAMINATION
BY MR. HERREMA:
Q. Mr. Reich or Ms. Moran, could one of you please explain for the State Engineer and the staff why you decided to do the Theis analysis that's included in your reports?
ANSWERS BY MS. MORAN:
A. We decided to do the Theis analysis to look -- to use something similar to what the Series C did as a cross check of how they approached it and to try to check to see if it made sense for the different wells.
Q. Thank you. Mr. Reich, Mr. Morrison asked you some questions regarding page 3 of the rebuttal report specifically related to the declines in water levels at the

Pederson Springs east and Pederson Springs locations.
Do you recall that exchange?
ANSWERS BY MR. REICH:
A. Yes, I do.
Q. Did you have page 32 of the rebuttal report before you?
A. Yes, I'm looking at page 32.
Q. Okay. The very last paragraph of that page, there's a sentence that says "these data support the conclusion that the change in spring flow at Pederson Springs east and Pederson Springs is closely tied to climatic conditions and not to carbonate groundwater pumping."
Is that still your opinion that that's the case?
A. Yes, it is.
Q. Thank you. I'd like to turn your attention to Exhibit 13, CSI's Exhibit 13, which is also one of the slides. Give me just a second. It's also slide 23 in the direct examination slides. Okay. Thank you.
In response to one of the State Engineer staff folks, the -- we've identified the locations of MX-6 is -- may not be correct on this figure. Other than that, is the interrelationship between the wells and the faults accurately represented on this figure?
ANSWERS BY MR. CARLSON:

A. Yes, with the exception of the MX-6, which we pointed out the relationship with the faults, the orientations, the placement relative to the wells that are established there is correct, yes.
Q. Okay. Okay. Mr. Carlson, is there -- in addition to the work that you did in your survey, is there any other data that you reviewed that supports that answer?
A. Yes. In the rebuttal slides this morning, we ran out of time, so we weren't able to present two or three of the slides. And one of those slides shows data from the USGS open file report. I don't remember the name, but it will be on the slide.
Q. And could we pull up slide 22, please, rebuttal slide 22?
A. From the rebuttal. Yes. So this is slide 22 from the rebuttal and copies are -- were passed out this morning. The base map of this is the southern section of plate one, which is titled isostatic gravity anomaly, USGS open final reports, 00420. They -- faults at all. It was 2000 open file report.
So all these contour lines that you see are -- all the contour lines that -- I'm just showing you the general location. That's the isostatic anomaly contours and what that's telling us is where the density of the subsurface rock

changes.
For example, if we included the entire map, we'd see the -- as we go this way across the contours, we're getting into higher and higher density rock. As we go down towards here and we see some negative contours in the lower left, that's the very low density rock. And it's just like topographic contours. The more contours you see in a given area, the steeper the slope basically.
And the USGS in 2000 did a fairly dense gravity survey along these orange lines called S -- gravity profile S1, S3, S2 down here and S4. And apparently their geologists were thinking the same thing as the CSI geologists and us.
This is an important area in Coyote Spring Valley. So they ended up putting their lines pretty much where we did. So our line A is right up here, our east/west line B is right here, and then C is over here. It runs behind the cross-section.
And all we've done here is align and size our cross-section for line B line, which is right here, lined up so we can look at what they saw versus what we saw.
On their map, they're showing faults that they interpret from the gravity data as these gray ovals. You see two of them up here, one right in here. There's actually two or three overlapped right in here, and then two down here that

we don't cross at all.
But if you follow these gray ovals that they interpret -- they call gravity faults because there's a big change in the gravity, which means there's a big change in density. If you just trace those overlay back -- those back to our line, that's where we see a big fault on the edge of that resistive rock.
They have a hole here, which is where we see a big change in color. That's where we see -- where we verified the concealed fault from. And out here, they put a gray fault right -- a very steep fault, you can see that by all the contours in that short area.
And if you project that onto our line, that's the west end of line B, approximately station 1500 to 2000, that general area. And they draw their faults as big, fat circles because they know that they can't place them exactly down to the 200-foot interval or anything like that.
But they can tell from all these contour lines in a very short area that there's a fault there, and that lines up virtually perfectly with the fault that we see on line B.
They don't have any dense gravity stations out here, so we can't verify the fault on line A, but we do verify the fault on line B very, very nicely.
Down here is their gravity cross-section. They

divide the results up into just two rock types basically. Cenozoics, which would include basin fill and some of the volcanics and the deeper Paleozoics. That's the high density harder rock. And you can see in their cross-section, that fault right there where we go from high density Paleozoic rock to low density Cenozoic fill and volcanics.

So it's -- I honestly wish we had seen the report before we did the survey because we would have adjusted our lines a little bit to line up even better. But this is a very pleasing result, at least to a geophysicist, because we're seeing a big change in two different physical properties at the subsurface at exactly the right points along those lines.

We're seeing a big change in electrical resistivity, which is how it conducts electricity, and we're seeing a big change in density, which is how dense that rock is, how tight it is. So a very good result, a very good correlation. And as I say, it's included in our rebuttal slide this morning, but we just didn't get to it.

MR. HERREMA: I have no further questions at this point. I'd like to move to have CSI Exhibits 1 and 2 admitted.

HEARING OFFICER FAIRBANK: The exhibits have been admitted. Thank you.

(Exhibit 1 admitted into evidence.)

(Exhibit 2 admitted into evidence.)

MR. HERREMA: Thank you. And then in terms of the slide presentations, should -- how should we mark those for identification in the record?

HEARING OFFICER FAIRBANK: Those will be included by the State Engineer in the hearing and filed. They're not being marked as exhibits.

MR. HERREMA: Okay. And these lovely posters that we brought today, I know one of them has already been used for additional purposes. Should we, perhaps, mark them and see if they're -- they continue to be used during the seatings?

HEARING OFFICER FAIRBANK: Again, they were presented for demonstrative purposes and I think we'll go ahead and just like the PowerPoint presentations, they will be maintained, we'll keep them available for the purposes of the hearing, and -- but I don't see that they're going to be marked as an Exhibit because the deadline for marking exhibits, again, it was a demonstrative document.

That was what was it was presented for, so it'll maintain -- be maintained summarily as the PowerPoint presentations that were not marked as exhibits in this list.

MR. HERREMA: Okay. I may have been -- or I meant just to mark them so that we can refer to them if

necessary.

HEARING OFFICER FAIRBANK: Well, yes, we'll have them. And then also I think there's some additional follow-up questions, if you don't mind, by our staff.

MR. HERREMA: Certainly.

MR. BENEDICT: John Benedict for the record.

EXAMINATION

BY MR. BENEDICT:

Q. So I'd like to follow up on the structures and make sure I understand the importance of these structures.

The first question, and I guess go to page 24 of this presentation -- no, it's not. It's the one that actually shows the structures based on, I guess, the interpretations of some aerial photos. Do you have that?

Yeah. So I wanted to make sure I understood which one of these structures represents what would be called the divide, I guess, or the isolating feature of the barrier of these, just so I'm clear?

ANSWERS BY MR. REICH:

A. So when we're -- excuse me, this is Steve Reich. What we're identifying as the carbonated block or the isolating feature would be if you look at MX-5, it would be the fault trending north, 30 degrees west, running through the location. And then the fault parallel to that on the other

side, which is also trending, there we go.

So this fault here, which is a continuation of the Arrow Canyon Range, and this fault here, which is the other side of that structural block. What you've seen today is the center area here is that dark blue area, which we're saying is high resistive formation. What we just discussed a minute ago then was this highway fault.

So the isolation faults there would be not only the structural block in between, but like we've seen in other areas, normal faults that can also act as barriers or conduits to flow. So there could be, you know -- there could be a movement or, you know, prevention of movement of water across a highway fault, across this fault, across that fault, you know. So those are the main -- those are the main faults that I think are germane to this discussion.

Q. So would it be fair to say then there are series of structures that represent that barrier or would you say that that horse block is primarily the feature of importance?

A. So I would say they're both important. The horse block is important as well as the other normal faults. If -- Anne, you could go to slide 5 or 6 or 7, which is the cross-section, maybe the conceptual drawing.

You know, the -- so I bring this up not because it represents that structural block, but rather it represents the importance of faults that are in the Coyote Spring Valley.

So again, as we look at these faults that are what we considered normal faults or due to extensional. Each one of these faults can impact the flow of water both in a lateral direction as well as a cross direction.

So when we look at that conceptual model and then we go to the -- that gravity survey that we were just showing a minute ago, I think it really gives us an understanding that -- the other slide -- of the importance of these and where they're located.

So again, looking at those -- looking at that last figure, imagining that one of those normal faults is trending that way. One of those nominal faults is trending that way, one of those normal faults might be trending that direction, a normal fault going up and down there, and also coinciding with that structural block. And then as we've shown before that the fault is located on that side.

So that's how we tie that conception model into what we're looking at from the geophysics data and then from the hydrology in terms of groundwater movement.

MR. HERREMA: Mr. Reich, can I just interrupt? When you're using the pointer for the purposes of the record, if you could just describe what you're pointing out with your words as well, that would be great.

MR. REICH: So I was responding to the question by indicating that on the rebuttal Exhibit 22, that there was a fault located through the gravity confirmed by the CSAMT. And when I'm using the pointer here, we -- these are high angle faults. So normal faults would typically be a high angle fault as compared to a low angle thrust fault.

So typically somewhere in this range, we would expect to see a high angle fault, and what I'm doing is drawing a near vertical line through the -- just a Paleozoic sediments to represent that high angle fault.

Same thing further in the gravity profile, the lower figure in rebuttal slide 22, we would expect there to be some type of fault in this direction. I don't want to venture too far into geophysics, but as we discussed earlier, there's both a down-drop side, as we see, and that's the vertical displacement that we would expect to see.

And I think that when you look at how this corresponds, you look at that low resistivity material that's shown in the geophysics slides and you compare that to the low density material that's in the gravity.

That correlation -- and I'm circling the low -- the red low gravity, low electrical resistivity material at the west end of line B, how that corresponds with the thick sequence of basin fill.

And then, of course, that's what allows us to draw the conclusion that there's a fault. I think when we go further to the right and we look at that dark red low high conductivity and low rate resistivity section, that also corresponds to the same thing that they saw in the gravity. It's a thickening wedge to the right. So that fault is located there.

And then, again, the high carbonate, high resistivity carbonate located here and then -- and again I'm just circling with the pointer on the geophysics on the CSAMT where, you know, you can see a slide replica in the same shape that we see.

So again, it's really combining the amount of information that's out there and putting it all together for us to understand why these faults are important, not just a structural block that we talked about, but also the normal faults that occur in the center of the valley, how they offset different sediments and forms.

Q. Okay. So last question. The structure that's identified that we've talked about quite a bit on the west, is there any reason from a geophysical perspective to characterize those two faults that are, I guess, mapped or interpreted based on the cross sections as being the same structure as you do in the map? I'm just curious.

You've got a couple of cross sections and you've identified a structure on the very west side on both of them, and then you've defined that as a single structure inferred on your plan view map.

Any reason that they need to be the same structure?

A. I'm -- I apologize. I'm not following exactly. Is there a figure that we can look at?
Q. Yeah, back to the aerial --
A. Yeah.
Q. -- photo image.
A. And I'm going to let the geophysicist answer that.
Q. Yeah.

ANSWERS BY MR. CARLSON:

A. Yeah, yes. I --
Q. You have the aerial photo? Yeah.
A. Yeah.
Q. So the western most, I'm just curious why that's drawn as a -- connecting the interpreted structures there. Is there an offset that's similar for both of those in the profile or some reason that they have --
A. No, the appearance of the fault is complicated on line A by all that culture. So we can't say that they look

similar enough to be 100 percent sure that it's the same structure.

We feel it is based on the fact that we have the continuation of this fault. We see it clearly on both lines, this fault clearly on both lines, and this one was at the same orientation as those.

So, yes, we are interpolating across from line B up to line A. There's no way that we can say geophysically that it's absolutely the same feature, but true.

MR. REICH: That's all I have.

HEARING OFFICER FAIRBANK: All right. Having no other questions from our staff, we can go ahead and conclude today's hearing. And so just to get everyone aware for tomorrow, we'll practice the same procedures again.

But, again, if people are expedient and efficient with their use of their time, which is much appreciated by the State Engineer and our staff here, we certainly appreciate that. And we will begin tomorrow with the United States Fish and Wildlife Service. So we'll see you tomorrow. Thank you very much.

MR. ROBISON: Thank you.

(Proceedings concluded at 3:36 p.m.)

STATE OF NEVADA)
) ss.
CARSON CITY)

I, MICHEL LOOMIS, a Certified Court Reporter, do hereby certify;

That on the 24th of September, 2019, in Carson City, Nevada, I was present and took stenotype notes of the hearing held before the Nevada Department of Conservation and Natural Resources, Division of Water in the within entitled matter, and thereafter transcribed the same into typewriting as herein appears;

That the foregoing transcript, consisting of pages 1 through 237 hereof, is a full, true and correct transcription of my stenotype notes of said hearing to the best of my ability.

Dated at Carson City, Nevada, this 24th day of September, 2019.

____
MICHEL LOOMIS, RPR
NV CCR #228

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In The Matter Of:

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES

Vol. II
September 24, 2019

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STATE OF NEVADA
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
BEFORE MICHELINE N. FAIRBANK, HEARING OFFICER

IN THE MATTER OF THE ADMINISTRATION AND MANAGEMENT OF THE LOWER WHITE RIVER FLOW SYSTEM WITHIN COYOTE SPRING VALLEY HYDROGRAPHIC BASIN (210), A PORTION OF BLACK MOUNTAINS AREA HYDROGRAPHIC BASIN (215), GARNET VALLEY HYDROGRAPHIC BASIN (216), HIDDEN VALLEY HYDROGRAPHIC BASIN (217), CALIFORNIA WASH HYDROGRAPHIC BASIN (218), AND MUDDY RIVER SPRINGS AREA (AKA UPPER MOAPA VALLEY HYDROGRAPHIC BASIN (219).
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TRANSCRIPT OF PROCEEDINGS

PUBLIC HEARING

HEARING ON ORDER 1303

VOLUME II

(A.M. SESSION, PAGES 239-379)

TUESDAY, SEPTEMBER 24, 2019

Reported by: Michel Loomis, RPR

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CARSON CITY, NEVADA, TUESDAY, SEPTEMBER 24, 2019, A.M. SESSION
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HEARING OFFICER FAIRBANK: Good morning. We'll go ahead and go back on the record, and this is the second day of the hearing in the administration of Lower White River Flow System hearing on Order 1303. We'll go ahead and get started this morning with the U.S. Fish and Wildlife Service.

But just before we get going, again, just to reiterate, this is an opportunity for the participants to go ahead and present their salient conclusions and point us in the direction of the evidence that supports those conclusions, and yesterday I thought was a very -- went well.

And so keep it in that path that we've been proceeding. And we appreciate everybody being succinct and making, you know, efficient use of their time. So with that, we'll go ahead and turn it over.

MR. MILLER: Hello to everybody, and good morning. My name is Luke Miller. I'm with the Department of the Interiors, Office of the Solicitor and I'm here on behalf of the Fish and Wildlife Service.

Today is our special day to bring forward our authors and experts who took part of drafting the reports on behalf of Fish and Wildlife Service that were filed with the

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State Engineer in response to Order 1303.

As you'll note, we have three authors. They each took part in drafting a specific section, a distinct section of the primary report filed on July 3rd, and we have one author who filed the rebuttal or drafted the rebuttal in whole.

They will each be providing today a summarization presentation that is distinct and precise to their particular section, and so hopefully you'll get it mixed up and see their own styles as well.

The reports, themselves, the Fish Wildlife Service believes are very robust, well rounded, rational, reasonable presentations of good information. They are solid and dense, so they took your recommendation to heart and they are trying their hardest to focus on the salient points and conclusions, and just trying to put some good useful information in front of you folks today so we can have a good discussion.

To that end, I'll just go ahead and have them introduce themselves, maybe we can start on the far end, get your name and spell your last name for the record and just tell them what you do.

MS. BRAUMILLER: Yeah, Sue Braumiller. I'm a groundwater hydrologist. The last name is spelled

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B-R-A-U-M-I-L-L-E-R, and I authored sections 1.1 through 1.5 and 1.7.

MR. MAYER: Hello, I'm Tim Mayer, that's M-A-Y-E-R. I'm a supervisor hydrologist of the water resources branch in the regional office of the U.S. Fish and Wildlife in Portland, Oregon and I think that's it.

DR. SCHWEMM: My name is Mike Schwemm, S-C-H-W-E-M-M, and I'm the Senior Fish Biologist for the Southern Nevada Fish and Wildlife Service office in Las Vegas, and I coordinate recovery efforts for the Moapa Dace.

HEARING OFFICER FAIRBANK: Okay.

MR. MILLER: Oh, just, we'll --

HEARING OFFICER FAIRBANK: And so at this point in time, we can go ahead and have the witnesses sworn in.

MR. MILLER: Yeah, that's a great idea. Sorry about that.

(The Panel sworn.)

DIRECT EXAMINATION
BY MR. MILLER:

Q. I would note just for the record that these three individuals were qualified in this proceeding as experts in their respective fields. And I'll go ahead and ask them now.

Sue, just starting down there with you -- I'm sorry, Ms. Braumiller, can you verify that you're familiar

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with Fish and Wildlife Service Exhibit 5, the report titled, "issues related to conjunctive managements of the Lower White River Flow System," filed July 3rd, 2019?

ANSWERS BY MS. BRAUMILLER:

A. Yes, um-hum.
Q. And can you attest that you personally prepared any part or parts thereof?
A. Oh, yes.
Q. Can you identify those one more time?
A. Yeah, sections 1.1 through 1.5 and 1.7.
Q. Okay. Mr. Mayer, same question for you. Are you familiar with the Fish and Wildlife Service Exhibit 5, the report filed July 3rd?

ANSWERS BY MR. MAYER:

A. Yes, I am.
Q. And can you attest that you personally prepared any part or parts thereof?
A. Yes, I prepared Section 1.6.
Q. All right. And, Mr. Schwemm, same question to you. Are you familiar with Fish and Wildlife Service Exhibit 5, the report filed July 3rd?

ANSWERS BY MR. SCHWEMM:

A. Yes.
Q. And can you attest that you personally prepared

any parts or parts thereof?
A. Yes, I prepared the entirety of Section 2.
Q. Okay. And, Mr. Mayer, I'm going to come back to you since you are extra authored here. Are you familiar with Fish and Wildlife Service Exhibit 7, titled "rebuttal to water level decline in the LWRFS managing or sustainable groundwater development," and that was filed August 16th, 2019?
A. Yes.
Q. And can you attest that you personally prepared any part or the whole part of that report?
A. Yes, I prepared the whole report.
Q. Thank you. I don't know if the format was for me to wait until the end or -- if not, I'll probably just go ahead and ask that these be admitted into evidence.
HEARING OFFICER FAIRBANK: They will be admitted.
MR. MILLER: Thank you.
(Exhibit 5 admitted into evidence.)
(Exhibit 7 admitted into evidence.)
MR. MILLER: So for our summarization presentations today, the Fish and Wildlife Service has opted to do a very narrative format style presentation for their direct testimony. And with that, I believe I will just go ahead and turn it over to Ms. Braumiller will start.
MS. BRAUMILLER: Sure. And there are handouts

over there on the left and they are my summary presentation slides and appended to those are a fairly large number of backup slides that I brought to assist me in answering questions, so I'm not fumbling through the report.
There are just a couple of slides that I accidentally left out of the package, but I can bring those tomorrow if you're interested.
Do you think that's about as bright as it's going to get?
HEARING OFFICER FAIRBANK: I think it will get better as it warms up.
MS. BRAUMILLER: Oh, okay. That's fine. Well, I will go ahead. My sections of the report are very simply an interpretation of geologic and hydrologic data leading to responses, my responses to the questions posed in Order 1303.
So what I'm going to present are my salient findings, hopefully just enough additional explanatory material to provide context and they are as follows:
They're -- I'm going to present them in the order in which I developed them because, in general, they followed one another. So I think that's the most logical way to present them.
I began by doing a literature search, probably by no means a complete literature search. But it was a pretty

earnest literature search in an effort to enumerate the sources of water in the Muddy River, from the Muddy River Springs to uppermost floor of Moapa Valley below which the river is oozing all the way to Overton.
In some cases, I found that sources were hypothesized, but hadn't been definitively demonstrated in the past, and I think I have identified definitively some of those sources. They are -- and most of this, we -- we already know.
The immediate sources of water in the Muddy River are, of course, Muddy River Springs, the surface discharges, seepage from alluvial aquifers into the river in the Muddy River Springs area in California Wash, and of course, intermittent runoff and precipitation in the river.
The Muddy River Springs, in turn, as we all know, are almost entirely derived from regional carbonate aquifer. The sources of water in the alluvium adjacent to the Muddy River Springs area and California Wash are infiltration of the surface discharges and some surface seepage from the springs in the Muddy River Springs area, the carbonate aquifer underlying Muddy River Springs and California Wash.
Alluvial inflows from basins bordering the Muddy River Springs area in California Wash, I found, or concluded that those included Lower Meadow Valley Wash and maybe Coyote Spring Valley.

And lastly recharge of local precipitation to alluvium probably to Pahranagat Wash from -- in Muddy River Springs area and Lower Meadow Valley Wash.
So most of that we already knew, but some of those sources, I think I was able to confirm -- oh, I'm not clicking in the right place. There we go.
In the process of confirming some of those sources of water in the Muddy River, I also demonstrated, I believe, that hydraulic connections exist between the alluvial aquifers of the Muddy River Springs area and California Wash and the underlying regional carbonate rock aquifer.
Oh, I didn't put that in the right place. Oh, boy. I should have brought my bifocals. Okay. Here we go. And the hydraulic connections also exist between the alluvial aquifers, Lower Meadow Valley Wash and the Muddy River Springs area between Lower Meadow Valley Wash and California Wash and between the Muddy Springs area and California Wash.
Second, I endeavored to clarify the DOI 2013 SeriesSEE Curve-fitting analysis of the Order 1169 pumping test and those findings since they are foundational to the identification of six basins and parts of basins under -- unclaimed by a portion of the regional carbonate rock aquifer possessing exceptionally high field scale transmissivity.
Those five plus basins being the Muddy River

Springs area, most of Coyote Spring Valley, Hidden Valley, Garnet Valley, most of California Wash, and the northwest part of Black Mountains area.

The basis for identifying the five-plus basins and that really occurred what, six years ago, was the development -- really the isolation of a remarkably uniform 1.5 to 1.6 drawdown in the regional carbonate aquifer due to the MX-5 test pumping as of the end of the Order 1169 test. That drawdown isolated using SeriesSEE analysis.

Of course, you know, we didn't analyze all of the water level records for monitor carbonate -- carbonate monitoring wells in the entire study area, but just did that for a select number of wells, far flung across the study area. And it -- I'll show you in a minute where those five wells were located.

At any rate, I'll just skip to this slide. This is really hard to see. So MX-5, if you can see this, is the triangle in the middle. All right. About three miles north of MX-5 is CSVM-6 in Coyote Spring Valley. It's -- it -- I think that was one point -- these are all between 1.5 and 1.6 feet of MX-5 induced drawdown.

So three miles north of MX-5 and CSVM-6, we see this 1.5 to 1.6 feet drawdown. Nine miles south of MX-5 in CSVM-2, also in Coyote Spring Valley, again, we isolated 1.5

to 1.6 feet of MX-5 induced drawdown.

27 miles south of MX-5 in Garnet Valley at GB-1, we, again, saw 1.5 to 1.6 feet of MX-5 induced drawdown, and 15 miles southeast of MX-5 in California Wash, in M-1, we saw the same thing. And nine miles east of MX-5 at SCSV-2 in Muddy River Springs area, we saw the same thing.

So -- oh, yeah, okay. So, I mean, this looks like a very small area on the screen, but it was a really expansive area of near uniform drawdown.

Clearly, it's a drawdown cone, it can't be anything else. But it was remarkably uniform, 1.5 to 1.6 feet of MX-5 induced drawdown over a very large area.

So in order to identify the five-plus basins, we then -- or I then interpreted that because it is a drawdown, flat or not. It must extend to -- at least to the nearest likely no flow boundaries and that is how we came up with the identification of five-plus basins that we did.

Okay. And that area, that portion of the regional carbonate aquifer based on a SeriesSEE analysis of 2013 of the pumping test, that area that possesses exceptionally high field scale transmissivity is something on the order of 1,050 square feet -- miles rather, miles, and as much as 24 miles from west to east and 60 miles from north to south. So I would deem that result, you know, foundational

to -- well, it was a starting place for where we're at right now.

Third, I concluded that the alluvium aquifers of, at a minimum, those five plus basins and the underlying carbonate rock aquifer function for all practical purposes as one groundwater basin as the source of the Muddy River Springs and Muddy River.

That conclusion based on my earlier findings, that the five-plus basins are underlined by a portion of regional carbonate aquifer possessing exceptionally high field state of transmissivity, and I mean, you know, the carbonate rock province of the Great Basin.

Secondly, the hydraulic connections that I think I've demonstrated exist between the alluvial aquifers of the Muddy River Springs area and California Wash and the underlying regional carbonate aquifer.

And lastly, that the alluvial aquifers of the Muddy River Springs area, California Wash, and Lower Meadow Valley Wash are, themselves, in hydraulic connection.

Okay. So fourth, yeah, I propose that Kane Springs Valley should be considered for incorporation in Lower White River Flow System pending clarification of the completion of the existing carbonate wells in Kane Springs Valley KMW-1 and KPW-1, relative to the Kane Springs Wash

Fault. That is still not clear to me. I'm not sure whether they would be completed on the -- it would be the northwest side or perhaps through the fault. They're very deep wells.

And also pending, the acquisition is sufficient hydraulic data to determine whether the hydraulic connection that I believe I've demonstrated to exist between carbonates in southern most Kane Springs Valley and central Coyote Springs Valley is limited to one side or occurs on both sides in the Kane Springs Wash Fault as I just said a moment ago.

And I'll just mention here that contrary to a 2007 ruling, I think it was 5712 -- yeah, it was 5712, that I believe I've demonstrated that although the transmissivity of the carbonates between central Coyote Spring Valley, I'm thinking like CSVM-6, might be the most northern extent and southern most Kane Springs Valley.

That although the transmissivity of the carbonates is clearly much lower than this chunk of the carbonate aquifer that just possesses exceptionally high field scale transmissivity.

It is still transmissive as evidenced by the fact that you can see the same -- at least temporally, you can see the same variations in water level preorder 1169 pumping test at CSVM-6 as you do in CSMV-4.

And, in fact, you can see it in KMW-1, and during

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the pumping test, you see the same response, not the same magnitude, but the same timing in the central Coyote Spring Valley, in CSVM-4 in northern Coyote Spring Valley, and in KMW-1.

So there is a hydraulic connection, the transmissivity is just lower in that chunk of the carbonates than in this very large area possessing exceptionally high transmissivity.

So let's see. So, you know, I think that more information is needed, but there's plenty of evidence that it should be investigated and considered.

And, you know, as a consequence, I propose a 3- to 4-month multi-well pumping test in KPW-1, which is needed, but not necessarily going to be sufficient to clarify the effects of carbonate pumping in Kane Springs Valley and Coyote Spring -- you know what I'm trying to say, Coyote Spring Valley, and its effect -- the effect of pumping Kane Springs Valley on the remainder of the Lower White River Flow System. Depending on what the completion of KPW-1 is and KMW-1 relative to Kane Springs fault, that's really key. We don't -- we've got to note that.

Five, you know, I conclude that the effects of carbonate pumping in northern Coyote Spring Valley or southwestern Kane Springs Valley within a wedge of the

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carbonate aquifer that is situated northwest of the Kane Springs Wash Fault and east of a north striking fault, normal fault, passing near CSVM-3 are currently unknown.

It's basically that chunk of the -- that chunk of the carbonates that is north or northwest of Kane Springs Wash Fault. You know, I think we just don't know what would happen if we moved carbonate pumping into the wedge, I would say, of the aquifer.

And, you know, I mean, on -- you know, based on -- if possible that this wedge of the carbonate aquifer is also compartmentalized by the Delamar Thrust Fault, then maybe gouge in the river's fault zone, unknown at this time.

And as such, because I know that's been considered, you know, I propose a 3- to 4-month multi-well pumping test in CSVM-3 to clarify the potential effects of moving carbonate pumping into this wedge, northern wedge of the carbonate aquifer, northern part of either Coyote Spring Valley or actually southwestern Kane Springs Valley is also part of that area.

What is to determine the effect of pumping within that wedge of the carbonates on groundwater levels in central Coyote Spring Valley and the remainder of the Lower White River Flow System, including the springs when they're flowing, of course.

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Six, I've concluded that the Kane Springs Wash Fault must be permeable over much of central Coyote Spring Valley. And I can go into this one, if I'm asked about, just based on water budget and secondarily, geologic considerations.

Seven, I think that Lower Meadow Valley Wash should be considered for incorporation in the Lower White River Flow System, given the potential for hydraulic connection between the portion of the regional carbonate aquifer underlying Lower Valley Meadow Wash, which I understand is poorly known, but apparently is there somewhere.

And that underlying northern and central Coyote Springs Valley, the Muddy River Springs area, and California Wash based on geologic considerations. The potential is there and -- but pending hydraulic confirmation following the installation of adequate carbonate wells in Lower Meadow Valley Wash of which I don't think there were any at present, and collection of sufficient hydraulic data to confirm a hydraulic connection between the carbonates being used Lower Meadow Valley Wash and these other five-plus basins, et cetera.

And that is a correction from our July report -- well, it's a clarification really, and we did submit that as this slide as some -- as an additional exhibit. I think we

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submitted four of these slides as exhibits just to be sure, because it was not stated that way in my original report.

But I would note that, at a minimum, the alluvial aquifer of Lower Meadow Valley Wash, I believe I demonstrated to be a source of water in the alluvium adjacent to the river in California Wash, plus a source of water in the Muddy River.

So for that reason, if for no other reason, I would advocate that it does impact water, the amount -- it does impact the Muddy River and California Wash to some degree. And for that reason, Lower Valley Wash should be considered, to some capacity, to be part of the Lower White River Flow System.

Okay. Eight, I identified climate signals and I did this very simply, just inspection of hydrographs, nothing statistical. I'm not trying to infer any statistical significance here, et cetera.

But I endeavored to identify climate signals in Lower White River Flow System groundwater levels and spring and spring flows in response to the 2004, 2005 and somewhat lesser, but still 2010, 2011 wet conditions for the limited purpose of characterizing the timing of those wet period responses of ground water levels and spring and stream flow relative to changes in the climatic conditions in the Nevada climate division 4, which includes the Lower White River Flow

System basins, the original five-plus basins, plus Kane Springs Valley, and Lower Meadow Valley Wash that I also proposed be considered. Those are all Nevada climate division 4 and -- I'm kind of rambling here. Okay. Sorry.

Characterizing the timing of the wet period responses in the groundwater levels and spring stream flows in the Lower White River Flow System relative to climatic changes and climactic conditions in division 4 and division 3, which are -- includes the basins that are immediate up gradient of the Lower White River Flow System basins and are the primary source of water in the Lower White River Flow System -- Lower White River Flow System.

And I -- I undertook this because I think that understanding the timing of the responses of groundwater levels and spring and spring flows in the Lower White River Flow System, the timing of those responses relative to the changes in climactic conditions are necessary, but also probably not sufficient to determine how climatic conditions are influencing groundwater levels and springs, spring flows, and the availability of water in the Lower White River Flow System.

And what I found or I believe I see, just based on simple inspection of the hydrographs, again, is that climate signals, really wet period signals in groundwater

levels and spring stream, you know, in flows at the Moapa Gage are detectible in carbonate water levels records basically throughout the five-plus basins in the alluvial water levels, in the Muddy River Springs area, in the hydrographs, water level records for Pederson and probably also Plummer springs, and the Muddy River Springs area, and arguably flows in the Muddy River and Moapa Gage all within about one year, which I thought was interesting.

In contrast, I looked at the water level record for both Baldwin Spring and I don't see those wet period responses in that record and I really don't know why.

But what I thought was very interesting and important because of big Muddy Spring is -- let's see, what is it? It's about seven CFS, it's a big spring and it's a significant component of the spring discharge to the river.

The Big Muddy Spring flows gradually increased and then decreased over about 12 years from 1995 to 2007 as that's a pattern not seen in division 4 or 3, Palmer drought of severity index trends since about 1977 to 1989 for 18 years prior, which I thought was very interesting. And I have a theory about that.

Nine, I identified the physical locations and conditions on the boundaries of the five-plus basins, Kane Springs Valley, and Lower Valley Meadow Wash consistent with

my earlier findings and using available geologic and hydrologic data, beginning with inflow boundaries. And the first and most prominent one, of course, is Pahranagat Sheer Zone, which is a constant inflow boundary between Pahranagat and northern Coyote Spring Valleys. I believe for the foreseeable future, two reasons, that is pretty clear this is a constant inflow boundary.

One, there is a potential for hydraulic resistance across a sheer zone based on geologic considerations, the three, I believe, slip falls that are the Pahranagat shoot zone. So, you know, water basically piles up in Pahranagat Valley behind the sheer zone.

And secondly, I estimate that a minimum of 1200 -- a minimum of a 1200-foot difference in head exists in the carbonate aquifer across this portion of the sheer zone.

That's a very large head difference, and consequently, I believe that -- I think it's pretty -- it's not -- it's pretty clear it changes on the order of many tens of feet in carbonate water levels in either Pahranagat and/or Coyote Spring Valleys, have no significant effect on the hydraulic gradient or basin groundwater flow across the sheer zone into the Coyote Spring Valley.

So it is -- you know, for all practical purposes, very conservatively you could say, it is basically a constant

inflow boundary. And it appears to be on the order of about 49,500-acre-feet per year based on the most recent water budget analyses I've looked at was using -- that is -- those were the water budgets developed by SNWA as part of their conceptual model for their CCRP model. Okay. So that was 2009.

Anyway, the other inflow boundary, I believe, is a variable inflow boundary between -- this is at the top of the Lower Meadow Valley Wash between Panaca Valley and Lower Meadow Valley Wash, given the potential for hydraulic conductivity through Lake Patterson and Panaca Valleys into Lower Meadow Valley Wash, all within the Meadow Valley Flow System based on geologic considerations. There's a continuity of carbonates and other permeable units.

And secondly, based on the available water budgets, again, they were SNWA's water budgets from their CCRP conceptual model, they concluded that there is water flowing from Panaca Valley into Lower Meadow Valley Wash based on those water budget analyses and variable -- a variable inflow boundary, given that, you know, the groundwater level data is pretty sparse in Panaca Valley.

But, you know, I found at least a couple records, well records, water level records where you could see long-term variations in groundwater levels up gradient of

Lower Meadow Valley Wash and Panaca Valley. It wasn't seasonal, it was longer than that. So I believe that to be a variable inflow boundary to the Lower White River Flow System.

And, again, based on SNWA's water budget analyses for their conceptual model for the CCRP model, it appears to be, you know, something on the order of 4700-acre-feet per year.

Next, I evaluated the potential for no-flow boundaries in the vicinity of the five-plus basins, Kane Springs Valley, Lower Meadow Valley Wash, you know, using geologic and hydrologic data that showed these -- well, okay. I'm babbling here.

The no-flow boundaries -- luckily no-flow boundaries were either coincidence with topographic that is for groundwater divides, coincidence with flow lines inferred from groundwater level data, or the locations where -- based on -- I made extensive use actually of HNL 2006, geologic cross-sections, and also, wherever possible, a 3D hydrogeologic framework model developed by SNWA to support the develop of CCRP numerical model.

Using those two sources, I attempted to locate places for the full sequence of Paleozoic carbonates are juxtaposed with low permeability rocks. Those being potential. Okay. I've lost my -- yeah, anyway, creating the

potential for no-flow conditions. I lost it again.

Okay. Confirmed by groundwater level data where it's available. It's pretty sparse, but where it was available, and also it -- including the propagation of pumping induced drawdown or lack thereof across some of these geologic discontinuities.

And, you know, in summary, what I see is that the available geologic and hydrologic data support that a large number of no-flow segments can be identified in the vicinity of the five-plus basins, Kane Springs Valley, and Lower Valley Meadow Wash, which largely define the aerial extent of what I propose would be considered at least as the Lower White River Flow System.

Ten, without going into the details until I'm asked about them, in which case we can talk about it. Ten, I wanted to know that whereas some ground outflow may occur across the Glendale and Muddy Mountain thrusts from Lower Meadow Valley Wash and California Wash into lower Moapa Valley and/or the Black Mountain area, that the rate of outflow is poorly known. It's uncertain. To date, it's based on Darcy-flux approximations and/or basin scale water budget analyses.

But more importantly, what I believe that that outflow to the extent that it occurs to lower Moapa Valley and

Black Mountain areas beyond the five-plus basins is unlikely to change significantly as a result of water management within the Lower White River Flow System in view of a 250-foot drop in carbonate water levels that is documented from west to east across the Glendale thrust.

That is from Lower Meadow Valley Wash to Lower Moapa Valley and a 100 to 150-foot drop in ground waters that is documented from west to east across the Muddy Mountain thrust, that is from California Wash to Lower Moapa Valley and Black Mountains area.

So, you know, although, you know, it may exist and it's not entirely clear what the rate of outflow is to Lower Moapa Valley or perhaps Black Mountains area, you would have to have -- it seems high unlikely that you would have sufficient change in head within the carbonates of Lower White River Flow System basins, or specifically California Wash, sufficient to change that gradient significantly.

And likewise, it seems unlikely that you get a really -- you know, I guess the 150 to 200-foot difference in head, it seems unlikely that you would get a large enough change in head of the Lower Moapa Valley side of these two thrusts to, again, change that gradient and that rate of outflow significantly.

So although it may exist, I'm not terribly

concerned that management within Lower White River Flow System is going to affect it, outflow to Lower Moapa Valley.

11, so in summary -- some summary, you know, I would propose revisions to the aerial extent of the Lower White River Flow System to include the following eight basins and parts of basins: The Muddy River Springs area, most of Coyote Spring Valley, Hidden Valley, Garnet Valley, most of California Wash, the northwest part of Black Mountains area, those being the original five-plus basins, plus Kane Springs Valley and Lower Meadow Valley Wash, pending, you know, the acquisition of the information that I mentioned earlier.

And that's really, really hard to see, but as you can see, that would be a significantly larger area than what has been proposed by others and what we recognize right now. So I'll just give that to you for your consideration.

12, you know, I conclude that knowledge of the relative transmissivities, storativities and hydraulic diffusivities of the carbonate and alluvial aquifers of the Lower White River Flow System are sufficient to address the remaining questions posed in Order 1303.

We don't -- you know, we don't need, you know, sophisticated estimates. We know that the carbonate aquifer had -- possesses high field scale transmissivity. All, of it compared to the alluvium, limited storativity and high, but

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finite, hydraulic diffusivity.

The alluvial aquifers of Muddy River Springs area and California Washburns are lower in transmissivity, higher in storativity and possess lower hydraulic diffusivity than the carbonate aquifer.

And I believe that's really all we need to know in order to answer the rest of the questions posed in Order 1303, such as, what are the effects of moving alluvial pumping into carbonates or carbonate pumping into alluvium.

13, based on all those previous findings, I developed a hydrogeologic conceptual model of Lower White River Flow System as a basis for addressing the remaining questions posed in the order.

And just generally, they -- it includes the effects of carbonate pumping. The effects of alluvial pumping within the Lower White River Flow System. The effects of constant inflow at the Pahranagat Sheer Zone. The effects of variable inflow of at the north end of Lower Meadow Valley Wash.

The causes of climate signals in groundwater levels and spring and spring flows in the Lower White River Flow System. The effects of decreased local recharge, local recharge or inflow to Lower Meadow Valley Wash due to changes in climatic conditions. The effects of changes in groundwater

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availability up gradient of the Lower White River Flow System basins due to development, time lags and the manifestation of pumping impacts and recovery, and lastly, the source of the Muddy River Spring, I have a hypothesis.

14, you know, I conclude the following about the sustainable levels of pumping in the Lower White River Flow System. Just an initial observation, carbonate and alluvial aquifers in the Lower White River Flow System are generally in good hydraulic connection, therefore, total carbonate and alluvial pumping must be used to establish a sustainable level of pumping. The total pumping, carbonate and alluvium.

Secondly, I observe, at least in my opinion, that there are too many outstanding questions regarding the hydrology and hydrogeology of the system to construct a numerical model at this time that will be useful in predicting the sustainable yield.

So I believe that the average rate of combined carbonate and alluvial pumping in 2015, '16, and '17, that was 9318-acre-feet per year or so, is the best initial estimate of a sustainable yield of Lower White River Flower System available at this time.

That is excluding rates of alluvium pumping that is currently -- that's occurring in Lower Meadow Valley Wash as that has not been inventoried as far as I can tell.

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Oops, I lost the place again.

That's assuming that flows in the Muddy River in 2015 through 2017 were sufficient to meet senior decreed water rights in the river, which, you know, is a domain in the State Engineer's office. I won't pretend to know that for certain.

And as I presented in my report and I -- you know, it's not here in detail in my summary presentation, but I do believe this to be conservative, but not overly conservative initial estimate of the sustainable level of total carbonate alluvial pumping in the system, if only because we know that pumping -- I can't bring it on the top of my head. It was like 10,000 something acre-feet per year was the total -- average total carbonate alluvial pumping during Order 1169 pumping test.

And when the test -- you know, when the test pumping ceased, the system was nowhere close to the equilibrium state as evidenced by the fact that the spring flows at Pederson and the Plummer Springs -- let's just say Pederson Springs because they're more accurately monitored, were in an undiminished state of decline and paralleled by changes in water level, in carbonate monitor well EH-4 is the closest monitor well, undiminished state of decline.

So the system was nowhere close to new steady state when the pumping test ended. So we know the 10,000,

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whatever it was, acre-feet per year was a total carbonate alluvial pumping during the test average is probably too much.

We estimated that the Pederson, one of the Pederson Springs would have stopped flowing if it had continued. So that is too much.

And I think we know from what we observed in 2015, '16 and '17, that assuming that the amount of water flowing down the river was sufficient to meet the senior decreed rights on a river, that the spring flows were pretty steady, the flow on the river was reasonably steady. It seems like a pretty safe bet and I don't know how we're going to know any better than that right now.

I also have a -- probably suggest an alternative approach. He's not here, so I've included it in my report, and he suggests that it may be possible to create a simple empirical model that can be used to project a level of combined pumping at a sustainable yield that will allow senior decreed water rights on the river to be met. And that would involve, if this can be done -- I'm not clicking again here, okay -- oh, here we go.

Yeah, what that would involve is if you could estimate what the total carbonate alluvial pumping was in the Lower White River Flow System basins, going back, you know, 20 years and just make an X/Y plot, that against -- I don't

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know if it would be flow to Moapa Gage, flow in the Glendale Gage, or maybe you'd have to look at both of them, but you could create a simple empirical relationship based on data, okay, that relates the rate of total carbonate and alluvial pumping versus what you saw going down the river at the Moapa Gage or the Glendale Gage or both of them. You could then pick off of that graph, okay, the level of total pumping that allows enough water to go down the river at the Moapa Gage or Glendale Gage.

And if you created such an X/Y plot using data that goes back, say, 20 years, you would also capture the effects of changes in climate, at least within that record. So it would have that benefit as well.

So I would suggest that be the next step. That, of course, would have to be updated periodically, but like I said, that kind of empirical model -- because I think -- you know -- it's -- we don't know enough to build a numerical model that can predict sustainable yield yet. That's what I think.

That kind of empirical model would have the advantage of accounting for climatic -- variations in climatic conditions at least in the past years. And regardless of what method is used, I do think that sustainable yield is going to have to be updated periodically to reflect changes in the

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available of water within the system due to changes in climatic conditions or groundwater development up gradient of the Lower White River Flow System, which at least at the top of Lower Meadow Valley Wash could affect rates of inflow to the basins. So I don't see this as being a static number.

15, I thought about the effects of moving carbonate and alluvial pumping within the Lower White River Flow System and this is my conclusion.

Carbonate pumping, total carbonate pumping should not be increased in exchange for reductions in alluvial pumping, even if total pumping is maintained at a sustainably overall level, since the Muddy River Springs, at least the Refuge Springs are derived almost entirely from the carbonate aquifer.

And existing carbonate pumping should not be moved closer to any of the springs or the river, which could reduce the lag time and the development impacts to the springs or the river, possibly before the impacts can be detected based on periodic data collection processing, because that does take time.

And with respect to alluvial pumping, I don't believe that it should be increased in exchange for reductions in carbonate pumping, even if total pumping is maintained at a sustainable overall level since, in addition to springs, the

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remainder of water in the river comes from alluvium in the Muddy River Springs area and California Wash, and that existing alluvial pumping in the vicinity of the river should not be moved closer to the river, pretty obvious, because that could reduce the time lag in development impacts to the river possibly before the impacts can be detected based on periodic data collection and processing.

And lastly, I enumerated -- it's probably -- it's not a complete list, but I enumerated some obvious unresolved technical questions, which I identified through my analysis regarding the hydrogeology for Lower White River Flow System, unresolved technical questions that I think are relevant to the development of an effective conjunctive water management program and eventually, you know, hopefully we can address. And that is it.

MR. MILLER: All right. Thank you, Ms. Braumiller. I think we're going to have to swap seats so Tim Mayer can put up his presentation.

MR. MAYER: Okay. I'm Tim Mayer, and I'm going to be talking about Section 1.6 of the report that was submitted in July, we go to the slide view. So the title of that section is, "groundwater and spring discharge relationships in the Muddy River Springs area and their importance to the trigger levels in the 2006 MOA."

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And basically we've all heard how Pederson Spring on the refuge is the highest, most sensitive spring in the system. And so I'm going to take a couple slides here and explain why that is just for those of you who haven't heard this before.

I think most of the people have seen these slides and heard this. This is our theoretical understanding of groundwater and spring discharge in relationship to the Muddy River Springs area.

So the springs are derived from the regional carbonate aquifer and that aquifer is confined and is under pressure. And so the potentiometric surface elevation of the aquifer rises above the land surface elevation in the Muddy River Springs area and that results in spring flow.

And because of the high transmissivity of the aquifer in this area, that potentiometric surface elevation is fairly consistent and uniform throughout the Muddy River Springs area. But the elevation of the springs, themselves, in the Muddy River Springs area varies quite a bit, by 70 feet or more.

So what this means is you have a range of hydraulic head differential driving the spring flow of the individual springs in this area. And by hydraulic head differential, that's simply the difference between the potentiometric surface elevation and the land surface elevation of the spring.

So if I can direct your attention to the higher elevation spring on the slide here on the left-hand side, and we have a potentiometric surface elevation at that site of 1,817 feet. We have a spring orifice with an elevation of 1,807 feet. So we have ten feet of difference between the potentiometric surface elevation and the spring elevation at that higher elevation spring.

So our hydraulic head differential is ten feet. If you move over to the right-hand side part of the slide and you look at the lower elevation spring, that spring is in elevation of 1,797 feet. All right.

Potentiometric surface elevation is uniform throughout this whole area, so it's still at 1,817 feet. So we have a hydraulic head differential at this spring of 20 feet. So the important part here is that we have a range of hydraulic head differentials at individual springs.

Now, why that is important is if you impose a drawdown, if you vary the level of the potentiometric surface elevation, say, through pumping or climate or whatever, so I've imposed a hypothetical five-foot decrease in the potentiometric surface elevation of the regional aquifer.

So now that potentiometric surface, it was at

1,817 feet, now it's at 1,812 feet. So if you look at the hydraulic head differential at the higher elevation spring on the left now, that went from an initial value of ten feet to a new value of five feet.

We have a 50 percent reduction in the hydraulic head differential at that spring. If you look at the lower elevation spring on the right, we had an initial hydraulic head differential of 20 feet, now we have a new hydraulic head differential of 15 feet, so we have a 25 percent reduction at that spring.

So we have 50 percent at the highest elevation spring, 25 percent at the lower elevation spring, and we -- because of Darcy's Law, we expect that the reduction in spring flow is going to be proportional to the reduction in hydraulic head differential, a change in hydraulic head.

So that means we would expect a 50 percent reduction in spring flow at the highest spring and only a 25 percent reduction in the spring flow at the lower elevation spring.

So that's why our highest elevation springs are the most sensitive to changes in water level elevations, at least that's our theory anyway. So this section is really an update of an analysis that we did of looking at groundwater and spring discharge relationships and the changes in flow and

the changes in head at several different sites in the Muddy River Springs area. And we did that in the Order 1169 report that the Department of Interior submitted in 2013. So this is an update of that order.

This is a map showing the monitoring sites that we looked at, the refuge boundary is shown in purple here. There are five sites that we looked at that are on or close to the refuge. Those are the Apgar Spring -- I mean, the Jones Spring, the Pederson Spring, Pederson East Spring, the Warm Springs West flume and then the Iverson flume.

Now, we didn't look at Baldwin Spring, but we did in 2013, but we didn't do it in this update. There were some funny things in the record there and we didn't look at Big Muddy Spring.

Big Muddy is the lowest elevation spring, it's the least sensitive, and we did not see any relationship when we looked at that in 2013. So we didn't look at that spring in this analysis here.

And then the -- just for reference, the monitoring well that I'm talking about, this is the carbonate monitoring well just south of the refuge, that's CH-4, and that's the well that we're using to represent the potentiometric surface elevation in the aquifer.

So I'm just going to walk you through one figure.

This is the top plot from Figure 19 in our report and this is showing the average monthly flow at Pederson Spring, which is the highest elevation spring versus the average monthly water elevation at EH-4. And this is for the period from 2004 to 2019.

So we've got discharge on the Y axis and the range of water elevations in EH-4 on the X axis. And you can see, we have a really good relationship between spring discharge and groundwater elevation here.

So what happens is the groundwater effects the springs there very clearly. We have an R-squared of about .97, that says that 97 percent of the variability in monthly discharge at the Pederson Spring is described by monthly groundwater elevations and EH-4. So that's really good.

So as I said, this was the most sensitive spring. And if you look at the coefficient or the slope of this line of this relationship, it's .05 CFS. That equates to about 19 percent of the maximum flow per foot of drawdown.

So, in other words, for every foot of drawdown that you get in EH-4, you lose 18 percent of the flow relative to the maximum flow. And that's the highest relative decline that we found in our analysis of the five sites that we looked at. So it makes sense. It's supposed to be the most sensitive spring, it looks like it is the most sensitive spring.

And then since we know the potentiometric surface elevation at the maximum water level here and at the minimum groundwater level, and we know the elevation of the spring orifice, we could estimate the reduction in head differential just like I did on the illustration that I just showed you.

So we did that and we estimated that the reduction in head should be or was about minus 72 percent. So we had a change -- that much of a change in head differential over this range of water elevations. And we compare that to what we measured in terms of reduction of flow and we see that we have very good agreement, 73 percent reduction in flow.

So that says that this spring is behaving pretty much exactly as we theorized that it should, and that it is the most sensitive spring in the system.

So this is just a table summarizing our results from the analysis of the five sites that we looked at, and the five sites are listed here in the first column on the left. Pederson Spring, Pederson East Spring, Warm Springs West, Jones Springs, Iverson Springs -- or Iverson Flume. I should say this is Table 1 in our report.

And these springs are ordered from high elevation to low elevation, so from high sensitivity to low sensitivity if they follow our theory.

And we've got the type of monitoring site here in the next column from the left. Some of these are spring monitoring sites, they're monitoring the outflow from the individual springs.

Some of these are flow monitoring sites and they're monitoring the collective discharge from a lot of different springs. And then we have the elevation here or the range of elevations depending on the site.

We have the R-squared value, I said was .97 for Pederson. You can see we get worse R-squares as we go to less sensitive springs. We don't have as much descriptive power in each water level elevations. We don't do as good a job explaining water elevation -- or water discharge changes at these lower elevation sites.

Then we have a slope coefficient, that's the slope of the line with key value associated with that coefficient.

And then over here, we have the changes that observed discharge that we measure over the range of water level elevations. And in the following column, the furthest column on the right, we have what we estimate was the change in head.

So these should agree pretty closely and then there's some variability, but they're fairly close. And they

are ordered from, you know, steepest or greatest decline to less decline. So it looks like these springs are behaving as we think they should, according to the theory that we developed. And this says that the Pederson Spring and those higher elevations springs are the most sensitive, and that if you protect those, you're going to protect the other springs in the system.

So, in conclusion, I've shown you that groundwater levels and spring discharge are really closely related, especially at these higher elevation springs. If you limit pumping in the Lower White River Flow System, you're going to maintain groundwater levels and you'll protect the spring flow.

I didn't talk much about this in the presentation here, but there are triggers on the Warm Springs West flume. Those triggers protect or measure the flow from the highest elevation springs, Pederson, the Pederson East, a number of other springs there. So those triggers are established to protect the flows on that use in the refuge, the Pederson -- the Pederson that has most sensitive springs.

So if we protect those springs, then we believe that you'll protect all the other springs in the MRSA as well. And that's all I have to say.

MR. MILLER: All right. We'll switch seats one

more time and let Mr. Schwemm sit over there. And after Mr. Schwemm's presentation, if you could let me know if the timing is such you'd like to take a break and then we'll have one more substantive presentation for the rebuttal report.

DR. SCHWEMM: All right. My name is Michael Schwemm and I'm going to be talking about Section 2 of the report, which deals with sort of the direct implications of the biology and springs for the Moapa Dace. So for this talk, I'm going to briefly go over a few elements that correspond to the sections straight out of the report.

So basically of the report that was divided up into these sections and I pulled out a number of salient features, not all of them, but ones that were important that I wanted to highlight here today.

It looks like we got the automatic timer on. So basically I'm going to cover elements of background biology of the Moapa Dace and some of the peculiarities that make it a really interesting species, and that led into a number of anthropogenic impacts and conservation actions that we've done on the Moapa Valley Refuge over the years, and that's kind of naturally led into the importance of cone activity and fragmentation and how that might affect the biology of the species.

And then that kind of -- after that is a discussion of spring flow and habitat needs, and for this section, I want to highlight one of the papers that I believe provides the best information in terms of this relationship.

And then I'll briefly touch on the -- our current and historical abundance of Moapa Dace and then I have a summary slide at the end. So I think it's only about 17 slides after the title slides. That's good news.

So starting off with where it is, I didn't think we had covered it already, but I wanted to just highlight a couple elements of the system that are important. So just starting at the very course of scale, I did have this one image here that isn't found in our report. It's just a map of the southern U.S., but this one here on the left is.

But as I mentioned or discussed in the report that the Muddy River Springs is part of a larger river system. Historically, in pluvial times, it was part of the pluvial White River, which is basically drainage that runs all the way down from the White River to -- through Pahranagat down into what's called the Muddy River and the original arm of Lake Mead. And that area here is shown in this little diagram I made.

But basically, at present, the Muddy River Springs provide a substantial water in the system currently. So that's -- makes it a really important sort of legacy of

water in the system from a biogeographic standpoint, which is why animals occur where they do. And that's an important -- I'll cover that in a minute.

On the left here is a diagram of the streams. The colored sections just represent areas that we identify as recovery units and we can communicate effectively. So the numbers just identify specific segments.

But as Tim just talked about previously, here's Pederson right here, here's Plummer Spring. This is Apcar. This green area here shows the majority of the refuge and these are some -- and then there's this -- kind of another branch here that's made up by the north fork and south fork that comes down, and this is the main stem down here.

So the Gage that Tim was talking about is right here on the Pederson stream, right at the refuge boundary, the Warm Springs West Gage.

MR. MILLER: Mr. Schwemm, just to remember, try to be specific with your descriptions since it doesn't come through with the pointer.

DR. SCHWEMM: Okay. So the system that we're talking about, the Muddy River, because as I mentioned that it's part of this historical drainage, there's a number of endemic species that live there. And the one we're the most concerned with is the Moapa Dace because it's endangered. But

it shares its habitat with a couple other fish, a couple snails and bugs.

So -- but overall what this system is characterized why it's unique from a biological standpoint is that Moapa Dace and others were sort of stranded in this little pocket of water that the Muddy River Springs area since the end of the Pleistocene. So as Holocene warming began, these fish were kind of stuck up there. And with the case of Moapa Dace, there's no other fish in genus Moapa.

So what that means is there are no really similar minnows. All of its very close relatives are extinct and it represents a unique component of the biodiversity of the system. So given that it's rare from, you know, a biogeographic standpoint, it also has some really interesting features about this species.

The first one is that it's thermophilic. That means that it likes hot water and for a minnow, this is way on the high end. So this species occurs from 32 to 26 degrees Celsius. That's about 90 or so on the top end. And spawning occurs at the very highest temperatures, 30 to 32. So it really likes hot water.

It's a small fish that's about 120-millimeter fork length with -- when it was sort of described in the '90's and -- oh, crap. That's about -- that's less than five inches

and it's left to live about four years or so.

But I'll come back to this at the minute -- or in a minute later in the slides that it's actually a little smaller now and probably only living a couple of years now. We have a little different age structure than was what we thought we had in the '90's.

A typical -- or typical threats of the species are those that affect most of the desert southwest, which is outright habitat change and then the effects of predatory invasive species, both fish and otherwise, and the availability of in-stream flow.

So you can touch -- boil down to rest of desert fishes of those three big ones. We don't have issues -- serious issues with pollution and stuff that we have as you move farther east in other systems typically.

So given all of this unique status that we've known about Moapa Dace for a long, it was listed as endangered kind of -- as kind of the first wave of fishes that came after the establishment of the Preservation Act in '66.

So it was right after that and it's one of the earliest fish to receive some protection. And it only occurs in the sort of upper mile or so habitat of the springs because it likes hot water. So as you go downstream, you're not going to find this in the cooler water areas or at least below 26.

So you're limited in that range.

But there's -- I'm going to talk a lot about movement within that range in the subsequent slides. But at present, we have about 1500 animals, which is considerably better from the 500 animals that we had in the recent past. So we're pretty pleased with that at the moment, but we still have quite a ways to go.

So given this rarity of the fish, it was important that a refuge was established for the Moapa Dace and just as an -- it's kind of an aside is that, you know, the wildlife refuge typically established for -- for waterfowl and wetland areas, and this probably was the only refuge established for a minnow. It's that unique in its biology that it warranted such an entire refuge based on this habitat. So it's really unique.

Early efforts on the refuge involved removing palm trees and trying to get stream habitat back to what it was naturally. And basically Plummer and Pederson were characterized by chlorinated swimming pools in which the stream was completely obliterated and similarly Apcar was taken all for municipal water supply.

So these springs had to be almost completely recreated and fish had to be moved around on the refuge and -- or off the refuge back onto those habitats. So it's really an

effort of extensive habitat recovery.

And similarly, when we do these sorts of renovations, we're trying to make habitat that's more amenable to Moapa Dace and less so to the invasive aquatic species like mollies and Mosquitofish and Tilapia that really have posed significant threats to the species and we've done a lot to mitigate these.

And on the refuge, more recently, we've really been thinking critically about what types of habitat we need the most benefit of the Dace, you know, how can we, you know, mitigate the effects of endangered -- of invasive species on the system and protect in-stream flow requirements. And the Fish and Wildlife Service has done this from a couple of previous agreements that I'll talk about.

What -- I guess probably what has -- what makes the species most interesting are a number of complex biological requirements that are really, really unique, but, however, they've also posed significant challenges to the recovery of the Moapa Dace and I want to highlight some of those here.

The first one is that the stream habitat where these fish occur varies with life stage, and specifically young fish feeding on really small stuff in slow moving pools. And as they get larger, they grow a little bit and become --

at juvenile stages, they drift downstream. This was shown by a lot of the early work of others that worked in the -- at the refuge. And then you typically find large fish in faster moving and deeper parts of the water.

And not only do they -- does the habitat vary by life stage, but it's also really interesting that the fish, even within their own lifetime, they vary where they are in the stream by their behavior.

And this is key and the adults are known to only spawn in the highest temperatures at the spring head that's about 30, 32 degrees, and yet they were found and typically feeding gross likely downstream. And this -- this is typical of even larger fish, kind of grow better due to, you know, metabolic concerns as they go downstream.

So the implication of these sort of complex biology is that Dace are continually moving upstream and downstream in the system on -- you know, daily, seasonally quite often because these fish are spawning year round, yet they feed in cooler water, at least historically. So we have a lot of issues with migration to deal with.

And I wanted to bring up one slide here, this is from the Warm Springs stewardship plan. And what I want to highlight here, it's just a nice diagram of the temperature of the spring heads. So you can see how the spring heads are hot

here, indicated by the red and as it goes through the blue, yellow, green as the streams cool down.

So what this means from Moapa Dace is that they're having to swim back and forth between the hottest spring areas of the spring head and downstream all the time and really highlight the importance of conductivity.

So what we've done for the conservation in Moapa Dace is kind of -- we've taken this three-part approach. And the first was to restore all types of habitat, because we know we need up at the spring head and we know we need slightly downstream.

And we've done this by trying to remove barriers and constructing habitat that's amenable to the species. And simultaneously, though, we've done a ton of work on trying to mitigate the effects of credation and non-native fish like Mosquitofish and Molly and the chemical removal of Tilapia from the entire system. And we think we have a pretty good handle on this now.

Just recently, we've come -- finished the entire system, treated the entire system of the Muddy River for non-native fishes over the course of the last decade or so.

And the last point is maintaining in-stream flow, and as I pointed out, it's -- we need to maintain these habitat -- specific areas of the habitat and the connectivity between them. And this has been accomplished through voluntary curtailment of groundwater pumping through a couple of Fish and Wildlife Service agreements.

In 2006, one was the MOA that we mentioned already that looks at Muddy River Springs area, Coyote Springs Valley. And the second agreement, which is the amended stipulation with Lincoln County, Vidler that dealt with Kane Springs. And so just to highlight some important aspects of the MOA is that it brought together the main water users in the area to actively protecting spring flow in the Moapa Dace.

And part of this was to establish a system where we would all meet monthly and discuss the needs and how they are changing so that we could have this sort of adapting management approach that has really been successful.

And then this included explicit financial agreements from all the parties to fund recovery actions of research that have made a difference, as you'll see, in the -- when we get to the current abundance slide.

Also, in there was these mandatory annual discussions of hydrology where we would discuss the pumping data that occurred only last year and how the triggers and the Dace are doing. And, of course, the important main in-stream flow triggers, which is the voluntarily curtailment of surface and groundwater.

And my report dealt only with the biology and not with other elements of these agreements, but I wanted to just highlight the triggers here just to show the -- what they are. And these are several exhibits and so I wanted to highlight that the -- it's 3.29 CFS or below 3.2 CFS, is where the first trigger in the MOA. And in the amended stipulation, it's 3.15. So they're approximately similar in where voluntary curtailment would occur.

So given that, you know, we have this, you know, this species that we know uses different parts of habitat and is likely sensitive to flow based on these habitat needs, I want to highlight one specific paper, in particular, that really shows -- provides the best evidence of how spring flow and Dace habitat, their relationship of those features. And I want to walk through this particular paper.

So what this -- what the authors did is they identified Dace habitat based on typical snorkel surveys and they measured habitat characteristics. And then what they did with this information is they wanted to ask, you know, what are the important variables for Dace, and they did this using logistic regression and model selection approach that used a presence/absence model and the -- and typical stream characteristics that you go out and measure like water depth, velocity, the sub-stream and the stream lithology which is

these -- which is sort of the shape, whether it's a glide or a riffle or a run type of habitat.

And then the second was to use this information, these variables that were important to develop a simulation that showed -- a model that showed when you actually changed the flow, how is that going to affect the amount of habitat that's available for Moapa Dace.

So starting with the first part, this is the part that developed a model for the number of variables and what variables they were. And there's a lot of text on here and a lot of stuff, and I don't want to get bogged down. I just wanted to cut and paste the direct figures from the exhibit unaltered.

But what I wanted to highlight is these are models here on the left, 1 through 13, and they included a bunch of univariant and multivariant models that -- virtually every one that they could and then they used the AIC, which is a model selection approach to choose the variables that best fit the data.

And typically with AIC modeling, models that have a delta AIC score of less than two is considered to be good models. So that limits us right here at the first two models. So they ranked them in the table convenient for us. So we're only concerned with these top two models. And within these

models, the variables that were important were depth, velocity, and the substrate, which is like cobble, sand, rock, so forth. And the other -- and a variable FRD which is that complex stream variable.

So given that these were the top models, the authors chose model 2 among them to carry forward the -- these sorts of important variables, depth, velocity and substrate to -- into the model simulation for flow.

So specifically what the authors wanted to ask is to address the question, how does habitat change in response to flow. And what they did to answer this question is they simulated 10, 20 and 30 percent increases and decreases of stream flow and they used this software, River 2D, to calculate how the amount of habitat that would be available at those flow rates. And they did this with Apcar, Pederson and Plummer.

So here's a slide showing a cut and paste of the data from the Hatten paper and there's two panels, A and B, and I'll sort of walk through what's on these panels and what they mean. So there's three colors on each panel. Those correspond to Plummer, Pederson and Apcar respectively.

Starting with the top panel, I'm going to point to the Y axis here. This is the amount of habitat per meter. So you can about this as an assessment of habitat. And then across the bottom are the different categories of flow.

So in the middle column here, this is start -- this is base flow right here. And then to the left would be at 10 percent, at 20 percent, at 30 percent increase or conversely a 10, 20 percent decrease in flow.

So as you can see, it's really obvious that there's a really nice pattern in the amount of habitat and then it's going down with decrease in flow. So whether you increase it, it goes up or decrease it, it goes down. And it's particularly clear on the descending limb. So as you get 10, 20 or 30 percent, you can see it's a really nice relationship.

Similarly, another way that the authors chose to graph this information to explain it a little differently was how habitat would change from what you had originally. And this is the same data, but it's formatted in a way that shows you the change in habitat on the Y. So it's either plus habitat or minus habitat as you go to the different flow.

And here, you see that same pattern. But I wanted to highlight that -- so when you reduce the flow at 10, 20 or 30 percent, and I'm pointing to those bar graphs, you can see that, in all cases, in all streams that they looked at, at all levels, that every time you reduced the habitat, you see a consequent reduction in the habitat in those

particular streams. And, in fact, it's really prevalent in Plummer, which is a pretty small one.

So the conclusions are that flow and habitat are proportional in this system and that any reduction in flow results in the decrease of the amount of habitat available for Moapa Dace. And given that's -- given it's endangered species, habitat is a premium.

So now I want to move on to talk a little bit about what the -- what we have currently in the system right now. This graph here shows abundance on the Y. I'm pointing to that and time across the bottom.

And this is Moapa Dace over time and you can see that this is about 2005 and '6. This is when that MOA was established and you can see the number -- you can see the increase in Moapa Dace in this diagram.

I didn't particularly identify specific features, but there's been so much habitat recovery going on since we've hit this really low, about 500 animals. This was when we had lots of invasive species. We had lots of Tilapia in the system. There's been, you know, fires, there's been a lot of recovery actions and things that have happened that result -- that all play into the amount of Dace that we see.

So it's complicated into attribute different features to exact to, you know, one particular recovery action

or another because they're all kind of happening concurrently. But it's important to note that we have the stable population of about 1500 most recently and we had a low of about 500 animals in their recent past.

Historically, it's fluctuated a lot from all the way up to in the high 3,000's at some point in time. But the system is dynamic in that stream reaches change and habitat changes, the effects of invasive species changes and so forth. So it's hard to pin down exactly what response is happening at what time.

So here is the same data and obviously these numbers are really small. I don't want anyone to read any of them. I just want to point out that we have the number of this stream reach. As I pointed out, there's a number assigned to each part of the stream along the -- on the left-hand side of this table, rather, and I just want to highlight that the bottom section of the table has all the zeros.

And those sections of the stream correspond -- the zero sections is that the north fork and south fork and the main stem river here, that we don't seem to have a lot of fish in that we used to historically, and that all the fish that we're counting now, basically are on the southern part of the system.

This is the Warm Springs natural area that's received a lot of recovery actions and, of course, the refuge that's received a lot of recovery actions. I'm pointing to the refuge and the southern portion of the Muddy River Springs area here.

So, with that, I want to summarize it up and wrap it up. Basically, we have this really interesting species that's a unique component of the biological diversity of the area given that it's a relic species and it's hot and it's a minnow and it uses cold temperature or slightly -- or hot temperatures, rather, and slightly cooler. And the implications are this fish is moving around and needing both sufficient discharge for deep water, as we noted, but it also needs all these kind of habitat concurrently.

And the ability for the fish to move back and forth among them is really paramount here and that's a little bit unique as far as fish go. This is an interesting species that has some challenges for us.

So recent estimates have shown Moapa Dace size has fluctuated a lot, but we have some protection in place that we've not hit the triggers. And the triggers at this point now are 32 and 315 respectively, and I think they have been useful in -- and particularly MOA in protecting the Dace.

However, with the caveat that, you know, we only have about 1500 Dace right now and as the Hatten, et al paper showed that increasing flow, even just 10, 20, 30 percent would result in a consequent increase in habitat, which would be reflected in Dace.

So it's important to remember that any decrease in flow is probably going to result in a decrease in habitat and could potentially harm the Dace. That's it. Thanks.

HEARING OFFICER FAIRBANK: So we have about another half-hour until we would take a break.

MR. MILLER: Okay.

HEARING OFFICER FAIRBANK: If you want to keep going.

MR. MILLER: What did we say, 30, 40 minutes?

MR. MAYER: My presentation is probably 30 -- probably 45 minutes maybe, 30 to 45 minutes. So we can start it and there is a place where I could break.

HEARING OFFICER FAIRBANK: If that works for you.

MR. MAYER: Yeah, sure.

HEARING OFFICER FAIRBANK: Let's do that.

MR. MAYER: Okay. I'm Tim Mayer again. I was the primary author of our 1303 rebuttal report. That rebuttal report really focused on the Moapa Band of Paiutes Order 1303 report, their initial report, and it really focused on the main argument in that report that there is long-term drought

in this region and that this has affected well levels and spring flows in the Lower White River Flow System and will continue to do so in the future.

So I don't mean to unfairly single out the Moapas. They were not the only one that made this argument. There are several other parties that did, too, but they were the main proponents of this argument. So I'm focused on their report.

So the first thing I did in my report is I presented this figure, which is Figure 1, and this is the monthly water level record for the carbonate monitoring well EH-4 from 1987 to 2019.

This is the well that's just south of the refuge that I showed you in my previous presentation and it's one of the longer records that we have of carbonate monitoring wells in this area.

And if we look at this figure just real quickly, it looks like we have about a ten-year period of fairly stable water level records in the beginning of the record there.

We have a decline that starts somewhere around 1997 or '98, continues to 2005, then we had widely recognized wet year response to what was an extraordinarily wet year in 2005. That response continued for a couple years.

Then we continued to decline again. The decline

steepens around 2011, beginning with the -- corresponding with the aquifer test. That continues until about 2013, the aquifer test and then the levels come back up somewhat. They don't come back up to the levels prior to 2010, but they seem fairly stable for the last few years or so.

So the main question is: How much of this that we see in this record is attributable to climate and how much is attributable to pumping?

So what I did in my report, the first thing I did was I looked at some of the climate data for this area. And I was a little surprised not to see climate data in the Moapas report. But they didn't include any, so I looked at climate Division 3 and Division 4.

We heard about climate division data yesterday from CSI that's available from the National Atmospheric and -- Oceanic and Atmospheric Administration, NOAA, and it's available all over the country.

I'm focused on Division 4, which is extreme southern Nevada. It's just the southern tip of Nevada and overlays the Lower White River Flow System as it's currently defined.

And then I also looked at Division 3, which is just north of the Lower White River Flow System in what is believed to be the area of recharge for the flow system. And

I looked at both precip data and Palmer Drought Severity Index data or PDSI.

Now, these are Figures 2 and Figure 4 from the rebuttal report. This is monthly precipitation totals in climate Division 3 on the top plot and Division 4 on the bottom plot. And this is for period 1990 to 2019.

And what you see when you look at this, there's the monthly precipitation totals plotted and then there's a moving average, a 12-month moving average, which just helps to identify the pattern of the data.

And what you see is quite a bit of variability, especially in the first half of the record. You'll see wet years, you see dry periods, less of that in the second half of the record. And, in fact, you may see a little bit of an increase if you look at the moving averages in monthly precipitation in the second half of the record.

What we don't see and what I was specifically looking for is some kind of long-term drying trend or drought here. I see dry periods, but they're sandwiched between wet periods and so forth. I don't see any consistent long-term drying trend in these precipitation data.

Next, I looked at drought indices data for the Palmer Drought Severity Index. This is, again, Division 3 on the top plot, Division 4 on the bottom plot. The same period of record, 1990 to 2019.

I also looked at Palmer Hydrologic Drought Index for Division 4 and that's plotted on the bottom plot there along with the PDSI. There was very little difference so I really didn't do much with that except plot it.

But, again, here, what we see if we look -- step back and look at this, first of all, let me explain what the Palmer Drought Severity Index is in terms of units. It's a standardized index. And so what that means is zero, a value of zero on the index represents average conditions. It's neither dry, it's neither wet. And the units of the drought index can be thought of as standard deviations.

So if you have a value of one, that means that you are one standard deviation wetter than the average conditions. All right. And a value of negative one, you're one standard deviation drier than average conditions.

And so Palmer defined negative 3 or 3 standard deviations drier than average as severe drought, okay? And correspondingly, he defined positive 3 or a 3 standard deviations wetter than average as severe wet conditions. So that gives you some idea of the relative value of what you're looking at here in these plots.

So we see -- we go from severe drought to severe wet, back to severe drought, severe wet. Bounce around a lot,

more so in the first half of the record, but then the second half of the record. But, again, we don't see any kind of long-term drying trend or drought in these data.

And even in the second half of the record, which looks a little bit drier, you still have some wet periods in there, some average or wet periods, especially one around the -- in the aquifer test, the time of the aquifer test.

And then I will note that both divisions showed that it's become severely wet in the last year or so. So things have gotten wet. We don't see that kind of similar recovery or that similar trend in the water level data or the spring flow data.

So next, I looked at well hydrographs for basins that were close to or adjacent to the Lower White River Flow System, but basins where there's little or no pumping. This includes Dry Lake Valley and Delamar Valley.

Delamar Valley is tributary to Coyote Spring Valley and the Lower White River Flow System and Dry Lake Valley is just north of Delamar Valley and tributary to Delamar Valley. And then I also looked at Tule Desert, and this basin is just east of the Lower Meadow Valley Wash and the Kane Springs area.

So presumably all these basins are responding to the same climate signal as what's happening in the Lower White

River Flow System. There's no reason to believe that there's different climate down in the Lower White River Flow System from these basins. And these basins have little or no pumping, as I say, so the well hydrographs in these basins should represent the climate response.

So this is the -- this is four monitoring wells monitored by SNWA and Dry Lake Valley for the period 2008 or 2010 to 2019. And if you look at these levels, the top plot, let's see, on the left there, is stable.

The top right plot shows a slight decline and then the bottom two plots here show slight increases. So certainly no consistent decline in these water levels in this basin.

Next, I dropped down to Delamar basin, which is, as I said, adjacent to Coyote Spring Valley, just north of it. And here we see two water levels, the top left plot and the bottom plot are stable, and then the top right plot shows a decline, but that really doesn't start until about 2015 or so. So it doesn't look like a strong drought signal in these water levels either.

Next, I looked at 13 monitoring wells in Tule Desert. Now, in the report, I only graphed these four, but I did discuss all 13 and I included them as exhibits, which I'll get to when I get to the next slide. But these four were

graphed in the report and you can see here that three of the wells show increases in water levels and one is stable.

And there's some funny things that happen in the first part of the record in all these wells, I think maybe there was adjustment in the elevations or measuring points or something. But if you look beyond that, basically three of the four wells are increasing over this period from 2007 to 2019.

Next, this is six more of the 13 wells in Tule Desert for the same period and all six of these wells show increases in water levels. And then finally these are the -- and I'm sorry, if I back up there, if you're looking for these graphs, these are exhibits down here in the lower left-hand corner.

These were not in the report, these six monitoring wells and neither were these last three on the left part of the slide. And those are exhibits, again, listed down in the lower left-hand corner presentation. But, again, these are three -- the last three of the 13 monitoring wells that I looked at, and you see increases in water levels in all these wells in addition. So certainly no drought signal in this basin either.

And then finally I looked at -- in the report, Figure 9, looked at the water levels in CSVM-5, which is the well we were discussing yesterday with Coyote Spring investment. They had a graph of this too and showed same figure, same period of record from 2003 to 2019. Basically that well has increased over time and may be stabilized in the last few years there. So no drought signal in that well either. And that's in a part of Coyote Spring basin that is believed to be unaffected by pumping, so that should be reflecting climate as well.

So my point with this is that there's no evidence that long-term drought or drying in the region exists or has affected water levels in this area. So I want to go back to the slide that I just showed you before, the hydrograph for CSVM-5, and I want to focus on this right here.

This is the wet year response to what I said was an extraordinarily wet year in 2005. We see that CSVM-5, we see that in almost all the carbonate monitoring wells in the Lower White River Flow System and even outside of the -- that system, we see it in other wells.

We certainly see it in EH-4 and this is a graph that was presented in our DOI 1169 report in 2013. This shows EH-4 water levels in red here and then the water year precipitation in Division 4. And I'm just singling this out to look at the wet year and dry year response in this figure here, which I discussed in the report.

So if we look at the wet years, particularly 2005, in 1992 and '93, we had back-to-back wet years in '92 and '93 and we see a little bit of a response there in the water levels. In 2005, a really wet year, the wettest one on record, and we see a really big response in water levels in EH-4.

So what you don't see is any kind of corresponding response to dry years. Let me back up here. I also looked at '95, you may see a little bump up there, and '98, they were fairly wet years, not quite as wet, and they weren't back-to-back wet years. But you may see some increase there, too. The '98 response may be obscured because of the climate trend started that year.

So what you don't see is the corresponding response to dry years in this record. So if you look back at 1989, that was a really dry year, look at the water levels there, really no change in the pattern before or after that or during that dry year. You look at '96, that was even drier, again, really no change in response to that dry year.

And then 2002, which is exceptionally dry. We had declining water levels through that whole 1998 to 2004 period, but we don't see any change in the slope of the decline related to that dry year in 2002. But we seem to have a response to wet years, but not to dry years.

One other thing I want to point out about this record, just kind of a side note is that, you know, why are we looking at climate and water levels? I would have looked at this first ten years of record here because that's a period where we had very little carbonate pumping, and yet we had a lot of variability of water, increased precipitation there.

And so if you wanted to try to illustrate the relationship between water levels and precipitation, that's a great record, a great opportunity to do it, and I'm -- I say I'm a little disappointed that no one did that.

So getting back to my previous point, we saw a response to the wet years. We didn't see a response in dry years. So should a water level response to extremely wet years imply a proportionate response or sensitivity to extremely dry years. And I would say, and we discussed this in our paper in 2008, listed as an exhibit there in the lower left-hand corner, that the answer to that is no.

The relationship between precipitation and recharge is nonlinear, especially in arid systems, which means that the system is much more sensitive to wet years than to dry years. And the reason for that is that a much greater fraction of precipitation becomes recharge in wet years compared to dry years.

So if you think about rain or snow hitting the

ground and what happens to that precipitation once it hits the ground. Well, it can be consumed by evapotranspiration in plants and evaporation from the soil. It can go to meet soil moisture demand or it can go to recharge the aquifer. But it usually meets those first two components first. It meets evapotranspiration and it meets soil moisture and it satisfies those requirements first before it gets down to the aquifer.

So in a dry year, after it satisfies those first two requirements, there's just not much water left over to recharge the aquifer. But in a wet year, the capacity of plants to transpire and evaporate water and the soil to take up moisture, that's limited. There's only so much they can do with that.

So there's a much greater fraction of the precipitation that's available to get down to recharge the aquifer in a wet year. And so that's why aquifers are so much sensitive -- more sensitive to wet years than dry years. So that's the physical explanation and we see that in the data, too. So I think that this is a pretty good place to stop if you want.

HEARING OFFICER FAIRBANK: That sounds like a good plan. Let's go ahead and take a ten-minute break.

(Recess.)

HEARING OFFICER FAIRBANK: All right. Let's go

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ahead and go back on the record, and you can continue on with your presentation.

MR. MAYER: Okay. Tim Mayer again and I'm finishing up the discussion of the rebuttal report.

So I'm going to switch gears here and I'm going to start to look at a critical review -- more of a critical review of the report that I reviewed of the Moapa's 1303 report.

But let me say again that I'm not singling them out, because a lot of the points that I'm raising with their report, I see in other reports that have been entered into the record here, too. So these are general points, just kind of using Moapa as an example.

This is Figure 3 from Appendix 2 in the Moapas 1303 report. And this figure represents the annual EH-4 water levels as derived by the authors from the annual base flow of the north fork, Virgin River, Utah. And in their own words, they're using the base flow of the north fork Virgin River as a climate proxy, okay? So something to represent climate.

And what they have here, they have water levels on the X axis, time on the Y -- or the X axis, I'm sorry, water levels on the Y axis. And then they have in blue, the water level record from the Gage 4 and those are water level elevations and then they have an orange kind of on top of

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that.

The training, what they call the training test data set, and I interpret that to meant that they derived that training set from the base flows of the north fork of the Virgin River. And then they -- if I'm interpreting the graph right, they hind cast the water level record back through time using the base flow of the north fork of the Virgin River.

So I want to make a couple points about this figure. First of all, I question why you would use a climate proxy, especially one in a different state when you have climate data as we've seen readily available, locally and regionally. So I question the need for a climate proxy.

The second point I'd like to make on this figure is -- and this is common to so many of the reports that we've seen. This is a time series plot. That means that time is on the X axis, and in this case, they're plotting these two variables parallel in time and trying to establish a relationship between those two variables.

The time series plot is not the best graph to establish a relationship between two variables. If you want to demonstrate a relationship, the best way to do it is to plot one variable versus the other in an X/Y plot. I think the technical people will know what I mean here.

So, for instance, when I showed you Pederson

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discharge in the Gage 4 water levels, I didn't plot the two in time to show that they varied together and all that stuff. I plotted one against the other, Y versus X and that's an X/Y plot. And that's the most effective way to evaluate the quality of a relationship.

So I would like to encourage everybody, if you're trying to demonstrate a relationship, started using X/Y plots. Do not use time series plots to demonstrate relationships. We looked at a lot of time series plots yesterday in the presentation from CSI. And they were trying to demonstrate a relationship between -- I think it was cumulative departure of the mean and the water levels and stuff. Over time, again, it's just easier to see that if you plot water level versus cumulative departure from the mean. So in an X/Y plot. So that's a second point I wanted to make about this.

And the third point I would make about this figure, and this is specific to this figure and this report, is that there wasn't a lot of information on how they derived this, I didn't feel. There wasn't enough information and I plotted in the slide, my Figure 1, which is the EH-4 water levels and then I derived monthly base flow for the north fork of the Virgin River from 1970 to 2020. And I lined the X axis up so the times would be -- you know, would correspond.

I look at these graphs -- I didn't look at this

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that closely, but I look at the graphs and I just question how you got the relationship we see there in EH-4 graph from the bottom plot. I don't see any similar kind of decline at any point in time like that.

So the points I want to make about this are, first of all, I would avoid the use of climate proxies when climate data are readily available. The problem with the climate proxy is there are questions about, was the site affected by the divergence, was it affected by adjacent groundwater pumping, has there been changes in the measurement location or method or something that would flow -- affect the flow record.

Again, we have climate data available and climate proxies were used -- you know, there were several kind of climate proxies that were used in this report, so I would have avoided those.

The second point is the point I made earlier about time series plots. I think we should avoid the use of time series plots when we're trying to illustrate the relationship between two variables and we should stick with X/Y plots.

So then I want to address some statistical questions and problems in the Moapa's report, and again, I'll emphasize that these were not unique to the Moapa's report. I see these same issues and some of these same problems in other people's statistics.

The first issue is model and variable selection and there was very little information in this report on how variables were selected in -- for regression analysis. And so they had a regression -- they had a number of regression analyses and those had multiple variables, as many as 27 in one case that I recall.

And so model and variable selection, how you choose the variables in your model that explain your -- the variable that you're trying to explain is very important. It's a very important issue.

Now, it's so important there are automated tools to help you do this objectively. There's the AIC, that's the Akaike information criteria. That's one tool to diagnose model selection. There's also step-wise procedures you can use that add variables, that take variables out and do that iteratively until you arrive at the optimum model.

What you want to do is you don't want to under fit the data, you don't want to over fit the data. You want the most parsimonious model, that is the model with the fewest variables that can describe the data because everything -- if you start adding a lot of variables, then you get into a lot of other issues, some of which I'm going to talk about here.

You start over fitting the data in the model.

So the next issue I saw in this report, and I've seen this in other reports to be fair, is the statistical significance of regression coefficients or I should say the non-significance. That was the issue.

So when you do a regression, you're trying to establish a relationship between explanatory variable, say, pumping or climate and a dependent variable, say water level, and that relationship is quantified through a coefficient in the regression. All right.

So the larger the coefficient in absolute terms, it can be negative or positive, but the larger the coefficient, the more impact that explanatory variable has on the dependent variable.

And every coefficient in the regression -- for every explanatory variable, you have a coefficient and every coefficient has a P value associated with it. And that P value is the probability of getting the value of the coefficient that you've got in regression when the true value is actually zero.

Okay. So the null hypothesis of regression analysis is that the regression coefficient is zero. That means there's no relationship between explanatory and the independent variable. And what you're doing with this

hypothesis testing, this P value is you're testing that.

You want to be able to reject the null hypothesis and the way you do that is with a really low P value. And traditionally we said that P values less than .05 are statistically significant, that indicates statistical significance. All right.

And so many of the regression coefficients that I saw in this report and in other reports had P values that were not even close to .05. They were much higher. I should say P values go from a value of zero to one. So .05 is on the lower end of the P value.

So this is just one example. This is output from table that was in the report in the Appendix 2. This is EH-4 water levels versus 16 years of north fork Virgin River base flows. So the regression is trying to establish a relationship between the EH-4 water levels looking at the current year base flow and the previous 15 years of base flow in the north fork of the Virgin River.

And the first column here on the left indicate that in this table, those are the 16 variables. LV-1 through LV-16. The second column on the left is the value of the regression coefficient itself. Okay. And we're testing that, that's the value that we're testing.

We're saying, is that really truly different from

zero. And this P value here on the furthest column on the right, that is telling us what the P value is, how likely is it that that value is truly different from zero.

And if we look at the ones I've highlighted there, I've highlighted 12 of the 16 variables and none of those are less than .05, which would indicate that they're statistically significant and statistically different from zero.

So -- and the R software here, the asterisks that are behind some of the ones that are statistically significant, the -- our software actually indicates which ones are statistically significant for the user.

So this is a problem. I think 12 of these variables probably should not have been included in the regression. So this is more output. This is from a regression of EH-4 water levels versus 13 weeks of Arrow Canyon well pumping.

So trying to relate the weekly water level, I think it's the weekly water level, and the EH-4 with the current pumping for the week at Arrow Canyon well and the 12 weeks prior.

And, again, you have like zero through like 12, on the left-hand column, those -- that represents the 12 weeks of pumping -- or 13 weeks of pumping, sorry. And then they

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have the regression coefficients, the values here in the second from the left column.

And then you have the P values in the middle there, and I've highlighted those. And you can see that 12 of the 13 are not statistically significant, so again, they should probably not have been included in this regression. It looks to be over fitted.

So this was not an issue I saw addressed in this report and I didn't see it addressed in other people's reports either.

So another issue that I raised -- that raised questions with me is the issue of multicollinearity and what that is, is that's the correlation of explanatory variables with each other.

So in a regression analysis, the assumption is that every explanatory variable in that regression is independent of others. And when you -- when they're not, when they're correlated, then you have multicollinearity and you have problems, you have regression coefficients that are unrealistically large. They can be unstable. So if you make a change in the data, they vary wildly in values.

They -- the statistical significance can be inflated, so you -- it looks like they're statistically significant, but they're not. And then also, finally, the

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sign of the regression coefficient cannot make physical sense.

So what I mean by that is the positive and the negative sign. So if you have a regression between a precipitation and water levels, you expect that when precipitation goes up, water levels are going to go up, right? So that's -- that would be a positive coefficient. That sign would be positive.

If you get a negative for some -- you know, you have a lot of correlating explanatory variables, you're likely to get a negative sign on that coefficient for precipitation just because it's trying to balance something else that's already accounting for the variability.

So when you have a bunch of variables that are correlated, that's a problem. And I think that this was a problem in the authors's report because they made a comment on page 44 in their report, they were discussing their two climate model, and they said, "the significance of over half, 17 of the 27 regression coefficients being negative in the combined models and not understood."

So I'm assuming that they probably expected positive coefficients, and in this case, they were looking at base flows and water levels. So you expect as base flow goes up, water levels should go up. They should be all positive.

The fact that they were negative probably

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indicates problems with multicollinearity in this regression. And again, they probably had more variables than they should have in this regression.

So the final issue that I questioned in the report was autocorrelation. So this is a little different from multicollinearity in that this is correlation of the dependent variable, the variable you're trying to explain. The dependent variable with itself.

So sometimes we -- say, for instance, we're looking at water levels in EH-4 on a weekly basis. Chances are that the water level from the previous week probably explains some of the water level that we see in the current week, right?

There's some information in that previous measurement that would explain a lot of the information in the current measurement. So they're correlated. This is called autocorrelation. And the problem with this is you have N observation -- N number of observations, but you don't have N number of independent observations. They're not all independent.

So what this does is it inflates the statistical significance too, and accept that these statistical significance that you see is probably worse than what it appears.

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There are ways to account for autocorrelation, there are ways to diagnose multicollinearity and account for that, too. So I would have liked to have seen a discussion of these issues in the report, and in all reports that there are any kind of regression analysis.

I'd like to see them address these issues and explain better in model and variable selection and address the significance of regression of coefficients and considerable to collinearity and autocorrelation and that kind of thing.

So I think that that is, yeah, the end of the slide. So I'm going to go back and I'm going to conclude the whole rebuttal report, okay, kind of wrap up here.

So I believe that there's no credible evidence that drought exists or has affected water levels in the Lower White River Flow System. The only water level response to climate that I observed in the wells in the Lower White River Flow System is response to extremely wet years. I didn't see a response to dry years.

So even if there is a drought, the question is: Does it really affect anything as far as water levels go? And then the analysis presented in the Moapa's 13303 report requires more information on methods and results. The authors either neglected or were not aware of many of the assumptions and proper procedures of a regression model. And that's it.

MR. MILLER: So that should conclude the Fish and Wildlife Services direct summarization presentation testimony. And if it is still allowable, I think we're ahead of schedule in the sense of our allotted time. I would still like to reserve maybe 30 minutes for redirect.

HEARING OFFICER FAIRBANK: Certainly. You have about 50 minutes left, so you can reserve that time for redirect and you can use as much or little as you like.

So we'll go ahead and get prepared for cross-examination. And cross-examination, we had a couple of parties that stated that they were not going to be participating in cross-examination today.

So I've adjusted the amount of time allotted to the various participants who have indicated or have not indicated that they would not be participating in cross-examination.

So based upon that, the parties will be allowed 16 minutes and then similarly, as yesterday, if there's additional time remaining after the State Engineer staff has an opportunity to ask questions, then we'll reopen that time frame up again on a limited basis to participants to follow up with additional questions that they may not have sufficient time within that first allotment of time or such.

So we'll go ahead and start the timer with

16 minutes and we'll begin with Coyote Spring Investments.

CROSS-EXAMINATION

MR. HERREMA: Good morning. My name is Brad Herrema and I represent Coyote Spring Investment in this proceeding and I have just a handful of questions for you.

I'd like to start with Ms. Braumiller. You conducted a SeriesSEE analysis, did you not?

ANSWERS BY MS. BRAUMILLER:

A. Actually, I did not conduct the SeriesSEE analysis that's in our DOI 2013 report. Keith Halford, who is the author of SeriesSEE, conducted that analysis in 2013. It was a pretty new code at the time.

It had only been published in 2012, and frankly, I think Keith was the only one that was proficient in it enough at that time to analyze all the data. We were working on a pretty tight timetable.

So he graciously volunteered to the other DOI agencies to perform that himself. He did it at my desk and tutored me in SeriesSEE and we walked through it together for about 11 hours. But he actually performed the SeriesSEE analysis.

Q. So you're familiar with the SeriesSEE analysis?

A. I am. I'm very familiar with it. But I wanted to be clear that I did not perform it in 2013.

Q. And have you relied on that SeriesSEE analysis for your conclusions in your current report?

A. Some of them. Okay. I think it clearly established this area of exceptionally high field scale transmissivity in the carbonate aquifer underlying those five-plus basins. So I -- it's a -- it is a very important conclusion.

Q. Okay.

A. One of many.

Q. Did that SeriesSEE analysis account for groundwater recharge?

A. No, it did not.

Q. Are faults or boundaries accounted for in that SeriesSEE analysis?

A. No. No, Keith did not. I'm not even sure it's possible. We -- a few of us have discussed this. It might be possible to use image wells in the SeriesSEE Curve-fitting analysis to account for no-flow boundaries, but he did not choose to do that and it's not clear to me at this time as even possible using SeriesSEE.

So -- but the reason he did not choose to do that, if this is helpful, is the purpose was to -- you know, there was a lot of pumping going on within the study area for water supply, right, at the time of the study. And it was

pumping at MX-5. That was the test pumping. That was really the test.

So the purpose of that SeriesSEE analysis was to try to isolate the MX-5 induced drawdown from all that drawdown induced by all the other ongoing water supply pumping, and just look at how aerially extensive the drawdown create by the MX-5 test pumping was or was not. The surprising part was that it was incredibly uniform over a very large area. That was unexpected.

Q. Did the analysis account for varying levels, I guess, of transmissivity and storability?

A. No, that's not how SeriesSEE works. Okay. There's no question that this fractured rock aquifer is heterogenous, no question about that. Okay. So SeriesSEE is a Curve-fitting tool, a Curve-fitting tool, right?

So, you know, I mean, in the simplest terms, the assumption is, is that there's a collection of pumping and non-pumping stresses and non-pumping stresses and environmental stresses that influence water levels in a well.

And they're each approximated by analytical expression and those analytical expressions, every one of them has a coefficient and they are jointly optimized. In the end, you have a collection of analytical approximations that represent the effect of each of those either pumping or

non-pumping stresses on the water levels that you observed in the well, right?
So what did you just ask me? I'm so sorry.
Q. I'll move on to the next question.
A. Yeah, that's fine. Sorry.
Q. Following the 2013 SeriesSEE analysis, did you check your results with available post-test data in preparation for -- of the July report that you prepared?
A. Yeah, did I cross check? I'm sorry. That doesn't quite make sense to me.
Q. Did you use any post-test data to check your -- the results of that SeriesSEE analysis in preparation of the July report?
A. No, that wouldn't have been relevant. The purpose of the SeriesSEE analysis was to look at how extensive the drawdown was created by the MX-5 test pumping. And the -- and it proved to be very extensive and it proved to be remarkably uniform.
The implication being that that chunk of the carbonate aquifer possesses exceptional high field skill transmissivity. So there wasn't anything in particular that I needed to clarify about that result.
Q. Okay.
A. Right. So, no, I didn't.

Q. Yeah. Could the same unprocessed data produce a different result in that SeriesSEE analysis?
A. Would a different set? I wouldn't expect it --
Q. No. Was it the same unprocessed data?
A. The same -- oh, the original input data to the SeriesSEE analysis?
Q. Yeah.
A. What, if someone repeated it or if there was a whole new data set -- I'm sorry, from the big pumping test which -- I'm sorry --
Q. No, the same unprocessed data, perhaps if the amounts were adjusted a little bit, would that produce a different result?
A. Well, it's a Curve-fitting tool and so the results of the Curve-fitting are a collection of -- it is certainly an approximation and an estimate, but the trend in the results were so clear that, yeah, if you repeated Curve-fitting to the original Order 1169 pumping test data, you -- I absolutely believe that you would come up with the same result.
Would you get the exact same estimates of the MX-5 drawdown at every single well? It would probably be somewhat different because it's a Curve-fitting process, right?

But you would -- I have no doubt that the results were so remarkable, the drawdown was so expansive and it was so surprisingly uniform, you know, that I have no doubt you would show that same thing there.
Q. Thank you. Could I change gears to talk about the boundary of the Lower White River Flow System?
A. Sure.
Q. In your conclusions, you identified a number of tasks that you would do to confirm your conclusion about the best boundary for the Lower White River Flow System?
A. Um-hum.
Q. Is that correct?
A. Yeah, with respect to considering Kane Springs Valley for inclusion in the system.
Q. And so pump tests as well?
A. And Lower Meadow Valley Wash both, right.
Q. Okay. And you also discussed the possible construction of I think what you refer to as an empirical model that, in my words, might -- you might be able to back out the total of pumping that could sustainability occur.
Do you recall that as well?
A. Yeah, absolutely. Right.
Q. Okay. One of the caveats that you had on the 9,318-acre-feet per year number in your presentation was that

that assumed that flows in the Muddy River during that period were sufficient to meet senior water rights.
Do you recall that?
A. Yes, and --
Q. Do you have -- I'm sorry.
A. No, go ahead.
Q. Do you have an opinion as to what quantity of water is necessary to satisfy those?
A. I -- this is a demand on the State Engineer's office and I do remember a table that was assembled and distributed in one of our Lower White River Flow System working group meetings.
You know, I wouldn't pretend to have a handle on what the total senior decreed water rights are on a river or how they're distributed on a river. So I didn't attempt to evaluate that. I said, assuming that what happened in 2015 to '17 was enough water, I think that total pumping during that period is the right starting place.
Q. Okay.
A. Yeah.
Q. Are you familiar with the MOA?
A. MOA.
Q. 2006 MOA that was discussed?
A. Um-hum, yes.

Q. Would the trigger levels that are in that MOA, would that be something that might be a mechanism that could satisfy the Fish and Wildlife Services concerns about the spring flows?
A. Yeah. So I cannot speak for the whole agency, okay? But from my perspective as a groundwater hydrologist, I would tell you this: They provide a level of protection that we've never had before and we have now and I think that's great.
But at the time that the MOA trigger levels were developed, we didn't know as much about how the system works as we do now. So I think it is important and obviously it exists and it's going to continue to exist, and that's very important. But it's not sufficient in and of itself in my opinion.
Q. I'd like to move to Mr. Mayer if that's okay.
Mr. Mayer, I'm going to ask you the same question I asked Ms. Braumiller. Do you have an opinion on what quantity of water is necessary to satisfy the Muddy River rights?
ANSWERS BY MR. MAYER:
A. No, I don't have an opinion on that.
Q. And your second conclusion on your conclusions five was that the trigger levels in the -- for Warm Springs

West flows established in the 2006 MOA are still valid and important for protecting the Pederson Unit Springs; is that correct?
A. Yes.
Q. All right. I'd like to shift gears to a couple questions on your rebuttal of the Moapa Band of Paiute Tribe report?
A. Okay.
Q. The data that you showed in your rebuttal presentation regarding precipitation records you reviewed, what was the period of that record; do you recall?
A. Well, I showed you two periods. I showed you 1990 to 2019 and then I also showed, on a later graph, I had data from 1987 to 2013.
Q. Did you consider precipitation data at the NOAA division for -- or NOAA division for precipitation data from 1895 to 1990 when assessing whether or not there are bad droughts or current drought condition?
A. Yes, I looked at the -- I downloaded all those data.
Q. And did those have any effect on your -- or impact your analysis?
A. No.
Q. And why is that?

A. Because there was no effect.
Q. Okay. Did you review the location of faults, recharge areas or discharge areas when assessing the hydrographs that you looked at?
A. No, I didn't.
Q. Would you expect that faults or recharge areas, other structural barriers might affect the hydrographs?
A. I would admit that they would probably affect some of them. I wouldn't expect them to affect all of them, though.
Q. Okay. Did you review any of the well driller logs for the wells that you looked at in terms of total depth or perforation zone?
A. No, I reviewed the aquifers that they were in, but that's it.
Q. Do you think that depth of the well perforation zones, those type of things you would see in a driller's log, that they might affect the groundwater level response?
A. Yes.
Q. Is it Dr. Schwemm?
ANSWERS BY DR. SCHWEMM:
A. Yes.
Q. Okay. Dr. Schwemm, a couple questions for you on the Dace. What is the greatest threat to the Dace immediately

downstream of Pederson Springs?
A. Immediately downstream? Well, it's a mix of immediately downstream of Pederson Springs. Most of the habitat that I believe this is from EH-5 on the diagram, and if you want, we can pull it up.
But I think that area that has undergone extensive -- at least at the transition point from the refuge to the Warm Springs natural area, that's undergone a lot of habitat restoration at this point and doesn't have the level of non-natives.
So in that particular stretch flow, I think, is probably the most important, maintaining flow. And -- but it depends -- it shifts because their shifting relative contribution of invasive species and flow and the quality of the habitat.
Q. What about barriers to the passage?
A. Oh, yes, there is a barrier below, right at the refuge boundary to the Warm Springs area. There's a relevant -- the old -- the Gage that's installed there is relatively old and it has a drop associated. We think it made it difficult for Dace to get up and down there very easily.
And we target that as something on the near horizon, to sort of increase the level below the Gage or change the Gage to a newer model, that there wouldn't be an --

as great of a small waterfall sort of barrier there.
Q. What is keeping that work from going forward?
A. It's just been an ongoing project because the Gage -- there's -- because the Gage is used for the MOA, there's just been a lot of discussions and meetings that have to take place and have taken place over what it takes to get a new Gage that would read accurately.
And in this case, our goal for moving forward is to place another Gage on there and make sure that they read the same. And then after that, we could remove the old Gage and leave the new Gage in there that would be a more modern style that would hopefully have less of an impact to migration.
Q. And do you have a time frame for when that might be done?
A. Not really. We're hoping the next couple of years. So I guess I do have a time frame, but exactly when that happens and getting the funding in place and getting all the asterisks to line up.
Q. Are there other barriers to fish passage in the vicinity of the Warm Springs Gage?
A. Yeah, there's a number of -- or one that we just -- were just addressing in the last few weeks to months, and that was one on the -- what we call the refuge stream,

which is down -- a little bit downstream of the Plummer and Pederson, where they come together.
But it's a -- so, yes, we have one barrier that we fixed and as -- because it's a dynamic system with flows changing and, you know, erosion happens.
So we end up with having parts of habitat that we don't think are the very best for Dace. So we target those areas first as they appear and work our way to improving all the habitat in the system.
MR. HERREMA: Thank you.
HEARING OFFICER FAIRBANK: Next will be National Park Service.
CROSS-EXAMINATION
MS. GLASGOW: Good morning. Hi, I'm Karen Glasgow with the Department of Interior Office the Solicitor and I represent the National Park Service.
Good morning. I have one question for you, Mr. Mayer. You talked about looking at the levels of EH-4.
ANSWERS BY MR. MAYER:
A. (Nodded head.)
Q. What caused the reduction in EH-4 water levels in approximately 1998, I think it was? Was it pumping or was it climate in your opinion?
A. I think it was pumping. You see, on this graph

here, there was a period of stable water levels until about 1998 and then there was a decline. That decline coincides with an increase in Arrow Canyon pumping, approximately a four-fold increase, I think we said in our 1169 report. So that's -- I believe that to be pumping related.
MS. GLASGOW: Thank you. No further questions.
HEARING OFFICER FAIRBANK: Next is the Moapa Band of Paiute Indians.
MS. BALDWIN: Thanks. Beth Baldwin for the Moapa Band, along with Debbie Leonard, local counsel.
CROSS-EXAMINATION
BY MS. BALDWIN:
Q. And these questions are for the whole panel mostly. Are your opinions the official position of the Fish and Wildlife Service?
ANSWERS BY MS. BRAUMILLER:
A. Well, I think that has to be the case, right? We did submit our report from the U.S. Fish and Wildlife Service, so yeah, um-hum.
Q. Is that true for all of you?
MR. MAYER: Yes.
DR. SCHWEMM: Yes.
BY MS. BALDWIN:
Q. Did you discuss the opinions expressed in your

reports with anyone else at the Service before submitting your reports?
ANSWERS BY MS. BRAUMILLER:
A. I did not.
DR. SCHWEMM: Not officially.
MR. MAYER: Did we discuss -- is the question, did we discuss opinions?
BY MS. BALDWIN:
Q. (Nodded head.)
A. Yes, with other Fish and Wildlife Service staff, I did.
Q. Did anyone from any other agencies like Reclamation or BLM provide technical review or comments on your reports?
ANSWERS BY MS. BRAUMILLER:
A. The National Park Service did provide some comments on my sections of the report, but I did not utilize them.
Q. Are you familiar with Fish and Wildlife Service policies on information quality and peer review?
A. Not in detail, no.
Q. And I saw nods from --
MR. MAYER: Yes.
DR. SCHWEMM: Yes.

BY MS. BALDWIN:
Q. Did you adhere to those policies with regards to your reports?
DR. SCHWEMM: Yes.
ANSWERS BY MS. BRAUMILLER:
A. I certainly think so. All the data sources that I utilized are thoroughly cited. They're public, they're published, et cetera. So I assume so, yes.
Q. Did you obtain any outside peer review from other third parties?
A. Only we had review from the National Park Service, and as I said, I didn't implement any of those proposed changes. And other than that, no.
MR. MAYER: I think the Park Service looked at my report, but they -- I believe they didn't give me any comments on it.
BY MS. BALDWIN:
Q. What is the services interest in this proceeding? Why are you here?
ANSWERS BY MS. BRAUMILLER:
A. I'm very happy to answer that. The State Engineer's office asked for technical input and I was happy to give it, and that is really the truth.
You know, the springs are such a significant

component of water flowing down the Muddy River that, you know, the reality is they'll be protected by default if an effective conjunctive water management program can be developed.
Q. So it's part of your role in implementing the Endangered Species Act?
A. No, what I'm trying to say is that -- that's obviously -- it's obviously -- it's obvious it's to the benefit of the Dace for an effective conjunctive water management program to be developed. That's obvious.
But my purpose was the State Engineer's office asked for technical input and I endeavored to help and that's it.
Q. That answer applies to all the rest?
DR. SCHWEMM: Absolutely.
MR. MAYER: I'll say that the mission of our water resources branch in the regional office is to protect the water resources of the Fish and Wildlife Service and that's primarily on national wildlife refuges. So we're here because -- or I'm here because of that.
BY MS. BALDWIN:
Q. Mr. Mayer, you said you're not -- you were not targeting the Tribe unfairly by submitting a rebuttal addressing only their report; correct?

ANSWERS BY MR. MAYER:
A. What I meant -- if I said that, it's true. I don't remember exactly what I said, but I --
Q. I'm paraphrasing.
A. Okay. I meant the criticism that I have and the comments I have apply more generally to everyone, not just the Moapa.
Q. Okay. Do you recall sending an e-mail to Katie Johnson on July 16th, 2019?
A. I sent him several emails, but I recall that.
Q. This is the e-mail where you asked to see his files relating to his analysis of the climate impacts?
A. I do recall asking him several times for the files that he cited in his report.
Q. Okay. And for the record, Mr. Criedter and Mr. Sullivan from the State Engineer's office were copied on that e-mail. Do you remember what you said in that e-mail, other than asking for the files?
A. No.
Q. Well, I'm going to read from it, quote, "I have to warn you that it's not going to look good and you will have a lot of explaining to do to the State Engineer if you aren't willing to share your results. I will make a point of this in my review, Tim," end quote. Does that sound accurate?

A. It does and I think I did say that in my report. I said -- in the rebuttal report, I said there was no data files, although they were cited in the report, they weren't made available to me. So I did make a point of it.
Q. Thank you.
A. And so I still believe it doesn't look good. I believe we should share data.
Q. It's okay. It was a yes/no question. So turning to the SeriesSEE, did you -- how did you get the values for the aquifer parameters that were used in the Theis transformation?
ANSWERS BY MS. BRAUMILLER:
A. A very common misunderstanding. They are fitting coefficient.
Q. Right.
A. So they're not intended to be or function as estimates of aqua parameters. And -- but the fitting coefficients are arrived at through -- there's a joint optimization of the fitting coefficients in whole series of analytical approximations, describing all the stresses that the SeriesSEE analysts believes are having a significant effect on the water level record that you're trying to interpret. And it's -- you want to know how they're optimized?

Q. Well, I'm just curious. So in order to do the Theis transform that you described, you have to assign some value to, T, transmissivity, and S, storativity?
A. Yeah, that's a good question. We don't -- they're not assigned.
Q. Okay.
A. They're joint -- they're not really optimized. We don't know what they are and, first of all, they're not aquifer parameters or it's not an attempt to estimate aqua parameters.
They're just fitting coefficients and they are jointly optimized, all the coefficients for each of these numerous analytical approximations for pumping and all these different pumping centers -- yeah, okay.
Q. But where do the numbers come from?
A. Well, they're -- they start out -- you have to give it some initial values like any parameter estimation process or any other thing. Give us some initial value.
And then the code includes routines for trying to optimize all the coefficients simultaneously to get the best fit of all your water level records. And it's a couple utilities that are -- were written by John Dougherty for PEST, it's -- let me find it.
Q. I don't need all the details because I can read

the paper.
A. Okay. Yeah.
Q. I'm just -- you know, when you come up with these -- these --
A. Yeah.
Q. You're -- are you -- you're inferring some high level of transmissivity from the model in some way. We're just curious where the numbers are coming from?
A. Well, yeah, the exceptionally high field scale transmissivity is inferred, not from the optimized values in the fitting coefficients in the SeriesSEE Curve-fitting process, but by the result, the result being that there was a really remarkable uniformity of drawdown of a very large area of the carbonate aquifer.
And that can only have happened, that could only happen if you have exceptionally high field scale transmissivity. It can't happen any other way.
Q. Okay. If we have more time later, we can talk about it.
A. Okay.
Q. So do you agree with Mr. Mayer's conclusions about a lack of a long-term drought in the region?
A. Well, we have very different backgrounds and I don't have Tim's background in multiple regression analyses.

So I have not endeavored to -- it's really not a -- it's not the kind of thing that groundwater hydrologists usually do. So I have not critiqued Tim's analyses. That's something he's quite good at.
Q. Is it correct that when the Service did the original SeriesSEE analysis in 2013, it never tried to remove climate-based fluctuations from the hydrographs because there was no reference wells to use?
A. No, that's not the case. I mean, I would say I -- it's difficult to come up with a reference well. Okay?
Q. Well, I'm looking at Page 9 of Nevada State Engineer Exhibit Number 256, your 2015 report?
A. Yeah, yeah.
Q. And that's what it says?
A. Yeah, happy to explain why things like barometric pressure fluctuations, bird ties, none of those things were incorporated in this Curve-fitting because the purpose was -- because the most significant drivers of changes in groundwater levels were pumping, okay? And the goal of the analysis was to see how aerially expansive the drawdown due to the MX-5 test pumping was.
So the goal -- the purpose of the SeriesSEE analysis was to separate out the drawdown create by the MX-5 test pumping from that induced by all the other ongoing water

supply pumping and study area of which there was a lot, all right? That was the goal.
And the assumption is, and I think it's a good one, that the effects of certainly barometric pressure fluctuations, bird ties were very small compared to the effects of pumping by changes in water levels. And at even groundwater recharge, you know, over two years is still going to impact water levels in wells, no question, okay.
But that's still relatively small impact on water levels in the wells compared to the pumping. So, you know, it was a simplest SeriesSEE analysis possible to answer the questions that the SeriesSEE analysis was done.
Q. Okay. Looking at your initial report for this proceeding, you said you did a simple analysis hydrographs to try and come up with some relationship between climate effects and what you were seeing in the wells?
A. Well, not a relationship. I --
Q. You were just looking to see if you could see anything that would be a climate --
A. Well, no, I was after something specific.
Q. Okay.
A. Okay.
Q. And you identified in your -- your best guess is that there appears to be a one-year lag between wet years and

when?
A. All those --
Q. Where the water level increased?
A. Within one year.
Q. Okay.
A. You can see the effects of those -- the 2004, 2005 and 2010 to 2011, in some cases. You can see the effects of those particularly wet periods in groundwater levels in the carbonate aquifer over pretty much the entire five-plus basin area. You know, if -- CSVM-5 is an interesting exception, but I think I know why. But it's not fair. Okay.
Q. Okay.
A. But at any rate, my purpose, I wasn't trying to come up with a relationship. I just believe that if we're going to get a handle on how climate is affecting groundwater levels from the spring flows, the first thing you have to do is get a handle on what is -- you know, what's the time lag between the change in climate, wet seasons and showing up in the groundwater levels in the spring flows.
And that will give you somewhere to start when you're trying to figure out how is it an affecting groundwater and springs and springs flows, right? And so with that and only that purpose, okay, I just use simple visual inspection of the hydrographs, the Palmer Drought Severity Index versus

groundwater level spring flows and stream flows, and noticed that it's not one year, but it's within one year.
Q. That'll be it.
A. Yeah, that was it. Yeah.
Q. Okay. Mr. Mayer, when you looked at the hydrographs in Dry Lake, Delamar and Tule Desert, did you consider whether water levels are responding to any delayed climate signal?
ANSWERS BY MR. MAYER:
A. No, I didn't.
Q. Is that something that you have done previously in your work?
A. Yes, I've looked at climate responses before.
Q. And did you reach any conclusions?
A. It -- well, it was a different study. I mean, yeah, I -- yes.
Q. So you have identified climate lag?
A. I have identified lags in climate responses, yes.
MS. BALDWIN: I don't have any more at this time. But if there is additional time later. Hold on a second. One question.
BY MS. BALDWIN:
Q. Mr. Mayer, you looked at 20 hydrographs in those adjacent basins, Tule Desert and Dry Lake and Delamar. Were

those all the wells in those basins or did you just pick certain ones?
A. I just picked what were designated as monitoring wells by SNWA or by Vidler, so --
Q. Thank you.
HEARING OFFICER FAIRBANK: Next is SNWA, Las Vegas Valley Water District.
CROSS-EXAMINATION
MR. TAGGART: Good morning. My name is Paul Taggart. I represent the Southern Nevada Water Authority and the Las Vegas Valley Water District, and I want to start with a few questions for Mr. Mayer.
How many years have you been analyzing issues regarding hydrogeology in the Lower White River Flow System?
ANSWERS BY MR. MAYER:
A. Well, I've been working down here since about 1997.
Q. Okay. And I have a few questions about -- just some quick historic questions about the role of the Fish and Wildlife Service.
Initially, the Fish and Wildlife Service, did it file protests against the water right applications in the Coyote Spring Valley?
A. Yes.

Q. Okay. And were you present during the hearings in 2001 on the CSI applications?
A. Yes, I was.
Q. Okay. At that time in 2001, did you have a similar opinion than you have today regarding the impact of pumping in Coyote Spring Valley on the Muddy River Springs?
A. Yes, I did. Yeah, I believe so.
Q. And were you involved in recommending that a pump test occur?
A. It's possible. It was a long time ago, but I could have been.
Q. Okay. And I'm wondering, did the pump test -- I'm sorry, the pumping test that was ordered by Order 1169, did that pumping test validate your understanding of the system in 2001?
A. I think it did, yeah.
Q. And did you review the State Engineer's rulings that came out after the pump test and after the reports were submitted by all the parties? And I want to say this was 2013, 2012, somewhere in that range.
A. Yes, I reviewed those reports.
Q. Okay. And do you agree with the findings of the State Engineer made in those rulings regarding the effect of Coyote Spring carbonate pumping on the Muddy River Springs?

A. Yes.
Q. You mentioned in some previous answers that the Fish and Wildlife Service owns a water right in the Muddy River Springs area. Could you describe that water right?
A. Yeah, we have a water right. It's measured at Warm Springs West and it's essentially -- it's for wildlife. It's essentially an in-stream flow right. So it's on the refuge.
Q. And --
A. That's the Pederson reach of the springs.
Q. Okay. And did you say -- did you say what the flow rate is in your opinion of that water right?
A. Well, that water right is 3.5, but I believe it has a priority date of 1991. So it's fairly junior.
Q. Okay. Now, was the MOA that's been described -- and you understand what I mean when I talk about the MOA?
A. Um-hum, yes.
Q. Was the MOA executed, in part, to address potential impacts to that water right or do you know?
A. It was designed, established to protect that reach of stream. The trigger levels are actually below the water rights. So in a way it doesn't protect the full water right, but it still protects the stream.
Q. Okay. And do you have an understanding whether

the MOA was completed in order to allow the 1169 pump test, itself, to occur?
A. Yes, it was.
Q. Um-hum. I have a couple questions for Ms. Braumiller, and they have to do with a couple points you made in your presentation.
And you identified a -- what I wrote down as a Kane Spring or maybe a Kane Spring wedge?
ANSWERS BY MS. BRAUMILLER:
A. Fault.
Q. And I was wondering where that's located in the Kane Springs area. I wasn't exactly sure.
A. Yeah, yeah, I didn't -- I didn't refer to as a Kane Springs wedge. But it's a portion of the carbonates. Some of it lies in southwestern Kane Springs Valley, some of it in northern Coyote Springs Valley. But it's between the Kane Springs wash fault and a normal fault that -- normal trend and normal fault, the passages just by CSVM-3.
Q. Were you present during yesterday's testimony?
A. Yes.
Q. And were you present when there was discussion, something we referred to as the highway fault?
A. Yes.
Q. And my simple question is: Does your opinion

about this Kane Springs wedge, fault or whatever we're calling it?
A. Yes.
Q. Does that somehow make it possible for, in your opinion, CSI to pump water from the west side of that highway fault without impacting the Muddy River Springs?
A. I can't say because it was never clear yesterday what -- which of the faults were discussed or the Kane Springs wash fault. So I'm not sure if the highway fault is the Kane Springs wash fault. I was never clear about that yesterday.
Q. Okay. And do you have your PowerPoint?
A. I do.
Q. Available?
A. Got to switch.
Q. Okay. There was a -- yeah, there was a figure with boundary for the proposed --
A. Um-hum.
Q. Your recommendation regarding the boundary for the Lower White River Flow System?
A. Yes.
Q. Could you find that?
A. Yes.
Q. It was probably maybe 25 slides in. So where on that figure is this area that you're talking about? And

again, I don't want to misstate what you said. I just recall you testifying about an area where it's unknown what occurred there or something like that.
Maybe you want to restate your view on -- or I don't want to misstate what your testimony was about. But I'm just trying to clarify where it's located. That's all I'm trying to do.
A. Oh, the wedge?
Q. Yes.
A. Oh, good. Okay. So -- oh, gosh, this is a little hard to see. Let me look at it on my screen a little bit there.
Okay. Okay. So that's the north trending normal fault that passes right by CSVM-3. So I mean from there to the Kane Springs wash fault, which is right there. So at -- there's also, you know, the Caldera Complex there. That's just virtually impermeable for all practical purposes.
So south and southwest of the Caldera Complex, west or northwest of the Kane Springs wash fault, and east of this north trending normal fault that passes right by CSVM-3. And I think CSVM-3 is completed within that kind of isolated wedge of carbonate.
Q. Okay.
A. Yeah, um-hum. So there's never been any

carbonate pumping in there and I don't know what the effect of pumping in that wedge of the carbonates would be. I don't think we have any data that we can use to anticipate that at this point.
Q. Okay. Back to Mr. Mayer.
So yesterday there was some testimony about water budgets being developed by Mr. Reich, and his view was that no one else in the hearing room had developed water budgets and that was something that he indicated as being significant in his opinion.
My question to you is: Just having been involved in this for decades, are we past the point of using water budgets as a method of analysis and could you describe, in your opinion, what you should -- you know, what you view the role of water budgets when you have empirical data from a pump test?
ANSWERS BY MR. MAYER:
A. Yeah, I think we are past the point where we need a water budget because we show that there's water available. You could define a perennial yield, but you could start to pump that water as we've done here in this basin and this flow system, and see the effects and impact springs and other resources and rights. So I would agree that I'm not sure how helpful the water budget is.

Q. And given -- and in your opinion, do we have empirical data from the pumping test that pumping in the Lower White River Flow System impacts the Muddy River and the Muddy River Springs?
A. Certainly, yes.
Q. And so would it be dangerous to make decisions about groundwater availability based on water budgets when we have that empirical data?
A. I think so.
Q. There was -- and I guess this is to you, Ms. Braumiller.
So one of your conclusions or recommendations to the State Engineer is the -- involves the 9318-acre-feet of pumping that's existing, I think, in the basin's lower or closest to the basins. Do you recall that opinion?
ANSWERS BY MS. BRAUMILLER:
A. Yep, um-hum.
Q. Okay. And is it accurate that that is a number that's associated with actual pumping in 2015, 2016 and 2017?
A. Yes, actual total carbonate and alluvial pumping.
Q. Okay. And I want to ask you a question about that and it's -- you see the binder over there on the -- I'll get it for you, just a second.
So I'm going to just ask you and I think you just

may have even alluded to it a little bit, is to ask you to partition that 9318, if you will, between carbonate and ground -- and alluvial. But do you see table -- are you familiar with SNWA's report that's been marked as SNWA Number 5, I believe?
A. No, I actually did not read the report.
Q. Okay. Well, then let me ask you -- or, no, let me ask Mr. Mayer.
Are you familiar with the SNWA hydrology report?
MR. MAYER: Well, I read it, but just briefly. I mean, I'm not sure I'm qualified --
MR. TAGGART: Okay.
MR. MAYER: -- I don't --
BY MR. TAGGART:
Q. Do you have Tables C-3 there in front of you?
ANSWERS BY MS. BRAUMILLER:
A. Yeah.
Q. Okay. And you're not familiar with this table?
A. No, I did not read your report.
Q. Okay.
A. I'm sorry.
Q. Well, let me just ask you this then. The table says that it's showing Lower White River Flow System or LWRFS carbonate aquifer annual groundwater production?

A. Okay.
Q. And over on the right-hand column, there's -- it says "total"?
A. Um-hum.
Q. Do you see that?
A. Yeah, I see that, um-hum.
Q. And so in the years 2015, '16 and '17, would you agree with me that this table indicates that there's been -- there was approximately 7500-acre-feet, give or take, there's a range of 7144 to 7791-acre-feet of carbonate pumping?
A. Sure.
Q. Okay. And so that's the amount of carbonate pumping that, in your recommendation, would be allowed as part of that 9318 number?
A. Right.
Q. As a maximum?
A. Well, right.
Q. Okay.
A. Because I did also, just for simplicity, suggest that carbonate alluvial pumping shouldn't be swapped.
Q. Okay.
A. That it just leads to too many questions about alluvial pumping. If you just swapped out carbonate for are now too close to the river, you know, et cetera, right? It's

a pretty simplistic recommendation, but I think implemented, so yeah.
Q. Okay. Now, in your report on page 37, I think is where you describe this. And so on page 37 of your report on the bottom of that page, there's a paragraph that begins consequently assuming a flow rate of 30,550-acre-feet to the Moapa Gage is sufficient to meet senior decreed rights.
So that -- and then you go on to say "the initial threshold of combined carbonate and alluvial of 9318"?
A. Um-hum.
Q. And that -- this is the base of your recommendation; right?
A. Yeah, I -- you know, I'm going from memory here now. But I think 30,550-acre-feet per year was the average of what was flowing through the Moapa Gage in 2015, '16, and '17. And 9318-acre-feet per year is apparently what the total of carbonate and alluvial pumping average in 2015, '16 and '17.
Q. So from a hydrologic standpoint?
A. Um-hum.
Q. If more than 30,550-acre-feet is required to meet senior rights in the Muddy River?
A. Um-hum.
Q. Would you agree that the amount of pumping that should be allowed from the carbonate system would have to be

less than the 7500 number we just talked about?
A. Well, I think that might be a step too far, but I would say that the total carbonate and alluvial pumping would have to be somewhat less.
Q. That's correct. Just so the 9318 number?
A. Yeah.
Q. Would have to come down in relationship to how much additional water would be needed to meet rights in the river?
A. Correct.
Q. Okay.
MR. TAGGART: Is that me?
HEARING OFFICER FAIRBANK: That's you.
MR. TAGGART: Okay.
HEARING OFFICER FAIRBANK: Next will be the Moapa Valley Water District.
CROSS-EXAMINATION
MR. MORRISON: Good morning, I'm Greg Morrison and I represent Moapa Valley Water District. I just have a couple of quick questions.
First, for Ms. Braumiller, now, you -- I'm going to paraphrase here, so please let me know if I butcher this. But I think what you said your analysis, you attempted to define the scope of the management area by -- you started with

the five-plus basins that you said indicated this clear connectivity, and then you kind of expanded outward, looking for low flow or even no-flow boundaries to help you define the extent.
ANSWERS BY MS. BRAUMILLER:
A. Yeah. Yeah, so the drawdown in the five wells that admittedly you couldn't hardly see on that plot, go figure, but the drawdown cone was extremely flat in the area of delineated by those five particular wells. Okay.
But it is a drawdown cone, flat or not, and drawdown generally -- I mean, this is a homogeneous or isotropic, sorry, aquifer decreases logarithmically with distance.
So you can't go from 1.5 or 1.6 feet of drawdown reduced by MX-5 to, you know, zero over distance. So, you know, as a practical matter, I had, you know, other -- it made sense to me to extend the area affected by MX-5 pumping to the numerous likely no-flow boundaries.
Q. Great.
A. And that's how I defined the five-plus basins.
Q. So this -- and I'm glad this slide is still up there. So you're showing your proposed extent there of the Lower White River Flow System. Is it safe to assume, looking at that, that you did not find any low flow boundary at the

northern end of Coyote Springs Valley or the southern end of Kane Springs Valley that would preclude you from including them in your analysis in your area?
A. Yeah. You know, I'll go back to the 2007 ruling, I think it was 5712. There was conclusion that there is a very -- there's like a 50-, 75-foot difference in head between CSVM-4 in northern Coyote Springs Valley.
And in a ruling, it was -- the exact location where head -- or the carbonate aquifer was 50 to 75 feet less than it is at CSVM-4, was not clearly defined. But the first location at which I found those kinds of carbonate water levels was in central Coyote Spring Valley in the area of MX-5, CSVM-6, et cetera.
So it's very clear because there's a much larger head difference between, say, CSVM-6 in Coyote Spring Valley and CSVM-4 at the north end, just south Kane Springs Valley, that the transmissivity of the carbonates is a whole lot less than it is in this other area that is just exceptionally high --
Q. Okay.
A. -- in field transmissivity. But --
Q. If I can just interrupt you for a second.
A. Yeah.
Q. You didn't find a low flow barrier that would

exclude Kane Springs from this management area as you have it included in your map up there?
A. Well, you could always hypothesize any number of such things. But what I noted is that water level fluctuations in CSVM-6 or MX-5, there's 4 or 5 wells in central monitor -- carbonate wells in central Coyote Springs Valley.
In any of those, you saw the same water level fluctuations as CSVM-4. They were of different magnitude, but there's clearly a hydraulic -- this is where -- don't touch that thing.
This is where it does make a sense to look at time series, right, as a hydrologist or hydrogeologist, okay? So there's a clear hydraulic connection. It's just the transmissivity is much less between central Coyote Spring Valley and southern Kane Springs Valley, but it is still transmissive.
Q. All right.
A. Right.
Q. Thanks.
A. Yeah.
Q. All right. And this generally is directed to Mr. Mayer, but I think any or all of you might be qualified to answer it. So if anyone feels more comfortable, please.

You concluded that the triggers from the 2006 Memorandum of Understanding based on Warm Springs West flows, those are valid and important for protecting the springs in the Pederson Unit or the Pederson Unit?
ANSWERS BY MR. MAYER:
A. Yes, I concluded that.
Q. Okay. And you're familiar with the amended stipulation between the Fish and Wildlife Service and Lincoln County, Vidler? It's on the record as Fish and Wildlife Service Exhibit 57.
A. Yes, I'm familiar with that.
Q. Does that agreement also have some trigger levels based on Warm Springs West flows?
A. Yes, it does.
Q. Would you say that those trigger levels -- those trigger levels are also valid and important to protect Pederson Unit Springs?
A. Yes, I would agree, they are.
Q. All right. I want to dig a little deeper into that stipulation with Lincoln Vidler. So that stipulation requires the formation of a technical review team, TRT; is that correct?
A. Yes. Is this more you, Sue or --
ANSWERS BY MS. BRAUMILLER:

A. I think you're right.
MR. MAYER: Yeah, it was. Yeah --
ANSWERS BY MS. BRAUMILLER:
A. And that team was never formed and never met, um-hum.
Q. That was my question. Great. Thank you.
When did it last meet is another. Has the stipulation, to your knowledge, has it ever been modified or cancelled according to its terms over the years?
ANSWERS BY MR. MAYER:
A. Well, it was -- there was a provision that required a monitoring well in the northern part of Coyote Spring Valley, two actually. One on Kane, one in Coyote Spring, one --
ANSWERS BY MS. BRAUMILLER:
A. One on --
MR. MAYER: I can't remember. Yeah, anyway, so that was modified. There was an agreement by the Fish and Wildlife Service to allow -- was it CSVM-4 to still be substituted?
MS. BRAUMILLER: I don't remember.
MR. MAYER: There was another well that was drilled that was substituted by SNWA that was substituted for the well that was required in the stipulation. But that was

just the one well. There was never anything addressed as far as the other wells as far as I know.
Q. So your knowledge then was one well was substituted and the second one was never drilled?
A. As far as I know, yes.
Q. All right. Was there ever -- so there was never any agreement obviously from the TRT that those monitoring wells wouldn't be required because the TRT didn't meet?
ANSWERS BY MS. BRAUMILLER:
A. Never met.
MR. MORRISON: All right. That's all I have. Thank you.
HEARING OFFICER FAIRBANK: And next up is Lincoln County with Vidler Water Company.
CROSS-EXAMINATION
MS. PETERSON: Good morning, panel, Karen Pederson representing Lincoln County Water District and Vidler Water Company. And I just had a question for Dr. Schwemm.
Are you familiar with the biological opinion U.S. Fish and Wildlife Exhibit 59?
ANSWERS BY MR. SCHWEMM:
A. Not really. I didn't really address the -- this is Mike Schwemm. Not really. I didn't address the biological opinion in my report. I just spoke of what the triggers

themselves and the values that were in that amended stipulation in relation to the Dace themselves. But I'm not overly familiar with the biological opinion.

MS. PETERSON: May I approach the witness?

HEARING OFFICER FAIRBANK: Yes.

MS. PETERSON: Thank you.

I am going to hand you and your counsel a copy of your Fish and Wildlife Exhibit 59, which is a biological opinion, and if you could turn to page 37.

ANSWERS BY MR. SCHWEMM:

A. Okay.

Q. I hate to waste my time on this. I mean, I need you to read it, not out loud, to yourself. But if you could read quickly, that would be great.

A. Which section?

Q. I'm sorry, number three.

A. (Complies.) Okay.

Q. All right. And do you agree that in this document, it's the Service's biological opinion that the action, as proposed and analyzed -- and again, this is related to the Kane Springs Valley groundwater development project in Lincoln County; do you agree with that?

A. Well, I haven't reviewed this document. So it's new to me in -- so I don't really know the entire -- the

entirety of what's referred to in the document.

Q. Do you agree that paragraph 3 there on this page, page 37 of what I'll represent to you is Fish and Wildlife Service Exhibit 59, indicates that it's the Service's biological opinion that the action, as proposed and analyzed, is not likely to jeopardize the continued existence of the endangered Moapa Dace?

A. Yeah, I can read that, but I don't really know what was stated in the biological opinion because I did not analyze that in my report.

Q. Do you think it was important to analyze the biological opinion before you drafted your report?

A. It could have been and it was -- would have been good background. But specifically what I wanted to address was if there was a -- the change in flow and how that might affect the species itself.

So I was just interested in the biological effect of how flow changes would affect the species and not the compliance issues because I did not address those in my report.

Q. My next questions are directed to Ms. Braumiller.

ANSWERS BY MS. BRAUMILLER:

A. Um-hum.

Q. You were not qualified in this proceeding as a

geologist, as an expert in the area of geology; is that correct?

A. Yep. Right. Yes.

HEARING OFFICER FAIRBANK: Please turn your mic on.

MS. BRAUMILLER: Oh, it's on actually. Okay. Yes, no.

BY MS. PETERSON:

Q. And you were also not qualified as an expert in the area of hydrogeology; is that correct?

A. No, I didn't ask to be qualified as a hydrogeologist.

Q. Would you agree that you provided a lot of opinions in your presentation that would be in the areas of geology and hydrogeology?

A. Yes, and I asked to be qualified as a groundwater hydrologist because I am a groundwater hydrologist by formal training and work experience. And I have become a hydrogeologist of a result of over 24 years of work. But I do not have a geology degree and so I was very conservative about that.

MS. PETERSON: And I just asked the State Engineer and panel to take the appropriate -- take into consideration that in offering the opinions today, that

Ms. Braumiller is not qualified as an expert in geology or hydrogeology.

HEARING OFFICER FAIRBANK: Thank you. We'll note that.

BY MS. PETERSON:

Q. Do you agree, Ms. Braumiller, that the boundary issue with regard to the Lower White River Flow System is a structural geology issue?

A. We're trying to define the boundaries of a flow system. So, in part, it's a geology issue; and in part, large part, it is not.

Q. Would you agree, then, that structural geology of the region controls the groundwater flow of this region?

A. It is. It's one factor influencing groundwater flow in this region, one of several.

Q. Do you agree, as a hydrologist, that you're making conclusions about where groundwater flows in this region. But if you're structural geology is wrong, your opinions could be wrong?

A. Well, but as I said, I have 24 years of work experience doing groundwater hydrology that cannot be done without also doing hydrogeology. So although I did not ask to be officially qualified as a hydrogeologist out of, you know, a sense of respect for the fact that I do not have a geology

degree, I have been doing hydrogeology for 24 years.
Q. Would you agree, though, if your assumptions about structural geology were wrong or if you had no assumptions about geology in your flow analysis, that your opinions could be wrong?
A. No, I don't, and here's the reason. Everywhere where I cited the likely existence of geologic discontinuities, I said subject to hydraulic confirmation. And there is not everywhere, hydraulic confirmation for those no-flow boundaries, if that's what you're specifically referring to. But at many locations, there are.
And so my approach is to first look at geology, look for geologic discontinuities that are very significant, and then look for hydraulic confirmation. I don't believe you can infer hydraulic connections or a lack thereof just based on geology.
Q. Directing your attention to pages 15 and 16 of your report, which is the Fish and Wildlife Exhibit 5?
A. Okay.
Q. You make some conclusions about 12 wells on those pages, that they're in the carbonate; do you recall that?
A. Let's see. Wait a minute. Oh, there were several -- there were 14, yeah, several of the carbonate wells that were the water level records for some of the carbonate

wells that were analyzed using SeriesSEE in 2013 are not part of the regional aquifer. So maybe you have to clarify your question a little bit.
Q. Well, directing your attention to the 12 wells that you have on pages 15 and 16; do you see those?
A. I see there are -- there's 1, 2 -- yeah. Okay, yeah, I see them.
Q. All right. You used a geologic map to determine which geologic units the wells represent; is that correct?
A. Not only geologic maps, but also the well logs.
Q. You did look at the well logs?
A. Absolutely.
Q. Did you note that in your report?
A. I don't know. If you want me to read the text, I'll do it right now. But I can tell you I looked at the well logs and the geologic mapping, of course.
Q. For all the wells listed on pages 15 and 16?
A. Correct, um-hum. Right, um-hum.
Q. And then directing your attention to page 14 of your report?
A. Um-hum.
Q. Exhibit 5?
A. Uh-huh, right.
Q. You talk about the parameters of the Theis

transforms. Do you see that? It's in the third paragraph down.
A. Um-hum.
Q. You're familiar with that sentence?
A. Which sentence are you talking about?
Q. It starts with "the parameters of the Theis transforms as applied in SeriesSEE analysis"?
A. Yeah, okay.
Q. Do you see that?
A. Right, right.
Q. That they're not intended or -- to represent or serve as estimates of aquifer parameters?
A. Correct, um-hum.
Q. Are you saying that the SeriesSEE analysis allows you to ignore structural geology and well construction?
A. It doesn't take those things into account because it's a Curve-fitting tool, Curve-fitting tool. You're fitting analytical approximations of various stresses that account for changes in water level in the well to document water level records for wells. That's the nature of it.
Q. And would you agree -- and this might have been asked already, so I apologize if it's a repeat. Would you agree that the SeriesSEE analysis does not incorporate recharge due to weather events, such as high precipitation in

2005 or 2010?
A. It could be made to do that, but that is not the way it was applied to interpret the Order 1169 pumping test, because our purpose was to characterize the aerial extent of the drawdown created by the test pumping.
And then secondarily, we were surprised to see how uniform it was over such a large area. It was not the purpose. This was pure application of SeriesSEE.
Q. Did the SeriesSEE analysis drawdown impacts extend from the Order 1169 pumping to Kane Springs Valley, which is about over 15 miles away?
A. You know, I don't believe KMW-1 was officially one of the water monitoring wells for the Order 1169 study, although there was monitoring. I found the hydrographs, of course, in the State Engineer's data basis. And it was not officially -- oh, I'm sorry, I'm getting to my point here.
It was not -- in fact, there was an explicit decision in 2007 not to include it in the Order 1169 pumping test. I know it was -- there was a decision not to include it in the pumping test. I think it was based on the 2007 ruling 5217. But there is groundwater level data for KMW-1 through the pumping tests and I think the monitoring started in about 2007 perhaps, something like that. So it's there, um-hum.
Q. Right. But I think I was asking you about -- and

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I believe you've stated that your SeriesSEE analysis, there were no drawdown impacts that extended from the Order 1169 pumping to Kane Springs Valley; is that correct?
A. No. What I'm saying is that the SeriesSEE analysis was only -- we only -- Keith Halford, okay, only analyzed a select number of carbonate wells throughout the Order 1169 study area because there were many, many monitor carbonate wells.
So he selected carbonate wells from far flung locations throughout the Order 1169 pumping test that were also based on other considerations, water level records, geologic mapping, well logs, et cetera, also believed to be completed in the regional carbonate aquifer, some carbonate wells that are apparently complete outside the carbonate aquifer and some other geologic units.
But at any rate, he didn't happen to choose KMW-1 as one of the records that was analyzed. So it just wasn't analyzed, um-hum.
Q. How come Mr. Halford is not here, testifying today about the work he did?
A. Well, we refer to the 2013 DOI report, okay? We refer to that. We cited it. I re-explained, verified the SeriesSEE analysis in my report because it's so foundational to the identification of the basins that it should be

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considered the Lower White River Flow System.
But we're not relitigating, as far as I know, Keith Halford's Curve-fitting in 2013. The results, the analysis that was done is described in the DOI 2013 report as one of our exhibits. I cited it. The results and our interpretation are also described and cited in our DOI 2013 report.
There is no need for Dr. Halford to be here, although I think it would have been helpful. I would have loved to heard him explain since he's the author of SeriesSEE, what it is and is not because there does seem to be a lot of confusion about that.
Q. Did you or Dr. Halford do any analysis of Kane Springs pumping impacts on the Muddy River?
A. No. No, not --
Q. And are you aware of the amended stipulation? You were answering questions about it. It's Fish and Wildlife Exhibit 57, I believe, the amended stipulation in Kane Springs with U.S. Fish and Wildlife and Lincoln County Water District and Vidler?
A. I think that Tim Mayer responded to those questions. And I do not have a lot of knowledge of amendments to the original stipulation agreement.
Q. And are you aware, in that stipulation, that Fish

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and Wildlife asked the State Engineer not to include Kane Springs in Order 1169?
A. I'm not terribly familiar with the original stipulation or with any amendment to it.
Q. And then directing your attention to page 22 of Exhibit 5?
A. Okay, um-hum. Sure.
Q. Where you want to --
MS. PETERSON: I'll be back.
HEARING OFFICER FAIRBANK: Actually if you want to finish that one question and then we'll break after that.
BY MS. PETERSON:
Q. You're asking about the geophysical surveys for the Kane Springs wells?
A. Well, I'm not asking about it. I'm just noting that I reviewed a URS well completion report that included a description of down hole surveys, including geophysical surveys that were conducted in both KMW-1 AKVW-1, and that in the interpretive material in that report, I saw no conclusions about which or perhaps maybe both sides -- these are both very deep wells completed over a large interval -- whether they are -- the completion intervals span the Kane Springs Wash Fault Zone or they're entirely limited to the northwest side of the Kane Springs Wash Fault Zone.

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I saw no indication in your report that that was interpreted from the geophysical surveys. And I just think that's critical because when you look at hydraulic data from either or both of those wells, we don't know what it means. So I do think that that question needs to be cleared up.
MS. PETERSON: I will be back.
MS. BRAUMILLER: Okay. Thank you.
HEARING OFFICER FAIRBANK: All right. So we'll go ahead and break for a lunch break. We will go ahead and get back on record and return to our proceedings at 1:15. So promptly at 1:15.
(Proceedings concluded at 12:09 p.m.)

STATE OF NEVADA)
) ss.
CARSON CITY)

I, MICHEL LOOMIS, a Certified Court Reporter, do hereby certify;

That on the 24th of September, 2019, in Carson City, Nevada, I was present and took stenotype notes of the hearing held before the Nevada Department of Conservation and Natural Resources, Division of Water in the within entitled matter, and thereafter transcribed the same into typewriting as herein appears;

That the foregoing transcript, consisting of pages 239 through 379 hereof, is a full, true and correct transcription of my stenotype notes of said hearing to the best of my ability.

Dated at Carson City, Nevada, this 25th day of September, 2019.

____
MICHEL LOOMIS, RPR
NV CCR #228

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In The Matter Of:

DEPARTMENT OF CONSEVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES

Vol. II
September 24, 2019

Capitol Reporters
123 W. Nye Lane, Ste 107

Carson City, Nevada 89706

STATE OF NEVADA
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
BEFORE MICHELINE N. FAIRBANK, HEARING OFFICER

IN THE MATTER OF THE ADMINISTRATION AND MANAGEMENT OF THE LOWER WHITE RIVER FLOW SYSTEM WITHIN COYOTE SPRING VALLEY HYDROGRAPHIC BASIN (210), A PORTION OF BLACK MOUNTAINS AREA HYDROGRAPHIC BASIN (215), GARNET VALLEY HYDROGRAPHIC BASIN (216), HIDDEN VALLEY HYDROGRAPHIC BASIN (217), CALIFORNIA WASH HYDROGRAPHIC BASIN (218), AND MUDDY RIVER SPRINGS AREA (AKA UPPER MOAPA VALLEY HYDROGRAPHIC BASIN (219).
______________________________________/

TRANSCRIPT OF PROCEEDINGS
PUBLIC HEARING
HEARING ON ORDER 1303
VOLUME II
(P.M. SESSION, PAGES 380-488)

TUESDAY, SEPTEMBER 24, 2019

Reported by: Kathy Terhune, RPR

APPEARANCES:
Micheline N. Fairbank,
Hearing Officer

Tim Wilson,
Acting State Engineer
Adam Sullivan,
Deputy State Engineer

Melissa Flatley,
Chief of the Hearing Officer Section
Michelle Barnes,
Supervising Professional Engineer

Levi Kryder,
Chief of the Hydrology Section
John Benedict,
Hydrologist

Christi Cooper,
Geologist
Bridget Bliss,
Basin Engineer

For SNWA: Taggart & Taggart, Ltd.
By: Paul G. Taggart, Esq.
Carson City, Nevada
-and-
Tim O'Connor, Esq.
For CSI: Robison, Belaustegui, Sharp & Low
By: Kent R. Robison, Esq.
Reno, Nevada

For CSI: Brownstein Hyatt Farber Schreck
By: Brad Herrema, Esq.
Los Angeles, California

APPEARANCES:
For NV Energy: Justina Caviglia, Esq.
Reno, Nevada`

For Lincoln County Water District
-and-
Vidler Water Company: Allison MacKenzie
By: Karen Peterson, Esq.
Carson City, Nevada
For Moapa Band of Paiutes: Beth Baldwin, Esq.
For NCA: Alex Flangas, Esq.
Reno, Nevada

For Moapa Valley Water District: Greg Morrison, Esq.

For Bedroc: Schroeder Law
By: Laura Schroeder, Esq.
For City of North Las Vegas: Schroeder Law
By: Laura Schroeder, Esq.

For National Park Service: Karen Glascow, Esq.

For Center for Biologic Diversity: Patrick Donnelly, Esq.
For U.S. Fish and Wildlife: Luke Miller, Esq.
Ass. Regional Solicitor
Sacramento, CA
For Muddy Valley Irrigation Company: Steve King, Esq.

SEPTEMBER 24, 2019; 1:15 P.M.; CARSON CITY, NEVADA.

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HEARING OFFICER FAIRBANK: Okay. We'll go ahead and go back on record.

So, next we'll take questions from the City of North Las Vegas.

And I should have said this yesterday, but just as reminder, all the witnesses are still under oath.

MS. SCHROEDER: Thank you. I'm Laura Schroeder, and I represent the City of North Las Vegas.

MS. SCHROEDER: Do I need to hit my button? Okay. Now can you hear me?

HEARING OFFICER FAIRBANK: Yes.

MS. SCHROEDER: I'm Laura Schroeder, and I represent the City of North Las Vegas. I just have a couple of questions for Mr. Mayer.

SUE BRAUMILLER, MICHAEL SCHWEMM, TIM MAYER, called as a witnesses herein by U.S. Fish and Wildlife Service, having been previously duly sworn, were examined and testified as follows:

CROSS-EXAMINATION
BY MS. SCHROEDER:

Q. And I would like, if possible, for you to pull up your PowerPoint. And this is -- we're looking at U.S. FWS Exhibit 7. I think we're looking at probably about slide number six.

A. Is this the rebuttal report?

Q. Yes, please. And this would be the one that includes figures 3 and 5.

A. Yeah, okay, this is it.

Q. All right. Thank you.

And this -- these two figures I believe, at least it appears to me, that they were in your rebuttal report at pages 5 and 6. And I'm going to focus just on the upper graph, which is the division three graph, which appears to be figure five from page 6 of your report -- your rebuttal report.

So, looking at that report and looking at that graph, can you give us an average drought severity index before and after 2000?

A. An average drought severity index? I would just have to guess. So, no, I really can't do that. I can't give you a visual average. But let me say that this drought index is an average. It's a moving

average. It looks back at the preceding 12 months. So, that's the reason I didn't put a moving average in here, because it is a moving average.

It looks back at conditions of the past 12 months, and just a running look back, so to -- so to speak.

Q. Right. So, looking visually at this, I drew a line on the zero axis through your graph.

A. Uh-hum.

Q. And drawing -- just using a visual on that, and drawing the line through the zero, and then looking at the year 2000 -- I think that you have January, 2002, but just ahead of that line. So, I have line at zero and a line that divides us between two -- before 2000 and after 2000. What I see is a lot more area below the zero line after 2000 than before 2000. Would you agree with me, Mr. Mayer?

A. Yeah, I would agree with you.

Q. Is there a Palmer drought severity index value that was published for the years before 1990?

A. I think this record goes back to 1885.

Q. And I think you testified earlier to that. But, I don't think that person who asked you -- the attorney that asked you, asked you why you didn't

include earlier years. And so, I'd like to ask you that question, Mr. Mayer.

A. Well, this is a 30-year record, and I -- this is the record that we have for the water levels. Basically, this is a time of interest, so, that's why I focused on this.

Q. That period of time?

A. Right.

Q. Okay. Now, the rest of the slides in your rebuttal report focus on illustrating water levels and basins that were without pumping. And I would like to ask you as to those if you have any opinion as to why some of those basins have declined and some have increasing water levels?

A. Some of them have decline, some have stable water levels, and some have increasing water levels. I would say the majority are increasing. That was my point. They're not declining. I have an opinion, yeah. It is that the climate is wetter.

Q. All right. At least in those basins, it's your opinion that those -- that it's wetter in those areas?

A. It's responding to the wetter climates, yes.

Q. And even though that your figures here show that there is more areas below the zero line than above

them?
A. Yes, this is just one data point. One metric.
Q. All right.
A. Yeah.
Q. But it's an average of those 12 -- rolling average of those 12 months, correct?
A. Yes.
MS. SCHROEDER: All right. No further questions.
HEARING OFFICER FAIRBANK: Next will be the Center For Biological Diversity.
MR. DONNELLY: Thank you. Patrick Donnelly with the Center For Biological Diversity. I have a lot of questions, so I'll be moving quickly, and probably taking some more time. Appreciate your testimony, and obviously, appreciate the work Fish and Wildlife does to protect the Moapa dace.

CROSS-EXAMINATION
BY MR. DONNELLY:
Q. These first questions I will direct toward Ms. Braumiller, but they could be for anybody there drawing on your experience as Fish and Wildlife Service employees and not on your legal opinions.

So, the Fish and Wildlife Service's mission is to conserve -- in part is to conserve, protect, and enhance fish, wildlife, and plants in their habitat; is that correct?
ANSWERS BY MS. BRAUMILLER:
A. That's my understanding.
Q. And that includes the implementation of the Endangered Species Act?
A. Definitely.
Q. The definition of "take" in section three of the Endangered Species Act is "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."
Does that sound right to you?
A. That sounds familiar. The focus of my work is not regulatory.
Q. To the best of your awareness, does section nine of the Act prohibit take of endangered species?
A. I think it does because there are take permits, but I don't know the details of the basis on which those are provided.
Q. Okay. I'm seeing nods from your co-witnesses there.
A. They probably know better than I do.

Q. All right. And perhaps I'll direct this to Dr. Schwemm. Might individuals or agencies taking action which result in the unauthorized take of species be violating Section Nine?
ANSWERS BY DR. SCHWEMM:
A. That's true.
Q. That you're aware of, are citizens able to file lawsuits to enforce the Endangered Species Act, including Section Nine, suits against entities responsible for unauthorized take?
A. Yes.
HEARING OFFICER FAIRBANK: If you'll make sure that your mic is on and that you're speaking in your microphone. Thank you.
MR. MILLER: I object, too. I don't know if it's a relevant line of questioning for the issue that we've been proffered here for.
HEARING OFFICER FAIRBANK: And I would ask if -- how this is relevant to the issue -- the four issues with respect to the geographic boundaries, the quantity of water that can be developed and the movement of pumping?
MR. DONNELLY: Understood. I will end that line of questioning.

HEARING OFFICER FAIRBANK: Thank you.
MR. DONNELLY: Thank you.
BY MR. DONNELLY:
Q. Dr. Schwemm, you state that flow and habitat are proportional to the Muddy River Spring area; is that correct?
A. Yes.
Q. And that any reduction in flow will decrease the amount of habitat available?
A. Yes.
Q. Would a reduction in habitat reduce the number of individual dace present?
A. Yes.
Q. In a general sense then -- I'll pass on that question.
Ms. Braumiller's presentation stated that carbonate pumping reduces spring flow; is that correct?
A. Oh, that's me?
Q. Either of you.
A. All right.
ANSWERS BY MS. BRAUMILLER
A. Yes.
Q. Thank you. Since that is true, doesn't this imply that carbonate pumping would result in a

reduction in the amount of individuals Moapa dace?
A. I guess that's a combo question.
I would say that's highly likely.
Q. It's highly likely. Thank you.
Given that maintaining stream flows is the stated goal of the MOA and other proceedings related to the Moapa dace, doesn't that imply there should be zero carbonate pumping in the Lower White River Flow System?
A. Oh, no, I don't think so.
Q. Is it the goal to maintain spring flows?
A. Yes.
Q. Does carbonate pumping reduce spring flows?
A. Yes.
Q. Doesn't it then follow that we need to cease carbonate pumping in order to maintain spring flows?
A. No, it doesn't.
Q. Why is that?
A. Okay. Yeah, because you do have inflows to the Lower White River Flow System's basins and local recharge. And some amount can be captured, right, without reducing spring flows below an unacceptable level?
Q. You stated -- and this is for you continuing, Ms. Braumiller.

Now, you stated that there are too many questions to come up with a sustainable yield number?
A. No, I did not.
Q. Okay.
A. Well, I -- what I did say -- let me clarify, if I could. That I think there are too many outstanding questions right now to construct a numerical flow model that could be used to predict the sustained level of total pumping.
Q. Okay. Thank you.
A. You're welcome.
Q. You stated then that 9318 acre-feet per annum is a good starting estimate?
A. I did.
Q. For sustainable yield?
A. Right.
Q. You justified this by citing the steady discharge and monitoring well management measurements since the pump test, correct?
A. Right. Groundwater levels, spring flows, and flows in the Muddy River, 2015, '16, '17.
Q. So, I'm going to ask you about a trend, and I'm referring to figures 7 to 8, and 13 from your report. Basically, these are charts depicting flow levels in

CSVM1, CSVM2, CSVM4, CSVM6, UNVM1, GV1, Warm Springs West and Iverson Flume.
Are you aware of a trend common to those since 2015?
A. Since 2015?
Q. Yes, in the 2015 to 2017?
A. I don't specifically remember what the hydrographs looked like from 2015 to 2018, not off the top of my head. I'd have to look.
Q. Are your other witnesses able to pull up those charts from your report? It's figure 7 to 8, and 13.
A. Go ahead.
Q. Yeah, it would be the CSVN wells, Warm Springs West, and Iverson Flume that I'm referring to.
A. You did say figure seven?
Q. It would be 7 to 8A, and then 13.
A. All right. I'm looking at that.
Q. Yeah. Thank you.
I'm just wondering if you observed a trend common to those monitoring points from 2015 to 2017?
A. Well, I'm looking at the hydrographs for the CSVN wells, and 2015 through '18, some of them generally appear to decline. All right.
The data measurements of KMW1 from 2015 to

2018, are pretty sparse, so I wouldn't conclude anything.
Q. Yeah, I think the other ones of interest to me would be Warm Springs West and Iverson Flume which are in figure 13.
A. Okay. I'm getting there.
Q. Yeah. Thank you for working with me here.
A. Iverson Flume and what else?
Q. Warm Springs West.
A. Warm Springs West. Well, you know, Warm Springs West, I -- just looking at the hydrograph, it might be declining somewhat. Right.
And Iverson Flume, I'm not all that confident in these measurements, but it certainly looks like it's declining.
Q. So, we can observe declines in numerous monitoring wells across Coyote Springs and Upper Muddy River Springs area?
A. Some decline.
Q. Some decline.
A. Not like pumping --
Q. Not like the pumps --
A. Not like the initiation of pumping, et cetera.
Q. So, if that's the case, if we have a decrease

in trend, and the 9300 number was arrived at due to some idea that there is sustainable yield right now, don't those -- don't those two things conflict with one another? That 9300 is meant to be maintaining spring flows, and yet we can observe spring flows declining at that pumping level?
A. Well, it's not to say that you couldn't have declines in groundwater levels in spring and stream flows at that level of total pumping. But the question is, does it leave enough water in the river to satisfy senior decreed water rights on the river?
Q. Well, so, I'd like to question that because in your presentation you said that was the justification, was maintaining spring -- maintaining senior water rights on the river. But isn't the Fish and Wildlife's mission to conserve, protect, and enhance wildlife populations? So, shouldn't your basis be whether or not spring flows that the Moapa dace requires are maintained?
A. No, and -- I'm sorry, I think I probably lost track of what you just said. Would you repeat that, Patrick?
Q. Yes.
A. Because the first part I don't think I agree

with.
Q. The justification for the 9300 number put forward in your slideshow was that it maintained senior water rights on the river?
A. I actually -- yeah, that's right. Stop right there?
Q. Yes.
A. I actually did not say that. What I said is that from 2015 to 2017, spring flows, groundwater levels and flow through the Moapa dace, for instance, was relatively constant. I didn't say it was constant. Relatively constant. And assuming that 9318 is sufficient to be senior decreed water rights on the river, that that is a best initial estimate of --
Q. Understanding that --
A. Yes.
Q. -- spring flows are declining at that pumping level?
A. Yeah, they're declining somewhat --
Q. Sure.
A. -- right?
Q. Sorry.
A. There's multiple factors that contribute to that, of course.

Q. You stated there should be no increase in either carbonate or alluvial pumping?
A. Oh, yeah. And above the 9318 --
Q. Yes.
A. -- as an initial starting point for sustainable yield, yeah. And we don't know precisely how much higher it might be possible to go than 9318 and still meet senior decreed water rights on the river. But I do believe that we have evidence that pumping at the average rate that we pumped during the Order 1169 pumping test is too high -- okay -- for the springs. As I said before, in an undiminished state of decline and at the end of the pumping test, meaning the system was nowhere close to being in a new steady state.
Q. But is it not in steady state now as we observe continued declines?
A. No groundwater system is ever in a steady state.
Q. Okay. Granted. Thank you.
Yeah. I'd like to change track for a moment and ask a few questions of Dr. Schwemm?
Does it sound correct to you that section two of the Endangered Species Act says that it is declared to be a policy of Congress that agencies shall conserve

endangered species and shall utilize their authorities in furtherance of the Act?
ANSWERS BY DR. SCHWEMM:
A. I'd rather speak to elements of the report.
Q. Absolutely. 1983 recovery plan for the Moapa dace details criteria for down and delisting. Are you aware if any of those criteria are currently being met?
A. No, the -- I believe downlisting is 4500 animals and 6000 for delisting. In the '90s, we've approached some pretty high numbers in the high 3000s and -- but then it really was a -- I think the effects -- the combined effects of tilapia in the system that really knocked it down to 500 animals, and then since then we've increased the -- we've taken care of the invasive species problem to a vast degree, and that's why we've gone up to 1500. But we're not -- you know, we're not too close to -- very close to the 4500 for downlisting.
Q. And additional delisting criteria is 75 percent of historical habitat unless we provide spawning, nursery, cover, or forging habitat; is that correct?
A. That is.
Q. Do you have a rough ballpark estimate of what percent of historic habitat is providing these

essential functions right now?
A. Not offhand. I'd have to calculate -- calculate that.
Q. Order of magnitude, 7.5 percent, 75 percent?
A. I wouldn't be comfortable with numbers, but I could estimate, you know, where that is on that figure. So, I -- when I showed that slide that had the data where the dace are, you can see that the majority of that is coming from Apcar, Pederson, and Plummer Streams. And where they intersect and then the main stem of Muddy River with the north and south fork is where there's very little dace that we find in any size range, whether it's a, you know, spawning, a juvenile, or whatever. There's few dace.
Q. So, based on the data you provided, it appears the Fish and Wildlife is successfully avoiding the extinction of the Moapa dace; is that correct?
A. Yeah, I think that we're stable at that 1500 animals, and we have been for a few years. Typically, they'll be some disturbance event or major recovery actions or -- such as removal of tilapia -- and you'll see an effect in that, and then you'll tend to see, you know, the system stabilize until the next event, whether positive or negative.

Q. So, understanding that extinct -- preventing extinction is being accomplished, do you feel you're making any headway toward the recovery goals?
A. We are. I consider, you know, recovery goals -- or recovering species, if you think about what it was in 2006 and '07, you had about 500 animals. So, I consider that having three times as many is great. But for a very small fish, and particularly one that has a complex life history but more importantly a very short lifespan, that's certainly not secure, and we have a long way to go.
Q. So, given that we're not rapidly advancing toward recovery, is the currently recommended pumping level of 9318-acre-feet per year going to contribute to the recovery of the species, given also that pumping at that level was causing spring flow declines?
A. That's a tough question. So, just to repeat and make sure I got the question right, is that at 3.2 -- well, you -- you're asking me at 3.2 would that be limiting the population of the dace at this particular point? Yes. And that's a -- that's a complex question because of all of the recovery actions.
It's difficult to say, but I would say that we

know that 3.2 is at least enough to maintain 1500 animals. And whether -- how that, you know, might fluctuate around that is difficult to say. But, wait. Let me refresh on this. We do definitely want to provide the caveat that, you know, based on the evidence that we have from the Hatten et al Paper is that increasing flow 10, 20, 30 percent is going to resolve increased habitat, and I believe that will be useful for the dace. So, I think that, you know, while it may be maintaining it, that 1500 may or may not be. But, certainly more habitat is going to get us closer to recovery.
Q. So, that means that if recovery is the primary goal, Fish and Wildlife should be recommending pull-over (sic) amount of pumping to increase spring flow?
A. That could be what -- it's difficult to make -- I really -- it's difficult to have a relationship directly between pumping and the actual number of the dace. But, I do believe that increasing the dace will increase the habitat because that's the best data we have.
MR. DONNELLY: Thank you.
HEARING OFFICER FAIRBANK: Georgia Pacific and

Republic.
MS. HARRISON: Good afternoon. Sylvia Harrison for Georgia Pacific and Republic Environmental Services. And with me today also representing George Pacific is Paulina Williams.

CROSS-EXAMINATION
BY MS. HARRISON:
Q. My questions today are more for Ms. Braumiller, and I would like you to refer to page 8 in Fish and Wildlife Service Exhibit 5. That's the initial report.
ANSWERS BY MS. BRAUMILLER:
A. Sure.
Q. And if I recall correctly, Ms. Braumiller, you you testified that you prepared this portion of the report; is that correct?
A. Yes.
Q. I just wanted to discuss with you the evolution of thinking that's described on page 8 about the recharge, or lack thereof, from the carbonate aquifer to the alluvial aquifer. And as you describe on this page, you note that back in the '60s it was believed that the Muddy Creek Formation could act as a barrier preventing the recharge in the carbonate

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aquifer into the alluvial aquifer and discussed that was because of the low permeability; is that correct?
A. No. Maxey et al 1966, mapped a lot on Muddy Creek Formations that went throughout the Wind River Springs area, and that's the difference.
Q. And that was also substantiated with the results at the time by the difference in the water quality between that alluvial aquifer water which is the better quality than the Muddy Creek Formation?
A. No, actually that --
Q. Low tow ray row(phonetic)?
A. Yeah, the -- yeah, the better water quality from the alluvial aquifer of the Muddy River Springs area -- yeah, the quality of water in the Muddy Creek Formation's poor. And so the fact that water quality was good in alluvial aquifer in Muddy River Springs Area suggests that water's getting in there from somewhere, and it's not coming through the Muddy Creek Formation in all likelihood.
Q. That's what I thought I said, but I guess I didn't.
Okay. But then you described how at the present time beginning in about the mid-1990s, it was later hypothesized that there was a significant leakage

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upward through -- into the alluvial aquifers from a carbonate aquifer to the point where the State Engineer has completed as you quote, "There's a significant connection between the carbonate aquifers and the alluvial", and essentially, the State Engineer has concluded the alluvial aquifers surrounding the Muddy River ultimately drives virtually all of its water supply from the carbonate.
Do you have an explanation for the different -- the basis for the different interpretations over time?
A. Well, I think what Dettinger at L95 says is that generally they observed, that they hypothesized that there was leakage from the carbonate aquifer into alluvial aquifer generally.
As for the basis, the State Engineer's basis, in the 2014 rulings for that same conclusion, I can't speak to that. It actually wasn't terribly clear in the rulings to me. But, I have -- which is why I took a really hard look at groundwater level data with carbonate aquifer and alluvial aquifers in the Muddy River Springs area and California Wash to see if I could demonstrate that indeed there is leakage from the carbonate aquifer into the alluvial aquifer into Muddy River Springs area and in California Wash, and I

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believe I can demonstrate that, and I did.
Q. Are there water quality data that would help substantiate that connection?
A. There may be, but I relied on hydraulic data.
Q. Okay.
A. Yeah.
Q. All right. I would like you now to turn to page 36 of that same report. Is it five? And again, I verify that you prepared this portion of the report?
A. I did, yeah.
Q. This morning when you were giving your direct testimony, you didn't really have a chance to get to your hypothesis of the source of the Big Muddy Springs, and I'd be interested to have you just give us a summary of that, those proposed sources for us?
A. And it is important because it is about 7 CFS. And it is just a hypothesis. But, Maxey et al 1966, during the 1966 report mapped Muddy Creek Formation in the Muddy River Springs area, including -- including high chromiability, massive limestone pebble fanglomerates, which were described as high permeability units within Muddy Creek Formation. And, you know, I noted that the Big Muddy Springs, it was approximately located within area of the Maxey, et al,

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'66 mapped as massive limestone pebble fanglomerates. And that could explain how there could be significant spring discharge through Muddy Creek Formation. It happens to be -- I submit it's probably not a coincidence. And there are -- you know, additionally, it's a warm spring, right? So, that means that the water is coming from depth. You know, I mean, and you can't say how deep. That's a whole another deal. But from depth. And also, if you look at the hydrograph for flows from the Big Muddy stream -- stream -- Spring, sorry, the -- the changes in spring fills are very attenuated compared to the rest of the springs.
And between the warm temperature, the fact that the location of the spring corresponds roughly to the location of these mapped limestone pebble fanglomerates by Maxey et al, it makes me wonder if what we're not looking at is water that's flowing at depth through Moapa Valley, either through the carbonates or maybe really deep basin fill, greatly attenuating water level changes. I'm sorry, the discharge from the spring. And yet deep, so warm.
And also, it was completely unresponsive as far as I think any of us could tell to the Order 1169 pumping. Which might be explained by the fact that

this chunk of massive limestone pebble fanglomerate is sort encased in Muddy Creek Formation. So, I think it could fit.
Q. So, is the -- just in short, it's clearly a different source from the carbonate aquifer so-called we've been discussing as the major source of many of the wells that have been discussed today?
A. Right. Well, it could be carbonate beneath Lower Meadow Valley Wash, but it does not seem to be portion -- the portion of the carbonate aquifer that we identified with the SeriesSEE analysis.
Q. At least not in direct hydraulic connectivity?
A. Yeah. The two may be in hydraulic connection, but it's not -- it's -- the source does not seem to be this highly -- exceptionally high transmissive portion of carbonate aquifer.
Q. And you mentioned that the flow of that spring was, what, 7 CFS?
A. Yes.
Q. And what percentage of that is -- does that make up of the river flow?
A. Yeah, so, I just ballparked that, because it depends on what years we're talking about. But it's about three percent of the Muddy River Spring

discharge, and about 15 percent of the Muddy River Moapa gage, at least in 2001 -- actually, when Beck and Wilson 2006 did their seepage study on the Muddy River.
Q. That's a lot.
So, is it reasonable to say that that discharge could be a significant source of recharge to the alluvial aquifers along the Muddy River?
A. I don't know about that. Because the spring discharges to a spring branch, flows into the main stem of the Muddy River, and on down the river, so.
Q. You don't whether the stream is gaining or losing at that point?
A. Yeah. And actually it's gaining through almost all the Muddy River Springs area. There is a losing reach. I can't remember. Maybe two or three miles, Moapa Valley gage. But most of it is gaining, apart from the actual spring flow. You know, the surface discharges in the springs in the river. If you take that out of what Beck and Wilson found in their 2001 seepage run, you could track out the documented spring surface flows into the river, you still end up with gains through most of the Muddy River Springs area.
So it's clearly gaining from the local alluvial aquifer, right? But the mud -- Big Muddy Spring itself

is discharging into a tributary that flows in the main stem. So, it's not necessarily -- in fact, it probably is not -- yeah, water is going the opposite way. It's going through the alluvial aquifer into the stream in the Muddy River Springs area not the other direction.
Q. Okay. Thank you.
In any event, would you agree that it would be a very important thing to know about the source of that spring as we're trying to determine sustainable yields within this proposed unit?
A. The source did you say?
Q. Yeah. Know more about it?
A. Well, yeah, it would be one of those outstanding, hydrogeology questions, right? Because it's clearly a large contribution to the river. And so, in order to, you know, to prevent unduly impacting the spring flow, we're going to have to understand more --
Q. About the sources?
A. Yeah.
Q. Thank you.
You mentioned that the Muddy Creek Formation has been mapped extensively. Is it generally true that that acts as an aquifer, at least in part?

A. Yeah. And first I would say I don't know I would say it was mapped extensively. It was a hand-drawn map by Maxey 1966, right? But, it is a relatively low permeability formation.
Q. So, with respect to trying to understand the recharge of the carbonates into the alluvial, again, is the extent of the Muddy Creek Formation something we need to know more about?
A. Do you mean the hydra -- what is the nature of the hydraulic connection between carbonate and alluvial aquifer --
Q. Yeah.
A. -- and the Muddy River --
Q. It's part of -- it's part of the question that we need to answer.
A. Yeah. I think I -- I think I demonstrated that there is a hydraulic connection, and I tried quite a while to see if I could figure out exactly where. Okay? And concluded that I can't tell. There is -- there is Bird Springs Formation carbonates. You know, in the surface geologic map there -- you know, there's contact between the Bird Spring Formation carbonates and the alluvial in the Muddy River Springs area, but I'm not convinced that the water table is lower than

that contact. Can't tell.
You know, and then over -- according to Maxey's, et al, hand-drawn geologic map, there's a lot of Muddy Creek Formation, you know, throughout the Muddy River Springs area. And also, Page et al 2005's geologic map, he maps a lot of Muddy Creek Formation throughout the Muddy River Springs area. And others map somewhat less.
But, what I concluded is that one way or the other, I know there's a hydraulic connection, but due to the carbonate aquifer and alluvial aquifer in the Muddy River Spring area? Because I see -- I see the -- the effect of carbonate pumping on groundwater level variations in carbonate monitoring wells. And I see those same signals in the water level levels for alluvial wells in the Muddy River Spring. I there's a connection. I just don't know exactly how. But I don't think that matters. I just know that there is one.
And additionally, the carbonate aquifer in Muddy River Springs area is higher, up to like a hundred feet higher than in the alluvial aquifers. So, there is a connection. I don't know exactly how. And there is an upward gradient from the carbonate aquifer

into the alluvial aquifer. So, it's happening, but I don't know how.
Q. And would you be confident that there's a similar connection with the -- in other areas of the proposed management unit?
A. Yeah, in California Wash I think I demonstrated the same thing, only through somewhat different logic. But, there the first thing I did was I noticed that water levels and basin fill wells, and this was -- I mostly rely here on groundwater level measurements provided to Fish and Wildlife Service and SNWA to prepare the photokinetic biological opinion for the groundwater project they had.
Anyway, long story short, there is apparently south to north flow through the basin fill in California Wash from, you know, higher water levels to lower, and yet there's no -- you know, according to water budget analysis, also prepared by SNWA 2000, it's part of their conceptual model -- or their numerical model. No local recharge. So, how is that occurring? Okay. Where is the water that's coming from south California Wash to north? Where is it coming from?
And I think it's coming from the regional carbonate aquifer. And again, head is a lot higher

than the regional carbonate aquifer in the California Wash than in the basin.
Q. I had the impression in the report maybe --
HEARING OFFICER FAIRBANK: That was the time. We'll get back. We'll have -- we'll probably have time to do another round.
Next will be the Muddy Valley Irrigation Company.

CROSS-EXAMINATION
BY MR. KING:
Q. Okay. Good afternoon. My name's Steve King. I'm counsel for Muddy Valley Irrigation Company. I think my questions will be to directed to Ms. Braumiller.
And first question, I know you've got the last set of questions. Would you agree that the carbonate and the alluvial aquifers are sources of supply of water for the Muddy River Springs and Muddy River?
ANSWERED BY MS. BRAUMILLER:
A. I would agree -- I would agree that a carbonate aquifer and the alluvial aquifer in the Muddy River Springs area is a source of water in Muddy River and also in California Wash.

Q. Right.
Now, in today's PowerPoint and I think in your salient finding number three, that's -- I believe it's for all practical purposes one groundwater basin is the source of the Muddy River Springs and Muddy River. Would be -- would that be accurate?
A. I'm sorry. I was looking at this when you said that.
Q. I just read what your PowerPoint said, and I just wanted to confirm that was your testimony. That for all practical purposes, it was one groundwater basin that is the source of Muddy River Springs and Muddy River?
A. Yeah, I think the combination portions of the source of water for Muddy River and Muddy River Springs.
Q. And is that the general conclusion in your -- in your mind of the results of the 1169 test?
A. Only part of that is based on the results of the DOI 2013. The only part of that conclusion he's asking about is based on the results of the DOI 2013 SeriesEEE interpretation of the Order 1169 pumping test, and that is the observation that -- or the conclusion that a large portion of the regional

carbonate aquifer is up to exceptionally high field to scale transmissivity.

HEARING OFFICER FAIRBANK: Ms. Braumiller, I'm just going to ask if you don't mind speaking into the microphone as best as possible. Because when you turn away, it fades out and it might be hard for people that are remote to hear.

THE WITNESS: I'm sure you're right. Okay.

BY MR. KING:

Q. Then if we could just turn pages that question the purpose of this hearing and other purposes of course. And Order 1303, I just -- several -- paraphrase several of the points there. It references the results of the 1169 aquifer test that caused significant decline in Pederson and Pederson East Springs. Would you agree with that?
A. I do, yeah.
Q. The order 1303, which I've read at this hearing, also noted that there were declines in Baldwin and Jones Spring. Do you recall that?
A. You're referring to the DOI 2013?
Q. The order itself on page 6.
A. Oh.
Q. The reason we're here for these hearings --

A. Right.
Q. -- 1303. I made that statement. I just want to ask if you agree with that?
A. Yeah, I can't recall off top of my head what the hydrographs for Baldwin and Jones Springs looked like. I cannot speak to that right now.
Q. Then further in the order, the State Engineer concludes there's a direct interrelationship with Muddy River -- excuse me -- Muddy -- Muddy River Spring flows and fully appropriated Muddy River senior decreed rights. Do you recall that, or similar language?
A. Perhaps.
Q. Do you know what Muddy River senior decree rights are?
A. I don't know the total of those.
Q. But do you know what --
A. What it is, yes, I do.
Q. Maybe you can give us a brief explanation of your understanding?
A. Okay. I should say I have a sense of what that means. Okay? I understand senior in priority, right? And by decreed, there was let's see an adjudication.
Q. So, surface water rights?
A. I think most of them, if maybe not all of them

are, but I don't know.
Q. So, under State Engineer Exhibit 333, that is the Muddy River decree?
A. Okay.
Q. It's a 1920 Nevada district court decree that was -- that incorporated the State Engineer's order of determination at that time, and it's all new surface water. So, I don't think anyone else so far during the hearing has asked the imbedded foundational protection that's discussed in Order 1303, senior decreed rights. That's why I'm trying to bring this into the record and your understanding what that means.

So, let's go back to page -- if we can, to I think it's Fish and Wildlife Exhibit 5. Your -- that's in fact has been referenced several times today. Page 37 I believe.
A. Okay.
Q. And there the very last paragraph. And this is your contribution to the report; is that -- is that correct?
A. Yes.
Q. And so, there is language that talks about assuming a flow rate of 30,550 acre-feet per year through Muddy -- through Moapa gage is sufficient to

meet senior decreed water rights on and along the Muddy River. (The domain of the State Engineer's Office.) So, do you see that part?
A. Yes.
Q. And so, that was -- I was asking the foundation of a question of what the senior decreed water rights meant to you.

So where did that number 30,550-acre-feet come from?
A. That -- you know, I think I mentioned this earlier. I'm going from memory here. But I thought 30,550 acre-feet per year, according to my calculations was the average flow through Moapa gage in 2015, '16, and '17 calendar years.
Q. And that's -- this discussion is placed in your report under section 1.4 sustainable levels of pumping of lower -- of the LWRS. So, by sustainable, what does that mean?
A. Well, I --
Q. Spring flows, would that be --
A. Yeah. Sustainable in the sense that the spring flows part from the Muddy -- Big Muddy Springs, which they're operating from a different place. The Refuge Springs flow through the Moapa gage and carbonate

groundwater levels throughout at least the five plus basins were all relatively constant -- not constant, and that there was sufficient water discharge springs to maintain the dace.
Q. Okay.
A. Yeah. And when I said assuming that this flow is sufficient to the senior decreed water rights on the river, I'm not assuming anything. I'm -- leave that to the State Engineer's Office. I'm saying assuming it is sufficient to meet them.
Q. So could you call that a placeholder number for just sustainable?
A. I'm sorry.
Q. Can we use the term as a "placeholder number" that you -- that you chose to use?
A. I think it is the best available initial estimate of sustainable level of pumping.
Q. And then you have again, same sentence turning to (the domain of State Engineer's Office.).
A. Right.
Q. Okay. So, and I understand you haven't read the decree, that's the State Engineer Exhibit 333. But that was a Nevada district court case in which bench/ State Engineer in 1920 issued an order and

determination. So, that took place then.
A. Okay.
Q. And that -- to be consistent it seems to me, but would that be -- strike that question, please. Put that in the record.
That's the State Engineer's Exhibit. It speaks for itself.
Let me ask you another question, if I may. Let's consider the following. If the decree, State Engineer Exhibit 533, which protects senior decreed rights, which is the subject of this -- one of the subjects of this hearing, and you can jump to management question with grandfather rights, if that decree provides that all of the stream system has been fully consumed by appropriation, would -- and that the river is -- excuse me. It says fully consumed by appropriation, would that change your opinion as to that 9,138 feet as far as a placeholder number?
A. Well, let me see if I understand your question. So, you're saying if the river is fully consumed meeting senior decreed water rights on the river, would that change my estimate?
Q. That's a fair -- yes.
A. Yeah. Well, assuming -- I guess what you're

stating is under this hypothetical senior decreed water rights are fully met and now there's no water in the river. Because it lies down stream from the Muddy River Springs, it's still possible that, you know, conditions -- there's still spring flow. It's just that downstream down the river is consumed by rights.
Q. Well, that --
A. Right? So --
Q. -- the answer I suppose. My question though wasn't -- isn't a very good question. This is a little different.
Really assuming that the decree determined that all the water was exhausted and that there was no other development allowed that would deplete the flows, would your number change as far as that 9138 acre-feet?
A. Well, you know, maybe it depends on the priority of groundwater rights of various other locations in the Lower White River Flow System. So, I can't exactly answer that.
Q. Okay. So, let me just ask one -- just a question.
So, I want you to assume that the senior decreed right holders in the Muddy River are entitled to the water that is depleted from the stream by

pumping, would that change your 9138 acre-foot -- feet number -- foot number for a placeholder number to satisfy senior decreed water rights?
A. Okay. So, let me see if I have your question right. So if pumping did not allow enough water to go down the river to meet senior decreed water rights on the -- on the river, would I consider that level of pumping to be sustainable? I would say no, by definition.
Q. Thank you. Okay.
I'll try to ask a similar question, a little different. If water is being captured by wells from pumping that was decreed water that was under the decree itself, was -- senior decreed water rights were entitled to all that water, would that change the 9138 acre number?
A. Somehow I got loss in the middle of that question. Could you give it to me again?
Q. Strike the question. I think your answers -- I know you're not an attorney, you're not familiar with the decree. But I was simply trying to wrap -- come around to the -- one of the conjunctive management questions here that's central that hasn't been asked yet.

Are there any groundwater rights that are available to be pumped under the 1920 decree which is already determined by the federal district court through the incorporation of State Engineer's determination, are there any groundwater rights that is able to be pumped without affecting senior decreed rights?
A. I think it depends on the uteral (phonetic) and the conditions.
Q. Thank you very much.
MR. KING: I have no further questions.
HEARING OFFICER FAIRBANK: Okay. Next will be Nevada Energy.
MS. CAVIGLIA: Justina Caviglia on behalf of Nevada Energy. I should be pretty quick. I have one question for Ms. Braumiller.

CROSS-EXAMINATION
BY MS. CAVIGLIA:
Q. So you state that you recommend that the State Engineer should not allow water rights to be moved from alluvial to carbonate, from the carbonate to alluvial; is that correct?
ANSWERS BY MS. BRAUMILLER:

A. Yeah, and I did -- it was intentionally, maybe somewhat oversimplified recommendation.
Q. Okay. As part of this recommendation, did you consider water rights or the priority of water rights?
A. The priority of water rights?
Q. Correct.
A. No.
Q. You did not.
Did you consider whether water rights were permitted, certificated?
A. I did not.
Q. What did you base your opinion on? Like, basically, the hydrology and that was it?
A. Yes. It was based on this. If you swap current alluvial water rights for carbonate water rights, you are going to impact the discharge of Muddy River Springs, and as a consequence, slow down the Muddy River. You're going to do that. If it's within that zone of exceptionally high field scale transmissivity, it's pretty much not going to matter where in that area. If you turn alluvial rights into carbonate water rights, you're going to impact Muddy River Springs.
Would you do it, you know, somewhat lower

transmissivity portion of the Lower White River Flow System, you're still going to impact it. It might be somewhat less. If you turn carbonate rights into a alluvial rights and they're close to the river, that's a bad thing. I think it's going to be a challenge to come up with rules that allow swapping alluvial rights for carbonate rights. That probably -- probably a bad bet altogether within that zone of exceptionally high transmissivity to carbonate. It's going to be hard to come up with rules that allow you to turn carbonate rights into alluvial rights without getting into a lot of debate like in Amargosa Valley -- or Desert rather, about has it moved closer, is it, you know, increased negative impact on water levels in the alluvial aquifers, Muddy River Springs area, and California Wash.
That gets complicated. That's why I just, you know, recommended something simple. Don't swap alluvial rights out for carbonate. Don't swap carbonate out to alluvial. Particularly with a concern that if you were to change carbonate water rights into alluvial rights and they happen to be close -- pretty close to the river, you may not have time to -- the impacts may occur before you can detect them and

process the data and go Oh, I think we're impacting flow in the river because we moved alluvial pumping, changed it from carbonate into alluvial, and we've gotten it close to the river. You may not be able to detect it in time. Right? Maybe not horrible, but, you know, you're going to find out about it after the horse is out of the barn, right? So, it was -- it was very, maybe oversimplified recommendation, but I think it's implementable. So, that's why I suggested it the way I did.
Q. And to follow up with that, because I know Mr. King asked you a similar question.
So you're -- are you familiar at all with Nevada water law when it comes to senior priorities or anything like --
A. Probably --
Q. -- when it comes to groundwater?
A. The basics, yes.
Q. So, based on this model, would you ask the State Engineer to completely ignore that?
A. The primary?
Q. The water priority system?
A. Oh, I don't think they can. Based on my understanding of water law I don't think that can be

done.
Q. So, even though there's a conflict between the idea of you can't move water rights, but you can't -- so, if you have -- for example, if you had a senior alluvial water right, they couldn't move to a carbonate?
A. Well, we're talking about change applications, right?
Q. Not necessarily under your recommendation. So, I'm just -- I'll leave it at that because you don't understand.
A. Yeah, I may not understand enough about that.
Q. Okay. It's just based -- your recommendation is based on the hydrology, and that's basically what where --
A. Yeah. And --
Q. -- it's coming from?
A. And handing an ability to protect impacts in a timely -- all right?
So, but for sure, if you turn alluvial rights into carbonate rights, and it happens to be within this very large area, you know, like a thousand square miles of exceptionally high transmissivity carbonate, you will impact the springs, which then impacts the river.

So, in general that -- you know, there might be some ways or some situations where you could do it. But, in general, I think it's probably negative that you would accept --
MS. CAVIGLIA: No other questions.
HEARING OFFICER FAIRBANK: Okay. So, at this time we'll go ahead and open it up to State Engineer staff for questions.
MR. BENEDICT: I'll start. John Benedict for the record.

EXAMINATION
BY MR. BENEDICT:
Q. I have a question about climate signature discussions, so to speak, maybe for Mr. Mayer. I'm kind of interested in your opinion after reviewing some hydrographs, getting a little bit more insight on what climate signature that you described. And I think Sue Braumiller also described this. So, this may be something that could be answered by either or both.
But in a review of those hydrographs, you've described that there's a response during wet years, in particular I think 2005, and perhaps 2010 as well, perhaps others in smaller response.

Would you say that that response that you see that in most cases I think you've also said it happens within a year of precipitation. Do you see any evidence that that response to what I guess I'd call a yearly spike in precipitation looks like a spike in water levels, or does it look like something else? Or can you tell me what that response looks like with respect to the water levels? Obviously, there's a rise. Is that the response that you're talking about? Is there any other dynamics there?
ANSWERS BY MS. BRAUMMILLER:
A. Yeah, I was just referring to a rise in groundwater level or spring flows?
Q. Water level, let's talk -- let's just talk groundwater level.
A. Yeah. A rise in the groundwater level, the water level.
Q. And that's the -- that's the response? So that one-year period of time is the climate response to --
A. Yeah. And it varied depending on whether I was looking at alluvial -- you know, water level records for alluvial wells, a number of spring areas or for carbonate wells, you know, almost throughout, but it was within a year. It's just -- you know, it was very

rough observation.
ANSWERS BY MR. MAYER:
A. Again, this is Tim Mayer. I think in 2005, the effect probably lasted for a couple of years it looks like when I looked at the hydrograph. The recharge response may have occurred right within a year, but lasted for a couple.
ANSWERS BY MS. BRAUMILLER:
A. Yeah. To clarify, I'm not talking about the length of the response. What I was looking for was how long did it take for change to manifest in the groundwater levels. Because what I -- what I was looking for was, you know, just something to start with to try to start figuring out by what means climate, wet season --
A. (MR. MAYER) Wet periods.
A. -- are influencing groundwater levels.
Q. (MR. MAYER) And also spring and stream flows.
A. Like that's the first clue to the mechanisms by which the climate, wet seasons, wet periods are influencing water resources in the Lower White River Flow. That was my purpose. It's only -- it seems to be possibly 18 years at Big Muddy Springs. That's wild. Okay? But, everywhere else it seems to be

within a year. That's pretty short really. So, I wasn't referring to how long the affects it takes for a recharge pause to travel through the system. That's not in evidence.
Q. Okay. So, your characterization really has more to do with the initial signature --
A. Yes.
Q. -- I guess actually seeing that in the water levels?
A. Yeah.
Q. Okay. Thank you. Next question. If I could, I'd like to go back to the CSVN5 hydrograph, and I think this is for Ms. Braumiller.
You've alluded to an understanding or a conceptual model for that hydrograph, but I don't think you've described, and I'm just curious. Because it does have a relatively unique response, and I just thought I'd see if I could hear your side on that.
A. Well, I'll say this much. I noticed that it's a pretty deep well. I can't remember how deep, maybe 900 feet or something like that. But, it's a completed up-rigging of a series of overturned anticlines. And in my past experience, and I cite northern territory of Australia, you know, the fractures, it's conductivity

through fractures, right?
So, if you have a over -- an anticline, much less overturn anticline, you could get disconnects across the anticline through the fractures. And so, I think when CSI said -- Steve said yesterday that perhaps it's kind of perched up there, I think it may be. And it's also at the bottom of a small drainage, right? So, you have recharge downhill, you know, and then you've got the well completed behind, you know, an overturned anticline. It could be -- could be, you know, relatively low permeability structure. I mean, you know, I'm sure it leaks, but I've seen that before where the fractures, there's just a disruption in the connectivity of the fractures around the anticline. So, I think somehow it's probably related to that. But, it's just an observation.
Q. I have one other question, and it goes to equilibrium, and I think this is for Ms. Braumiller, again. Because you had indicated that based on the responses that we're seeing during the 1169 aquifer test, both to water levels and discharge, that the system wasn't in equilibrium and end of aquifer testing. I'm just wondering has there been any thought to length of time to reach equilibrium? It's apparent

that water levels -- in your opinion, at least the water levels that the response is relatively rapid and widespread. And the springs also respond rapidly to that change. So, it seems as though in some sense time becomes a little bit less important with respect to impacts, and yet, in addition it's discussed that equilibrium's not reached very rapidly. I just wondered -- see if I could get your thoughts about that concept and when you think something like equilibrium would be reached in a system like this?
A. Yeah. I don't think those two observations are inconsistent. Because equilibrium is reached when the cone of depression expands to the point where it's capturing, you know, sources of water out there at the same rate that you're pumping, right? So, although the cone of depression was very expansive through the official two years of the test, it hadn't come anywhere close to tapping into sources of water that it could capture. It wasn't anywhere close. So, does that make sense?
I mean, the transmissivity of that the carbonate aquifer is exceptionally high, but it still has to get out there far enough that it captures sources of water. Where would they be? Well, the

Muddy River. You know? The language phrase. But it hadn't gotten there. It wasn't anywhere close. And if that's clear, because carbonate water levels were still declining at, you know, undiminished rate when the MX5 pump was turned off at the end of 2013. And so were spring flows to Refuge Springs. So, I don't think that those two things are inconsistent at all. I mean, that's a basically, capture problem, right?
Things keep declining until you capture enough ET, screens, springs, et cetera. And it hadn't gotten there. I don't think they contradict each other.
Q. Okay. Thank you.

EXAMINATION
BY MS. COOPER:
Q. Christi Cooper. Looking at your map of the Lower White River Flow System, page 60 in your report, figure one of your presentation, could you elaborate a little bit more as to what your opinion is on the areas of high transmissivity and lower transmissivity in the Lower White River River Flow?
A. Yeah. You know, in 2013, DOI used SeriesEEE to isolate MX-5 induced drawdown in select wells. If we had the time we could have done that with virtually all

of them. But, based on the analysis we did do, see that extends at least the CSVM-6, the Coyote Springs down, which I described as a simple Coyote Springs well. It extends as a far south as GV1 in Garnet Valley for sure. I have to look at a picture. Let's see. I'm just going from memory here.
As far east as CSV2 in Muddy River Springs area for sure. I think EH4 was only isolated 1.2 feet of drawdown rather than 1.5 to 1.6. You know, five other target wells.
But I think that the SeriesEEE curve fitting may have underestimated the MX5 induced drawdown in H4 because there's, you know, a low permeability structure that creates the layer of spring flow that was not accounted for in SeriesEEE as a MX5 reduced drawdown. And it extends into California Wash to I think it was -- I think it -- which one is the more northern, M1 or M2? I can't remember off the top.
Q. M1.
A. M1. I keep getting them mixed up. You know, so, you know, CSBM6 in Coyote Spring Valley. GD1 in Garnet Valley over to M1 in California Wash, CSV2 in Muddy River Springs area, that was all 1.5 and 1.6 feet of drawdown to MX5 pumping. That's what we estimated.

So, at minimum it includes the area delineated by those wells. And, again, because drawdowns due to pumping generally decreases what rhythmically the distance. You know, that can't be the end of it. It extends further than that. And with no better option, I extended -- I extended my delineation of a portion of the aquifer that's exceptionally high in transmissivity to the nearest likely known full boundaries. And that's -- that was the basis for the five plus basin, roughly a thousand five hundred square miles.
Q. Thank you.
MS. COOPER: Okay.
MR. SULLIVAN: Adam Sullivan.

CROSS-EXAMINATION
BY MR. SULLIVAN:
Q. Mr. Mayer, I have a clarifying question about the 2006 memorandum of agreement.
ANSWERS BY MR. MAYER:
A. I'll do my best.
Q. This is actually an exhibit that Mr. Schwemm had done, but it demonstrates the consequences of the discharge at Warm Springs West reaching certain flow level. One of the columns is regarding Arrow Canyon

Well in that it flowed Warm Springs West less than three CFS that pumping Arrow Canyon Well would have to cease.
And in reviewing the exhibit, it seems that that is only for the duration of the Mumford test. I'm curious if you recall what the rule would be or what the Agreement is if that threshold were met now?
A. I can attempt to answer that. And I honestly don't recall all, but I do remember having the same question, Adam, when I -- when I saw that agreement way back in 2006. I think I may have even asked about it, but I honestly don't remember. I'd just have a look at that agreement.
Q. I don't remember that.
ANSWERS BY MS. BRAUMILLER:
A. I remember that. I remember the MOA reading just like you said, Adam. That restriction on Arrow Canyon pumping was during the pumping test. Which didn't make sense for me.
ANSWERS BY MR. MAYER:
A. I think that's the way it was.
Q. Okay. Thank you.
And one more question about the MOA.
Is there a -- is there a provision in the MOA

that defines what the -- what the cause of spring flow decline would be? I mean, the consequences of the pumping would be reduced, but say a portion of the decline was determined to be pumping from a variety of different wells or climate. Does it matter?
ANSWERS BY MR. MAYER:
A. Yeah, according to the terms of the MOA, from our understanding, it doesn't matter. We went low enough that we felt we were below any climate variability impacts. So, it would clearly be responding to pumping impacts and not the climate variability. So, that was the idea. But, I don't think there's any means in the MOA of saying no. Unless maybe pad together and renegotiate it or something, I don't know, but if we said yeah, all of -- all of us agree this is climate, you don't have to -- even if it's climate, then, you know, you still -- pumping is going to make it worse. So, it would still seem like it has to be ratcheted back or cut off.
Q. Thank you.
EXAMINATION

HEARING OFFICER FAIRBANK: Ms. Braumiller, I actual have a question. Would you mind describing or differentiating the difference between a groundwater hydrologist and a hydrogeologist for me as you understand it.

ANSWERS BY MS. BRAUMILLER:
A. Thanks for asking that. I don't think -- a groundwater hydrologist is schooled in groundwater flow dynamics and transport, the physics of groundwater flow and transport. And hydrogeology is that and also all the geologic considerations you have to make in order to analyze groundwater systems. So, they are inseparable. My education happens to be as a groundwater hydrologist, flow dynamics and transport.

But, actually, beginning before I started working, which was 24 years ago or so, even my master's thesis was a hydrogeologic -- hydrogeologic site characterization for a research site in northern territory of Australia. So, that was literally my introduction to hydrogeology, not being an undergraduate geologist. They're inseparable. You can't do groundwater analysis without, you know, giving not minor but constant consideration to geologic information.

And yet, I don't believe that geology alone, clearly, is not enough to analyze groundwater problems,

because that -- you know, that's only one factor in determining groundwater flow problems, right? They're -- they're one in the same. You can't do one without the other.

HEARING OFFICER FAIRBANKS: Okay. So, we have some additional time. So, we'll reopen it back up to the participants for some additional time for questions. At this point, I think we'll go ahead and note that there's about an additional seven minutes for each of the participants if they have follow-up questions, and we'll start with Coyote Springs Investments.

MR. HERREMA: We have no further questions.

HEARING OFFICER FAIRBANK: Thank you. National Park Service?

MS. GLASGOW: No questions. Thank you.

HEARING OFFICER FAIRBANK: Okay. Thank you. Same no questions from National Park Service.

The Moapa? Okay.

FURTHER RECROSS EXAMINATION
BY MS. BALDWIN:
Q. Beth Baldwin for the Moapa Band of Paiute Indians. I know it's been a long day, and I appreciate

the witnesses' participation. Just bear with us for a few minutes.

Mr. Mayer, we left off talking about your rebuttal report, specifically the hydrograph in Dry Lake Valley, Delamar Valley, Tule Desert.

You said you looked at 20 wells total, correct?

ANSWERS BY MR. MAYER:
A. I think you add them up.
Q. Okay.
A. I will accept that.
Q. Okay.
A. That's about what it was, yes.
Q. Were there more wells available that you did not include in your analysis?
A. Well, there are more wells in those basins, yes.
Q. So. I'm looking at I believe it's rebuttal slide eight. It's the four monitoring wells in Dry Lake Valley.
A. Okay.
Q. So, I can tell that the top right one is a decline, correct?
A. Uh-hum. Right.
Q. Which of the other three are increasing?

A. The bottom two have slight increases and top left one is stable. And I apologize, it's probably hard to see on this hardcopy with slides. It's clear in the report.
Q. Can you give a rough estimate of the magnitude of the increases?
A. It's hard for me to see the scale on the graph, so.
Q. I can't -- I can't read the numbers at all.
A. Yeah.
Q. Have you done any kind of statistical analysis to look at whether those increases are significant in any way?
A. I'm not sure how you would determine what was your hypothesis test to be if they're significant or not. Are you saying, is that noise? Is that random noise?
Q. You're the statistician. I'm asking you.
A. Looks consistent to me.
Q. Okay. So, looking now at two slides forward, Tule Desert wells, do you know what causes that drop in early 2009 that we see in all four wells?
A. No, I don't know what that is.
Q. Do you know if water year 2011 was a

particularly wet year or dry year?
A. Water year 2011 was pretty wet.
Q. Do you see any reflection of that in these hydrographs?
A. No, I don't.
Q. In your opinion, are groundwater levels more sensitive to wet years than dry years?
A. Two of the wet years closest.
Q. I'm sorry?
A. I need to clarify these wells are not in Lower White River Flow System.
Q. Thank you. Give me one second.
Is it your opinion that groundwater systems react more slowly than surface water systems to short terms wet trends?
A. It would generally be generally true. Not in all cases.
Q. And just to -- I think I asked this before. But did you examine whether the water levels in Delamar Valley, Dry Lake, or Tule Dessert are responding to any delayed climate?
A. No. I didn't look at these well hydrographs in relation to climate. I just looked the well hydrographs.

Q. In your opinion, is there any consensus on how climate variability is reflected in well hydrographs?
A. I don't have an opinion on that question. That's a hard one to answer.
Q. As a hydrologist, do you have any opinions about the hydrological impacts of climate change?
A. Yes.
Q. Would you agree that climate change may bring warmer air temperatures?
A. Certainly. It has.
Q. Could we expect to see spacial changes in the distribution and timing of precipitation?
A. We already have.
Q. Could you explain what that means in terms of rainfall or snowfall?
A. Well, we're seeing more warmer temperatures and seeing more rain versus snow in the winter in terms of winter precipitation. We're seeing earlier snow melt, so, earlier runoff. We're also seeing more frequent and intense rainstorms, rain events. So, more heavy rain events. It was just a little bit.
Q. So, hypothetically, if we were experiencing an average water year -- not dry, not wet, average -- but more of that precipitation was falling as rain, would

you expect to see a rising hydrograph as a result, or no change at all? Or a decrease? How would you expect that?
A. The hydrograph we're responding to is precipitation only, and you are saying there's less precipitation or recharge -- implying there's less recharge, then I would expect the water level to go down. If that's your question.
Q. So, yeah, maybe -- I don't know. Let me ask it again. We can see if we're understanding each other.
Average water year but more precipitation falling as rain as opposed than snow, does that have any impact on a hydrograph?
A. That would be hard to say on a stream. That was probably -- that's going to be reflected more, and I'm more comfortable looking at the impacts of that kind of situation in a stream and what that is going to mean is that the runoff signal is going to be advanced in time. It's going to occur. It's not necessarily you would have less runoff, and so, it just may be coming earlier. So, it may be the same way in the winter having been groundwater. I shouldn't -- but there's a lot of other factors, because you get into the rain evaporates, but now it falls earlier. So, I

don't know. It's sort of complicated.
Q. Fair enough.
And Sue, I have one question for you.
Mr. Donnelly was asking you a question about a pumping rate of -- I think he said 9318 acre-feet, and whether that carbonate pumping was causing spring discharge to decline. And I think, I think you said that there were other factors to consider.
I might have misheard you. So, I'm just trying to understand.
ANSWERS BY MS. BRAUMILLER:
A. I think what I remember Patrick asking was if the average total pumping rate in 2015, '16, and '17 calendar years was about 9318 acre-feet per year. And then he asked me if, you know, there were visible declines in groundwater levels and some spring flows during that same period. And I said, I mean, just visually.
There were some. But they were -- it was still relatively constant groundwater levels and relatively constant spring and stream flows during that period. And for that reason, 9318 is as good a place as I know to start.
Q. I just wanted to make sure I understand.

A. Okay.
Q. Thank you.
HEARING OFFICER FAIRBANK: SNWA.

RECROSS-EXAMINATION
BY MR. TAGGERT:
Q. Good afternoon. Once again, Paul Taggert represent Southern Nevada Water Authority and Las Vegas Valley Water District. I think this question may be to Dr. Mayer, but, we'll see.
Do you -- now, it has it do with the MOA. And would you agree with me that the MOA is an environmental -- there is an Endangered Species Act compliance document. Is that a fair statement?
ANSWERS BY DR. MAYER:
A. Yes. This might be for Mike, too.
Q. Okay.
A. (DR. SCHWEMM) Yeah, I'll chime in as necessary. But, yes.
Q. So, this ESA is based upon biological opinion, right? I'm sorry, not the ESA. The MOA is based on biological opinion, right?
A. (DR. MAYER) Right.
Q. And is it fair to say that the parties to the

MOA have Endanger Species Act Compliance to the extent that Warm Springs West goes down to 3.2, for instance? Do you understand my question?
A. I think I'll let Mike answer this.
ANSWERS BY DR. SCHWEMM:
A. I don't think I'll be able to answer it accurately.
Q. Okay. Well, does the MOA allow the parties who've signed it to pump groundwater and to have that -- have the flows at Warm Springs West go down to 3.2?
A. Yes, I believe that one, that's what it means.
Q. Now, are -- I guess Dr. Mayer, this would be you. Is -- are there parties -- strike that please.
Are there entities that are pumping water, in your opinion, that are not parties to the MOA but their pumping is affecting the Muddy River Springs?
ANSWERS BY DR. MAYER:
A. Yes.
Q. And do any of -- do those nonparties of the MOA, do they have Endangered Species Act compliance through the MOA?
A. That would be, again, a question for Mike.
ANSWERS BY DR. SCHWENN:

A. That's difficult for me to address because that's not really something that I talked about in my report. But, the Fish and Wildlife Service would always entertain any conversations with anyone that thought that they needed compliance.
Q. Okay. Is it fair to say that if the flow of Warm Springs West gage goes below 3.2, it calls into question far more issues with the Endangered Species Act than if the flow is above 3.2? Do you agree with that?
A. Yes from a biological standpoint. This is Michael Schwenn.
Q. Okay. In your opinion, should the State Engineer include the consideration of how to maintain the 3.2 CFS flow at Warm Springs West gage as a consideration of what the sustainable quantity of groundwater is that should be pumped in the Lower White River Flow System?
ANSWERS BY DR. MAYER:
A. This is Tim. I'll say yes to that. So, yes.
Q. Anybody else?
ANSWERS BY MS. BRAUMILER:
A. I would say no. Because that's not -- enforcing the MOA is not the jurisdiction of the State

Engineer's Office.
Q. So, you don't think the State Engineer should take into account --
A. I'm not saying --
Q. -- the flow that's necessary for the fish?
A. My understanding is it's not their obligation.
Q. Okay. But that wasn't my question.
A. Okay.
Q. I mean, do you think they should just ignore the fact that 3.2 is necessary for the fish when they manage groundwater?
A. Well, I guess I can't answer that.
Q. You -- I --
A. I can't answer that. I mean, as a hydrologist. I'm not -- neither biologist or a regulator, so.
Q. Okay. Mr. -- or I'm sorry, Dr. Mayer, the precipitation analysis you did looked at standard deviations, and you were asked about the time period that you selected. Do you recall that question?
ANSWERS BY DR. MAYER:
A. Yes.
Q. And were you present yesterday when there was a presentation that was done by I think Ms. Molly Palmer that was using cumulative departure from the mean? Do

you recall that?
A. Yes.
Q. And which is a better approach, and why?
A. Well, the cumulative departure of the mean -- this is really getting into the weeds, so I don't want to say too much about this except that that behaves very, very strangely, and it should not be looked at as a moving average, which people tend to read it as a moving average. But, it does some very strange things when you start playing around with the angles of cumulative departure of means. And there's a paper by a person who we didn't cite it in the exhibit. There's a paper that looks critically at the use of critical departure by -- cumulative departure from the mean as a a parameter of climate, and it brings out several critical points about it.
I thought that was just -- I know this is just, sort of like I said, going into a lot of detail, a lot into the weeds, so I didn't bring that up. But, I don't really support that as a good measure of precipitation. I think something like a moving average or a low S smooth or something like is much better. So, the parameter I looked at was the Palmer Drought Severity Index, the PDSI, and that really is in itself

a moving average.
Q. Okay. And my other question to you, Dr. Mayer, is, you were present during yesterday's testimony, right?
A. Yes.
Q. And what is your opinion regarding Mr. Wright's conclusion that 5280 acre-feet of water can be pumped to the west side of the structures that he identified in Coyote Spring Valley without impacting the Muddy River Springs?
A. Oh, I think that's a better question for Sue because she's really looked at the groundwater. So, if I can defer that to Sue, I'd rather do that.
ANSWERS BY MS. BRAUMILLER:
A. Yeah, I think it's clear that -- and again, I wasn't -- I wasn't very clear about which of these various faults CSI talked about yesterday corresponds to Kane Springs Valley fault. But, at any rate, there are all basically north trending, and what I think is really clear, is that there's about 50,000 acre-feet per year that flows into Coyote Spring Valley from Pahranagat Valley with the -- creating a share zone. And probably largely does that on the west side of the Kane Springs Wash fault.

Only because -- I say that only because it's on that side of Kane Springs Wash fault, and actually a normal fault trending that whole sequence of Paleozoic carbonates is present. So, you got a large volume of water coming over the Pahranagat shear zone mostly on the west side of Kane Spring Wash fault, and clearly it gets through the fault at some point in Coyote Spring Valley because a large amount of it discharges into Muddy River Springs. Right? So, whatever that barrier was that was hypothesized yesterday, I think it's pretty clear that there's no complete compartmentalization.
Q. Okay. Thank you.
MR. TAGGERT: I heard my buzzer go off, right?
HEARING OFFICER FAIRBANK: Yes. Thank you. Moapa Valley Water District.

RECROSS-EXAMINATION
BY MR. MORRISON:
Q. Hi. Greg Morrison again. Moapa Valley Water District. I'm going try to keep this as brief as possible?
Real quick for, Dr. Mayer. And anybody else, feel free to chime in if they feel like they have a

better answer.
But when Mr. Sullivan asked you about State Engineer's Exhibit 244, which showed trigger levels under the MOA and required responses to those trigger levels, everyone seemed little confused as to why Arrow Canyon pumping curtailment would only apply during the 1169 pump testing. So, I just want to see if you have a little better understanding than I think of that 2006 MOA.
Are you aware that Moapa Valley Water District operates the Arrow Canyon well -- wells?
ANSWERS BY DR. MAYER:
A. Yes.
Q. Okay. You're also aware that pursuant to that 2006 MOA Moapa Valley Water District dedicated 1.0 CFS against Jones Spring water right for dace protection and restoration?
A. Yes, I do remember that.
Q. And that was 25 percent of the district's water portfolio?
A. Yes.
Q. All right. Now, dedication of that 1.0 CFS had the effect of augmenting flows at Apcar Springs?
A. Right. With the Apcar unit, yes, it did.

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Q. Okay. So, that's it for that line of questioning.
Now, Dr. Schwemm, I want to take it back to the Center For Biological Diversities' cross-examination. Mr. Donnelly was asking you whether -- I think in a nutshell it's safe to say he was asking if any amount of pumping in carbonate aquifer would per se result in reduction of dace numbers because of reduction of dace habitat. Does that sound pretty familiar?
ANSWERS BY DR. SCHWENN:
A. This a microphone?
I don't know about the carbonate aquifer. I wouldn't want to attest to that on the hydrology part. But, I'm happy to talk about the Hatten et al published paper that showed reduction in flow result in reduction in habitat.
Q. Okay.
A. Carbonate's that's something that would be --
Q. Maybe his --
A. -- my colleague.
Q. If I direct you to your testimony, it was slides 16 and 17. You talk about dace abundance and dace counts.
A. Okay. Let me -- let me key it up.

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Q. Sure. Dace is on there. Is that slide 16?
A. Go ahead. Yeah. This one slide?
Q. Slide 16. I'm looking at -- the period of order 1169 pump testing, which I think you can place from roughly early 2011 to the end of 2012?
A. Right.
Q. Can you tell me what that trendline of dace abundance is showing during that time frame?
A. From 2012 to 2013, it's going up.
Q. Pretty -- would you call it pretty steep spike?
A. Yes, absolutely.
Q. Okay. If you to go your next slide.
A. Just for -- if I might explain it?
Q. Please.
A. So, right after -- in this time period we had a lot of recovery action taking place, so, we had a lot of expansion into other areas and positive dace response.
Q. Great. Thank you.
Next slide more or less shows the same thing. Shows pretty good increase in dace population. I think I see a February 2010 count of right around 700?
A. Yes. It's exactly the same data.
Q. Okay. So, then I think what this shows us --

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and I want to get your concurrence on this -- is that Lower White River Flow System pumping at some volume can coexist with the dace and dace habitat restoration?
A. Yeah. Especially when the dace population is -- it was as low as it was. So, I believe that at least for -- at that level, that provided enough habitat for the population to increase.
So, if we may go back? So, during that period, that was, you know, just little over 500 or so fish. So, that was likely enough water to provide for that population size -- that amount of habitat rather.
Q. Okay. So, just to wrap it up with a bit of a bow, accomplishing a goal and restoration of dace numbers and dace habitat, that does not require that carbonate pumping to cease, does it?
A. Can you rephrase that? I guess.
Q. Sure.
A. Can recovery of the base as far as the -- as defined, let's say to 4500 for downlisting or 6000. So, they're -- I guess I see it as three main threats that a affect the dace, and they all have a role to play.
And what exactly is limiting the dace at that particular time could be all three of those. And in

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this case, what this graph depicts is their recovery that we had based on recovery actions that have gone on in that period, and that allowed the dace to expand. So, I would say that we have approximately 1500 animals, and that may be -- may be compatible with the amount of water that was at the time, but certainly a long ways from recovery I would say. Because we still need to incorporate more habitat to approach, you know, 3-, 4-, 5000 animals.
Q. Sure. And I would assure --
A. Yeah, I understand.
Q. I'm not trying to get you to pin down a number --
A. Yeah, but --
Q. -- you fantasized but some pumping can occur and of course not all dace habitat restoration and dace health.
A. For very low numbers of dace, yes. Such as what's shown here.
Q. Okay. I'll leave it there. Thanks.
HEARING OFFICER FAIRBANK: Next will be Lincoln County Water District.
MS. PETERSON: Thank you. And just to note for the record, Dylan Frehner, the Lincoln County District

Attorney, is now here.

RECROSS EXAMINATION
BY MS. PETERSON:
Q. Thank you. Good afternoon, Panel, again. Karen Peterson representing Lincoln County Water District and Vidler Water Company.
And, Ms. Braumiller, when we left off we were talking about the geophysical surveys from the 2006 USR study. Do you recall that?
ANSWERS BY MS. BRAUMILLER:
A. Yes.
Q. And you've had a chance to review those geophysical studies now?
A. I reviewed, you know, them briefly a couple months ago. I mean, I didn't actually review the studies. I skimmed through the report looking for any interpretation by the authors of the geophysical results concerning whether or not either one or both of the wells are completely through the Kane Springs -- or you know what I'm trying to say. Kane Springs Wash fault. And I didn't see it.
Q. All right. And the reason you wanted to see that is you needed clarification of the completion of

the two existing carbonate wells in Kane Spring Valley relative to the Kane Springs Wash vault; is that correct?
A. Yes. To facilitate the interpretation of water level data that's collected. Either one of them. Or if a pumping test is conducted, I know one was conducted previously, how to interpret that concerning the transmissivity of the carbon on one side or perhaps both sides of that fault in Kane Springs Valley.
Q. And so, you didn't look at figure 3 3, from the -- this is the cross-section of the well location?
A. No, I -- you're right. I did look at the text, and I didn't see that.
Q. Okay. And so, you're not familiar with the Willow Springs fault?
A. There's a whole series of faults in Kane Springs Valley, and I'm not sure which one that is. No, I don't know the details.
Q. In forming any of your opinions did you look at any of the precip data in Kane Springs?
A. No. No, and I didn't have an opinion. I really had a question is what I had.
Q. All right. And the U.S. Fish and Wildlife Services proposing a pump test to determine whether to

include Kane Springs into the Lower White River Flow System; is that correct?
A. Well, what I expressed was that if we understood which side of the fault, or perhaps both sides of the fault, KPW1, that's be KMW1, are completed on, then a pump -- a longer pumping test with observation wells that include MW1, but also many other observation wells that are very close to KPW1. All right? You know, it could be informative. But only if we know which side or sides of the fault the two wells are completed on.
Q. And leading up to your July 3rd report, the U.S. Fish and Wildlife Service had all the data in the URS 2006 report at it's -- it was available to them. Would you agree with that?
A. Yeah. I can't remember when it became available to me, but it was -- yeah, it was pretty close to June.
Q. Okay. Well, it's been on the State Engineer's website, and of course, it's been available since the Kane 2006 hearing.
A. Okay. I didn't actually know about it.
Q. So, the U.S. Fish and Wildlife Service had every opportunity to do the pump test that it's

proposing in this case prior to your July 3rd report. Would you agree with that?
A. Do I agree? No, I don't. No, they would not be. They're not our wells, and we don't conduct pumping tests.
Q. Did I hear you correctly that you did -- there was no approval of superiors for the position taken in this report -- in your reports to include Kane Springs?
A. There was. It was reviewed internally. Not by any other groundwater hydrologists or hydrogeologist because there are none available to us within the agency. But no, it was reviewed by management and a number of other -- number of other folks within the agency and Solicitor's Office. And yes, it was was approved to submit.
Q. Was a legal opinion specifically requested to determine whether your position violated the amended stipulation in the Kane Spring's proceeding?
MR. MILLER: Objection; lack of relevance and calls into question attorney/client privileged information.
HEARING OFFICER FAIRBANK: I'll sustain that objection.
BY MS. PETERSON:

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Q. And do you understand that the position that you -- that U.S. Fish and Wildlife is taking in this proceeding by wanting to include Kane Springs into the Lower White River Flow System would impact Lincoln County Water District and their various property rights?

ANSWERS BY MS. BRAUMILLER:

A. Well, first of all, I have to disagree with the premise of your question. I don't want Kane Springs Valley to be included. I said I think it should be considered for inclusion pending clarification of what or which sides of the Kane Springs Wash fault the two wells are completed in and the collection of additional hydraulic data to characterize the nature of the connection between Kane Springs Valley and Coyote Spring Valley. I don't -- I think what I was trying to clarify -- and I certainly don't want Kane Springs Valley to be included in the Lower White River Flow System.

I said that I think it should be considered pending clarification of what side or sides of the Kane Springs Wash fault the two existing wells are completed on and the collection of the additional hydraulic data to fully characterize the hydraulic connection between

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Kane Springs Valley and Southern Kane Springs Valley and Central Coyote Spring Valley, Consequently the remainder of the Lower White River Flow System.

Q. Mr. Mayer, sorry, I don't mean to be rude. I just -- I'm sorry. I thought I heard you say that pumping from the Arrow Canyon wells impacts Pederson Springs?

ANSWERS BY MR. MAYER:

A. Yes, I may have said that. It does.

Q. Okay. What are the impacts?

A. It lowers the groundwater level.

Q. And do you -- do you have a quantification of that?

A. It's the top plot in figure 19 in the report.

Q. Okay. Thank you.

And, Mr. Mayer, again, is the hydrologic setting for the Tule basin the same as the Lower White River Flow System?

A. The hydrologic setting? Could you define that?

Q. Like the geologic structure?

A. I don't know.

Q. I'm sorry?

A. I don't know.

Q. You don't know?

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A. No.

Q. Okay. Do you know if the recharge sources are the same?

A. I would assume that the climate's the same.

MS. PETERSON: Darn it. Thank you. Thank you.

HEARING OFFICER FAIRBANK: City of North Las Vegas.

MS. SCHROEDER: No questions.

HEARING OFFICER FAIRBANK: So, no additional questions.

Centers for -- Center for Biological Diversity.

MR. DONNELLY: Okay. Thank you.

RECROSS EXAMINATION

BY MR. DONNELLY:

Q. Patrick Donnelly, Center for Biological Diversity. I want to go back to this question of take. And so, the -- I'm trying to get at a question that involves both Ms. Braumiller and Dr. Schwemm, and so, you're going to have to build on each other's answers I think.

So, Ms. Braumiller, as you said earlier, just to confirm, carbonate pumping in the Lower White River Flow System causes spring flow declines in the Muddy

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River Spring area; is that correct?

ANSWERS BY MS. BRAUMILLER:

A. Yes, generally.

Q. Dr. Schwemm, spring declines caused a loss in habitat; is that correct?

ANSWERS BY DR. SCHWEMM:

A. Correct.

Q. Loss in habitat causes a loss of individual dace; is that correct?

A. Likely, yes.

Q. As we confirmed based on your general knowledge of the Endangered Species Act earlier, a loss of individual dace constitutes take; does it not?

A. If could, yes.

Q. Therefore, carbonate pumping causes take?

A. Yes.

Q. And thus as we defined section nine of the Endangered Species Act earlier, carbonate pumping would be a violation of the Endanger Species Act?

A. Yes.

Q. To go to the line of questioning that came up just earlier regarding the population trends of the Moapa -- oh, I'm sorry, were you not done?

A. Yeah. If it -- if it's below the -- I assume

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if it goes below the thresholds.
Q. So, I'd like to explore that for a moment.
What is the current flow rate at Warm Springs West? Ballpark.
A. It's around 3.2. This is Michael Schwemm and -- but, I think Tim might know a more recent number.
Q. We can go with -- we can go with around 3.2, maybe a little more, maybe a little less. As we -- Ms. Braumiller observed earlier, spring flows and groundwater levels are slightly declining since 2015; is that right, Ms. Braumiller, as you observed?
ANSWERS BY MS. BRAUMILLER:
A. They appear to.
Q. Thus on some level, Dr. Schwemm, there is incrementally less habitat now than there was, say, six months ago? Incrementally less so?
ANSWERS BY DR. SCHWEMM:
A. On average there could be, yes.
Q. So if we are experiencing declines in spring flow and thus -- incremental, granted -- declines in habitat, why would we think that 3.2 CFS is an acceptable flow level and a sustainable flow level for the dace?

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A. Say that again.
Q. If we are currently at current pumpage levels experiencing -- and at thus flow levels of 3.2, we are experiencing declines in habitat, why should we think 3.2 is an acceptable level to prevent the decline of the dace?
A. I think that if -- maybe I'm not getting the whole question. But at 3.2 -- or at our current level, I believe the dace population is fairly stable. Given the other factors, if those stayed the same and we're just going off of flow, it looks like the population is relatively stable, around 1500 animals for that flow.
Q. And thank you. So, that gets to a question that was raised earlier from the Moapa Valley Water District regarding the population trend during the pump test.
The MOA's set up a number of conservation actions to be conducted; is that correct?
A. Yes, they did. But, I'm only aware of them kind of in a general sense that --
Q. Sure.
A. -- recovery actions would be taken.
Q. So, there were a number of ongoing recovery actions simultaneous to the pump test?

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A. Yeah, they've been ongoing since '79.
Q. So, in some ways, dace populations during the pump test were increasing in spite of trends on water levels?
A. Yeah. Because there's multiple forces at work. I mean, what could be increasing could be -- is the interplay of those three things, and they could all be modified to some extent.
Q. Okay. I just want to clarify a question you answered earlier, Ms. Braumiller. You seem to imply there are some years in which you can't pump any groundwater in the Lower White River Flow System without impacting senior decreed water rights on the river.
A. Oh, I don't think I said that. Not the way I'm interpreting --
Q. Okay.
A. -- what you just said.
Q. Are there years in which one can -- any amount of pumping would result in impacts to senior decreed water rights on the river?
A. You know, again, I don't know the total volume of senior decreed water rights on the river, so, I can't answer that question.

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Q. Okay. Thank you.
I'd like to go to the boundaries of the Lower White River Flow System, in particular the idea of a pump test in Kane Springs Valley. You said earlier that you don't know what the affects of pumping would be there right now; is that correct?
A. I think based on data that we already have that predated -- water level data -- groundwater level data that predated the Order 1169 pumping test than a response KMW1 during the pumping test, wasn't official part of it, but there was groundwater level monitoring in it during that period, and since then, all show that there is a hydraulic connection between southern Kane Springs Valley and Central Coyote Springs Valley and the the rest of the Lower White River Flow System. But, it's -- well, since we don't know -- or I don't know at least -- which side of the Kane Springs Wash fault KMW1 is completed on, or perhaps both, I don't know if the connection only meets carbonate on one the side of it --
Q. Sorry --
A. -- the other side, or both. I don't know.
Q. And I get why you want to do it. The question is, if -- is there a chance that the system is so

interconnected that a pump test would result in catastrophic declines at the Muddy River Springs just like we saw on the last pump test?
A. Well, I took a three-month long pump test is long enough to pick up signals in the observation wells that I specifically posed -- proposed in my analysis. But, as in -- at other locations, you could -- you could identify stopping criteria for the test.
Q. If there is the potential for impacts to endangered species, does Fish and Wildlife Service need to conduct a Section 7 consultation before embarking on such an exercise?
A. Regulatory matters are not something I'm very well-versed in, and I can't tell you. But somebody would know.
Q. Perhaps one of your other colleagues?
ANSWERS BY DR. SCHWEMM:
A. Repeat the question.
Q. If Fish and Wildlife is to embark on an exercise such as a pump test which could cause impacts to endangered species, does Section 7 compliance need to be done, a consultation.
A. Yes.
Q. Thank you.

HEARING OFFICER FAIRBANK: Georgia Pacific and Republic.
MS. HARRISON: No, questions.
HEARING OFFICER FAIRBANK: Muddy Valley Irrigation Company.
MR. KING: No questions.
HEARING OFFICER FAIRBANK: NV Energy, do you have any further questions?
MS. CAVIGLIA: No questions.
HEARING OFFICER FAIRBANK: We'll go ahead and open it up to State Engineer and finish with Water Resources staff for questions.
MS. COOPER: Christi Cooper.

EXAMINATION
BY CHRISTI COOPER:
Q. Ms. Braumiller, just in my previous question and your answer, you identified GV1 well as one of the highly transmissive wells; is that correct?
ANSWERS BY MS. BRAUMILLER:
A. Identified it as one of the wells that -- in which we isolated MX5 induced drawdown on the order of 1.5 to 1.6 feet.
Q. Okay. So, in the hydrograph of 4GV1 on page

71, figure 12, did you describe your opinion of the trend of the hydrographs since the conclusion of the Order 1169 test?
A. I can't even read my own X axis, so, that's bad news. So, must have ended right there.
You know, there are always seasonal variations, and it was fairly constant for a year, year and a half, and then it did seem to start declining. That's what I see.
Q. Okay. So, is it -- do you think that it is possibly still declining, or a static steadying off, or what may be causing that?
A. So, are you asking if it's recovered from the pumping test, or just in general are water levels --
Q. In general in this particular well.
A. Yeah, yeah. Yeah, in general it looks like in 2017 and '18, that they were continuing to decline somewhat. I mean, just based on a visual inspection of the hydrograph.
Q. Okay. Thank you.
A. Sure.
MR. SULLIVAN: One question.
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RECROSS EXAMINATION
BY MR. SULLIVAN:
Q. Ms. Braumiller, I have a question regarding the hypotheses that you described regarding the source of water for Big Muddy Spring.
Do you have an opinion of whether or not the water discharging at Big Muddy Spring is part of the same water budget that is represented by the approximately 50,000 acre-feet involved with the Pahranagat shear zone?
ANSWERS BY MS. BRAUMILLER:
A. Well, no. Right? Because, I mean, these groundwater flow systems boundaries are, you know, a simplification, right? But, if you look at the trends in groundwater levels, it's mostly basins of water levels. Right? Down the Meadow Valley Flow Systems, it's clearly north to south from lake to, you know, get them down Patterson to Panaca to Lower Meadow Valley Wash, and that is a separate flow line. But it's not -- it's separate from the flow that's coming down the White River Flow System to Pahranagat and to Coyote Spring Valley.
So, that would not be. I don't think that would be. If you've got a -- say that one more time.

Now, so, the 50,000 acre-feet is previous estimate of known flow from Pahranagat, right? That would be separate. Although, based on SNWA's water budget analysis for their conceptual model, the CCRP model, the inflow at the north and to Lower Meadow Valley Wash from Upper Ameous(phonetic), is like 4700 acre-feet per year. It's a tenth, tenth of what comes across the Pahranagat shear zone as far as we know.

Did that answer your question? I'm not sure that it did. I'm sorry.

Q. It does in part. I'm gathering that there isn't enough data to validate that hypothesis; is that a fair characterization?

A. Well, we have the water budget analysis from SNWA new conceptual model, and, you know, it's a water budget analysis. So, you know, I'm sure it's approximate, and not necessarily 100 percent correct, but, it is a reasonable, probably the best approximation we have right now of what would be coming from Panaca into Lower Meadow Valley Wash versus what's coming from Pahranagat into Coyote Spring Valley. It's the best that we have.

And so, they're in different flow systems, and, you know, they -- the inflow to Lower Meadow Valley

Wash would be separate from what's flowing in from up gradient and White River Flow System.

Q. Okay. Thanks.

MR. BENEDICT: John Benedict for the record.

EXAMINATION

BY MR. BENEDICT:

Q. So, I just want to try and understand that because it's maybe not still not clear. So, you're suggesting that the flow coming from north to south which has a different flow path, but then also enters Muddy River Springs Area is more likely to go to Big Muddy Springs? I mean, can you really diagnose the flow path once it's gone into the Muddy River Springs and say that these particles of water from other basins are correlated to Muddy River Springs, and then the others go to the other springs? Or is that -- is that an interpretation that's based on data?

A. I didn't quite follow the question, John. So, better try that again on me.

Q. You seem to apply a connection between water that's flowing from north to south, but outside of what we're calling Lower White River Flow System currently as being connected to Big Muddy Springs? Am I wrong?

A. It looks like it to me. I mean, one, we didn't see any response to the order to combine pumping in Big Muddy Springs, right? And it's a really big spring. So, it's discharging from something that is pretty darn conductive, right? And that those fanglomerates that Maxey et al '66 mapped are -- happen to be in, you know, the general vicinity. As far as I can tell, they're right about at the location that we currently map the Big Muddy Springs, and that could be such a conduit. Plus, the water is warm, so it's flowing through some kind of pretty significant depths. And the water level variations are very attenuated compared to the other springs. So, to me that suggests that it's flowing for some distance at depth through something before discharging through something that's quite permeable which could be those same fanglomerates that Maxey et al 1966 mapped.

So, I think it's a reasonable hypothesis. I by no means have any proof of that. It's just an intriguing problem because it does seem like the climate signal is delayed by perhaps 18 years or something like that. Which I believe the Moapa Band of Paiute suggested in the past. It's just a hypothesis. Yeah.

Q. Thank you.

HEARING OFFICER FAIRBANK: All right. We'll go ahead and take a ten-minute brick, and then when we return from our break, we'll go ahead and open it back up if there's any redirect on the part of Fish and Wildlife Services.

(Recess.)

HEARING OFFICER FAIRBANK: Okay. Let's go ahead and go back on the record, and we'll open it back up for Fish and Wildlife Services.

MR. MILLER: Okay. Thank you. This is Luke Miller again for the Fish and Wildlife Service. I just have a few questions here. I don't think this will take too long at all.

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REDIRECT EXAMINATION

BY MR. MILLER:

Q. Sue, I'll start with you. A couple of questions here. Just kind of referencing back hours ago now, you were discussing, I think some Kane Springs Valley well issues.

Can you just clarify whether either of the Kane

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Spring Valley wells were officially monitored as part of the 1169 study?
ANSWERS BY MS. BRAUMILLER:
A. Yeah, my recollection is they weren't -- they weren't officially part of the Order 1169 study monitoring that work, but KMW1 was in fact monitored. Groundwater levels were monitored in that well throughout the pumping test and prior to it for at least a couple years.
Q. And I think Ms. Fairbank touched on this, but just to clarify. In your 24 years of working experience, how much have you spent, say, using both hydrologic and geologic information to analyze groundwater levels?
A. With the exception of maybe a year or year and a half where I did some laboratory testing, read rain gages on Yucca Mountain, 22 out 24 years easily. Every single groundwater problem that I've worked on, I've evaluated the geologic and hydrologic data to do those groundwater analyses. There's no other way. So, easily 22 years of experience doing that. Plus, you know, I hate to harp back to my master's thesis, but it was a really tough hydrogeology problem.
And it had -- just the hydrogeology of that

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international test site, you know, Australia had been a complete mystery through two international NRC funded studies in the '80s and the '90s. So, I was quite pleased with that. It was good experience. But, that's when I first did hydrogeology, was 19 -- early 1990s.
Q. Okay. Thank you. Let me lob one over there to Tim for a minute.
Again, referencing back probably a couple hours now, you were asked about using your -- or your use of well or driller log information in relation to your analysis hydrographs. Do you recall that?
ANSWERS BY MR. MAYER:
A. Yes, I recall that.
Q. Was that really a necessary function or action for what you were trying to do?
A. No. It was -- I was really looking at the long-term regional response to climate in those wells, and I wasn't trying to look at individual well responses. So, I didn't even look at well logs.
Q. Now, Mr. Schwemm over there. You were also asked -- and I think this was actually the first line of questioning from the morning. So, you were asked I think about the overall and biggest threats to the

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Moapa dace, in particular fish passage issues at the I think the Pederson gage. Do you recall that?
ANSWERS BY DR. SCHWEMM:
A. Yes.
Q. Okay. How do these impacts maybe relate to your -- the fish passage impacts related to your presentation about the impacts and overall preservation of the dace?
A. Okay. So, overall -- so there's -- there's -- the overall picture of Moapa dace I think is generally formed by that having available habitat, the right kind of habitat, invasive species and adequate flow for fish to move around. And while that -- whether they -- well, I -- the Pederson gage issue, while that does limit dace, that's only in one particular spot. And when we look at the numbers as a whole, I don't believe that that -- that any one particular part of the stream is responsible for the overall population size. There's enough movement that -- you know, collectively, we need to maintain connectivity, but any particular issue is -- you know, it's of small importance in the bigger picture.
As the overall threat to Moapa dace right now is, you know, potential or going in the future, I think

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is much related to the flow of the water given what we know about Hatten et al paper. Because we've done so much recovery action to improve much of the habitat and we've removed nonnative -- just finished removal of nonnative fishes from the system, part -- tilapia explicitly. But, we've been working to remove them from other parts of the system as well. So, those two -- at this point in time, those two threats are like I say, are lower level to the flow.
Q. Okay. Well, in relation to the questions related to the ESA, I know you got peppered with a couple of different approaches to your thoughts and conclusions about ESA and take.
And I should ask first of all, were any of you actually proffered today to give testimony and discuss ESA compliance issues?
A. I'm not. I'm not an expert in ESA compliance. I typically work more on the biology and recovery end of things.
Q. Tim?
ANSWERED BY MR. MAYER:
A. No, I'm not expert in that or qualified to talk about that at all.
ANSWERED BY MS. BRAUMILLER:

A. Nor am I.
Q. Thank you.
So, is it -- is it -- is it something you can clarify then whether you have a position that you think that -- I think was inferred maybe from the Center for Biological Diversity's cross-exam that essentially any or all pumping is just inherently take?
ANSWERED BY DR. SCHWEMM:
A. I'll clarify that. This is Michael Schwemm. You know, likely not. And it's -- take is a more nuanced -- it would -- it would -- it would take a very sophisticated explicit analysis to analyze take. Because of the other features -- or the other attributes that are at work. It's difficult.
Q. Okay.
MR. MILLER: That's all I have.
HEARING OFFICER FAIRBANK: Thank you. All right. Thank you very much.
So just one final clarifying matter.
So, Ms. Braumiller, you were admitted as an expert in groundwater hydrology. And Dr. Mayer, you've been previously admitted by our office. And Mr. Schwemm, you were admitted for the purposes of this hearing subject to no objection in the discipline of

biology, but that will be limited to the purposes of this particular proceeding on the basis of there was no objection. And so we appreciate you guys' testimony, and providing us the information with respect to your reports.
Just a couple of other housekeeping matters since we have a little bit of extra time today. So, one of the things is, is for purposes of this week, we're limiting. Even though we may conclude a little bit early, just due to the efficiency by the participants, we're not starting subsequent participants early. So, tomorrow we'll proceed with the National Park Service, and then -- and then again, on Thursday will be the Moapa Band of Paiute Indians, and then commencing Friday will be Southern Nevada Water Authority. Beginning next week, because we have multiple parties over multiple days, if we had happen to conclude a particular participant early, then we'll go ahead and immediately move into the next participant.
And also, I just wanted to address on October 3rd we had originally scheduled Technichrome as a participant based upon their submission of initial report. We've subsequently been notified by

Technichrome that they are not going to present anyone with respect to that submission. And so, we're just going to go ahead and move -- advance everyone, you know, basically by that time.
So, I just wanted to find out or just provide notice to the Moapa -- or excuse me -- the Muddy Valley Irrigation Company unless it presents some form of a scheduling problem, anticipate that we would probably start you on October 3rd. And then we're going to move that additional time that was allotted to Technichrome for public comment just because we had tried to maximize the time for all the participants and limited the time for public comment, and that was certainly our -- our desire was to allow for additional time for public comment as that was an essential component of our public process.
So, that's just kind of a little bit of forecast into next week. And I thank you very much, and we'll go ahead conclude today's hearing.
Yes, Ms. Harrison?
MS. HARRISON: Now, if you don't mind, can you let us know when transcripts might be available? I mean, how soon they would be available online.
HEARING OFFICER FAIRBANK: The question was how

soon the transcripts would be available, and I don't have a good answer to that right now. But, I can go ahead and have an answer by tomorrow.
MS. HARRISON: Thank you.
HEARING OFFICER FAIRBANK: All right. Thank you very much everyone.

(End of Proceedings.)

* * * * * * *

CERTIFICATE

STATE OF NEVADA)
)SS.
CARSON CITY)

I, Kathy Terhune, CCR 209, do hereby certify that I reported the foregoing proceedings; that the same is a true and correct rough draft as reflected by my original machine shorthand notes taken at said time and place, Pages 380-488.

Dated at Carson City, Nevada, this 26th day of September, 2019.

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CCR #209

SE ROA 53148

JA_17545

SE ROA 53153

JA_17550

In The Matter Of:

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

Vol. III

September 25, 2019

Capitol Reporters

123 W. Nye Lane, Ste 107

Carson City, Nevada 89706

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SE ROA 53161

JA_17558

STATE OF NEVADA
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
BEFORE MICHELINE FAIRBANK, HEARING OFFICER
---oOo---

IN THE MATTER OF THE ADMINISTRATION AND MANAGEMENT OF THE LOWER WHITE RIVER FLOW SYSTEM WITHIN COYOTE SPRING VALLEY HYDROGRAPHIC BASIN (210), A PORTION OF BLACK MOUNTAINS AREA HYDROGRAPHIC BASIN (215), GARNET VALLEY HYDROGRAPHIC BASIN (216), HIDDEN VALLEY HYDROGRAPHIC BASIN (217), CALIFORNIA WASH HYDROGRAPHIC BASIN (218), AND MUDDY RIVER SPRINGS AREA (AKA UPPER MOAPA VALLEY HYDROGRAPHIC BASIN (219).
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TRANSCRIPT OF PROCEEDINGS
PUBLIC HEARING
HEARING ON ORDER 1303
VOLUME III
(A.M. SESSION, Pages 489 - 598)

WEDNESDAY, SEPTEMBER 25, 2019

REPORTED BY: CAPITOL REPORTERS
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For Center for Biologic Diversity: Patrick Donnelly

I N D E X

CARSON CITY, WEDNESDAY, SEPTEMBER 25, 2019, A.M. SESSION
---oOo---
HEARING OFFICER FAIRBANK: So today is the third day of the hearing in the matter of the administration of the Lower White River Flow System 1303 proceedings. And, so similar as we've done the last couple of days, we're going to go ahead and start with the National Park Service.
And, again, we have a sign-in sheet. And just for everyone's reference as well, each of these sign-in sheets are going to be marked as State Engineer subsequent exhibits. So I think our State Engineer exhibits ended at 334. So they're going to just be marked next in line. So those will be exhibits to these proceedings.
And, so, Ms. Glasgow.
MS. GLASGOW: Housekeeping matters to that effect. So we're signing in every day?
HEARING OFFICER FAIRBANK: Yes.
MS. GLASGOW: Okay. So yesterday's sign-in sheet is still available for signing in?
(The court reporter interrupts)
MS. GLASGOW: My name is Karen Glasgow, G-l-a-s-g-o-w. Hello, good morning. I'm Karen Glasgow with the Department of Interior Office of the Solicitor and I'm here representing the National Park Service. And today we

are presenting our expert witness, Dr. Richard Waddell, Junior, for your consideration.
Good morning, Dr. Waddell. Would you please introduce yourself and spell your name for the court reporter.
THE WITNESS: My name is Richard Kent Waddell, Junior, and my last name is spelled W-a-d-d-e-l-l.
MR. GLASGOW: Dr. Waddell, by whom are you employed?
THE WITNESS: I am employed by a company called Tetra Tech.
HEARING OFFICER FAIRBANK: And, Ms. Glasgow, sorry. Not to interrupt, but can we go ahead and swear in the witness before we proceed with questions.
MS. GLASGOW: Thank you. Yes.
(The witness was sworn in)

RICHARD WADDELL, JUNIOR
Called as a witness on behalf of National Park Service, having been first duly sworn, Was examined and testified as follows:

DIRECT EXAMINATION
By Ms. Glasgow:

Q. And, again, you work for a company called Tetra Tech?
A. That's correct.
Q. And what do you do there?
A. Well, Tetra Tech is an environmental consulting company that works in lots of different areas. My concentration is in groundwater hydrology. I do a combination of different things, contaminant transport, computer modeling, water resource investigations, and so forth.
Q. And were you at some point hired by the National Park Service to respond to the Interim Order 1303?
A. Yes, I was.
Q. And what were you hired specifically to do for the National Park Service?
A. I was hired and my company was hired to perform some computer simulations to look at the effects of questions before the State Engineer's office, specifically the effects of moving the location of pumping from the Muddy River Springs area and more specifically alluvial pumping in that area and along the Muddy River to different parts of the Lower White River Flow System.
And, in addition, to provide, prepare reports, and to prepare for providing testimony such as today.

Q. And did you provide reports?
A. Yes, we did.
Q. I would like you to -- Do you have a copy of what has been marked as NPS Exhibit Number 2?
A. I do.
Q. Could you read the title of that for us please?
A. It is titled prediction of the effects of changing the special distribution of pumping in the Lower White River Flow System dated July 3rd of 2019.
Q. And is this a report that you prepared or was prepared at your behest in furtherance of the contract with the park service?
A. It is. There were some sections specifically related to the simulations or the input data sets for pumping for the simulations that was written by Gary Carst. He had put together I guess the request to which wells and what pumping to move and how to do that. And then we took that information, modified our modeling data sets, and made the simulation. So he prepared the section describing those. And he also prepared an introductory section describing the resources that the National Park Service has in the Lake Mead area and the needs for protecting those resources.
Q. Is this your signature on the July 3rd, 2019 document?

A. Yes, it is.
Q. So is this -- And as you sort of peruse this document, is this the document that you prepared or had prepared for the park service?
A. Yes. Let me just correct. Some of the sections in here specifically related to some of the modeling were prepared under my direction dealing with some of the simulations being performed. Some of the data tables and that sort of stuff they prepared. I did not.
Q. Okay. And, similarly, do you have a copy of NPS Exhibit Number 3?
A. I do.
Q. And could you tell us what this document is?
A. It's entitled National Park Services response to July 2019 Interim Order 1303 reports.
Q. And did you prepare or have prepared at your behest this report?
A. I prepared this report in its entirety.
Q. Is that your signature on the face page?
A. It is.
Q. And, as you look through the document briefly, does this represent the document that you prepared for the National Park Service?
A. It is.

MS. GLASGOW: At this time I would actually like to introduce in to evidence NPS Numbers 2 and 3.
HEARING OFFICER FAIRBANK: NPS Exhibits 2 and 3 are so admitted.
MS. GLASGOW: Thank you very much.
Q. (By Ms. Glasgow) So, Dr. Waddell, prior to preparing the park services reports for the -- for the Order 1303, had you worked in the same or had you worked in the geographic area before?
A. Yes.
Q. Could you tell us what -- a little bit about your experience in that area?
A. I would be glad to. When I completed graduate school in 1977, my first job was with the US Geological Survey working on a couple of projects at what was called the Nevada Test Site at that time. Most of the work involved the Yucca Mountain project. My assignments were to look at regional geology and hydrology around the test site, prepare a computer model of flow in the vicinity of Yucca Mountain that basically covered the entirety as it was thought of at that time of the Death Valley Regional Flow System. I also did research on movement of radionuclides and fractured rocks, specifically tufts around Yucca Mountain and carbonates that underlie Yucca Mountain to the east or

present to the east.
I left the USGS in 1985 and went in to environmental consulting with a company then called Geotrans, which was shortly thereafter purchased by Tetra Tech. I was the manager of our Colorado office until 1991 when Tetra Tech had joined with IT Corporation to submit a proposal to the US Department of Energy to be their environmental resource services contractor. And that work was to basically get the process going on closing contamination sites at the Nevada Test Site.
And part of that project that I was part of was investigation of the underground test sites, all of the underground explosion cavities in the vicinity. I was listed on that proposal as the key hydrogeologist for that contract. We won that work.
And I was informed about a year later by the DOE project manager that the reason that IT Corporation won that contract was because of my inclusion on the proposal, my experience, that had been gained at the test site in the Yucca Mountain area as well as in some of the testing areas, underground testing areas.
And so it started about a 12-year project with IT Corporation and later on became Shaw. Basically serving as the key hydrogeologist for the underground testing project

that the contractor was a participant in and worked in conjunction with numerous national laboratories at the time as well as Desert Research Institute and US Geological Survey.
That work continued, like I said, for 12 years when the contract was rebid and was a small business set aside so our team did not win that work because we were a large business. But I still maintained involvement with the DOE project as the subcontractor to the company or the company team that won that work. And through the years that kind of tapered off.
But as recently as last year I served on a blue ribbon peer review committee for modeling that was done for closure of the Ranier Mesa corrective action unit. There were four peer reviewers and I was the reviewer selected based upon my experience with Southwestern US Hydrogeology and specifically Nevada Test Site, now Nevada National Security Site geohydrology.
Q. Thank you.
A. So that describes my experience at the test site basically within the Death Valley Regional Flow System.
In addition, I think, in approximately 2001, there was a hearing coming up related to applications in Coyote Spring Valley. I was hired by the National Park

Service at that time to put together a computer model of flow within Coyote Spring Valley and surrounding areas, which included the Muddy River Springs area.

And so that went to hearing. And other instances came up where support was required either by National Park Service, Fish and Wildlife Service, or Bureau of Land Management. One of those was work in the Corn Creek area associated with water rights within the Death Valley Flow System. And then another one -- another hearing related to proposals for change applications in the Amargosa Desert and the impact on Devil's Hole.

Q. Thank you. I understood today that you prepared a power point presentation to assist you in your testimony; is that correct?

A. That is correct.

Q. Okay. As you -- Are there any corrections or changes to your power point presentation that you would like to make before you get started?

A. There are. And I've changed the presentation, but I wanted to notify people that when they're going through the copies of the presentation there are some minor changes that they need to be aware of.

The first of these is on slide eight which is a map where there's a hydrograph for MX-4 and an inset map that

shows the location of MX-4. When I was putting this together, I needed to move the location of the map so that the page number would not get hidden by the map. And I forgot to move the location point for MX-4. So, in your copies, MX-4 is shown as the red cross is in the wrong location, so that has been corrected.

On page 36 there is a discussion about oxygen and deuterium isotopes and water. And I have a short discussion about, as I recall, precipitation. And I make this statement in there about something being isotopically lighter on one of the bullets that should have read isotopically heavier. There is a second instance on that same page where I made the same mistake. So in the presentation it now says isotopically heavier in those two locations.

And then the third is just a slide that is out of order. I decided not to move it in the presentation so it wouldn't mess up the page numbering. So that when questions are -- arise, the page numbers on your copies are the same as they are on the presentation. And that was just a summary slide for discussion about water levels. So that's out of location in the printed packet. I did not move it in the presentation and I'll deal with that during the presentation.

Q. Thank you. So before we get started, I wanted to sort of identify the subjects at which you had been qualified

as an expert here today so that it will aid in your testimony. We qualified you as a geologist, a hydrogeologist, and computer modeling; correct?

A. That is correct.

Q. Thank you. And with that, if you would like to get started on your testimony.

A. I'll be glad to. So this is an outline of my presentation. I'm generally trying to answer the four questions that were asked that I have woven in other aspects related to the geohydrology of the area.

I wanted to first talk a little bit about water balance. I had something earlier that became apparent the last couple of days I really didn't need to discuss. There's a pretty good understanding of the concepts of capture and depletion in the aquifer, so I removed that. But I still have a little bit in there that I might talk about.

I want to talk about recommendations on changes to the geographic boundary for the joint administrative unit. One of them kind of tongue in cheek, but I'll discuss that.

Third bullet is discussion about climatic effects. And this will be somewhat similar to what Tim Mayer had talked about previously, but I'll be presenting additional examples of rising water levels in the area.

And then there will be a discussion about the

flow model that we had constructed in 2013 and then its use in the report in our Exhibit 2.

And then certain discussion about the concept of using capture zones to describe where pumping effects will occur.

And then I'll wrap up with a summary.

So, this first slide, slide three, is just a short quote out of a paper by Lynn Konikow and Stan Leake of the USGS. Discussion and depletion and capture. And the bullet -- I'll just read the first part of it. An important corollary to Theis' 1940 principles is that the average pre-development rate of natural recharge itself is largely irrelevant to storage depletion and capture responses.

And then it lists some references to John Bredehoeft and others discuss this concept. If you're unaware of who John Bredehoeft is, he's an ex USGS researcher and he testified before the State Engineer's office back in the Coyote Spring Valley hearing.

So the idea here is that when you're looking at capture, we don't really need to know what the recharge is. It does serve as a constraint on modeling and so forth. But it's less important than understanding what the discharge is. You're capturing discharge. You're not capturing recharge. And if you change the estimates on recharge, then you have to

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deal with where that water is going, say, in a computer model or in your conceptual model. But the discharge number is pretty well fixed. And so if you change discharge and, say, overestimate -- I mean, if you change recharge and you overestimate what the recharge rate is, that water has got to be leaving the system somewhere. And if it's not discharge because you have a good idea of what that number is, it's got to be through the boundaries of the system, which gets to the next slide about the sources of uncertainty and water budgets.

In my view, the two largest sources of error are in estimates of those boundary fluxes. So in the concept of here, how much water is coming across the Pahranagat Valley sheer zone. Their guesses as to what that is, they seem reasonable in terms of the water budget for a much larger area, but there's still uncertainty in those numbers. How much water is discharging in to Lake Mead, for example? This was an area of discussion a couple of decades ago when recharge, some of the recharge estimates, were high and the excess water was being shut off in to the Colorado River in to Lake Mead. So there are arguments about was there any evidence for that discharge occurring. So there's uncertainty about the boundary fluxes.

I already talked about the recharge rates.

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Discharge is something that we can measure. We can measure that pretty well. We've been measuring spring flow for years. We know how to do that. And in the last decade or so techniques have been developed for developing good estimates of evapotranspiration, using field instrumentation and using satellite imagery to assess the help of plants and so forth. And USGS has done this at several sites in the southern Nevada area. They did that some for this particular flow system.

One of the first was in the Oasis Valley areas near Beatty and then down in the Amargosa Desert. So that's been applied very, you know, in recent years and it was a pretty reliable technique. And then we can measure the discharge in rivers by synoptic surveys along the river -- measuring flow along rivers and measuring how much inflow or outflow there are along different stretches.

So, since recharge can't be measured, we can't measure the boundary fluxes, but discharge is one of the things that we're interested in in terms of effects of pumping. We need to concentrate on the discharge question, not what the over water budget is because there's going to be error in the budgets.

I do want to make one comment about recharge. I was involved with a modeling effort in the northeastern part

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of Arizona with the Navajo Sandstone. This was a model that was put together for water management questions related to the pumping of water by Peabody Western Cold Company from the Navajo. And one of the questions in that modeling is what is the recharge rate.

And so we did a, basically a computer experiment using a calibrated model. We calibrated it with a parameter estimation technique called PEST and ran the simulations of what the effects of pumping would be. We then modified what the specified recharge rate was by a substantial amount. I think we increased it by 50 percent or something like that. We were able to successfully recalibrate the model to the pumping -- One of the things about this particular question was Peabody had been pumping water for decades and they were really the only major pumper in the basin. It was, in effect, a pumping test that had gone on for decades.

And what we found was, in our simulations, that changing the assumptions on recharge rates really didn't change the effects on the simulations when we predicted the effects of their pumping on capture from the streams. It really didn't change those results because we had this good data set that we could calibrate against.

So, again, my recommendation is let's concentrate on the discharge and the process involved there.

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One of the questions from the State Engineer was are there any recommendations for changing the boundary of the Lower White River Flow System for this joint administrative. And, to my mind, the critical question there is what is the connectedness of the different areas. And this is where the Order 1169 test provided very valuable information. I'll make a comment on that just real briefly.

There's a lot of seasonal pumping, seasonal ET, going on in the area that generates a water level response signal throughout the area. Back when the 1169 pumping test was being designed, the National Park Service was adamant that the pumping signal related to Order 1169 pumping be different than the seasonal pumping throughout the area so that we could separate out the effects of the pumping. So instead of doing seasonal pumping in the same -- in the phase with the other seasonal pumping which would generate a signal that we couldn't separate, we were insistent that that pumping signal looked differently, it was shaped differently.

I'm not sure that our arguments really had much effect on the State Engineer's office, but it turned out that when that test was run it was run the way that we were recommending. And so that helped in terms of differentiating the effects of other pumping in the area from the MX-5 pumping.

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Getting back to the question here, the overriding consideration on which areas should be included in this joint unit is related to connectedness. And so I've got some examples here. And I use the terms well connected or connected or briefly connected or unconnected. And so I'll go through some of these examples.

One of the things that surprised I think everybody on the basis of the results from Order 1169 was how connected large areas were. We also found out that the areas that don't have swift connection.

So what determines this connectedness? The first I've listed here is lithologic continuity. If your aquifer is not well connected through faulting or something like that -- And I'm not talking about the barrier effects that faults may have. But if, say, the carbonate aquifer is much thinner and there was normal faulting which completely offset the carbonate aquifer from itself, we wouldn't have this connectedness to cross that fault.

One of the nice things about the carbonate aquifer is it's very thick. And that provides that geographic continuity throughout the flow system.

The next on the list is faulting and fracturing. And that's related to the next bullet, the permeability of the rock matrix. The carbonate rock itself, excuse me, with

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exceptions doesn't have that high of a matrix permeability. It's not like a basin fill aquifer developed in a gravel where there's a lot of permeability within the matrix itself. Generally the grains are small. The rocks are well submitted. There's not a whole lot of water that you can push through that. There are exceptions to that. The limestone or dolomites being carbonates are subject to dissolution features.

There is a well that we deepened on the Nevada Test Site and a well that had been constructed in volcanic rock and we were understood in getting information from carbonates, which we would underlie that location at a slightly greater depth. This well was UE-10-J. We deepened that well in to the carbonates. We got a lot of water out of it. Ran a camera down that well and found a zone that was basically a small cave system. There was this interval that was about two or three feet thick that you could see a noted calcite that had been precipitated on the walls like you see in caves and produced a lot of water.

That doesn't happen all -- You know, we don't see that very often. Commonly, we don't send cameras down many wells because of the expense. But there are dissolution features within the carbonates.

So fracturing is important. The water moves

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through fractures. And so knowing -- understanding something about the details of the fractures isn't all that important. But recognizing that we are dealing with a fractured medium is important in terms of understanding the system.

There have been discussion about the row of faults in the carbonates and whether or not they provide a barrier. And my answer to that is it depends. There are examples of where we do aquifer tests across the faults and we don't really see that the fault has much effect on responses.

But there's a very good example again at the Nevada Test Site of where faults and the data that were collected show that there is a significant barrier effect at times, certainly in this location.

We had installed a well to run a tracer test in the carbonate rock so that we could get some information on running nuclides in to the carbonates. There were two wells that were put in. One was going to be an injection well and the other was a pumping well. And we were pulling tracers, not really nuclides, but the tracers that were injected in the injection well -- I think there are actually two injection wells -- towards this pumping well. And that well pumped for approximately seven months as I recall.

Almost immediately -- Again, the concept was

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let's pump this well, ER-6-1#2, and pull the tracers out. Transducers were placed in a large number of the wells in the vicinity in Yucca Flat. And, fortunately, in addition, there were measurements of water levels being made in other areas, including off the test site.

Almost immediately after the well was turned on, drawdown was seen in a well about seven miles to the north that was located in the same fault block as ER-6-1#2.

At the same time, there were wells that had been instrumented across faults that define that fault block which saw very little response. And that's probably because those faults were providing a barrier. So that's certainly something that I think is a valid argument in trying to understand the system here in this flow system and understanding the role of faults as serving as impediments to flow.

The next bullet is fracture fill and alteration. I bring this up with respect to fracture fill. There was some discussion on Monday about the role of thrust faults versus normal faults and the different stress environments for the faults. The older thrust faults moved rocks over large distances, miles, tens of miles. And commonly the upper thrust sheet, the upper plate of that thrust sheet, was intensively faulted and fractured. You look at maps of certain exposures of the upper sheet and the faulting is just incredible. And you wonder how somebody, first of all, how could they map it?

But when you look at the permeability of those, because those rocks are old, a lot of those fractures and faults have been filled in by precipitation of calcite and other minerals.

There's also, in the upper part of the carbonate aquifer, there is a long hiatus where those rocks were exposed, younger rocks had not been placed on top of those yet, and their dissolution features in those. Very commonly when you drill through the contact, say, between basin fill and carbonates or volcanic rocks and carbonates, you find a lot of red clay that filled the pores. Those dissolution features in the upper part of the aquifer. So this is something that also affects what's going on and something to watch out for.

And I can't remember if it was EH-3 or EH-7, the well went in to carbonate aquifer and this red clay was found, which to me indicates that that was Paleozoic rock and Paleozoic carbonate aquifer.

The other well went in to what was described as a carbonate but it was overlain by cretaceous rocks without any description of this. I think it was actually Muddy Creek on

top as well. It's unclear to me as to whether that was Paleozoic carbonate or some younger carbonate associated with Muddy Creek. So this is a different thing that may affect connectedness.

The final bullet is just related to the permeability detected in the monitoring well. If you happen to have bad luck and drill a well in a location that doesn't encounter permeability -- Again, this is secondary permeability associated with fracturing -- that low permeability around the well board itself may prevent you from seeing effects of pumping other wells. So just another thing to be aware of.

So one of the signs of connectedness within the flow system. My first bullet here, just because it's been going on for so long, water level responses to seasonal pumping or seasonal evapotranspiration. I think both of those generated signals.

I went back and looked at flow measurements within the Muddy River back in the period of approximately 1910 to 1920 before much pumping would have been going on. I'm not saying there wasn't any pumping, but before much pumping was going on in the alluvial aquifer. And you see the same seasonal pattern in the flow of the river that you saw -- that you see today. So evapotranspiration certainly

has a seasonal impact that generates a response, a seasonal response, in other areas.

But, then again, the pumping is on top of that. People like to pump water in the summer for crops and running power plants and that kind of stuff. So certainly in the Muddy River Springs area and along the Muddy River there's seasonal pumping that generates a signal. CSI's wells in the Coyote Spring Valley pump seasonally that generates a seasonal signal. Wells down in Garnet Valley, some of those are seasonal pumping and generate seasonal signal.

So you can see these seasonal changes in the record, you need to be mindful of there are multiple sources of these seasonal stresses.

The next bulletin is the Order 1169 pumping test where water was pumped almost continually for a couple of years that generated a very nice signal, generating water level responses in the area. And we'll talk more about that.

Next is looking for low hydraulic gradient. And basically from the mid part of Coyote Spring Valley southward and down through Garnet Valley and down to the shear zone the hydraulic ratings are very low. The hydraulic gradient is basically determined by two things. One is how much water is moving through the well. And, two, what the permeability or transmissivity of the rock is. And these very low hydraulic

gradients tell us that with the amount of water we think is coming through the shear zone that there's a lot of high transmissivity in the rocks that generates that low gradient.

There are other areas where the gradients are not as low, certainly. If you get in to the volcanic rock, gradients are much, much higher. It tells us that the transmissivity of those rocks is much, much lower.

And then of interest to these proceedings is the gradient in the northern part of the Coyote Spring Valley where the gradient is higher than it is a little further to the south.

Water chemistry provides this information really on what the sources of water are for discharge areas. And I bring this up because with respect to Rogers and Blue Point Springs, which are important to the park service, we think that the water chemistry gives us information about connectedness to the aquifer.

I also mention temperature on here. I'll show you something later on that Vidler had put together that demonstrates this as well.

And then, finally, the geology. And I put on here whether I think that something is sufficient to demonstrate connectedness or necessary or whatever. So geology I think is necessary. If you don't have geologic continuity, you can't have connectedness.

The water level responses to seasonal pumping to, say, Order 1169, I think those are sufficient to demonstrate connectedness.

The low hydraulic gradient, I said it was supportive but not necessarily sufficient. The reason I did that was some of the older conceptual models of flow in the southern part of the system was that most of the water -- And this depends on what your estimates of the water budget are. But most of the water that is moving down the White River Flow System discharged in the Muddy River Springs area. And the flow continuing to the south may not -- certainly is not as high as in the northern part. And the low gradient there may be due to just absence of flow.

Water has a hard time getting across the Las Vegas Valley shear zone. It has a hard time getting across some of the rocks that intervene between the carbonate aquifer and the Colorado River, limiting flow and discharge out of the system. So there might just be not that much flow. The waters there, the gradients flow, but the gradient could be low because there's not much flow.

That was the conceptual model until the Order 1169 test when we saw that pumping signal propagate down the Garden Valley very quickly.

The water chemistry I said is supportive but not sufficient. I just talked about geology. I think it's necessary.

So not to beat a dead horse, but I'm going to talk about hydrographs. And this is one of the slides that I mentioned I had to make some changes on. Specifically the location of MX-4 in your handout, it's a little bit further to the south. And that was just an error made in preparation of the slide.

But MX-4 is a well that is important in the history of carbonate pumping in the Coyote Spring Valley.

Early time -- And, again, the MX wells were put in by the Air Force to look for water supplies for the MX program. So that's why this well is available for measurements in the early part of the period of record.

So you'll see a combination of manual measurements here that are made either by USGS or SNWA. And then there are also some transducer data shown as a line, which provides a more continuous data set and is nice to have in terms of looking at short term responses and seasonal effects.

And so we see a fairly flat hydrograph in the early part with some, I would say, some measurement noise. And then, as Tim Mayer testified yesterday, in 1998 Arrow

Canyon started pumping at a higher rate at approximately four-fold. And MX-4 -- Again, Arrow Canyon is down in the Muddy River Springs area to the southeast of MX-4. There was a very quick response that was noticed in the hydrograph with a pretty significant decrease in water levels showing that the carbonate aquifer between those two areas was connected.

And this is the 2004-2005 recharge event. We don't see a lot of other recharge events in most of the record. This is a significant one.

And then, following that, we see a decline in water levels. You still see the seasonal effects going on. But we see a decline in water levels and we can discuss what the cause of that decline is. But you'll notice that the slope of that decline is very similar to the decline that occurred before the recharge event that was due to pumping of Arrow Canyon.

The Order 1169 test began late in 2010, continued for a couple of years. MX-5 pumping continued at a higher rate in to 2013. And so you see a change in slope in this area beginning with initiation of MX-5 pumping. MX-5 is turned off and you see a recovery occurring very quickly in MX-4. Realize that MX-4 is only a short distance from MX-5, the well that was being pumped.

And then that recovery kind of levels off and

it's kind of looking like flat responses through the period since then. But, as you'll see in other hydrographs, there might be some hint that we're starting to downward trend again.

One other point and it's kind of hard to see in this one, this is CSVM-1, which is located in the same general area. The base map that I'm using here is the map of faults that CSI had put together based upon their CSAMT work. And this is -- Well, here's a fault just to the west of the red cross representing CSVM-1. And then there's an area just to the west, which is a structural block that CSI has interpreted to be a barrier to flow. It's bounded on the west and crossed by both the CSAMT lines, AA prime and BB prime. And this showed up very well in the CSAMT record.

The CSAMT is, in my opinion, a good technique for trying to pick up these faults where you have carbonate rock that is present at depths within the depth of investigation of the technique. And you saw -- you saw these lines. And this shows that very distinctly.

So this well is located, according to this map, just to the east of that structural line. And in this, the period of record is much shorter. We're missing the earlier time data or it doesn't exist. But we see the 2004-2005 recharge pulse, a decline in water levels like we saw in

MX-4, the initiation of MX-5 testing, which increased the slope of decline. And then shut off of the well, we see recovery. And then it looks like we've got declining water levels going on again.

And what I was going to try to show on the other slide was that during the Order 1169 test, pumping stopped for a fairly short period of time, as I understand, to do some work on the arsenic treatment facility. But it resulted in a pretty sharp increase in water levels. And then when the pumping started again there was decline in one of those. It shows up nicely in the transducer data. So this is another part of the signature of the MX-5 pumping.

So in these two examples, you see the seasonal pumping, you see the Order 1169 pumping. MX-4 we saw Arrow Canyon pumping. I would turn these wells being well connected with the source of the stresses, those sources being Muddy River Springs area and -- Well, let's just say Muddy River Springs area for the seasonal signal and then MX-5 for the Order 1169. So it's well connected to both areas.

Same kind of story on CSVM-6, shown again pretty close to MX-5. We see similar types of responses. The seasonal pumping, the decline prior to initiation of MX-5 pumping, the shutdown of the well about halfway through the

testing, recovery at the end of the test. And now it looks like water levels are starting to decline again after that recovery.

Another well, CSV-2, looks similar to what we saw with MX-4. So a fairly stable water levels early on, a lot of noise in the measurements. Measurement protocols were being worked on, developed, to improve those or perhaps getting new equipment that responded better. And transducer data that shows the seasonal effects, shows the 2005 recharge event, the decline in water levels following that event. Order 1169 pumping recovery and now water levels appearing to start downward again.

Okay. This is a well, CSVM-2, which is located quite a bit to the south along the highway. MX-5 is in this general location. CSI testified that that well penetrates the fault on the east side of the structural block and that the reason it's so productive is because of faults or fracturing faulting -- fracturing associated with that faulting.

And, according to the model of the permeability associated with faults, that permeability runs parallel to the strike of the fault, the high permeability. And then the low permeability perpendicular to it. And, again, this structural block is one that CSI has interpreted as being a

low permeability.

So here we see seasonal effects and transducer data indicating connection with the Muddy River Springs area. We see the increase in slope with MX-5 pumping. We see the recovery that takes place after that and then a decline starting to appear in the more recent record. And this well is quite a bit to the south.

I'm not going to present hydrographs from California Wash or from Garnet, but they have similar responses to these, showing that those areas are well connected.

CSV-3 -- The other wells that I presented are all on carbonate. And CSV-3 is completed alluvium. And it shows similar but attenuated responses. So, fairly flat hydrograph up until initiation of Arrow Canyon pumping where we start seeing water levels decline. We see the 2004-2005 wet winter creating an increase in water levels, the decline in water levels following that until initiation of MX-5 pumping, at which time the slope of the decline increases. We see the recovery from MX-5 towards the end of this record and then water levels starting to go down.

So what this shows us is that at least at this location the basin fill aquifer is also connected with these areas. When that means is that if you wanted to go in and

pump from the basin fill in this area, you would obviously get different responses because of the different properties in the basin fill compared with the carbonates. But the water level changes in the basin fill will be transmitted downward in to the carbonate aquifer. And because of the connectedness both with Muddy River Springs area and MX-5, those effects will be transmitted to those areas.

CSVM-4 is one that is of interest with respect to the connectedness with Kane Spring Valley. We still see similar responses, although, they are greatly attenuated compared to the others. Now, we see an increase in water levels associated with 2004-2005 wet winter recharge event. We see a decline in water levels that kind of matches the slope that we've seen in others. We see an increase in the slope associated with Order 1169 pumping. We see recovery following cessation of MX-5 pumping. And then we see water levels start to go down again.

So I would term this, instead of being well connected, I say this is connected. We're not seeing the seasonal effect of the pumping in ET in the Muddy River Springs area. But we are seeing all the other characteristics of the hydrographs that we've seen. And, you know, obviously there are reasons for why this is attenuated that CSI has discussed and Vidler has in their reports. And

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I'll get in to those. Did I skip one? Yeah.

So this is CE-VF-2, which is located along the highway on the west side of this structural block. And, unfortunately, from this plot it's a little difficult to see what's going on with the hydrograph. And I guess for the record I should say that all of these hydrographs that I've been showing are out of Nevada State Engineer Exhibit Number 228, which is the 2018 HRT report. And these are all plots that were produced by SNWA.

So this is the well that had a casing failure during the Order 1169 test. So there's a sharp increase in water levels as water levels in the well try to start to calibrate with the higher water levels in the alluvium overlying the carbonates.

And what we see in it is basically a flat response and basically the noise disappeared for the most part in these measurements up until a certain point. And then we see water levels starting to go down beginning with pumping in Arrow Canyon. We see the 2004-2005 wet water recharge event. There's a period of additional decline. And I think that it's kind of hard to pick out, a decrease in water levels associated with Order 1169. At the bottom of this, I show that the later part of that record expanded just to make it a little bit easier to see. We do see that there

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is still this seasonal response. But I don't think it's as well defined as what we had otherwise.

Order 1169 started approximately here and then there's a change in slope. But, unfortunately, the record is not as complete in others. And so there's still a question about are we seeing MX-5 pumping. I think we are. But it certainly can be debated. But the overall parts of the hydrograph looks similar to what I've been showing you.

CSVM-3 on, this is slide 16, is located in the northern part of Coyote Spring Valley. It is shown here right along the highway. There's an increase in water level occurring. The record starts about the same time as the recharge event, 2004-2005. This increase in water level seems to continue longer than what we see in other areas. The hydrograph flattens out and then starts going down again. And basically this is not as well connected as the other areas that we've been talking about. It's got some of the characteristics of the other hydrographs, but it's certainly much more difficult to make a definite statement that, oh, we're seeing MX-5 pumping in this well. So the degree of connection -- connectedness is less than what I've been showing you.

And then, finally -- And you've seen this hydrograph before. This is CSVM-5, which is located further

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to the west. And this one is pretty anomalous to what everybody -- you know, all of the other wells have been looking at. This isn't new to you. You've seen this.

There's the recharge pulse. There's rising water levels. There's probably an adjustment of the measurement data at this break in the record and then continuation of increasing water levels to the present.

But this one clearly behaves differently than the other wells further to the east. And I'll show you gradient information a little bit later. But this well has a higher water level than those to the east.

Because of this different hydrograph response, I classify this as not connected. It doesn't mean that it's not connected. But based on the data we've got, I classify it as not connected.

So CSI has made claims that the wells that are on the western side of the structural block don't show a response to pumping the signals generated in the springs area or MX-5. I differ in my interpretation from them. I think that CSVM-2 located to the south is well connected. I showed you that hydrograph. It's got the seasonal effects. It's got all the hallmarks that we saw in, for example, MX-4. It's well connected to the sources of those signals.

On the other hand, CSVM-3 is, I classify it as

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poorly connected.

CSVM-4, the one just southwest of Kane Spring Valley, I say is connected. It is on the eastern side of the structural block.

CSVM-5 I agree with that's not connected.

And this well, CE-VF-02, which is on the western side of the fault that was -- that defines that structural block has a weak connection.

Their basic claim is that as you go from east to west the degree of connection with, for example, MX-5 or with the spring area decreases. And I would say in a general way I agree with that, that it does decrease. But it doesn't necessarily mean that it's not connected.

They have made the claim that the structural block is impermeable, this is carbonate rock that is impermeable. Recognize that the carbonate aquifer is the aquifer that's transmitting all of this water. This block itself is impermeable, according to CSI.

So why would the permeability of the carbonate rock in this horst block, this structurally high block, be low? I agree with them that permeability is perpendicular to the fault is probably lower than parallel to the fault. There is a gouge zone that's developed. There is fracturing on either side of the fault that would enhance permeability parallel to the fault. So we agree on that.

But, within the fault block itself, I think the permeability is high. And I'll first talk about just in a general sense why within the region we don't -- we don't think that carbonate rock blocks between faults have low permeability or are impermeable.

You can go in to these wells when you're doing aquifer testing and run flow surveys or temperature surveys during pumping and see where water is coming in to the well bore. We did this all the time on the test site. And what you find out is that, one, you can't predict very well where the water is going to come in because you don't know where the permeable fracture zones are. You also find that in instances you know from the core or the cuttings that are collected in the well that you've gone through a fault and you see no water coming in through that fault. Certainly much, much less, I mean, to the point of not being easily detectible than what you see in other areas.

So, the structures, the fracture zones, within the carbonate block that are not the fault in many of these instances turn out to be the permeable part of the rock, not the fault zone itself.

So we know that we have of permeability elsewhere than just the faults.

I already mentioned this pumping test of ER-6-1#2. I can't get into details, because the report has not been released by the USGS. I talked a little bit about the responses seem to pumping in the near vicinity within a few miles of the pumping well itself. But USGS has done an analysis and has determined that they see responses from that pumping test in a well called Army 1, which was an old carbonate water supply well located just to the south of Mercury. And those -- Like I say, I can't get in to details, because it has not been released yet.

But there is an Amargosa tracer site located a little bit further down, a little bit further meaning in the context here, several miles, further down gradient where those pumping responses were also picked up. So we've got another example of where pumping responses from this pumping went tens of miles. And ER-6-1#2 was in the middle of this fault block. There were faults on either side of it. But we were pumping -- I say we were. I helped design the test, but I left the program by the time the test was run. But the well was in a fault block, not along the edges, not the fault down to the edges.

The carbonate aquifer that is up gradient of Ash Meadows is very transmissive. I don't know if it's the same as what we see between MX-5 and the Muddy River Springs area,

if it's that high. But it's very transmissive. There's 17, 18,000 acre feet of water coming out at Ash Meadows. And all of that water is traveling through this area to the northeast of that, which has a very low gradient. I don't have specific information that it's not moving just to the faults, but it makes sense that it's moving through the rock and the faults might assist.

The Amargosa Tracer Site, I mentioned a while ago, is a site that the USGS had constructed in the early, mid-seventies, early to mid-seventies to evaluate tracer movement, in fact, radionuclide movement in the carbonate aquifer. They actually injected tritium in to the aquifer and watched its recovery. And I don't recall the details on the wells and their productivity. But I think there were, like, six-inch wells that produced in the vicinity of eight or 900 GPM out at Bonanza King. And certainly a lot of permeability there.

And I mentioned earlier the very low gradient in most of the Lower White River Flow System I think is an indication that the fault, although they certainly have probably more barriers, is that the rock itself is permeable and plays a significant role in the transmission of water.

We mentioned earlier that we had put together a flow model, a three-dimensional flow model of this system as

well as aquifers to the east. As part of that effort we compiled transmissivity information from aquifer tests that were performed in these wells. We had I think about 25 or 30 analyses that we found. And I went through and just listed the ones with transmissivities greater than 100,000 feet squared per day. MX-5 certainly showed up in this list. MX-4 did. Arrow Canyon did. There's a lot of carbonate wells, including one way down to the south.

Let me correct something real quick. The upper ones came out of our modeling report. Well BM-DL-2, the number I pulled was the one that Moapa Band of Paiutes had put in to their initial report for transmissivity.

And so there was a significant number of wells, significant population out of this, say, 25 wells where we've got data or that I had readily available data that show high permeability. This is maybe a fourth of the wells. So, you know, there's transmissive rock out there.

Moving on to slide 21, I want to discuss in a little bit more detail the structural block as a barrier. I like CSAMT. I think that it does a very good job of picking up changes in electrical resistivity which can provide clues as to not only the geology but the hydrology.

In the profiles that were shown by CSI and in profiles that Vidler has prepared, you can definitely see where you've got faulting associated with carbonate blocks. Because if the carbonate comes up high enough that it's within the depth of investigation of the technique. You see a very definite change in the measured resistivity from the lower resistivity of the carbonate block to the higher resistivity basin fill. Yeah, I got that backwards. Higher resistivity of the carbonate rock and the lower resistivity basin fill. So it is very good at that.

It does not measure hydraulic properties. There's nothing in that technique -- It's responding to the rock matrix. It's not responding to the fractures. It does not provide you information on the hydraulic properties of the rock. It shows you where there's fault and displacements very well if you have good contracts. And, in general, I think it's a good technique and provides various flow information.

I think there is a high degree of connectivity that's been demonstrated across this block. MX-5 was said to be penetrating, getting productivity out of the fault, on the eastern side of the block.

CSVM-2, the well to the south and on the west side of the block, is highly connected with both MX-5 and the Muddy River Spring area. That signal is being transmitted across the structural block that is reported to be

impermeable. I think that indicates it is not impermeable.

And my comment here is that if there's going to be a claim that a block or whatever is impermeable, that needs to be demonstrated. The CSAMT does not provide you information on that. You just can't make the assumption because it has a high resistivity that it has low permeability. That's an invalid interpretation.

So how do you get that? You can do aquifer tests. I mentioned the response that you see across the block between MX-5 and CSVM-2. If hydrology is correct, you can maybe measure hydraulic gradients across the block. But, you know, you can have low gradients across a block that do not show that it's permeable. That may be due to just the geometry of the flow system. So you have to be careful on how you interpret stuff. And I'll show you an example a little later, I think, that also provides information this structural block has permeability.

So let's get back to the geographic boundary of the flow system. I'm going to talk about three different areas: Kane Spring Valley, which is one that others said should be included. Las Vegas Valley. I mentioned early in the presentation that there's one that I recommend kind of tongue in cheek. That's Las Vegas Valley. And then the remainder of the Black Mountains area. And I'll talk about

Rogers and Blue Point Spring in the context of that.

So Kane Spring Valley I've already discussed. The hydrograph, this is just another set of those. The presentation provided by Lincoln County, Vidler produced the diagram on the left. And this is that CSVM-4 and Kane Vidler 1 in it. And the same information is shown on the right presented in a slightly different form. It's the same data.

And one of the things that Lincoln County Vidler did on theirs was draw a line in here which talks about -- Let me look at that. I think the long term water level trend line. And that kind of draws your eye to there's this declining water level in there, at least it drew my eye to that, and drew it away from the fact that we have an increase in the slope of the decline associated with the Order 1169 test.

And so on the right what we had done is to break the lineup in to different segments, three different segments, and run regressions on those. I know you can't read the numbers on the slide. But it is in the report as well. And what we see in both of these wells is an initial trend of declining water levels, an increase in the slope of declining water levels during the period of the Order 1169 testing and then at the cessation of MX-5 pumping either a trend that is shown as being slightly increasing -- I'm not

going to claim that it is increasing. This may be the data set. We see that in Kane W-1. And then in the other well which is located to the southwest in Coyote Spring Valley return to declining water levels. And note that the slope post Order 1169 record is basically the same as what the slope was prior to that.

Lincoln County, Vidler, also performed CSAMT testing. I think it provides useful information. Again, I think it's a good technique that provides you information on the structure, especially where you have carbonates shallow enough to be picked up by the technique. If they're too deep, you can't see them.

I didn't say a while ago, but in these profiles that were produced, and I think they mentioned this, if you see blue up near the surface, it's indicative of unsaturated sediments. There's not water in the sediments to increase the conductivity or decrease the resistivity of the rocks. And that shows up as blue. It looks like it might be carbonate, but it's not. It's dry sediment. You can see in the basin fill where the sediments are saturated. They show up as red. So you can get some hydrologic information on water content and that kind of stuff as well as the location of carbonates.

So Vidler, Lincoln County, ran CSAMT surveys.

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One is shown here. The trends from this outcrop area in the southeastern side of Kane Spring Wash across the wash to the northwest. Another line that has a similar trend, just to locate it a little bit further to the southwest, and then across the line. And the two lines that trend from southeast to northwest have a different response. They show different geology. That was their interpretation. That's my interpretation.

And on the basis of that difference between those two lines, they say there must be a fault in between those two. And that's the fault that's shown on their diagram as a red dash line and they have named that fault -- Let me make sure I get it right -- the northern LWFSX boundary fault. So in their interpretation, this is the boundary of the flow system. And normally a geologist wouldn't say, you know, give it a name like that. You know, they might say, you know -- I know geologist who has done a lot of work in the area and he likes naming his stuff after women that he knows. So he might call that the Susan fault or something like that. So it could be the Weiser or the Kane Spring Valley termination fault or something like that. But not, you know, indicating it's the fault, it's the boundary for the flow system.

And I don't necessarily disagree that there's a

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fault in this area. I provided in my report -- And this is referred to by CSI -- a gravity interpretation that was published by Phelps and others for Coyote Spring Valley. And CSI had discussed these lines further to the south and the results from those.

And I want to concentrate a little bit on what's going on further to the north near Kane Spring Valley. And basically what this shows is that on the eastern side of Kane Spring Valley there is a gravity low in this area that indicates that carbonate rocks are deeper than they are further to the west. And there is an area of high gradient on the eastern side of that gravity level. And one of their profiles in two goes across that, not in the middle of it, because they didn't know where the middle of it was at the time they were in the survey. But their interpretation of N-2 is that there's a fault on the eastern end of that profile. And you see closely spaced contour lines in that area leading down in to the basin. The gravity data had picked up a fault in that location.

Similarly, further to the south and closer to where CSI was looking, we see another area of high gradient. The contour lines are close together. And here we have gravity profiles that again picked up faulting in that area to that gravity level in that location. And these are data

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that have been available for years and are very useful. We use data, these data and other data, when we constructed our flow model.

Between N-2 and N-1, two of the survey profiles, there is an area of moderate gradient in the contour lines that extends from southeast toward northwest over to an outcrop area in the northwestern corner of the right panel on this figure that is carbonate outcrop. And this indicates that there is also likely to be some faulting in this area, something that is causing the carbonate to be deeper on the southwestern side of that moderate gradient gravity signature than to the northeast.

And this is in the same general area where Lincoln, Vidler County(sic) has interpreted a fault to be present. So I think that the location might be somewhat uncertain. This third east/west profile that they ran did not really pick up the location of that fault, but it's because the carbonate rock is too deep to be picked up by the technique.

So, you know, there's likely to be faulting in that area. We don't know specifically where it is. And based upon this conceptual model that normal faults, which these would be, produce an impediment to flow -- I like to use the term impediment as opposed to barrier, because

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barrier sounds pretty absolute. Impediment allows flow to go across it. So I'm going to try to say impediment, but I'm going to forget sometimes and say barrier. I'll try to be clear, when I say barrier, I'm talking about a significant barrier. Here I'll say these faults are likely to be impediments to flow.

So we're basically in agreement with CSI that there's faulting in this area and that those faults may impede flow through Kane Spring Valley in to Coyote Spring Valley.

I had mentioned gradients earlier and this has been an argument that data set that's been available for quite a long time. And, in fact, in a previous order from the State Engineer's office pertaining to whether or not Kane Spring Valley should be included -- I don't know the terminology at that time, but, you know, their area of concern I guess for the carbonate aquifer. They had noted that -- or you had noted -- I don't know if any of you were part of that process -- but that there is water that's moving from Kane Spring Valley in to Coyote Spring Valley, that there's an area of higher gradients in northern Coyote Spring Valley than what we find to the south. So in our figure there are gradients listed in such a small font that they're difficult to read on the printed page. I put those in scientific notation in boxes so that you can read those.

So, up to the north between Kane W-1 and CSVM-4, we had measured a gradient that is indicated here as five E minus three. That's L-4 tran terminology. It means five times ten to the minus three. And the units would be feet per foot or meters per meter or whatever. But five times ten to the minus three is what that indicates.

A little bit further to the southwest, moving between CSVM-4 and CVF-2, the gradient is somewhat lower, but recognize that it is calculated over a much larger area and there may be higher gradient areas along that profile. We're looking at the average between those two wells. But that's four times ten to the minus four.

Another area up in the north, again, a long distance between wells, you're looking at a gradient of five times ten to the minus three. These are all reasonable gradient that you see in groundwater systems everywhere. If you saw these numbers for a gradient in, say, a basin study, your response would be that's pretty typical, you know, that's not a high gradient. That's a pretty common gradient.

When they move further to the south -- And I'll skip on down to the gradient calculated between I think that says CSVM-5 but I'm not sure, and EH-4, this well that's close to the Muddy River Spring area that Tim Mayer talked

about, we see gradients considerably lower, three times ten to the minus five. So we're about two orders of magnitude in this area lower than what we see in the northern part of the Coyote Spring Valley.

So the argument that it's less permeable to the north I think is substantiated by the gradients that we see. We have a very good idea of how much water is moving through this area because of the discharge measurements in the Muddy River Spring area. And, you know, we know that this is very transmissive. This area to the north is less transmissive. And I think Sue Braumiller yesterday was using language like it's much, much lower or something like that.

You know, the transmissivity is potentially a couple of order of magnitude lower than what we see in this area even though you have to take in to consideration that the cross-section, the area across which the flow is occurring is larger than it is in this corridor between Coyote Spring Valley leading to the southeast down to EH-4.

CSVM-5, which I had classified as not connected to either the MX-5 pumping or to the seasonal pumping in the spring area, we see six times ten to the minus three. But, again, that is averaged over this distance.

We don't know what causes this to have a higher head and a separate hydrograph response than the other wells.

But there's likely a structure on the east side of the elbow range in here which provides the barrier effect. And I use the word barrier here. I didn't say impediment. It doesn't mean that it does not flow across it. But it's more significant than what we see in this area. And I make that statement based upon the different hydrographic response we see in CSVM-5 than we see in these two wells at the mouth of the Kane Spring Valley.

Interestingly enough, down here to the south, which I think is CSVM-2 -- I can't read it either. But these data show a gradient -- a gradient for flow back to the north. Water levels are lower in the central part of the Coyote Spring Valley than they are to the south down where there's this little break in the range between Arrow Canyon range and the Elbow range. So water levels are higher here and they decrease to the north. We see a low gradient, you know, approximately ten to the minus four, but a little bit lower than that between those wells.

And just an aside here, the conceptual model generally has been that water is moving to the south through Coyote Spring Valley and continuing further down in to Hidden and Garnet Valley, just kind of as a continuous pathway. I haven't done an in-depth study of what's going on in this well, but that conceptual model may be a little bit of an

error, it may be that that groundwater divide in the southern part of Coyote Spring Valley at least in the shallow part of the aquifer, maybe the depth we would have an underflow to the south. You know, we don't know.

It doesn't really affect this question of connectivity. This is a -- If this is a divide, it's a divide based on water levels. It's not a divide based on a barrier between the two basins.

To the west in the Sheep range, we have a divide in both water levels. You know, when water levels are highest and associated with the springs and the kind of stuff we see here and measured levels either to the east or west. And, in addition, we've got low permeability rock that's present in here, what's been termed by Ike Winograd as the lower class to defining unit. That's a permeability barrier as well. We have no evidence of permeability down in this area of CSVM-5.

So Vidler's argument is that the lower hydraulic gradients in the northern part of Coyote Spring Valley are indicative of lower transmissivities in the northern part of the valley. And I agree with that one on that. Something had resulted in lower permeability and lower transmissivity in the northern part of the Coyote Spring Valley than what we find in the central and southern part.

Just another geologic aside, we've talked some about normal faulting and thrust faulting. And then there are lateral strike slip faults that are also present. And Kane Spring Valley is one of these. The primary strike slip faults in the region is the Las Vegas Valley shear zone which runs from southeast to northwest. It's a right lateral strike slip fault and it's got kilometers of displacement across it. It's believed to be a significant permeability barrier.

There are some other right lateral strike slip faults. And at least some have been mapped. And it shows up on the Reilly and others map of this area between Central and Coyote Spring Valley, the area where MX-5 pumping occurred and the other production wells are and the Muddy River Springs area. If you look on Pete's map and there is right lateral strikes that faulting indicated in this area that may be responsible for the high transmissivity we see in that area.

To the north of this figure is the Pahranagat shear zone. It's a left lateral strike slip fault and is a permeability barrier. The White River Flow System flows to the south. Water hits that barrier. And because of the high gradient that gets developed across it on the northern side of the barrier, groundwater discharges. There is surface

water discharge in that area. There's a lot evapotranspiration that's occurring because of the low permeability caused by the Pahranagat shear zone.

There's another left lateral fault that runs up Kane Spring Valley. This is another one of these shear zones. And the argument has been that the presence of the shear zone on the southeastern side with that strike slip fault comes and turns to the south and forms a normal fault on the east side of Coyote Spring Valley, which is part of the basin range pull-apart structure. Others have interpreted it as extending a little bit further towards the middle of the valley. We don't really know.

So the presence of these right lateral faults is significant to the hydrology and hydraulic properties is significant to the hydrology of the area.

So here is the Reilly and others map of the Kane Spring Valley area. It's kind of hard to pick up. And you have to be careful that you're not -- There's also some thrust faulting that shows up in the Paleozoic rocks in this area. There's some mapping of this left lateral shear zone through here. You can see lots of older non-basin range faulting that runs through -- I take it back. I'm getting confused with the volcanics and the boulder limestones and other. You see basin range associated with faulting in the

volcanics in this area.

One thing that I wanted to point out to you -- Oh, before I move on. This is one of the displays of the Pahranagat shear zone. So one of the displays here a little bit further to the north is another. This is left lateral movement. There's a third. This would be on echelon faulting. Basically the movement across the shear zone is taken up on several distinct faults that have been mapped and outcropped in this area.

But what I wanted to point out -- It's kind of hard to see just because of the calibration and that kind of stuff. And I'm outlining something called the Kane Springs Launch Caldera Complex. Most of that caldera complex is on the northwestern side of the Kane Spring Valley. Just to the northeast of the Kane Spring Wash Complex is another caldera complex called Boulder Canyon. And then there's a third one to the north of it, Narrow Canyon Caldera. What these calderas are, are ancient, ancient meaning tertiary, volcanic centers. A caldera is a volcanic feature in which the magma is high silica, high water content. And when they erupt, they tend to erupt explosively. So you get this large volume of ash that comes out of the caldera complex. You then have an instant magma chamber. What used to be a magma chamber is now basically empty. And the overlying rock of the volcano

fall back in to that magma chamber and you end up with a caldera complex.

On the test site there's a large series of these that are present up in the Paiute Mesa area. Timber Mountain is a well known caldera in that area that is a little bit different. It's got a resurgent dome. These do not have resurgent domes.

They are important here though is not the fact that we've got these complexes with the boundaries as depicted here. It's the fact that we had this large magma chamber sitting in this area that had a lot of heat associated with it. You know, we're looking at temperatures in the magma chamber that are, you know, a thousand to 2,000 degrees celsius, so hot rock, a lot of heat.

Why is this important to the hydrology? That heat makes a very good tracer for water coming out of Kane Spring Valley. This is a figure that Lincoln Vidler put together showing temperatures measured in wells in the northern part of Coyote Spring Valley as well as down in the central part. And what we see here, again, the calderas are in kind of the central part of Kane Spring Valley, kind of where the labeling is. The hottest water temperature measured was 130 -- 136 degrees Farenheit in Kane W-1. A little bit to the southwest of that we had a measurement of

106 degrees. This is warm water. And typically we talk about warm water springs occurring down in the measurement spring area. You know, yeah, there is warm water but it's not of the same temperature.

A short distance to the northwest where we've got water coming down out of Pahranagat Valley across the shear zone, water temperatures are in the upper seventies. So we're looking about, you know, 30 or 40 degrees Farenheit temperature difference between these two sets of wells in the northern part of Coyote Spring Valley.

As we go to the south, temperatures decrease, but they still remain elevated on the eastern side of Coyote Spring Valley. We've reached this complex of wells that we've been talking about and looking at values of 90, a hundred, 106 degrees. Continuing down to the south to CSVM-2 where we have still got a hundred degrees.

And then as we go, this water that's moving toward the spring area, the temperatures decline to about 90 degrees in EH-4. When the Arrow Canyon well was first pumped its temperature was similar. I'm not saying it's changed. But we're looking at similar temperature water in the upper part of the carbonate aquifer of that location.

And then, like I said, up in the northern Coyote Spring Valley on the western side, we've got temperatures in

the upper seventies.

Move down to CSVM-5, which is this well that has a different hydrographic response on the west side, it's about the same temperature. And so what Vidler has done is interpreted flow along these paths connecting areas of similar temperature. So the wells in the northwestern part of Coyote Spring Valley with temperatures of 77 is associated with flow in CSVM-5 where the temperature is 76. So here's a western flow path in their interpretation. And I don't disagree with that.

And then they also -- they don't show flow from Kane Spring Valley down to these areas in the eastern part of the Coyote Spring Valley. But they show a flow line from this well. And I can't read what it is. But with a temperature of 99 degrees extending to the south to CSVM-2 with a temperature of a hundred degrees and then some movement. 89 degrees in the central part down to the warm springs on the Muddy River Spring area.

What's important about this is -- Well, two things that are important. The first is that this demonstrates that we've got water moving out of Kane Spring Valley in to the eastern part of Coyote Spring Valley. Kane Spring Valley is contributing flow to Coyote Spring Valley and it's contributing flow to the Muddy River Springs area.

This is hydraulic connection. So that's one interpretation from this that I think is important.

The other is related to the structural block that CSI maintains is impermeable. We've got water on the eastern side of that block up to the north -- northern end of up close to the Lincoln County line that flows across that block to CSVM-2, which is on the western side of the block. Something is carrying this heat down to this location. It's not another magma chamber sitting down here. It's transport of heat by water from the area on the eastern side of the structural block to the western side of the structural block.

The structural block itself is permeable enough to allow that flow to occur. The faults on the side of that structural block are permeable enough to allow that flow to occur. So I've got another signal here in the data that tells us that this impermeable structural block is being mischaracterized by Vidler -- I'm sorry -- Lincoln County.

And then final note, we have gradients, and this has been known for quite a while for flow to occur out of Kane Spring Valley. The heads, the springs are about 3200 feet at the head of the valley and at the southwestern down around 1880 feet. So we know we've got flow that's coming out that's contributing flow to the Lower White River Valley flow system.

Okay. Las Vegas Valley. I wanted to talk about this in the context of some statements made by the Moapa Band of Paiute Indians. The common interpretation of the Las Vegas Valley shear zone is it's got low permeability. Some of the first indications of that were -- Well, at least they were identified by Ike Winograd in his landmark professional paper on the Death Valley System with the springs at Indian Springs and Corn Creek on the northern and southern side. Corn Creek is on the northern side of the shear zone. Indian Springs is water coming off the Spring Mountains that's on the southern side of the shear zone. So on both sides we know that we've got a permeability barrier that causes this groundwater flow to move to the surface for discharge.

There may have been other hydrologists that picked that up earlier. Ike's is just, his was the first one that I became aware of.

In SNWA's Exhibit 9 where they were also responding to the Moapa Band of Paiute Indian claims they talked about the low permeability sediments in wells near the Las Vegas Valley near the shear zone. I'm going to say if anybody knows about the geology of Las Vegas Valley, it ought to be SNWA and the Las Vegas Valley Water District. I think this is a very significant finding or comment from them.

Jim Harrill, who is a USGS hydrologist who worked in Nevada for decades and moved the regional hydrology of Nevada very well was hired by the National Park Service to develop estimates to help guide us in our modeling effort of this area. And he estimated, I can't remember the number. We ended up using a value of zero, treating the shear zone as a no flow boundary based upon his recommendation.

And then, finally, when you look at water level data, you're not seeing a gradient, a nice strong gradient across the shear zone, which you would expect to see if you're getting a lot of water movement across the shear zone. On both the north side and the south side of this shear zone flow is to the southeast. So there's no indication from the data that we've got that the shear zone is a permeable area that's allowing water to leave the, you know, the area that we're concerned about. Senior moment here. So it does not appear to be a discharge area for flow from the carbonate aquifer.

City of Las Vegas did some modeling. Their estimate is that there's about 700 acre-feet flowing actually in to our flow system from Las Vegas Valley. I'm not sure I believe that. But it's still we're looking at low numbers in terms of what that flux is.

In contrast, the Moapa Band of Paiute Indians calculated the flow of about 40,000 acre-feet using darcy

calculations of water moving across the shear zone from a well in that area that I showed you that has a value greater than 100,000 feet squared per day. And this is a considerable amount of water. And I think they're saying this so that they say that there's excess water that's available for somebody to pump.

And the reason I'm bringing this in -- Well, there's another part of this. They made this one calculation and then did a second calculation using combination flow and heat transport modeling that for their Las Vegas center they used what the current groundwater production is in an assumed steady state for the flow and it shows all of these flow lines going in to that pumping center. And I think that calculated a large area but it's including flow from the Death Valley system as well as in our system. And it's even a larger number.

So my interpretation is I believe the conventional conceptual model, I see no evidence to suggest that it's invalid. But just a tongue in cheek I guess that if Moapa Band of Paiute Indian interpretation is correct and if they get water rights based upon all of this excess water then somebody is going to be impacted by that pumping and it's going to be Las Vegas Valley, which has water that's been beneficial use for years. So don't put Las Vegas Valley

in to the definition of this, the area.

HEARING OFFICER FAIRBANK: Dr. Waddell, we've been going for about two hours. Is this a good time to maybe take a break?

THE WITNESS: It's a great place.

HEARING OFFICER FAIRBANK: Okay. Perfect. Let's go ahead and take about a ten-minute break and so we'll go back on the record at 10:34. Thank you.

(Break was taken)

HEARING OFFICER FAIRBANK: Dr. Waddell, you may continue.

THE WITNESS: So at this point I would like to discuss the Rogers and Blue Point Springs and the reason that the National Park Service is participating in this process. Rogers and Blue Point are a couple of springs that are located in this approximate location near the Overton arm of Lake Mead. You can't see it all that well. I'll show you a geological map in just a minute. But there's an escarpment along the northern edge here of this block and the Rogers Spring fault is in this general location.

And looking at it in greater detail in this Google Earth image, Blue Point Springs is the spring that's located kind of at the apex of this geomorphic feature associated with the Arrowhead fault in this location and the

Rogers Spring fault in this location.

So this is Blue Point. And then a little bit to the southwest is another spring, Rogers Spring. And flow from both of these areas, the discharge flows in to Lake Mead. And you can see the increase of vegetation in this area that creates habitat and is one of the few locations in this area with these type features.

There are other springs that are present along the Rogers Spring fault that I'm highlighting on the northwestern side of the road between Blue Point and Rogers Springs. And then some others that are a little more difficult to see further to the southwest.

This is the hydrograph for Rogers Spring. A little over one and a half CFS discharges. It's got a little bit of noise. When you're measuring discharge from something like this, you have problems with the flume getting chock with vegetation and stuff like that. So the record tends to be a little noisy. But we're looking on average, according to this calculation, about 1.6 CFS discharge. And I really wouldn't want to say I see trends in these data.

This is the discharge hydrograph for Blue Point Spring. A little over .5 CFS. When we get out in time, 2013, something was going on in the record here. The discharge decreased. There's a gap in the record that was actually associated with new construction of the discharge measuring facility. And since that time kind of a slow increase in flow. I would have expected that you fix the flume and you see a sudden increase and the thing stabilizes. But that's not quite what we're seeing. I don't know the cause for this.

There have been two sources of the water discharging from the springs that have been proposed. Desert Research Institute, Carl Pullman and others did a geochemical study of the springs in the area. And based upon the isotopic composition -- We'll talk more about it in a minute -- of the water discharging from Rogers and Blue Point Springs and measurements that were made in wells and springs in other locations in the vicinity, they suggested that the Weiser Wash area is a likely source of the water discharging at Rogers and Blue Point and they base that on samples from EH-3 and EH-7.

These waters have similar chemistry to the discharge at Rogers and Blue Point. But, as I will point out, the geology is unfavorable and as well the hydraulic head in that area is unfavorable, the Weiser Wash area being a source area for this discharge.

The other proposed source is California Wash and Garnet Valley, the carbonate aquifer in those areas. The

chemistry is different, which is why Pullman and others suggested Weiser Wash would be the source. But the chemistry is easily explained by contact of the carbonate water with younger rocks containing gypsum and the back right deposits.

And Randy Bassett, who has also been -- is qualified by the State Engineer's office as an expert in geochemistry, did some modeling of that area. First sampled a lot of wells and springs in the area and then did some geochemical modeling. And the difference in chemistry is explained very easily by dissolution of gypsum from these younger rocks as well as other evaporite minerals, one including bromine, bromine-bearing halide, and then mixing of some local recharge to change the isotopic composition.

And this source area has favorable geology and favorable hydraulic head in contrast to the Weiser Wash area. I just already said this. I don't need to repeat it. Slide 35.

So I'm going to talk a little bit about isotopic chemistry or composition of waters, waters, H20. It's got hydrogen and oxygen. There's two hydrogen isotopes. The heavier one is deuterium and the lighter one is just called hydrogen or protium. And then oxygen has two isotopes, O18 and O16. And it's very easy to sample and measure for these isotopes in the water. And there's a pretty good data base

on this. Stable isotopes in water has been used for decades as a tool to understand hydrology as well as other processes. It's a very commonly and well-accepted technique.

And, as I said a while ago, in order to match the isotopic composition of the Rogers and Blue Point discharge, based on water discharging from California Wash and Garnet Valley, we need to produce a -- mix it with a water that's isotopic heavier because the spring discharge is heavier than the carbonate waters that were in California and Garnet Valley.

And one of the comments that we received was that the discharge that we see could be described or could be produced by evaporation of the water from the carbonate aquifer, which I disagree with, but it doesn't really matter, because we do have an explanation.

But here's what is termed the global meteoric water line. You plot the oxygen isotopic composition versus the hydrogen isotopic composition shown on the X and Y axes of these plots. And the blue diamonds towards the lower end of the line, say, between deuterium compositions of, say, minus 80 down to minus 100 per mil applaud on the meteoric water line.

The meteoric water line is a line that shows a relationship between the hydrogen and oxygen isotopes in

precipitation. And it varies around the world. But this is a fairly standard way to display these data and it allows you to point out differences in composition as well as look at processes such as evaporation.

When you get to the lighter end, which means more negative values, we're looking at water that has been exposed to cooler temperatures in the atmosphere. In contrast, if it's up towards the upper end, that indicates warmer temperatures. And I'll show that again in another slide or figure.

Evaporation can occur during the recharge process. It can occur as precipitation is occurring. It can occur after discharge occurs. The commenter had suggested that evaporation was occurring in the groundwater system, basically waters up close to the water table was evaporating from the water table. At least that was my interpretation of his comments. And we do not think that is taking place.

Randy Bassett plotted the composition of Rogers and Blue Point Springs on this in the black circles. And just slightly more positive or slightly heavier composition than the waters in California, sampled in California and California Wash and valley. And there are other springs that plot a more positive or heavier compositions from some of the evaporative springs in the area.

Slide 38 is again showing on a global perspective the left most panel for the global meteoric water line showing the composition of the precipitation samples. Again, showing it at the upper end of that, we're looking at warmer temperatures in contrast to colder temperatures at the southern end. And in the southern Nevada area, the yellow 18 composition of precipitation is in the minus 13, minus 14 range. There is a paper published by a geochemist at Mark Tibble International Labs where they sample lots of groundwaters and that's what they found. So that's about in the same area that the samples that we're looking at.

When evaporation occurs, the composition of both the oxygen, which is the upper curve on this upper panel, and hydrogen change with time. You start off with your original water composition shown to the left end of those curves. And with evaporation the composition changes. And basically what's happening is the lighter isotopes, the hydrogen in contrast to deuterium, in O16 in contrast to O18 evaporate more readily because they're lighter. They evaporate off the water surface. And it changes the composition in the remaining water. And so when you plot these together against each other, you get a progression as shown in the lower panel on the right. So we're looking at low evaporation close to the global meteoric water line. And with increasing

evaporation we get a shift off of that line at a lower slope than what we see for the global line. And we do not see evidence of this in the Rogers and Blue Point data.

So here's the geologic map of the area. This is a map produced by Page and others showing Muddy Mountains area. Rogers and Blue Point Springs are located along the Rogers Spring fault towards the eastern end of this block. This block contains carbonate rocks exposed at the surface in this area and then a cover of younger rocks. And underneath this cover of younger rocks are carbonate rocks. So we've got carbonate aquifer rocks present in this area. This is California Wash to the northwest of that area.

So what I'm trying to show here is we've got carbonate rocks present in outcrop as well as under this younger cover that extends over to the Rogers Spring fault and it's terminated by that fault on the southeastern side.

So here's a couple of cross-sections. Unfortunately they don't go right through the Rogers and Blue Point area. But these, again, were produced by Rick Page. And we're going to -- What I want to show here is that in California Wash and so forth, this is section FF prime, which extends from the west side of the Sheep range across in to the area where there's a bend in the section and then across to the southeast, north of the Muddy Mountains where the

springs are located.

But it shows carbonate rock. The carbonate aquifer that is thrust on top of younger sedimentary rocks, cretaceous and Jurassic rocks that are exposed in the Valley of Fire. So colored in green are those younger rocks. And Valley of Fire is in this general location that I'm pointing at there underneath the word mountains.

And then we see over -- I take back what I had said. The section line that's shown on the map inset is a little incorrect. It's actually further to the south. And it does cross Rogers and Blue Point Spring. They show Blue Point I think right here at the Rogers Spring fault, discharging from carbonate rocks present.

And then there's the original aquifer plate, the lower plate of the thrust, at depth. And in between the two, like I said, are the Jurassic and cretaceous sedimentary rocks that are exposed at Valley of Fire.

Section GG prime runs to the southwest of FF prime. And basically it's showing the same type of thing. The carbonate rocks being thrust on top of the younger Mesozoic, Jurassic, cretaceous rocks with carbonate aquifer present at depth.

The depth of the lower sheet of the thrust is approximately five kilometers. It's pretty deep.

When we look at a section that runs from the Weiser Wash area, which is on the southern side of the Mormon Mountains, runs across and goes across Rogers and Blue Point, we don't have that upper thrust sheet present. All that is present in the carbonate rocks is the lower sheet. And, again, its depth is fairly deep. It's not as deep as the other, but two or three kilometers in this area. And, again, is to the right end of this section shown in the green colors are the Valley of Fire sediment exposures. And then to the right of that is the upper thrust sheet that I was describing before present in the other sections.

So why do I think that there's not a pathway for flow from Weiser Wash? Weiser Wash would be in approximately this area. There are carbonates present. That water could move to the south in the carbonate rocks and then come up along the Rogers Spring fault from depth.

One reason is that permeability data on carbonates as well as lots of other rocks in the area, those data show the permeability decreased with depth and these data are collected from aquifer testing, primarily pumping test but also including slug testing, that was put together by Wayne Belcher of the USGS as part of the modeling work that the USGS was doing for the Death Valley system.

We had -- When I was working on the project with

IT, we had put together similar figures. And what you see is most easily seen when you look at the higher values is that there's a decrease in the number of higher value measurements as you get to deeper and deeper depths of measurement.

I've highlighted on here in blue the measurements made in carbonate rocks. And you see that same trend is not as steep a trend as you get in basin fill where the alluvial sediments, basin fill sediments are more compressible. But you still get this same trend and it's because of the weight of the overlying rocks closing the fractures that are the source of the permeability in the aquifer.

There's a large spread in this when you're looking at words of magnitude difference or change in the data of particular depth. But the trend is definitely there. If you -- One way to approach this would be to calculate a geometric mean of the data by depth and look at that trend. And you would see a trend that runs approximately as I'm showing you here. So depth of 2,000, 3,000 meters, which is the depth of that lower sheet, we're looking at permeabilities that are orders of magnitude lower than what they are in shallower settings.

There had been a comment about our modeling that said that there's a disagreement about this. One was that Wayne Belcher disagreed with it. And, interestingly enough,

he put this same trend in DV-1 or he was involved with DV-1 and put it in to DV-2. The model that the USGS put together for DOE of the Death Valley Flow System is a comment that Keith Halford disagreed with it. Interestingly enough, Keith was doing DV-3, version three of the Death Valley model. And instead of putting a relationship like this, he did something much more drastic. He had, I think, the upper 500 meters of the carbonate aquifer as being permeable and below that impermeable. There was about a six order magnitude difference in permeability in his model as you went from the upper 500 feet of the aquifer to everything below that. So he recognized that there's a decrease in permeability with depth. He just expressed it a different way than I do.

So long and short, my opinion is that lower part of the thrust sheet or the lower presence of the carbonate aquifer below the Muddy Mountains is too imperme -- has too low permeability to transmit much water.

I also think that head data suggests that California Wash and Garnet Valley are the source of the spring water. The springs are shown here to the right of the map. They have elevations of 1,562 feet and 1,576 feet. And what this map shows, it heads in California Wash or Garnet Valley or 1800 feet or higher that there's a gradient for flow to the southeast or east. The flow is perpendicular to

the contour lines and we're looking at flow moving directly towards the springs.

In contrast, Weiser Wash is located up to the north. There's a yellow triangle in this area. That does not represent why the EH-3 or EH-7 wells, but they're in the same general location. And their heads are around 1540, 1560 feet. So they're at approximately the same head as the springs are.

And in between here is an area of lower heads. And I'll show that on this figure. This is showing the most recent measurement of heads in numerous wells in this area. Rogers and Blue Point Spring are shown here. And, as I said before, the heads in California Wash are conservatively higher, providing the gradient for flow in this direction in to the upper thrust sheet to discharge at the northeastern end of the Muddy Mountains.

And, again, Weiser Wash samples would be approximately at some point above the -- the area on this figure. And they're at the same approximate and are actually a little bit lower than Rogers and Blue Point Springs.

There's a well that USGS had put in that is being monitored to look for water level changes. Nothing has really been seen in that that can be interpreted. We generally see, if we look at the spring locations, a decrease

in head as we move toward Rogers and Blue Point in these springs. So, basically, flow is coming in in the upper thrust sheet, reaching the Rogers Spring fault and then moving along the fault to discharge at Rogers and Blue Point Springs and the other associated springs.

We did some simulations with our three dimensional flow model of the area. The outline of that is shown here. The model area is shown in white. And this is the southern end of our model. And basically what we did to this was to backtrack particles from the discharge point at the springs and see where the particles according to the model came from. And we see a path that runs to the west toward the recharge areas in the Sheep mountains, the Sheep range. That's not to say that these areas up in here if we had pumping in these areas we wouldn't affect these. And I'll talk about this in more detail.

But in order to affect spring discharge, we're not forced -- we're not having to pump within this source area for the springs. Pumping in other areas will also affect the springs. And, again, this is a section cut through our geological frame model showing the pathway near the sheet. If this section had been in a slightly different area, you would have seen that upper sheet continue over this area. That's just a function. We happened to cut this to an

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area where the Mesozoic rocks are exposed at land surface.
So I think there is a hydraulic connection between the Rogers and Blue Point Springs in the carbonate aquifer and thus the carbonate aquifer in California Wash and Garnet Valley and thus for the aquifer in the up gradient areas. I'm going to classify this as a limited connection. There's a significant gradient, as Sue Braumiller pointed out yesterday for flow from those basins to the springs.
One thing of interest is there's a well that the USGS had put in called the Buffington Pockets well that went through the upper sheet carbonates, and the carbonates are dry in that well.
HEARING OFFICER FAIRBANK: Mr. Waddell, I don't mean to interrupt, but --
UNIDENTIFIED SPEAKER: Can we move the demonstrative -- We're at an angle where we can't see.
HEARING OFFICER FAIRBANK: Yes. Thank you.
UNIDENTIFIED SPEAKER: Thank you.
HEARING OFFICER FAIRBANK: Thank you, Mr. Taggart.
THE WITNESS: That's just at one point the water levels in the wash are in California Wash and Garnet Valley need to be high enough to go over that lip. We think that that's the case in many areas, but pumping lower levels to

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that lip, it's going to have -- impact some spring discharge. We don't know enough about the area to really discuss that except to say that it's a concern.
So we need additional data on the connection. And I think that additional water monitoring wells need to be put in to the upper plate to see what's going on with water levels in the upper plate as they may impact the discharge from the springs.
Moving on to aquifer recovery. I already went through hydrographs showing that prior to Order 1169 we had declining water levels due to pumping from the carbonates and that subsequent to cessation of pumping in MX-5 we see recovery and it looks like we're seeing water levels starting to decline again. And that's of concern. The recovery of water levels pretty quickly after pumping in MX-5 stopped. But we're continuing to see declines.
The further away we are from the production, the greater the delay. But it's a very small delay. Their response in the wells of great distance was very quick. And I'll get in to this in more detail in a minute. But when we simulated the effects of longer term pumping and asked the question if we move pumping from the alluvium along the Muddy River to the carbonate aquifer, say, in Garnet and -- primarily Garnet Valley, is that going to provide much

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benefit?
And what the model showed -- And the model does have limitation. But what the model showed is that it will delay the effects, which is what you would expect. But it does not prevent them. And this is consistent with conclusions that SNWA reached.
And, again, the hydraulic connectedness is a primary factor in determining whether or not there will be impacts from additional pumping. And that's a real thing that needs to be demonstrated before significant pumping can occur in the areas.
HEARING OFFICER FAIRBANK: Yes, Ms. Baldwin.
MS. BALDWIN: We have an objection to Mr. Waddell testifying about the opinions of the geological survey scientist during his power point. It's hearsay. It's --
(The court reporter interrupts)
MS. BALDWIN: Should I come up to the mic?
HEARING OFFICER FAIRBANK: If you would, actually, that would be great because then I don't have to repeat what you say for everyone listening on the internet.
MS. BALDWIN: This is Beth Baldwin for the Moapa Band of Paiutes. We're going to object to Mr. Waddell testifying to the opinions of the geological survey scientist contained in the power point referenced by this slide. It's

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hearsay to the extent he's using it to bolster his own opinion. Those scientists have not been presented by the park service as experts. They're not here to testify and be cross-examined. So if he has opinions about the data, that's one thing. But he can't just be a conduit for their opinion, well, they agree with me, that's hearsay.
MS. GLASGOW: Yes, it is hearsay. But it goes to the weight, not the admissibility. The witness is allowed to have relied upon other people for his own judgment, which is what he's been testifying to is that his judgments are in alignment with people that he's relied upon. So to our mind he's adopted these judgments himself and therefore is testifying about his opinions as to the work that he did.
HEARING OFFICER FAIRBANK: Thank you, Ms. Baldwin. Your objection is noted and the State Engineer will take note of that objection and we'll assign the appropriate weight to those references and reliances on work of others that are not here to testify for themselves. Thank you.
MS. BALDWIN: Thank you.
THE WITNESS: I am primarily going to be presenting data from this presentation --
HEARING OFFICER FAIRBANK: Mr. Waddell, make sure your mic is on. Thank you.

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THE WITNESS: I'm primarily going to be presenting data from this presentation that was authored by Tracie Jackson, Joe Fenelon, and Keith Halford. This was presented at a Nevada Water Resource Association meeting. I actually became aware of this presentation after I became aware of some of the work that Dr. Halford had done in this respect.

And I'll skip ahead just real quick to the next slide. I mentioned earlier that I served on a peer review panel for modeling that the Department of Energy was doing at Ranier Mesa, which is one of the weapons testing areas on the NNSS. And part of that model had to do with how recharge was addressed in the model. And so there was presentation of information related to water levels in the Ranier Mesa area that had been provided to the Department of Energy contractor from the USGS.

And so, again, in the context of Ranier Mesa, there are measurements and water levels that show rising water levels in this area, in response, primarily to the 2004-2005 winter precip event. The well that had the greatest response was in a granite. Granites have low porosity. There's not a lot of storage for water, so the only way to take that water is by increasing water level. So that's why it's most sensitive in this well.

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But what you see was a rising trend that started prior to this period of record that's shown here in 2004-2005. Subsequent to that, the trend increases in slope and then begins to flatten out and then we would expect that it would drop off as the tail end of this curve shows.

There's some carbonate wells shown in blue which showed a similar type of response of rising water levels prior to 2004-2005, an increase in slope and then a flattening out and a recovery starting until the 2011 wet winter where we see a similar pattern but smaller magnitude development. And that's also appearing in two of the wells.

So I was first introduced to this concept as part of that peer review. And I and other peer reviewers deemed that to be an acceptable appropriate model for the recharge processes of what's occurring, that it is sporadic, it occurs in association to wet winters. And, in this particular instance, we see rapid responses and then levels starting to decline again.

So I'll return back to the other slide, slide 48, which shows wells on the west side of the Sheep range and in Indian Springs. The Sheep range is the western -- at the western edge of Coyote Spring Valley, basically is the western boundary. And we see immediately to the west in the Corn Creek Spring area that water levels have been increasing

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through time. We see more attenuated effects of the 2004-2005 recharge event. And that's because it's in an area that's not as immediate to recharge as Ranier Mesa. Ranier Mesa is the highest point on the test site. It gets the greatest amount of snow fall. And it is one of the primary recharge areas. But we do see water levels increasing through this period of record shown here.

Moving over to Devil's Hole. Devil's Hole is part of the Death Valley Flow System. Prior to the 2004-2005 recharge event, we had declining water levels that's attributed to pumping in the Amargosa Desert. And then following that wet winter, water levels start rising again. So we're seeing the effect of that recharge at that time. So this is one where we go from a period where water levels are responding to pumping to one where water levels are responding to increase -- an increase in recharge over a short period of time.

There are several hydrographs in northern -- in Yucca Flat shown on slide 49, all with rising water levels over the period of record.

I had mentioned previously the well that had the dissolution feature with one or two foot open interval. And that's UE-10-J. It responded very quickly to that recharge event.

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And what we primarily see at this location is response to recharge event of tailing off, response to recharge event and then, again, tailing off. So it's not a nice continuous increase in water level but one where we can pick out the individual recharge events such as the well in the Lower White River Flow System where we see the 2004-5 -- 2004-2005 recharge event and then response from that.

Move a little bit further to the south, again, in Yucca Flat, and we see rising water levels for the period of record. We look over on the western side, we see rising water levels through this period of record.

So around the NNSS or Nevada Test Site, which is a well documented pattern of rising water levels over the last few decades. In areas where pumping has occurred, and this is in Las Vegas Valley, we see declining water levels, a recharge event, declining water levels, a recharge event, declining water levels. This is an area where pumping is affecting water levels. So you see the effect of the recharge, you see the effect of the pumping being repeated and repeated.

Moving in to different areas, and this is within the area that we modeled. Well EH-6 shows seasonal effects from seasonal pumping and rising water levels. Basin fill well shows a similar pattern. This is down in the southern part of the flow system, the BM-ONCO-2 well, which is one of the clastic aquifers, not the carbonates. Rising water levels. PW-2 in Basin 221, shorter period of record, but we see the same kinds of things.

Dry Lake Valley, rising water levels. Garden Valley, rising water levels. And there's some other stuff going on. I expect the question is going to come up when we did this did we look at all the wells and did we find examples of wells going up and wells going down. I did not go do an exhaustive search for all the wells to see what their pattern is. But we see many, many instances, at least on the test site, and almost all the instances of rising water levels when we look in these other areas, it's less clear because there aren't as many wells with reducing rising water levels.

So what determines when recharge occurs? What Tim Mayer testified to yesterday is that there are three avenues that precipitation can take, I guess, before -- or two avenues before it becomes recharge. One is that you have to satisfy the runoff. If it rains, for example, you get runoff that occurs. And so that water is not available to infiltrate the soils. It's runoff.

The second thing is the water that is available to infiltrate the soils has to overcome a deficit. We're in

an arid environment. The soils dry out. The permeability of soils is very low at low water contents. So you can't get very much movement until you get some water in the soils so that infiltration can occur. So that's number two.

And then after you overcome that deficit, then water can start entering the soils and move to deeper, greater depths and potentially become recharge.

I agree with that general model that he described.

And just some studies that I'm aware of related to this, Dick French, a couple of decades ago, he was a researcher at Desert Research Institute instrumented some shallow borings in stream channel Fortymile Wash coming down off of Paiute Mesa and instrumented some more upland locations just outside the channel and found that recharge did sporadically occur with the sporadic runoff events in Fortymile Canyon in the canyon -- in the wash itself, the channel deposits. But when you got up to the upland areas, you did not get recharge occurring. So the precip by itself was not sufficient to cause recharge, but the collection of water in to the channels did provide enough water for recharge to occur -- or infiltration. Not instrument. The water table.

Scott Tyler did a study in association with the

area five radioactive waste management unit in Frenchman. These were deep borings. He did chloride balance determinations trying to measure what recharge was in those environments, and again found the same kind of thing. If you have a deep boring -- I'm talking hundreds of feet -- below a channel, he saw some evidence of recharge occurring in that location because flow was concentrated in the channel, move out of those areas and just slightly higher elevations but in non-channel environments recharge was not occurring. This was over long periods of time. I have forgotten the time frame for this. But thousands of years.

There were also some wells that were put in Fortymile a little bit further down gradient that were close enough to the channel that we could see changes in water levels. There were changes that we saw with the sporadic runoff events at Fortymile Wash. Fortymile Wash is a huge channel. If you're driving up to Yucca Mountain, there is an area that is probably one or two-tenths of a mile across the channel. You drive down in to it, you drive across the channel, and then you drive up the other side. There's some large flows that occur in Fortymile Wash but very sporadically. So the recharge is a sporadic process.

The stable isotopic data indicate that recharge occurs from cold water, occurs from snow melt, not summer

precip. We're looking at a process of having a sufficient snow pack that you can fill up the pore spaces down to a depth that prevents evaporation from removing that water. And admit that that's not a great depth. But then it has to have enough water to continue downward because as it moves downward it's going to spread out and you'll end up with residual water in the soils and in the fractures that can't move down any further until the next recharge pulse or infiltration pulse occurs.

So the data indicate that as the groundwater chemistry and other data that the recharge that we're seeing is winter precipitation is basically the snow melt.

MS. GLASGOW: Dr. Waddell, I just wanted to let you know that you have about 35 more minutes.

THE WITNESS: Thank you.

MS. GLASGOW: You're welcome.

THE WITNESS: And so this information on winter precip, importance of winter precip is a concept that I've been aware of for decades or was a fellow researcher at the USGS that was doing recharge specifically looking at summer versus winter recharge and mountain environments, particularly to try to come up with the processes. So I for a long period of time I've been a believer in, at least in Nevada, of sporadic recharge associated with winter precip.

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The Halford model is similar. And what this represents is data collected from or obtained from the Noah site. I'm sorry. This is from the Western Regional Time Center. But basically precipitation data and it's looking at precipitation during the winter months, October through March. And you'll notice that the cut-off on this is five inches. What this model -- And this is not mine. This is Halford's -- is that you need five or six inches of winter precipitation in order to get a precip -- or a recharge again.

The 2004-2005 precip as shown here, that was a major recharge event. Not just infiltration but recharge. When you see that in hydrographs, essentially many, many, many hydrographs that were looked at, this is the 2011 one that shows up in some but not all hydrographs.

But this period, what this shows is that when you look at winter precip over five inches, that in the early part of the century you get relatively few of these higher winter precip episodes. And then starting at approximately 1970 the frequency of those increases and then we get these really whoppers like the 2004-2005.

And, again, this is Keith's interpretation, not mine, just for the record. But he interpreted the period of record from the beginning of the century up to approximately

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1970 as a dry period and the time after that a wet period because there's a higher number of these higher winter precip events. And this is his explanation for why we're seeing rising water levels. It's consistent with research that I've been aware of for a long period of time. And it's consistent with the geochemical data. And I think, you know, there can be arguments about what this threshold value should be. But I think it's a -- it's a valid model for when recharge occurs and what allows it to occur. It's an increase. It's a high amount of precipitation over the winter months and then, in my opinion, the snow melt process after that.

So just revisiting, we see in our flow system declining water levels over, you know, the period of record with a precip or recharge event, the 2004-2005 showing in there, the effects of Order 1169 pumping that can affect the record shows after that with our CSVM-5, for example, showing up as an example of where we have rising water levels during this process and continuing. And you will recall that I classified all of these except for this as connected or highly connected to the spring area. CSVM-5 I classified as not connected. I think it is in a different flow regime than the other wells. By being not connected, it's not connected to pumping from the carbonate aquifer.

So moving on to annual quantity of pumping. I

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was asked to run a model, our model, to come up with an estimate to do that. I refused to do that because I knew the shortcomings in the model. So I did not provide an answer to the State Engineer's office except to say that it was something less than approximately 14,000 acre-feet a year, which was the pumping during the Order 1169 test.

I think there are questions about, you know, whenever you pump you're going to have impacts. That's not a debatable issue. Somebody has to set a limit. It sounds like the limit might be set to protecting senior water rights in consideration of ecological constraints of the model base. To me that is reasonable.

One of the questions that ought to be part of the considerations is whether or not your evidence data will be delivered. If the concept is that you can have a natural system, you can pump it, water levels will go down and you'll start capturing water from the discharge areas and boundaries and you'll reach a new state of equilibrium, which is basically a new steady state. And the rates of impact or rates are captured and not continue to increase. It doesn't look like we're at a new steady state yet of equilibrium.

If we don't reach that, what will happen is discharge will continue to go down to hopefully at some point if we do reach an equilibrium, but potentially we won't. It

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depends on how much water is being pumped and how much water can be induced to flow across, say, barriers, like the Las Vegas Valley shear zone to replace that water. But we're not at a point yet, in my opinion, of being at equilibrium.

We talked about -- I showed many examples where water levels are continuing to go down. There's some wells where it looks like things are flattening out after the end of the test. But it looks like what happens over a longer period of time is that they flatten out and then they're starting to decline again.

We ran our model as part of this exercise out 500 years. And, again, I don't put a lot -- I wouldn't put a lot of stock in this 500 years. But our model predicts that after 500 years we're still not at equilibrium. Take that with, you know -- I recognize that the model has some issues that need to be fixed.

And so, you know, are the current discharge rates acceptable? That's not my decision. That's yours.

I'm going to discuss similar modeling results. As I've indicated, we have received comments about the model, heard statements that the model should not be used. And I agree that there are some things the model should not be used for. But let me discuss the process that's gone on. We early on, 2001, 2002, developed a model that was specifically for the Coyote Spring Valley hearing, recognition that it was an estimate but it wasn't based on as good a data set as we would have liked. It had some shortcomings. It was used for that particular use and that was it. And there was recognition of it needing to be improved.

So, in approximately 2010 or so, National Park Service came up with funding to develop a new model, which we did. And it used a lot of additional information and modeling tools that we did not have a available in 2000, 2001. Our calibration data set was halfway -- went through halfway through the Order 1169 test. So we got the first part of the test. We didn't get the last part of the test.

So I'm going to talk about this a little bit. But we provided the modeling report. We provided the modeling data sets for anybody who wanted to use that model to test the model and evaluate its performance. And we received comments from SNWA. They pointed out in a very generous fashion that our report didn't have as much information as it should have. They pointed out some other things that should be looked at. Very useful set of comments. We received other comments that were kind of like we don't like your model. One was a description of what we did but didn't really go through an evaluation of it. But the model has been out there for people to take a look at

since approximately 2012. And they can run the model, whatever. In fact, Argonne National Lab has used the model to make some predictions of pumping in the valley.

We built the geologic framework for the model based upon surficial mapping, cross-sections, well control, physics. We built in independent discharge so we can look at the effects of pumping on stream discharge, stream aquifer interactions. We calibrated using PEST, which is an automated calibration tool to come up with unbiased aquifer parameters.

I already talked about the decrease in permeability and the depth. One of the things it does not have in it is the decrease in storage, specific storage of depth, which I think is an important thing that is needed.

This is the area that we covered in the model. The flow system we're interested in is at the western edge, this portion in here. But we also include Lower Meadow Valley Wash, Tule, the Virgin Valley.

I'll point out that the calibration data or data for constrained calibration in this area, especially with respect to pumping effects, were much -- many fewer data points than what we had available in this area. So in terms of reliability, this is -- has higher reliability but still has shortcomings.

27 hydrostratigraphic units because of all the fault, different thrust faults in the area, in order to capture the detail of the geology, we have 18 computational layers. So it's an 18-layer model. Layers being thinner at the top and increasing as we go deeper.

So there's the surficial geologic map that constrains the Framework model. In the left panel and the right panel are the locations of the cross-sections and where we had geophysical control to constrain our geological Framework model.

These are just a couple of examples. This is a section put together by Rick Page. And this is the same section, at least part of it, put together in our Framework model. The white area in here are the locate crystalline rocks that we did not map or didn't assimilate as a separate unit. But you can see that it captures the geometries that are depicted in the cross-sections very nicely. So that's one section. Here's another. Here the carbonates in blue. Here the carbonates shown in the cross-section.

The Framework model does a good job of matching the data as interpreted by Rick Page in his cross-section and based on geophysics and well control.

A little bit further down -- We talked about the thrust sheet earlier. Here's the thrust sheet with

overturned rocks. So, you know, a lot of work went in to developing this Framework model.

We've got head dependent discharge that occurs. These are where we're simulating evapotranspiration. There was a question earlier about where you could pump if you wanted to capture water from ET. This shows you where ET is occurring. There's a little area of ET downstream of Rogers and Blue Point Springs, which I showed you. It's not very extensive. Primarily, we're talking about the areas that we're concerned about. If we're pumping over here, here's where you can capture ET and extreme flow.

The right panel shows our extreme routing systems so that we can simulate what the effects of capture are on the stream flow.

Just some of the results. This is water table map pre-development. I mentioned the low gradient through Coyote Spring Valley down in to hidden Garnet. So we see here the gradient increases when we get in to the northern part of Coyote Spring Valley. Once we get up in to the volcanic area, lower permeability, higher recharge, gradients are much higher.

And we also simulated halfway through the 1169 pumping, this is -- I can't read what the limitation is on that color range. But we ran a simulation with and a

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simulation without the MX-5 pumping, subtracted the two to show where we were simulating the extent of drawdown at that time.

Notice we did not -- This had extended down in to hidden Garnet Valley. We under predicted the amounts of drawdown and the extent at least at that point in time.

When we ran pumping in this area for a longer period of time, it extends further down and runs all the way to the Las Vegas Valley shear zone. It has connectivity within the carbonate aquifer all the way down.

So I think the model does have utility. I say here to evaluate the extent of pumping effects. In the short term, I think it will under predict what the extent is going to be based upon the Order 1169. In the long term, I think it does a good job.

We can only develop an approximate estimate of the magnitude. We underestimated drawdown and we underestimated impacts on decreases in the spring discharge. So you have to use the result knowing that that is a shortcoming.

We can evaluate flow paths because I think we do a good job of matching the pre-development flow. I would not use it to develop accurate estimates. How much are we impacting Pederson Spring. I can't do that. Can I come up

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with a safe yield number? I can't do that. So that would be a misuse of the model.

I think that we can improve it. But there's a lot of work that's gone in to it. It's got a lot of capabilities. There's new data out there. Lincoln County, Vidler has said we did not incorporate the data that they had developed in to it. That's correct. We got that data too late to include in our model. It's still not in there.

I think, and I've made this recommendation before, that there needs to be a model that can be used by the State Engineer's office to answer some of these questions. I don't care who develops it. But I think it needs to be put together in a group fashion, transparent. Everybody knows what's going in to the model as it's being put in. Everybody understands shortcomings. Everybody is, you know, a participant in that process. How that gets put together is something the State Engineer can decide. But I think it needs to be something that would be very useful that everybody is involved in. It can be my model. It could be somebody's else model. I'm trying to retire, so I don't care.

This is a slide that's out of place. I forgot to mention it. Surrounding areas -- I covered part of this. Water levels are rising because I think there's been an

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increase in recharge since approximately 1970 based upon Halford's work. Within the Lower White River Flow System, water levels are primarily declining. And I think that's because of pumping from the carbonate aquifer. I don't think --

(The court reporter interrupts)

THE WITNESS: I don't think we're approaching a new equilibrium.

HEARING OFFICER FAIRBANK: And just as a reminder, make sure you're speaking in to the microphone, because not only does it help the court reporter, but it also helps those that are remotely listening.

THE WITNESS: Okay. So we did some simulations to look at the effects of moving pumping from the Muddy River Springs area and the alluvial pumping along the Muddy River in to different areas. There were three different scenarios that we put together that did that in different fashions in scenario two and three. Scenario one is kind of a baseline. The total amount of pumping was the pumping at the time of Order 1169, not the current level. So be aware of that.

This slide, slide 69, shows changes that were made in the distribution of pumping. The panel on the left has a different area, Coyote Spring Valley shows the decline and the pumping within Coyote Spring Valley as the pumping is

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moved further to the south within the carbonate aquifer.

There's the Muddy River Springs area shown on there as well. There's a decrease in total pumping as you go from scenario one to scenario three, basically being shifted down in to Garnet Valley and California Wash.

The right panel shows the redistribution from the Muddy River alluvium in to the carbonate aquifer. The alluvial pumping is in the brownish color. Carbonate is in the yellow. And then the total is in green. And as you go from simulation one to three, the alluvial pumping drops off and the carbonate pumping is increased and primarily down to the south.

This map just shows the locations of the simulated wells. You have to look at it pretty carefully to kind of see the details of it. But that's provided in our report.

So we simulated the effects. We looked at impacts from simulated discharge in the Muddy River Springs area and along the river. And those are shown here. Be aware as you look at this. And it's kind of hard to tell, that not all of these figures run from zero up. On this page they both do. But we're showing that in the bottom scale it's hard to read those from zero to 500 years. So we're primarily interested in the first part of this.

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The model predicts that there will be decreases in spring discharge as a result of either pumping under scenario one at 14,000 acre-feet per year and change as well as the other. But as we move from scenario one to scenario three, the results aren't that much different. We get quicker results and quicker impacts at early time with scenario one, more delayed as more and more pumpage is moved to the south, but only by a small amount.

When you look at Rogers and Blue Point, you know, we're predicting that there is, you know, a change, but it's not something that is a drastic change unless we get below that lip that I said may exist.

This is stream flow. So impacts on water rights. People diverting from the stream. And we see similar kinds of things, similar results from all three simulations with -- because we're -- here we're looking at the effects of moving. Pumping adjacent to the springs we see a greater delay than what we see with the springs. But we're primarily seeing a delay, not a total change -- change in the total impact.

So my conclusion is that if pumping is moved there will be temporary benefits but at some time the things are going to catch up with us. I say this, but I want to emphasize that our model under predicted the rate at which discharge spread from Order 1169. So I think we're

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predicting longer delays than will actually occur.

I think it's important -- This gets back to this connectivity thing, that if there are ideas of moving pumping in to less well-connected areas, there needs to be a demonstration that they are less well connected and that there aren't impacts. I don't think that CSAMT surveys provide you information on that brief connectedness to the extent that we would like.

Capture zones. Moapa Band of Paiutes has stated that pumping in California Wash or at least most of California Wash is not going to impact the Muddy River Springs area because it's in a different capture zone, that California Wash is in the capture zone for Las Vegas Valley pumping, not in the capture zoning for the Muddy River Springs.

A lot of people make this mistake. How can I be affecting somebody that's down gradient from me? I can impact somebody down gradient from me if I pump water because that water is no longer available to flow to them. But if I'm side gradient or I'm down gradient from them and I pump, my pumping isn't going to affect that area, that discharge area. That's a surface water concept. You can take water downstream from another user from a stream and not impact the upstream user. You cannot do that in groundwater because

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your pumping will cause declines in water levels to people up gradient from you or side gradient from you and decrease the discharge or deepens -- increases the pumping expenses.

So, in my view, this evaluation that was done provides no useful information to you. One, it was based on a model that is interesting but not a calibrated model. It doesn't do a good job of returning flow system. But then it uses a concept that is invalid. A lot of people make the same mistake.

And just a simple illustration. This is out of a book by Stan Lowman showing the effects of well interference. In this particular example it's how can we simulate using the Theis equation and impermeable boundary. So no flow across this boundary. Here's a capture zone, here's a capture zone. We can't get flow across it because we have this no-flow boundary. It's a simulated no-flow boundary.

But, if you look at this lower diagram, the pumping at this well goes across that boundary in to the area of the other well and causes drawdown in the other well. Similarly, the reverse is true. So the total drawdown is the sum of these two drawdown curves. If you're looking at a discharge area, it's the same kind of thing. You have to sum the effects of pumping from all the wells. The presence of this boundary in quotes it has no effect.

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And this next slide is from the Theis modeling that CSI did. I'm using just an example of the same kind of thing. Pumping of two different wells. I believe it was MX-5 and Arrow Canyon. And calculating by Theis what the drawdown cones associated with this are. They add them together correctly and we develop a groundwater divide between the two wells. So to the right side of this divide is the capture zone for the canyon. To the left of it is the capture zone from MX-5. Different capture zones. But the two wells are affecting each other. The capture zone has nothing to do with the -- how far the extent of pumping impacts goes.

So to quickly summarize, I really like the idea of joint administrative unit. I had argued in a hearing related to pumping in the Death Valley Flow System that even though there are different hydrogeologic areas, different basins, those basins will impact each other when pumping occurs. And I urge the State Engineer's office to manage those as a collective groundwater system because that's what it is. So I'm really happy that this is happening. It's going to require continued collection of data. I think that long-term production shouldn't be allowed unless there has been a demonstration that it's not going to impact groundwater discharge in the springs area or along the river.

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And in areas -- And this is getting in to Rogers and Blue Point, we know that there's not a strong connection between those two, but it's a very important resource. And monitoring will be needed to make sure that resource isn't affected.

Next conclusion is that water levels are declining in the carbonate aquifer, a large area, while they're rising in other areas in the same climatic regime. I think this is because of existing pumping from the carbonate aquifer and needs to be recognized in decisions.

I kind of already stated this. Rogers and Blue Point are fed by water from the carbonate aquifer. They're connected but not a strong connection to the aquifer in California Wash and Garnet Valley. But monitoring is needed to see if there are changes that might impact those springs.

And then, finally, moving pumping from the sensitive areas, the Muddy River Springs area and the Muddy River, is going to help for a short period of time, but eventually the impacts will be the same. Thank you.

MS. GLASGOW: Thank you. That concludes our presentation.

HEARING OFFICER FAIRBANK: Okay. Thank you. So, let's see, we will go ahead and take a lunch break and we will reconvene at 1:00 p.m. Thank you.

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(Lunch recess was taken)

STATE OF NEVADA)
)ss.
COUNTY OF WASHOE)

I, CHRISTY Y. JOYCE, Official Certified Court Reporter for the State of Nevada, Department of Conservation and Natural Resources, Division of Water Resources, do hereby certify:

That on Wednesday, the 25th day of September, 2019, I was present at the Legislative Counsel Bureau, Carson City, Nevada, for the purpose of reporting in verbatim stenotype notes the within-entitled public hearing;

That the foregoing transcript, consisting of pages 489 through 597, inclusive, includes a full, true and correct transcription of my stenotype notes of said public hearing.

Dated at Reno, Nevada, this 26th day of September, 2019.

____
CHRISTY Y. JOYCE, CCR #625

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SE ROA 53210

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In The Matter Of:

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES

Vol. III
September 25, 2019

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Carson City, Nevada 89706

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STATE OF NEVADA
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
BEFORE MICHELINE N. FAIRBANK, HEARING OFFICER

IN THE MATTER OF THE ADMINISTRATION AND MANAGEMENT OF THE LOWER WHITE RIVER FLOW SYSTEM WITHIN COYOTE SPRING VALLEY HYDROGRAPHIC BASIN (210), A PORTION OF BLACK MOUNTAINS AREA HYDROGRAPHIC BASIN (215), GARNET VALLEY HYDROGRAPHIC BASIN (216), HIDDEN VALLEY HYDROGRAPHIC BASIN (217), CALIFORNIA WASH HYDROGRAPHIC BASIN (218), AND MUDDY RIVER SPRINGS AREA (AKA UPPER MOAPA VALLEY HYDROGRAPHIC BASIN (219).
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TRANSCRIPT OF PROCEEDINGS
PUBLIC HEARING
HEARING ON ORDER 1303
VOLUME III
(P.M. SESSION, PAGES 599-693)

WEDNESDAY, SEPTEMBER 25, 2019

Reported by: Kathy Terhune, RPR

APPEARANCES:
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For Muddy Valley Irrigation Company: Steve King, Esq.

SEPTEMBER 25, 2019; 1:00 P.M.; CARSON CITY, NEVADA.

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HEARING OFFICER FAIRBANK: Okay. Let's go ahead and go back on the record. And so, we'll go ahead and start the opportunity for cross-examination and questions.
And we will commence -- start with Coyote Springs Investments.
And again, we've had several parties that have indicated that they're not going to be participating in cross-examination today, and so, I've adjusted the time schedule so each of the participants will have 16 minutes for their cross-examination. And then, again, if there's time at the end of today, then we can go ahead and see about maybe allowing a second round of questions.
Go ahead and proceed, Mr. Herrema.

RICHARD K. WADDELL, JR.,
called as a witness herein by the National Park Service, having been previously duly sworn, was examined and testified as follows:

CROSS-EXAMINATION
BY MR. HERREMA:
Q. Good afternoon, Dr. Waddell.
A. Good afternoon.
Q. I'm Brad Herrema. I'm counsel for CSI. I have with me at the table Emilia Cargill who is a General Counsel for CSI. And I have handful of questions. I'm going to try to do as much as I can with my 16 minutes. So, I'm going to try to move quickly. But, I would like to get your full answers to each of the questions.
First, you stated in your presentation that discharge has the smallest -- excuse me -- has the smallest amount of uncertainty.
What do you use to measure groundwater outflow from a system? Can --
A. I want to make sure I understand your question. When you talk about groundwater outflow, are you talking about outflow across a boundary, or you talking about outflow to the surface?
Q. How would you measure either?
A. Well, the outflow across a boundary really can't be measured. You can estimate it based upon estimates of the transmissivity of the aquifer and gradient. But, there's a lot of uncertainty in the

transmissivity values. Same answer for inflows. But, whereas say discharge to a spring, you can, depending on that, the discharge rate from the spring, use different techniques. If it's a large capacity spring that results in spring flow, you can build a flume or other type of measurement, strike them on the stream and measure the flow with that technique.
If it's a very small stream -- a very small discharging spring, you can estimate it -- I'm sorry -- measure it through a bucket and stopwatch method, if you will, where you capture the discharge from the spring over a certain period of time, measure that volume, and divide it by the amount of time.
So, you know, it depends really on what the characteristics of that spring discharge are. If you're interested in discharge into a river, you would do like the USGS did with their synoptic study that they performed on the river where you set up stations along the river and make measurements at those stations either by measuring water velocity cross-sectional area and integrating that to get a value, or you -- if you have a gauging station with a flume or weir or something like that, you can use those data. But, you do that at different points along the stream so that

you can see changes. And the concept typically is to measure those several times and average out the years.
Q. Okay. Thank you. I'd like to move on to some questions about your model.
Looking at the 2012 report on development of your model, there's a table 3-4. It's average annual evapotranspiration discharge by hydrographic area. Do you recall that?
A. I do not, but I think I've got a copy of it here.
Q. Okay. The report states that -- or that table states that there's 4000-acre-feet per year of evapotranspiration in Muddy River Springs area, there's 2000-acre-feet per year of evapotranspiration in Black Mountains area, 6000-acre-feet per year of evapotranspiration in California Wash which totals 12,000-acre-feet per year. And this references a 2008 USGS study.
Do you know if these were predevelopment evapotranspiration rates, or they were current in 2008?
A. They were current in 2008.
Q. Your 2012 report also states that flow in Coyote Spring Valley comes from a combination of recharging in Delamar Mountains and underflow at the

northern most end of Coyote Spring Valley, and the flow continues south through carbonate rocks. Some of the groundwater flow discharges into the Muddy River either through the Muddy River Springs and some regional groundwater flow likely to continue southeast into California Wash.
Are you suggesting that there are two flow paths through Coyote Spring Valley, one toward Muddy River Springs and the other toward Hidden and Garnet Valleys?
A. I'm suggesting that the flow to the south in Coyote Spring Valley, some of that goes towards the Muddy River Springs area. I don't -- I would answer yeah, there are -- there are at least two flow paths, but they're three-dimensional flow tubes, if you will. So, you can't necessarily draw a line on a map and say to the east of this line that all goes to Muddy River Spring and to west of it, it goes further to the south.
But, in essence I'm saying there are two areas that that flow goes to.
Q. Okay. A review of your 2012 report indicated that you did one steady-state and two transient calibrations. Could you explain why you performed two transient calibrations?

A. I -- my recollection -- and I haven't reviewed that report in that kind of detail, but let me first answer your unasked question about the state of the study. We wanted to get a base model base so it would be consistent with the estimated fluxes across the external boundaries, the estimated recharge rate so that it calculates the discharge and the distribution of water levels throughout the model. My recollection is that for the transient calibrations we did one calibration process with longer time steps that didn't look at the pumping affects in as much detail. And then another one was shorter time steps to get additional tempo information. But I -- I -- that was a long time ago, and I don't recall that detail.
Q. Okay.
A. I can check the report if you'd like.
Q. Not right now, thank you.
Review of that model report shows that simulated flow at the Muddy River near the Moapa Gauge goes up to 15 CFS less than observed. Was that Moapa Gauge considered during the model calibration?
A. It was, yes.
Q. And could correcting for simulated flow at the Moapa Gauge change any of the opinions that you

presented today?
A. It would change the output that I showed you with respect to discharge rates into the river along the different stretches of the river. It would not really change my conclusion that we would be looking at similar effect just delayed with movement of pumping from the regular area down into the southern part of the flow system.
Q. For the simulations that you discussed today, did you update the calibration of the model with any data collected since December 2011?
A. We did not.
Q. So, the updated model that you presented today and you refer to in your report, does it include any form of recalibration using data collected after December, 2011?
A. No, it does not.
Q. Are you able to provide any estimate of accuracy of your model for the recent simulations based on that 2012 calibration?
A. It's going to depend upon the area that you're looking at. In terms of the amount of drawdown, my recollection is that we were -- the model estimated about half of what was measured, but it varied on which

well you were looking at. So, in some wells, it would match better than it did in others.
With respect to the flow, I don't recall the detail about how much we estimated decline at Pederson Springs versus what was measured with something less than that. I just don't recall.
Q. Something less than half?
A. I didn't -- I said less than that.
Q. Okay.
A. Less than what was simulated. I'm not saying that correctly. I don't know how to -- I don't have the information to say how much that model simulation was off in front of me.
Q. Okay. You have said that continued development of the model should include changes in recharge and the implementation of structural features. Would either of these elements effect the underestimated impact of Order 1169 pumping?
A. By themselves? I think if we added some additional structure -- you had mentioned the mismatch at one of the gages where water bypassed -- in the model bypassed that gage location to discharge further downgradient. A structure in there that would keep that flow would provide a better match.

So, yeah, increasing structure and that kind of stuff would, I think, be an improvement to the model. I don't think that's sufficient. The changes in recharge that I had in mind was putting in the transient recharge data set so that we could simulate the increases in water levels from the 2004, 2005 recharge event. So, we had a process for simulating that change that was observed in the data. That currently does not exist in the model.
Q. In regard to the faults that are included in the 2000 -- I'll call them the 2012 model. Should we call it the updated 2012? You haven't added any faults since 2012, correct?
A. That is correct.
Q. In regard to the 2012 model, is it correct that the only faults that were simulated in that model is the Coyote Spring Valley and the Muddy River Springs area? Are the Kane Springs Wash faults and the White Narrows fault?
A. That's my recollection, yes.
Q. And could additional faults be added to the model based on the recent geophysics work that CSI and Vidler had commissioned?
A. Additional faults could be added in the Coyote

Spring Valley, yes.
Q. And if you added those faults into the model, would the model then need to be recalibrated?
A. Yes.
Q. Would the addition of the faults allow you to better understand -- I'm sorry -- to better estimate the predicted drawdown in water levels that you stated were underestimated?
A. I don't think they testified that we underestimated water levels. We underestimated the amount of drawdown. And the additional faults will change the distribution of the estimated drawdown.
Q. Okay. So, the addition of faults would allow you to better estimate the predicted drawdown in water levels which you said were underestimated?
A. With other changes, yes.
Q. If I could turn attention to slide 19. Do you have your slides in front of you? Could you pull that one up? Thank you.
This slide includes different suggestions about how you might evaluate the permeability within a fault block. Did you do any of that analysis in the Coyote Springs Valley?
A. This slide does not provide suggestions about

how would they -- we'd estimate that. I was using this slide to say that in other areas where this type of information has been collected, the information indicates that the fault blocks are not impermeable.
Q. So temperature and flow testing or tracer testing is not something that you could do in the Coyote Spring Valley to analyze the fault block there?
A. No, it could be. I was just -- I thought you had mischaracterized what this slide said. But, yes, that type of work could be done.
Q. Did you do any of that type of analysis in Coyote Springs Valley?
A. No.
Q. Would you recommend that it be done?
A. I would recommendation additional work. I wouldn't necessarily recommend, for example, tracer testing in Coyote Spring Valley.
Q. There is additional work you would recommend?
A. I think --
Q. To characterize that fault system? I'm sorry.
A. I think additional drilling and hydrologic testing looking at the amount of attenuation of the drawdown signal across the fault would provide useful information.

Q. Do you have an opinion as to whether MX-5 and MX-4 wells are completed within the structural block or within the damaged area or fractured area associated with normal faulting?
A. I think that whole area has been -- has enhanced permeability. Whether or not it's due to the normal faulting associated with the lateral extent of your canyon range and the subsurface or whether it's due to the right lateral movement of a shear zone that runs from that area towards the Muddy River Springs area, I'm not sure about.
In CSI's presentation the response to one of the questions was that MX-5 penetrated the fault on the east side of that block. I did not go back and look at the log to see if there was evidence for a fault at MX-5.
Q. Okay.
A. So, I -- you know, they -- those wells could be within the damage zone, but I have not looked at that carefully to provide you an answer accurate answer.
MR. HERREMA: Okay. Thank you. I heard my buzzer. Thanks.
HEARING OFFICER FAIRBANK: Thank you. Next is Luke Miller, Fish and Wildlife Service. I see that

they have the no questions.
Moapa Band of Paiute Indians.

CROSS-EXAMINATION
BY MS. BALDWIN:
Q. Good afternoon. I'm Beth Baldwin, attorney for the Moapa Band of Paiute. And with me is Lyna Tanner, our local counsel.
Mr. Waddell, I'm going to try to follow the general order of your PowerPoint with my questions. So, I'm going to refer to the slides when I ask the questions. We may get out of order, but that's my general intent.
So, starting with slide number seven. So, you've listed five I guess factors that you look at when examining hydraulic connectedness. Is it fair to say that geology is the most important?
A. What I indicated on this slide is that continuity of the geologic unit, or the active unit, is so high importance that it's -- you have to have that continuity. But, just having that continuity does not indicate that there is connectedness.
Q. Okay. And then, so, would low hydraulic gradient and water chemistry then be the least

important? I'm just trying to understand if there's a hierarchy here or not necessarily.
A. As I explained, you can have high -- I mean low hydraulic gradient in rock that is not highly permeable. There's just not a lot of water movement through it. So, by itself it's not sufficient to indicate a high connectedness.
Groundwater chemistry provides information that you can use to -- I'm looking for the right word -- to show some type of connection, but, by itself, not the quality of that connection.
Q. Okay. Going ahead to slide ten, this is the hydrograph for CSVM-6. I'm having trouble reading the dates on the X access. Is there an Order 1169 response in this hydrograph in your opinion, and if so, when is it beginning?
A. There is a response in -- give me just a minute. Let me see if I can read the date.
Q. They're very small. My best guess is 2013, but, I can't really tell for sure.
A. Are you asking for a response from initiation of the test or --
Q. Yeah.
A. -- the ending of the test?

Q. Roughly, yeah.
A. It looks to me like it's the latter part of 2010. There's a declining water level prior to that that's part of the seasonal effect.
Q. Okay. All right. Thank you.
Moving ahead to slide 23. This is Kane Springs Valley. These are the hydrographs for KMW-1 and CSVM-4. It looks like there's this dip in 2014. Do you know why? Did you have an opinion why?
A. You asked about a dip?
Q. Well, it looks like there's a drop in the water levels around 2014. Again, I'm having trouble reading that exact. So, that might not be the right date.
A. No. It looks to me like the affects of pumping continued past the end of MX-5 pumping, which was early 2013. On the hydrograph for CSVM-4 there's a gap in data, so, it's -- you can't really say much about it.
Q. Okay. Thanks.
A. But it's -- the pumping over, you know, the two-year period and then the delay because of the result of the attenuation of affects delayed the start of recovery.
Q. Okay. Going to slide 28, this is titled Las Vegas Valley. I'm confused whether you're proposing to

include Las Vegas Valley in the Lower White River Flow System or not?
A. I am not proposing to include it.
Q. Okay.
A. That was my tongue in cheek recommendation.
Q. So, I believe in -- somewhere in your report and you're talking about your modeling results, the simulations you did for this proceeding, that you did notice drawdown in Las Vegas Valley way out in the future. Do you recall if that's?
A. We did not simulate Las Vegas Valley. The model simulated that there would be drawdown affects that extended to the boundary of the model but was along the Las Vegas Valley shear zone.
Q. Okay. So, it goes just the boundary?
A. That's correct.
Q. And I think -- I believe your opinion was that not much water flows across that shear zone, the Las Vegas Valley shear zone; is that correct?
A. That is correct.
Q. And I don't want to misstate this, but I believe you also said that it's the -- there's a low hydraulic gradient?
A. I didn't find evidence of a high gradient

across that.
Q. Okay.
A. I don't believe I testified or wrote that it was -- that the low flow was because of the low gradient. I think that there is a permeability change associated with the shear zone that limits the flow across the shear zone.
There were questions earlier about changes to the model that I would make if we were doing additional calibration, and one of those changes would be to change that boundary condition in the model from a no flow boundary to independent boundary.
Q. And I'm not a scientist, so these questions might be off base. But, if there's a low hydraulic gradient, how does that impact the measure of transmissivity? Or does it not impact it?
A. It depends on how you're trying to measure transmissivity.
Q. Okay.
A. There's -- the standard, commonly implemented way is to run an acra test. Drill wells, you hopefully -- or you should drill observation wells, or have available observation wells. You pump a well and look at the drawdown that occurs in the surrounding wells.

And you develop a model of that drawdown experiment and back calculate transmissivity storage coefficient. So, that's one way.
The other way, if you know the discharge through that area -- and I will stress again, if you know it, then you can measure the gradient and calculate the transmissivity.
Q. But we don't -- we don't know flow. I believe you testified that that's something we don't actually know, but it's presumed to be low?
A. That is correct. We do not know the flow. This would not be a good location to use this other approach.
Q. Okay. So, let's talk a little bit about Rogers and Blue Point Springs. Looking at slides 32 and 33, which are the hydrographs, I see mean annual discharge at Rogers is 1.63 CFS, and then at Blue Point it's .52 CFS. But I have a total of 2.15 CFS; is that correct?
A. That sounds right.
Q. I think your report you mentioned 2.25, and I realize it's, you know, one-tenth of a difference, but, is there a reason why the figures differ?
A. Not that I know of. I'm not sure which report

you're referring to, but --
Q. It's when you're talking about the 500 years in the future. It was simulated change. I think you said it drops from 2.25 down to 2.0. But, if the current discharge is 2.15, then it would -- that's a difference?
A. That is probably the reason.
Q. Okay. Okay.
A. It was not intentional.
Q. Okay. Thank you.
So, on slide 34, we're talking about the source of the water that discharges at Rogers and Blue Point Springs. Did you look at heat as a tracer or temperature as a tracer?
A. I did not. I know that because the temperatures is warm --
Q. How warm are we talking?
A. My memory is somewhere in the low '90s, but they didn't do an analysis of that. That typically suggests to a hydrologist that the water has gone at some depth, and I didn't do any calculations of depth. I know that people have suggested using the internal gradient or an average thermal gradient. Gradients make that calculation, and I think that's appropriate

in some areas. I don't think it's appropriate in the Muddy River Springs area to do that. But no, I did not.
Q. Would the temperature and the correlation that it's coming from depth support Wiser Wash as a potential source?
A. I think it would be a similar situation as flow from California Wash.
Q. So, doesn't tell us one away or the other, in your opinion?
A. I haven't looked at it in that detail, but, I don't believe so.
Q. Okay. Going onto slide 36, the isotope analysis. Does temperature play a role in isotopic composition?
A. It -- the temperature of the recharge certainly does. At the temperatures that we're talking about, we're not looking at changes in the composition through mineralogical changes which have been documented to a period that requires higher temperatures. But, the primary influence of temperature here would be in looking at it and trying to estimate what the temperature at recharge was, that recharge source.
Q. Okay. Slide 37, you're showing us the Global

Meteoric Water Line, and it generally goes from the lower left to the upper right more or less.
What if we have a situation where as oxygen-18 gets heavier and deuterium is getting lighter, what would that tell us about the water?
A. That may suggest mineralogic changes, but I -- I'd have to say I don't know.
Q. Okay. That's fair.
Going into slide 36, and it's your opinion there's a hydraulic connection between Rogers and Blue Point Springs and the carbonate aquifer beneath California Wash?
A. That is correct.
Q. And is that different from the opinion the Park Service offered in 2013?
A. I'm not familiar with what they offered.
Q. Were you a part of the 2013 report that they prepared in the Order 1169?
A. I was part of that, yes. I don't recall what they would have said.
Q. Going ahead. Talking about the water levels, slide -- starting on slide 48. Actually slide 15.
At the bottom of the Spring Mountain hydrograph it looks like there's two wells that are either

declining or holding stable?
A. Excuse me. Which slide?
Q. Slide 15. Sorry. So, at the bottom right of the hydrograph it looks like there's two wells, and one is holding stable. The water levels are stable. And another it looks like they're declining? Is that -- is that accurate?
A. Yes.
Q. Do you have an explanation or an opinion why?
A. I wouldn't want to speculate. The BLM well is down on the, you know, lower elevation close to where there may be pumping. So, it may be associated with that. I didn't want to speculate, but I just did.
Q. That's fair enough.
MS. BALDWIN: I think that's that my buzzer. Thank you.
HEARING OFFICER FAIRBANK: Yes, thank you.
Next is Southern Nevada Water Authority, Las Vegas Valley Water District.

CROSS-EXAMINATION
BY MR. TAGGART:
Q. Good afternoon, Dr. Waddell.
A. Good afternoon.

Q. My name is Paul Taggart. I represent the Southern Nevada Water District and the Las Vegas Valley Water District, and I had some questions for you.
First, how long have you been involved in analyzing the hydrogeology of the Lower White River Flow System
A. I -- my first involvement was in approximately 2001.
Q. And at that time, were you involved in the hearings involving CSI's applications for new groundwater applications in Coyote Spring Valley?
A. Yes.
Q. And at that time, were you concerned about the impact of pumping water in Coyote Spring Valley on Rogers and Blue Point Spring and the Muddy River itself?
A. I was concerned about the effect of pumping not on Rogers and Blue Point, but on the springs in the Muddy River Springs area and also on the Muddy River.
Q. And during that hearing did you make those concerns known to the state engineer?
A. I haven't reviewed the transcript, but, I believe I did.
Q. Okay. And as a result of the pumping test that

was in result of Order 1169, were some of your concerns validated, or how would you describe that?
A. Yes, I would say they were validated. A lot of those concerns had previous develop -- previously developed from observing the impact of pumping of Arrow Canyon wells, wells in Coyote Spring Valley. So, we knew that there was a hydraulic connection, but, the pumping test provided additional information on impacts on the springs, as well as water levels in the springs area.
Q. I have a number of questions for you about the proposal that Mr. Reich made. Were you here during his testimony?
A. Yes, I was.
Q. And the questions I'm going to ask you now, are -- I'm going to ask you to, if you can, base the answers on your analysis of the geology, the hydrology, as opposed to the groundwater model. So, I'll -- I'd like you to just tell me if these conclusions can be made based upon your analysis of that other information. And the reason I say that is because I know -- I have a couple of questions about your model, too. But, since you've indicated some concerns about the calibration of it, I just want to be clear about

whether you're relying on that or not in some of your answers. Does that -- does that make sense?
A. It makes perfect sense. I prefer, you know, if there are data to support the conclusion that's a much stronger base than relying on a model.
Q. Okay. And so, this line of questions I want you to rely on the data itself. Okay?
So, you said during your testimony that the geologic structures that Mr. Reich identified and plotted on his figure ten, that you didn't think that they were impermeable; is that -- is that accurate?
A. Yes, it is.
Q. Okay. And it's true that you said that the resistivity data that you relied upon, while it's useful for identifying fractures, it's not useful for identifying hydrologic properties; is that fair?
A. No. What I said was that the geophysical data are useful for identifying faults, the effect of faults and displacement of the carbonates. But, it does not provide information on fractures --
Q. Okay.
A. -- that are present.
Q. I'm sorry. That was my mistake on faults.
But, do you disagree with Mr. Reich to the

extent you rely upon the resistivity data as a basis for there being a hydrologic barrier in that location? Was it wrong to use resistivity data for that conclusion, if that's how he used it?
A. I think that you can use the mapping of faults to hypothesize that there may be -- I will use my term -- impediment to flow across the fault. But, that it's necessary to do hydrologic work to establish whether that's indeed true.
Q. Okay. Now, did you also on hear testimony about new recharge estimates that were made in the Sheep Range by Mr. Reich and others on behalf of CSI?
A. I did.
Q. Okay. And would that recharge estimate fall within this category of recharge parameters that you tested with the pest product and determined that the recharge really isn't a significant factor in drawdown generally, and the changes in recharge values aren't as significant as other factors are in how drawdown occurs?
A. Yes, but, let me make clear so that there's not confusion. That modeling and testing that I did, was in a different area. But what that testing showed me was that I could develop different models with

different assumptions, and I looked not only at recharge but some other assumptions. I went through a recalibration step with each of those models and determined that the predicted affects varied very little.
Q. Okay. And do you think the state engineer should determine what the long-term quantity of groundwater that can be pumped without impacting senior rights or the public interest? Did you think that water budget should play a significant role, or analyst data should play a significant role in that?
A. I think -- and again, to avoid confusion, I'm going to say analytic data is not chemical data. But, I think hydrologic data where pumping is done and observations are made of discharge -- affects on discharge rates, your water levels is much more valid.
Q. Now, I'd like to ask you about the hydrologic information regarding CSI-1, -3, and -4, the three wells. And in your testimony you talked about your analysis of hydrographs of certain monitor wells in Coyote Spring Valley, and I want to ask you about how that analysis informs your view of these three wells.
So, I've put out on the table there, that's copy of SNWA's Exhibit Number -- can't remember. It's

our rebuttal report. And do you see that?
A. I see it, yes.
Q. Okay. And on figure five -- I'm sorry, figure 2-5 on page 9, there is a set of hydrographs that include CSI-1e, CSI-3, and CSI-4, and at -- and at the bottom is also the CSVM-1. Do you see that?
A. I do.
Q. Okay. My question for you is, do you believe that pumping can occur at CSI-1, -3 or -4 wells, without impacting the Muddy River Springs?
A. No.
Q. And do you believe that the hydrographs for CSI-1, -3 and -4 reflect a signal from the pumping at MX-5 during the 1169 pumping test?
A. I believe that -- excuse me. I believe that the hydrographs are complicated by pumping that was ongoing during that test that had the seasonal signature to it. But, the declines in wells levels that occurred during the period of MX-5 pumping indicate that that pumping from MX-5 affected water levels in CS-1, -2, and -3.
Q. Okay. I asked about CS-1, -3, and -4.
A. I'm sorry. One, three, and four.
Q. And there's been some questions about CSVM-5.

Are you familiar with that monitor well?
A. Yes.
Q. Okay. And is it fair to say it's on the fan, alluvial fan coming down from the Sheep Range?
A. Yes.
Q. And that's on the west side of Coyote Spring Valley?
A. Yes.
Q. And I believe your testimony was that that hydrograph does not show a signal from the pump test -- pumping test that Order 1169 allowed?
A. That's correct.
Q. Do you have an opinion on whether a large quantity of water could be developed at that -- at that well, or at that block area?
A. I don't have sufficient information to give an opinion.
Q. Okay. Did you hear the testimony of Ms. Braumiller yesterday for the Fish and Wildlife Service?
A. Yes.
Q. And do you recall her answer and question about CSVM-5 and it's hydrologic condition?
A. I remember her answering a question, but I

don't remember what her answer was.
Q. All right. The -- the -- okay.
Could you turn to slide 45 from your PowerPoint, please?
And my question has to do with the opinion that you have regarding a flow path through the Glendale Thrust in this area and from which Rogers and Blue Point emanate. Okay? And is that a fair summation so far of your view, that there is some flow that occurs through this location, and that's where the Rogers an Blue Point source water is?
A. Yes.
Q. Okay. Do you believe that there's significant water going through that flow path in addition to the water that is daylighting, if you will, at Rogers and Blue Point?
A. No.
Q. Now, I'd like to ask you couple of questions about the model results. Now, slide 65, and that's just one I'm particularly excited about, "The Proper Uses of Models."
So, I understand your testimony, I think, so, I'll ask you to confirm it. Your model you feel isn't appropriate for quantitative assessments or actual

numbers in terms of calculations of drawdown at certain locations; is that fair?
A. That is fair, yes.
Q. But, would you agree that it can be used to test trends or general conceptual models that hydrologist and hydrogeologists have about this area?
A. Oh, absolutely.
Q. Okay. And so my questions are going to be along those lines. And specifically, if you turn to page 73, I think it is in your slides, and there's actually a couple of figures in your report.
But -- and you may have already said this, but, the fact that -- well, let me slow down.
Slide 73, on the right panel is a projection of simulated capture flow near Glendale from the Muddy River, correct?
A. Yes. What it is shown here is our simulated flow in the Muddy River at those locations.
Q. Okay.
A. The decline in flow is what happens.
Q. Yeah, the figure -- I wanted to ask about the figure that's in your report, but I'm running short of time, so I'm going to -- I'm just going to ask you a couple questions about it.

When we look at the simulations that are shown in your report and the impact on specifically Muddy River flows at Glendale, would you agree that regardless of where the wells are located and the pumping's located, portions of carbonate wells versus alluvial wells which vary through the three simulations, that really doesn't make much difference where the well -- wells are located or where the pumping's located, generally the same amount of drawdown occurs at the Muddy River Springs area?
A. That's correct.
Q. And that -- is it fair to conclude from your model that groundwater pumping in the Lower White River Flow System ultimately captures Muddy River flow?
A. Yes.
Q. And also that that would, regardless of whether it's carbonate, pumping or alluvial pumping, ultimately in your model simulations river flow is captured?
A. Yes. I want to make sure that there's not a misinterpretation that I'm saying that the capture is on one, one basis. I don't think I can say that.
Q. Okay.
A. For example, along the Muddy River, not only would flow be captured but it's evapotranspiration

would decrease because of lower omauda take (phonetic), so you capture it from a different source.
Q. Okay.
A. There's also a possibility of increasing inflow I think a small amount into the lower -- the flow system. I'm sorry. But that that's probably would be insignificant.
Q. You're talking about potentially inducing flow through boundaries or that sort of thing?
A. That's correct.
Q. And so, that's a relatively minor additional capture?
A. Yes.
Q. And other than that, is it just river flow that can be captured?
A. River flow and evapotranspiration.
Q. Now, is it possible to capture ET in the Muddy River area without also capturing discharge from the Muddy River itself?
A. Not in my opinion, no.
Q. Okay. One last question is, were you present for the questions yesterday about the Big Muddy Spring that Ms. Braumiller was answering?
A. I was.

Q. Would you agree or disagree with this statement? That the general hydrological consensus is that the Big Muddy Spring is sourced from the same sources as the Muddy River itself?
A. I don't think I have looked at that enough to provide an opinion.
MR. TAGGERT: All right. Thank you.
HEARING OFFICER FAIRBANK: Up next, Vidler Water Company and Lincoln County?

CROSS-EXAMINATION
BY MS. PETERSON:
Q. Good afternoon, Dr. Waddell. Karen Pederson representing Lincoln County Water District and Vidler Water Company.
A. Good afternoon.
Q. Good afternoon. And in your early testimony this morning regarding Kane Springs Valley, I was under the impression that you had read State Engineer's Ruling 5712, which was the 2007 ruling from Kane Springs.
A. I have read a small portion of that, yes.
Q. All right. And did you read the portion of the ruling where the state engineer indicated that because

of the water level changes between Kane Spring Valley, Coyote Spring Valley, and the other portions of the basins covered under Order 1169, that the marked difference had supported the probability of a low permeability structure or change in lithology between Kane Spring Valley and the southern part of Coyote Spring Valley? Do you remember that?
A. I remember reading that section, yes.
Q. All right. And in that same paragraph the National Park Service at that time was wanting Kane Spring Valley to be part of the Order 1169 proceedings, do you recall that?
A. Yes.
Q. All right. And this -- the state engineer determined based upon those findings that he made regarding the elevation, the different elevations and the probability of the low permeability structure that -- and the quantity of water granted by the applications, that he would not include Kane Spring Valley in the Order 1169 proceedings. Do you recall that?
A. Yes.
Q. And then directing your attention to slide 24.
You indicated based upon the recent CSAMT work,

that you agreed that the two lines shown represent different geology; is that correct?
A. That is correct.
Q. And that you didn't necessarily disagree that there is a fault there? Do you recall that?
A. Yes.
Q. And you indicated that it was an impediment to flow?
A. I indicated that I believed there are impediments to flow in northern Coyote Spring Valley. I don't think I testified that I thought that that fault was an impediment to flow. It might be an impediment to flow, but, I don't think the evidence says that that particular fault is.
Q. Do you think that that could be the low probability structure or the change in lithology that the State Engineer referenced in his ruling 5712?
A. I don't know what the State Engineer was thinking when he said that.
Q. Is there any evidence that you've provided in this proceeding that shows that there is a change from -- with regard to Kane Spring Valley within -- including it in Order 1169, that would change the findings that the State Engineer made in Ruling 5712?

A. I believe there is, yes.
Q. And what is that?
A. I think it's the observed water level response in those two wells to pumping of MX-5 during the 1169 testing.
Q. Okay. And we'll get to that.
I did want to ask you a question about your model. The model, did you simulate Kane Spring's pumping in your model?
A. We did.
Q. And was it a thousand acre-feet?
A. I think so. But I would have to check. On the order of that, yes.
Q. And there was drawdown at Muddy -- the Muddy River Springs area from the Kane pumping?
A. I did not investigate that.
Q. So, your model simulated the Kane pumping, but you did not investigate whether there was any impact or drawdown at the Muddy River Springs area from the Kane Spring's pumping?
A. We did not simulate that. Now, we could have done that by running simulation with that pumping, and then a second simulation absent that pumping, and then comparing the two results, but we did not do that.

Q. Did you do any simulations of Kane pumping for drawdown at Rogers and Blue Point?
A. No.
Q. And then direct your attention to slide 23. You just had some questions about what you -- what you have showing here in your hydrograph.
The MX-5 test started November 2010, and ended in March 2013; is that correct?
A. I don't recall the exact dates, but that sounds correct.
Q. All right. And your yellow dots that you show in your hydrograph here, they start approximately nine months after the MX pumping starts?
A. Correct.
Q. And what is the explanation for that delay?
A. There was testimony yesterday by Ms. Braumiller and then testimony by me today that we both believe that there's a decrease in transmissivity as you move further north in Coyote Spring Valley, and that lower transmissivity delays the transmission of affects to the location of these wells.
Q. And then you show water levels don't start recovery until the beginning of 2015; is that correct?
A. I don't believe that's correct, no. It looks

like it occurs -- starts to occur before that.
Q. And when do you have it occurring?
A. For KW-1, early in 2014. And for the other well there's a gap in the data at that location. It looks like based on a limited number of data points, recovery was occurring later in 2014, but then changed into a declining trend.
Q. Is there any reason why drawdown and recovery responses would be different?
A. Yes.
Q. And what is that?
A. When pumping occurs for a period of time, you get a response curve that shows faster drawdown and slower recovery. It's because of the depletion in amount of water stored in the aquifer, and the lower gradient that exists during the recovery phase.
There was a paper prepared by Stan Leake of the USGS in Arizona that evaluated this through a modeling exercise and showed very significant affects. We saw those same affects in our model of the aquifer in that Black Mesa area in Arizona. Because it's a function at how long the well is pumped in terms of the different apparent behavior in the draw -- initial drawdown and the late recovery responses.

Q. Did you do any analysis of the affects of pumping the Arrow Canyon wells?
A. No.
Q. And in Appendix B of your report you -- well, on page 15 of your report you indicate there was pumping and you included for Kane, Tule, and Virgin River Valley. Do you recall that in your report?
A. I do.
Q. And in Appendix B, we don't see any rate of pumping for Kane, Tule, and Virgin River Valley?
A. You're referring to the table that we provided?
Q. Yes.
A. That's correct. I believe it's correct. I haven't -- reviewed that. But this table was intended to provide with the changes in pumping for the three scenarios. And the pumping in those other valleys was maintained I believe at the rates that we used for scenario one in our, approximately -- I think 2012 report on affects of pumping that had seven different scenarios. But, it was not modified in this report, and would not have impacted results from this report.
Q. The Kane -- the Kane, the Tule, and the Virgin River Valley pumping would not have impacted the results of your report?

A. I'm sorry. The Kane would have, yes.
Q. Okay. But I thought you said you didn't -- you I didn't know -- well, you simulated pumping, you didn't know what the results were at the Muddy Springs area? Okay.
A. Correct.
Q. All right. Is there any where in your report where the affects of the Kane pumping are described or quantified?
A. I think all we showed were on some maps of drawdowns, that there was drawdown associated with the pumping of the Kane Spring wells and that drawdown extended into Coyote Spring Valley.
Q. But, of course, with your model, you wouldn't be able to have any kind of precise quantification of that that you could rely on; is that fair?
A. That's fair, yes.
Q. And if Kane should be included in the Order 1169 proceedings, shouldn't Dry Lake, Delamar, Pahranagat Valley, Cave, Garden, all the way up the pipeline to Ely, shouldn't they all be included?
A. I would say at some point the line has to be drawn. We have evidence from the responses in those two wells to the MX-5 pumping, as well as the other

evidence that I presented earlier today, that there's a close association of Kane Spring Valley discharge with Coyote Spring Valley. And it's my opinion that pumping in the carbonate in Kane Spring Valley would effect water levels in Coyote Spring Valley.
I have not investigated whether or not that that would be -- if you could test it by pumping only Kane Spring Valley and no other wells, then you would detect that at the Muddy River Springs. My opinion is that you wouldn't, but, that in combination with the other pumping, you would see affects.
Q. And this -- that would be based on your model?
A. No.
Q. And if you could look at slide 27. You made some statements there based on the water levels you have at the bottom of the slide there. One of them you said was a 3200-foot spring at the head of the valley. Isn't it correct that that's sort of a spring in the Delamar Mountain?
A. My recollection is -- it's for a spring that's at the northeastern end of the valley.
Q. Which spring?
A. I couldn't tell you.
Q. And would you agree that the 1880-foot

reference there to the water level at the southwest end of the valley is for the carbonate monitoring well, KMW-1?
A. It probably is, yes.
Q. And then one of the statements that you made in your report which is Exhibit 2, I believe it was on page 22, you indicate the model predicts that the carbonate aquifer at the Kane Spring Valley and Coyote Spring Valley are connected. Do you recall that statement?
A. I don't remember it specifically, but, it sounds like something that we would put in.
Q. And wouldn't you agree that connections such as your indicating -- well, such as between Kane Spring Valley and Coyote Spring Valley are built into models by their authors?
A. Would you repeat that question?
Q. Would you agree that connections such as between Kane Spring Valley and Coyote Spring Valley are built into models by their authors?
A. I would agree. I don't know if you would say that we were guided in how we built our framework model based upon the work of Rick Page and the geologic maps I had available for the area.

MS. PETERSON: This you.
HEARING OFFICER FAIRBANK: Thank you. Next City of North Las Vegas.

CROSS-EXAMINATION
BY MS. SCHROEDER:
Q. Hello. I'm Laura Schroeder. I represent the City of North Las Vegas, and I am just going to ask you for some clarifications.
And in doing that, I'm going to have you look at your slide 40 in comparison to 41, because I'm wanting to understand better how you explained the -- how the water -- the source waters get to those springs. Because when I look at 41 in my simple lawyer way, it looks like it's an easier path than when I'm looking at 40 to get the water there.
That's the one question. Why are we trying the more difficult path? And I'll let -- I'll start with that one.
A. Thank you for giving me one at a time. Yeah, there's a thrust fault to that area that has permanent rocks in the -- up a thrust sheet that extends over a large area in the mountains.
Q. So we're looking at 40?

A. That is correct.
Q. The thrust? Okay.
A. And because of -- there is a cover of other rocks on top of that thrust sheet. So, you don't see it at the surface, but it's likely present at depth. I would say we've got to drill a hole to confirm that. It's consistent with the geology that has been mapped.
The cross-sections that are drawn, you know, one of these sections goes through an area that's a window in that thrust sheet so you see the underlying rocks, the Jurassic and the Crustaceous rocks that are colored in green. So, there's a hole there that the water would have to flow around. The hole in the carbonate thrust sheet, and this section just happens to go through that hole. So, it's the opinion of the geologist, Rick Page, that that thrust sheet is present in other place. There's also mapping by Bill Bohannon that indicates the same thing.
But a thrust sheet is not everywhere continuous. So, it looks more complicated as a result of that. The deeper pathway in carbonates is depicted on the section. Shows it's, you know, more continuous. But, the problem is getting flow through that is because of its great depth, the permeability's low.

And therefore, not much water can move through that pathway, you know, to the fault, and then up that fault. So, I don't believe that the lower carbonates are transmitting a significant amount of water. But that the younger thrust sheet is.
Q. And is that different than your report? Did your report suggest that it went through the carbonate and then this is now your opinion that it goes through that sedimentary layer?
A. Which report are you referring to?
Q. Well, I don't have the page in front me, but I -- my understanding was that the source waters for those springs was the carbonate, but now I think you're telling me it's the sedimentary layer?
A. No. The -- our geochemical report, which was one of the appendices. Talks about water being in contact not only with the carbonates, but also the these younger sediments. Sedimentary rocks that have the gypsum and other type minerals. So, geochemistry is tell us that it's in contact with both.
Q. Okay. So, when -- so, your conclusion then is that the source waters for those springs -- what is that pathway then? What is that flow pathway?
A. It's eastward from the carbonate aquifer that

is beneath California Wash in Garnet Valley, into the upper thrust sheet and flowing towards the east. Along the way it either is in contact with or mixes with water that's been in contact with the younger sediment and rocks. It reenters, if you will, or continues in the carbonate until it reaches the Rogers Springs fault in that area, and then has to go to discharge along that fault line.
Q. Okay. Thank you. I have no other questions. Oh, I do have one.
Another point that I didn't understand. You talk about a lip, and I didn't understand where this lip was. So, is that the thrust? Or where is this lip that is preventing or influencing the flow?
A. What I had said was that in the Buffington Pockets well, which went through carbonate rock, the upper thrust of this upper thrust sheet.
Q. Uh-hum.
A. Into rocks below that. Carbonate's at that location are not saturated. Groundwater is not up this high. So, water's not passing from the carbonate aquifer to the west into that upper thrust sheet or flowing through that upper thrust sheet at that location.

Q. So, do we know any elevations for what that lip would be at?
A. We would know at that location what the elevation of the base of the carbonate thrust sheet is. I don't know that offhand.
Q. Okay. And so would this be then a logical monitoring place for us to look at in terms of further testing?
A. No.
Q. No? I guess I would like to know -- because you did talk about helping us with going into the future or different monitoring places that would be most helpful. What is your opinion about some places that you would suggest the State Engineer look at or that would be helpful?
A. I haven't looked at that. In order to come up with a recommendation like that it'd be necessary to take a much more detailed look at the geologic mapping in that area and look at the elevations of the -- that contact where it's exposed to try to get an idea -- better idea of the geometry of that thrust sheet and come up with locations for it.
MS. SCHROEDER: Thank you, sir.
HEARING OFFICER FAIRBANK: Next is Center for

Biologic Diversity.
MR. DONNELLY: Will you remind me how much time we have?
HEARING OFFICER FAIRBANK: 16 minutes.
MR. DONNELLY: Thank you.

CROSS-EXAMINATION
BY MR. DONNELLY:
Q. Patrick Donnelly, Center for Biological Diversity. Few questions about pumping.
Do you observe that carbonate levels are going up -- carbonate water levels are going up in areas distant from active pumping; is that accurate?
A. It is not only carbonate, but, water levels and other lithologies as well of.
Q. Okay. And you have observed a downward trend on carbonate levels within the the Lower White River Flow System?
A. In almost all areas, yes.
Q. Does this imply that existing pumping is causing declining carbonate aquifer levels in more of wherever you're the closest?
A. That's my interpretation, yes.
Q. And you've observed a downward trend on spring

discharge as well?
A. Yes.
Q. Does this imply that the state of declining water levels will mean continued declines in spring discharge at the status quo pumping level?
A. For at least some time, yes. I can't estimate how long.
Q. Okay. Now, you stated that within 500 years, according to simulations you ran, the system at pumping levels of 14,500-acre-feet per year will not reach equilibrium; is that correct?
A. Those were the results of the simulation. Again, the 1169 pumping test demonstrated that the pressure response is transmit much faster than simulated by the model.
So, in reality it would be some period. It would be faster than what the model simulated, but, I can't tell you when.
Q. The drawdown would be faster?
A. I was trying to say that if equilibrium were to be reached it would occur sooner --
Q. Oh.
A. -- than predicted by the model.
Q. Okay. But it will be hundreds of years most

likely?
A. I don't want to --
Q. That's fine.
A. -- speculate on that.
Q. And your simulations showed that throughout that period of time before reaching equilibrium spring discharge will continue to decline at Rogers and Blue Point and in the Muddy River Springs area?
A. That's what the simulation showed, yes.
Q. You ran your model at 14,500-acre-feet per year, correct?
A. That's correct.
Q. And we just stated just a few minutes ago that current pumping, which is 9318-acre-feet per year, at least from 2015 to 2017 -- although it may be different at this exact moment -- also shows decreases in spring discharge?
A. That's correct.
Q. In your report you deined to provide an estimated number of sustainable yield for reasons you've explained, and instead said that it should be somewhere below 14,500, correct?
A. That is correct.
Q. Given that what we just stated, that current

pumping is showing current decreases at spring discharge. Shouldn't it likely also be below current pumping levels, 9318?
A. I would say that the recent data showed that levels are continuing to decline. That would suggest it ought to be less than the current amount, but, you know, continued monitoring would be prudent.
Q. Indeed. We can all agree to that.
I want to switch tracks a bit.
In your role as a hydrologist, you have had an opportunity to visit many desert springs?
A. I don't know what you mean by many. I have toured the Muddy River Springs area.
Q. Okay.
A. I've been to Rogers and Blue Point Springs. I've been to springs in the Death Valley System.
Q. You've been to a desert spring or two?
A. Yes.
Q. Okay. And have you observed not as a biologist, but just as a observer of desert spring systems wildlife in those springs? For instance, fish, invertebrates, et cetera?
A. I have, yes.
Q. Have you been to Blue Point Spring?

A. I have.
Q. So, in your report you mentioned that Blue Point Spring is home to three endemic springsnails; is that correct?
A. The report says that, that's something that Gary Karst wrote.
Q. Okay. And the report also mentions that one of those snails was recently petitioned for the Endangered Species Act; is that correct?
A. I believe so, yes.
Q. In slide 32 to 33 of your presentation, you have hydrographs for Blue Point and Rogers Springs. I believe I have those numbers correct.
So, I'm wondering if you observe a trend in spring discharge in these springs over the past several years with regard to mean annual discharge, for instance?
A. Rogers Springs, which I think -- it appears that after approximately 2009, discharge rates are lower, but, I'm hesitant to conclude that a discharge has actually decreased. If you look at the period in 2008, there's a rapid decline in discharge that I think is probably not due to actual changes in discharge, but, maybe changes in the discharge system.

I think you're probably familiar with the spring monitoring that took place in the Muddy River Springs area in this year -- through the years with those gages, and there had been -- put up slide 33, which shows Blue Point Spring, and there's a gap in the data, which I understand is during a period of reconstruction of measuring apparatus because of the leakage around that.
So, it does look like things may have -- discharge rates may have gone down, but there are other factors that need to be checked out, and I have not done that.
Q. Okay. But, without assigning causation, we can say that discharge right now is below the historic average?
A. I would say that measurements are.
Q. Measurements. Thank you. Yes. Measuring desert springs is a tricky art perhaps.
In your report you say that reduction or cessation of spring discharge on federal lands would have an adverse impact on sensitive habitat and species; is that correct?
A. I believe the report says that. It sounds like something that Gary Karst wrote.

Q. So, if spring discharge is below historic norms here as you attested just moments ago over the model simulation, spring discharge will continue to decline at Blue Point in spring, based on the piece that you said Mr. Karst wrote, we can expect impacts to biota at Blue Point Spring?
A. I'm not a biologist, and I don't know what the sensitivity of the biota are at discharge. So, I won't answer.
Q. Okay. But, your report does say that reduction of spring discharge would have adverse impact on the species?
A. It does say that. And what it doesn't state, just so that there's clarification, is how much discharge it's anticipating to occur.
Q. Sure. Okay.
MR. DONNELLY: I have no more questions, thank you.
HEARING OFFICER FAIRBANK: Next would be Georgia Pacific, Republic.
MR. HARRISON: No questions.
HEARING OFFICER FAIRBANK: Okay. Same, questions? Muddy Valley Irrigation Company.

CROSS-EXAMINATION
BY MR. KING:
Q. Good afternoon, Dr. Waddell. I'm Steve king. I represent Muddy Valley Irrigation Company.
A. Good afternoon.
Q. Several questions. I believe you testified that you're aware of a published response, Fourth Turn Report's yet to be released noted, USGS. I believe it was titled the Amargosa Tracer Site Report; is that correct?
A. I didn't say that. I don't know that title at all.
Q. I'm just asking the questions from my notes, sir. But associated with Amargosa Tracer Site Report on USGS?
A. What I had talked about was -- and let me ask you a question. Are you referring to the pumping that I was describing that happened in Yucca Flat with PR61 number two?
Q. I don't have an answer for -- let me perhaps ask a better question.
I believe that you stated that you felt that the Fourth reports by the USGS would show a pumping response further west, perhaps to the Amargosa or Ash

Springs area from pumping within the Lower White River Flow System, would that be inaccurate?
A. No. I did discuss pumping that took place during a tracer test at ER61 number two. And that pumping responses were observed in that area extending to the south and then to the southwest. The report that I referred to has not yet received direct approval from USGS. So, I don't know if it will be coming out, but, I assume that it will.
And that work was documenting pressure responses from that pumping extended to the Amargosa tracer site. I did not say that it concluded, that those responses extended to the Ash Meadows area, and it's certainly not from pumping in the Lower White River System.
Q. Very good. In fact, that explanation is the answer to my next question, if you knew or were aware of a possible release date for that report to the public?
A. I do not.
Q. Thank you.
HEARING OFFICER FAIRBANK: Nevada Energy.
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CROSS-EXAMINATION
BY MS. CAVIGLIA:
Q. Good afternoon, Dr. Waddell. My name is Justina Caviglia, and I represent Nevada Energy. I believe you stated that you estimate there's approximately 2500-acre-feet of groundwater that is being discharged to Lake Mead and the Colorado River; is that correct?
A. I don't recall making that statement, no.
Q. Okay. I thought that that's what that stated. Was it groundwater discharge, or was it surface water discharge that is making its way to Lake Mead?
A. I do not think I talked about any amount discharging to Lake Mead. What I did talk about was that in the past decade or so, there were estimates of leakage or recharge into the flow system. And when I asked where that water was going, it wasn't going to the Muddy River Springs area. The response was it's discharging into the Colorado River or to Lake Mead. But I don't recall stating an amount.
Q. Okay. Was there anything in the model that estimated that --
A. No.
Q. -- by chance?

If there was water that was being discharged -- groundwater into that area, could that be captures by pumping without affecting the Muddy River flows?
A. I believe it would be possible to put a well close to the lake and pump it and capture water from the lake. The permeability between the are of Rogers and Blue Point Spring and the lake are fairly low permeability as sediments. There are salt deposits in that area. Which indicates there's not a lot groundwater movement. So, it's pretty low prem, but dry. If you put a well there, I didn't think you'll be capturing water out the carbonate system.
MS. CAVIGLIA: Thank you. I have no further questions.
HEARING OFFICER FAIRBANK: We'll go ahead and open it up to questions from the staff of Division of Water Resources and the State Engineer.
MS. BARNES: Michelle Barnes, for the record.

EXAMINATION
BY MS. BARNES:
Q. I was wondering for the plot shown on slide 37, use to generate this from Appendix A, table three of the report. Do you have the standard deviations for that

data?
A. I'm sorry, do I have what?
Q. The standard deviations from the laboratory analysis?
A. I don't know that I do.
Q. Okay. Then I'm a little unclear on I guess your perception of recharge. You had mentioned at the beginning of your talk that the pest analysis shows -- depending upon the current variable input, that there may be little impact on recharge within a model. But then you talked about changing your Tetra Tech Model to include transient recharge. Can you clarify for me?
A. Yes. What I was -- the point I was trying to make is that typically it is a lot of uncertainty in recharge rates, estimates of recharge rates. And the question that I was trying to answer with respect to that particular model was does that uncertainty effect decisions based on or made from modeling results?
And so, I looked at the sensitivity of modeling results to changing our estimate of recharge rate and found out that the management decisions wouldn't change.
That's a separate question than putting transient recharge into a model to allow you to better

match the observed changes in water levels.
You know, everybody who talks from the hydrographs is talking about this recharge bump 2014, 2005. And without putting a mechanism in the model to allow that to occur in simulations, we really can't match those. And so improve the calibration process to include that mechanism. Those were the changes I was -- one of the changes I was talking about implementing.
MS. BARNS: Thank you.
MS. COOPER: Christie Cooper for the record.

EXAMINATION
BY MS. COOPER:
Q. Just for some clarification on your opinion, do you think that by using more recent total pumpage values -- which I'm not going to throw out a number but would just be less in your simulation -- would that change the outcome of your simulation?
A. I missed part of your question. If we used updated pumping values would that change the output?
Q. Yes.
A. Yes, it would.
Q. Can you elaborate onto how?

A. Well, perhaps I answered to hastily. When we did the simulations that were recorded in our report earlier this year, we updated our pumping rates based upon data on the State Engineer's website. So, those were updated from our 2012 modeling data sets.
So, I should have answered we've already done that. Going forward, if we change the numbers, the pumping, yeah, it would change the results.
But, you bring up a point, that, you know, the simulation or the model at the time we started those three scenarios was based upon lower pumping rate and then that pumping rate was bumped up to the 14, 5.
So, you know, part of that bump-up is why you started seeing -- I mean, I think there are responses that would be occurring regardless of whether we did the increase in discharge rates. But, by increasing that, it increased the amount predicted change.
MS. COOPER: Thank you.

EXAMINATION
BY MR. BENEDICT:
Q. I'm sorry clarify that a little bit further. So, if you were to use pumpage, which I think now is more like 10,000 acre-feet, then the captures also

would be proportionately less?
A. To make sure I understand the question, if instead of using 14, 5 we used something around 10,000?
Q. Yeah.
A. Yes, it would decrease the simulate effect.
MR. BENEDICT: I'm sorry. John Benedict. For the record. I had a couple questions.
Q. So, early on in your discussion you suggested that seasonal responses could be seen in the record and ascribed them as I think to the Muddy River area predominantly, and I just wanted you to elaborate on that. When it -- whether I misheard that, or whether that was during a period of time when most the pumping occurred there. I think you also ascribed it both pumping and ET. So, I want -- do you want to may be talk a little bit about that seasonal response, and it's relationship to pumpage and ET?
A. Okay. To ask for further clarification, I had mentioned looking at discharge records at one of the Muddy River gages. We had went back to about 1910. Is that what your question's about?
Q. I don't that. I think what I heard was I think you suggested that the seasonal responses and water levels in monitoring wells or --

A. Okay.
Q. -- groundwater wells showed seasonality and you seemed to imply that it was vectored towards Muddy River Springs area, but, I may have misinterpreted that. So, I just wanted to get your thoughts on the cause and effect I guess for that seasonal variation, whether it's a function of some specific pumpage within the region or any and all pumping?
A. Okay. I was looking at a hydrograph that went further -- furthest back in time, and I think it was MX-4. And we saw seasonal affects in that well. I did not go see if there was seasonal pumping occurring in Garnet Valley at that time. But because of the proximity to Muddy River Springs area, I guess I would say I interpreted that to be driven by pumping and ET in the Muddy River Springs area. But you raise a good point. If seasonal pumping were occurring in Garnet Valley, that could be an input as well.
Q. Okay. I'm curious -- next to -- kind of shifting gears to Black Mountain area and talking about temperature, as I recall, Blue Point and Rogers are warmer springs; is that correct?
A. That's my understanding, yes.
Q. Could that be used as a tracer to talk about or

describe or maybe refine whether the aquifer system that drive that water was from the deeper carbonate or from a carbonate that's thrusted in there? I don't know exactly what those depths are, but I'm curious about what pathway would cause that water to be what I think is probably warmer than Garnet Valley California Wash water?
A. I have not looked at it, the temperatures in comparison to Garnet, California. It certainly could be useful information. You know, if what you say is correct, that it's warmer than what we see in California and Garnet Valley, that would certainly be something to take a careful look at.
Q. And my last question, in terms of discharge in the Black Mountain area, do you have an opinion on the amount of discharge that exists within that basin? I know we've got discharge measurements on the springs. Do you -- do you or does your model simulate simply that discharge as being another discharge in the Black Mountain area? Or do have you an opinion on that?
A. The model is set up to calculate from the modeling result what the flux is into the lake. But, that calculated number is going to be very dependent upon what the assumed permeability was, sediments and

rocks and near the lake are. And that's an area -- I mean, I would say that's uncertain. We know that the permeability is low enough that we see a barrier effect. In other words, the springs are at the elevation you are because the water can't flow out the base of the carbonate, at least it my interpretation, into the sediments.
And so, we're probably looking at a similar gradient within the sediments and rocks between the fault line and the lake. And it's probably something similar to what the surface to base gradient is. But, I don't think that there is a large volume of water moving in that area. But, you know, the model does calculate it. I just don't know what it is, off my hand.
MR. BENETICT: Thank you.

EXAMINATION
BY MR. SULLIVAN:
Q. Good afternoon, Dr. Waddell. My name's Adam Sullivan.
A. Good afternoon.
Q. I want your concluding recommendations. Is that the State Engineer employ regional model to guide

management decisions that you provided in your slideshow. And you're also really careful to point out the appropriate uses and limitations of a model. And in your testimony you generally put a lot of weight on the actual data over model simulations.
So, my question is, given the amount of hydrologic and geologic data that we have for this region that continues to be collected, could you expand on that recommendation, or explain why what you think a model would give us, how that would improve our understanding of the system?
A. Excuse me -- I'd be glad to.
First, the statement that was part of my presentation. The use of a model was the Tetra Tech 2012 model as it currently stands, that clearly needs some additional work to improve it based upon -- I mean, what we learned through the Order 1169 test, as well as just a -- modelers, or at least modelers I respect always have an uneasy feeling. You know, are we good enough at this point, and even when I was doing -- you know, finishing up that model I was like this could be improved. We knew that from our calibration.
But, I think that additional work can improve

the calibration. We've gotten good comments from reviewers. We've learned a lot in terms of data. The -- what the data can't tell you without having a calculation tool is what's going to happen longer term. It tells you what's happening now. It helps you set the framework for constraining the model. But, if we're making predictions with it, we'd be done in the context of not obeying, say, throughout the domain that you're interested in, mass balance constraints versus law, these types of things the model does provide to you. So, I do think that models are -- can be quite useful for, you know, helping guide management decisions. But, they have to be a model that it -- it has to be a model that you're comfortable with its performance, that it's a good representation of the system, that it matches observations better than my existing model does.
There will be uncertainty in the model. I mean, we cannot know everything. And if you're trying to make management decisions based upon your existing database, you're going to be making errors in that as well. Because you can't know everything.
But, the model puts it in the construct that obeys the flow loss, which are important constraints.

It also tells you what you don't know, and it gives you a tool that you can look at the affects of not knowing things that -- otherwise, we're just looking at data, my gut tells me this or my gut, you know? It's a tool. Not to be, you know, viewed as a tool. They can be very useful.

MR. SULLIVAN: Thank you.

HEARING OFFICER FAIRBANK: Okay. So, we've been going for close to two hours, so, let's go ahead and take a break, and we'll reconvene at 3:00. And we'll open it up for some additional questions by participants. Thank you.

(Recess.)

HEARING OFFICER FAIRBANK: Let's go ahead and go back on the record. All right.

All right. So, what we're going to go ahead and is we'll open it back up for additional questions by the participants, and we're going to go ahead and give everyone seven minutes. Get my chair situated so I can keep track.

All right. And we'll go ahead and start again, back with Coyote Spring Investments.

MR. HERREMA: Thank you.

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RECROSS EXAMINATION
BY MR. HERREMA:

Q. Brad Herrema for CSI. Dr. Waddell, just a few more questions.

First, do you recall during your exchange with Mr. Donnelly, you've indicated that something he quoted sounded like something that Gary Karst wrote?

A. I remember -- excuse me.

Q. You responded a couple times I think. Okay? Do you recall which particular documents or writings Mr. Donnelly was referring to?

A. I don't remember exactly what he was saying, but, I think it was probably our report prediction if effects of changing special distribution pumping in the Lower White River Flow System.

Q. Who is Gary Karst?

A. Gary Karst is an employee of the National Park Service who is stationed in Las Vegas and has been working for the Park Service. So, these particular questions.

Q. And which particular portions of this report did he write?

A. Sorry to be eating up your time.

He wrote it looks like a large part of section

1.0, and at least parts of section 1.1, the setting. Looks like he wrote section 1.2. Or at least parts of it. And then section 3.2.

Q. Okay. So is the work in those sections, are those your conclusions or are they Mr. Karst's conclusions?

A. Those are my conclusions.

Q. But, Mr. Karst did them for you?

A. I answered on top of you.

Q. Whose work is this? I'm sorry. Go ahead.

A. I was going to say would you restate your question?

Q. What's written in those particular sections, section 1.0, 1.1, 1.2, 3.2 of your July 3rd, 2019, report, are those sections your conclusions or Mr. Karst's conclusions?

A. I don't know if I would classify those as conclusions as opposed to statements, kind of setting the background. They don't appear to be conclusions from the work that I did.

Q. Okay. In regard to the recharge from Sheep Range, have you done any analysis of that recharge? Recharge from the Sheep Range to the Coyote Spring Valley?

A. We did back in -- in support of the 2012 model, but, we did not revist those estimates.

Q. So, you haven't done any work on Sheep Range recharge since 2012 or earlier?

A. We have not.

Q. Okay. In response to a question from Mr. Taggart, you indicated that groundwater pumping in the Lower White River Flow System captures Muddy River flow. Do you recall that?

A. Yes.

Q. What is the mechanism for that capture? Does the pumping pull water out of the river toward the wells?

A. It lowers the water level in the groundwater system beneath the river or adjacent to the river which pulls water from the river. It doesn't pull it to the well. It's, you know, contributing to the pumping, but, it reduces the flow in the river.

Q. Changes the gradient between the groundwater and the river?

A. That's correct.

Q. Okay. Groundwater pumping affects other discharges from the lower labor of closest to them besides river flow; isn't that correct? Such as

evapotranspiration?
A. Yes.
Q. And even groundwater subflow?
A. It will effect groundwater subflow, yes.
Q. If I could turn your attention to slide 54? Where is the station -- the weather stations located from which this data comes from?
A. I don't know where the station or stations are. These are data downloaded from the website.
Q. Do you know which website?
A. It's listed at the bottom. Western Regional Climate Center, 2015, and there's a link at the right end.
Q. Is this data specific to the Lower White River Flow System?
A. No.
Q. You don't know exactly where it's specific to?
A. I do not.
MR. HERREMA: Thank you.
HEARING OFFICER FAIRBANK: Thank you. United States Fish and Wildlife Service. And the Moapa --
MS. BALDWIN: Tribe.
RECROSS EXAMINATION
BY MS. BALDWIN:

Q. Hello, again.
A. Hello.
Q. Since we're on this slide, which is slide 54, I do have a question about this one, as well.
This -- if I'm not mistaken this graph is taken from the USGS PowerPoint that was Appendix A to your rebuttal?
A. That's correct.
Q. And it was entitled, "What Drought? Water levels on the rise in Southern Nevada."?
A. That's correct.
Q. Okay.
Is it correct that when the USGS produced this chart, it was in the context of trying to define a steady state for the Death Valley Flow System?
A. No, I don't believe it was.
Q. I'm looking -- unfortunately, the Appendix does not have page numbers, but, I'm looking at a slide entitled, "How do we define steady state?" Then it says, "Steady State. Water levels do not change over a period of time. What is that period of time? DVRFS" -- which is Death Valley -- "Assume steady state is on a century scale." And then it appears to reproduce that same chart; would you agree?

A. That's the same presentation, yes.
Q. Yes, okay. Do you have any opinions on whether there's a similar century scale steady state in the Lower White River Flow System?
A. I think the first question is, is there a century steady state?
Q. Yes.
A. The -- provide more information on your first question about was this done to develop a steady state model. This was done to develop -- help in the development of the transient model of what's called DV3 or Death Valley three. And the concept is that there is an approximate steady state. It's not absolute. You know, you're trying to develop a model which has a good representation of average conditions, predevelopment, and to use that for doing transient calibration simulations from that point on. And there's a process of going back and forth between calibrating the -- and quote "steady state" in transient.
Q. So, these are -- it's an approximation, and therefore, up for debate, subject to new information?
A. Certainly.
Q. Do you have any opinion on whether groundwater

levels could be responding to previous climate variability in that there's some sort of time lag between when the hydrographs respond to wet conditions and dry conditions?
A. Oh, I think there is. That was the reason I started off by describing what was going on up there near Mesa, which is known to be a new charge area and showing the quick response that occur there. And then moving to other areas that have slower responses, and it's due to the time it takes for things to work their way through the system.
A part of the recharge model -- we haven't talked about SeriesSEE today. Thank you.
Q. And we're not going to.
A. Good. There is a recharge capability within SeriesSEE that has two components to it. One of those is the response to wet precipitation that you can put in. And then the other is a long-term drainage from the system, such as from springs that are a long distance away from the recharge areas. And so, the concept is that the -- or the simplification is that the discharge in the spring areas doesn't change quickly to changes in what goes on in the recharge area.

Q. I think I have at least one other question.
Do you agree that a decline in water levels is not necessarily drawdown?
A. It certainly can be other causes, yes.
Q. And in your opinion, what would water level trends look like in the Lower White River Flow System in the absence of pumping?
A. I think water levels would be rising.
Q. Why?
A. Because there's been a change from drier conditions to wetter conditions, and the system will respond to that.
Q. Okay. I'm looking now at slide 74, where you talk about the effect of moving water rights between alluvial and carbonate wells.
You propose that areas should demonstrate that they are -- there should be a demonstration in an area is not connected with the Muddy River Springs area prior to permitting long-term use of the water. That's per -- that's an accurate statement of your opinion? It's the second bullet point.
A. Just for you reading to make it short. I wrote it the way I intended to, yes.
Q. What kind of test -- what would that test look

like and what kind of result would you expect to see to demonstrate no connection?
A. What I would recommend is that there be a pumping test that has a different pumping schedule than the seasonal pumping schedule that occurs elsewhere so that you have a separate signal to detect. That there be good monitoring in the vicinity of the pump well, certainly between the area of the well and the well-connected parts of Coyote Spring Valley. If your talking Coyote Spring Valley.
And if the -- if that pumping shows a quick response in those monitoring wells in areas that are well-connected, you basically established that there is connection, and you can terminate the test and expense associated with that.
Otherwise, if it takes -- you know, in talking about in terms of several months, I think what Braumiller had suggested was a several month long test. Once you see a responses in areas that you know are connected, you basically got information that you need. But, additional testing would be required. Longer term pumping would be required if the response isn't seen until you're satisfied that it's not connected. There may be, you know, three or so. Kind of thing that a

calibrated flow model would help you answer.
MS. BALDWIN: Thank you.
HEARING OFFICER FAIRBANK: Southern Nevada Water Authority, Las Vegas Valley Water District.

RECROSS EXAMINATION
BY MR. TAGGART:
Q. Good afternoon.
A. Good afternoon.
Q. We're getting there. Just a couple of follow up questions.
And your model simulated 14,000-acre-feet of pumping. Some questions were presented to you about what if your model had simulated pumping at levels that are more like what's occurring now as opposed to what was occurring during the pump test. And I -- and so my question is, even at lower pumping volumes -- and I think the hypothetical was 14,000 instead of that being 10,000 -- there would still be captured stream flow from -- demonstrated in your model; is that a air statement?
A. Yes.
Q. And the -- and the bulk of that pumping would be capturing Muddy River stream flow?

A. I'd have to look at how much of the model simulated stream flow versus ET.
Q. Uh-hum.
A. So, I would know.
Q. Okay. Oh, I didn't mean --
A. I can't answer.
Q. But in the long term -- and in the long term, would your answer be different, like at equilibrium? Strike that. And I do that because I don't have a lot of time.
So, could you go to slide number 56?
Okay. And your last two bullets there indicate the conditions at a new equilibrium condition or before a new equilibrium condition. And so, is it -- is it your testimony that currently we are not in an equilibrium condition, and therefore, the last bullet on your slide here is the condition we're in?
A. No. The last bullet is intended to address the situation where new equilibrium can't be obtained.
Q. Okay.
A. So, that, you know, your rate of capture isn't sufficient to sustain the pumping.
Q. Okay.
A. So, eventually it will stop capture.

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Q. Okay. But the bullet before that, at an equilibrium condition, all pumping would be capturing discharge with an equal relationship. Every drop of pumping would be capturing river flow at equilibrium?
A. I would say not -- you asked a similar question before. Not -- I can't say every drop because you're going to be increasing flow into the system through the boundaries, and part of what you're capturing is ET. But, it's primarily going to be capturing ET and stream flow.
Q. Okay. Now, if you could look in the -- at the bind I put on your dais there. And this is from SNWA Exhibit 9, the 2000 SNWA rebuttal report. And there's a figure 3-3 there. And I want to ask you a few questions about that.
During your testimony you talked about the current trends in water levels, and my question is going to be whether this information here is consistent with your own view.
So, in the top panel is CSDM1, which is Coyote Spring Valley Monitoring Well Number 1. And you see on the right-hand side there, there's a -- there's a trendline.
A. Yes.

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Q. Is that trendline consistent with what you found in Coyote Spring Valley at monitor wells as well?
A. I would say, yes.
Q. Okay. And I don't want to test you here, but, is it generally your testimony that in Coyote Spring Valley, Garnet Valley, which is shown in the second panel, and then below that California Wash, that this is the type of declining trend we're seeing currently in water levels in those three areas?
A. Yes.
Q. Okay. Now, what I'd look you to look at is, is there's a single piece of paper there that I've given to you which is SNWA Exhibit 81. Do you see that?
A. I do.
Q. Have you -- have you reviewed hydrograph of EH-4 at all in preparation for your testimony?
A. Yes.
Q. Okay. So at the -- and EH-4 is -- is it fair to say it's a monitor well that monitors water levels close to the Warm Spring West area and is sometimes used by folks as an index well for changes to stream flow related to changes in water level?
A. I agree.
Q. Okay. So, what I -- what I want to ask you

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about is, is the trend, the current trend in EH-4 and given your testimony, would you be expecting based on precipitation trends for water levels to -- if that was the exclusive factor, water levels would be rising, currently, right? And when I ask you that, you can look at the second panel from the bottom, which shows precipitation. Shows in 2017 a little bit more than a 70 percent of the average. In 2019 a major -- or not a major. I'll just say a 150 percent precip events. Would you normally expect those kind of precipitation events to effect a hydrograph?
A. I don't know if they're sufficient in magnitude to effect it. My concept of recharge is similar to Tim Mayer's. It takes a certain amount of water to match the other needs for the soil, and that until you overcome that, you're not going to get a recharge.
Q. Okay.
A. That's general sense.
Q. Do you have any reason to believe that the declining trend you saw in other areas of the Lower Flow System is not also occurring at EH-4?
A. I have no reason to believe that.
Q. So, the same. You think your opinion -- you're viewing the same condition as -- existing at EH-4 as

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the rest of the area?
A. That's correct.
Q. All right. Now, there was some questions about modeling, and I appreciate you're -- you are a modeler and modelers love to model. The -- but, the question that I have for you is, at this time, do you think there's sufficient empirical data at hand for the State Engineer to use to limit permanent other water uses at this time instead of waiting for a new calibrated groundwater model? Do you understand my question?
A. I understand your question.
Q. Well, I'm -- and I just -- sometimes we feel constrained to wait for more tools to make decisions. But, given that we had a pump test 1169 pump being tested 1169, and all the talk about all this evidence, is that sufficient evidence for the State Engineer to use to make decisions?
A. Well, I think it is. The reason I was hesitating is it depends on what the nature of that decision is.
If it is to not allow additional pumping, I think the information is sufficient. If it's to decide upon a rate at a lower rate that would be a safe yield, I don't think it is sufficient.

Q. Okay.
A. Depends what the answer is, the question you are trying to answer.
Q. All right. Thank you very much.
HEARING OFFICER FAIRBANK: Moapa Valley Water District.
RECROSS EXAMINATION
BY MR. MORRISON:
Q. Good afternoon, Dr. Waddell. I'm Greg Morison with Moapa Valley Water District. I know it's the end of what's certainly been a very long day, so I have what I think are just a couple of softballs for you. We'll see.
A little bit earlier in your cross-examination you were asked by Ms. Peterson from Lincoln/Vidler about Ruling 5712. Do you recall that interaction?
A. I do.
Q. I just want to follow up a little bit on that. In your recollection of Ruling 5712, do you remember whether the State Engineer found evidence of a hydrologic connection between Kane Springs Valley and Coyote Springs Valley?
A. That's my recollection, yes.
Q. If I told you that the exact words were that

evidence indicates a strong hydrologic connection, would you have any reason to doubt that those are accurate words?
A. No.
Q. All right.
In the bi-op, Fish and Wildlife Services --
A. Let me --
Q. Sorry.
A. His definition of hydrologic connection or strong might be different than mine. But, it's my belief, my interpretation that there is a hydrologic connection. You know, I think there's connections and not the strong connection I showed for other wells. Strong isn't the word I used. But.
Q. Okay. Thanks.
On the bi-op that led up to Rule 5712, Didn't that bi-op evaluate a thousand acre-feet of pumping; is that accurate?
A. I don't recall.
Q. Okay. Did you know if any further biological opinions have been requested or issued regarding Lincoln/Vidler applications or Kane Springs Valley pumping?
A. No, I do not.

MR. MORRISON: All right. That's all I have. Thank you.
HEARING OFFICER FAIRBANK: Vidler Water.

RECROSS-EXAMINATION
BY MS. PETERSON:
Q. Hi, Dr. Waddell. Just a couple.
Do you recall the -- sorry. Karen Peterson representing Lincoln County Water District and Vidler Water Company.
We had a discussion with regard to slide 23 about drawdown and recovery. Do you remember that?
A. Yes.
Q. And you referenced Mr. Leake in I believe a paper that he had prepared?
A. I remember that. I messed up my presentation +though, so.
Q. Yeah, we don't need the slide?
A. Okay.
Q. I'm just asking you if you remember that. Do you -- we can't find reference. So, were wondering if you could provide some more information about that? Like the paper, or the journal?
A. It was a USGS publication. And I would have to

search for a reference for you, but, I'd be happy to do that.
Q. Okay. And then I'm just trying to understand the drought position I guess of the Park Service.
And would you agree that the Bureau of Reclamation has repeatedly stated that we are in the 20th year of the largest drought in history? Would you agree with that?
A. Have no reason to dispute it. I don't know what they've said.
Q. You didn't know what they say. Are you aware that water purveyors, local governments, SNWA, they're all preparing drought contingency plans?
A. I was not aware of that, but, it doesn't surprise me.
Q. Okay.
MS. PETERSON: I don't have any other further questions. Thank you.
HEARING OFFICER FAIRBANK: Thank you.
City of North Las Vegas.
MS. SCHROEDER: No more questions.
HEARING OFFICER FAIRBANK: Okay. No further questions.
Center for Biological Diversity. No additional

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questions.
Georgia Pacific. Thank you. No additional questions.
Muddy Valley Irrigation Company?
MR. KING: No questions.
HEARING OFFICER FAIRBANK: So being no additional questions, Nevada Energy, see no additional questions.
Okay. Then at this point I'll go ahead and open it back up to the State Engineer staff if there's any additional questions. All right.
All right. So we'll go ahead and open it back up just for few extra minutes for other participants. If they haven't any additional questions, I'll go ahead and go back to Coyote Spring Investments. Did you guys have any additional questions?
MR. HERREMA: Not at this time.
HEARING OFFICER FAIRBANK: Not at this time.
And the Tribe, do you have any additional questions at this time?
MS. BALDWIN: No.
HEARING OFFICER FAIRBANK: Southern Nevada Water Authority, do you have any additional questions?
MR. TAGGERT: No.

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HEARING OFFICER FAIRBANK: Maybe I'm going to just make this easy. Does anybody have any additional questions?
All right. Nobody's jumping up, so we're going to go ahead and conclude today's hearing. Thank you very much for everyone. All right. We will see you tomorrow morning.

(3:35 p.m. conclusion.)

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CERTIFICATE

STATE OF NEVADA)
)SS.
CARSON CITY)

I, Kathy Terhune, CCR 209, do hereby certify that I reported the foregoing proceedings; that the same is a true and correct rough draft as reflected by my original machine shorthand notes taken at said time and place, Pages 599-693.

Dated at Carson City, Nevada, this 26th day of September, 2019.

____
CCR #209

SE ROA 53241

JA_17638

In The Matter Of:

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES

Vol. IV
September 26, 2019

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STATE OF NEVADA
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
BEFORE MICHELINE N. FAIRBANK, HEARING OFFICER

IN THE MATTER OF THE ADMINISTRATION AND MANAGEMENT OF THE LOWER WHITE RIVER FLOW SYSTEM WITHIN COYOTE SPRING VALLEY HYDROGRAPHIC BASIN (210), A PORTION OF BLACK MOUNTAINS AREA HYDROGRAPHIC BASIN (215), GARNET VALLEY HYDROGRAPHIC BASIN (216), HIDDEN VALLEY HYDROGRAPHIC BASIN (217), CALIFORNIA WASH HYDROGRAPHIC BASIN (218), AND MUDDY RIVER SPRINGS AREA (AKA UPPER MOAPA VALLEY HYDROGRAPHIC BASIN (219).
_______________________________________/

TRANSCRIPT OF PROCEEDINGS

PUBLIC HEARING

HEARING ON ORDER 1303

VOLUME IV, A.M. SESSION
(Pages 694-830)
THURSDAY, SEPTEMBER 26, 2019

Reported by: Michel Loomis, RPR

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Deputy State Engineer

Melissa Flatley,
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For National Park Service: Karen Glasgow

For Center for Biologic Diversity: Patrick Donnelly

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CARSON CITY, NV, THURSDAY, SEPTEMBER 26, 2019, A.M. SESSION

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HEARING OFFICER FAIRBANK: Good morning. This is a continuation of the hearing in the matter of a Lower White River Flow System Order 1303 proceedings. And so today, we're going to go ahead and hear from the Moapa Band of Paiute Indians. And we might have additional -- more time for cross-examination today based upon conversations I've had with the Tribal representative.

So once we get through the initial presentation by the Tribe, then we'll go ahead and make a determination of how much time to assign, and then we'll go from there.

And so I'll go ahead and let you guys start in, Ms. Baldwin.

MS. BALDWIN: Thank you, Mr. King, Ms. Fairbank, Ms. Flatley, the Division of Water Resources staff. My name is Beth Baldwin. I'm an attorney for the Moapa Band of Paiutes. With me is Debbie Leonard, our local counsel.

Before we put Dr. Johnson on to testify today, we have two things that we want to put into the record.

The first is a general objection to the State Engineer's authority to engage in the proceedings based on the absence of an express legislative direction. The only

statutory provision cited authorizing Order 1303 is Nevada Revised Statute 533.024, which is a legislative declaration of policy to conjunctively manage the waters of the State.

It does not expressly authorize the State Engineer to manage distinct basins is one, and secondly, even if that does provide statutory authority, this proceeding is an ad hoc rule making in the absence of any regulations regarding conjunctive management in multiple hydrographic basins that until now, were managed as the State, therefore, it's arbitrary and capricious. We just want to make this objection known on the record. Thank you.

Secondly, the Tribe chose not to put on any witnesses as to policy matters because we understood those to be outside of the scope of this proceeding. We only have a technical expert. But we understand that other parties may be putting on witnesses describing the extent of their water rights or hypothetical interference with their water rights.

So for that, we'd like to just point out three things for the record:

The Tribe possesses federally reserved rights to surface and groundwater appurtenant to the original 1,000-acre reservation with an 1873 priority date and groundwater rights to the 70,000-acre expansion with a 1980 priority date.

Those rights are an asset held in trust by the

United States for the benefit of the Tribe, and the United States has a money mandating responsibility to manage those rights for the Tribe's benefit.

Those rights are unadjudicated and unquantified as of yet, but the Tribe has the right to invoke those rights and ask that they be adjudicated in Nevada State Court.

The Tribe leases 3,700-acre-feet annually of Muddy River surface water from the Muddy Valley Irrigation Company, and those rights are contractually senior to all other Muddy Valley Irrigation Company rights per the 2006 lease, which is Nevada State Engineer's Exhibit Number 242.

And one housekeeping matter. I brought about 30 copies, paper copies of the PowerPoint presentation. That's probably enough for every party, but maybe not every person. So if someone didn't get one, if you could share with your neighbors, that would be appreciated.

And now I'll stop talking and let Dr. Cady Johnson, the Tribe's hydrogeologist begin.

HEARING OFFICER FAIRBANK: And before you start speaking, Mr. Johnson, let's go ahead and have you sworn in.

DR. CADY JOHNSON,
called as a witness in this matter,
having been first duly sworn,
testified as follows:

DIRECT EXAMINATION
BY MS. BALDWIN:

Q. Dr. Johnson, can you spell you name -- say your name and spell it for the record, please?
A. Cady Johnson, C-A-D-Y --
Q. And turn your microphone on?
A. Thank you. C-A-D-Y, Johnson, J-O-H-N-S-O-N.
Q. And are you currently employed as a hydrogeologist?
A. I'm an associate with Mifflin and Associates, practicing as a hydrogeologist, self employed.
Q. How long have you been working in this field?
A. 47 years.
Q. How long have you been focusing on the hydrogeology of southern Nevada?
A. 47 years.
Q. We've already presented Dr. Johnson's CV as MBOP Exhibit 1. So I believe it's already in the record. What were you asked to do for this proceeding?
A. Quite specifically, offer our analysis of the most appropriate boundaries, administrative boundaries for the -- what's presently designated the Lower White River Flow System. Try to estimate the flux through that system. Address issues related to transfers of water rights from

alluvial locations in the MRSA, in the Muddy River Springs area, to presumably someplace more remote and in the carbonate rock, completed in carbonate rock. And then there was an offer to raise any other issues that we felt were legitimate and related to this topic.
Q. And you formed opinions as to all these matters?
A. Of varying certainty, yes.
Q. Did you author any reports containing those opinions?
A. Many.
Q. Specifically, the two reports that were submitted to the State Engineer's office?
A. Yes. There was an Order 1303, I think we filed it with the original report and then there was also -- after we reviewed the other participants submittals, there was a rebuttal report.
Q. And those reports are your own work?
A. They are in consultation with Martin Mifflin.
Q. And they accurately reflects the opinions you're going to offer today?
A. They do. They do.
Q. And you intend to allow yourself be cross-examined by the other parties present?
A. Actually I'd like to keep the direct as brief as

possible and do most of our information exchange during cross. I prefer to take questions that matter to the other participants than try to anticipate those.
MS. BALDWIN: Okay. Thank you. We would like to offer MBOP Exhibit Numbers 2 and 3, which are Dr. Johnson's report into the record.
HEARING OFFICER FAIRBANK: Those shall be admitted.
MS. BALDWIN: Thank you.
(Exhibit 2 admitted into evidence.)
(Exhibit 3 admitted into evidence.)
BY MS. BALDWIN:
Q. Dr. Johnson, if you want to just go ahead and start giving your presentation and I'll interrupt you with questions as they arise.
A. Thank you. I'll start with just touching on our model we developed. This was -- and we'll lead from this to why we did this.
We built a finite element model in two weeks with a demonstration version, I mean, fully capable demonstration version of the de-flow code. And what we were able to accomplish is two weeks is part of the record, I don't have the number there, but the actual binary model is available for anyone who's licensed for de-flow.

And as you'll see or may have seen if you read the reports, there's a lot we could -- a lot more we could do with the model.
But just briefly, at this point, I'd just like to say that we -- what enabled this, what enabled this is a conversation I had with Andrew Burns --
HEARING OFFICER FAIRBANK: Mr. Mifflin, if I can just remind you to speak in the microphone --
DR. JOHNSON: -- oh, I'm very-- I'm very sorry --
HEARING OFFICER FAIRBANK: -- so everyone else --
DR. JOHNSON: -- I was looking at Colby because she was present at the conversation.
I've always thought, in thinking about the Las Vegas Valley, that all that water can't be coming from the Spring Mountains. There's just -- on one end, not enough high terrain up there. And underlying the carbonates in the high terrain is Aztec sandstone, which you can see from Las Vegas, the beautiful red cliffs up there in Red Rock.
And that Aztec sandstone is a heck of a difficult environment to get a groundwater supply out of. And Dr. Mifflin worked on it a lot, I've worked on it some, trying to get a water supply in a Valley of Fire, and it's not a very satisfying place to get somebody a potable water supply.
But anyway, I don't want to get distracted. All

I want to show here is the way this model, you can present model results in a number of ways. Most of -- or I would say all of what we've seen in the past three days has been potentiometric surfaces or contours, potentiometric maps.
You can also present the groundwater flow field as stream lines and -- in a steady state in a steady field. It -- let's just leave it at that.
So we built a steady state model based on Andrew Burns' comment to me that they're pumping between 70 and 80,000-acre-feet per year in Las Vegas Valley, reinjecting about 15, and so that gives me a nominal 60,000-acre-feet to start with.
Q. And, Dr. Johnson, when you say "they" and refer to Mr. Burns, can you explain who that -- who you're talking about?
A. Well, I had a certain conversation -- I made -- I made a -- in our first 1303 meeting, I made a comment and Colby objected regarding Las Vegas Valley and its relevance to this topic.
And I was asking for a -- I felt they should do a full-blown analysis, water balance analysis within Las Vegas Valley to see how closely the system has reached a new steady state, you know, how would you characterize that.
How much water is really being produced and what

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does that mean in relation to the 25,000-acre-feet that Malberg estimated back in the '60's as the sustainable yield.

So something's not making sense. You got a lot more water coming out of Las Vegas than the estimated perennial yield by Malberg and where is all that water coming from?

You know, it's been how many years since the pipeline, '46 or '7, and the temporary permits were revoked. And we've had nearly half a century for those water levels in Las Vegas Valley to reach new equilibrium, and that's clearly the goal is to stop the drawdown in Las Vegas Valley.

So whether it's really happening or not, I don't think anybody could argue that in Las Vegas, the runaway decline's been arrested. But without an analysis, all I have is a number from the expert, a rough number, and I don't know -- I don't know if it includes what the big hotels are pumping, what Nellis Airforce Base, what the Airforce is pumping, and any miscellaneous small, but senior rights.

So I don't know the total from Las Vegas Valley. But based on what Dr. Burns told me, I went ahead and started the model with a sync -- with a 60,000-acre foot feeder strength in Las Vegas Valley and through the calibration process, which was both the water levels and temperatures.

Now, this is the -- how a model differs. It's a

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model of anisotropic system, and surprisingly, we've been here for three days, and the word "anisotropy" has not been mentioned. It was mentioned that the Theis equation needs an anisotropic aquifer on these anisotropic ya da, ya da, ya da, perfectly confined, but nobody's mentioned the anisotropy. We've mentioned faults and the anisotropy they create at a larger scale, but the word wasn't mentioned. I'm just amazed.

So we're taking a regional approach. This shot is just about the southern third of our model, which we -- I mean let me get off the slide so I don't run out of time. Okay. Let me go back and do this better because I'm going to -- first slides are for history.

Basically we present our model results that's calibrated in terms of temperatures at Tule Springs and an assumed one degree Celsius temperature of the recharge. Okay. So -- and we're solving for the temperature at the springs, all right, at Tule Springs. So -- and the way we're doing this is we're taking heat from the Eureka low.

Now, that's another thing, I was shocked I haven't heard in the last three days, especially yesterday with all the Nevada test site experience that was referenced. Has the -- has somebody else solved the problem of the Eureka low? The Eureka low is a heat flow deficit in the central great basin and it's always been assumed to be due to flowing

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groundwater. But our question is, where does that water go?

There was some preliminary attempts by John Sass. We have one of those exhibits, preliminary interpretation of the Eureka low. The Yucca Mountain people care, the Eureka isolation people care because it's a tracer. It's a tracer and they're really interested in groundwater travel time. In fact, the early regulations restrict -- they put a numerical limit on the groundwater travel time for a nuclear waste site.

But anyway, we see two flow fields indicated here and the red one on the left includes Pahranagat Valley, just kind of -- or Pahranagat Springs, Pahranagat discharge area, it's kind of nested in this much larger flow field through Las Vegas Valley. And these flow lines over here ought to make the lake (ph.) isolation people really unhappy if there's any related to that.

There's a -- there's another flow field indicated that feeds the MRSA, and I didn't include the slide. It's in the report. But this -- these -- this area needs to be turned off of the model. The model domain has line segment boundaries just because of the way the meshing works, and like I said, I only had two weeks. So this is what you get for two weeks of work.

And whoever can afford free flow and load it in a model, the first thing you want to do is cut off the flow of

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the mountains and some of this stuff over here. And I've got an illustration with how we clean that up. And there were other things to clean up. So here we have, apparently, a hydrodynamic life. I mean, this is a -- it's a two-dimensional system, it's one layer, constant transmissivity, 10 to 1 anisotropy ratio. In other words, transmissivity north/south is ten times as great as the transmissivity east/west, not exactly, no.

Q. So --

A. Transmissivity in the primary, in the most transmissive direction in any element is ten times the transmissivity normal to that.

Q. Dr. Johnson, I'm sorry to interrupt you. But when you're talking about the hydrodynamic divide, for the record and for people who can't see your pointer, you're referring to those blue dots?

A. Thank you.

Q. That run down the middle?

A. Yes. I should have spoken while I was pointing. There's a series of blue dots dividing the red streamlines from the yellow streamlines, and that is a hydrodynamic divide.

And the red dot is where there were numerical difficulties in the model, but one of the goals was just to

see if we could get a numerical solution.
I mean, I was amazed that the model solved with realistic -- how should I say realistic? Everything in this model was assumed. On cross, don't ask me what we assumed because we assumed everything.
We assumed the transmissivity, we assumed the anisotropy angles, we assumed the thickness. We assumed the amount of heat going into the aquifer under the water, and I'm not sure if that was correct.
I didn't have a way to figure out, do you apply the heat just to the water, to the aquifer or both? Where do you apply the heat? The Eureka low is ill defined and we've got a couple of slides later and in the report, you can see.
But without knowing what -- how much heat is really being lost, see, you have to know how much is coming in from the bottom, which is probably the order of 80 to 90 milliwatts per square meter, but we don't know. We don't know.
So anyway, I'd like to get off this, but what you -- off this particular slide. But this is the defined element model and we'd love to keep working with it. It's a joy to work with. You can couple geochemical codes, you can couple FREAK, which means you'd be doing a nonlinear iterative solution for the geochemistry in every element. Now, there

are about 49,000 elements here on this one.
But it's doable. I mean, this model solves in five seconds. So it's not like a big complex model with a framework that you don't want to touch. We can fix this or add a layer below it or, you know. These days now, we can make a good mesh.
Now, this is the first finite element I've ever built on my own, only because, you know, I've studied finite elements for 30 years, taken courses and things, but they never give you a good meshed area, so you can't apply it.
Q. Dr. Johnson, did you make -- and I don't know the exact term, but did you make the code or the file that you used to generate your model available to the other stakeholders in this proceeding?
A. Yes, it's binary. All you can see is the first line that identifies it as a feed flow file. Apparently the binary file has a first line of text when I tried to look at it. But it'll load right into a feed flow, and this is what you'll have.
Q. And to your knowledge, do you know if anyone else has attempted to work with your model or build upon it?
A. I really hoped Tim Durbin would be here because he would -- he would have.
Okay. Yeah, so we calibrated temperatures to --

and heads. We calibrated heads between Tule Springs and we'll have them on another slide. The Steptoe is next up off this map to the north.
Just catch me on cross with this, I've got to get off this slide. We talked about a little history. We don't like cumulative rain averages or that kind of thing either. But Eakin did it, Maxey did it.
And just for history, I just want to show, and I'm going to point at two features of this graphic that's from Eakin 1964 where he noted that at the weather station at or about up in White River Valley, he had some wet years in the '40's and then the Muddy River seemed to peak in around 1960.
Well, Maxey comes along two years later, trying to get the water supply for Nevada Power and he got a couple more years of data. And he -- and the same data that Eakin used, and he, again, make this suggestion that it looks like maybe you've got a 15- to 20-year lag between your wet years and your response in the river.
Well, that was -- just keep that in mind. As we look through this and for our whole professional careers, we've known about this. What is the lag? We're talking about a regional system and I think the argument today is whether it's centuries like the Water Authority has asserted in their DDC work and accepted by you in your rulings, or is it decades

like we'll try to convince you today with bringing in additional lines of evidence.
So we'll get to that. But first, I'd like to show a slide of tree ring data. And this is from Salzer, from -- he's at the University of Arizona. These are proxy temperatures and there was a comment made and this is a really important point. There was a point made that why use proxy data if you can do the real thing? In other words, why use a river base flow when you can measure the rain?
And the answer is the rain is proxy data. We're talking about recharge. So is the snow pack. So we -- and so that's one point. This is all proxy data. And the other point is if you want to extend the instrumental record, now we're open to the idea that these groundwater travel times could be centuries.
How do you -- what's diasostic? But what we do -- and so if you want to extend the instrumental record, say, of temperatures, I don't know what it is, a couple hundred years at the most before we had good thermometers and record keeping, the tree rings were as good as a thermometer for what's going at the tree line.
So we use and value and cherish proxy data like this. It's these -- and I'm going to point at the warming since the industrial revolution. You know, you talk about the

anthropogenic or climate or driven climate signal, I'm pointing at the up ramp from about 18 -- oh, just before 1850 up to the present. And the tree ring proxy temperatures from the year about 850-AD, they wiggle a lot, but they trend down until about 1850 and then they just take off.

And then you see, I'm pointing at the top chart where this -- you've got the same record, just squished down for comparison with the model record.

So the climate modelers build the climate modelers and build on the climate modelers and trying to track this. It's tree ring data, and the tree ring data are now a sufficient resolution where they're getting pretty good, pretty good.

So we have a -- we're getting to a point where we have a theoretical and an empirical proxy database for temperatures at the recharge areas. That -- by the way, that Salzer paper was from Great Basin data all across the Great Basin, from Bristlecone pines up the tree line.

Why did we build a finite element model when we've never done that before? Well -- and there was a -- let me clear one thing up. Our model explains this one. We have another separate parallel model for the H-4 water logs. This is a model for Big Muddy Spring, explaining its annual discharge -- annual total discharge in terms of a prior

interval of climate history as represented by water year total flows of the Humboldt River.

So when we do that, and we don't know what that span of time is. Is it two years worth of precip or climate data from this year and last year or last year and the one before? Fish and Wildlife, I think, uses a two-year -- and get me -- if I misrepresent anything, please get me on cross, because I'm not trying to.

It's -- I think, if I understand the Mayer Congdon work, it's a couple of years of climate that they're dealing with, immediately preceding the observation. And we wanted to test that.

And what we had to do is figure out how to automate the search because what we're talking about is once we found a hundred year record at the Palisade Gage of the Humboldt River, and each annual discharge tallied, how are we going do a thousand multiple regressions, every two-year interval going all the way back to the beginning of record, you know, which would indicate, if that worked, maybe we do have a hundred year lag and two years of climate to explain the discharge.

So we had to do a thousand or so multiple regressions and find out how to do that and look for the -- and hope there was one fault positive correlation coefficient.

BY MS. BALDWIN:
Q. Dr. Johnson?
A. Yes.
Q. Just to orient us all to the slide, what you're talking about is Big Muddy Spring discharge; is that correct?
A. Yeah, let me -- before -- let me just speak to the slide before I speak generally.

So the slide, representing the climate response model, has observed data in the blue dots connected by a solid dark blue line, and these are in acre feet. So there's 53, I think. Yeah, 51, 53, 5500, 700-acre-feet.

So Big Muddy Spring varies quite a bit and we were avoiding it for the longest time because the swimming pool and the Boy Scouts, when you get in and look at that record, they used to drain the pool every weekend.

So you get this huge surge going down there one day and then there wouldn't be anything the next day when you fill up the pool. And so your day to day looks pretty bad, but your annual data, it all adds up.

So we looked at annual discharge from the Big Muddy Spring as measured by the USGS. It's their gage 1549 -- 5900 -- I mean, I -- scratch that. Strike that. I'm not going to give you a gage number off memory.

So then the other parts, others items on this

chart -- well, the model predictions. These are forecast. See, this model, the one that works, the only solution out of a thousand-plus trials of different pieces of time at different locations in time, the only solution was all positive correlation coefficients, suggesting that -- you know, more flow, more water in the system.

And I also agree with the comment about the negative. You shouldn't have negative correlation coefficients, and that's another issue and I've had no argument with that.

We have -- there are two -- our spring flow model and our gage floor model, we insisted there be no negative correlation of coefficients. And there was one unique solution. It was the interval of time from 12 -- inclusive 12 to 22 years before an observation, weighted roughly normally across that distribution explains the river flow.

So here's -- we have got two models. We have -- the yellow dots are the actual, that -- those solutions, those spring flow estimates, forecasts or estimates are based on the actual model, the coefficients that came out of the model. The other one, the green one, the smoother looking one -- let's see.

I don't think I put the -- no, I didn't put the response function in there. But the way those regression coefficients vary across that interval of time, in the oldest, they're low, at the oldest measurement, then they're highest in the middle years, and then they're, again, low at the youngest, at the 12-year mark. And so I approximated the real solution with a normal -- with a bell curve shaped response function and got this.

And so now we've got a system where we can hind cast all the way back to -- as far as we want and we can forecast 16 years, because that's the way -- I mean, it's history that's driving the spring flow, not yesterday.

So first couple of years, and these are the two we presented at Devil's Hole, talking about the climate sweet spot. That's one of our -- we got a cool PowerPoint as one of our exhibits. These we presented in 2018 at Devil's Hole workshop.

This one was from last -- from water year 2018, just -- all that the same there. And this one here, I've estimated the last two weeks of water year 2019 at the average rate for the prior two years for -- the average September rate for the prior two years.

So this one will change a tiny bit, what we can finalize this in four days. But it's not -- it's hardly moving. We've got a whole year behind -- record behind it and two weeks to go. And I've guessed that two weeks. So my

guess can't be off enough to move that, or else you'd be reading about Big Muddy Spring in the newspaper.

Okay. And so in hind cast, here's -- now, this is a really important point. When we hind cast this model, 19 -- I'm pointing with my pointer to the hump on the left of the diagram, hind cast high flow in Big Muddy Spring in 1960. 1960, that's when the river was high.

So the little we know, it seems like the Big Muddy Spring type or form of hydrograph is representing the system that dominates the Muddy River in terms of its discharge.

So the many hydrographs we have with the same form, I would -- we'll get to this, but a form that I would claim is dominated by climate and somewhat perturbed by bumping, they're all very similar and so similar that they've been called -- well, the reason we're here is that they're so similar, it looks like -- if you think the hydrograph is drawdown, it's the same everywhere.

But when you start subtracting hydrographs from one another and looking at differences, that's when you see the drawdown. This is one piece of the hydrograph. That's our professional opinion and a very strongly held one.

Q. Dr. Johnson?
A. Yes.

Q. Before we get off the slide, just to clarify some things. So when you -- so you looked at Muddy -- Big Muddy Spring discharge and you said that there's a lag of 12 to 22 years, but I don't think you actually explained what you were comparing it to.
A. I'm not sure -- Beth, I'm not sure I understand.
Q. You were talking about the Humboldt River flow?
A. Oh, that was -- there's another very important point, very important point. In the rebuttal reports, there was some misunderstanding. I'm not sure which one. I think it may have been Nevada Energy's -- clearly, there was a misunderstanding. We're not saying water comes from Humboldt River and goes to Big Muddy Spring.

We're saying that the Humboldt River with its huge catch of perennial flow and location in the zone two of climate is representative of the climate that we think is relevant to recharge.

So we think, as you'll see from our model input that I'll show next, we think the recharge occurs in high country from snow, no recharge to the regional system. Let me make sure we understand.

We're talking about a regional system that recharges, in our opinion, in high terrain, regionally high terrain in central and east central Nevada, and then finds its

way through the regionally continuous pre-Mississippian shelf carbonate section to southern Nevada.

So the water, we're not claiming that the water is moving. We're claiming that the annual water going down the Humboldt River is a proxy for the wet versus dry climates, that because of that tree ring data, you'll see whether it's centuries or decades, those tree ring signals are driving the oxygen or the -- both the stabilizer to composition of the recharging precip.

And so we should be seeing those tree ring signals somehow transformed through whatever hydrodynamics occur to some other signal like the -- at the discharge area.

Now, regional springs are not constant. Muddy River flow is not constant, the natural flow. That's absolutely clear. Eakin knew that. So when we start averaging things, we get into trouble and we've got some examples where people have averaged things and they're in big trouble.

I don't have anything in direct here on the isotopics, but we have a lot of information and some slides, and that's one reason I'd like to leave plenty of time for cross. I'd hoped Jim Thomas would be here to talk about that.

Dr. Thomas is a former director of the DRI Water Center. He's a geochemist and was the author of the -- he's one of the -- it's an important report. We've got a geochemistry report in support of the Water Authority's Delamar Dry Lake and Cave work, very important report.

But we've got problems with it and without him there or somebody that's equivalent for -- to discuss it with, we're not going to bring it up on direct. But we're happy to talk about it on cross.

BY MS. BALDWIN:

Q. And, Dr. Johnson, you've been going about 30 minutes.

A. Thank you.

Q. If that's helpful to you.

A. Oh, thank you, thank you. Let's look at some model input.

On the left is the way we defined our flow to main and then this -- and then on the right, you can see with those straight boundaries, that's the way that they approximated it.

And what you see, and I'm going to point first to the left diagram, it's the one that's blue. This shows how we constructed our recharge cutoff surface.

Now, our -- our idea for the recharge is that it comes -- it's a regional problem, there's a regional solution or a regional component of the solution. The regional high

terrain is in central and east central Nevada, Kane, the Monitor Range, the Grant Range, Egan, Schell Creek and Snake Range, that's the high country. And I'm pointing.

Q. So just for everyone, we're looking at slide number seven and you're pointing at the diagram on the left, which is mostly blue. And can you explain maybe what the different colors are showing?

A. Yeah. Yes, yes, I'm getting there. The point -- the first point I wanted to make, though, was the way we constructed our recharge cutoff surface. We -- we constructed a plainer surface. In other words, we're going to chop off the terrain model to leave us a bunch of islands where we think the recharge occurs.

But the surface we used to chop off the terrain, to cut off -- you know, our recharge cutoff surface is higher. It has to be higher in the south. The pine trees are higher up on the trees in the south, the climate's warmer.

So where is that? Well, fortunately, the Kaibab Plateau over in the Grand Canyon area is well enough constrained in terms of its area and the spring discharge, because you can see the spring discharge is coming out of the canyon wells to where you can take a pretty good -- and just because of the way the elevations are there, we thought 8500 feet, about where the Ponderosa pines start, was probably a

good recharge cutoff elevation in the south at latitude 36 north.

On the other hand, in the northern areas, we look at the hill slope in Ruby Valley up behind the fish hatcher, and the whole thing -- you know, there's no runoff from that thing. So it's -- you know, the carbonate section there on the Ruby Mountain, the east side of the southern Ruby Mountains. So we think maybe 7,000 feet is an appropriate recharge cutoff.

So in other words, up north, you only get recharge above 7,000 feet to the regional system. To the south, you have to be up above 8500 feet to get recharge. And so look what that does to the Spring Mountains.

What I've done here with this tint, this isn't all that effective, but you can see the white areas are where that recharge cutoff surface. As I'm pointing, I'm pointing now to the Spring Mountain, just a little white speck with a little gold in it at the -- near the southern part of the blue flow domain and there's a Sheep Range.

Almost all of that high terrain is carbonate rock. Sheep Range is a pretty good recharge area. Spring Mountains, look at that. All that high country and just a little carbonates up there above 8500 feet, just reinforces what I've been claiming about Las Vegas Valley. You just

can't get all that water off the Spring Mountains.

And the sheep range, maybe, but we know the sheep range is -- is -- the water is flowing this way because there's -- and I'm pointing to the area of the Divide well, BLM wells, up toward the northern -- east side of the northern -- or sorry, west side of the northern Sheep Range.

There's a three well complex up there where you can see it flows to the north and -- but there's also plenty of opportunity to -- for a flow off the sheep range to get to the Muddy River Springs area or to Las Vegas Valley. So we think the sheep range is an important recharge area.

And all I've done here with these circles, too, those are just sort of scaled representations of how much discharge is occurring from these different sinks that I have in the model.

And just for your -- because of our concept of this system in the model, you don't have Pahrump and you don't have Indian Springs. Our concept is that Spring Mountain -- I'm pointing at the Spring Mountains with the pointer, I'm pointing at Indian Springs, which is north of the Spring Mountains.

I'm pointing at Pahrump, which is southwest of the Spring Mountains, and also Tecopa, which farther to the southwest than the Spring Mountains. The USGS work says that lower Amargosa -- or that the Amargosa River also gets a lot of its water from the Spring Mountains. So how do you all that and supply Las Vegas with 60,000-acre-feet or more? You've got to have water coming in from the north. That's our strongly held professional opinion.

Now, how does that happen because the water levels are iffy. A lot of questions. Now, the other item on this that I'm pointing to with a little gold -- still on the blue left-hand diagram.

The gold areas are those elements that are mapped as either Ortivision, Silurian or Devonian carbonate rocks. So those are the regionally continuous shelf rocks. And so what we did is we just got -- the Bureau of Mines has a beautiful GIS data set of all the county geology reports.

And so I just went through that table and clicked off everything that had a -- one of those rock types in it and then went through and selected the elements that -- and with the map as a guide, the geologic map, just selected all those elements with those rocks in it.

So what we're left with is a right ring where the recharge -- we take all the recharge from -- based on the discharge. Remember Dr. Waddell's comment from Dr. Bredehoeft? It's the discharge. It is the discharge. It's the discharge, we believe it.

We use the discharge, add it all up, it's a couple thousand acre-feet annually and distribute that over all these elements equally.

All these yellow or gold elements get what? See, they like -- these are all -- well, fee flow, they're from Germany, so they like, you know, some funny units. These are recharge in meters per day. Okay. Fine, .00, that's -- it's about 15 centimeters a year, okay? So all these gold spots.

Also, here, you can see on this right-hand diagram, the location of the Steptoe annex well. And Tule Springs well, we calibrate -- see, we first did this as a one dimensional problem. And I showed it to -- I showed it to Christi and she laughed in my face so we made a --

(Reporter interrupted proceedings.)

MR. JOHNSON: Oh, I was -- I just said that I showed a one-dimensional version of this model to Christi and she chuckled. So anyway that's the way we handle -- we take all the discharge measured and the portion after the right geology to tie enough up in the mountains.

We also build an anisotropy and I would have like to go farther with this and I would like to try an anisotropy ratio greater than ten.

But in my reading, you get in numerical difficulties, more numerical difficulties if you have such a

strongly anisotropic system. And I think at that point, you want to start thinking about two bundles or streams.

And there was a comment that -- how capture zones are misleading, they're for surface water. You can get into all kinds of trouble and so forth. And I accept that, but again, the word "anisotropy" was not mentioned and that worry becomes less and less relevant as the anisotropy ratio gets higher and higher.

So what we have here, the way you enter anisotropy angles or directions into free flow is as counterclockwise rotations from the east direction.

So let's just -- now I'm going to point at the left-hand slide here and just show you, I mean, here in the greens, say, between -- not even the 90-degree area. Okay. 90 degrees, all these greens, those were -- the green areas represent a principal access of anisotropy that's rotated 90 degrees from east. So in other words, it's north/south.

So the green areas are most transmissive in the north/south direction. Then you have areas like the Pahranagat Sheer Zone, which I'm pointing to here, and it's got more of a purple hue to it, lower numbers, and those numbers are like in the 30's.

So picture 30 -- a 30-degree rotation from east, so the -- I'm pointing now, I'm moving the pointer over the

Pahranagat Sheer Zone in the model grid, moving it from southwest to northeast, showing the principal direction of anisotropy in the Pahranagat Sheer Zone.

And that's what this -- pretty much the same thing all the geologists were saying over the last three days, was how these faults affect the -- you know, you can have an enhanced permeability parallel to the strike of the fault or your reduced relatively low permeability perpendicular cross fault.

And then you have other areas like down here in the -- where you start getting down into the Gerlach fault domain, where the north Las Vegas sheer zone, like here, I think, where the -- or, no, the resin oranges are places where you have northwest striking structure, I believe, yeah, because there you're up in the 150 degrees from east.

So now you're at a northwest orientation with the principle axis. So every element of those, almost 50,000 of them, gets its own preferred -- it's own anisotropy angles.

And on the right, we got the Eureka well and that's another -- it was mentioned, this is a heat flow deficit in the central Great Basin. It was well known for years, almost universally attributed to groundwater flow removing the heat.

Nobody's ever said where that heat is going. So

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that's what we tried to do is say the heat is going to the Warm Springs. Again, that would be a terrible thing for DOE to come up with from what I saw the waste at Yucca Mountain. You know, to have -- if this -- now, our solution didn't work over on that side for unknown reasons, probably because the -- I'm pointing at our representation of the Eureka well now, probably because we should have had more heat loss on the west side of our representation of the Eureka well.

But anyway with these values of -- and they're like joules per square meter per day. I like milliwatts per square meter, but whatever, because a joule -- watts joule per second, okay. So they like joules, we use watts. But what you see here is that's how, you know, our -- we had two weeks, we had one shot at it.

This is what we came up with to see if we could get a model, first off --

(Reporter interrupted proceedings.)

THE WITNESS: Sorry. Thank you.

Okay. One of our -- well, our first and foremost goal in modeling was to just see if we could get it to solve and not just be mathematically unstable, not diverge, not reach a solution. And so that was the goal. And we knew from our one-dimensional approach, what worked.

We knew how fast the water had to move and how

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much to move to assume the amounts of heat loss to the springs, and warm them by the -- warm the water from one degree C to, we assumed -- I think we assumed 30. We might have assumed 35, but I don't remember. And this is awkward, too, see, because I can't get back into the model code because we're not licensed.

So I can't go back and go back into the model and answer any questions you might have or improve it, because it's -- you know, I need 10,000 bucks and another couple thousand a year to get back on the model.

I've run out my demo. But anybody else can get two weeks on this thing, go for it. You know, and the mesh and hard work is done, I think.

Now, this one, I hope you like this. This is an animation of the last 35 million years of western North American tectonics, what plate tectonics have done to the continent. And you're probably wanting me to play this, and I'll be happy to play it again.

But before I start it moving, this is what -- it's the Colorado Plateau. Las Vegas or former Las Vegas is going to be somewhere over in here because you got the -- you know, the root country, the transition zone, you've got Flagstaff, and you know, all that -- the Muddy Rim is down here. And then up here is Wasatch Front and the whole, you

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know, driving 515 to Salt Lake.

So, no, that's the Colorado Plateau. You're breaking away a little bit over by the front range in Colorado. But that in fact blocked the Colorado Plateau and I've been pointing at that. Also, now pointing at the Baja Peninsula that hasn't formed yet. And so this is the landscape 30 million years ago with some of the plate tectonic boundaries shown.

I think there's a triple junction about to go under the edge of the continent. I'm pointing almost at the middle of the slide, kind of near where probably you'd want San Diego to go. But I'll play this and I'll probably play it a couple times.

And remember, seduction stops and strikes the faults, starts about between 10 and about 14 million years ago. So watch the Baja, California start to break away, watch the Great Basin start to extend, now the Calderas come out. It was about 11, Kingsbury Wash Caldera and takes us up to the present.

Again, yeah, there it goes. See seducting, seducting, seducting, and then the transform fault goes under the edge and starts ripping away Baja, California. Another thing to watch, look at these accommodation zones. Watch in here, how things extend a lot and not much.

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So I think if you're looking for an impediment -- this another thing we need to talk about. If you're looking for an impediment to north/south flow, and again, last three days, I didn't hear anybody tell me why the Muddy Springs are there. Nobody showed us a structure.

We saw a lot of north/south faults, we've seen maps from the Water Authority, showing no obstacles to flow from either California -- or Coyote Spring Valley to California Wash or the MRSA to California Wash. So my thought is then why the springs.

See, we couldn't get our model to work. This is not our first model. We did publish a little element models, one of our exhibits. And where was I going with that? I lost my train of thought. I'm sorry. Let me just move to the next slide.

This is just zoomed in a little bit to the -- to our solution, the streamline solution for the Muddy River Springs capture zone, and this is the area that needs to be cut out of the model. So we see -- because you've got the Mormon Mountains, you've got basin rock exposed in there, and you've got the Clover Mountains, intrusive rocks.

And so I would put my -- I -- you know, it's just a matter of time. You know, we can be running the thing, we see things we don't like about it, and we fix what we can and

then we're out of time. Demo's over.
And so the last thing I did -- was able to do in the demo with the help, you know, of tech support was get these time to travel capture zones mapped in there.
And so our model with a 300-meter squared per day regional transmissivity, one kilometer thickness, tiny proxy, which I don't remember, but it's in the report, I think .00015 as a an inter -- regionally interconnected proxy. So that's what we -- that's what we get. I mean, that's our solution.
And the water's coming from the high mountains. I mean, I don't know what else to -- how else to argue the regional -- our case for this being a regional problem. Now, here's our -- where we get 40,000-acre-feet and this is not tongue in cheek. This is serious and I think it's relevant.
An anisotropic system, and these are just roughly indicating how we think the flow works following the preferred orientation of the transmissivity field, we go from the elevation at the bedrock well across from the mouth of Kane Springs Valley to the Gil Breece Ranch spring mountain in northwestern Las Vegas Valley.
Here we go from MX-6 down to the Wilshire well, north Las Vegas, one of the longest production well records. And just by accident or happenstance, you get exactly the same -- and I'm pointing to the lines along which we estimated

the hydraulic rating in -- from Coyote Spring -- or from the LWRFS to Las Vegas Valley.
So between bedrock and to Gil Breece's place, we get -- I can't read it, .00021, I think, for hydraulic gradient. And in between MX-6 and the Wilshire well, we get the same thing. It's different in the third significant --
(Reporter interrupted proceedings.)
THE WITNESS: Oh, the hydraulic gradients from those two lines are identical in -- they only differ in the third decimal place.
Now, going by colors here, the reds are what we think are the boundaries. We're actually doing the first two questions in this one slide. The red lines are what we think are the flow domain boundaries. The gas peak thrusts are not bothered by that, really, but we query whether water actually goes under there. But you got to get the water into Las Vegas Valley.
This is just not acceptable, getting that -- getting any quantity of water -- and we tried this. This is what our -- our published element model had outflow on this boundary because hydraulic gradient is like this, it's from west/northwest, east/southeast. But we don't think -- but in anisotropic system -- and nobody called this out yesterday.
I don't understand why this -- how this could

happen with all this fault discussion. In anisotropic system, the water does not move perpendicular to the full extension lines. Those are at an angle. And they were strongly isotropic, the more they differ. Until you get to a pipe and it flows straight down the preferred orientation because there's no permeability, lateral permeability to that preferred orientation.
So I'm doubting this a little bit on the west side if -- maybe we shouldn't move this boundary in only because our well -- like I say, our well, Mifflin and Associates -- no, it was DRI at the time, did a groundwater exploration project for Nevada Power in 1986, and one of the wells we drilled was -- the one I worked on was a 4,000-foot well under what is now the tailings or flash.
But we had tertiary rocks all the way to 4,000 feet. We -- the first 400 was Muddy Creek. All the way down to 12,000 was a gooey white, greenish sticky ash. It was ash, ashy, very ashy, very thick.
And 3960 -- and this is from memory, I remember it well, dense red sandstone, fine red sandstone and quit, because after 40 more feet because we decided 4,000 feet was deep as we'd go looking for carbonate aquifer.
So there may be a fault. There -- with as much geophysics that's been done, I would not be surprised at all

if there's a fault out here that's keeping the good water away from the tribal plaza. They can't get good water there. So here along the north Muddy Mountains, there's probably -- we should probably move this boundary in.
What haven't I talked about? This is the -- this is the hydraulic barrier that we presented it at the GSA in Seattle in 2003, because in building our model, we couldn't get the water to come out without obstructing the flow.
Then I called Brian Wernicke. He's the author of a couple of our exhibits. He's a professor at Cal Tech and he's -- he and his mentor, Clark Birchfield and Greg Davis, they've been leading the charge in reinventing the geologic framework, if you will. And I'll show a slide. It's the next slide.
Now we may have trouble. We'll talk about geologic frame works in just a little bit. The other thing I haven't mentioned here, I've got a couple of colors, the model -- see, the captures on the model showed us -- included this part that I've colored brown. The part that I said should be cut out of the model. So I just -- for this slide, I just colored it.
So this is roughly elevations in Lower Meadow Valley Wash that are too low to the springs. I just went up there, I think about the elevation of the -- elevation of the

springs or along the contour line. That's just hand -- that's just our -- that's just our -- but this is -- this is -- the model solved in here where it shouldn't have.
Wells, these are so close together, they look like one. Kane Springs well, Vidler well, Lincoln County wells right there. CSVM-4 is right there in Coyote Spring Valley or maybe it's this one. I think it's this one. Anything else? Pahranagat sheer zone, you can see it from the terrain. You know, it's a bunch of washed up faults and the way -- there's another thing.
We know they're actually faults because the Caldera Rim's offset, you can see it and you can measure offset. Now, whoever says there's a fault in Pahranagat Wash and the Water Authority is putting arrows on it, I don't see the offset. I mean, show me the offset. I mean, I'll believe it. It's schematically consistent with the right lateral fault. But if you don't -- if you can't show me offset, don't show me the fault.
But back to what Dr. Wernicke said, I was asking him about the structure because the existing structural maps and interpretation don't help us explain why those springs are there. Something is obstructing that flow. And he said, well, maybe you found the lateral ramp.
Well, that's a really good point because if you

look at that Glendale thrust, some places, it sits on Mississippian rocks, and some places, it sits on -- I mean, the -- you know, the -- I'll just refer you to the exhibit.
The fact that the rocks under the Glendale thrust differ imply that that thrust had to cut through the section at some point that's not -- somewhere that's not exposed.
And if that lateral ramp -- it could be, it could be, but there's so much we don't know about the subsurface out there. It's obvious because we don't know why the springs are there. And, you know, maybe on cross, I'll leave you as much time as you can, maybe somebody will tell me why those springs are there.
Q. And, Dr. Johnson, you've been going for about an hour. I know you want to --
A. Yeah, I going to zoom right through these now.
Q. Okay.
A. Okay. Here, you have the geology we've been hearing about. This is the traditional framework, whether it's Page, Dixon, Rowley, it's the USGS framework or the USGS derivative framework.
These are two sections from -- oh, it's noted there, north and south of the section that Swanson and Wernicke published. And they recognized in the central Meadow Valley Mountains, and I don't think anybody said the phrase

Meadow Valley Mountains yesterday either.
Did I do something wrong? Did you --
Q. I didn't say anything.
A. Nobody interrupted? Okay.
Q. No, proceed.
A. Okay. They believe they've got the ramp's incline identified in the central Meadow Valley Mountains, which allows them to correlate -- or how should I say, characterize the extension, because there are a number of features in these thrust faults that you can see in the Spring Mountains, you can see in the Sheep Range, and now you can see in the Meadow Valley Mountains.
So some of these -- and this is the key to Swanson and Wernicke's long history of waking us up to the extensional regime is using what they know about the thrust faults and the style of thrusting. You know, the leading thrust, the Keystone thrust is the dead column one. In other words, the thrust moves along parallel to the stategraphy for a long ways.
Other thrusts, part of their back, the older ones cut up section there and they don't follow the stategraphy as much. So each of these thrust faults has its own unique characteristics that, once understood, can be found in these fragmented extended rocks.

And also kinematic model like that allows you to extrapolate much deeper. Now, I'm pointing to the Swanson Wernicke section on the slide. They extrapolate much deeper in the subsurface than we can with the surface mapping.
What are the -- oh, and this slide, slight modification from the report. And I hope you don't make me turn it off. We just added the Delamar, Dry Lake and the Cave basins because there's a little sample calculation I would like you to -- there's an area there where we can do another Darcy-flux calculation that I'd like to show you next.
But this is Allen Chamberlain's dissertation map of the 21 Devonian sequences that make up the Sunny Side Basin, and this is a Devonian shelf, continental shelf. There was a -- well, a lot of stories there. Anyway, the point is the Sunny Side basin is thick in the middle, thins off to nothing around the edges, and we're sitting on the flanks of it.
So one idea, and a very reasonable one, the reason we have the springs, maybe it's purely stratographic. I mean, even though we find the water there in Mississippian rocks, don't forget, those aren't the regionally continuous.
The regionally continuous rocks are the Ortivision, Silurian, Devonian carbonate rocks for sure and I didn't include Cambrian because there's not a lot of exposure

and, for example, with the Grand Canyon, the water comes out of the top of the Cambrian Limestone. So it seems to be more of an aquatar.
Even though we have Cambrian rocks just surging over in the groundwater over in the Amargosa, we didn't use them. This shows why we picked our flow domain for the model the way we did. There's a structural thinning, you know, Eureka quartz side's is absent. You know, all the Paleozoic is in -- across it.
So we took that as a boundary and plus there's a -- on the surface, there's a drainage divide to the Humboldt River up here. So we took this as a rational northern boundary for our flow model and we did have to let some water out.
But that -- and then the western boundary, the Roberts Mountain thrust is part of the whole orogeny that thrusts deep water. So let's just -- let's say impermeable rocks up over the shallow water are permeable carbonate rocks. You don't have carbonate aquifer over here, so that's the boundary.
Anyway, let me just -- okay. This is a good one. I think everybody yesterday was kind of on the same page, thinking this was --
Q. Okay. Can you talk into the microphone?

A. I am so sorry. Yeah -- and I actually -- I'm sorry, I'm not talking more directly to the panel, but it's so much easier to see the slide on the wall than on my little computer screen here.
So I'm pointing at a feature of this CSVM-4 hydrograph, beginning in 2014, and only lasting about a year, maybe a little more, maybe two years.
That's been -- I think whoever -- all the speakers that addressed this feature, I think, were on board with it being a pumping response and I don't think so. If it's pumping response, it starts up here.
The hydrograph doesn't look anything like the other ones, except KMW-1. There's no -- I don't think this is it with monthly measurements. But there's no mid-test recovery from that 2012, 5-month shutdown.
It's diagnostic in the southern -- what we'll call the southern flow field as far as apex. You know, the BMDL well shows it clearly. I'd say that mid-test recovery is what is diagnostic and it's absent here.
So if these things are moving in lockstep or anything close to it, this one seems like it waited two years. And as a -- one other philosophical point, as a practicing hydrogeologist, you know, if I go ten miles up gradient from a well I'm interested in to try and find a reference well or an

unperturbed site, even in terrain like this, I'm going to feel pretty safe because I know that in the case of MX-5, the well right beside it only draws down to two feet. You know, pump it for years and it only draw downs two feet.
And so -- and you go, you know, a couple of miles away and because we don't believe the full hydrograph is drawn down, draws down a fraction of a foot. So ten miles away, I'm comfortable with draw down's in there. I can't see it.
So we -- well, I -- Marty and I are -- I don't think Marty -- Dr. Mifflin is convinced, but I'm emphatic that I believe this is not pumping response. And if I add the whole Order 1169 evaluation to do over, this would be the signal I would use for my reference well.
I'd go in and clean that up interplate with -- or approximate it with empirical mode composition and use that as a reference.
Q. So, Dr. Johnson, for the record, because it's hard to know what you're -- exactly what you're doing, I'm just going to recap.
We're looking at slide 14 and you're comparing the hydrographs for KMW-1 and CSVM-4, and you've been pointing at -- there's an apparent dip beginning around early 2014; that's correct?
A. Correct.

Q. And when you -- and at the top of your figure, you say "reference trend negative .2 feet per year". Can you explain what you mean by a reference trend?
A. Oh, yes. Thank you. That's a linear regression. In other words, the slope of each of those records. So the blue line is the slope of the blue measurement trend and the red line is the slope of the red, CSVM-4 measurement trend.
Thanks. Thanks for that.
Q. You're welcome.
A. Okay. Now, you might want to object to this. It's an example calculation of inflow to northern Cave Valley.
Q. Just -- this is inserted for demonstrative purposes only; correct? You're showing a sample Darcy calculation?
A. I don't know. You tell me.
Q. We're trying to clarify that this actual slide is not in the report, but Dr. Johnson is trying to show an example of how you would take different numbers from different wells and do a Darcy calculation.
A. I just made it up. Thank you.
The Steptoe MX well, which we pointed out earlier, and the Water Authority's 180 -- 180W5011 monitoring wells, the northern most monitoring well in the Cave Valley.
What we've done is just look at the difference in

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elevation of the water levels in those wells. And they vary, so this is what they're -- you know, an approximate -- approximation of the water level, both are trending.

But just separation, distance and difference in elevation gives you the hydrologic gradient. And because of our model, we had a number we could guess with and that's 300 meters squared per day, much less than any of our aquifer tests have given us.

So we used our regional transmissivity, the observed water levels, and by the way, this area is, in its entire width, underlaid by Paleozoic carbonate rocks. So if you look at the geologic map, I mean, it's covered. These wells are -- there's cover, but the expected section is entirely Paleozoic carbonate rocks in both of those wells.

So -- and I haven't looked at the well rocks, and maybe I'm wrong. But what we do have is a hydraulic gradient that assumed or derived, I would say, calibrated regionally transmissivity, and we take -- for the width of the aquifer, what did I say, 14 miles.

So for 14-mile width of aquifer with those properties, we can get 25,000-acre-feet of water into Cave Valley from the north.

Now, remember the assessment for that area said all the water supply is derived from within the mountain

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blocks surrounding the three basins. And I'm not doing this to pick on the Water Authority. We're trying to make the case that all this water, the regional water comes from farther north.

Now, this one, there's an addition here, and I hope this is going to be helpful to Nevada Energy because this is not -- this is VH-4 water levels from the last three years.

And this record, I don't know, you might want to go spank the contractor, but this is actually based on four discontinuous record segments, three breaks in the record, not very long ones, but the data was confused.

And we called numerous consultants who actually does the work to ask about these offsets that I've prepared here and they didn't know about it, they weren't sure.

You know, I talked to a senior person and the field tech wasn't there, and I don't know if they were inspired enough to go fix the problem. But I know Nevada Energy has, in their rebuttal, the fragmented record. But that's the record that's in your files. So there's -- there is a problem, but there's also something beautiful here.

Once you reconnect the dots, you've lost the data, but you've got the trend. And so when we take an even three years, just so we don't do something screwy at the end, we've got exactly three years there of data that we do a

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linear regression through, and take that -- project that line back. We want to find our datum again. And this is -- here's something that is pretty amazing.

These are adjusted data, they're -- our green data there are adjusted for Arrow Canyon Well pumping according to our model that's one of our appendices in our direct report -- or in our original report.

So we fit that projected trend to pretest data. And I didn't include it, but that is exactly the trend that Rick Felling presented at the Nevada Water Resources Association meeting in 2014, in early February, only his was offset. His was -- it was almost exactly that slope, but his fit the blue. See, his data weren't adjusted for Arrow Canyon Well pumping.

But I think, you know, Congress can recover that data, but -- that datum, but they need to -- they need to fix that because it's really misleading. We saw that, tried to resolve it with converse, and when we weren't able to, you won't -- this is our favorite hydrograph and we didn't include it in our report because of that.

Okay. Inclusions and recommendations. We've authored 40,000-acre-feet based on Darcy's law with two estimates of hydraulic gradient in close agreement, a transmissivity intermediate between what's been measured in

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our aquifer tests and yours. And that leaves 19,000-acre-feet from somewhere else, Spring Mountains maybe, though I think that's way too much for the Spring Mountains, to make up the 59,000 that we assume is coming from Las Vegas Valley.

And the two flow fields are -- those that explain the Big Muddy Spring are those that nourish, I guess, Big Muddy Spring and another that seems to be represented in most hydrographs, I'd say those of the EH-4 form. And because that latter one, the response function was funny and Dr. Mayer pointed out it was funny.

Well, it's funny because it's got two humps on it and I think we may have also something local, most likely Sheep Range because that's the only available recharge area that fits our criteria, sending in those immediate pulses and maybe that needs to be treated separately.

And so using the Virgin River as a proxy to explain the needs for water levels, we got a funny response function and I'm not comfortable with it either.

And when we combine the two to try and make the Muddy River, we get negative. And that was just an experiment and probably shouldn't have been in the report. And we don't accept negative correlations coefficients. It didn't work. You know, it fits the data, but it doesn't make physical sense, and that's incredibly important.

We've got a lot of things that seem to fit the observations, but don't make physical sense like this. It was assumed, and I don't think anybody can offer me one shred of evidence that this was not just an assumption, pumping goes up, water goes down, cause and effect. And that's why we're here.

That's why we're here today is because of that assumption. Oh, there's -- oh, yeah, see these -- this is the response function for the EH-4 explanatory. It's these jagged -- it's this jagged curve. See, instead of having a -- what you hope for or normally distributed or somewhat normally distributed, you know, high in the middle, low on the end, you got two humps.

And so I say, well, maybe that really is an environmental distribution and this is coming from the Sheep Range and this is coming from -- now we're -- this one now, it looks like it makes more sense coming from the north, though we can't -- I don't know how to separate these. You know, maybe somebody else can. It's important. If we could find the well -- if we could find the hydrograph that we could attribute to the Sheep Range purely, we could do that.

Okay. Everybody seems to ignore the antecedent trend that was -- you know, that's been our thing is, you know, most aquifer tests, you know, you're going to get your

Theis response in the first half-hour in a place like this if there is any Theis response. And so what point am I trying to make here? There's not much of an issue with the reference water level, starting water level changing during that six hours.

If it -- they'll be a little bit from the -- from, you know, barometric and title effects or semidiurnal, so you will have something. But those are small, those are small. If you're going out now a week, you might have some weather, you know, a big barometric dip.

And so you might have things coming in, interfering with the test. And now if you're going a year or two years, there is absolutely no way that you can predict -- or there was no way that you can predict what that hydrograph would look like in the absence of pumping. We heard yesterday, one interpretation that would likely be rising if there was no pumping.

You know, all those rising hydrographs, I'd say, well, if it's not rebuilding and the hole's full of drilling mud and slowly, slowly, slowly, the water freshening, and therefore, rising because of the equivalent fresh water head is rising, well, you know, it's delayed climate. You know, you can't have bad well construction in all the Nevada test site wells.

And we know, even though this is not really the issue, I don't think there is an issue about drought. It's a red herring. It's a red herring. It's the pattern -- it's a pattern in past climate over a number of years that explains these hydrographs in a regional system, because it takes time for the signals to get through the system.

That's all there is to it. And the farther away, in general, the longer the signal. So we think Big Muddy is sourced from farther away than the Refuge Spring.

We think recovery is complete to that declining trend. I'll let you ask the geochemistry questions. There's some very intriguing anomalies or -- how should I say it? Anyway, interesting geochemistry if anyone wants to talk about it.

Oh, I did put that in. Okay. Yeah, cold water. Dr. Waddell, cold water, I wanted to ask how cold. We've got -- if anybody wants to go into that, we'll show that the water assumed to be recharged, modern recharge for the DDC study is way, way, way too cold. It's a collaboration -- the collaboration temperature based on the oxygen isotopes is way, way, way too cold.

And finally, this is the last slide. We think this is the way to think about this hydrologic system. We don't have the mountains on the right end. We have a chart

here based on a work of Joe Toad in Alberta, early in the 60's, conceptualizing regional flow. And then that was implemented as numerical modeling came on in 1967, one of the first applications, looking at the effects of layered heterogeneity on groundwater flow.

And in this example, you have a number of basins with a low hydraulic conductivity, and a beneath them a layer, continuous layer with a hydraulic conductivity a hundred times greater.

And so you can see these basins are -- and the little -- I've got some -- I've colored in some little green splotches in the basins to represent phreatophytes. And I've colored in blue in the regional aquifer just to point at them with the pointer, just to clarify the diagram a little bit.

But we think this is how it's working. The water is coming in in the high mountains, following the lower -- the Paleozoic shelf domain rocks to the south and discharging these warm springs, picking up heat from the Eureka low on the way. Now, this is the system we're here to protect.

Now, as far as the basins, we'd suggest that any kind of phreatophyte capture up here, if you truly don't value those phreatophytes and what lives in them, take it. But it's not going to affect the regional aquifer hardly at all, you know, at this contrast.

So that's really where I'd like to leave it before I just, you know, blabber on and go ahead with as much cross as you want to throw at us.
Q. We'd like to save about 30 minutes for redirect, if necessary, but Mr. Johnson's making himself available for cross. So that's all I have.
HEARING OFFICER FAIRBANK: Okay. Thank you. Okay. So thank you. So we'll go ahead and start the cross-examination. And based upon kind of the additional time that you guys are allocating for the use of cross-examination, we'll go ahead and assign 17 minutes to a participant for cross-examination.
And as we've done for the past several days, if there's additional time remaining, then we may open that back up to participants to ask additional questions if they don't get through all their first questions in the first go-round. So we'll go ahead and start with Coyote Springs Investments.
MR. JOHNSON: May I have a question?
HEARING OFFICER FAIRBANK: Yes, Mr. Mifflin?
MR. JOHNSON: May I -- no, Johnson.
HEARING OFFICER FAIRBANK: Johnson. Sorry. Excuse me.
MR. JOHNSON: That's okay. Would it be okay if the attorney sits here to do any computer things that need

doing, so I can just talk?
HEARING OFFICER FAIRBANK: I think you -- I mean, you know your PowerPoint presentation probably more extensively.
THE WITNESS: Okay.
HEARING OFFICER FAIRBANK: And so I think we'll just go ahead and let you go to those pages and we'll let the attorneys --
THE WITNESS: Right. I was just concerned about being distracted by the technology when I'm trying to answer a question.
HEARING OFFICER FAIRBANK: If it -- if we -- if there's a problem, we can go ahead and address it.
THE WITNESS: Okay. Okay.
HEARING OFFICER FAIRBANK: Thank you.
CROSS-EXAMINATION
BY MR. HERREMA:
Q. Good morning. Brad Herrema and Emilia Cargill for CSI.
A. Good morning, Brad and Emilia.
Q. Good morning, Dr. Johnson. I'd like to start with a question that relates to something you said when you were looking at slide four, although I'm not sure that -- I'll to find slide four. Let's see.

A. You went past. That's three. That's one -- there's 1, 2, 3, 4 -- Maxey?
Q. Yes.
A. Okay.
Q. When you were discussing this slide, you stated that you do not like cumulative departure from mean curves. Are you familiar with the limitations of CDM curves?
A. Not in a formal sense, I'd say no.
Q. Okay. Do you know whether there's a limitation associated with a set of data's period of record, meaning is there a minimum number of years required to accurately use a CDM curve?
A. No, I think the -- I would only use it with really sparse data if I -- you know, when I'm looking for a trend and I've got data that's too sparse to, you know, look at -- well, I really don't want to go there, because we're sort of venturing into statistics and I want to completely fail at answering any statistics questions and refer those to the -- you know, to the experts and we can do that.
Q. Okay.
A. But I'm not going do well answering that line of questioning.
Q. Okay. Then what methodology would you recommend for describing periodic wet and dry cycles over century-long

periods based on rainfall data?
A. Well, I would not base it on rainfall data.
Q. Okay. What methodology would you recommend for describing periodic wet and dry cycles?
A. Well, I think I -- I think I understand your question. Try again, if I don't. I think you're saying what type of proxy records are most appropriate in my opinion to characterize climate annual -- let's say annually -- annual climate.
Q. If you don't think CDM curves are a good way to describe these trends or cycles, what do you think is the best way to do that?
A. Well, I think you don't get more than one trend. I mean, it -- I don't -- I won't do well -- I'm just admitting here, I won't do well with this line of questioning.
Q. Okay. I can move on.
A. Yeah.
Q. In Appendix 4 of your initial report on page 66, you stated that drawdown in EH-4 resulting from Arrow Canyon well pumping has been established by comparing hydrographs of EH-4 to reference well MX-4. Does that sound familiar?
A. MX-4 was the reference well, right.
Q. Could you describe the relationship you found between EH-4 and MX-4 during 1993, 1994 testing of those Arrow

Canyon wells?
A. Well, the figure -- we have a figure with a direct comparison, one on top of the other. So without looking at it and it's not in my packet -- oh, thanks, Beth.
MS. BALDWIN: You're welcome.
MR. JOHNSON: Okay. I've got the figure. What would you like to know?
BY MS. BALDWIN:
Q. You're on Page 66 of your initial report?
A. I am, I've got it.
Q. Okay. Great. Could you describe the relationship you found between EH-4 and MX-4 during the '93, '94 testing?
A. Oh, actually that's not the figure. We do figure of another figure. Well, the adjustment is given in Figure 4 on page 69. I think the point -- I think the point of this -- yeah, I can't answer that precisely. That interval is what's considered on page 69, I think. Adjustment of EH-4 for the 121-day testing of Arrow Canyon well. So that's what we ended up with.
The comparison here is just meant to show you how similar they are. You know, they have the same form and those differences are what we consider to be drawdown, because we consider MX-4 to not be affected by Arrow Canyon Well pumping

and we considered EH-4 to be affected by Arrow Canyon Well pumping. You know, MX-4 is eight miles up gradient, EH-4 is what, a mile down gradient.
So we're pretty comfortable, as hydrogeologists, that MX-4 is an appropriate reference well with which to compare EH-4, if you're looking for differences attributable to somebody pumping remote from MX-5.
Q. You stated that Order 1169 pumping created about a one-foot drawdown at EH-4 and a reduction in flows of .6 CFS at Warm Springs West?
A. I believe so.
Q. Okay. And then you compared that to the '93 Arrow Canyon Well tests that produced the .8 feet of drawdown at EH-4 and about .5 CFS reduction of flow at Warm Springs West?
A. Okay. It sounds reasonable. I can't remember the place and time I wrote that.
Q. So do you recall whether you accounted for recent hydrologic conditions when you compared the two pump tests?
A. Interesting question. Recent hydrological conditions. Well, we didn't -- put it this way, when you say compare the tests, I analyzed the 1169 test. Every combination of pumping and observation using MX-5, MX-4 and RW-2. I think I got five estimates of transmissivity and

storativity. I don't know if anybody else analyzed that record. Crazy, but no, I analyzed that one.
The Arrow Canyon Well, I didn't analyze in terms of aquifer properties. All I did was come up with a procedure for establishing the drawdown in response to Arrow Canyon Well pumping and it could be analyzed.
But, again, you got such funny geometry that it won't be a Theis well, but I'm going off. The point is I didn't analyze Arrow Canyon well pumping for aquifers, I did the other.
Q. Okay. Do you recall what the pumping rate during -- was during the Arrow Canyon Well pump test?
A. I don't recall. It was -- no, I don't recall.
Q. Okay. Do you recall whether you took different pumping rates into account when you were preparing the impacts caused by the 1169 pumping test in the Arrow Canyon well pumping test by comparing those impacts at Warm Springs West Gage?
A. I'm not sure I understand the question. I'm really not trying to be difficult, I just -- I'm not sure I understand.
Q. Well, this is complicated stuff.
A. It's complicated.
Q. When you were comparing the impacts at Warm

Springs West Gage from the Arrow Canyon Well pumping to the 1169 pumping test, when you were comparing those impacts, did you take into account the different pumping rates during those tests?
A. I'm still -- maybe I'm just slow today. I'm just not understanding the question. I'm sorry.
Can we -- do it again. We got time, do it again. I want to answer you, I just -- I'm not sure I can.
Q. Okay. The two different pumping tests, 1169 pumping test, Arrow Canyon well?
A. See, you're referring to things that I wrote that I can't clearly remember writing what I was thinking at the time. So that's why I'm having a problem.
Q. Okay. I'll move on.
I believe you indicated that pumping at Arrow Canyon wells does not affect Big Muddy Spring and Warm Springs West measured flows equally; is that accurate?
A. Yes.
Q. Okay. What evidence did you use to make that conclusion?
A. Maybe I shouldn't have answered so emphatically. The -- just ask me again so I can be clear.
Q. In your conclusion, in making your conclusion that pumping Arrow Canyon wells does not affect Big Muddy

Spring and Warm Springs West measured flows equally, what evidence did you use to make that conclusion?
A. Oh, okay. Well, the way I'm thinking about it, I'm not sure if I -- you know, historically, if I'm accurately thinking about it. We accept and value the correlation that Dr. Mayer's made between EH-4 and the Pederson Spring flows, and so we accept that fully.
And so, with no hesitation, if we see an impact on the EH-4 hydrograph, we know what that means in terms of flow at the high elevation springs.
And so through this Order 1169 test, you know, we see within the southern flow field, widely propagating pumping signals, but not of the magnitude that everybody has been thinking.
So Big Muddy, I'd say there's only, you know, negative -- what's the right word? There's no evidence that Big Muddy Spring of Arrow Canyon Well impact, but on the other hand, I haven't figured out how to analyze it.
There's no reference spring or well. We don't have another hydrograph that looks like that. I just -- I don't know how to -- I can't say that Big Muddy Springs is not affected. I can't say that. But I can say that the higher elevation springs are.
Q. Okay. Could there be a contribution to the Muddy

River Springs from flow paths other than from Coyote Spring Valley?
A. Oh, absolutely, through the Meadow Valley Mountains, yes.
Q. Okay.
MR. HERREMA: I have no further questions at this time.
HEARING OFFICER FAIRBANK: Thank you. Next will be the United States Fish and Wildlife Service.
CROSS-EXAMINATION
BY MR. MILLER:
Q. Good morning, Luke Miller for the Fish and Wildlife Service.
A. Morning.
Q. Dr. Johnson, just a few questions here. Are you aware of the Fish and Wildlife Service, I guess, proffered reason for the discharge at the Muddy Springs at the location that they exist?
A. Are we speaking of the trigger levels? Do I understand the rationale for the trigger levels?
Q. Well, just -- I believe it's just the reason for why there was discharge at the Muddy River Springs at their location?
A. Oh, that was one of my earlier points, is we

don't know. We think we need to -- we need to impede the flow to get the water to come out and I know that from my own modeling.
But the feature that actually causes the water to come out is -- it's not in anybody's map. And, you know, the -- you know, the Cal Tech geologists suggested, you know, maybe it's the lateral ramp. Well, we just don't know.
We put an obstacle to flow. We reduced the permeability until the water came out. You know, all I can say, we don't know. We don't know what it is. But if there's not an obstacle to flow, it's going to keep going.
You know, there's some permeability reduction, whether it's a -- whether it's a barrier like we represented it, whether it's a thinning of the section, whether it's a lateral ramp fault that's maybe just not exposed, we don't know. We don't know. But you got to impede the southward flow to get the water to come out.
Q. All right. In reference to some of the statements in the report, you mentioned that there has been a 20-year drought or so that began in 1999. Can you clarify the data that you relied on to determine when that drought started and how it's lasted 20 years?
A. Thank you for that question. On the one hand, I think arguing about drought is a red herring. What we think

is a more important or valid or legitimate concept is the idea that some interval of past climate is responsible for the discharge in any given year at, let's say, Big Muddy Spring. And so how do you find that interval of climate?
Now, that interval of climate won't be all drought and it won't be all wet. Maybe if it's a short one, but in general, no. And like you saw in our -- I guess that's five -- no, six, yeah, in our slide six, there's a lot of action in the discharge and what is that? You know, the -- everybody seems to think it's pumping. I just think that's madness.
Q. Well, you know, in reference to the slide six, here, can you kind of explain then where the drought response is in here for the Big Muddy Springs?
A. Well, let me -- can I first answer you? I got you sidetracked a little. I can answer your first question, the way this started. If anybody has access, and I've got the image here to the December 14th, 2010, issue of the proceedings of the National Academy of Sciences, the issue is on the drought in the southwest. It's full of articles. There's fear of mega-drought.
I've got another article from 2019. Now, they're talking about mega-droughts and if we don't change our behavior, we might have a drought like we haven't had since

1600 or before 1600.

So drought's an important concept to uncover, by the way, of that issue, which shows Lake Mead with the water levels way down, you know, obviously the Colorado catchments have seen hard times water wise.

So, you know, the drought, we can argue about the drought. But in aggregate, you know, a series of less than normal water years are going to decrease the resource at the outlet, whether it's the lake or the spring or whatever.

So I think -- I really do think this is the right way to think about the problem and we presented it as an analysis opportunity. And knowing we're not statisticians, but we think -- and we think -- and as far as any expertise, all I know is I'm licensed to use Excel and I know how to run some regression in it. And what was hard to figure out was how to look at a thousand cases without wasting the next year doing it.

And we got that in our report, too. It's a little R routine that you still have to, you know, look through output for each interval length, but we got it done. And we found one, this is out of a thousand or more candidate solutions. The only one came up positive correlation coefficients. But the reason I hope somebody else would get engaged with this is because you might do better or worse with

a different base flow selection.

See, our explanatory variable set are these annual base flows and those are obtained by chopping off the storm searches in the hydrograph, and there's no one best way to do that. And maybe for this, we care most about the snow and we only chop off little piece. You know, there's rain and melting snow in that hydrograph. So somebody that's expert in that could run with this and I think it's the keys to the kingdom. And instead we get beat up about it.

Q. Well, I -- you know, I'll admit to having some layman approach to this and I'm just trying to determine whether there is -- you know, the slides labeled climate response for big Muddy Springs, and I'm trying to understand the climate response, it seems to go, again, layman term here, around 1990, seems to drop, then it goes pretty up to 2000 and then it drops down roughly 2009?

A. Are you looking at -- are you looking at the spring discharge? That's the heavy -- the dark blue line, solid line? Those are the observations. Those are the observations. That's what actually came down the -- came out of the spring in each year, each water year, so --

Q. Is the spring discharge equivalent somehow to a climate response that's coming through the system and --

A. Oh, I see. I see. Okay. Let me go back and try

to explain the whole procedure.

Let's say, just in the simplest case, that the amount of water coming out this year, let's say 5,000-acre-feet, let's say I can explain that as -- and let's say I've got three measurements of river flow. Let's say Humboldt River flow, which is what we actually use.

So I've got three years of data and I've got three years of -- three years of spring flow data and I've got three years of run-off data, just the totals. Okay.

So I'm going to say, can I come up with something like one times this amount of river discharge, plus two times this amount of river discharge, plus one times this amount of river discharge equals spring flow numerically. Forget about dimensions and units and stuff numerically.

And so, if so, if one times this one, plus two times that one, plus three times that one equals 5,000, perfect. But now if I have -- if I'm going to have a test case where -- well, all I'm saying is that you take a chunk of -- a sequence of annual river discharge measurements and see if statistically you can explain those through some set of variables with individual weights that the program tries to -- it does -- Tim is going to have to explain this if you really need it.

But you're trying to explain a variable with some

other variable. So you're trying to explain spring flow with river flow, which we're claiming is -- those are parallel with the climate. In other words, low river flow, you've got a dry year.

Q. Well, I think I'm following you that far and that's why I'm just trying to stay with this.

A. Okay.

Q. This slide represents even maybe a delayed pulse or something, I think is the word -- some of the terminology I've heard as precipitation or --

A. Oh, I see. I see what you're saying. I see what -- okay. In the old days, there was an observation or a suggestion that this -- the river flow, because that's all that was gauged at the time, Muddy River, and the springs weren't measured yet.

But the suggestion was made that the high flows in the river seem to follow wet weather by about 15 or 20 years. And so -- and then Maxey got into that. So we came on the scene with two of the greatest Nevada hydrogeologists suggesting there's a 15- to 20-year lag in response. And so -- but how do you do better, you know?

And so that's what we tried to do with this exploratory multiple regression thing is just try and see if we could find a way to -- you know, without wasting our -- the

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rest of our lives, get in there and test all these possibilities and see if one worked really good. And there was only one with all positive correlation coefficients. It was mind boggling.
Q. So do you think this slide represents a general trend of drought for the past 20 years?
A. Not drought. This -- no, because this record -- see, these are projections. The only record is the blue line. So let's just talk about that. What we're saying, we're agreeing with Eakin and Maxey that this wet in these -- this high spring flow in about 2000, okay, followed by about 20 years something back here, where's 20 years? Okay. 20 years. 12 to 22, 12 to 22.
So from here, some interval of climate in this range up north produced what you see in that year. So in other words, the measurement from 2000 is explained by function of base flow measurements, weighted base flow measurements dating from 12 to 20 -- two years before that observation. And the model just seems to hit that observation right on almost.
I mean, it's not very good in some places. I mean, you know, it's not good here and especially not good here. But it comes back, it comes back in the last two years we're on, we're on our projection. And we'll keep this going

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for ten years and see what happens.
You know, it looks like the Muddy River or the spring is in for a not too bad the next ten years according to our model.
Is that helpful at all?
Q. I think I'll -- I'll leave it there. I'm trying not to be redundant as well.
A. Okay.
Q. So okay.
MR. MILLER: Okay. Yeah, no further questions.
MR. JOHNSON: I feel kind of bad about that. I wasn't very effective.
HEARING OFFICER FAIRBANK: Okay. National Park Service.
MS. GLASGOW: The National Park Service has no questions at this time. Thank you.
HEARING OFFICER FAIRBANK: Okay. Seeing no questions from National Park Service, we'll move to the Southern Nevada Water Authority and Las Vegas Valley Water District.
CROSS-EXAMINATION
BY MR. TAGGART:
Q. Good morning, Mr. Johnson.
A. Good morning, Mr. Taggart.

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Q. My name is Paul Taggart, I represent the Southern Nevada Water Authority and Las Vegas Valley Water District.
Mr. Johnson, are you aware of how many other expert reports have been submitted in this proceeding?
A. Well, I've looked at all of them and printed and bound the thick ones, no.
Q. Okay. Would it surprise you if there was 11 separate expert reports submitted on the --
A. Not a bit.
Q. Okay. And your analysis is one of those 11 expert reports. Does that sound about right?
A. The one outlier, yeah.
Q. And I guess that's one of my questions is, do any of the other expert reports agree with your conclusions?
A. Well, in part. That's why I was so hoping I'd hear the word anisotropy because when you back off from these individual fault studies to a regional picture, that's what those local features give you.
So we're, in a small sense, comparing apples and oranges in your question, because we base all of our thinking at this point on regional study. And even though our Tribe has local interests, the physics is regional. And everybody else has -- seems to have taken a much more local approach.
So I think there's lots of points of agreement

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regarding any or all of the discussions in faulting. But it's -- there's not a direct -- they're different. I mean, we think differently about this.
Q. Okay. And you describe, I think, your report as the outlier; is that a fair statement?
A. Just this moment, I did. It is.
Q. Okay. And who's Marty Mifflin?
A. Dr. Martin Mifflin wrote the book on delineation of groundwater flow systems in Nevada in his doctoral dissertation in 1968 and he's sitting behind me.
Q. Okay. And you've worked with Mr. Mifflin on a lot of the questions and issues that your presented in your testimony this morning; correct?
A. All of the key issues. I mean, he's reviewed everything. We're in general agreement, not on every single small item, but yes, he's reviewed all my submittals -- our submittals, our submittals.
Q. Now, do you have the -- well, I'll ask you to turn to the slide under presentation. Do you have that available?
A. Well, I can click down to it.
Q. All right. Let's go to -- well, there's the slide with the large blue dots on the line with the large blue dots; do you recall that slide?

A. Um-hum. It was a -- I think -- yep.
Q. And that's in your report; correct?
A. It's in the appendix on the scope and model. That's a plot made by the scoping model or by the software hosting the scoping model.
Q. Now, you're familiar with the MX-5 well and the 1169 pumping that occurred at that well; right?
A. Yes, sir.
Q. And do you agree that the MX-4 well and the hydrograph for the MX-4 well reflects the pumping signal from pumping at MX-5 during 1169 pumping test?
A. Well, it's dominated by that, and of course, you didn't ask about the environmental, the barometric and title. But I think there was some Coyote Spring Valley pumping. I doubt if it would be -- we don't know, we can't resolve it. But there would be minor influences, but I'd say that would be dominated to our measurement limitations by MX-5 pumping.
Q. Okay. And you'd agree with me that the two wells are essentially on the same pad. They're on the same property within a couple hundred yards of each other; right?
A. I think they're in a broken zone of sorts and we've seen different representations of that. But they're definitely in a -- they share a high permeability domain.
Q. Okay. And you heard the testimony from

Mr. Reich; correct?
A. Yes.
Q. Okay. And I don't want to mischaracterize his testimony, but do you recall what his testimony was about his conclusion regarding the effect of pumping at MX-5 during the Order 1169 pumping test on EH-4?
A. No, I've just been focused on that horse block, having some ideas about that.
Q. Okay.
A. Not EH-4.
Q. Would it -- do you know if you were the only expert who believes that pumping at MX-4 during the 1169 pumping test does not influence EH-4 water levels, do you know if you're the only expert that believes that?
A. It does.
Q. Oh, it does. Okay. Could you --
A. Oh, yeah, yeah, yeah.
Q. Okay.
A. Yeah, it's in -- oh, yeah, we've presented that over and over in different places, yeah. The -- it's got -- I want to guess roughly half of the drawdown of MX-4, maybe more.
Q. Okay. So you agree that pumping in the Order 1169 pumping test demonstrated a hydrologic connection between

EMX-4 area and the EMX-5 area and EH-4?
A. Oh, not just that, I think that pumping signal is diagnostic all the way down to Apex. And the reason it's diasostic is because of that unplanned -- I won't say unplanned, maybe you planned it, that five-month shutdown, that recovery during the early 2012, that was diagnostic. Nobody could say that BMDL-2 signal is not MX-5 pumping.
But I will say the upper Kane Springs Wash does. No, that's a -- that put out a diagnostic signal, that went along these features 20 miles.
Q. Okay.
A. Maybe not 20, but all the way to Apex.
Q. And the next question I have is, do you -- you have a page in your PowerPoint that I was a little confused about, page 14?
A. Okay. Yeah, and I'm not counting. What do you want to see? About there, am I close? I don't have -- oh, yes.
Q. Yes, next slide, right there.
A. Yeah, yeah, yeah. Good, good.
Q. I thought I heard you say that, in your view, this would be the only index that should be used in the area? Was that --
A. No.

Q. Am I accurate in --
A. If I knew what I know now and we were beginning the Order 1169 analysis, trying to separate the pumping from whatever else was interfering with it, and that we do that in every pump test, I mean, to some extent.
This one is just difficult because it was so alarming because the antecedent trend is so dynamic and not predictable. And it's not very --
Q. Well, in your earlier diagram where there was the dotted line, the blue dotted line?
A. Um-hum.
Q. On the right side of that dotted line or to the east was shaded in yellow, right?
A. Yeah, I cut out some low elevation terrain that the model solved, but shouldn't even be in the model.
Q. Okay. But that -- other than that part that you cut out, which was to the far extreme east, I think, of the original domain?
A. Um-hum.
Q. But the area that would remain in shaded yellow?
A. Yes.
Q. And you referred to that as Muddy Springs capture?
A. Well, the -- yeah, the capture zone, it goes to

Meadow Valley Wash, Meadow Valley Mountains and out into Coyote Spring Valley.
Q. Okay. And so when we talked about MX-4, MX-5 earlier, you'd agree that's in that capture zone for the Muddy River Springs area?
A. Yes.
Q. Right? Okay. And is this well that we're looking at on this hydrograph, which is in Kane Springs, I believe, is -- do you also believe this is in that capture zone?
A. Yes, yes.
Q. Okay. And I guess when -- I mean, I don't understand what you mean by this one being an index. Is it an index for seeing what happens?
A. Oh --
Q. Well, sir, let me finish my question, please.
Because I understand what you mean by an index well. But to what value does that well provide you that index? Is it what occurs from pumping or what doesn't occur from pumping? I mean, do you see --
A. Oh, the background, yeah, yeah. What we like -- I mean, ideally you'd like to know what that water level in your -- at your test location would look like if you weren't pumping because that's what you subtract from to get drawdown.

And so if you don't know it, you don't know drawdown if you don't know the antecedent trend. And these long-term acre antecedent trends are horribly difficult. I mean, I can almost not believe that we've actually got a useful working relationship for it. It can be improved for the -- now we're back to the climate model.
But, no, this is what I would take as what those water levels would look like throughout the -- what we've been calling southern flow field. Let me -- I would say hydrographs of the EH-4 form might be subtracted from this hydrograph to get a different kind of pumping signal than we analyzed.
Q. Okay.
A. Yeah.
Q. And in your testimony, you indicated that you only had two weeks to perform your modeling exercise?
A. Yeah, it's --
Q. And I have a question about that.
A. Yeah.
Q. You understand the order that the State Engineer issued requiring -- or asking stakeholders to submit information was on January 11th, 2019, and the due date for expert reports was in July of 2019. So that's roughly six months, I think?

A. Um-hum.
Q. Why did you only have two weeks?
A. No money. It's a demo. It was a -- it's -- the software developers will give you a free two weeks, hoping you'll buy their software. And this is a really high-end expensive software package, really capable world wide.
Q. I see.
A. You know, in the waste management community, it's used everywhere.
Q. So the demo period ran out in the two-week period?
A. Yeah, I need to give them -- they haven't given me a price, but it's real -- it's too expensive for DRI, put it that way.
Q. Okay. So that two weeks is the demo period that you were able to use the model and --
A. I did as much as I could in two weeks.
Q. Okay.
A. Around my drinking.
HEARING OFFICER FAIRBANK: Mr. -- Dr. Johnson, if you'll just go ahead and let Mr. Taggart finish his questions before you start answering. Otherwise, it creates a very difficult record for the court reporter to decipher.
MR. JOHNSON: I caught myself, and I apologize.

BY MR. TAGGART:
Q. Would you agree with me that, generally, before numerical model is developed, a conceptual model has be to created; right?
A. Yes.
Q. And you developed a conceptual model of the regional area that you believe contributes to the Muddy River Springs, you developed a conceptual model before you developed the numerical model, right?
A. Yes.
Q. You'll have to --
A. Yes.
Q. And would you agree with me that that conceptual model that you developed is not the consensus of scientific opinion regarding the hydrologic and geologic conditions in the region you analyzed?
A. Well, it's a -- there's a couple of points worth making. It's a scoping model and you're the only folks that have seen it, you know, so there's not -- and I don't know if even if you've seen it, if you've had a chance to really digest what we're saying and think about it.
Q. Okay. And let me clarify my question because I'm short on time. But you understand that many times when a numerical model is developed, the conceptual model is

documented and distributed for peer review by other scientists in the community; right? That occurs; correct?
A. Well, I won't agree because I'd like to make a -- well, let me just not -- can I just not answer that question?
Q. Okay.
A. Because I don't have a good one.
Q. So you do not agree that the conceptual model of a hydrologic region is not generally reviewed prior to the development of a numerical model?
A. Now, can I speak? Yeah, here's my answer. You have a conceptual model. The binary model is on the website. It's very simple. We like simple models. If you read our ADM paper from 2006, the entire model -- I mean, there's pictures, but the entire model is in one table.
You have recharge, your permeabilities of free flow domains, the thickness, it's all in one place. You could -- half an hour, you could have G-flow, you could recreate our model.
Same with this one, except you don't have to do the mesh. You can just load it up and start filling in with properties. So it's so simple that it is the conceptual model and it's all our assumptions. So everything is assumed, so it is our own conceptual model.
It's just not -- it hasn't been circulated and

thought about enough for too many people -- well, nobody's really argued with us because nobody really understands it yet. I mean, it's easily understood, it's just, you know, are these guys crazy or is there something that -- you know, bringing in the heat and the anisotropy, does it help us.
Q. Well, and earlier when you were testifying, you said something about getting beat up about all of this when we presented it. What did you mean by that?
A. Tongue in cheek. This -- you know, this Las Vegas Valley, you know, just think about, what if that's real?
Q. Okay. I don't want to ask you --
A. And -- well, who brought up that --
Q. Well, Mr. Johnson, you understand the State Engineer has to make a decision about groundwater in the Lower White River Flow System?
A. Right.
Q. And that decision needs to be made based upon, you know, sound scientific judgment?
A. You bet.
Q. Right? But is there any other scientist who believes that the amount of water is flowing into Las Vegas Valley as much as you believe?
A. Yeah, he's sitting behind me.
Q. Okay. Other than you and Dr. Mifflin, is there

any other person who have any other literature that you can point to that postulates that amount of inflow to Las Vegas Valley?
A. Well, I've told you, it's misestimated. Everybody's stuck with the Spring Mountains ever since Maxey.
Q. Okay. So just to be clear, that's a new idea that you've authored; correct?
A. See, I don't know that. I don't know that it's a new idea.
Q. Well, then is -- you can't point to any other literature with that opinion in it; correct, other than your own?
A. Well, there's no -- yeah, I'll agree with that.
Q. Okay.
A. We're out in -- we're outliers.
Q. Do you know what the gradient is between Garnet Valley and Las Vegas Valley?
A. Yeah, we showed you -- we've got the photo --
Q. Okay. Is it true that there is an upward gradient before you can get into Las Vegas Valley from Garnet Valley?
A. Not necessarily, because you don't know the thickness or the composition of the water colony.
Q. Okay.

A. So the freshwater head is unknown.
Q. All right. Well, there's a page in your PowerPoint, it's page 11.
A. I didn't mean to get testy there, Paul. Sorry.
Q. That's okay. I understand. I think my time is up.
HEARING OFFICER FAIRBANK: It is. Let's go ahead and take a ten-minute break and we will go ahead and resume at I'll say 10:50.
(Recess.)
HEARING OFFICER FAIRBANK: All right. We will go ahead and go back on the record.
And so the next participant up is the Moapa Valley Water District. And I saw Mr. Morrison here a moment ago, but I do not see him here right now. I think maybe -- and we may end up -- if Mr. Morrison doesn't step in here in a moment, we may just go ahead and go out of turn slightly, just to go ahead and keep this proceeding moving forward.
Not seeing Mr. Morrison, so we'll go ahead and get back to Mr. Morrison and open it up to Lincoln County and Vidler.
MR. MORRISON: We've got no questions for Mr. Johnson.
HEARING OFFICER FAIRBANK: Okay. Just for the

record, we'll go ahead and just make a note that the Moapa Valley Water District indicated they did not have any questions. Thank you. Ms. Peterson.
MS. PETERSON: Thank you.
CROSS-EXAMINATION
BY MS. PETERSON:
Q. Dr. Johnson, Karen Peterson representing the Lincoln County Water District and Vidler Water Company.
A. Good morning.
Q. And I heard you say, I thought a couple times during your direct presentation, that you couldn't get your model to work; is that correct?
A. No.
Q. Okay. Is your model calibrated?
A. No. Oh, correction, I might say there are degrees of calibration, but remind everybody this was a scoping model where we just pick a set of parameters and see if it works, see if it works both in terms of getting reasonable predictive heads and temperatures or -- and also mathematically if it works. So it was a scoping model, we just set out to see what we could do in two weeks.
Q. Right. And you don't recall testifying that you couldn't get it to work? I thought I heard you say that a couple of times.

A. Well, it worked -- when you say "worked," we think it gives reasonable results in the eastern part because both the heads and the temperatures look reasonable and the captures zones look reasonable.
But in the west, there's no warming in the springs. So it doesn't work in the western areas and also there's some elements along the edges that need to be removed from the model domain. So I'd say it's partially calibrated and incomplete.
Q. And would you agree that a model must be fully calibrated in order for it to be reliable?
A. Well, models have all different purposes and there are many kinds of models. I'd say, no, without being -- I'm not being argumentative, but the answer is no.
Q. You don't think models need to be calibrated?
A. No. I have a model for how fast this will hit the floor. I'm holding a pen and threatening to drop it. That comes from gravity. So calibrated, I'm not -- I mean, I'm not calibrating anything and I don't know about -- but see, that's a model.
A model is just a concept and it can be implemented in a number of ways, mathematically, by experiment or whatever. Model is just a way of thinking in our case a process.

Q. Is -- again, not to -- I think calibration's really important. So is your model calibrated to observations of groundwater elevations in the Lower White River Flow System?
A. We attempted to match -- well, this is a beginning. But we attempted to match heads and temperatures at Tule Springs based on -- no, we calibrated to the head at Tule Springs and the Steptoe MX-4 well, and let the model calculate temperatures with the assumption that the water goes in at one degree Celsius.
So we think we've got a foundation that we can build on. It's mathematically stable and if -- with reasonable parameters, it gives us reasonable outputs of heads and temperatures.
Q. But it's not fully calibrated?
A. Not --
Q. Would you agree?
A. No, no, no, not even close. It's the beginnings. It's just the beginnings of a working tool.
Q. The model, we're talking about your feed flow model?
A. Yes.
Q. All right. And so would you agree that at this point, just because it's the beginnings, that it's probably,

at this point, not something the State Engineer can rely on; would you agree with that?
A. Well, the -- without having a big discussion about reliance, I mean, he's going to put some weight to it and it's at his discretion. So I don't think it should be discarded and I don't think that it's accurate in the sense that, you know -- well, on the west side, it's completely wrong. The water doesn't warm up. So, no, it's the beginnings.
There -- it's a -- it illustrates a conceptual model. That's its value is it shows the State Engineer how we're thinking about the problem and we're thinking about it differently.
Q. And is your model calibrated to observations of spring discharge in the Lower White River Flow System?
A. The spring discharge is an input. We take -- we total up the -- from one reference from a recent USGS -- it's Carlisle and Brooks, I believe. We total up all the regional springs or a -- we select the larger regional springs and take that total discharge estimated, except for Las Vegas Valley now. We take a new number for that.
But we distribute that quantity of water annually over all those elements that were colored yellow and gold, so over about 1400 square miles, which comes out to about

15 centimeters a year of recharge into the carbonate rocks. So that's the conceptual model.
That's a conceptual model and it's easily recorded or documented in our submittal. So that's what a submittal does. It's not a calculation tool, it's an illustration of how we think about the problem.
Q. So would you agree it's not a -- it's not a calibrated model, you said if it's an illustration?
A. Well, it's calibrated because we have a calibration point. We have a temperature and a head at Tule Springs that we're trying to match. And so we matched it as closely as we could with the uniform transmissivity.
See, our -- part of the -- part of the reason we did it this way is what does this system look like in the absence of features? It's unform -- uniformly anisotropic -- how should I say? There's no faults, there's no faults. There's no heterogeneity, it's all the same transmissivity, just the orientations are different.
So you take out all that stuff that the others build into -- or typically we build into a framework and we don't have that. So our model is really simple. It's not a -- it's not a calculation tool.
It's an illustration of how we think about the system with the potential for being calibrated, depending on

what your purpose might be, because this is a -- it's a powerful software that can do lots of different things that we haven't tried to do.
We just tried to set out the geometry and answer the question, why is this recommended flow domain so big, because that's where the physical boundaries are. And what are the -- what are the properties of this great big thing? Well, transmissivity pretty much has to be what it takes to get the water and the heat at the right place at the right temperature.
And so it's a beginning. It's a beginning and it's not calibrated in the sense that management tool would be calibrated, not even close. But there was a period of time devoted to calibration just as there was a period of time prior to that developing the mesh, dealing with the anisotropy angles, you know, a number of things before we could even think about calibrating in the last couple of days before sending the thing.
So it illustrates how we're thinking about it, and if we ever get back into it or someone else does, they can start making it work better.
Q. Do you -- is it a tool or calibrated in any fashion that impacts could be -- impacts could be shown that would be reliable?

A. Well, I -- at this point, and depending where, I think you could use it for first approximation of impacts. You know, something you might -- might help you design an aquifer test maybe, maybe in terms of how much area might I need for this aquifer test, because if it's tight rock, you need to be enclosed if it's like we have, you know, you'll get responses possibly miles away.
So it could be useful for test design, for identifying areas where we're less confident about the relationships, but not in a quantitative sense to -- it's not a management tool, but perhaps could be grown to be one.
Q. And so directing your attention to page 59 of Appendix 3 in your Exhibit 2?
A. Um-hum.
Q. You make a statement there at the bottom of the page with regard to pumping in Kane Springs Valley?
A. I'm sorry. I'm looking for the page.
Q. Yes.
A. Okay. Okay. 59?
Q. Yes, 59 on the bottom?
A. Okay.
Q. The very last paragraph?
A. Um-hum. Right. Those are the time of travel capture zones that the program computes.

Q. Correct. But do you agree that that should -- that's, I guess -- well, sorry.
Did you calculate the propagation of drawdown from assumed pumping in Kane Springs Valley?
A. Well, the model is a steady state model, so no.
Q. All right. And how about in Delamar Valley?
A. Well, it's a steady state model, so it's all constant in time.
Q. And then, Dr. Johnson, I'm going to direct you to Lincoln County, Vidler, Exhibit 19, and I have a copy for you here and I have a copy for your counsel.
MS. PETERSON: And may I approach?
HEARING OFFICER FAIRBANK: Yes.
BY MS. PETERSON:
Q. Are you familiar with that, Dr. Johnson?
A. I wrote it, at least part -- no, I'm sorry. I wrote it with Marty Mifflin.
Q. Yes. And if I could direct your attention to Table 1, which is on page -- well, it's page 31 on the bottom?
A. Yes.
Q. And could you read -- do you see the -- on the left-hand side, there's a column that says "far field controls," and under V-12, it says, "Kane Springs Wash Fault fault". Do you see that?

A. I see far field controls.
Q. Oh, I'm sorry. No flow barriers. I apologize.
A. Yeah, um-hum. I do. I see that.
Q. All right. And could you explain what this means, the notes here under the stream flow barrier that you have here for Kane Springs Wash fault?
A. Okay. I need to look at the figure to see B2.
Q. This was a model that you built; is that correct?
A. Yes, and the reason -- you know, it's been a long time. But that was one of the features. We put a number of features in there to impede flow to try and reproduce water levels using known or suspected fault zones.
I mean, simplified, obviously, but with those F's and B are barriers to flow. And I think they're fully penetrating, I think they're like a wall, if I'm not mistaken.
Q. And this was a model that you built the AEM model; is that correct?
A. That's correct.
Q. And this was a regional carbonate aquifer model that you built -- well it was -- this abstract was published in this groundwater publication in 2006; is that correct?
A. Well, the article was published in 2006, but it took us about two years of peer review. So I'm not -- what was your question? I'm sorry. It was published in 2006.

Q. Right. And so the model was built sometime, a little prior to 2006?
A. Yes.
Q. Would that be accurate?
A. Um-hum.
Q. And if I understand this correctly, what you're indicating is to make the model work, you had to put in this Kane Springs Wash fault no-flow barrier, right, to make the water elevations match between the two wells that you have there?
A. Well --
Q. VF-2 and CSV-3?
A. Well, two parts to the answer, if you don't mind. You know, I don't remember the details just because it's been as long as it has and I -- there are a lot of things I do in this paper differently now.
But I think the takeaway was that, you know, from this whole effort, was that without B -- let me just make sure which B it is in the figure.
Q. It's Figure 3; is that right?
A. Yeah.
Q. Or are you looking at Figure 5?
A. Yeah. Well, okay, I would have taken these from geologic mapping. And all we're doing here, this is pretty

simple minded, we've got a -- we've got a steady state flow field.
We're trying to assign -- we assume a thickness and we assigned hydraulic conductivities to the different domains and then we try to match water levels. And we fiddled with it and we fiddled it. It's trial and error. I mean, this one is truly trial and error.
And it runs quickly and so over thousands of attempts over, you know, two months, we get the water levels to match pretty well with the transmissivities that we've measured.
You know, that's the beauty of this, is these K's in there are with our assumption of -- I think we said 4,000-foot thickness. I can't remember. But with the -- these give the -- with our assumed thickness, these get our representative of transmissivities that were measured.
So that's the one place we're proud of the model. The place we're not proud of the model is the EH-4 and 5 simulations, Figure 5.
MS. PETERSON: I don't have any other questions. Thank you.
HEARING OFFICER FAIRBANK: Next, City of North Las Vegas.
MS. URE: We have no questions.

HEARING OFFICER FAIRBANK: Okay. Seeing no questions, the Center for Biological Diversity.
MR. DONNELLY: Thank you.
CROSS-EXAMINATION
BY MR. DONNELLY:
Q. Patrick Donnelly for the Center for Biological Diversity. Thank you, Dr. Johnson, for your testimony.
A. Greetings.
Q. I've got a number of questions. I guess, first, as a baseline question, how long do climate signals take to show up in the Lower White River Flow System approximately?
A. Our position -- I'll have to answer in general, because obviously there's not a single number.
Q. Sure.
A. I mean, in reality. But our position based on our analyses is decades. And the previous, I will say, conventional wisdom is centuries.
Q. You cited, at various times, a 20-year lag time. And in a previous question with the Fish and Wildlife Service, you cited that the two greatest hydrogeologists had determined that time. Who are these two greatest hydrogeologists?
A. Did I say that? George Maxey and Tom Eakin, I think.
Q. Okay. And so you're citing Maxey-Eakin for a

20-year lag time on pond signals?
A. Well, Eakin found it by comparing the autobahn precip gage record with the Muddy River discharge record. And then when Maxey and his students came along, a couple of years later as consultants for Nevada Power, they had a couple of more years of record and basically made the same suggestion, that it looks like you might have a 15- or 20-year lag between wet years and high discharge.
Q. Were you here for yesterday's testimony from the National Park Service?
A. Yes.
Q. And do you recall them siting data showing climate signals taking less than one year to show up in the carbonate groundwater levels in the Lower White River Flow System?
A. Well, we think -- yes.
Q. And you did not find that data compelling?
A. In part.
Q. Which part?
A. Well, we have -- if -- well, we find two distinct forms of the -- of discharge hydrographs. Okay? There's one common that I'll call the EH-4 form that is the form that receives these diagnostic pumping signals.
The ones with the 2012 recovery in the middle

diagnostic. I'm sorry. Now, with that, going off on that, I lost my train of thought.
Q. I'm actually going to have to move on. I have a number of other questions.
A. All right. I just --
Q. Thank you, thank you. You cited climate data from tree rings in your report?
A. (Nodded head.)
Q. Does tree ring data demonstrate anything about recharge rates?
A. The width of the tree ring -- now, this is from reading. This is not expertise. But the width of the tree ring, in general, represents a wet year.
Q. Does that indicate anything about recharge rates?
A. Potential recharge rates, yes, but not recharge rates.
Q. Okay. So the tree rings do not indicate recharge rates?
A. No.
Q. You cited data from the Humboldt River at Palisades. Do Humboldt River flows indicate anything about recharge rates?
A. I believe they do as a proxy for available moisture.

Q. Might there be confounding factors which might alter the climate signals as -- excuse me.
Might there be confounding factors, which might confound climate signals as they pertain to recharge rates?
A. Well, where I have been confounded with this particular problem was the increasing flows in Maggie Creek that affect the flows at Palisade, which we're using as an explanatory variable set. The municipal water used in Elko, I don't know if they take river water.
Somebody upstream is taking some river water. So I'd say, in my mind, the biggest confounding factor is that we don't know if the diversions have affected our -- the total at Palisade.
Q. Are you aware of mine dewatering in the Humboldt River basin?
A. That was my point -- yes, yes.
Q. Are you aware that it has cumulatively removed millions of acre-feet of water from the groundwater there?
A. Well, that's another confounding factor -- yeah, yes.
Q. Might this make it such that Humboldt River flows at the Palisades do not accurately depict a climate regime?
A. Yes, if that -- if that cone of depression is interacting or affecting or depleting the river, absolutely.

Q. In your report, you also cite data from the Virgin River; correct?
A. Yes.
Q. Are you aware as to where the head waters of the Virgin River are?
A. In Zion Park, I believe.
Q. Is Zion Park part of the Colorado Plateau?
A. I don't know.
Q. Okay. Are you aware as to whether the climate in Zion Park and the other head waters of the Virgin River is the same climate as the Great Basin in North Mojave Desert?
A. Well, the climate -- if you're looking for a hundred year representation of the climate, there's nothing else out there.
Q. You seem to indicate that significant recharge occurs only above 8,000 feet in eastern Nevada; is that correct? I was not totally clear on that.
A. It's a northward plunging recharge cutoff surface, that latitude 36 north is at 8500 feet based on horology of the Kaibab Plateau.
And at latitude 40 north, it's at 7,000 feet, just above the fish hatchery, entering the Ruby Mountains is where it comes out.
Q. Does this imply that there's essentially no

recharge within the Lower White River Flow System, for instance, since there's no terrain above 8,000 feet?
A. We have some -- very minor areas, but I'd say, yes, to the regional system that's sustaining these Warm Springs, most of it comes from further north.
Q. If there is no recharge below 8,000 feet at latitude 36, doesn't that imply that the vast majority of Nevada's calculations for recharge in perennial yield are wrong across the whole state?
A. Well, the basin -- see, the difference is there's so much more water in the alluvial systems than in this regional carbonate system, that for water balance in individual basins, they can just ignore this.
Q. They can ignore recharge?
A. Well, the -- we're talking about 200,000-acre-feet of water here. And how much water is in Spring Valley? I mean, this is a -- you know, we're -- as far as the state-wide resources, this is not a big deal.
It's a big deal environmentally, but it's -- in terms of the recharge, there's plenty of recharge through infiltration into the alluvium basins through the stream beds.
And like we heard yesterday, much less -- any of us that have dug holes in the desert know that there's not a lot of -- even after it's raining, that the wetting front

isn't very far into the soil.
So there's recharge to the alluvial basins primarily through the streams and well documented, like 40-mile wash especially, good data there, Amargosa, good data --
Q. Excuse me. Is there a connection between the alluvial and carbonate aquifers?
A. Unknown, but probably because the isotopic composition continues to become more and more -- in general, more and more enriched as you go southward.
Q. Thank you.
A. So there's got to be some contribution.
Q. Thank you. Excuse me one moment. I have a figure I need to pull up.
MR. DONNELLY: May I approach the witness with a figure?
HEARING OFFICER FAIRBANK: Yes, you may.
MR. DONNELLY: I have to apologize, it's on my laptop. I'm a new fangled kind of guy and didn't print anything out for this thing. So -- but I have it blown up and the brightness all the way up.
HEARING OFFICER FAIRBANK: And, Mr. Donnelly, if you'll just make sure that you identify what it is that you're showing the witness.

MR. DONNELLY: Before I give it to him.
HEARING OFFICER FAIRBANK: Well, we --
THE WITNESS: We're looking at --
MR. DONNELLY: I've given him Figure 5 from the Center for Biological Diversity's July 3rd report, a depiction of annual precipitation from 1990 to 2018 in the southern -- extreme southern Nevada District of the Western Regional Climate Center data.
HEARING OFFICER FAIRBANK: Thank you.
BY MR. DONNELLY:
Q. Do you observe a trend with that data?
A. No.
Q. So we see that precipitation is essentially -- I'm sorry?
A. No.
Q. So precipitation, on the whole, is essentially flat?
A. There's an annual periodicity, but the trend is -- there might be a trend, but it's not visually.
Q. So there's no reason to think there's a drought in southern Nevada over the past 30 years?
A. Well, from the dying vegetation, something's going on.
Q. No doubt, no doubt. But there's no reason to

think there's a drought or decline in precipitation over those 30 years; correct?
A. Correct. From that record, correct.
Q. Thank you. You declared that the drought starts in 1999; correct? The drought signal begins in 1999?
A. I don't think I did. But that would be about when -- well, no, no, no, that's not -- I don't think I said that and I don't know how you would define the beginning of it, a drought.
Q. I'm going to have to come back to that at a later time. You show on page 32 of your report, an increase of approximately one CFS at Big Muddy Spring from 2010 to 2014, after which it continued increasing by more than 12 percent; is that correct?
A. 132, I've got Iverson and Warm Springs West. Are we on the same figure?
Q. I'm sorry, I was going off of our rebuttal report. So now I need to -- I'm going to come back to this question as well in my next go-round. Thank you.
You estimate 40,000-acre-feet per year to the Las Vegas Valley. That estimate is based on Darcy's law; is that correct?
A. In part.
Q. And what was the transmissivity used for that

calculation?
A. It was in -- it's in the report. It's intermediate between what Mifflin International got at some wells down in Black Mountains area and the MX-5 or the -- yeah, the Order 1169 transmissivity and it was higher than we determined at ECP-1, I believe. But the number is in there.
Q. And for one of the references to determine that transmissivity, you used your own unpublished report from 19 -- I'm sorry, your collaborator, Dr. Mifflin's unpublished report from 1992 prepared for Nevada Cogen?
A. I did.
Q. Is that correct?
A. Yeah, he --
Q. Was this 1992 report peer reviewed?
A. I don't know.
Q. There are no fewer than 13 unpublished reports in your July 3rd report; is that correct?
A. I'm not sure. They were mostly HRT reports, I think.
Q. There are 13, at least 13 reports unpublished from a variety of years dating back to 1945, I believe?
A. '45?
Q. -- or, I'm sorry, sometime previous to 19 --
A. Our reports?

Q. I do not know. I would have to double check.
A. Our reports are almost -- have been considered or submitted here, all have been shared with the HRT, I believe.
Q. You site this report for your estimates of transmissivity -- excuse me. Your report indicates that the anistropy causes that high transmissivity are directly parallel to the flow path to the Las Vegas Valley; is that right?
A. In the Darcy's flux calculation?
Q. Yes.
A. Well, we have -- our two hydraulic gradient estimates are along almost parallel lines and the flow is generally southward. And so we just simply use the transmissivity, the width, the gradient and Darcy's law.
Q. Was there geophysical evidence to back that up?
A. To back what up?
Q. The analysis you just stated that you conducted?
A. Well, I mean, there's always geophysics in the literature. I mean, the big issue with that particular calculation is the Las Vegas sheer zone. We don't know what it is and the Air Force owns it.
So, you know, that area is unknown, but the gradients are such that if you follow the structural grain, you can easily get water comfortably in the Las Vegas Valley.

The uncertainty is not much.
Q. Did you rely on a water budget to determine the 40,000-acre-feet per year of inflow?
A. It was purely Darcy's law.
Q. Were you able to measure discharge or other variables related to that within the Las Vegas Valley?
A. I used the estimate of 60,000-acre-feet, the net withdraw rate of 60,000-acre-feet a year that I got from Dr. Burns, as a starting point, and had to back that off a little through calibration to 59,000.
Q. Is there any reason to think the Las Vegas Valley is in steady state?
A. Yes.
Q. What evidence do you have that the Las Vegas Valley is currently in steady state?
A. Because the Las Vegas Valley Water District has been trying for 47 years to make it so.
Q. Okay. Well, I'll leave it at that.
But -- and you did not use a water budget; correct?
A. What -- budget for what?
Q. For calculating the 40,000-acre-feet of inflow?
A. Well, yes, I -- oh, for that? No, no, no, just Darcy's law.

Q. So no water budget was used and no discharge was measured?
A. Well, I'm not sure how Andrew measured it, but they obviously know what their production is. So, yes, discharge was measured.
Q. Is there evidence that the Las Vegas Valley is in steady state, other than the heroic efforts of the Southern Nevada Water Authority to make it that way?
A. The existence of the import water, the revocation of all the temporary permits since it first showed up in 1972, and the determination of the Water District to stabilize it.
Q. You reference many efforts made to bring it into steady state. Do you have any evidence of it actually being in steady state, of those efforts being successful?
A. No, no, I have a model that assumes it is in steady state and the model can be tested.
Q. Okay. You allege that there is a vast flow field originating in northeast Nevada and moving, down gradient to the Las Vegas Valley; is that correct?
A. According to the fee flow results, yes.
Q. And this flow field includes the Ruby Mountains, the Steptoe Valley, the upper White River and the Pahranagat Valley?
A. Well, not the Ruby Mountains, a portion of

Steptoe. I'd have to look at -- I mean, we can look at the map. But it extends up -- it includes part of the Schell Creek range, does not include -- well, the southern most Snake Range. It includes the Grant, the Eagan.
Q. Perhaps the most pertinent here, it does include the Upper White River and Pahranagat Valley?
A. Well, the model domain does, but the elevations are low. So the recharge areas are not there.
Q. Sure. I guess the point is, you're saying there is not flow from the Upper White River to the Lower White River in Coyote Springs Valley?
A. I'm not saying that. I don't understand what you're thinking I said.
Q. The map you depicted showed flow from Pahranagat Valley, heading westward toward Las Vegas Valley.
My question is, is there any flow from Pahranagat Valley in the carbonate to Coyote Springs Valley and beyond?
A. Oh, we would agree with pretty much everybody, the other presenters that believe there's flow southward across the Pahranagat sheer zone from Pahranagat Valley to Coyote Spring Valley.
Q. So the waters part?
HEARING OFFICER FAIRBANK: And that will be your last question.

MR. DONNELLY: Thank you.
BY MR. DONNELLY:
Q. The waters part at the southern end of the Pahranagat Valley and half goes to -- some portion goes to Las Vegas and some portion goes to Coyote Springs?
A. Every molecule has to go somewhere. It can't go both.
MR. DONNELLY: Okay. Thank you.
HEARING OFFICER FAIRBANK: Next is Georgia Pacific and Republic.
MS. HARRISON: We have no questions.
HEARING OFFICER FAIRBANK: Thank you. Seeing no questions, and Nevada Cogeneration Associates? Okay. I haven't seen Mr. Flangas today. Muddy Valley Irrigation Company.
THE STATE ENGINEER: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions, and I have been informed that Nevada Energy does not have any questions. So let's go ahead and open it up to the Division of Water Resources and State Engineer for questions.
EXAMINATION
BY MS. COOPER:
Q. Christi Cooper, for the record. Hi, Mr. Johnson.
A. Hi, Ms. Cooper.

Q. Page 11 in your presentation today. Thank you.
Based on your flow domain boundary lines on this slide, do you think that the current geographic boundary defined as the Lower White River Flow System is appropriate?
A. Not for the intended purpose as I understand it. Not for the intended purpose as I understand it.
Q. What is -- elaborate on what you think is the intended purpose.
A. Well, I think the -- there's enough evidence that there's throughput. In other words, the water in the Warm Springs, the water in Las Vegas has to come from somewhere. Let's just get back to Las Vegas. And the Spring Mountains don't cut it. I don't think anybody can torque max the Maxey-Eakin method enough to get warm water out of the Spring Mountain.
So it has to come from somewhere else. So that's our thought process is if the water has to get to Las Vegas in much greater quantities than the Spring Mountains can sustain, and will it -- I think we know where it's coming from.
Q. Okay. I have just one more question and I'm sorry if you did say this in the presentation and I missed it. But what do you think is the source of the Big Muddy Springs?
A. Northern high terrain probably. And this is just based on our capture zones, probably areas east of the area

sustaining Pahranagat and Las Vegas. So probably areas east of the blue dots in our first blue graph cover slide.
MS. COOPER: Thank you.
THE WITNESS: Um-hum.
EXAMINATION
BY MR. BENEDICT:
Q. Jon Benedict for the record.
Dr. Johnson, to follow up on the question about Big Muddy Springs, so a discharge hydrograph for that looks also different from other springs that are in the Muddy River area. Would you care to provide an opinion on why those are different and then what the source area might be for those if you think it's a different source?
A. Well, the -- it's a whole leap to go from recognizing that you've got a different source area to recognizing what it is.
But what I can say with high confidence is that the conceptual model for the sensitive high elevation springs, and the low elevation springs both being fed by the same carbonate aquifer.
I don't see any way in the world you can make those such vastly different hydrographs from the same aquifer, you know, half mile apart.
So I think it's just inescapable that there are

different sources. Now, they may -- like was suggested earlier, flow paths might have diverged. We've got some very similar isotropic compositions, but they haven't been monitored sufficiently. See, that's the thing. We have 1 or 2 or 10 analyses, possibly not arid in time, these different springs. So we don't know.

Big Muddy might be more different than we think it is chemically and isotopically than Warm Springs, because they can't be coming from the same place under the refuge, you know, or under the MRSA. So if they're not coming from the same place under the MRSA, where are they coming from?

Well, we can track that EH-4 form hydrographs back up into Coyote Spring Valley and down to Apex. But we don't have anything that looks like Big Muddy Springs, except for the river itself. So it's a really interesting problem. We don't know where -- all I can say is it's coming from somewhere, right? That's a famous quote from Ed Weeks, it's coming from somewhere.

So it's coming from the north and it's coming from High Mountains. And it's probably not coming from the Snake Range, just because of the geology. So any of the other ones.

Q. Could we go to your slide number -- I think it's 8? A couple of questions here. I just want to make sure I

understand the image on the left with anisotropy. The color for the Pahranagat sheer zone area is blue and you suggest that that anisotropy is has a principle direction that's about north 60 east; is that correct?

A. That's about right -- I'm sorry, that would be about right. And I'm pointing with the pointer on the screen to the Pahranagat sheer zone that's colored blue based on its anisotropy.

Q. You've got a large area that's also blue, I'd say south of the Sheep Range and it kind of trends in a north 80 west direction, but it has an anisotropy with a principle direction, which I think is probably similar color. So it'd be about north 60 east?

A. Yeah, the faults, the structural grain bends around -- see, up the Las Vegas sheer zone.

Q. So I'm just curious what that blue zone represents?

A. You're seeing northeast trend -- you're seeing northeast trends. See, those are the structure bending around in California Wash and, you know, Dry Lake and Garnet Valley. The special grain bends in there, and so right in here is trending northeast.

Q. Okay. So that fabric is -- principle direction is northeast to southwest; right?

A. Yes, that's bedrock. This is the bedrock.

Q. Okay. The next question goes to slide seven.

You had stated that your recharge that was used was 15 centimeters a year. Is that applied across the -- well, is that an average for the whole area?

A. Well --

Q. Or is that an average for the mountain range or what's that --

A. Well, it's the total amount of -- quantity of assumed or measured discharge from the different regional springs, spread over the fixed area of high altitude carbons. So we'd have to fiddle with it. See, when we let some water out of the model to improve the calibration, then we'd have to do something with the recharge.

We never messed with the discharge. It was all assigned. We never messed with the temperatures and we never messed with the Eureka well, you know, trying to vary things to make them better.

But we -- to get it to work, you know, we needed to let some water -- and I'm pointing to the northwest corner. We'd have to let some water out up by Kobeh Valley to go into Diamond Valley.

And there's some good -- there's MX wells up there. It'll give you a pretty good hydraulic gradient and a

good basis for estimating the outflow of -- and we'd have to do other work on the model. But the way it worked is we'd have this fixed amount of water we'd want to apply on the -- to these recharge areas, but then how well did it work?

Well, we've got to let some water out over here, and so then we've got to increase the recharge a little bit to make up for the deficit. So that was sort of the workflow in the last two days when we got everything built.

Q. Do you recall what the overall discharge volume for the model was that you used to --

A. It was about -- it was a little over 200,000-acre-feet a year. But they're all -- it's all in how Allen and Crooks, in their table -- it's in our references and I'm not sure which table, but it's in their table of spring flows. And we used their numbers exclusively except for Las Vegas Valley where we assumed 59 -- well, we assumed 60 and then backed it off to 59,000.

Q. Okay. And so just to be clear, that recharge is really considered only the recharge that you would apply to the carbonate aquifers and not recharge that would go into the alluvial system; is that correct?

A. Right. This is treated as isolated from the alluvial system.

Q. Okay. So that portion of recharge that might

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otherwise go into the alluvium wasn't considered?
A. Well, recharge going into the alluvium is irrelevant, unless it also recharges the -- I mean, it's not irrelevant, it's irrelevant to our analysis.
Q. Okay.
A. So unless there's a gradient that gets it into the carbonates, which we don't see or know about, we don't care about it. So we're saying all the water that goes into the carbonates goes into the mountains. Yeah, that works.
Q. Okay. Same for the discharge then?
A. And the discharge is all coming out at the regional springs at a temperature -- we assumed the temperature and I can't remember if it was 35 or 35C, but warm and -- you know, just trying to see if this will work and -- yeah.
Q. Okay. I think that's all I have.
EXAMINATION
BY MR. KRYDER:
A. Levi Kryder, for the record.
Mr. Johnson, I've heard, I think, several different things today. If you could go to slide -- your slide 14, please?
A. Okay.
Q. Thank you. So I thought I heard you say earlier

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that the responses or the trends on this graph were due solely to effected climate and not pumping? Did I understand that correctly?
A. Yes, because I don't know of any pumping near there in those -- in that time frame, yes.
MR. KRYDER: Thank you.
EXAMINATION
BY HEARING OFFICER FAIRBANK:
Q. Dr. Johnson, I have just a few questions.
A. Yeah.
Q. And I'm going to focus on page 35 of your July 2019 report submission where you basically summarize your conclusions and relations to the questions that were, you know, requested or proposed by the State Engineer in Order 1303.
And I guess I wanted to focus on -- first on your fourth conclusion on that page where you state that pumping from California Wash has little to no impact on the Muddy River Springs area and much more groundwater is available in California Wash than previously assumed.
And my question is, did you conclude how much more water is available than previously assumed? Did you quantify that?
A. Well, I don't know what previously assumed was,

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but our 40,000-acre foot estimate is quite a bit different than everything else we've heard, you know.
Q. So just to clarify, so then are you saying that there's 40,000-acre-feet additional water in California Wash?
A. In transit, and including also Hidden and Garnet Valleys through the -- flowing through the Las Vegas sheer zone to Las Vegas Valley is 40,000-acre-feet, according to our Darcy flux calculation.
Q. But you didn't quantify that additional water over those prior assumptions specific to California Wash. You're only talking about that pass-through flow to the Las Vegas Valley?
A. Well, I guess I must think about it differently, because I'm not really making sense of the distinction.
I mean, we've got a -- there's really no alluvial aquifer out there, except for near the springs. So we've got a carbonate aquifer transmitting an unknown quantity of water southward. I think we could probably all buy that. I mean, there's anywhere from little to no water going through the Las Vegas sheer zone or maybe as much as 40,000-acre-feet.
It depends on how you calculate or if you calculate it. Now, the zero to -- some of the early ones that we heard about this morning references two other calculations. I didn't really see any data, any evidence.

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Q. But your conclusion was that there was 40,000-acre-feet going to the Las Vegas Valley wash --
A. Well --
Q. -- based upon the numbers to support what you see is to be the deficit between the Spring Mountain recharge and the water budget essentially in Las Vegas Valley?
A. Oh, I think I understand you better. The uncertainty in that Darcy-flux calculation is almost entirely in the transmissivity that we used. You know, the hydraulic gradients pretty much indisputable. The transmissivities is -- they vary over the magnitude. So they could be northern magnitude, less, it could be more.
Q. So are you -- never mind. I'll move onto another question.
With respect to Subpart 6 on page 35 of your report where you make a statement that if a long-term drought trend evident in climate records persists, no amount of pumping curtailment will restore or maintain high elevation spring flows.
Curtailment of pumping in sustainable locations will serve no purpose, and thus, mitigation measures, including curtailment will likely not prove effective in protecting seeded right holders in the Muddy River and Moapa Dace habitat from continued drought impacts.

So my first question is, is -- and I haven't been clear today on what you believe or what your opinion is as to that timing delayed response for climate in the water flow. It's -- I've heard a range from it can be as little as ten years to centuries.

And so I'm trying to understand a little bit better from our perspective in terms of trying to make management decisions, what your opinion is as to what you believe that climate delay may be?

A. Yeah. We're advocating centuries as shown in that last figure of our direct report with the time of travel capture zones. That's the best we can do now.

And it's consistent, we believe, with both the isotopic data and the heat flow and the radiocarbon ages. If you take the -- well, I don't want to get too technical on you.

But we think it's decades. I only mentioned centuries because others have claimed it's centuries. And, in fact, in the waste isolation business, there's a school of thought that we're looking at ice age water, just centuries just sitting there.

Q. So I guess I'm still confused because you started out your response saying you believed your opinion was it was centuries, and then you said that you believe it's at least

decades. And so I'm trying to get a better understanding.

A. You misunderstood me. I was giving credit to the Southern Nevada Water Authority and their work to the north in the estimating centuries to impact to senior water rights from activities north of us.

So with that background, that's not my belief. That's a professional opinion of somebody else that you've accepted. So I just gave that for reference.

And in our analysis, because -- both because of these climate solutions, and I think you may have a little misunderstanding.

What we're saying with these two climate solutions, the one for Big Muddy, we're saying is explained by the wet years between 12 and 22 years prior to the observation.

So in other words, this year, whatever we total up in two weeks or a week from Big Muddy Spring for the last year is explained by the weather between 12 and 22 years ago as proxied by domino.

The other one in the EH-4 hydrographs, we're saying that those were explained by weather from last year to 16 years ago. So it's got a 16-year memory, but it's right on us. You know, the first year, we don't know. The first year, we get a kick in the hydrographs.

So that leads us to suspect that maybe that is actually a composite hydrograph as something from the north and something from the Sheep Range.

Q. And so I guess the final question is based upon that opinion that was expressed in Subpart 6, and in this kind of uncertainty or this delayed response to climate change or that -- you know, these declines as you've expressed in your testimony today and in response to Mr. Kryder's question, that if these declines are -- the declines in water availability is due to climate change, and that there's nothing that we can do.

Is it your opinion that the State Engineer shouldn't actively manage the system to try to create some form of sustainability? I guess I'm just confused?

A. Well, I won't say a word about what you should do, okay? But what I will say is that is a very big "if". I should have capitalized that "if," the number six, if the trend continues, because all those hydrographs were presented in the EH-42 now that we have an update to it.

Everything is still declining after the test. Now, we're not doomed. That's not going to go on forever. Nothing goes on forever. But if it continues, the big "if," if it continues, at some point, we'd start hitting trigger levels at the Warm Springs West Gage. We know it.

And so that's what we're trying to call out for you is a big "if," and try to bring in all this other evidence to show you that it's not pumping to blame for all of this. Pumping has an effect. The location matters, it really matters.

Q. So to understand that, then, no matter what we do with respect to pumping, if we don't -- if -- you know, if pumping is able to escalate or deescalate, it will make no difference in the end? Is that what you're saying to us?

A. No. Pumping, in general, will affect -- have more effects closer to the pumping well than more distant. But we all know already that in this heterogenous and anisotropic terrain, you can get minimal effects close in or almost identical effects, you know, drawdowns, you know, a great distance as near. So I don't -- that's a big "if".

You know, we're not saying we're doomed and the climate drought is going to keep going. Everybody needs to be concerned about that, but there's not anything we can do about it. But what we can do is just recognize that all of this water level change is not -- you don't blame the pumping. It's about as -- I don't think it's scientific, honestly. I don't think it's scientific to continue to attribute all the water level change in the EH-4 form hydrographs to pumping.

It's just -- you know, I feel like we've proved it, but -- and obviously it's -- there's a lot of doubt. But I think the pumping effect is minimum. And if something happens with the climate, you're going to have to deal with that as a new process. You've never had to deal with that before. But I would just manage the -- you know, I think if you manage the pumping smartly, you'll be fine.

The climate will do what it will do. You might have to take some extraordinary measures someday, but that's to be figured out. It's a hypothetical. What we do know is -- I say "we," and this is me and Marty and the few we've convinced, is that once you start looking at this more realistically in terms of the flow field and the nonuniformity of -- spatial nonuniformity and temporal nonuniformity of impacts, you'll see it completely differently and I think much more favorably.

Now, it won't be favorable to anybody that -- like Dr. Waddell pointed out, what do you about the excessive production in Las Vegas Valley if it's excessive? Did you really issue water rights far in excess of the perennial yield? That's your problem. But if you didn't, that's somebody else's problem. But I can't talk about -- I'm not authorized or experienced to talk about, you know, the water -- the users.

HEARING OFFICER FAIRBANK: Thank you. All right.

So we're about ten minutes from noon. I just want to kind of get a sense of additional participants because we'll -- we do have time to open it up for additional questions if there are additional questions.

So I'm just going to kind of run down the list, and then assuming there's additional questions, we'll resume after lunch. So Coyote Spring Investments, will you have additional questions?

MR. HERREMA: No.

HEARING OFFICER FAIRBANK: No. Okay. U.S. Fish and Wildlife Service, any additional questions?

MR. MILLER: No.

HEARING OFFICER FAIRBANK: And National Park Service?

MS. GLASGOW: No.

HEARING OFFICER FAIRBANK: No additional questions. Southern Nevada Water Authority, Las Vegas Valley Water District?

MR. TAGGART: Well, I don't want to be the only reason we come back after lunch.

HEARING OFFICER FAIRBANK: So if you're not the only person, then yes, you have additional questions?

MR. TAGGART: If there's going to be redirect and we're going to come back, then we would have questions.

HEARING OFFICER FAIRBANK: Okay. And then Muddy Valley Water District -- excuse me, Moapa Valley Water District?

MR. MORRISON: We don't have any questions.

HEARING OFFICER FAIRBANK: No additional questions. And Lincoln County, Vidler, will you have additional questions?

MS. PETERSON: Not right now, but I don't know what Mr. Taggart's going to do, so --

HEARING OFFICER FAIRBANK: And City of the North Las Vegas?

MS. URE: No.

HEARING OFFICER FAIRBANK: And Center for Biological Diversity?

MR. DONNELLY: Yes, regardless of what Taggart does.

HEARING OFFICER FAIRBANK: And Georgia Pacific?

MS. HARRISON: No questions.

HEARING OFFICER FAIRBANK: Okay. Seeing no questions there. And then Muddy Valley Irrigation Company, will you have any additional questions?

MR. KING: No questions.

THE STATE ENGINEER: No questions.

HEARING OFFICER FAIRBANK: And then, Ms. Baldwin,

will you have -- want to do some redirect?

MS. BALDWIN: Not the full half-hour, but yes.

HEARING OFFICER FAIRBANK: Okay. So let's plan on coming back after lunch and so we'll resume at noon -- or, excuse me, 1:00 p.m.

(Lunch recess at 11:52 a.m.)

STATE OF NEVADA)
) ss.
CARSON CITY)

I, MICHEL LOOMIS, a Certified Court Reporter, do hereby certify;

That on the 26th of September, 2019, in Carson City, Nevada, I was present and took stenotype notes of the hearing held before the Nevada Department of Conservation and Natural Resources, Division of Water in the within entitled matter, and thereafter transcribed the same into typewriting as herein appears;

That the foregoing transcript, consisting of pages 694 through 830 hereof, is a full, true and correct transcription of my stenotype notes of said hearing to the best of my ability.

Dated at Carson City, Nevada, this 27th day of September, 2019.

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MICHEL LOOMIS, RPR
NV CCR #228

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SE ROA 53309

JA_17706

In The Matter Of:

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

DIVISION OF WATER RESOURCES

Vol. IV

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STATE OF NEVADA
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
BEFORE MICHELINE FAIRBANK, HEARING OFFICER
---oOo---

IN THE MATTER OF THE ADMINISTRATION AND MANAGEMENT OF THE LOWER WHITE RIVER FLOW SYSTEM WITHIN COYOTE SPRING VALLEY HYDROGRAPHIC BASIN (210), A PORTION OF BLACK MOUNTAINS AREA HYDROGRAPHIC BASIN (215), GARNET VALLEY HYDROGRAPHIC BASIN (216), HIDDEN VALLEY HYDROGRAPHIC BASIN (217), CALIFORNIA WASH HYDROGRAPHIC BASIN (218), AND MUDDY RIVER SPRINGS AREA (AKA UPPER MOAPA VALLEY HYDROGRAPHIC BASIN (219).
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TRANSCRIPT OF PROCEEDINGS
PUBLIC HEARING
HEARING ON ORDER 1303
VOLUME IV
(P.M. SESSION, Pages 831 - 863)

THURSDAY, SEPTEMBER 26, 2019

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For National Park Service: Karen Glasgow
For Center for Biologic Diversity: Patrick Donnelly

I N D E X

CARSON CITY, THURSDAY, SEPTEMBER 26, 2019, P.M. SESSION
---oOo---
HEARING OFFICER FAIRBANK: Okay. We'll go ahead and go back on the record. And we're going to go ahead and reopen things up for recross-examination. And we'll start with Southern Nevada Water Authority. And we'll allow an additional ten minutes at this point in time for the further questions.
RECROSS-EXAMINATION
By Mr. Taggart:
Q. All right. Good afternoon, Dr. Johnson. Again, Paul Taggart for the record. A couple of quick questions.
One is you were asked about -- by Ms. Peterson about this groundwater study or paper that you did in the groundwater magazine that's marked as Tribe's Exhibit Number 30. Do you remember those questions?
A. I remember the session. Not the specific questions.
Q. Okay. Do you remember whether in that study you considered the -- there to be a no-flow boundary between Garnet Valley and Las Vegas Valley?
A. Well, from the F-1 -- Excuse me. I'm referring to figure one in the reference publication. The F-1 is drawn along the Las Vegas shear zone but it's a segment. It

doesn't -- Yes, there's a segment of the Las Vegas shear zone that's represented as an impermeable boundary.
Q. Okay. Do you believe that alluvial pumping in the Muddy River area captures Muddy River flow, water that would otherwise, I'm sorry, be in the Muddy River as flow?
A. Yes.
Q. And do you believe that happens essentially as a -- on a one-to-one ratio?
A. Yes.
Q. Do you believe that carbonate pumping within the capture zone that you've identified also impacts the Muddy River and the Muddy River Springs?
A. Yes. With qualifications.
Q. Okay. Now, do you have a figure that shows where your Muddy River -- your Muddy River capture zone is?
A. Figure -- Page two.
Q. It's the one with the --
A. Power point. First figure up in the --
Q. Yeah. I was hoping we could find one that's a little bigger. But -- Oh, yeah, figure five from your report, but also that one that's up on the screen. So my specific questions have to do with what is in and what is not in the MRSA capture zone, which I think is depicted in yellow here with your qualification that part of the eastern part of

that would be taken out if you were to do that again today. Does that make sense?
A. Excuse me. I missed most of that as I was looking for figure five in our initial report. And I've got a hydrograph for that of BMDL 2.
Q. I'm looking at page 55.
A. In our initial report?
Q. Yes.
A. Okay. That's the same figure as on the screen.
Q. Okay. And I just want to ask you do you know whether you would consider CSI Well Number 1, CSI Well Number 3, and CSI Well Number 4 to be within that yellow MRSA area, which is the MRSA capture area in your figure?
A. Repeat the wells again, please.
Q. CSI-1, CSI-3, and CSI-4.
A. I think so -- I have another plot, I believe, with those plotted, and I would say yes.
Q. Okay. So, therefore, in your opinion would pumping from those wells, CSI-1, 3, and 4, impact the Muddy River Springs?
A. No. With qualification.
Q. Okay. Well, they're within your capture; am I right?
A. It's a scoping model.

Q. Okay. Earlier you were testifying about how Sheep Range recharge makes it to the Big Muddy Spring, do you recall that?
A. No, I don't believe that's correct.
Q. Okay. Do you think that that Sheep Range recharge makes it to the Muddy River Springs?
A. Yes. To those with the hydrograph of VH-4 form, if that makes sense.
Q. Okay. Now, I think earlier I asked you about impacts from pumping at MX-5 during the Order 1169 pumping test. Do you believe that pumping at Arrow Canyon impacts the MX-5 area?
A. No.
Q. Are you -- Are you aware of anyone else who shares that opinion other than Dr. Mifflin?
A. Well, the opinion has been shared with everyone in this room. And I haven't taken a poll. And I think opinions are changing.
Q. Okay. Now, I'd like you, if you could, could you look at Figure 5-5 that I put in that binder right in front of you?
A. Thank you.
Q. So that is a -- that is in SNWA's initial report and you've reviewed that; correct? You reviewed that report?

A. Well, yes, weakly, w-e-a-k-l-y, reviewed. I've looked at it.
Q. All right. Okay. I'm just using this to look at the hydrographs. So, do you see the top hydrograph there, which is CSVM-1, the top panel?
A. I do.
Q. And would you agree with me that this is a monitor well that is very close to MX-5?
A. I think it is. That's one I'm not as certain of the location on as some of the others. But I believe it is close and northeast, if I'm not mistaken, of MX-5.
Q. Okay. And do you agree that that monitor well shows the signal of pumping at MX-5 during the pump test?
A. I do, because of the diagnostic -- Let me see here. 2012. The 2012 recovery. So yes.
Q. Okay. Now, and can you -- have you quantified the amount of drawdown at that location in quantity?
A. I am not sure. I don't believe -- Well, I'm not sure. I'm not sure. I looked at several wells using our method of differences. And the nearest well was MX-4. And I think the next one out was UMVM-1. So I think I have not looked at any of the detail CSI-1 or -- Is that what it is? CSVM-1.
Q. But is it kind of, in your words, is it okay to

blame pumping for this drawdown in this particular hydrograph?
A. Important point. Drawdown, yes. Water level change, no.
Q. Okay. Now, if you look down at the California Wash, there's one, two, three panels down, there's Pauites-TH2 California Wash. Do you see that panel?
A. Got it.
Q. Okay. And would you agree with me there was also a change in water level during the pumping test?
A. Yes.
Q. Okay. But in this well you do not believe that pumping can be blamed for that change in water level; correct?
A. Not for the entire change. There's a component of environmental -- environmentally -- Excuse me -- environmentally-driven change also.
Q. Okay. But can pumping be blamed for any of this change in this water level?
A. Absolutely, based on the diagnostic 2012 recovery peak.
Q. Okay. And, let me specify, pumping at MX-5 during the 1169 pumping test.
A. Understood.

Q. Yes. Could you go to slide 17 on your power point there, please.
A. I'm trying. I'm trying. 17?
Q. Yes. No. Keep going. Two more. Now, before I ask this question, I've got another slightly different one. You talked about a opinion that you have regarding roughly 40,000 acre-feet of water going through the shear zone, Las Vegas shear zone in to Las Vegas Valley from the Lower White River Flow System; right?
A. Yes. Qualified.
Q. Okay. But would you agree with me that if that was occurring that that amount of water is already being appropriated in the Las Vegas Valley?
A. I don't know what the status of appropriations is. All I have is verbal hearsay. I think better than hearsay, but a verbal total quantity pumped and total quantity reinjected estimates both.
Q. Okay. Did you check the State Engineer's pumping inventories on their website and to validate the statement that was made to you by Mr. Burns or did you just simply rely upon that statement that he made?
A. I relied on his statement.
Q. Okay.
A. And it was modified slightly during the modeling,

during the calibration. But initially precisely on his estimate.
MR. TAGGART: Okay. Thank you very much.
HEARING OFFICER FAIRBANK: All right. So the next participant who had expressed interest in asking additional questions after the lunch break was the Center for Biological Diversity. And you will have ten minutes.
MS. PETERSON: I think I would like some questions.
HEARING OFFICER FAIRBANK: I'm sorry. What was that, Ms. Peterson?
MS. PETERSON: I think I had a couple of questions and I had reserved some time after I heard Mr. Taggart's questions.
HEARING OFFICER FAIRBANK: I'm sorry. I didn't mark you down. But I will go ahead and -- Mr. Donnelly, if you'll wait, we'll just continue in the order as we've been going. So, excuse me.
Ms. Peterson, we'll go ahead and call you up for Lincoln County and for Vidler. Thank you.
MS. PETERSON: Thank you.
RECROSS-EXAMINATION
By Ms. Peterson:
Q. Hi, Dr. Johnson.

A. Hello.
Q. Karen Peterson again for Lincoln County Water District and Vidler Water Company. Were you here for Dr. Waddell's testimony yesterday?
A. Yes.
Q. And did you hear him express an opinion that drawdowns do not stay in capture zones?
A. I did.
Q. And do you agree with that?
A. No. Qualifying.
Q. No. Qualify. Okay. What's your qualification?
A. Depending on the anisotropy of the system, which we're the first to discuss and I'm not sure if we're the first to analyze. But depending on the degree or the extent of how anisotropic the transmissivity is, in the extreme you would have a pipe. And then he's wrong, okay.
So the argument or the explanation that Dr. Waddell gave us is absolutely correct for an isotropic system. And it begins to -- And if you can get him to respond, maybe I've got this wrong. But I would suggest that for an anisotropic system, which is what we analyze, that's less correct than the context of the statement he made yesterday.
MS. PETERSON: Thank you. I don't have any

further questions.
HEARING OFFICER FAIRBANK: Thank you. Mr. Donnelly.
RECROSS-EXAMINATION
By Mr. Donnelly:
Q. Thank you. Patrick Donnelly with the Center for Biological Diversity. Hello again, Dr. Johnson.
A. Mr. Donnelly.
Q. I want to hit a couple of topics we talked about before in a little more detail. First, I would like to get back to this idea of the two flow fields. One we can call the illegal Las Vegas Express. And the other I feel like we didn't get a whole lot of detail about. You know, the map you showed -- I believe it was slide two in your presentation with the two flow fields -- shows a pretty small area for recharging the Muddy River Springs.
And can you expound more on the exact boundaries of this recharge area, particularly how far north and east it goes?
A. And I, unfortunately, because the -- Well, we had access to the software, we didn't make a plot of -- or I didn't preserve a plot of stream lines for the whole state, for the whole flow domain. So what these do north of the illustration is widen out and get really squirrelly as all

the water from all of these little recharge patches tries to get in to get organized in to the system. So it's much less clear.
There is a boundary between the capture zones farther north. But the look of those -- The stream lines are a mess. Put it that way. For it to solve all of these little bits of flow, it doesn't do anything for you visually.
Q. So the northern and eastern boundaries of these flow paths are unclear?
A. Well, not so much the boundary. It widens out. What the eastern captures zone widens out. So they're more proportional to the north. But you do have more water in our assumed conceptual model coming out of Las Vegas and Pahranagat in those springs than you do out of Muddy and Panaca. So we would have a proportionately smaller capture zone, all other things being equal.
Q. Do you have any geochemical or other types of analysis to prove these flow paths?
A. Yes.
Q. Did you present those here and I'm just glossing over that?
A. No. I didn't present any geochemistry, because I was hoping to get it on cross, and so far nothing.
Q. So you have a geochemical analysis tracing water

from north and east of Panaca to the Muddy River Springs area, you're saying?
A. Well, can I show you just one example from a slide?
Q. Sure.
A. I'm going to have to go backwards in my power point. But I want to show you one -- a couple locations and a couple of numbers. Okay. That was it. We've got the slide. That's slide 11. It shows our Darcy flux calculation. And, by the way, that 40,000, in our opinion, is, even though we use transmissivities that were mid-range of what's been measured, we're only comfortable with asserting to you that that would be an upper limit, pending any more data.
But in this figure --
(The court reporter interrupts)
THE WITNESS: I'm pointing to the Craig Ranch Number 2 Well at the southern end of the page 11 diagram of our power point. That well, if you refer to Thomas and others professional paper, I believe it's 1409C, that's got a stable isotope composition of, if I recall correctly, minus 107 and a half or 107 on the deuterium and about minus 14 on the oxygen. That's exactly what Vidler has in KPW-1.
How did that isotopic composition that's lighter

than anything that can be developed at this latitude, how did it get from there to there?
Q. (By Mr. Donnelly) So that is on the western, the Ely to Vegas Express flow path, but not on the Muddy River Springs area flow path; correct?
A. The way we visualize the flow fields as, again, drawn by a scoping model and we can see in detail the problems. But, yes, the water that we claim as entering Las Vegas Valley, I forget the quantity at the moment. But we've got a gradient and everything has got a finite permeability. So some water has got to be going in there.
Q. Can I move this on? But I appreciate this depiction there. Thank you. You're aware of past characterizations of the carbonate groundwater flow paths in central Nevada showing Railroad Valley as a regional sink?
A. Can you be more specific about the literature?
Q. You got me. I do not have a reference for that, so I'll move on. You declared in your report the drought starts in 1999; is that correct?
A. I don't think I said that.
Q. On page 29 of your July 3rd report, you say, since the start of the ongoing drought in 1999.
A. Okay. There's -- If you want to --
Q. I'm just asking if those words are in your report

or not.
A. Well, I don't remember, so I would have to look. Tell me again the page. Actually, let's don't waste time on it. I believe you.
Q. Okay. So you said the start of ongoing drought in 1999. Are you aware of when the significant increase in Arrow Canyon pumping began?
A. It was about the same time. And that's the assumption that we're challenging. That's the fundamental problem here. That assumption that those two are cause and effect rather than just correlative.
Q. I understand.
A. But it is our -- That's our fundamental problem. It all starts there.
Q. Are you aware of anyone else, hydrologists, the other 11 reports being presented here, who agree with that?
A. My co-author.
Q. Indeed. From the 11 other parties in this?
A. I'm not sure. I really honestly think opinions are evolving here. And so ask for a show of hands.
Q. I don't think I'm permitted to do that, so I'm not going to.
A. Well, no. I mean --
Q. I'm not an attorney, but I don't think --

A. I'm not trying to be funny with you. I'm serious. I don't know. I don't know. I hope we've convinced somebody. I hope one hand would go up.
Q. Okay. Thank you. I have one remaining set of questions and I'll move things along here. You show on page 32 of your report, you describe an increase of approximately one CFS at Big Muddy Spring from 2010 to 2012 -- '14; is that correct?
A. Page 32?
Q. Page 32.
A. Figure 27?
Q. You just verbally describe or in text you say there's an increase.
A. Tell me where in the text.
Q. I'm sorry. I don't have it in front of me.
A. Okay. I can find it. Just read it to me.
Q. You say there's an increase of approximately one CFS at -- I'm sorry. I'm flipping between files here -- Big Muddy Spring. Center of the page. Second sentence of the second paragraph.
A. However between 2010 and 2014?
Q. Yes. Discharge --
A. The Muddy Spring increased by one full CFS. Okay. And I'm referencing a figure, 27.

Q. Yes. So are you aware of a fire near Big Muddy Springs in 2010?
A. Absolutely. I was there.
Q. Might the reduction in evapotranspiration due to the fire cause increases in spring discharge?
A. There's been that speculation. I don't know that there's any evidence.
Q. But that could be a cause for the increase in spring discharge?
A. An influence. A component, a forcing agent, yes.
Q. Okay. Finally, one last thing. As we've determined, you said your 40,000 acre-feet inflow to Las Vegas Valley number is based on modeling; correct?
A. Very simple. It's all there, all of that modeling.
Q. Yes, yes. And then in a question from the State Engineer's office you said it could be in order of magnitude more or less?
A. If you were to use the transmissivity of roughly a hundred thousand meters squared a day from the MX-5, 1169 pump test, you would get a lot more water coming across that boundary. But from our steady state, from REM, the published one, we think the transmissivities in that domain in California Wash are much less than at MX-4. And because --

So we put a mid-range between our Calpine test, our ECB-1 test, and the Mifflin International Test down in Black Mountains that got about a -- I'm going to screw up units because they use gallons per day per foot -- about a million.
Q. So but in theory, as you've attested earlier, the amount flowing in to Las Vegas Valley could be between 4,000 acre-feet per year and 400,000 acre-feet per year?
A. Well, if you --
Q. Is that correct?
A. Yes. With qualification.
Q. Would having 4,000 acre-feet of inflow a year throw off the budget that has been conceptualized here?
A. Well, hasn't -- Excuse me to answer with a question. But I think everybody has hypothesized inflow from the Pahranagat Valley. I mean -- I guess I don't understand what you are --
Q. You developed a model for the Las Vegas Valley and the amount of water flowing in and this flow path --
A. Now, this is this simple little model that's on the screen. Is that the one you're discussing?
Q. Yes, yeah.
A. Good. Okay.
Q. So would a flow amount, in-basin flow amount of 4,000 acre-feet substantially alter your results here?

A. No.
MR. DONNELLY: Okay. I guess we'll leave it at that.
HEARING OFFICER FAIRBANK: Okay. Thank you. So and just to confirm, those were the only parties that I had listed for asking questions after the break. Are there any other parties, participants, that wanted to ask questions?
Seeing none, then I'm going to go ahead and open it up to State Engineer staff for any questions.
EXAMINATION
By Ms. Cooper:
Q. Hi. Christi Cooper for the record.
A. Hi, Christi.
Q. Can you go to slide 14, please. Thank you. I believe that you stated that the drop in the water levels that we see after 2014 in to 2015 maybe but you thought that was not due to the pumping response; is that correct?
A. Correct.
Q. Okay. So what do you think is the reason for the subsequent water level rise?
A. The way I would approach this is exactly the way we approached the Big Muddy Spring to find that piece of climate record that explains the, in this case, the hydrographs. In other words, it's a parallel study to what

we did at EH-4, but we would have to go back in to R and look at the thousand possibilities for -- Again, I use -- I would try both rivers. I would try both rivers and see which one I get a better fit with. But, you know, we have hundred year stream flow records that we can sample to try and explain these hydrographs. And if we get with one all positive correlation coefficients, maybe we got it. Maybe that's it.
So that's what -- I don't like to talk about drought anymore. I think it's a red herring. I think most of these explanatory climate intervals are longer than the typical drought segment. So we're better off, I think, thinking in terms of a data-driven model based on the best climate long term, century type climate proxies that we can find.
MS. COOPER: Thank you.
EXAMINATION
By Mr. Sullivan:
Q. Adam Sullivan. I have one question on your slide 11. You give an explanation for this in your testimony, and maybe I didn't quite understand it. But at the bottom end of the figure, there's -- you're showing flow arrows in blue that are going in the southwestern direction and then you show water surface elevations at Gilcrease and Wilshire Wells?

A. The Gilcrease is a spring. Wilshire is a City of North Las Vegas well.
Q. Can you just explain why it appears on this figure that water is flowing from low gradient to high gradient?
A. It's a function of the anisotropy. It's not -- If you follow the flow path, it's not.
Q. Maybe I'm misunderstanding. I'm just looking at the number 539.5 and the number 714.8.
A. Yeah. But that's not where the -- The water is flowing down those -- follows those arrows. See, that's the anisotropy. That's what's confusing people. See, if you believe that the -- Just imagine a bundle of tubes, a tube bundle, a bunch of little pipes instead of an aquifer, contained between those red lines, the California Wash and the Gas Peak Thrust, you've got a river. You've got a river and it -- a molecule stays about the same distance from the bank of that river all the way down.
So that's the conceptual model that we suggested, I believe, somewhere that maybe a paradigm shift is needed. Maybe treat the system like the Muddy River was treated. You know, lock in the water rights, get a special master if you need it, treat it like a stream. Because there's no question there's a hydraulic gradient. There's no question there's

flow. There's a lot of water to the south that's coming from somewhere. And so it's an idea that it's new, it's not basins anymore. And you've got to start somewhere, but at least you know where you finish.

So that's what an anisotropy does. Just imagine that you've got a bundle of little tubes in that aquifer that it can't -- the water can't move sideways. We're not that restrictive in our model. It's a ten-to-one ratio. But imagine if that anisotropy ratio was a hundred-to-one or a thousand-to-one like it might be down a fault fracture, right. Super permeable transmissivity in the long axis of the fracture next to nothing, you know, out in to the rock. So that's the concept that -- one of the concepts we bring that I'm sure everybody has that's got any hydro background, but it's not been part of this analysis. And once you start treating this as a strong anisotropic system favoring north/south flow, everything looks a little different and easier actually, management wise.

So it's a function of the anisotropy that's giving it. The water is not flowing that high. It's flowing north to south and restricted in how much it can get out and flow east to west. That's the anisotropy.

Q. Is there some water level data that you can point to that supports that characterization?

A. Well, these are all -- Well, it's more the pumping response. When you see a direction -- directional dependence to the pumping response, you've got -- Well, one explanation is that you've got an anisotropic system. Heterogeneities will do that too. But if the water, for example, the best example I can think of is the response of CSVM-6 to MX-5. This response and actually its water levels are identical to those in MX-4, identical. So that thing is one transmissive fracture connecting the broken zone or whatever it is at the pumping site with a well a couple of miles to the north in Coyote Spring Valley. So that thing responds instantly and exactly like the monitoring well close right beside the pumping well.

On the other hand, CSI-3 production well there to the west of the Horst they discussed the other day, they did a, it was either 24 hours long aquifer test on that thing while CSVM-6 was being monitored by transducer. No response. No detectible response. And then you can quibble about whether there was any response from CSI-1 or CSI-2, which were on and off during that testing. They didn't silence the other production wells while they tested a new one.

So there's a little bit of -- But there's good evidence that there's directionality to the transmissive properties, strong directionality. I mean, how can you have

that and yet another response 20 miles away that looks -- that's half as strong, I mean, it's attenuated, but there's no doubt based on that 2012 recovery signal that, yeah, that pumping schedule is getting down to apex but it can't get across half a kilometer of rock in the other direction.

So, once you realize how strongly anisotropic the system is, everything changes. You might want to treat it like a river. And I don't say that tongue in cheek. I mean, we don't know how strong anisotropic is. So it's just an idea that might make things easier.

Q. Okay. Thanks.

A. Yeah.

EXAMINATION

By Mr. Benedict:

Q. Jon Benedict for the record. I just want to follow up on that. Do you see any problem with using MX-6 as the monitoring well to measure that gradient going across the capture zone that's shown in --

A. Well, it's a production well, so you have to go look at the recovery intervals to estimate water level. And, of course, it's trending too. So these are -- We've got -- Let's take that one, 553 and 539, there's 14 meters of difference between those and there's not that much uncertainty in taking the water level at roughly the same

time. So, you know, if we're off by a meter so in representative water level three to one, it won't change the fact that there's a gradient north to south.

Q. But if you think they're in separate capture zones then why would you suggest that that gradient is important?

A. Oh, I see what you're saying. Well, again, the capture zone is from a scoping model and you can see -- we can already see that it's not accurate out in the Coyote Spring Valley. We're capturing from areas where we know there's -- The example I just gave you, the CSI-3 example. No effects. But, you know, you go where you can get a good water level.

Now, if I went to -- Actually, if we want to do some math, we could. I know Wilshire -- Well, somebody convert 539.5 to feet. And we're looking for something up there about 1812 or 1815. So I think there will still be a gradient. I think you can move south on that. I was looking for long -- the longest distance I could get, you know, to do those Darcy calculations.

So you either use just the other one. If you don't like that one, let's go down and use maybe H-4. That's a couple of feet lower, but it's also a little bit south. So I bet it would come out pretty close.

MR. BENEDICT: All right.
FURTHER EXAMINATION
By Ms. Cooper:
Q. Christi Cooper. Can you just maybe following up on your statement about CSI Well Number 3. Do you think that there was any pumping effects seen from the MX-5 pumping test there?
A. It's a production well, so I don't know. It's been busy and it was in service.
Q. What would you say as far as to the other CSI wells, 1, 2 and 4?
A. Well, the production wells aren't -- You know, when I think about the effects, I want to look at them in the CSVM sense and not in the production wells. I mean, we could. But that's exactly where you'll find the messiest data and the most uncertainty about what's, you know, recovered water levels. So I avoided those for -- as designers.
MS. COOPER: Okay. Thank you.
EXAMINATION
By Ms. Barnes:
Q. Michelle Barnes for the record. I'm looking at figure seven from appendix three. It's the isotope data. I don't have a question specifically on the chart. I was just

wondering if you would be willing to make that data available.
A. I don't have any isotope data of my own. Let me see what this is. I'm sorry. What --
Q. Appendix three, figure seven, page 57.
A. Which appendix, number wise, is this?
Q. Three.
A. Page three. Oh, I see. That must be here. It must be here. Oh, okay, okay. We're getting there. I've got it. I've got it. Which page? I'm sorry.
Q. Page 57, figure seven.
A. Oh, yeah, good, yes.
Q. I'm just wondering if you would be willing, I guess, and able to make that data available?
A. It's TRI data. It's in your -- This is all out of the baseline data report.
Q. Oh, okay.
A. It's Southern Nevada Water Authority's baseline data report.
Q. Perfect. Thank you.
A. And I don't think we put that as one of our exhibits, but it's in here. It's around.
Q. Okay. Thank you.
A. Yeah. It was just the number and just the

analyses, so everything in that one reference.
Q. Okay. Thank you.
HEARING OFFICER FAIRBANK: All right. So we're doing well on time today and so I wanted to just find out whether or not Southern Nevada Water Authority has any additional questions?
Seeing no additional questions, Lincoln County, Vidler, do you have any further questions? Seeing none.
And, finally, Center for Biological Diversity?
Okay. Well, then we'll go ahead and open it up to -- you wanted to reserve some time for redirect?
MS. BALDWIN: I think we're okay.
HEARING OFFICER FAIRBANK: So seeing that you're going to not do anymore redirect, okay, we'll wrap things up and we will go ahead and conclude the hearing for today.
Oh, yeah. Thank you for reminding me. So yesterday Mr. Waddell -- Dr. Waddell, you had wanted to get -- you had said you were going to get back with some information regarding a report. Would you like to go ahead and share that with us?
THE WITNESS: Should I move, pack up?
HEARING OFFICER FAIRBANK: Yes, Dr. Johnson, you're done for the day. Thank you.
MR. WADDELL: Yes. Rick Waddell for the record.

I was asked to provide the reference to that Stan Leake work dealing with recovery time from pumping. And so I found that. It's in a US Geological circular -- US Geological Survey circular by Paul Barlow and Stan Leake. It was published in 2012. Title is Stream Flow Depletion by Wells, Understanding and Managing the Effects of Groundwater Pumping on Stream Flow. That's US Geological Survey circular 1376. And it's available on the web at the following URL: HTTPS, colon, front slash, front slash, DOI, dot ORG, front slash, 10.3133, front slash, CIRC, 1376.
HEARING OFFICER FAIRBANK: Thank you very much, Dr. Waddell.
All right. Well, I think we've concluded our proceedings for today. So we will go ahead and commence tomorrow promptly at 8:30 a.m. Thank you very much.
(Hearing concluded at 1:40 p.m.)

STATE OF NEVADA)
)ss.
COUNTY OF WASHOE)

I, CHRISTY Y. JOYCE, Official Certified Court Reporter for the State of Nevada, Department of Conservation and Natural Resources, Division of Water Resources, do hereby certify:

That on Thursday, the 26th day of September, 2019, I was present at the Legislative Counsel Bureau, Carson City, Nevada, for the purpose of reporting in verbatim stenotype notes the within-entitled public hearing;

That the foregoing transcript, consisting of pages 831 through 862, inclusive, includes a full, true and correct transcription of my stenotype notes of said public hearing.

Dated at Reno, Nevada, this 26th day of September, 2019.

____
CHRISTY Y. JOYCE, CCR #625

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In The Matter Of:

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES

Vol. v
September 27, 2019

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Carson City, Nevada 89706

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STATE OF NEVADA
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
BEFORE MICHELINE N. FAIRBANK, HEARING OFFICER

IN THE MATTER OF THE ADMINISTRATION AND MANAGEMENT OF THE LOWER WHITE RIVER FLOW SYSTEM WITHIN COYOTE SPRING VALLEY HYDROGRAPHIC BASIN (210), A PORTION OF BLACK MOUNTAINS AREA HYDROGRAPHIC BASIN (215), GARNET VALLEY HYDROGRAPHIC BASIN (216), HIDDEN VALLEY HYDROGRAPHIC BASIN (217), CALIFORNIA WASH HYDROGRAPHIC BASIN (218), AND MUDDY RIVER SPRINGS AREA (AKA UPPER MOAPA VALLEY HYDROGRAPHIC BASIN (219).
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TRANSCRIPT OF PROCEEDINGS

PUBLIC HEARING

HEARING ON ORDER 1303

VOLUME V, A.M. SESSION
(Pages 864-986)
FRIDAY, SEPTEMBER 27, 2019

Reported by: Michel Loomis, RPR

APPEARANCES:

Micheline N. Fairbank,
Hearing Officer

Tim Wilson,
Acting State Engineer
Adam Sullivan,
Deputy State Engineer

Melissa Flatley,
Chief of the Hearing Officer Section
Michelle Barnes,
Supervising Professional Engineer

Levi Kryder,
Chief of the Hydrology Section
Jon Benedict,
Hydrologist

Christi Cooper,
Geologist
Bridget Bliss,
Basin Engineer

For SNWA: Taggart & Taggart, Ltd.
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-and-
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APPEARANCES:

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-and-
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By: Karen Peterson, Esq.
Carson City, Nevada

For Moapa Band of Paiutes: Beth Baldwin, Esq.

For NCA: Alex Flangas, Esq.
Reno, Nevada

For Moapa Valley Water District: Greg Morrison, Esq.

For Bedroc: Schroeder Law
By: Laura Schroeder, Esq.

For City of North Las Vegas: Schroeder Law
By: Laura Schroeder, Esq.
For National Park Service: Karen Glasgow
For Center for Biologic Diversity: Patrick Donnelly

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CARSON CITY, NEVADA, FRIDAY, SEPTEMBER 27, 2019, A.M. SESSION
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HEARING OFFICER FAIRBANK: Good morning. So we will go ahead and get started this morning. This is a continuation of the hearing regarding the Lower White River Flow System and Order 1303.

And this morning, we will be starting with Southern Nevada Water Authority and Las Vegas Valley Water District. And, Mr. Taggart, you may go ahead and proceed.

MR. TAGGART: Good morning. As was said, my name is Paul Taggart. I represent the Southern Nevada Water Authority and Las Vegas Valley Water District.

We've assembled a panel this morning to provide you with the information -- hydrologic information related to the 1303 order, and we will also have a panel to describe the biological issues that we have -- that we plan to present, that will be on Monday.

So with me here today is Ms. Colby Pellegrino, Mr. Andrew Burns, and Ms. Warda Drici. And after we swear them in, I'll have them introduce themselves to the panel.

HEARING OFFICER FAIRBANK: Okay. If we can go ahead and swear in the witnesses. Thank you.

(Panel sworn.)

DIRECT EXAMINATION
BY MR. TAGGART:

Q. Good morning. And could each of you, for the record, state your name and spell it for the record, and also what is your position at the Southern Nevada Water Authority.

MS. PELLEGRINO: I'm Colby Pellegrino, P-E-L-L-E-G-R-I-N-O, Director of Water Resources for the Southern Nevada Water Authority and Las Vegas Valley Water District.

MR. BURNS: I'm Andrew Burns, A-N-D-R-E-W, B-U-R-N-S, and I'm the Manager of the Water Resource Division for SNWA and Las Vegas Valley Water District.

MS. DRICI: Good morning. I'm Warda Drici, Warda, W-A-R-D, as in David, A. Drici, D, as in David, R-I-C-I. I am a hydrologist with the Southern Nevada Water Authority.

BY MR. TAGGART:

Q. Thank you. And my first questions will be for you, Ms. Pellegrino.

Could you provide the State Engineer briefly with an explanation of the role SNWA has in the Lower White River Flow System, why SNWA and the Las Vegas Valley Water District is a stakeholder in these proceedings?

ANSWERS BY MS. PELLEGRINO:

A. Okay. So very briefly, the Southern Nevada Water Authority is essentially a wholesale water provider with seven member agencies, the largest of which is the Las Vegas Valley Water District. We were originally created in 1991 to manage the State's Colorado River allocation, but our responsibilities now include regional water supply planning.

So we have a myriad of water rights in this area and I'm going to go through those very briefly. The SNWA controls about 20,000-acre-feet of decreed surface water on the Muddy River, about half of that is through the Muddy Valley Irrigation Company shares that we own and lease.

We also have 9,000-acre-feet of water from Coyote Spring Valley that was originally owned by the Las Vegas Valley Water District. 2200-acre-feet of water in Garnet and Hidden Valley that are used to meet the needs of the power plants and the future needs of the City of north Las Vegas.

As I mentioned, the district is the largest member agency of SNWA. The two agencies share common staff, and in addition to the district owning the groundwater rights in the Las Vegas Valley, they are also the operator of the Coyote Springs Water Resources General Improvement District, which is responsible for the water -- which is responsible for the water system that serves the Coyote Spring Development.

Q. Is SNWA also a party to the MOA and could you

describe their role in that way?

A. Yes. So there's a series of agreements that were implemented post Order 1169 to allow the pump test to continue. One of those was a memorandum agreement with the Moapa Band of Paiutes. It's actually a series of agreements.

The Muddy Valley Irrigation Company, the Moapa Valley Water District, ourselves, the Fish and Wildlife Service all related to the compliance and settling claims to groundwater associated with these basins.

Q. And could you describe the role SNWA has played in the activities that have led us to where we are here today?

A. Okay. I think I'm going to go back and talk a little bit historically to do that.

One of the things that the Water Authority in every -- and the Water District in every proceeding before the State Engineer has said, is that our conceptual models cannot be validated until we have not only significant pumping stresses, but also recovery data.

So in 2001, we went before the State Engineer on applications in this area, and I want to read two quotes that were Mr. Ricci summarizing our testimony in that hearing.

And the first one says, "while testimony presented indicated that belief that significant quantities of water may be available for capture from storage, it is unknown what quantity that would be and if any underground water could be appropriated without unreasonable and irreversible impacts."

He went on to summarize that our testimony and evidence, and I quote again, "indicates that their own expert witnesses are unable to make a suggestion to the State Engineer as to what part of the water budget could be captured without a great deal of uncertainty and that the question cannot be resolved without stressing the system."

So after Order 1169, we prepared for the pump test and entered into the MOA and several other agreements, like I mentioned previously. A few years after that, we also had a series of agreements in relationship with NV Energy regarding the surface water on the Muddy River as well as water for Garnet Valley for use of the power plants.

We later constructed the 348 pipeline to facilitate the Order 1169 pump test, and we were required to submit, within a relatively short period of time after that test was done, data to the State Engineer that would be used to determine whether the outstanding applications, how they would be dealt with.

After that, it was a pretty significant period of time where through the recession, economic activity in this general area was low. But we began to see more aquifer

recovery data in the response to the aquifer in general after the pump test had concluded. And then we began, within the last maybe 3 to 4 years, seeing more significant economic activity occurring.

And we were really coming to a new realization that the aquifer was not recovering as well as that there were on going declines. So when the Coyote Spring development really began ramping up again, we began expressing to the developer --

HEARING OFFICER FAIRBANK: Mr. Herrema.

MR. HERREMA: Brad Herrema for CSI. Ms. Pellegrino has not been designated or qualified as an expert. I believe she's here as a fact witness and so opinions or conclusions about recovery of the aquifer, I don't think are appropriate.

MR. TAGGART: We don't disagree. Any expert conclusion on that topic will be provided by Mr. Burns and Ms. Drici.

HEARING OFFICER FAIRBANK: Okay. So the testimony will only be considered in this relationship as that as a fact witness, and certainly any expert opinions or interpretations of data will be relied upon by the testimony of those experts so designated.

MR. HERREMA: Thank you.

THE WITNESS: So as the development began to ramp back up in this area through our role as the operator of the general improvement district, we began expressing concern that the water that they were relying upon would not be there in perpetuity to support that development.

I'm not going to get into the whole history here, but essentially after sending that message to Coyote Springs Valley several times without much response, we asked the State Engineer for their opinion on whether there was water there for that development, and ultimately that's what's led us to the process that we're here involved with today.

BY MR. TAGGART:

Q. Ms. Pellegrino, are -- was SNWA's reports for the hydrologic and biologic resources that were submitted to the State Engineer, were those prepared under your direction and supervision?

A. Yes.

Q. And I'm going to ask you to just summarize for the State Engineer what SNWA's recommendations are based on the four 1303 questions that were asked. And I just want to clarify for the record that you're summarizing what would be supported through the expert testimony of Mr. Burns and Ms. Drici?

A. Yes.

Q. Okay. Please -- what recommendation is SNWA making regarding the geographic boundary for the Lower White River Flow System?

A. This question was the hardest question in a lot of ways for us to reach a conclusion on, because it's much easier for us to identify where there is high levels of connectivity and degree of connectivity.

But the boundary really depends a lot upon how the basins are jointly managed together. And I'm going to give just a few hypotheticals that I think will shine some light on why this is a little bit perplexing for us.

For example, if there are water rights that are really at a very far distance from the springs and the impacts to senior water rights and a new basin is added, and that water is allowed to move between all of the basins, there is the potential that that pumping could move closer to the springs and could impact senior water rights and the endangered Moapa Dace sooner.

So in some ways, hydrologic connectivity may be there, but the management decision of allowing water to move across the basins could be a problem.

Similarly, there's less connected areas, which Ms. Drici will talk about, such as the Black Mountains area where taking that water and moving it closer to the springs and into a more connected area would accelerate impacts. So ultimately, regardless of the boundary, we know that the State will have to continue managing the adjacent basins to ensure that we're not negatively impacting the Lower White River Flow System, because no matter where the boundary is drawn, if the adjacent basins are allowed to significantly pile up points of diversion along the boundary, that's going to have a negative impact along with -- so there's just some unintended consequences that were really hard to contemplate here.

So we make the recommendation that the boundaries should not change, but should be revisited in the next portion of this where we'll talk about groundwater management decisions. But we do have some extensive testimony on hydrologic connectivity within this region.

Q. Now, the second question that the State Engineer has asked under 1303 has to do with the hydrological responses to the Order 1169 pumping test and what will SNWA's recommendations be regarding that?

A. I'm going to be very brief here, again, because Andrew and Warda are going to present a lot of testimony on this. But essentially water levels are continuing to decline in this area as a result of the ongoing pumping.

Q. And with respect to the question about moving

alluvial pumping to carbonate wells or moving current carbonate pumping to alluvial wells, which is the fourth question the State Engineer had in his 1303 order, what is SNWA's recommendation with respect to that?

A. Our recommendation is essentially that it doesn't matter where you move it. You may change the timing of impacts, but impacts will still occur to the Muddy River Springs and senior decreed water rights.

Q. Okay. Now, lastly, what is SNWA's recommendation regarding the long-term annual quantity of groundwater that can be pumped in the Lower White River Flow System, including the relationships between the location of pumping on discharge from the Muddy River Springs and capturing Muddy River flow?

A. This hydrologic region is unique. I think everyone in this room knows that. If the Muddy River were not there, the changes that we see in groundwater levels would not constitute an unreasonable lowering of the water table. And if the springs were not there, there weren't endangered fish in those springs. The capture of senior decreed water rights could be dealt with in a way that the Moapa Dace prohibit in a lot of ways. So we have kind of two answers on this.

There's no quantity of water that can be pumped long term without conflicting with the decree by capturing Muddy River water. If you set aside those conflicts with

senior water rights and look at what the Moapa Dace need, we formed the conclusion that based upon protecting a flow of 3.2 CFS at the Warm Springs West Gage, there's approximately 4 to 6,000-acre-feet of water that can be pumped long term.

However, that water cannot and should not be pumped long term without dealing with the conflicts and the capture of Muddy River water. I'm just going to go on to say that conflicts, the State's very familiar with. There's litigation, there's damages and that can be very costly.

But violating the SAS criminal penalties and as a water manager, I take that very seriously, and I don't believe there's any way that we can reasonably separate those two issues when we consider how much water can be pumped in this basin.

Q. And my last question for you, Ms. Pellegrino, is what would you like the State Engineer to do at the conclusion of the hearing with those recommendations?

A. We appreciate the State Engineer's process that they've laid out, that this is the first phase in that process. We would ask that the State accept written closing arguments as well as a written draft order that addresses the technical findings that are the subject of this hearing, including the hydrologic connectivity of the basin, asking that they reserve final resolution of the jointly managed

boundary for the next phase of management discussions.

We also feel that there's ample evidence that groundwater pumping should not be allowed to increase and new permanent use is not being allowed within the five basin area while we continue to set out on a path for decreasing water use in this general managed area.

Q. Thank you. Now, I have some questions for Mr. Burns and Ms. Drici.

Both have been pre-qualified in this proceeding based upon being qualified in prior State Engineer hearings. Mr. Burns was qualified in prior hearings and is qualified here in this hearing in the areas of groundwater hydrology, surface water hydrology and hydrogeology.

Ms. Drici was previously qualified and is qualified in this proceeding in the area of groundwater modeling and groundwater hydrology.

And, Mr. Burns, Exhibit 3 that SNWA's provided is your resume. Is that a true and correct copy of your resume?

MR. BURNS: Yes, sir.

MR. TAGGART: Okay. And then, Ms. Drici, Exhibit Number 4 is your resume. Same question to you?

MS. DRICI: Yes.

BY MR. TAGGART:

Q. And we have done a pre-qualifying exercise to

avoid spending time, significant time on voir dire and questioning witnesses. But I would like, if you could for the record, to briefly describe your background in the areas that you're about to testify about so that the record's clear on your level of qualifications.
So can we start with you, Mr. Burns?
ANSWERS BY MR. BURNS:
A. Sure. Well, my background is a hydrologist. I've worked in this area, in the Great Basin range province my whole career. I started at the Nevada test site, principal responsibilities being data acquisition and data analysis. I worked there for about six years with Ms. Drici and Dr. Waddell on the test area project.
Subsequent to that, I worked for the State of Nevada and the Colorado River Commission in doing Colorado river modeling.
Moved to the Southern Nevada Water Authority where I continued to do the Colorado River modeling. And then at about 2002/2001 time frame, worked in earnest on this area, setting up monitoring networks, doing investigations as we'll talk about today.
So I've been working not only in this area, but in the eastern Nevada for other groundwater projects, doing this of type of work.

Q. Okay. Thank you.
Ms. Drici, could you please describe for the State Engineer briefly your background and experience?
ANSWERS BY MS. DRICI:
A. Sure. Warda Drici. So my education is in petroleum engineering and management. However, my whole experience has been in dealing with the groundwater and surface water problems.
So I started out by working for the Kansas Geological Survey for a few years. From there, I moved to Long Beach to work with First Technology, the people who drilled all the wells for the MX project in Nevada. I wasn't there when they did it, though. I came in after.
And then from there, I went to work for contractors for the Department of Energy. And like Andrew said, for a while, we worked on the Death Valley model for the DOE with Andrew and Dr. Waddell, too. And after that, I came to work with SNW -- for Parson's, but on SNWA projects.
And since 2010, I've been working with SNWA on projects relating to groundwater and surface water.
Q. Thank you. And did each of you participate in the development of the report that was submitted to the State Engineer and has been marked as State Engineer Exhibit Number 7?

MR. BURNS: Yes.
MS. DRICI: Yes.
MR. TAGGART: And did each of you sign that report?
MR. BURNS: Yes.
MS. DRICI: Yes.
MR. TAGGART: And then also did each of you work and contribute to what is marked as SNWA Exhibit 9, and did you sign that report?
MR. BURNS: Yes.
MS. DRICI: Yes.
MR. TAGGART: And just for the hearing officer, those reports also include biological resource assessments and so the biological witnesses that testify on Monday will be presented. And after they're presented, then we will offer those into evidence.
HEARING OFFICER FAIRBANK: So the report regarding the Lower White River Flow System assessments are so admitted and we will admit the biological reports at that time.
MR. TAGGART: Okay. Thank you.
BY MR. TAGGART:
Q. All right. So, Mr. Burns, could you describe how SNWA went about -- how and why SNWA went about developing the

two reports I just described?
ANSWERS BY MR. BURNS:
A. Sure. First, we appreciate the opportunity to present our summary conclusions in this presentation, and I'll first just review the general approach to how we went about analyzing -- collecting, analyzing and reporting on the data pertinent to this Order 1303.
And the first part of our effort, of course, was a compilation processing of data, literature review, that sort of thing. Groundwater levels are from various sources of EWR website.
Our own data basis is the USGS precipitation data from NOAA, ground water production data available to everyone to on NWRD website, and then USGS data surface water, stream flow data, perennial stream flow data, of course, and spring data. So that was the first step in our effort.
Next, we performed a quality assessment. So these are time series data that we've collected and we've compiled and now we wanted to look at them in a qualitative sense through time to see what they -- how they informed our knowledge of the system as behavior. We had -- and I'll go through a series of these hydrographs, but --
(Reporter interrupted proceedings.)
MR. BURNS: So we looked at winter season

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precipitation from Nevada climate division 4, as I mentioned, groundwater levels from wells throughout this domain, spring discharge, perennial screen flow, groundwater production. And so that was a -- we looked at this and these time series data in a qualitative sense to see how they formed and told us what was happening with this system, given various stress conditions we know are occurring, whether it's climate related or man related.

So after looking at those hydrographs, we saw some relationships. We also -- we performed simple linear regression analyses to assess correlation between water levels responses and what we refer to as representative carbonate wells in these basins with EH-4.

And as you heard described previous testimony, EH-4 is an indicator well of the conditions, the groundwater conditions at the spring area, principally, the Pederson Spring area, which is in close proximity. We considered that an index well.

Then we know that there's been, as a result of the test, drawdown responses measured in the MX-4. So we wanted to see what we thought we saw and confirm that with linear regression analysis to assess the correlation of these same wells with drawdown responses that we know were measured at MX-4.

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Next, we had looked at the same type of analysis, but using EH-4, our index well, with spring discharge. And these are the high elevation springs of Pederson Spring complex and Warm Springs West Gage.

Next, we performed a multi-linear regression analysis to assess the effects of individual basin carbonate production on EH-4 water levels and then we performed a ratio analysis to estimate the contribution of various springs to the total Muddy River Springs discharge over a period of several years and under different stress conditions.

And when we refer to total -- well, I'll call it MRSA discharge, we're talking about the Muddy River flow itself. ET in the area, groundwater production, fluid groundwater production. So that constitutes the total discharge that we're talking about.

In that analysis, we're approximating the slope of the lines correlating a given spring record to this total discharge. And we estimate a change in the discharge basin not a change of the Warm Springs West Gage for that same period.

And then finally, we observed, in the flow record, a long-term tend of declining flow and we wanted to investigate that try to identify its causes. We had our suspicions, but we wanted to go through the analysis to come

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to a definitive conclusion.

In doing so, we quantified what we were terming a Muddy River flow deficit. This is a depletion, in essence, on the river and we did that for a period of 1993 to 2018. So that's the general approach we took and I'll go through these in that order.

So first, you can take a look at a map and I know you've seen a lot of water level and a lot of hydrographs this week, but I appreciate your patience in giving us time to give our perspective on what we've seen.

This figure is a figure in our report and it's of the Lower White River Flow System domain, and we have water levels, carbonate wells, alluvial wells depicted here throughout.

And what I want to go through is -- first is this qualitative assessment that we performed and here's -- under these orange circles are the wells that we're going to look at and to give you perspective on where they are within relationship to other wells within the flow system.

So on the next slide, we look at well CSVM-1 and this is a well just down the road on 168 across from MX-5 in very close proximity. And then I had mentioned EH-4, if you can go back, I'll try to point these out.

So here is CSVM-1, EH-4, here by the springs.

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And then next is the Paiute TH-2 well in the California Wash, the GB-1 well, which is on the boundary of Hidden Valley and Garnet Valley. And then to the very south is BMDL-2, which is in the Black Mountains area.

And so this next to the slide, what we're showing here is just the time series data of water levels at these locations over the period 1993 to 2020 or 2019. On the Y axis is the elevation of the water level.

The bottom panel, as I mentioned before, we looked at the Nevada division or climate division 4, and what's represented here is the percent of winter season precipitation.

We used October through March as the definition for the winter season and we computed the average for 1990 to 2019. And what these bars represent is a percentage of that average over this period of record.

So blue bars are above normal. And then so if you look at 2005, what I'll talk -- and I'll present in hydrographs, that's about almost 300 percent of normal. So if the average was, let's say, four inches, that would be about 12 inches that year.

On the bottom is below normal or below average of percent of average winter season precipitation. Those are the red bars. And, of course, those can only go to zero, and you can see how the distribution of these red and blue bars over time.

Now, then we look at what we see in the hydrographs when you do this assessment, and the first thing we see is that all of these look very similar. They have very similar seasonal change.

They have very similar long-term trends. What always pops out first is the 2005 effect from this 300 -- almost 300 percent of normal precipitation, winter season precipitation.

We see a general decline and then we see, in the gray shaded area, this is the period of the test, your 1169 pumping test, and we see declines there as well. And so this -- we wanted to look at these a little closer and so we did so. So I want to go back to look at these a couple at a time.

So that -- this slides shows you, it's the two I'm going to talk about, which is, again, CSVM-1 and GB-1. CSVM-1 by MX-5, GB-1 on the boundary of Hidden and Garnet Valleys.

Okay. So I've added something to this panel as well at the very -- the bottom panel, which is carbonate groundwater production. This is -- and the reason we choose this period, the 1993 to 2019, is because that's when all of

the data series are available to us.

So on this bottom panel, this carbonate groundwater production by basin within the Lower White River Flow System, you can see that it starts at about 1993 in the Muddy River Springs area and then starts to increase with Black Mountains production and so on.

And then you can see in 2006, it begins -- it sort of levels off from 1999, 2005, increases in 2006 with Coyote Spring pumping. Then you can see the test effects of production in 2011, '12 and '13. In that period, the increase is about almost 3,000-acre-feet at its peak between 2012 and 2013, for example.

So at any rate, we have those indicators as well. And here we see at the top panel, CSVM-1, and we see the effect that this 2005 precipitation has had on the record. Water levels increased somewhat dramatically with respect to the rest of the record and then the -- they go down, and then right before the test, you can see the influence of production from MX-5 and the test itself.

Q. Mr. Burns, just for the record, could you describe how far is CSVM-1 to where the pumping occurred at MX-5?

A. CSVM-1, I -- off the top of my head, I'm not sure exactly the distance, but it's about maybe a quarter mile down

the road off 168, towards Muddy River Springs area. And it's just on the shoulder of the highway. If you go back to the map, I'll -- so MX-5 is just right here and CSVM-1 is right there on 168.

Q. Thank you.

A. Now, so what we notice in these records is we go to the south at the boundary between Hidden and Garnet Valleys is the same -- essentially what we see is the same record in a different well. And you have this peak from 2005 and you have an observed decline during the test period. And then some recovery, all be it, it looks muted, and then water level declines since.

Next, I'd like to talk about EH-4 and Paiute Tribe well TH-2. So EH-4, you can't see on the screen very well, but EH-4 is just opposite -- just upgradient from the Pederson Springs complex on the other side of Battleship Wash. And the well there is important, as we heard in previous testimony, because it's representative of the conditions, the head conditions at the springs themselves.

The next one was TH-2, which is on -- in California Wash and so the next slide will show you hydrographs there. And TH-2 has some intermittent record, but you can generally see the same pattern. EH-4 and EH-5B are wells that have the longest period of record, and you can see

that there's a pretty consistent decline since 1998, 2004.

And then in 2005, we, again, have our precipitation effect or -- I'll call it -- it's really -- we use precipitation as an indicator, but it's really a recharge effect. And then, of course, we see the decline during the Order 1169 test period, a slight recovery, and what we view as a declining trend since about 2016.

Okay. Next, we talk -- I want to talk about KMW-1, which is on the boundary of the Kane Springs Valley and Coyote Spring Valley and then CSVM-4, which is also near the boundary by carbonate rock outcrop. These are both monitor wells located to the northern third of Coyote Spring Valley on the east side.

So, again, we see here, CSVM-4 record. You see this, the effect, but it looks a little bit delayed or taking a little bit longer to see this recharge influence from 2005, the stabilization of water levels pretty much. And then during the test period, a noticeable decrease or decline during the test. Subsequent to that, water levels come up a little bit and stabilize and then look -- appear to be going downward after.

CMW is a shorter period record that exhibits very similar traits as CSVM-4. The declines, the variations are -- aren't as dramatic as these other wells, but we think we can

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still see the effects from not only the recharge of that, but also the pumping at MX-5.

So with that qualitative assessment, we've seen how these -- we think that these water levels behave in concert with each other. We believe that they were correlated well with EH-4, and so our next step was to perform linear regression analysis to assess the correlation of these variables.

Q. Mr. Burns, can I just ask you a couple questions quickly about the qualitative assessment that you completed?

Based on that qualitative assessment, were you able to observe these -- any similarity in groundwater level declines between where pumping occurred in Coyote Spring Valley and Garnet Valley, for instance?

A. Yeah -- excuse me, yes. We see it as very similar pattern in CSVM-1, for example, which is next to MX-4 on the east side of Coyote Spring Valley, and then also GB-1, which I talked about, which essentially has the same patterns to it.

Q. Okay. Same question with respect to California Wash?

A. California Wash, the Paiute TH-2 well, again, although the record's a little -- there's some missing parts early on, the record shows very -- to me, it was very clear,

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has a very clear response as the other wells do to the various stresses, whether they're climate related or pumping related.

Q. Okay. And finally the same question with respect to the Muddy River Springs area?

A. Yeah. So we use, as I said EH-4 as our index well. And you saw in the hydrographs I presented that those -- all of these wells that I mentioned appear to have very strong correlation with each other, and therefore, that implies an interconnected nature of this aquifer in this area.

Q. Thank you. And then did you attempt to statistically analyze the data to confirm your observations?

A. Yes.

Q. Could you describe that, please?

A. Right. So the process that we've gone through here is we computed monthly average values for the entire period of record for these wells.

And we wanted to see -- because EH-4 and the conditions at the spring are so important, we wanted to see how well these wells throughout the basins correlate with that -- the water levels at that location.

And so we just did a simple linear regression on the data and we found a linear relationship and high correlation between all of them, as we suspected when we did our qualitative assessment. And those are presented on

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Figure 510 of our report. We have ours squared here, but the national correlation coefficient is higher. But you can see that they're all very high, all in the 90's and above.

The lowest one is CSVM-4, which is .82, and I attribute that to the Kane Springs fault and perhaps low -- lesser permeability units between the pumping centers -- or between EH-4 and this well to have an attenuating effect on water levels, whether they're affected by recharge or other stresses. And so what we did is observe a trial and error effort -- or trial and error.

We looked at it doing it repeatedly lagging months from no lag to 12 months of lag. And we found the best fit to be a three-month lag for the correlation with EH-4.

Q. Okay. And then did you also see if there was a statistical correlation during the pumping test period?

A. Yes. Well, before I get there, so what this indicates with these high correlations is that these wells all are highly correlated with responses measured in EH-4, and this implies the interconnected nature of this system throughout, independent of the stress condition. So these water levels in these wells behave the same way, whether it's reacting to a climate stress or a pumping stress.

But what we really wanted to look at then is since the pumping test was of keen interest to all of us, we

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wanted to see how these wells correspond to a known pumping stress measured at MX-4. So we just took the monthly average values at MX-4 for the period of the test, and of course, MX-4 is maybe 200 feet away from MX-5.

So during the pumping test, we can attribute the drawdowns or the water level declines at MX-4 predominantly to the -- as a result of the pumping at MX-5. So that's the predominant stress of lowering the water tables at MX-4. We wanted to see how these other representative wells correspond to those water levels that were measured.

So we did the same analysis for the same wells and those are listed in Figure 514 of our report, and again, we find a high degree of correlation between these wells at the MX-4 drawdown.

So now we can confirm that these wells also -- not only are they interconnected, but they also respond in the same way to MX-4 drawdown. And so there's a connection there as well.

Q. All right. Thank you. Did you then look at spring flows?

A. Right. So we did the same assessment. We did a qualitative assessment on the spring flows and our interest primarily is a high elevation springs, Pederson Spring complex, and the Warm Springs West Gage, which measures the confluence of that discharge.

I have here a Figure 6.1 from our report. This Figure 1, it shows the distribution of springs throughout the Muddy River Springs area. On the lower right-hand side is the Muddy River near Moapa Gage, and I have elevations posted next to the spring names.

And you -- and on the backdrop is the elevation -- digital elevation model with the darker colors being the higher elevation and the lower colors -- or the lighter colors being lower elevations. And so this just -- this shows you a distribution of the springs with respect to elevation as well.

Now, I noted again the elevation of the springs behind their name. So if we focus on Pederson Springs here on the refuge, the highest -- the one we're looking at is Pederson Spring Gage, itself, at 1811 feet in elevation. And so we wanted -- we did a qualitative assessment there as well, looking at Pederson Springs and Warm Springs west.

Q. And just one quick -- a couple quick questions. So is Pederson at the highest elevation of all the springs?
A. Yes.
Q. And why the focus on high elevation springs in your analysis?
A. Well, one, they're the most sensitive because of

the elevation of the orifice with respect the potential metric surface of the carbonate aquifer. So the driving force is small. The driving force defined by the heads in the aquifer with respect to the spring elevation is small relative to those on the basin floor like Big Muddy Springs, for example, which is quite a bit lower.

So it's -- I think Tim Mayer gave an eloquent discussion on why this spring is so sensitive, but it -- our interest is because of the sensitivity, we can measure sort of detailed effects of groundwater pumping from the carbonate aquifer at this location based on the head elevations measured at EH-4.
Q. And do you expect this to be the first place you'd see a signal from groundwater pumping?
A. Yes.
Q. Okay. Could you turn to Figure 5-7 and explain what's shown there?
A. So as I mentioned before, you know, in our process, we look at the time series qualitatively. We try to identify trends or certain instances that we can relate to other factors.

We have two panels at the top, Pederson Spring first and then Warm Springs West Gage next, and then again, the same winter season precipitation chart and groundwater

production at the bottom.

And what we see here, what I see is a response similar to those measured in the wells that I just discussed, and I also have shaded here is the test period for the Order 1169 test. And here we see another decline like we see in the wells, and we see a slight recovery and then it looks to be declined after.

And then similar to the Warm Springs West Gage, you see previous to this long-term decline, the effect, you know, from '98 to 2004, let's say. And then the effect of the recharge event in 2005, the start of the test at the end of 2012 and this decline by 2013 and beyond really.

Now, on this chart I also have listed or marked the initial trigger level for the 2006 MOA, which is the 3.2 CFS.
Q. And how close does the hydrograph indicate the flows came to 3.2 CFS at any time in the data set?
A. Well, right -- so the test ended at the end of 2012, but the pumping at MX-5 continued through April, mid April of 2013. And you can see, you know, after the springs, at least at Warm Springs west, continued to decline almost reaching 3.2, but not reaching it for any period of time or extended period of time.
Q. And could you describe your understanding of the

source of water for the springs versus the source of water for which MX-5 was pumping?
A. Well, it's the same source. So this is the carbonate rock aquifer that underlies and interconnects the basins of Lower White River Flow System. So they are the same source.
Q. Okay. Did you do additional analysis of the data related to these surface -- or these flow records?
A. Yes. So we wanted to look at, again, is how -- since we use well EH-4 as an indicator for groundwater conditions at the springs themselves, we wanted to see how those head levels at that location correlate to the spring discharge.

And we figured it would be a linear relationship when we did our regression analysis. This is very similar to what Tim Mayer did and presented the other day.

But high correlation between hydraulic head at EH-4 with spring discharge at Pederson Spring. So we know there's certainly a connection between head levels in the carbonate system and spring discharge at Pederson Spring.

We did the same thing for Warm Springs West Gage, which is -- measures the confluence of the Pederson Spring complex and any gains from the spring orifice to the Warm Springs West Gage, and we did the same analysis.

We showed that the head levels, again, in the carbonate system at EH-4 with respect to Warm Springs West Gage were highly correlated and linear in nature.
Q. So, Mr. Burns, did the statistical analysis you just described confirm what you observed when you reviewed the hydrographs?
A. What we saw in our qualitative assessment of the hydrographs, these time series plots was confirmed by the regression analysis that we performed, the high correlation that we found with respect to the representative wells in EH-4 represent an interconnected nature of the carbonate rock aquifer in this area.
Further, we found or confirmed that the discharge from the springs was highly correlated to the head levels in the EH-4 well, which is representative of the aquifer conditions at that location at the spring heads.
Q. And when you say the aquifer at that location, is that the carbonate aquifer?
A. Correct.
Q. And going forward, do you consider EH-4 to be an index well?
A. Index -- yes, I do.
Q. Okay.
A. It's an index for the conditions, the groundwater

conditions observed at the springs, themselves, and underlying the springs.
Q. All right. A couple quick questions before we move onto the next part of the analysis was that performed.
Could you describe the conceptual model of how the carbonate aquifer is related to the river or the springs and how the alluvial aquifer is related to the river or the springs, and how this empirical information from the pumping test compared to that previous conceptual model?
A. Well, if I understand your question, you're asking about what we viewed as a conceptual model at the Muddy River Springs area, which is the -- we think of the alluvial system there as an alluvial reservoir as we call it, and that water is sourced by the carbonate aquifer.
But you also have discrete springs, such as Pederson Spring and others that are -- that discretely source to the carbonate aquifer and they behave, I guess, separately.
So what we've seen is you can pump the alluvial reservoir without impacting the springs, but you -- when you pump the carbonate aquifer, you can affect the spring discharge as we just described by that relationship. And that ultimately captures flow, any diffuse flow that would go into the alluvial reservoir or discharge from discrete springs like Pederson Springs.

Q. And there's been some discussion of water budgets in prior testimony at the hearing.
Do you have a view of the role water budgets can play in making hydrological conclusions about the connectedness of the Lower White River Flow System versus the type of empirical data you've been describing?
A. Well, I don't think that water budgets are, at this point, very informative with I think the data that we've collected or collectively.
It's certainly more informed because we're at a -- we're not really litigating or debating water budgets so much as how pumping affects this system, affects discharge, affects depletions in the Muddy River. And it's those responses that I think are more important than a debate on water budgets themselves.
Q. All right. And lastly, when you went through the observations of the hydrographs for groundwater or groundwater levels, and this was in Figure 5-5 and 5-14 -- I'm sorry, 5-5 and 5-12, was there a similar recovery signal in those hydrographs as well?
A. Yes, I'm looking at Figure 5-12, page 6 of the handout, and yeah, I mentioned before that you can see the recovery beginning -- and this is at CSVM-1, promptly beginning after the MX-5 well is shut off. And it appears to

recover by the first quarter of 2016.
And I see the same thing in GB-1, which is, again, at Hidden and Garnet Valley boundary. That one may be attenuated -- or affected by local pumping in Garnet Valley, so it does appear that recovery was as high.
Let's see. But you see this recovery throughout at TH-2 in California Wash, EH-4, Muddy River Springs area, and even to the far north of CSVM-4. All be it somewhat muted, you can still see a recovery by about 2016, half part of 2016.
Q. All right. Thank you.
Ms. Drici, I'm going to now have some questions for you.
ANSWERS BY MS. DRICI:
A. Yes.
Q. Did you perform any further analysis of the cause of change in water levels and spring flows based on the 1169 pumping test?
A. Yes. The analysis that I performed is the MLR. So MLR stands for "multiple linear regression," and basically it's just a little bit more complex form of the simple linear equation that Andrew was describing.
Instead of having -- so you have an -- in the simple linear regression, you have Y equals AX plus B. So the

A is like a slope of the line that correlates two variables. Y is the dependent variable, for example, spring discharge, and X is, for example, the water level at EH-4 in the -- some of the correlations that he showed.

In the multiple linear regression, so you have the same Y, but you have an intersect, the B in these equations, but you have several independent variables, like X-1, X-2, X-3.

And the way I used it is to answer the question, how much each of the basin groundwater production contributes to, for example, the water level at EH-4 because what you measure at, for example, EH-4, you see a curve.

But that curve is like a combination of the effects of different stresses, including, you know, productions from different basins and then recharge pulses coming in at different times. And you can't really -- for recharge, you can't really separate that, because like I really -- I don't know.

I just know that it's coming in as pulses at different times from the different recharge areas. But I can't quantify -- I don't want to use any proxies. I just want to separate the responses to the groundwater production from the different basins.

So in this MLR, Y is the EH-4 water levels and

the X's are the -- X-1, for example, the first one might be the total production in the Black Mountain area, excludes the total production in the California Wash, et cetera. So 5, 6 basins basically, six X's or independent variables.

So the reason we can do this, you know, we use principles superposition where in an aquifer like this, that's highly interconnected and we saw that it is acting like a combined aquifer. So therefore, it acts -- it behaves in a linear fashion because the transmissivity is constant. It doesn't change with changing water levels.

So when we conduct this analysis and we extract the responses to the individual basin groundwater production from the carbonate aquifer, and if you look at the first graph there, the slide, that would be the Black Mountain area. And it appears, from this analysis, that the groundwater production from Black Mountain is not really affecting the water levels at EH-4.

So it's an indication that, perhaps, the boundary down there might be a little bit off because the boundary was defined based on the observation well, the VMDL-2, I believe.

And VMDL-2 did respond to the MX-5 pumping during the Order 1169 aquifer test, and these wells, the production wells are just a little bit south of there. So this is an indication that, perhaps, the boundary might be a little bit

off.

Q. And, Ms. Drici, just for the record, you're referring to Figure A-3 in your expert report?

A. Yes.

Q. Okay. And now, can you continue on talking about those figures?

A. Sure. The second figure is the response to groundwater production from the carbonate aquifer in the California Wash. In this one, we see that the groundwater production is not really a lot. It's relatively small, and yet, it produces a significant response at well EH-4. Next slide, please.

The next figure, Figure A-5, we see the response to groundwater production from the Coyote Spring Valley. And in this one, you see that there's a lot of -- a lot of pumping, especially during the Order 1169 pumping test.

But here the response, I mean, is not huge and this is because of the higher transmissivity in that area. When you have very high transmissivity, you might not see a great response, as great as you think.

Figure A-6 is the response to groundwater pumping in Garnet Valley. As you can see, the response for the magnitude or the changes in the groundwater production. And the last one, Figure A-7, is the response to groundwater

pumping from the Muddy River Springs area. Again, the response follows the magnitude of the pumping to time.

But perhaps it's not as significant as you might think it is, is because it's close. But the response at a given observation well is not just a function of the distance. It's also a function of the level of connectivity between the groundwater production and the observation well.

And the last figure I have here, Figure 3-2, this is basically the -- putting together, adding up all those -- the responses to groundwater pumping from all the basins at EH-4. And I show in comparing them with the observed, so the orange line is the calculated EH-4 water levels and the blue is the observed EH-4 water level.

Now, when you do the regression, you always have residuals. In theory, if you knew what all the stresses were, you would be able to extract the responses to every one of them and the residuals would only represent the errors.

And they would be randomly distributed and they would show up as, you know, random points about the zero line. It's like you would be -- you would want to be error, whatever is left zero, like the residuals, the difference between observed and calculated.

But in this case, because I could not extract specifically the response to the recharge variations, I left

it in with the residuals.
So the residuals in this case, they are some kind of indicator of the effect of recharge on EH-4 water levels during this period that I looked at, which is from 1993 to 2018. And this period represents the period during which carbonate pumping was occurring.
I know that the carbonate -- the pumping, the carbonate production from the carbonate aquifer started a little bit earlier.
But the records -- I don't know if they were not kept, we could not find them, we did not want to use any estimated -- anything, we wanted to stick with the data and so this is what we get.
As you can see, the downward trend in the water levels at EH-4 is clearly caused by groundwater production in all these basins of the system. And the drop caused by groundwater pumping from '93 to 2018 is about four feet, whereas the recharge variations have been causing like, perhaps, a maximum of like 1.4 feet around like in 2013, you see that deviation from the zero line for the residuals.
So the relative contribution of the recharge to the water levels or the decline in EH-4 water levels is relatively small compared to the effect of groundwater production.

Q. Thank you. And when you -- in your last statement about recharge and its role in affecting the hydrograph, does that recharge term include climate and the types of precipitation that's been talked about at this hearing already?
A. Yes, definitely include. I mean, the recharge is -- starts as precipitation on high elevations and it's mostly precipitation during the winters that turns into recharge and moves down the system.
Q. Okay. Now, I'd like to ask you, Ms. Drici, about a separate analysis that you performed. And so let's move again to Figure 6-1.
And did you then perform an analysis of proportional flow at springs versus the Muddy River to determine the long-term annual quantity of groundwater that could be pumped from the Lower White River Flow System?
A. Yes. In this analysis, I was trying very hard to answer the question that the State Engineer asked, which was basically, you know, how much can we produce from this carbonate aquifer in the sustainable manner. And like we said before, sustainable can mean different things.
So this analysis is mostly concerning the Moapa Dace. And to do this, based on the conceptual model that Andrew was describing that all the springs in the MRSA are fed

by the carbonate aquifer as represented by EH-4 as the index well.
So based on that model, conceptual model, I think that the flow that you see at any spring and, for example, Warm Springs West Gage, which is like a -- represents spring discharge from the group of springs, the Pederson Springs and some seeps in between would behave in a linear fashion with the total discharge in the spring area.
Now, the total discharge in the spring area cannot be managed directly because we don't have just a bunch of discrete springs. And so we could like just measure each one of them and add them up and come up with like, okay, this is the total discharge to this area.
We have a combination of springs and then seepage into the alluvial reservoir. And so the only way that we can estimate what the total discharge in the springs area is by using the Moapa Gage on the Muddy River.
And the way to do that is if you look at Table 6-1, the way we do that is we take the flow as measured at the Moapa Gage adjusted for like over land flow, and we add all the losses that occur above the gage.
And the losses include the stream diversions, the alluvial groundwater production from the alluvial reservoir in the Muddy River Springs area, and the ET that occurs above the

Moapa Gage.
So if you are looking at this table, let me see. The cone, 1, 2, 3, 4, 5, 6, 7, the seventh column, which is labeled "total MRSA discharge," gives you the estimated total discharge to this area.
Q. Ms. Drici, let me look -- there's a lot of information on this table. So let me just make sure I -- the record's clear.
So we're looking at Table 6-1, and in the first column is the year obviously. And that second column, is that annual -- average annual CFS; is that a value from a measurement?
A. Yes.
Q. Okay. And the column total or annual total, is that just a conversion of that CFS into acre feet?
A. Yes.
Q. Okay. And then the next three columns that are all under the heading "losses above MR Moapa Gage," just could you describe again what those three columns are?
A. Okay. So the first one is the total three-year of all the stream diversions that occur above the gage.
Q. Okay. And what about the next one?
A. The next one is the total annual production from the alluvial reservoir, which is located above the gage, too.

Q. And then ET?
A. And the ET also is the annual ET from -- there's an ET area within the Muddy River Springs area that is above the gage. So this is what those numbers represent.
Q. And what's the source of those numbers?
A. The source of those numbers. They're measurements and -- let me see. I have a little cheat sheet here. The diversion data came from NEWR, NV Energy, and NVWD and some of it from USGS.
The alluvial production came from NEWR, NV Energy and NVWD. What else? The DET -- oh, yeah, I need to say this. ET, we don't have measurements of ET all the time. But for this period of time that I considered, and this is why I considered this -- sorry, I should have said this before.
The reason we're looking at only from 2001 through 2002 is because a study was conducted to estimate ET above in the MRSA area for those years.
Q. And those years being 2001 through 2012?
A. Yes. And so these were estimated during that study for other years. All we have before was Eakin 1964 estimate or -- and I don't know.
Right now, we could probably try to figure out the other years by looking at satellite imagery and all that, but we did not. We just used what we had.

Q. And that work was done by Justin Huntington?
A. Yes.
Q. Okay. And then those three columns, losses above the gage were added together to reach the total MRSA discharge?
A. Exactly.
Q. All right. And then what did you do?
A. Well, after we had that, I mean, we obtained measurements for the Warm Springs West Gage, which are measurements at that gage, and we took them -- again, we converted from CFS to acre feet.
I mean, you could do these -- the last column is the ratio basically. You just take the Warm Springs West discharge for a given year, divided by the total MRSA discharge for that year, and you get the ratio.
This ratio is something I did not mention in the report because I was trying to keep it as simple as possible, represents the slope of the line that correlates these two measurements. Warm Springs West Gage discharge versus the total MRSA discharge.
So because if you plot these and you try to fit a line, because the MRSA -- the full MRSA discharge is not measured -- it's not known very accurately, you do see a trend that looks like, you know, a linear trend. But the scatter is

relatively large so that you couldn't really figure out what the slope would be.
So that's why I calculated the ratios and these ratios are, in my opinion, approximations of that slope. And knowing the slope would allow us to basically say, hey, if the discharge at Warm Springs varies, say, by .1 CFS, what does that correspond to in terms of the total discharge to the MRSA.
And then you could use that number and say, well, what if this reduction in total discharge is caused by production from the carbonate aquifer.
So you could use that number to say if I don't want to bring down Warm Springs West by more than, you know, this much, then I shouldn't be pumping more than this proportional quantity of groundwater.
Q. And did -- were you able to make a conclusion about whether there was a proportional relationship between Warm Springs West flow and MRSA discharge?
A. Yes. To confirm it farther that basically this would be applicable to different springs in the area, if you look at the Figure 6-2, you can see that for the same period of time, the Baldwin Springs and Jones Springs also show a relatively constant ratio with a total discharge of spring data.

Q. And on Figure 6-2, is that in the lower two rows, Baldwin and Jones?
A. Yes.
Q. Okay. In preparation for this hearing, did you discover a clerical error in this table?
A. Yes. The first -- well, the second row. The first row is the year and the second row is supposed to be the total Muddy River Springs area discharge.
In putting this figure table combination together, we inadvertently used the ET values from the table, rather than the total MRSA discharge numbers.
Q. Okay. And do you have a new version of the table?
A. Yes, it is the one shown here. It says "corrected".
Q. Okay. And did this clerical mistake affect your analysis?
A. No. It was just a presentation.
Q. Okay. And just for the hearing officer, we had a copy of the corrected Figure 6-2 that we'd like to offer into evidence as our next exhibit in order, which I think is Number 85?
HEARING OFFICER FAIRBANK: So basically what -- if I'm understanding you correctly, you're just offering that

as an errata to this particular form. We'll accept it as an errata.

MR. TAGGART: Thank you.

(Exhibit 85 admitted into evidence.)

BY MR. TAGGART:

Q. So did looking at Baldwin and Jones Spring confirm what you found with respect to Warm Springs West?

A. Yes.

Q. Okay.

A. It appears that there is linear relationships between discharge at these springs and total discharge to the MRSA to the carbonate aquifer.

Q. All right. Now, I'd like to ask you what you did next and we've got a slide up on the screen relating to Eakin 1964?

A. Okay. So in search of a good approximation of this slope between Warm Springs West and the total discharge with the MRSA, I found a -- I think a more accurate value, looking into the literature, namely the work of Eakin in the 60's.

So the reason I think that this would -- his numbers would provide more accurate estimate of the slope of the linear relationship is because he measured the -- all the springs he could measure at the time. He measured the

discharge at various times between 1963 and 1964 and he also measured the flow at the Moapa Gage on the Muddy River.

And so at that time, he had a measurement at Warm Springs West of 3.78 CFS, whereas the total MRSA flow or discharge was at 49.8 CFS. And at the time, what he said is it wasn't much human activity going on there, except maybe for a few irrigation wells that were -- he accounted -- he put them like within the ET.

And he figured that in -- if he measured the flow in the river in January, that ET would be minimal at that time, and so therefore, because he didn't have any other production going on upstream from the gage or in the carbonate aquifer in the '60's, so therefore, the January measurement of the Muddy River at the Moapa Gage represents a total discharge to that whole area.

So from there, you take the -- you divide the Warm Springs West by the discharge, by the total discharge coming in, and you get a ratio of 0.076.

And this ratio is probably representative, it's the most accurate representation of the slope of the line correlating these two discharges. And I want to add that these relationships with the springs are only valid when the springs are flowing.

I disagree with anybody that takes them below

that and takes them to zero or negative numbers or whatever. They don't mean anything.

Q. Okay. And, Ms. Drici, was that one of the critiques against this approach that was presented in rebuttal reports?

A. Yes.

Q. Okay. So if all the springs are flowing, that's an assumption in your approach?

A. Yeah, this is -- I think this is a good approximation if all the springs are flowing.

Q. Okay. Now, how -- compare -- I'm sorry. Strike that, please.

Of the Eakin number that you have on the screen, is that comparable to the values that were calculated for the ratio between 2001 and 2012?

A. Yes, it is.

Q. Okay. Now, once you derived that ratio, what did you do next?

A. Okay. So the -- that ratio was used to estimate the decrease in the total discharge that would be -- that would correlate with a decrease in Warm Springs West. And we did this in Table 6-2 by using the Warm Springs flow conditions that were in the MOA, 2006. And so this table, if you look at it, it has in the first column the Warm Springs

flow conditions.

The first one is the -- what it was or what we estimated it was during predevelopment conditions as calculated from 1945 to 1962. So it's like an average of what was going on there at that time.

And I think that starting from that value rather than from what we see now is conservative, so that you're not taking into account, you know, the variations in recharge and considering the extraordinary recharge spikes that we saw, for example, in 2005 because, of course, you can't count on that to develop groundwater. We have to use like a -- some kind of a base or basic number.

So we went back to predevelopment conditions and we started from the average of 3.82, and then we moved down by, you know, 2, 3.6, 2.4, 2.2, 3, 2.9, 2.8 and 2.7. Some of these, I think starting at 3.2 down to 2.7 were in the MOA.

Q. And just quickly, when you say they're in the MOA, those are values for triggers in the MOA?

A. Yes.

Q. Okay.

A. They were defined as triggers to protect the Moapa Dace. So from there, we go to Column 2. It's -- that's just a difference between, so 3.82, the first number in column one minus the next one, basically the decrease from average

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predevelopment conditions.
So you go down the line that way. From the third column, we convert those numbers into acre feet per year, and in the fourth column, we calculate the corresponding volume of water that the total discharge to the springs area would decrease by.
And this decrease, of course, could be caused by different stresses. It could be climate or it could be production. But in our calculation, we're saying it -- we would attribute these to groundwater production for management purposes because we can't control what the climate does. We can only control what we do, educating the production from the carbonate aquifer.
Q. Okay. And then in the columns related to MRSA discharge, what is contained there?
A. Well, that is the basically the number in CFS, you just take the Warm Springs West discharge and CFS, and of course you don't do it for the first one, but you would be dividing -- you know -- well, you would get zero anyway.
But anyway you take the decrease in the Warm Springs West discharge, for example, 0.22, you divide that by the ratio of 0.076 and you get a 2.89 decrease in the MRSA discharge.
Convert it to acre feet, that means if the Warm

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Springs West, it drops to divide .22 CFS -- no, I was in acre feet. If the Warm Springs West discharge drops by 159 in acre feet per year, that would mean that the total discharge to the MRSA is going down by about a couple thousand acre feet.
And if all that's going on is groundwater production from the carbonate aquifer, you could equate that to the groundwater carbonate aquifer. You turn it around and you say, if I pump a couple thousand acre-feet, the Warm Springs West discharge will go drop by about 0.2 CFS.
Q. And according to this analysis, what amount of carbonate pumping can occur in the Lower White River Flow System to maintain the 3.2 CFS at Warm Springs West Gage?
A. Well, on this table, if you look at the rows -- the row where the Warm Springs West in the first column is at 3.2 CFS, you go across and you see that's the corresponding decrease in the discharge in the springs area is about 6,000-acre-feet per year.
I'm not going to say that these numbers are a hundred percent accurate. They are approximate again, because the analysis, we don't have like extremely accurate data. That's why we chose a range rather than a number.
Q. And you chose 6,000, is that what you mean by --
A. Well, we said that to protect the Warm Springs West discharge or keep it at about 3.2 CFS per year. We

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shouldn't be pumping more than 4 to 6,000-acre-feet per year from the carbonate aquifer.
Q. And that's rounding up from the 5908?
A. Yeah.
Q. Based on the limitations of the approach that you just described?
A. Yeah, definitely. I mean, we kept the -- all the significant digits here just for tracing the calculations. But we know it's not going to be down.
Q. Okay.
A. To that level of accuracy.
Q. Now, at the beginning of your discussion of this proportional flow analysis, you indicated that this was related to the Moapa Dace.
Is there a different analysis for what amount of pumping is allowable without impacting senior groundwater rights -- or let me ask it differently.
Is this a separate and distinct concept from what would be required regarding senior groundwater rights?
A. Yes, definitely.
Q. Okay. All right. We're going to move to another topic. This might be a good time for a break.
HEARING OFFICER FAIRBANK: We've been going for about an hour and a half, but we can go ahead and take a break

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right now if that works, if that's convenient for everybody.
MR. TAGGART: I think that would be good.
HEARING OFFICER FAIRBANK: Okay. Let's go ahead and take a ten-minute break and we'll get back at 10:15.
MR. TAGGART: Thank you.
(Recess at 10:05 a.m.)
HEARING OFFICER FAIRBANK: Okay. Let's go ahead and go back on the record. Mr. Taggart, you may continue.
MR. TAGGART: Thank you.
BY MR. TAGGART:
Q. All right. Welcome back. And my next set of questions are to you, Mr. Burns.
The number of experts in this proceeding have offered opinions regarding weather. The Lower White River Flow System groundwater levels are in a steady state condition or are continuing to decline. Have you reviewed that question?
ANSWERS BY MR. BURNS:
A. I have.
Q. Okay. And what is your view on that question?
A. Well, when I look at the water levels in the carbonate system throughout the domain, I see, after the recovery period, that I believe sort of obtained it's peak in 2016. About the first quarter, I see after that period of

time, that water level trends have been declining in the wells I've looked at.
Q. All right. I want to show you Figure 3-3 from your rebuttal report, which is Exhibit SNWA Exhibit 9. Could you describe that, please?
A. Okay.
Q. And please describe whether this figure is significant with respect to your opinion regarding whether water levels in the Lower White River Flow System are at steady state or are continuing to decline?
A. Correct. This is a figure with -- I'm going to go back to hydrographs, and I want you to look at this period after 2016 or at the peak of the view as recovery, 2016 to current. If you could back up a slide in your presentation, I want to show you, again, where these wells are located.
The first one, CSVM-1, again, is maybe a quarter mile, half a mile to the east of MX-5 pumping well on the way to Muddy River Springs area.
Again, there's GB-1, which is at the boundary of Hidden Valley and Garnet Valley and then Paiute TH-2 is in California Wash. All these are carbonate completed wells.
So if we look at that period from 2016 to current, what I did here was to take the maximum water level that occurred in the year, and typically that's in the first

quarter of the year, and with those four values, just developed a trend line. And that's depicted on the chart. And, of course, you can see for each of these three wells, the trend line is going down.
Now, I want to make a point here of some of the other conditions occurring during this time frame. One, if you look at the bottom panel, it's not that easy to see on this figure, but we can maybe go to the table and I'll show you. But what you see from 2016 to 2018 that groundwater production has actually gone down.
In this period, 2017 -- or in the same period, 2016 is essentially a normal year, but the -- two of the three years after are above the -- I'm sorry, let me back up. The precipitation index is greater than normal in 2017 and 2019.
So the average annual percent of winter season precipitation is higher than average. 2018, it's actually lower. So what I see here, and we're talking southern Coyote Spring Valley, northern Garnet Valley, and then California Wash is there -- is a declining trend.
So my impression here and my conclusion is that the system, at least in these areas, has not attained the, as some people call, steady state condition, that water levels are still declining.
If you go to the next page, I think I can maybe

illustrate with some of the numbers of production. Here, if we look at 2016, for example, the last three rows of this Table 2016, 2017, 2018, at the top we have Coyote Spring Valley from left to right. Coyote Spring Valley, Black Mountains area, Garnet Valley, California Wash, Muddy River Springs area.
Q. And, I'm sorry, Mr. Burns, this is Table C-3?
A. Yes, sir.
Q. Okay. Go ahead.
A. And then on the far side is the total production and this is carbonate aquifer and groundwater production. So I mentioned earlier about these declining trends in these wells.
I'd like you to look at the total on the very far right-hand side, and these are the production numbers during that period, about 7800 in 2016, less than that, 2017, and then 7,630 and in 2018, 7,344.
Q. Mr. Burns, what about specifically in Muddy River Springs area? What was the change in production from 2017 to 2018?
A. Well, in 2016 and 2017, it's about the same, around 2800. But it -- production was reduced by about, let's say, 150-acre-feet in that area. If you'll oblige, I'd like to talk about California Wash as well and some of these other

basins.
In California Wash, production from 2016 to 2018 also declined from 200-acre-feet to 24. In Garnet Valley, peak production in 2016 at 2242, down in 2018 to 1751.
However, in Black Mountains area, there's a slight increase from 1434 in 2016 to about 200-acre-feet more at 1623 in 2018. I'll point out, though, the net production between Black Mountains area and Garnet Valley, I think, has actually gone down if you combine those two. And then Coyote Spring Valley in 2016, production at 1117 increased to almost basically 1400 in 2017 and then almost 2,000, 2018 at 1,967.
So the point here is, well, while production -- we see these water level declines coincident with groundwater production being reduced coincident with a period of time where we've had above normal winter season precipitation.
And so this tells me -- this is -- the response is something different than you might expected. You had production lowered and higher that normal precipitation, you might expect that the water levels are steady or even increasing, perhaps, and that's not what I see.
Q. Did you also review the EH-4 hydrograph with the same questions in mind?
A. Yeah, I took a look at EH-4 as well, EH-4 and EH-5B. Now, remember, EH-4 is just adjacent to the gradient

Pederson Springs complex. E-5B is to the northeast of that or basically north near the Arrow Canyon wells, production wells. And so these wells on this next figure --
Q. Let me just, for the record, identify it. Is this the document that's been submitted as SNWA Exhibit 81?
A. That's correct.
Q. All right. Go ahead.
A. Okay. So if we look at EH-4 and EH-5B, and starting about 1998, we see a very linear decline to the end of 2004. And we can look at the production at the bottom and see that production had increased during that time frame. Then 2005 is the extraordinary recharge year that kicked the water levels up. And then, of course, we see the test again, starting in 2011 and the water levels responding accordingly.
Here, the recovery period, again, about the first quarter of 2016, I've applied the same process and it's very simple of taking the maximum water level in each of those years and using that to develop the trend lines. And in both of these cases, I see the trend declining.
Q. Okay.
A. Now, one thing I might note is in this period, I just recited for you some of the production in this area. So in 2018, it was reduced by a little over 800-acre-feet.
And I think when we see -- when we look 2018,

that first quarter, it's actually a little higher than 2017 and 2019. And I attribute that to that change in pumping operation at the Arrow Canyon wells.
Q. So, again, at this EH-4 location that's depicted on Exhibit 81, what would you expect to be happening at this location if groundwater pumping was down and precipitation was above average in two of the last three years?
A. Well, frankly, with respect to the precipitation index or indicator, we actually don't see much in terms of -- in the hydrographs, we don't see much in terms of response to these years where you're approximately normal or below normal, you know, 100 percent or even when it -- the signals that we see are these extraordinary events like in 2005.
But what I would expect to see with the decline in groundwater production and these above normal years in 2017 and 2019, at least -- I would at least see that the water levels are flat or no trend or perhaps even rising.
Q. And does this declining trend that you've described in EH-4, does it have implications on whether flows at Warm Springs West will remain stable or will begin to decline?
A. Well, earlier in our presentation, I established that the change in heads at EH-4 have proportional change in flows at the Pederson Warm Springs complex. So I would expect

a proportional change up in those flows or reduction in flows if this -- if there's a declining trend from here to the future.
Q. And I'd like to show you again Exhibit 5-7. Would continued decline in the flow at Warm Springs West potentially lead to the initial trigger of 3.2 at that gage?
A. Right. Absolutely. If the potentiometric surface as measured by the water levels in EH-4 continue to go down, of course, the discharge from this spring complex will also go down.
Q. And could you describe that in relation to the solid line on that Figure 5-7, which is identified as the initial trigger level?
A. Okay. On Figure 5-7, the second from top hydrograph is the Warm Springs West near Moapa Gage record, and what you see here after a test, we encroached upon the 3.2 initial trigger of 3.2 CFS. They recovered and then it looks to me as it's declined, maybe sort of bouncing around as a steady level around 3.4 max.
Q. Okay. And then this new last three-year decline, do you view that as a decline in this hydrograph as well?
A. From 2016 to first quarter of 2019, yes.
Q. Okay. So do you believe that current pumping levels in the Lower White River Flow System, the gage record

at Warm Springs West could fall below 3.2?
A. Yes, I mean if what we see continues, we'll continue to see declines in the head levels at the springs, themselves, and as I said earlier, a proportional decrease in flow.
And so it's not -- you know, we're not there yet, but I think if water levels continue to decline, we will be at some point.
Q. Okay. Now, Ms. Drici, I want to ask you now about this question of steady state versus continuing to decline in the Lower White River Flow System.
Can you turn to Figure 6-3 of the SNWA report, Exhibit Number 7?
ANSWERS BY MS. DRICI:
A. Yeah, I'm there.
Q. And explain what we're looking at here?
A. Okay. So this -- to get to this analysis was to approximately calculate where we're at in terms of the capture by the ongoing groundwater production from the carbonate aquifer. So the way this was done is, again, going back to that ratio between Warm Springs West and total discharge.
So, again, we look at the historical record of the Warm Springs West Gage and we looked at it from basically the estimated start of groundwater production from the

carbonate aquifer, which is like from 1991 to 2018 on using annual data.

So if you take the decrease in the Warm Springs West Gage from -- at the start, from 1991 and you go down every year and you see how it's been decreasing, you can use the ratio to calculate the corresponding decrease in the total discharge of the MRSA. And that total -- the discharge in the total MRSA discharge could be equated to the capture by the groundwater production from the carbonate aquifer.

So this graph shows the cumulative MRSA discharge capture in green through the years. The total groundwater production is the blue line -- is it blue or purple? Blue line on top.

And so from there, you take the total groundwater production for each year and you subtract the amount captured from the spring discharge. You get -- the difference would be the volume of groundwater captured from storage of the carbonate aquifer.

So this basically -- that shows that by the time you get to 2018, we're -- we haven't reached steady state definitely because we're still capturing groundwater from storage.

We see the blue area is still going up, because if you were getting close to a steady state, that line would

be flattening, signalling that there is no more change in groundwater storage.

So in my opinion, considering the approximation of the ratio and the lack of production data before like 1990, approximately I could say that was probably around 50/50, for capturing 50 percent of the groundwater production from the carbonate aquifer from the spring discharge and about 50 percent from groundwater storage.

Q. Thank you. Now, I'd like to move onto a new topic. Mr. Burns, I'm going to ask you about the question of the relationship between pumping in the Muddy River, carbonate pumping in the Muddy River.

So let's turn to Figure 7-1, 7-1. And with that, could you -- I'm going to begin asking you about the Muddy River depletion analysis that you conducted.

But before we do, could you orient the State Engineer and his staff to the major points on this map that we'll be talking about?

ANSWERS BY MR. BURNS:

A. Certainly. This is the aerial extent of the Muddy River Springs area where the springs that we've been talking about occur, Pederson Springs. This is the -- you need to go -- this -- there you go, there you go.

Okay. Sorry about that. So Pederson Springs

here. What's of interest to this analysis is the gage record at the Muddy River near Moapa Gage. But just to identify some of the other features, we have -- this area on your imagery, this is areas of evapotranspiration, whether it's irrigation or natural. That's the extent.

We have production wells in the area. We have the Lewis well field to the northeast. We have LDS Central east and west, alluvial wells, those are all production wells that draw from the -- or have historically drawn from the alluvial reservoir and then Perkins down to the south --

(Reporter interrupted proceedings.)

-- Perkins production well and Beamer production well below the gage to the south in your lower right-hand quadrant of the figure. And so that gives you a sense of the layout and you have Arrow Canyon production up in the northwest corner.

And so what we -- I think not just we, I think anyone who's looked at the gage record of the Muddy River near Moapa Gage has observed that since about mid 1960's, there's been a decline in flow. We have that in our report, the hydrograph for that. But what we've seen is this decline has persisted over time and we wanted to know what that was attributable to.

The obvious factors include surface water

diversions above the gage. What's not depicted here is that there's a Nevada Power Energy diversion right above the gage, and there's some diversions from the springs in this system as well. So those are obvious factors that could contribute to this decline.

Others could be land use changes, perhaps, or changes in ET or even long-term climate trends that have reduced flows. And we looked at each of those and found that they were not significant with respect to the magnitude of the decline.

And we attribute -- so what we did is we -- if you turn to the next slide, is if we were to assume predevelopment condition of 34,000-acre-feet in this area of surface water discharge, as the predevelopment condition, I'm looking -- let me back up. I'm looking at a period 1992 to 2018 here.

And if we assume that we can see that this bottom line, that we were substantially below that predevelopment condition. So something, in our mind, has depleted the river flows in this area of over this time period.

This bottom line is what we refer to as a flood adjusted flow. So it's a -- what we're interested in is the base flow that's measured by the gage and we've adjusted that flow to remove the overland flow and flash flooding events and that's what's represented there.

We derive a flood adjusted natural flow, so this is the natural flow that would occur. We -- in doing so, we add the surface water diversion back to create this natural flow record.

And on the next page, what we see then is we have the bottom line, which is the record. We've added in the blue part, which is the Muddy River diversions. But we're still left with -- we're turning the Muddy River flow deficit. These are what we identify as the depletions in the river system as measured at the Moapa Gage.

And so as I said earlier, we don't think ET, which varied, as Warda's described earlier in a study from 2001 to 2012, varied around 800-acre-feet over that time period, a decline. But that doesn't account for, you know, about 6 or 7,000-acre-feet in -- at its maximum here.

We looked at long-term trends. We look at the winter season precipitation pre- and post-1965 when experts began -- groundwater experts began and surface water diversions.

We find that was actually slightly higher 1965 to present than it was pre-1965. So we rule out this being attributable to climate factors. That's not to say that there's some variability with flow record due to that -- those

factors. But we all feel that that can attribute for this entire deficit.

So what we did next is looked at this low deficit. So we attribute the deficit to groundwater production and here's a ground -- here's a figure, this is Figure 4-5 of our report. This is the inset that we just showed earlier where groundwater production occurs. You have base -- alluvial reservoir pumping, you have Arrow Canyon carbonate production in this Muddy River Springs.

But outside this area, we have these other pumping centers. And Warda earlier mentioned about, in her MLR analysis, attributing some of the declines at EH-4 to these pumping centers. So in Coyote Spring Valley, we have the SNWA's MX-5 well, CSI production wells, there's a CSVRW-2 that's not been operated. You have in California Wash, the Paiute ECP-1, 2 and 3 wells, and then you have a series of production wells in Garnet Valley as well.

And, of course, at the far southern end is pumping the Black Mountains, EBM-4, 5 and 6. So all of those, as Warda showed earlier, contribute to declines at the EH-4 well site and the heads as measured by that well.

And so if we go to the next page, what I'm presenting here is this red line is what is the actual Muddy River Flow deficit. These are what we view as the depletions

in the river system above the Moapa Gage.

Underneath the line is a stacked bar chart and I stacked these based on proximity of the wells to the gage -- or to the river system. So we have the alluvial pumping on the bottom, arrow Canyon on top of that and then I only included the Coyote Spring production here. But this was done -- this analysis was -- or this assessment was done prior to the MLR analysis.

So in retrospect, I probably would've -- because the contributions from all these production wells in the basin, I probably would have just had this as a single blue bar.

So at any rate, that is what we view as depletions over this period of time ranging from, you know, around -- max, around, you know, 7200 or so down to the current level of about 2300. And so these have been occurring over time. This is what we've estimated for this period and these are what we view as the effect of pumping on this river system.

And, of course, I think most folks I've -- well, all the folks I've talked to believe that the alluvial pumping is -- occurs as the -- the impacts of alluvial pumping occurs at a one-to-one basis. So one volume of -- one volume of pumped water from the alluvial reservoir is equivalent to one

volume depleted from the river.

And then we have the same -- at least for when we look at the MRSA production from the carbonate system, if that were the sole contributor to the declines at EH-4, that would be the contribution and that would approach one to one.

Q. And, Mr. Burns, do you agree with the opinion you just described that others have talked about, the one-to-one depletion rate?

A. Yes.

Q. Now, as a result of your Muddy River depletion analysis, you were able to determine in acre feet, the amount of depletion from the river had occurred over this time period?

A. Yes.

Q. And did you then convert that depletion into ICS credits or intentionally created surplus credits on the Muddy River?

A. Right. So let me explain. So when these depletions occur, there's two systems that we -- that I think of on this river with respect to how we derived ICS credits.

We have an upper Muddy River system where we have rights and those are unaffected because we had the river -- sufficient water in the river to make those demands or those obligations.

The depletions really affect the water that's delivered at Moapa -- or the Muddy Valley Irrigation Company at wells sighting diversion down in Lower Moapa Valley. And so if you look -- I guess I'll look at the figure real quick. What I was describing here is sort of a delineation between an upper and lower system. As I said, there's sufficient water in the upper system to meet these right obligations, decreed rights.

The depletions actually are realized here at the well sighting diversion in Lower Moapa Valley. What this analysis accounts for is just the effects of those depletions above the Moapa Gage and their impact to the flows delivered to the irrigation company at well sighting diversion. So just as a demonstration for --

Q. Oh, just a second, please. Just a point of clarification, why is it that it's that water delivery at well sighting that it's where the depletion occurs? Is that a hydrologic issue or is that something different?

A. Well, the depletion, itself, is a hydrologic issue. It's called -- well, maybe it's a hybrid. The depletion is caused by pumping operation that's depleted the flow of the river, whether it's alluvial pumping or carbonate pumping. The effect is realized by decreased flows at the delivery point at the well site diversion.

Q. And is the well site diversion significant from a decrease standpoint or from a water rights standpoint?

A. Well, it's my understanding that the irrigation company there is entitled to the entire flow of the river, at that point, less any amount used in the upper system. So to the extent there's water unused in the upper system by those other decreed rights, the remaining water is assigned by decree to the Muddy Valley Irrigation Company at the well site diversion.

Q. Okay. Thank you.

A. So if you look at the next slide, please, Figure 7-2. What we list in here is our certified ICS credits that we develop from our irrigation company shares. We have purchased shares and leased shares in the Muddy River Irrigation Company.

The water that arrives at the diversion is distribute based on those shares, so it can vary from year to year. But in the first two columns, we have year from the program's inception in 2008 to 2017, and these are certified ICS credits listed for those years. And when I mean certified, these are amounts certified by the State Engineer and the Bureau of Reclamation.

What I want to demonstrate here is what the potential ICS credits would have been if there was no

depletion on the river, and so we assume this 34,000-acre-feet. And under -- we -- for a certified credit, there's a natural flow condition that was observed in that time. So, for example, 4983 in 2008 under a flow condition of 29,016-acre-feet, which happens to be about 86 percent of the predevelopment base well.

So it's a simple calculation of what would our potential ICS credit have been if we had 100 percent of the river flow to 34,000, and that's simply computed by dividing the certified right by .86. And you get this in the 1, 2, 3 -- the fifth column, potential ICS credits under 100 percent predevelopment base flow.

So without these depletions, that's what we would have realized, that with our shares in the irrigation company. The next column, the impact, I demonstrate here that the impact in this year is simply the difference between the potential and what was certified, 811-acre-feet. And for the period of analysis here, it's about approximate 12,000-acre-feet.

Q. All right. A couple of follow-up questions there. I asked you about -- now, we are moving on to a new subject.

I asked you about your opinion regarding the capture ratio between alluvial pumping and river depletion and

you indicated your opinion on that. What about pumping of carbonate water versus river flow?

Could you describe what your view is on what the rate of capture is from carbonate pumping?

A. Well, I can't tell you what the rate of capture is. Warda has an analysis that shows you our estimation of what's happened. But if we look out long term and we think about -- when I say "long-term," it's not five years or 10 years from now. It's decades. It's what happens when you pump this water, what are you capturing? What source of water can you capture?

The only discharge in this flow system is the ET and the spring flows and the river flows in this area. And at some point in the future, I think I would expect that carbonate groundwater pumping would essentially be one for one and capture that flow.

Now, how long that takes, I can't fathom a guess. It is also possible that the carbonate production could capture a boundary flow, perhaps some amount of -- some limited amount of underflow or outflow to some other basin. But given the framework, I don't view that outflow is significant.

One of the things that we've seen with our qualitative and regression analysis is that throughout this

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system, we have very high degree of connectivity. These wells are very responsive to pumping changes, and I just don't see how -- where you could put a well, at least in the areas we've examined, and pump that well without having some effect at EH-4 and, of course, the proportional effect at springs.
Q. Mr. Burns, SNWA submitted a report after the 1169 pumping test. How does the inclusions in the report that you submitted here relate to that and the conclusions in that report? How does this report add to what was done in the past?
A. Well, what adds to the analysis is the six or so years of data that we've collected since the test is over and since those reports, those first analyses were provided to the State Engineer.
What's changed is we've seen what the recovery is. We stop pumping about 3,000-acre-feet from the MX-5 well, and frankly, I was expecting more of a recovery. But I think the recovery was suppressed by ongoing pumping. I think I lost your question. What's your question?
Q. How does the analysis that's done in the report that you're presenting to the State Engineer supplement what was done in 2013?
A. Well, this report here is -- I would say is more comprehensive view of the issues, using more data and more

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data analysis.
Q. All right. Now, I'd like to ask you some questions about some of the testimony that's been offered before your testimony here at this hearing.
In your rebuttal report, there's a Figure 2-4, and let's put that up on the screen. And there was testimony from Mr. Reich about the location of a fault in Coyote Spring Valley and the -- and in his view, the fault being not permeable or having limited permeability.
Do you recall that?
A. I do.
Q. What's your opinion about the fault structure that he described and its level of permeability?
A. Well, what I demonstrate in this chart, what I want to show you is a series of hydrographs. And you can see for yourself that they all behave in the same manner as we confirmed in our regression analysis.
But one well, this top one, CSVM-2 is located -- if you can go to the map, please. CSVM-2 is located in southern Coyote Spring Valley.
This is on the west side of the highway and you can see how it responds to the various stresses during this period of record. And it's the same as CSVM-1, which is, as I said, next to MX-5 pumping well and in the same for UMVM-1 to

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the east.
If you compare CSVM-2 to UMVM-1, they look very, very similar, identical in essence. And then further to the east at EH-4 at the springs area, again, the same. And then to the very far south is GB-1 and that one, as well, very similar.
So what this shows me or tells me is that, first off, between the CSVM-1 and these eastern -- easterly located wells in the carbonate system, there is no real difference. There's no attenuating effect by these faults.
I don't see any attenuating effect by the horse that sits there, the structural block that's much discussed the last couple days. I just don't see it. If it was there, I would -- you know, we wouldn't see these responses from the MX-5 pumping. And this shows the degree of connectivity in this area.
Q. All right. And could you turn to Figure 2-5 from your rebuttal report, figure number 9 and describe what this shows?
A. Let's go to a map first. Well, first off, what this shows are the records for CSI-1, 3 and 4. And then below there is CSVM-1, again, next to MX-5. But if you could go to the map. That's hard to see.
But this map figure is the hydrogeologic map of

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Rowley, 2011. And what I've done is posted the well locations on this map to show -- just to orient you where these wells are in proximity to MX-5 and some of the other structural features that are prominent in this area.
First off, along Highway 168 is the CSI-1 well and it's right here in the middle of the map. To the east of that is CSVM-1 here, which is on -- within that structural block, and then CSI-4, which is along the highway to the north, and CSVM-3, which is in the middle of this structural block that's been talked about.
And so it extends -- I mean, CSMAT data has moved this fault a little closer to the mountain -- the range front. But this structural block extends to the central part of the valley and that was characterized by Mr. Reich as an impermeable boundary. Also, the same, I think, with the faults that they mapped.
So here -- I guess here's the story as I understand it. They're purporting that CSI-4, CSI-1 and CSI-3 are in a separate compartment, in essence, than the other wells to the east and to the springs area.
So if I go back to the hydrograph, if we first look at the bottom panel, which is CSVM-1, which is very -- like I said, right next to this MX-5 pumping well. If we just focus on the test period, which is the gray area, we can see

that prior to 2011, they're starting the pump, getting it ready for the test, and then it starts in 2011.

And then about at the end of the first quarter of the year, MX-5 shuts off and you see CSVM-1 respond accordingly, water levels come up. The pump is then turned back on, water levels decline. And then they shut off again, the well shuts off and the water level recovers.

And then the remainder of the test continues and you have this decline to the end, to the end of MX-5 pumping.

Now, when I look at CSI-1, I can see the same sort of responses to this pump shut down at MX-5. I see the water level come up when it's shut off. I see that it goes down when it's turned on, and then come back up when it's turned off, and then for the remainder of the test, the decline. So at this well, I see that there is no real feature that attenuates the well -- the drawdown response.

Incidentally, if you go from the beginning of the test, you can see it's -- I have a list in my table report, but you can see a decline over the period of the test of -- let's see, 1, 2, about 3 feet or so.

Going to CSI-3, I think it's -- the record is a little, there's some missing data, I suppose, or missing measurements and -- but you can still see that when the pump's turned on, you have a decline. When the pump is shut off, an

increase and then a decline.

Now, superimposed on here is -- are the pumping effects, responses of the well itself. And so the record is a little by complicated in that regard and the same for CSI-4. But what you can see here is the start of the test to the end of the test, there's certainly an effect.

Now, CSI-4, same story, we're missing some important data here that might show what happened when the pump was turned off in the early first quarter of 2011.

But you can see 2012, when the pump was turned on, the water level declined and it pops it back up when the pump shut off. And we just don't have much data after that, except for this little record of five points that is lower than it was.

So what I see here are clear responses to the MX-5 production. The response is compounded by some of the production from the well itself, but you can see the signals of the MX-5 in this record.

So I conclude here that the structural block is not impermeable, nor are the faults on the west side of that block.

Q. So do you believe production of water, it had significant levels, for instance, 4,000-acre-feet could occur at CSI-1, 3 and 4 without impacting the Muddy River Springs?

A. I don't think that's the case.
Q. Okay. Moving on to your next slide, there's been some discussion about CSVM-5. Are you familiar with that monitor well?
A. I am familiar.
Q. And why are you familiar with that monitor well?
A. Well, that was a monitor well that was installed by SNWA. I was the contracted administrator for that. It was some time ago, I mean, 2003 time frame. But I think as Sue Braumiller said the other day, this well was sited by the TRP, is my recollection and it's about -- I think it's about 1800 feet, the water level is about 1080.

So it's deep, depth to water. In all these CSVM wells, we tried to have about 700-foot saturated thickness penetrated by the well as is the case with this one.

As she said and as we -- you can see when you drive out there, this well is in -- at a site where there's overturned beds -- not overturned, but near the vertical beds and those are influenced by, I think, the Glendale. They're the gas peak thrust fault.

But regardless, depth to water is deep here. It appears to me that -- well, the data shows that it's not connected as others have concluded to the structural base, the wells in the structural basin of the flow system.

However, you see this little blip in 2005 that we've seen in the other wells. So it is receiving recharge from the Sheep Range, it looks like. I don't know what else you want to know. I mean, it looks to me like the materials are tight.

They're not very -- it's not very responsive to recharge pulses unless they're extraordinary and that's sort of the case for all these wells.
Q. Okay. And I think my last question is -- has to do with a 2011 report that SNWA prepared and it -- are you familiar with the 2011 report SNWA prepared that included Darcy Flux equation calculations in the Lower White River Flow System?
A. Yes.
Q. And there's been some discussion of those calculations in some of your reports that are submitted here. Do you have a position on the role of that information in this proceeding?
A. Well, we can't rule out that there is -- well, there's obviously flow throughout this system. The two calculations in this area that I recall was one was in the -- below the Muddy River springs and that was a calculation to estimate a flux to the Muddy Creek formation at that location just below the springs.

We also did another one here south of -- I think it was south of CSVM-2. I forget the exact number, but it was on the order of 8,000 or so acre feet. The previous one was about 9900 and those were -- in our conceptual model, we -- the issue with this area near CSVM-2 was that based on the isotopic composition of waters in Garnet Valley and California Wash, we thought -- and I still I think that there's got to be some amount of water going into Garnet Valley.

We don't know what that is. But based on that isotopic composition, it couldn't just be local recharge. And so we computed Darcy Flux just to try to get a sense of what it could be potentially and then we did the same thing over in the Muddy Creek formation, south of the springs.

Q. Has -- in your opinion, is there any evidence of any wells being able to capture any of that water yet?

A. Well, what we've seen is that because of the high degree of connectivity in this area from -- at least from -- extending from the wells that we've looked at and in between, it's hard to imagine that you could put a well in this system without impacting EH-4, for example.

So there might be underflow there, but I don't know -- I can't think of what means of finding the well location that would only -- it's only going to capture this outflow, wherever it occurs.

Q. All right. Now, let's turn to your next slide. And can you summarize your conclusions, please?

A. Sure. I'm just going to read these so it's clear. We have conclusions for each of the points of -- in the Order 1303. First item, A, Lower White River Flow System geographic boundary.

Our conclusion here is the boundary defined by the State Engineer is appropriate. However, any applications or permits close to the boundary should be scrutinized, and this is a point that Colby elaborated on at the opening.

B, the hydrologic responses to the cessation of Order 1169 aquifer test. The linear regression analyses that we completed confirmed hydraulic connectivity throughout the system.

The recovery of water levels blended by continued carbonate production. Carbonate water levels and high elevation spring discharge have resumed a declining trend.

Item C, groundwater production and the capture of the Muddy River springs and river flows. Linear regression analysis confirmed high correlation and linear relationship between carbonate water levels at the Muddy River Springs area and spring discharge.

The Muddy River Flow deficit analysis quantified estimated impacts to river flows due to groundwater

production. Ratio analysis quantified potential changes and total Muddy River discharge based on the changes in the Warm Springs West discharge for the same period.

And then our main conclusion on this point, if the conflicts with senior water right holders are adequately addressed, these depletions we've talked about, the total annual carbonate groundwater production should be banned between 4 to 6,000-acre-feet over the long term to maintain 3.2 CFS at Warm Springs West Gage in order to protect the endangered Moapa Dace.

Lastly, D, the effects of moving water rights between alluvial wells and carbonate wells. Changing points of diversion to move groundwater production on the Muddy River Springs area alluvial reservoir to locations sourced by the carbonate aquifer will not mitigate impacts. It will only delay their inevitable occurrence.

Such changes would exacerbate issues associated with the already over appropriate carbonate aquifer by accelerating the timing of impacts to the high elevation springs due to the additional groundwater production.

The timing of impacts, of course, will vary based on the magnitude, the duration and location of groundwater production. Detectable impacts may occur relatively quickly, within weeks or months, if additional groundwater production

were to occur in areas directly upgradient from the Muddy River Springs area.

Detectable impacts of groundwater production in areas farther away may take longer, but as we demonstrated, the properties of the aquifer are such that these impacts will eventually result in reduced spring discharge and depletions of the Muddy River stream flow.

MR. TAGGART: Thank you, Mr. Burns. And that concludes our direct exam, and we'd like to reserve the remainder of our time for redirect.

HEARING OFFICER FAIRBANK: Okay. Thank you. So based upon today's presentation, we will go ahead and assign 14 minutes to each of the participants for questioning. And, similarly, as we've done in the previous days, if there's addition time, then after the State Engineer has their opportunity to ask questions, then we will go ahead and reopen that up for additional questions by the participants. And we will start this morning with Coyote Spring Investments.

MR. HERREMA: Good morning. My name is Brad Herrema, and I represent Coyote Spring Investment in this fact gathering proceeding.

CROSS-EXAMINATION

BY MR. HERREMA:

Q. Initially, I had a couple questions on the

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July 3, 2019, report. It's labeled SNWA Exhibit 7. That report is signed by two other folks who aren't at the table today, Casey Collins and James Watrus. What did they do in the preparation of the report?

ANSWERS BY MR. BURNS:

A. Casey Collins is a hydrologist that works for me in my division. His main effort was in data compilation and presentation. So all these fantastic hydrographs you see in some of these charts and figures, he prepared.

Jim Watrus, who also -- he's a senior hydrologist for us. He and his staff helped compile some of the information in the report. He helped considerably on Section 7, which is the depletion of Muddy River Spring flow and impacts to SNWA.

Did you ask about both reports or just this one?

Q. Yeah, I don't believe they signed the other report.

A. Okay. So I don't know. That's correct.

Q. Did they draft any portions of the -- of your July 2019 report?

A. I have a June -- okay. I've got dated June 2019, but it's the July submittal, you mean.

Q. Exhibit 7, yes.

A. Yes. Yes, they did parts, I would say primarily

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in Section 7. And Section 3, Jim Watrus assisted with the discussion.

Q. Are any of the conclusions in those sections their conclusions?

A. I think we share all of these conclusions.

Q. So you reviewed their work and came to similar conclusions?

A. Yes, sir.

Q. Okay. If I could turn your attention to one of slides 6, 8 or 10 from your presentation this morning. The carbonate groundwater production graphic that's at the bottom of each of these slides shows total annual pumping by basin. Did you analyze groundwater level response in each basin based on pumping in that basin as opposed to the total pumping?

A. No.

Q. Did you analyze impacts in individual basins compared to pumping on the west side of Coyote Spring Valley and then analyze it with the comparisons of pumping on the east side?

A. I presented an analysis that it talked about CSVM-2. So in that respect, I think so, the answer is yes if I understand your question.

Q. Okay.

A. CSVM-2 is on the west side of these faults in

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that structural block and I showed a series of hydrographs comparing that well with wells on the eastern side of that structural block and faults.

Q. Did you compare pumping from the east side and the west side or were you just looking at effects on the east side versus the west side?

A. Both.

Q. Okay. I think you mentioned in response to -- or your response to a question from Mr. Taggart about water budgets was that they were not useful for determining connectedness of an aquifer. Do you recall that?

A. I recall having a discussion on that.

Q. My recollection is that is what you said. Do you agree with that?

A. Well, maybe, let me clarify. With respect to water budgets and volumes of water, I think that's less important at this stage in the process than how pumping a well impacts other wells conditions in the aquifer and how those impacts or those effects manifest themselves at spring locations, and ultimately depletions on the spring discharge or the Muddy River.

So I think it's the pumping and response data that's more important than water budget analysis at this point.

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Q. For the purposes of managing a basin?

A. Yes.

Q. Okay. The administrative area is roughly a thousand square miles and composed of six basins. Did you describe the empirical test that you relied on -- that you would rely on to manage the basin?

A. From which perspective from a water rights perspective, an effects perspective, manage effects in the system or how to manage water rights? I'm not sure what -- could you clarify it, please?

Q. Managing the total that could be sustained and pumped from the basin?

A. Okay. That might be a question for you. We performed the ratio analysis, a portion of a ratio analysis and we concluded 4 to 6,000-acre-feet as a range to manage this system.

This is carbonate groundwater production we're talking about that would maintain a level at the Warm Springs West Gage at three point -- approximately 3.2 CFS. And the biologists inform us that that's a level of flow that's needed to maintain the current populations of the Moapa Dace.

Q. Are there other pump tests that you relied on other than the Order 1169 pumping test?

A. Not for this analysis.

Q. Okay. There were no pumping tests from California Wash or Garnet Valley?
A. Not for this analysis.
Q. Would pumping tests in California Wash or Garnet Valley help you develop a better understanding of the basin?
A. California Wash and what was the other one, I'm sorry?
Q. Garnet Valley?
A. Well, let me say this. If it's a pumping test like Order 1169, certainly. What I see for this system is that you need a significant stress imposed on the system to elicit the response data that can be analyzed and done with the Order 1169.
So it would need to be something of that magnitude to be more informative than what we've already learned from response data we've observed and the regression analyses that we've performed that confirmed the interconnected nature of the system.
If it's just an aquifer test that's, you know, a five-day or 72-hour test, that tells us a little bit of something about the test, the material between the test well and the observation well. But I'm not sure it would be meaningful for informing us any more than what we already know.

Q. Okay. If I could turn your attention to Slide 25. This is Table 6-2, limits on carbonate aquifer production based on selective discharge rates at Warm Springs West Gage. I think you were just talking about this analysis. Does this analysis assume that all pumping in the carbonate aquifer affects the Warm Springs West Gage?
ANSWERS BY MS. DRICI:
A. Yes, it does.
Q. Does it account for flow paths from other areas, such as have been discussed over the past couple days regarding the difference between Big Muddy Spring and Pederson Springs?
A. Well, implicitly, it does. As far as the Big Muddy, in our conceptual model, it's a source is a carbonate aquifer.
Q. So if there are flow paths, then this accounts for them?
A. Yes, if there is water coming from somewhere else, it wouldn't be accounted for. But I do not believe that there is water coming from somewhere else based on the analysis that I did.
Q. Does this analysis assume that carbonate pumping anywhere in the Lower White River Flow System will affect spring flow on a one-to-one basis?

A. In the long run, yes. When you get near steady state conditions and steady state conditions.
Q. Is there an assumption of what that time frame would be?
A. Well, we saw from the analysis I did on the capture that thus far, I mean, we started production like mid 80's up to 2018. We roughly captured about 50 percent of the total production from the springs.
So -- and we know from doing simulations that you capture the first half a lot faster than you capture the second half. So it will take a much longer time to get to a new steady state, but I cannot tell you how long exactly.
Q. Okay. And in terms of a number of years, was there an assumption that carbonate pumping anywhere in the Lower White River Flow System would affect spring flow on a one-to-one basis? Do you have an estimate of the number of years?
A. Oh, the effect? Well, from the Order 1169 test, when we compared like the hydrographs from daily data at the observation points where we have data, it looked like you got there like within a day. They were all responding the same.
Q. And so this analysis assumes a one day response?
A. Which analysis?
Q. The analysis here on Table 6-2?

A. No. This would be -- this is kind of independent of how long it takes. But we're assuming that, for example, if you want to maintain the Warm Springs West at a given level shown on the first column, you would have to be pumping the volume on that last column kind of like on a continuing basis.
So at steady state, yeah, you would be getting that much water and you would be maintaining the Warm Springs West flow at that given level.
Q. Okay.
A. Discharge.
Q. I'll move on. Did you compare the results of your theoretical analysis to observe data like actual flows at Warm Springs West or the -- in the Muddy River?
A. Yes, I did. I did not -- we did not put it in the presentation, but there's a comparison in the report -- you want to see what page that is, please. And it should be right here after the figure. Yeah, if you look -- do you have the report in front of you?
Q. I do, yes.
A. Okay. Like on page 610.
Q. Okay. I'll take a look at that later. I want to move onto Slide 27.
A. Okay. So the first paragraph right after the figure that shows the capture analysis.

Q. All right. Thank you. In regard to Slide 27, Mr. Burns, could the water levels in the past four years on the top three graphs on this page be declining due to climate?
ANSWERS BY MR. BURNS:
A. There's been a debate for a long time about whether these effects are climate or pumping. The fact is the responses are due to both because they're both implicit in the water level measurement. So they would be a component of the change that's observed.
But I'll note that in 2017 and 2019, for those years, the percent of average annual winter season precipitation was greater than normal, not less than normal.
Q. Did you perform a rainfall recharge analysis to assess under what conditions recharge occurs?
A. I did not.
Q. And do you believe that groundwater recharge occurs every year there's rainfall?
A. I believe it does, but I believe in dry years, like in 2002, it's probably very small amount. In this area with the potential evapotranspiration rates, I wouldn't expects a lot of it to be -- to make it past the demands of the plants and the soil for years like that, but I still think there's some that occurs. I have no measure of it, though.
MR. HERREMA: Okay. Thank you.

HEARING OFFICER FAIRBANK: Okay. Next will be the United States Fish and Wildlife Service.
MR. MILLER: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions from Fish and Wildlife Service, National Park Service.
MS. GLASGOW: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions from National Park Service, the Moapa Band of Paiute Indians.
CROSS-EXAMINATION
BY MS. BALDWIN:
Q. Good morning. This is Beth Baldwin for the Moapa Band of Paiutes. If we could go to Slide 17, I believe it was. Okay. And this is for whoever can answer the question, I'm not sure who the best person is.
If I'm not mistaken, the graph on the bottom is the California Wash results compared to EH-4; is that correct?
ANSWERS BY MS. DRICI:
A. Yes, it is.
Q. So, am I -- I don't know if I'm reading this right. It suggests that there's a -- there's two feet in drawdown at EH-4 that you're attributing to increased production in California Wash?
A. Yes. It was not me personally, it's the numbers in the analysis.

Q. I get it. I'm trying to -- I'm just trying to understand what I'm looking at. And you talked a little bit about the residuals, and I assume that's some sort of error estimation?
A. Usually, yes, if you can account for all the explanatory variables, which, you know, I included all the production -- well production from all the basins. But I could not include the specific effect of recharge because I don't know. I cannot quantify recharge like I can the production, the groundwater production.
Q. Okay. If you had to say you were -- your relative level of confidence in this estimation, where would you put it? High in the confident, low, somewhere in the middle?
A. Well, with all of them, if you look at the appendix, we did include all the statistics that resulted from the analysis, including the P values, and therefore, this one and all of them, except for Black Mountain area, the P values were below that .005. So it tells me that within 95 percent confidence, the -- this is happening.
Q. But you're not considering recharge?
A. Recharge was left with the residuals because, again, I could not extract it.
Q. Okay.

A. This, alone, should just show the effect of production on the water levels at EH-4, if nothing else was happening.
Q. So it assumes everything else is staying the same?
A. It assumes that -- it's basically like if you had the level at EH-4 at the basic level, which was somewhere around 18, 17, and you were only pumping California Wash that much, that's what you would get. That's what you would see.
MR. BURNS: If I could add?
BY MS. BALDWIN:
Q. Sure.
ANSWERS BY MR. BURNS:
A. If you turned you turn to Slide 11, you asked about the certainty of the relationship, and I think this could help answer your question.
The Paiutes TH-2 well versus EH-4 regression analysis, you can see that the correlation between that well and EH-4 is extremely high.
Q. Okay.
A. And so that gives us certainty that the response that's measured at EH-4 attributable to EH-42 is also high.
Q. All right. So now that we're on Slide 11, Andrew, I do have a question about it. I think you said the

wells were responding to the same stresses, whether that's climate or pumping, the same stresses are applying throughout the system?
A. That's correct.
Q. Okay. And in your opinion, that supports the idea that the aquifer's all interconnected?
A. That does, yes.
Q. All right. If we try -- and I know that this is difficult, but if we try and think about separating climate out from pumping, could it be just a reflection that the wells are all sharing the same recharge area?
A. It could be that and all other factors that are influencing the water level record.
Q. Okay.
A. Now, when it comes to the pumping, itself, if you turn to page 11, in this analysis, we tried to isolate the pumping effect at MX-4. And we know that that's a pumping effect because it's right next to the pumping well, a well that's pumping probably 3,000 gallons a minute.
So we know that the response there is predominantly from the pumping well. And so we do the same analysis with EH-4. We can see, again, a very, very high correlation to that pumping response. So we can look at it both ways and that's how we looked at it.

Q. And I'm not sure exactly which slide this was, but there's -- there are a whole bunch of slides where you have the blue bars showing the carbonate pumping?
A. (Nodded head.)
Q. Did you look at alluvial pumping at all in those analyses?
A. Well, in the location of these -- well, in these areas where these wells are, there's not a lot or if any alluvial pumping. The alluvial pumping any significant amount is at the bedrock aimed to the northern Coyote Spring Valley did not look at that, and I did not look at the alluvial -- pumping from the alluvial reservoir to Muddy River Springs area and its effect on these carbonate wells.
Q. Okay. And I would like to talk a little bit about Big Muddy Spring. And we've heard the other experts earlier in the week talk about how Big Muddy Springs seems to respond differently or have a different hydrograph.
Did you look at Big Muddy Springs hydrograph when you were looking at the other spring discharges?
A. No, not in any detail. When this issue came up, I looked at the -- you know, the trend the other day, but we've done no particular analysis to see what that spring is doing and what it's responding to and what factors may contribute to its record.

What I can tell you, though, is I've been to the spring. It's highly managed above the gage. I mean, there's a pool for one, I'm not sure that affects the long-term record.
But there's also alluvial pumping around that spring and it's the lowest elevation spring. And I think some due diligence is owed to looking at all of those factors and how they may or may not influence the record. I have not done that.
Q. Okay. Does Big Muddy Spring contribute to Muddy River flows?
A. It does.
Q. Do you have any guess of what percentage of the flows it contributes?
A. As I recall, Big Muddy is about seven CFS, and if we assume a -- well, I think its flow at about 40, so seven over 40, whatever that percentage is.
Q. Is it greater than the contribution of Warm Springs West?
A. It is.
Q. To the Muddy River?
A. Yes.
Q. But you -- but more work should be done in that area, looking at Big Muddy's contributions?

A. To the extent someone really wants to understand it and be definitive about its source and how it responds to pumping, wherever it occurs, I think for certain.
Our conceptual model is that even with these low elevation springs with respect to Pederson Spring, we think that they're connected to the same system, same carbonate system, that Pederson Springs is, for example, and that any diminished potential that's driving the spring discharge would affect its discharge. But it'd be less -- it's less sensitive to these high elevation springs.
Q. We've heard other experts express varying opinions about whether there is a lag in hydrographs showing a response to climate variability.
Do you -- do either of you have an opinion about whether there is a lag, and if so, how it appears?
A. I didn't look, I didn't analyze any lag. The only lags we looked at is how effects propagated to northern Coyote Spring Valley and the impact or the attenuating effect of the Kane Springs Wash fault zone. With respect to recharge, we did not look at time lags in the records.
MS. DRICI: If you look at the 2005 extraordinary precipitation event and you compare that to the hydrographs, you can see that the recharge from that -- from the local mountains probably showed up in the hydrographs like probably

within a month. But as far as recharge from other areas located farther, I can't tell you.

I did a lot of theories about that. I think that they come in pulses, like every year, you know, the precipitation of the mountains infiltrates down and creates like a recharge pulse and it moves down.

So this is probably a bunch of those coming down. So people think like recharge from thousands of years ago, you know, are coming down. So it's like a continuous and we cannot really -- we can't see that from, identify them from the record.

BY MS. BALDWIN:

Q. So water levels could be responding to all sorts of climate variability going back tens, hundreds, thousands of years?

A. It could be. But like in the analysis that I showed for the period since we've been pumping from the carbonate aquifer, the effect of recharge during that time period is much smaller than the effects of pumping.

It was probably like maximum 1.4 foot due -- changing the water level at EH-4 due to recharge changes versus four feet changed from like the early '90's to 2018 due to groundwater production to the carbonate aquifer.

Q. And that -- so that period, early 90's to 2018,

that's only about 30 years?

A. Yeah.

Q. So the water levels could be responding to something happening before that 30-year period?

A. Yeah, sure. In that recharge within the residual, it's like the effects of all of it. I can't separate it.

MS. BALDWIN: Okay. That's all. Thank you.

MS. DRICI: You're welcome.

HEARING OFFICER FAIRBANK: Next is the Moapa Valley Water District.

CROSS-EXAMINATION

BY MR. MORRISON:

Q. Morning, everybody. I'm Greg Morrison with Moapa Valley Water District. I just wanted to follow up on a couple questions regarding the efforts SNWA put into preparing its Order 1303 report.

So whoever would like to answer, feel free. I'll direct these at Mr. Burns, but if there's someone better.

So in your role as the water resources division manager, did you oversee and/or coordinate SNWA's efforts in preparing the Order 1303 report?

ANSWERS BY MR. BURNS:

A. Yes, I did.

Q. All right. And you're aware of SNWA's scientific, be it, geologic or geohydrological efforts that resulted in the reports' conclusions?

A. Yes.

Q. And in between October 2018 and July 2019, did SNWA conduct or contract to have conducted on its behalf any geohydrological studies specific to boundary flows between Kane Springs Valley and Coyote Springs Valley?

A. Not to my recollection, no.

Q. And SNWA didn't conduct or contract to have conducted on its behalf any geohydrological studies in northern Coyote Springs Valley?

A. No.

MR. MORRISON: Okay. That's all I have. Thank you.

HEARING OFFICER FAIRBANK: Lincoln County and Vidler Water Company.

CROSS-EXAMINATION

BY MS. PETERSON:

Q. Good morning, panel. Karen Peterson here, representing Lincoln County Water District and Vidler Water Company.

And, Mr. Burns, I just put in front of you a page from Nevada State Engineer Exhibit 245, which is -- it's

page 36 of the SNWA June 27, 2013, Order 1169 report.

And do you have that in front of you, the one-page document I gave you?

ANSWERS BY MR. BURNS:

A. Yes, ma'am.

Q. And at the top of the paragraph there, there is a statement having to do with CSVM-4; do you see that?

A. Yes.

Q. And is it true that this report -- your report -- SNWA's report, sorry, lets everybody know that the transducer in CSVM-4 has had a high failure rate due to the high water temperature in the well, so fluctuations of a foot or less should not be used to infer an absolute response.

Do you see that?

A. I see that.

Q. And do you -- I'm going to show you the thick document I gave you was State Engineer's Exhibit 115, which is the water level data from that CSVM-4?

A. (Nodded head.)

Q. Do you have that?

A. Yes, ma'am.

Q. Okay. And if you could look at the second page, it looks like the transducer was removed 10/14/2013; do you see that?

A. Could you say the date again, please?
Q. 10/14/2013. It's on the second page.
A. Yes, I see that.
Q. All right. And that aquifer test, the 1169 test was conducted between November 2010 and April 2013; is that correct?
A. The test ended at the end of 2012, but MX-5 pumping continued into April of 2013.
Q. And the transducer was pulled after the end of all the pumping by about six months?
A. Are you talking from 10/14 to 5/6 -- what's your reference again?
Q. I'm sorry. When did the MX-5 pumping end?
A. Oh, in April of 2013.
Q. Okay. So between April 2013 and when the transducer was pulled in 10 of 2013, we're still having the suspect transducer or the error transducer taking those water level measurements; is that correct?
A. Well, it looks to me -- yeah, there was a failure. Failure could not connect the transducer. So for the period -- I'm just looking at the measurements and there is data.
So it's likely that once it's failed, we've installed a new transducer, but supplementing the transducer

record are periodic measurements as well.
Q. Correct. But after 10/2013, it looks like they're all sounder measurements; is that correct?
A. After -- well, I'm going the wrong --
Q. Yeah, you've got to go up?
A. Okay. All right. That makes more sense now. Yes, they are E takes, yes.
Q. Okay. And has SNWA indicated in this page from Nevada Power State Engineer Exhibit 245, what -- how long that transducer data is suspect for that CSVM-4?
A. It doesn't appear so.
Q. And did you take that transducer failure information into effect when you were analyzing your hydrographs?
A. We use -- let me look at the hydrograph, just a sec. We have both reflected in the record, so there's a transducer and a periodic measurement.
Q. Right.
A. So --
Q. But there's no -- you know how sometimes you -- like you put on those hydrographs when the 1169 test was or there's a break because there's no data, that kind of thing. You don't have anything in your hydrographs that explains this transducer area of a foot, is there?

A. No.
Q. And has anybody that you've heard testify earlier this week indicated in any of their hydrographs that they've accounted for this transducer error failure of a foot or so?
A. Not that I heard.
Q. All right. And the drawdowns that were -- or the impacts, I guess, or the effects that everybody's been talking about this week with regard to CSVM-4 are in that one-foot range; aren't they?
A. Yes.
Q. All right. Directing your attention to Slide 11?
A. Okay.
Q. Was there an R-squared criteria that you were using?
A. I'm not sure I understand your question.
Q. Was there any kind of target R-squared criteria that you were trying to get to?
A. Oh, for any -- for CSVM-4, the maximum.
Q. Which is?
A. Well, in this case, .82.
Q. All right. And I know you indicated in your testimony that you thought maybe that was the maximum because of the Kane Spring Wash Fault, that there was lower permeability; is that correct?

A. Well, let me clarify, if you'll indulge me for just a second.
Q. Just a second.
A. Okay. I'm sorry, as quick as possible. What I was saying is that the effects that we see at CSVM-4 attenuated by the fabric of the Kane Springs fault structure or some other lower permeability, relatively lower permeability feature.
And we use this analysis to estimate what -- the lag time that those attenuating features have on the response measured at the well.
Q. And if there was an another new fault in that area, would your analysis still be the same with regard to the attenuated effects?
A. Yeah, the fault -- I mean, what's there is there.
Q. (Nodded head.)
A. So whether we map two more faults, five more faults, this would be the same response.
Q. Okay.
A. You know, what's there is there, right.
Q. What -- is there a scientific reference or where did you get this idea to do a regression analysis to determine interconnectedness by comparing water levels between wells?
A. Well, if you remember at the start of our

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presentation, I walked through our general approach, and in the first step in that approach was to look at these time series data in a qualitative sense.

And when we review that information as a professional hydrologist or geologists, we have a sense of cause and effect relationship. And those cause and effect relationships are what we test with this analysis.

And what we find, because of the high degree of correlation, is that these wells all respond in the same way as EH-4 does for the period of record and as does MX-4 for the pumping period.

Q. Right. But -- I'm sorry, were you done?

A. I think so.

Q. Okay. But other than you, you and your team doing that, are there any -- are there any other scientists that agreed with this?

I mean, for example, we looked at your reference that you have here on A-7 that's at the end of the section with regard to your regression analysis, and we don't find -- we don't find any other, you know, like peer reviewed or any other scientific basis, I guess, or reference that uses regression analysis comparing water levels?

A. Well, we may be talking two different things. I'm trying to get to A-7. My apologies. I don't have A-7 --

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oh, this reference. So there's two things. The multilinear regression analysis that Ms. Drici did and then there's this simple linear regression analysis that I did. That one is well chronicled in Dr. Mayer's testimony the other day.

Q. Right.

A. Perhaps you can answer for her, the other.

Q. Well, wait, do you mind -- well, go ahead. I'm sorry. Go ahead.

MS. DRICI: Okay. Well, this reference is a USGS reference describing statistical methods and it has basically every type of statistics you can apply to -- like it says here, water resources investigations, and it describes a single linear regression, multiple linear regression and other types of statistics. It has all kinds of examples, how you can relate, you know, to a time series.

And the first thing when do you -- like he's saying, is the quantitative analysis, if you look at two times series and they appear to be moving in parallel like these hydrographs do, that's a strong indication that they are varying in a linear fashion.

Q. Right. But the concept that you can do a regression analysis and compare water levels, and therefore, conclude that there's some kind of connectivity between them, where -- who -- what scientific basis is there for that

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principle?

MR. BURNS: Well, first, I think there's a professional judgment. We're trained, as observers of data, to understand what these responses are, what these -- what factors would contribute to these responses.

And it's not difficult, you don't maybe need to even be a hydrologist to see that these time series plots behaved in a same way and in a linear fashion, as Ms. Drici described, and that's what we tested with the analysis.

BY MS. PETERSON:

Q. Okay. So it's your professional judgment?

A. I think it's more than that. I think it's a standard approach.

Q. But can you give me a site?

A. Well, not off the top of my head, but it's something professional hydrologists are trained to.

MS. DRICI: Again, this reference has all kinds of examples in water resources.

MS. PETERSON: Right. Which -- and we couldn't find any that -- specifically in this application, that's what I'm getting at.

So let me move on, okay, because I don't have a lot of time. So looking at figure -- page 11 of your slides and page 12 of your slides where you did this analysis to

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CSVM-4 versus the MX-4 well, if your hydrographs are off by a foot, are these -- your data is going to plot different on these two graphs, charts; is that right?

ANSWERS BY MR. BURNS:

A. If they're off a foot? Well, if they're all off a foot, I think the relationship would be the same if I understand your question.

Q. Right. But with the transducer --

A. Systematic error, I wouldn't expect the correlation to change.

Q. Were you here for Dr. Mayer's linear regression testimony on Tuesday?

A. I was not here, but I viewed some of his testimony.

Q. He said that his acceptable P value coefficient was less than .05?

A. I did hear that.

Q. All right. And did you have an acceptable level for your P value coefficient?

A. In fact, we did. I went -- we looked -- we didn't post it here on this chart, but there were .0000000 something, so certainly below .05 threshold that he cited.

Q. But I'm going to go to -- I guess it's Appendix A-4 and you've got your P values there for your figures that Ms. Drici talked about?

ANSWERS BY MS. DRICI:

A. Yes.

HEARING OFFICER FAIRBANK: You can finish this question and then we'll move on.

MS. PETERSON: Okay. Thank you.

BY MS. PETERSON:

Q. So I'm looking at your P values there in that table. Do you have that figure A-1?

A. Yes.

Q. Okay. And Garnet Valley's the only low -- the P value I see?

A. Well, the way I see it, all of them are below the .05 threshold, except for Black Mountain area and the Muddy River Springs area.

So for the Black Mountain area, it's 0.69, which is larger than 0.05. But we already showed the results that we think that Black Mountain area production wells probably should not be within the Lower White River Flow System boundary.

As for the Muddy River Springs area, I do not just go by the statistical results. I have to use facts and like what I know. Does anybody think that production from the carbonate aquifer in the MRSA does not affect EH-4 water

levels.

So this value is a little bit higher than the .05, but I still believe and I know that production in the Muddy River Springs area does affect water levels in EH-4 because they're in the same basin.

MS. PETERSON: Thank you. Sorry. I'm out of time.

MS. DRICI: Sorry. Bye.

HEARING OFFICER FAIRBANK: Okay. So we've reached the noon hour and let's go ahead and reconvene at -- let's go ahead and do five after 1:00, and we'll get back going after lunch. Thank you.

(Lunch recess at 12:01 p.m.)

STATE OF NEVADA)
) ss.
CARSON CITY)

I, MICHEL LOOMIS, a Certified Court Reporter, do hereby certify;

That on the 27th of September, 2019, in Carson City, Nevada, I was present and took stenotype notes of the hearing held before the Nevada Department of Conservation and Natural Resources, Division of Water in the within entitled matter, and thereafter transcribed the same into typewriting as herein appears;

That the foregoing transcript, consisting of pages 864 through 985 hereof, is a full, true and correct transcription of my stenotype notes of said hearing to the best of my ability.

Dated at Carson City, Nevada, this 28th day of September, 2019.

MICHEL LOOMIS, RPR
NV CCR #228

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In The Matter Of:

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES

Vol. V
September 27, 2019

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STATE OF NEVADA
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
BEFORE MICHELINE N. FAIRBANK, HEARING OFFICER

IN THE MATTER OF THE ADMINISTRATION AND MANAGEMENT OF THE LOWER WHITE RIVER FLOW SYSTEM WITHIN COYOTE SPRING VALLEY HYDROGRAPHIC BASIN (210), A PORTION OF BLACK MOUNTAINS AREA HYDROGRAPHIC BASIN (215), GARNET VALLEY HYDROGRAPHIC BASIN (216), HIDDEN VALLEY HYDROGRAPHIC BASIN (217), CALIFORNIA WASH HYDROGRAPHIC BASIN (218), AND MUDDY RIVER SPRINGS AREA (AKA UPPER MOAPA VALLEY HYDROGRAPHIC BASIN (219).
_______________________________________/

TRANSCRIPT OF PROCEEDINGS
PUBLIC HEARING
HEARING ON ORDER 1303
VOLUME V
(P.M. SESSION, PAGES 987-1091)

FRIDAY, SEPTEMBER 27, 2019

Reported by: Kathy Terhune, RPR

APPEARANCES:
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Adam Sullivan, Deputy State Engineer

Melissa Flatley, Chief of the Hearing Officer Section
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SEPTEMBER 27, 2019; 1:12 P.M.; CARSON CITY, NEVADA.

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HEARING OFFICER FAIRBANK: So we'll go ahead and reconvene the hearing. And next up is the City of North Las Vegas.

CROSS-EXAMINATION
BY MS. URE:
Q. Good afternoon. My name is Tracy Ure and I'm representing the City of North Las Vegas. And I have a few questions for you.
In your presentation you had some values for Garnet Springs Pumping, I believe they were on slide 28, and my question is where did you obtain the data for these?
ANSWERS BY MR. BURNS:
A. These data were obtained from the NVWR website, the pumping inventories.
Q. Okay. So, for the area between 1992 and 1995 for Garnet Valley, did you obtain those values from the pumpage inventory as well?
A. Yes, ma'am.
Q. Okay. Are you aware of the facilities in

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Garnet Valley in the 1980s and operating in the late 1980s to 1990s that were pumping in Garnet Valley?
A. I'm not wear.
Q. Okay. So then you are not aware by the mid 1990s, that there was approximately 1100-acre-feet of certificated water rights in Garnet Valley?
A. No.
Q. So, if this data was not or these data were not included in your report, does that throw off your regression analyses?
A. It would for the multilinear regression. But I trust that this data is reliable.
Q. Okay. Has your -- or has the Garnet Valley pumpage equilibrated and achieved a maximum capture at this point in time?
A. It doesn't appear so.
Q. Okay. Would equilibrated pumping in Garnet Valley achieve a one-to-one capture at some point?
A. Based on the correlation analysis that we did, and given the framework around this area, and the sole discharge part at Muddy River Springs area, I believe at some point in time. If you look at our figures you can see that this area, like other areas to the south in Black Mountain areas of very highly correlated with

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water levels at EH4 so, to the extent water levels change effect EH-4, I would expect spring discharge to also have a proportional decrease.
Q. Okay. Were you here when Mr. Waddell was testifying?
A. I was not.
Q. Okay. Is it possible that there is flow from Las Vegas Valley into Garnet Valley?
A. I don't believe so.
Q. Okay.
A. I'm sorry. I misunderstood. From Las Vegas Valley into Garnet Valley?
Q. Correct.
A. It's possible but I guess I would caution on that. I say that because there -- we found a new well. We didn't find it. A new well was drilled in Las Vegas Valley, just on the other -- it would be on the west side of apex in Las Vegas Valley, carbonate well. And the elevation of that well is higher than those wells that we've measured in Garnet Valley. So that implies there is a gradient. But then you have to figure out from that where is water coming from. We had Las Vegas shear zone to the west of that well and, you know, two, three kilometers of basin fill. So my question -- to

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say -- I wouldn't say yes, but I would acknowledge there is a gradient at that location.
Q. Okay.
A. At the boundary.
Q. So, assuming that there was a possibility that there is some flow from Las Vegas Valley into Garnet Valley, if there was capture of that flow, in part, from a well in Garnet Valley, would that cause a one-to-one capture from the Muddy River Springs area?
A. If that was part of the capture -- if that made up part of the pumping from that well, then no, it wouldn't be one-for-one.
Q. Okay. Is it your position that the one-to-one capture of the Muddy River Springs area is from any pumping, anywhere, in the Lower White River Flow System?
A. There's two -- I guess there's two things I would say about that.
First the alluvial pumping. Certainly that adds impacts, one-for-one impacts to the river. We measured those of the those are the Muddy River flow deficit depletion I mentioned. With respect to the carbonate pumping, that's the only discharge in the regional -- in this system, excepting for any amount of

outflow. So, over time, over a long time, as water levels in EH-4 and carbonate system at the springs decline, I would expect the proportional decline in the spring flow.
Q. Okay. And so when you were talking about the alluvium, it's the alluvium in that Muddy River Springs area; is that correct?
A. Yes.
Q. Okay. And what are the main variables when you are talking about this one -- I guess that go into this one-to-one capture of spring flow? Like when you look at or when you opine that there is going to be a one-to-one capture of the spring flow from pumping in the carbonate or in the Muddy River Springs area, what are some of the variables that you look at to assess that one-to-one capture?
A. The first one is where is the water discharged. Ultimately over time, a long period of time, I don't know how long, but that is the water that would be captured. At a point when capture, capture of storage is complete.
Now, it's possible that there is other water that could be captured like outflow, could induce flow are a boundary outside the White River flow system that

could also be captured.
Q. Okay. Does magnitude of pumping also play into that?
A. Yes. Magnitude, duration, location. All have some influence on how the drawdown cone propagates.
Q. Okay. Thank you.
HEARING OFFICER FAIRBANK: Center for Biological Diversity.

CROSS-EXAMINATION
BY MR. DONNELLY:
Q. Thank you. Patrick Donnelly, Center For Biological Diversity.
Excuse me. I'm going to direct my first few questions to Ms. Pellegrino. Given that you're a fact witness I will be asking you facts.
I will refer to the Moapa dace, and the 3.2 CFS level but only in reference to Southern Nevada Water Authority's previous statements or interaction with those entities.
Just to start with to get on the record, did the Southern Nevada Water Authority and the Center for Biological Diversity coordinate in any substance attached and prior to this hearing?

ANSWERS BY MS. PELLEGRINO:
A. No.
Q. Just wanted to get set on the record.
To your awareness have the Southern Nevada Water Authority and Center for Biological Diversity ever coordinated?
A. No. No.
Q. Loud and clear.
I'm going to ask you about your criteria for evaluation of some of the points in Order 1303. Specifically, Order 1303, Section 6-2-C says we're trying to determine or offer input on the long-term quantity of groundwater that may be pumped from the Lower White River Flow; does that sound right?
A. Yes.
Q. And would your say you ICS credits are a constraint on the amount of water that can be pumped out of the flow system?
A. I would say the capture of Muddy River flow is a constraint. Because the decree appropriated the entire flow for Muddy River of which our ICS credits are derived from.
Q. Understood. And what are the ICS credits used for?

A. ICS is a program that was created by the Bureau of Reclamation to allow water users essentially to store water in Lake Mead year-to-year which was not allowed under the operation guidelines before 2007. So, water users take extraordinary measures to allow additional water to flow into Lake Mead, and to get credit for it.
It was a very large benefit to southern Nevada, because it allowed us to take water that was on tributaries like the Muddy and Virgin and instead of having to construct very expensive pipeline to deliver that water directly to Las Vegas, it allowed us to put it into the Colorado River, account for it entering Lake Mead and withdraw that water from our existing facilities.
Q. And so the Southern Nevada Water Authority has a substantial supply stored in Lake Mead right now from ICS credits?
A. Yes. Roughly speaking we put about 30,000-acre-feet a year in, since the program started, and to date we have not withdrawn that water.
Q. Is that supply intended for emergency use?
A. No.
Q. If it is flowing in an unimpaired condition, is

the Muddy River a reliable source of water for Lake Mead perhaps as compared to the Colorado River?
MR. TAGGART: Objection; reliable and is vague.
MR. DONNELLY: Withdrawn.
BY MR. DONNELLY:
Q. What is Southern Nevada Water Authority's interest in the Moapa dace?
A. The Southern Nevada Water Authority I guess, as part of our operating regime, is to be a good steward of the environment where we are developing our water resources, because we cannot rely upon those resources in the long run if we are impacting endangered species. So, we've taken a myriad of actions, a lot of which the panel on Monday, much more qualified to talk about than me, to protect the Moapa dace, because of all of the water resources that we have in this area.
Q. Would you say, in some ways, that the Moapa dace and the flow in the Muddy River are tied together?
A. Yes.
Q. Would you say then that in some ways that the fate of Moapa dace is tied to Las Vegas's drinking water supply?
A. No.
Q. Would you say that the fate of the Moapa dace

is, in some ways, tied to Las Vegas's ability to store water in Lake Mead?
A. No.
Q. Okay. In coming up with your assessment of the Order 1303 6-2(c) question, of the sustainable long-term pumpage, were you focused your assessment on senior water rights and instream flows, or on the sustainable amount for the Moapa dace?
A. As I mentioned today, we have a two-part answer of which Andrew and Ward are presented both sides of that coin. Which is the amount of water that we think can be developed in the long term without conflicting with senior water rights by capturing Muddy River flow is zero, assuming that those conflicts with senior water rights are mitigable. There is a finite amount that can be developed without adversely impacting the Moapa dace, and that's 4- to 6,000-acre-feet.
Q. Thank you.
I'll have some more hydrologic questions for Dr. Burns.
Your data strongly suggests declining carbonate groundwater levels since 2016, correct?
A. That's correct.
Q. And this is despite declining -- this is

despite increased precipitation levels during those times to some degree?
A. To some degree. To two of the four years.
Q. Does this imply that current carbonate pumping is lowering groundwater levels?
A. That's my observation.
Q. Based on figure 6-3, in your report, showing the relationship between storage and discharge capture, there appears to still be an ongoing decline in storage, correct?
ANSWERS BY MS. DRICI:
A. Accumulative storage is actually increasing. So it's still capturing groundwater from storage.
Q. So, accumulative storage is increasing, yes, thank you.
A. Yes.
Q. Does that imply we are not in steady state yet?
A. Yes, exactly.
Q. This may go back to Dr. Burns. Are you aware that yesterday USGS reported Warm Springs gage at 3.23 CFS?
ANSWERS BY MR. BURNS:
A. I'm not aware of that.
And just to clarify, for the record, I'm not a

Doctor Burns. I have a brother who's a Dr. Burns. I'm Mr. Burns.
Q. Mr. Burns. I apologize. Thank you for clarifying.
At current pumping, is it likely the gage will fall blow 3.2?
A. Yeah, I mean it looks that way. I think -- but I'm not certain of the time frame. And continued monitoring will let us know.
Q. As far as an order of magnitude 110 or hundred years, can you get that close to an estimate?
A. Well, we're very close as it stands. When I looked in my report last value I had was about 3.4 as the max around this year. The data you're talking about is probably provisional, so I would hold on that number. I'd like it see what it says once its final; but, I think, based on what we see, there's two things.
One, I see water levels continuing to decline. I don't see a prospect of a new -- of another 2005 precipitation recharge event. That was the highest in the period of record. And that's the recharge that's sort of reset these trends at a higher level but those trends, to me, have continued to decline. And now we're near the 3.2 CFS. And it would not surprise me,

within the next ten years or less, that we reached that value.
Q. Thank you.
Referring to slide 25, the chart relating discharge and Warm Spring well, Warm Spring gage flows. As I understand it this chart, the data in this chart, are the basis for the determination of the 4- to 6,000-acre-foot recommendation. Is that correct, in part?
ANSWERS BY MS. DRICI:
A. Yes.
Q. Thank you.
A. You're welcome.
Q. I'm not sure who's going to answer this question. Given that we know that 3.2 is what the MOA sets forth for the Warm Springs dace, is 3.2 sufficient to meet senior water rights on the river?
ANSWERS BY MR. BURNS:
A. No.
Q. So we are --
A. So let me elaborate.
Q. Sure. Thank you.
A. I say no because, you know, I just went through some testimony and some demonstration of the impacts

that alluvial pumping has had on the river flows, these depletions.
The reduced discharge from the springs also has a contribution to the depletion, albeit much smaller than the alluvial pumping. But, it's measurable, at least during the test. When we saw Pederson Springs decline almost 60 percent or so.
And Warm Springs about ten percent.
Those are small in terms of magnitude, not discernible in the Muddy River record. But we know that it's not going to the river itself.
Q. If we have any hope of reaching, excuse me.
If we have any hope of fulfilling senior water rights on the river, am I hearing you saying it's going to be necessary to stay above 3.2?
A. Yes.
Q. With regard to the question of alluvial pumping, did your data or analysis account for upward flow from the carbonate into the alluvial subsequent to alluvial pumping?
A. That's part of our conceptual model. Maybe explain where you are speaking of.
Q. I'm speaking of the conceptual model that led to this chart, ultimately, and the calculations of how

much carbonate water can come out while maintaining these levels at Warm Spring West, did that factor in, do these numbers factor in the loss of carbonate water to alluvial flow, upward flow?
ANSWERS BY MS. DRICI:
A. Yes, it does. In the measurements of the total area.
Q. Okay. Thank you.
How would we know if steady state was reached at 4- to 6,000-acre-feet of pumping. What would be the indication that steady state has been reached?
ANSWERS BY MR. BURNS:
A. Well, one indication is to do what we've done the last 20 years is to monitor how these effects have propagate under different pumping regimes. And to recess steady state, we would expect to see water levels flatten about, you know, there might be some variation, I suppose, due to recharge events over a year or two. But we'd expect those to flatten out. We'd expect the same for discharge of the springs. And we use, as I said and others have said, the Pederson Spring complex and Warm Springs West gage, as indicators, for conditions in the Springs area.
Q. How many years of flat data would we want to be

certain that steady state has been reached, given that a miscalculation could result in really catastrophic impacts for endangered species among other resources?
A. I'm not -- we would always want a period of record that's longer.
Q. Sure.
A. And I'm not sure I can answer your question. I mean I wouldn't be the -- I'm not the management entity who would make that decision. But as a professional, I would think if we have, let's take now, for example, last three years or four years. I think in the next two years, we'll have a pretty good indication of what this system is really doing. Because there is -- apparently, there is still apparently some debate on whether the system in steady state now or if it's not. What I observe is declining water levels in some of the these indicator wells.
And two years more of data or three or ten, however much we need. But I think the more you have, the better indication you will have of where you are at with respect to steady state. And so if the State Engineer decides to put a limit on the amount of total overall pumping somewhere between 4- and 6,000-acre-feet, we would then want several years of

data to determine if that was effective?
A. I think so.
Q. I believe I'm at 14 minutes. I have more questions, but I'll come back.
HEARING OFFICER FAIRBANK: You have 18, 17, 16 seconds.
Georgia Pacific/Republic.

CROSS-EXAMINATION
BY MS. HARRISON:
Q. Good afternoon, panel. Sylvia Harrison for George Pacific and Republic Environmental Technologies. I guess I just want to pick up where CBD left off and talk about the interaction between the alluvial and the carbonate aquifer. I believe Mr. Burns, that you said your conceptual model assumed there would be some recharge from the carbonate aquifer into the alluvium; is that correct?
ANSWERS BY MR. BURNS:
A. Yes. Maybe to clarify or to simplify, I believe the source of water in that alluvial reservoir is from the carbonate system.
Q. Do you have any direct evidence of that conclusion?

A. One is that I don't see that there is a lot of recharge in that small basin that would contribute to different source of water to that reservoir.
Q. What about a different source to the Muddy Springs? Have you taken that into consideration?
A. Well, yeah. I think -- I guess what I'm trying to say is that conceptually we have -- we can have some defuse flow from the carbonate system into this reservoir. We also have some discrete springs like Pederson Springs, for example, directly from the carbonate system that flow out into the ground. And I suppose can contribute to the storage in that reservoir. But I sort of view it all as the same source of water from the carbonate system.
Q. Okay. But you don't have any temperature data, or isotope data or anything like geochemical data that would demonstrate conclusively that water from the carbonate system was being introduced into the aquifer at least at this point in time?
A. Not in this report but that data is available. I think it's widely recognized the in scientific community that the source of water in the alluvial system there is the carbonate aquifer.
Q. And you suggested that would be diffuse flow or

would it be discrete area, where there may be the equivalent of underground springs, for example?
A. It could be both.
Q. What would be the mechanism for defuse flow from the carbonate into the alluvial aquifer?
A. Well, if you have, let's say, a fault that runs along the boundary, you can have water that comes up along that fault and into the alluvial reservoir, for example.
Q. But that would be a structural feature, correct?
A. A fault is a structural feature.
Q. Not necessarily just because there is a contact between the carbonate and the basin fill doesn't necessarily mean that there is water flowing from the basin fill to the -- I mean from the carbonate aquifer to the basin fill, correct?
A. Could you repeat that?
Q. If there is simply a contact between the carbonate and the basin fill, would you assume that there is necessarily assume defuse flow from the carbonate into the basin fill?
A. Well, I mean --
Q. Just to stratographic contact?

A. Well, maybe this will help. Another way to look at it is the tension-metric surface of the carbonate aquifer is higher than the elevation of the basin fill, right? So there is however -- whatever opportunities there are, whether it's through maybe a cemented pipe in essence right into the basin fill or whether it's through a contact, like you suggest, there are different mechanisms by which that water can get into that reservoir.
Q. But there is, at this point in time, no quantification of that amount or where it actually occurs within the lower Lower White River Flow; is that correct?
A. I suppose you can quantify it by some of the spring flow measurements.
Q. At the Muddy Springs you mean?
A. That could be one. And there's gaining reaches along those small streams before they go to the river. The main stem of the river. Those can be measured and those gaining streams are in -- that source of water to those streams are to the alluvial system. So, I guess what I'm saying there is multiple sources that feed these streams.
Q. Okay.

Page 1011

A. I'm not sure how else I can --
Q. Okay.
I want to pick up on a question that Ms. Peterson asked you about the potential for doing a pump test to evaluate the effects of Garnet Valley pumping. On EH-4 or the MRSA. And you mentioned that just before we broke that a significant stress would be needed.
Can you give me an idea of the values and duration that would be necessary to make an effective pump test or design an effective pump test with Garnet Valley?
A. Well, first let me say we have established a connection between Garnet Valley, and EH-4. We can see that on the hydrographs, we can see that in our regression analysis, or correlation analysis is really what we're doing.
With respect to a pumping test, over some period of time, we observe what happened with the Order 1169 test; and it's my opinion that you need something on that order, some stress of that magnitude in duration to have a discernible effect that separates it from the other stresses that are ongoing.
Does that make sense?

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Q. Yes. I mean sort of.
The -- what is the elevation or the water level elevation at EH-4?
A. It's 18 -- let me. Standby, I'll -- while I look, I'll just mention that they are variable. EH-4 most recently is a little under 1812.
Q. And what's the elevation of GV-1? And these are -- I was looking at figure 3.6, if that helps?
A. What page?
Q. It's figure 3 -- 3-6.
A. For this -- on this figure it's 1808.
Q. So five-foot difference?
A. Yes.
Q. And there are nearby wells in Garnet Valley. Do you know whether the water elevation in any of those wells is affected by the water quality? In other words, is there a significant salinity or are you aware whether there is significant salinity in any of those wells that may effect the water level?
A. I'm not wear of any significant salinity in those wells that would effect the water level.
Q. If there were, would it effect the water level or could it?
A. I suppose there could be a density contrast

Page 1013

that may effect it.
Q. And that could make the well elevation appear to be higher or yeah, than it actually is?
A. Perhaps.
Q. And would that effect the actual hydraulic gradients?
A. From which point?
Q. From the wellhead to, for example, pumping source or receptor?
A. It could. We think the pumping source would be the controlling mechanism that creates the gradient if it's close by.
Q. Okay. So, if -- in order to -- let's just take GV-1, for an example. In order to conduct a pump test that overcomes that five-foot difference in gradient, does that suggest that you might need an even a larger stress than was illustrated by the 1169 test, to see any kind of effect of the EH-4?
A. I think I'd have to see.
Q. So you can't say for sure that just even a pump test of magnitude of 1169 would be a sufficient stressor to detect the effect of pumping in Garnet Valley?
A. I think a stress like 3000-acre-feet in Garnet

Page 1014

Valley, I think we would see that signal throughout.
Q. And does that consider the possibility of other sources of flow? In other words, if there is inflow from other sources, that make up some the volume that's being pump amended, would that suggest you could get and incorrect -- you could draw incorrect conclusions or that the pumping test would not be as accurate as it would otherwise be?
A. Well, for something like that, I would think we would design a test with as many assurities that we have those factors monitored. And by that I mean, to the extent you would induce groundwater flow to the well from another area, you would probably want to put a monitor well between that boundary and the pumping well. So, you could see how that -- you can see what's going on there.
Q. So potentially, without more data or information, you are not confident that you could design a reliable pump test at Garnet Valley just based upon her conceptual model at this point in time?
A. I haven't thought -- I haven't thought about that.
Q. Does it follow that it's a bit speculative to assume that any pumping at Garnet Valley is going to

effect the MRSA area?
Q. I didn't catch the last part?
A. I said isn't -- would you agree that it's still a bit speculative to assume that any pumping at Garnet Valley is going to effect the MRSA? The Muddy Spring area?
A. Well, I think what multi letter regression analysis shows is that we have monitored -- we have measured those affects at EH-4.
Q. Going backwards from the well, okay?
A. Yeah.
Q. Just this is kind of an open-ended question.
Can you look at figure 5 point or 5 dash -- five- what's five -- I don't have my glasses on. Figure 5-4? Sorry.
A. I could not hear.
Q. I'm sorry, 5-4.
A. Okay. I'm there.
Q. This isn't any fancy statistical analysis or anything. But would you agree that there is at least a strong visual correlation between the alluvial pumping and the Muddy River deficit that's illustrated in that figure?
A. I would agree with that.

Q. And if you were to remove the alluvial pumping and simply look at the amount of carbonate pumping, would you see a similar decline or deficit?
A. You would see like you see in 2018, that the deficit would be going down. You see in 2018, there is alluvial pumping?
Q. Yes. So I'm saying if you -- if you simply removed the alluvial pumping from that, and you look simply at the relationship between the Muddy River deficit and the amount of carbonated pumping, would you see such a strong correlation?
A. Well, you'd have to -- I'm not sure how -- this is a hypothetical.
Q. Yeah, it is.
A. Right? And --
Q. That's why I said it was open-ended.
A. Okay. Certainly is, no doubt about that word.
If we pretend that there is no alluvial pumping, we would see something similar I would think.
Q. Okay.
A. But not to this magnitude. You would have to recompute this deficit because you would be -- you would see more water in the river. You're not capturing it from the basin fill.

Q. Okay. You are assuming that the -- that the carbonates would somehow -- the amount of carbonate on the blue bars would be larger, is that what you are saying?
A. I'm not sure what we're assuming at this point.
Q. Okay.
A. Honestly.
HEARING OFFICER FAIRBANK: All right. Ms. Harrison, you're out of time.
MS. HARRISON: Thank you.
HEARING OFFICER FAIRBANK: You can go ahead and move on.
Nevada Cogeneration.

CROSS-EXAMINATION
BY MR. FLANGAS:
Q. Good afternoon. My name is Alex Flangas. Just a couple of questions. And I really mean that.
A. I appreciate that.
Q. I'm focussed on your rebuttal report for a moment, which is SNWA Exhibit 9. At Page 16 and 17, there is a statement that is made, that was summarized a couple times here today by Ms. Drici that the current production wells in the Black Mountains area are

probably not within the Lower White River System, and the boundaries should probably be adjusted. So, in some ways I would focus this to Ms. Drici.
But my first question is the report was signed by Mr. Burns and Ms. Drici. Did you both reach that same conclusion?
MR. TAGGART: Objection, that mischaracterizes the evidence. And witness's name is Drici.
MR. FLANGAS: I'm sorry.
MR. TAGGART: You mischaracterized the testimony.
HEARING OFFICER FAIRBANK: The objection -- just so I can make it clear so that those that are attending or viewing the hearing remotely, so the objection is that it mischaracterizes the testimony.
MR. TAGGART: Yes. The question was that the testimony was that the boundaries should change. I don't think that's what the testimony was.
BY MR. FLANGAS:
Q. Let me ask Ms. Drici.
Ms. Drici, earlier today didn't you say the boundary was not accurate?
ANSWERS BY MS. DRICI:
A. I said it may not be. The analysis I performed

indicates that the production from the Black Mountain area, according to the analysis, it appears not to effect water levels at EH-4.
To make that determination that production should not be in the Lower White River Flow System, I think we would need some additional lines of evidence.
Q. Well, the exact statement you made, and just so we're clear, the exact statement you made in the rebuttal report, I'm reading the last -- this is the last paragraph on Page 16, first paragraph, first portion of the paragraph on Page 17 of the rebuttal report.
"This indicates that while well BM-DL2 is undoubtedly within the carbonate aquifer of the LWRFS. The current production wells, figure 2-8, are probably not."
Now, that means "are probably not" within the carbon aquifer of the LWRFS; isn't that correct?
Isn't that what that means?
ANSWERS BY MS. DRICI:
A. Yes, it is. But, the word probably has some meaning there. It means I'm not sure. The analysis indicates that it may not be in there. But I cannot say, you know, with hundred percent certainty that it

is true. I mean to demonstrate things like this, you would need to look at it from different angles. So, this analysis indicates that maybe they are not in there, it's probably other things that we need to look at to confirm it, and honestly, I did not. The only thing I looked at was like the completion of the wells. Like the observation well, BMDL-2, was quite a bit deeper than those production wells, a little bit south of there. Does that have -- is that the explanation? I'm not sure. Maybe there is a structure in between there, somehow. I did not look into it in any more detail than this.
Q. So back it my first question, Mr. Burns, did you concur in that analysis.
ANSWERS BY MR. BURNS:
A. Yes. Yes. We did. Yeah, this is our analysis.
Q. And were there any other hydrologists that reviewed this report besides you and Ms. Drici that came to that same conclusion?
A. Well, my staff reviewed this. We didn't go through an external review process, no.
Q. I don't mean outside the area. I'm talking about your staff of hydrologists that worked on this

process?
A. Yeah, it was basically Warda and myself and Jim Rogers.
Q. Ms. Drici, in reaching part of that conclusion I believe you talked about the P values earlier that were shown on Exhibit A-1 to that report. I think its in appendix A-1.
ANSWERS BY MS. DRICI:
A. Yes.
Q. Was that some of what led you to that conclusion?
A. Yes. The P value is larger than the 0.05. But you can also look at the graph. You know, as compared to the others, it appears that in figure A-3, despite the production from those production wells, it appears that if it causes any water level decline at EH-4, it's small to none. But I cannot say with certainty, because there is a certain level of uncertainty in all the numbers that we have.
Q. Okay. And just so that we're clear for the State Engineer, the production wells we're talking about are EB-2, -5 and -6, correct?
A. Yeah, I believe so.
Q. Those are the wells that are operated by Nevada

Cogeneration Associates?
A. Yeah, just south of BMDL-2. The observation well.
Q. But the production wells that you referred to that you say are not -- those are the production wells we're referring to, those are Nevada Cogeneration Associates' wells?
A. I believe so. I mean I lumped all the production from the portion of the Black Mountain area. That has been included in the Lower White River Flow System by the definition of the boundary there by the State Engineer.
Q. Okay. Mr. Burns, do you know that we're talking about EB-5 and -6 and EB-2?
ANSWERS BY MR. BURNS:
A. I believe so. But, I'd have to maybe --
A. (Ms. Drici) It's over there in the appendix.
Q. I'm just trying to clarify when we refer to the production wells we're not referring to any other production wells in the Black Mountains area?
A. (Mr. Burns) Well, let's take a look.
A. (Ms. Drici) I think be in Appendix A.
A. (Mr. Burns) Here we go.
It looks like the pumping that was EVM-4.

Here.
A. (Ms. Drici) I think in the first. So, Black Mountain area. We have these three right here. Yeah. EVM. What's this?
A. (Mr. Burns) 62 and -3.
Q. Thank you.
HEARING OFFICER FAIRBANK: Can you say that again, a little more loudly. Difficult to hear what you said.
A. (Mr. Burns) EBM-6, EBP-2, EGB-3. Is that right? I'm sorry, I got it wrong. EBM-5.
A. (Ms. Drici) here, we have an indication of which ones are the pumping wells. These three. So EBM-4. Sorry. Getting old, can't see.
EBM-5, EBM-6, and EBP-2.
Q. Thank you.
A. (Ms. Drici) you're welcome.
Q. You didn't work with anyone from Nevada Co General. This was an independent analysis; isn't that correct?
ANSWERS BY MR. BURNS:
A. That's correct.
Q. There was entirely your analysis, Southern Nevada Water Authority; isn't that correct?

A. That's correct.
Q. You don't have any contractual relationship as far as working on this, with any other engineers or any outside consultants working with Nevada Cogen; is that correct?
A. That's correct.
MR. FLANGAS: I have no further questions. Thank you.
HEARING OFFICER FAIRBANK: Muddy Valley Irrigation Company.
MR. KING: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions. Bedrock?

RECROSS-EXAMINATION
BY MS. URE:
Q. Hello again. So I'm Tracy Ure representing Bedrock. And I just have a few quick questions for you.
Do you believe that it is possible to pump from an alluvium aquifer within the proposed Lower Whites River Flow System boundary without causing a one-to-one impact on the Muddy River?
A. In certain areas.

Q. And what areas would those be?
A. The only area I'm aware of is to the north, a portion of Coyote Springs Valley where Bedrock has some wells. I think pumping those won't impact the carbonate system.
Q. Okay. Thank you.
HEARING OFFICER FAIRBANK: Nevada Energy. Nevada Energy.

CROSS-EXAMINATION
BY MS. CAVIGLIA:
Q. So we started looking at some of your analyses, and tried to look at how they work together. Starting on slide 17, this is for Ms. Drici, please.
And Justina Cavaglia on behalf of NV Energy?
So, when we look at slide 17, we focused on 2015 and it looks like there was a 1.7-foot drawdown forum and EH-4 from pumping that year. Is that about accurate?
ANSWERS BY MS. DRICI:
A. Which figure?
Q. Oh, I'm sorry. On the lower one. So the lower one where California Wash is pumping, it looks like there is about a 1.7-foot drawdown from 2015?

A. Yeah, approximately.
Q. Okay. And it looks like on Page 28, there is probably about 400 acre-feet of pumping that year, based on the information that you've provided?
A. Okay.
Q. Now, looking at Page 16, looking at the effects of EH-4 on discharge at Moapa gage, with this level 1.57. Yeah that's it. And it looks like if you compare the two if you multiply the 1.57 by the 1.7, you get roughly .267 CFS at the Warm Springs West gage, if we do the math correctly. Is that correct, roughly?
MR. TAGGART: Objection as to clarity. I don't think the question's clear.
HEARING OFFICER FAIRBANK: The question, I guess is do you understand the question that is being asked?
MS. DRICI: No, I don't.
BY MR. CAVIGLIA:
Q. Okay. So, we'll go back it 17.
So you would agree that there is a 1.7-foot decline?
ANSWERS BY MS. DRICI:
A. Yes, approximately.
Q. -- vertically?

Q. Okay. So when we use that number based upon your curve on Page 16 with your trend line, so, a 1.7-foot drop times by the 1.57 slope would approximately be about a .267 CFS in decline if we used the numbers from that, that you used in this graph?
A. Okay. I can't calculate in my head but I trust you. You used a calculator?
Q. We did.
A. Okay.
Q. We used a calculator.
So looking at that and then looking at the total contribution to the Warm Springs decline and looking at Page 22 or slide 22, it looks like with the ratios that are in there, which is a .78 on average, and that's the ratios from Warm Springs West flow to total Muddy Springs discharge.
A. Okay.
Q. When we look at that if you apply that ratio to .267 CFS?
A. Okay.
Q. You get 3.42 CFS in discharge from California Wash or from --
So you get a total discharge, or so the total Muddy Springs recharge discharge for that figure would

be three point, sorry looking back at our math. 3.42 CFS. Would that be approximate, correct?
MR. TAGGART: Objection, again, not clear what the question is. Whether it's a statement or a question.
HEARING OFFICER FAIRBANK: I agree. I was having a difficult time following the question as well. Ms. Caviglia, please restate the question.
BY MS. CAVIGLIA:
Q. So if we compare on Page 17 to 16 with the 1.7-foot decline, and we use your numbers, and there is -- would you agree that that would -- if we used your numbers it would be a .267 CFS decline. Decrease in what Warm Springs West if we compare the two charts, for the same.
A. The correlation between the Spring and EH-4?
Q. Yes.
A. -- the one with the correlation. 17 is it.
That one.
Okay. Just taking 1.7. I have to use a calculator.
MR. TAGGART: Again, we're going to object because I have no idea what the question is. If the witness understands the question, she might want to

answer it, fine. But I have no idea what this question is.
HEARING OFFICER FAIRBANK: I believe the witness understands the question, but I --
MS. DRICI: So far.
HEARING OFFICER FAIRBANK: But I observe -- your objection is duly noted.
ANSWERS BY MS. DRICI:
A. Can you say that again?
Of the 1.7 --
Q. So back on Page 17 it looks like there is -- according to your numbers in your multiple linear regression model, there is a 1.7-foot reduction from the 2015 pumping in EH-4.
A. Okay.
Q. If we take that 1.7-foot reduction, and we apply it to the trend line that you've provided on Page 16, our math shows that that would -- result in a 0.267 CFS?
A. Yes.
Q. Reduction?
A. That's correct.
Q. Okay. And then looking at Page 22 or we'll do 24. And we're looking at the ratio 0.76 from Warm

Springs West to Muddy River Spring area. Okay. And if you apply that ratio to .267 CFS?
A. Okay.
Q. We get approximately 3.42 CFS of Muddy River reduction.
A. Yeah, I get that about 2.5. But close enough.
Q. Okay. So that would be equivalent to 2450-acre-feet of Muddy River reduction; is that correct?
A. Conversion 2.5 CFS to acre-feet. Yeah.
Q. Okay. So, according to your analysis, 400-acre-feet of pumping in 2015 in California Wash has caused 2400-acre-feet of depletion in total Muddy Spring River discharge in that year only, is that possible in reality?
A. Well, the only way I have to tell you whether it's possible or not, is the analysis I did.
MS. CAVIGLIA: No further questions.
HEARING OFFICER FAIRBANK: At this time I'll go ahead and open up questions to the State Engineer and Water Resources, Division of Water Resources staff.
EXAMINATION
BY MS. COOPER:
Q. Hi. Christy Cooper for the record.

Could you go to slide 35, please. And maybe you said this, and I missed it, but, for some clarification.

Where are you getting your values for, your Muddy River diversions?

Is that like a table, was it table B-1.

ANSWERS BY MR. BURNS:

A. Yeah.

Q. C-3?

A. B-1. Surface water diversions above the Moapa -- Muddy River Moapa gage in the Muddy River Springs area.

Q. Okay. So, to follow up, just so I understand, if its B-1, and say in 2017 cumulative between Nevada Energy diversions and the Moapa Valley Water District diversions was 126. Is that why the line is flat, are you saying none, or how is that?

A. It may be typographical. Because it looks -- maybe the line might be on top of a little sliver of blue. If I think I understand what you are saying. But, there should be blue in 2017 on this chart.

Q. Okay. Yeah, it's small. And then subsequently after that like in 2018, when it went up to 802, that's why you see it opening up a bit more?

A. Correct.

Q. Okay. Just because I was trying to count on the Y axis and the secondary. If there was some kind of -- I couldn't really follow which one that you were saying was in the presentation if I were to --

A. At this scale, 15,000-acre-feet, that that 126,000, I'm sorry, 126-acre-feet is hard to see.

Q. Okay. I did have another question. Thank you for clarifying that one.

Specific to the basin fill monitor wells in Coyote Spring Valley, have you seen the decline that you've observed from -- in the carbonate wells from 2016 to present?

A. There is -- I haven't looked recently. I remember Rick Waddell, yesterday, brought up CSV-3, is my recollection, and thought he saw a decline or some influence, is my recollection. I did not look at those wells, so, to observe this decline.

Q. Okay. So you are not sure if they are actually going down?

A. I'm not prepared to say. I'd have to look.

Q. Okay.

And Ms. Drici?

ANSWERS BY MS. DRICI:

A. Yes.

Q. What transmissivity value did you use in your MLR analysis?

A. The MLR does not require any transmissivity analysis.

Q. Okay.

A. It's just a tool to break down a response to several stressors. And because the carbonate aquifer behaves like a confined which means the linear behaviors you can just like take different stressors, calculate their effects and then add them up, and you get the composite response. In this case we're doing that but in reverse. So we start from the EH-4 water levels time series rears and we break it down into responses from different stresses.

Q. Okay. And table 6-1, let me see what page that was in there. It was where you came up with all the ratio numbers. Thank you.

Is there a reason that you only went through 2012 in the analysis?

A. Yes. The reason was that those were the only years for which we had estimates of ET. Because ET is a loss above the gage. And it needs to be added back into the reading of the Moapa gage, along with the

diversions, and the carbonate -- I mean the alluvial production upstream to recompose the total water volume that's coming up below the springs area. Because we don't have any other way to measure how much water total is coming into the MRSA discharge area except from the reading at the Moapa gage on the river. And like I said before, under predictable conditions, it was easier because you didn't have any of these losses except for ET. So if you took the January measurement when ET is low negligible, then the total discharge to the MRSA area would be equal to the measurements at the Moapa gage. Does that make sense?

Q. Uh-hum. So, maybe hypothetically, if you were to assume like an average ET or something similar, that has been since 2012, do you think that if you did the calculation with the pumpage from 2013 to 2018, would your ratio change?

A. I think the ratio stays the same as long as you know you have flow at Warm Springs West. It's -- because there is a linear relationship between that spring discharge and the total discharge. It's the slope of that line. Unfortunately, you know like I said, I had to estimate the total discharge.

So, if you plot, if you plot those values on the X axis, one on the Y axis you do see a linear trend but the scatter is significant that you cannot figure out what that slope is exactly. That's why I went back to the measurements made by Eakin. And used that ratio as an approximation. Because that's the cleanest data point that we have along that line.

MS. COOPER: That's all. Thank you. That's all for me. Maybe.

EXAMINATION
BY MR. BENEDICT:

Q. Jon Benedict for the record.

I'd like to go to the slide 10, please, from your presentation.

So if we back up to CSVM-4, there was some discussion about the quality of those data with respect to the transducer.

I just want to make sure I understand what those data are and how they were used, if possible. I know that on this plot of CSVM-4, I think the blue dots are manual measurements and the green lines are transducer?

ANSWERS BY MR. BURNS:

A. That's correct.

Q. So in the correlations and various analyses that were done, which were used? Were the quota fusion. Could you describe which data were used and how?

A. For the -- yes, so for correlation analysis, both were used. So for a given month you will have a mean daily value. You will have maybe a periodic measurement as well. And those are averaged. So value for that month. And these are correlated with either in our report, EH-4, or MX-4.

Q. Do you have a sense of which are likely to be more accurate or less accurate, based on those issues that have been described?

A. I believe the periodic measurement would be more accurate. But I see really that they plot -- better put on my spectacles. They plot pretty much on top of each other. So I wouldn't expect that one would -- I think they'd be approximately the same.

Q. Do -- and this is another question I don't have an answer to and maybe you can help me with because I haven't looked at all the data recently. But were all the wells employing transducers or were there some that were only water level measurements? What was of the distribution of those data that were collected? Do you

know?

A. Off the top of my head, generally all of our wells that we monitor have are equipped with transducers. Now, I should say when we set the transducer, we know set depth, we make a manual measurement at that time. And from that point on, we can account for a drift in the transducer and we can account for any stretch in the cable, adjust that record to those manual measurements, which are good to about a hundredth of a foot.

With respect to our wells, I don't have a count for you, but, it's our practice to install transducers in all of them.

Q. But can you use the manual measurements to correct any drift or error in those?

A. If it needs it.

Q. Okay.

A. They are really used almost as a calibration in some respects. You have a manual measurement but calibrated E tape, and that is -- so we can compare that measurement with what the transducer is reading. And if we find that it's maybe the cable slipped, maybe it's stretched when it's new, those are instances which aren't frequent but those are instances, where you

might correct that continuous record. To get it back on the observed, what we call the observed periodic measurement.

Q. Okay. Thank you.

And another question, then on the actual data for CSVM-4. The response in this hydrograph has been suggested to be attenuated, and maybe to have lags in it based on some of the work that's been done here. And I wonder if you would provide an opinion on -- if that tells us anything about the recharge and/or the pumping in connection with respect to the fact that recharge may be coming from somewhere else rather than where the pumping comes from, and yet what I think I'm hearing you saying based on the statistics is that the recharge lag and the lag in the pumping are similar. Is that wrong, or is that --

A. I think they are similar because when we look at, for example, regression analysis for that well, which is on the next slide, we see that CSCM-4 or EH-4. EH-4, you know, represents the recharge in that record that represents pumping in that area or elsewhere as we find out now. So to the extent that that well is correlated with the other well, we find that connection.

When we have a correlation factor of maybe .85, I'm sure. I'd have to calculate but this is R Squared, but it's significant.
And I guess maybe, you asked about the lag.
Q. I was just curious because if the lags are similar between recharging and pumping, it suggests that those sources are coming from a similar vector, I guess, if you will, potentially. Maybe that's simplifying things too much. I'm trying to get some sense out of what that attenuation might be telling us.
A. Well, because we don't know the exact location of the recharge source, the closest is probably the Delamar Mountains to the north.
But, with respect to the pumping part, we did the same analysis, and correlated with MX-4, compared those two variables CSVM-4 to MX-4 and we found lesser correlation but still significant. Here it's in R squared of .78. So the square root of that would be our so correlation coefficient. And that's still good, and significant I would say.
Of course, that's applying a three -- let's see, our lag here was three months.
Q. Okay. Fair enough.
Let's see, I'd like to go to slide, I'd say

maybe slide 19 is a good one.
So we had some discussion about reaching equilibrium or steady state. And separate from looking at these correlations, I'm trying to piece these two things together. I note it is that in a lot of these graphs where pumpage is uniform and doesn't change over a period of time, the water levels as well don't show a change, suggests -- and maybe this is common sense, but that relationship which is empirical is really set up so that it's time independent. So in other words, basically you are describing I think a correlationship which is almost like steady state.
Correct me if I'm wrong. But the way I kind of envision this, at least I look at years from 1999, for example, 2005 wherein the pumping based on this graph is very similar, and the water levels remain pretty much the same.
Would you agree with that? At least on this plot?
ANSWERS BY MS. DRICI:
A. Yeah on this plot. Yeah.
Q. So I just wonder how that fits with the concept that equilibrium isn't recently reached. And whether that suggests that is these results are either

conservative, or maybe overestimate drawdown. Either way, I don't know. But I'm trying to kind of reconcile this concept between not being at steady state therefore water levels would continue to go down with a certain amount of pumping and correlationships that show predictive water levels that remain stable with a constant amount of pumpage.
A. I think what this particular slide is telling us, is that these particular, the production in this in the MRSA would be causing this level of decline, and if you keep pumping at this level, it could be stabilizing what with respect to this production.
But, to look at the whole, the effects of all the other basins, then, you have to look at the next I think it's the next slide where we put everything together. And it doesn't look like it's stabilizing, still going down. In slide 20.
No, I'm sorry. Page 19. Slight -- okay. When you put all of them together, their combined effects is making the water level at EH-4, causing it to go down. And if you look at 2017, 2018, you know, you might see, oh, maybe it's stabilizing or going up. But, you cannot base that, you know, equilibrium, just like on a year or two. You have to go, I would just use like

longer term or longer periods to figure it out.
Like in here, I'm not looking at, you know, daily or, you know, earlier we were saying Oh, did you know that Warm Springs West went down to 3.2 yesterday. You have to look at it in bigger terms of time for quite a while before you can say it has stabilized.
A. (Mr. Burns) And I might add, if that's okay. That this is a single point EH-4 in the system, so whereas it might look like it's declining or it's stable here, we observe elsewhere in the system that it's not. Like Garnet Valley, for example, some of the other locations we talked about. When you look at figure 19, I'm sorry, page 19, you can see that the production in this area, the Muddy River Spring area actually declined -- I mentioned this earlier -- about 850 acre-feet or so. And so we see a response here at EH-4 of some higher value than 2017.
So I wouldn't -- I'd caution to use a single point in a system of 1100 square miles as the indicator for whether or not the flow system is in equilibrium. We need to look at the body of evidence, the body of the data that explains other areas and what's happening there?
Q. Okay. Thank you.

Another question about I guess maybe this is a Garnet Valley question.

It's been suggested there may be -- there could be some other source of capture, and that was one that was pointed to, and in thinking about the results of the 1169 test would, you had mentioned, well, if another test were to be done down there, you'd want to have monitoring wells that were between that pumping well, and a given boundary so that you could see that. Would the Garnet Valley well represent such a monitoring well for the 1169 test?

Would you expect to see it drawdown in Garnet Valley well where it would show you something about whether there was a boundary nearby you could capture water from?

ANSWERS FROM MR. BURNS:

A. If I'm following your question, I don't know if -- if that was the production well or a monitor well.

Q. If it was a monitoring well. I guess what I'm thinking of is a lot of times when you've got that a monitoring site close to boundary condition you can induce flow from, the water levels tends to be muted or unless, for example, you got a well next to a river, you pump from an area away from that, that water level

will be relatively fixed because you're drawing water from the river. Similarly, if you had a boundary condition where you could induce flow, and may be Garnet Valley one would be an example. If you had a boundary condition somewhere down there that you could induce flow, maybe the water levels might not be as large there, compared to other places.

So I'm just wondering, if there is anything in the data that suggests whether or not there are other boundary conditions that exist out there, that you could derive flow from based on data we currently have?

A. I'm not sure I know the answer.

Q. Okay.

A. I don't think so. But if we're designing a test, and we had a boundary that we're -- we thought was a boundary, maybe the idea is you put a well on the other side of that boundary, and then that would be more definitive on whether or not -- it would be more definitive about it's character, on whether or not it's a permeable or impermeable. When it comes to groundwater flow in these areas, I'm not sure if that was some of the commentary. There's been some discussion about being able to capture groundwater flow

rather than Muddy River Springs discharge. And first off, what we see based on these correlations is this connection between these areas and the springs. But there is some that think you can also capture a large percentage of this groundwater flow, underflow let's say or flow to somewhere outside the basin.

And those are thoughts. I think what is owed to you, is an explanation for where that water is coming from, and where is it going to, through which rocks is this water flowing, to what point is it discharging, is there a commitment on that water if it's leaving the basin. And I didn't see those discussions in any of the stakeholder reports. For those folks that have offered this concept of capturing outflow as opposed to Muddy River Springs flow, that's the extent of conversation -- the extent of the analysis as far as I can tell, just a postulate that it's there, and their wells could capture it. I think you would need to have some at least initially, an explanation for where that water's coming from, like I said, through which is rocks if it's going along what gradient to where, which point, where is it discharging. And then we can really have a sense of how to design the test to see.

If you are going to capture that outflow.

What we've shown today, what we've demonstrated, is there is a hydraulic connection throughout this area, strong hydraulic connection. And we feel if you'll pump in those areas, it will impact the conditions underlying the springs, and therefore, have a proportional effect on the discharge there.

MR. BENEDICT: Okay. Thank you.

EXAMINATION

BY MR. SULLIVAN:

Q. Earlier, Mr. Burns, you mentioned an estimate that SNWA had done several years ago about 10,000 acre-feet bypassing the Muddy River Springs area. Based on the description that you just gave, do you think that -- what is your feeling about that estimate now?

ANSWERS BY MR. BURNS:

A. Let me make sure we're clear on what the estimate was.

It's in, as I recall, Appendix D of our report, issued in 2011 for that hearing.

That was a boundary or a Darcy flux calculation, and I don't have the report here.

With my recollection, just south of the spring, the spring area in California Wash, and what we're trying to look at is what is the flux in the basin fill there. So the properties we used for the transmissivity, for example, were derived from what we could find for the Muddy Creek formation.

Sadly, I guess, none of the those estimates were in that area. So, I'd say the estimate is pretty uncertain.

But there was a flux to calculate or there was calculation to determine or estimate the flux through that material at that location.

With respect to capturing that water, I think Nevada Power Company back years ago in the early '90s, maybe late '80s, tried to -- they had a well field they put in south of their I guess it'd be south and east of the springs, in the Muddy Creek formation, trying to capture some of that water.

And my recollection was that water levels declined over a period of years, and then water quality decreased and they abandoned well field. So I don't think production from that area promising.

Elsewhere, in the basin we find because of this connection, I find it would be hard to construct a well

in carbonate system in these locations we've looked at that would not have some impact to the Garnet system and water levels in the spring area. And as we've shown there is that proportional effect to the discharge.

So, I can't think of a well location that that I would put a well thinking I'm just going to capture outflow or a large percentage of it.

Q. Okay. Thank you.

EXAMINATION

BY HEARING OFFICER FAIRBANK:

Q. I have a question for Mr. Burns.

And I'm going to refer to page 39 of your slide show, which is also Exhibit 7, page 7-5. 7.2. I believe the original report was filed in July of this year.

And I guess one of the questions I had was can you explain how assigning a dollar value could be analyzed depletion of the Muddy River ICS credits relates to the specific questions that we're set forth in Order 1303 listed by the State Engineer?

ANSWERS BY MR. BURNS:

A. I think these last two columns don't associate

with those questions. But I do think demonstrating the impact of depleted flows at the Muddy Valley Irrigation Company is important. One of the -- I can't remember which letter, but, I believe it was -- actually I can tell you. One of the letters about capture of Muddy River flows, and spring flows. I think it relates to that to that.

C. It's actually C. C as I paraphrased here in conclusions Groundwater Production and Capture of Muddy River Springs and River Flows.

The costs, impacts in terms of cost don't relate to this. But the analysis, that illustrates the depletion on this river as result of capture of Muddy River and spring flows I think is pertinent.

Q. So I guess just as a quick follow up, so based upon that, is that an inference that SNWA may be amenable to financial mitigation of conflicts if SNWA decreed Muddy River surface water rights are depleted.

MR. TAGGART: I'm going to object. I thought this case was about facts and not about management.

HEARING OFFICER FAIRBANK: You presented the evidence, Mr. Taggart.

MR. TAGGART: You specifically told us this was not a conflicts hearing. And we submitted that

evidence before you made that clear.

HEARING OFFICER FAIRBANK: The evidence was presented today, Mr. Taggart. Thank you.

ANSWER BY MS. PELLEGRINO:

A. I'll answer the question.

We are one shareholder in the Muddy Valley Irrigation Company and we cannot speak on behalf of what is appropriate mitigation to the Muddy Valley Irrigation Company.

There are many options which we think would be amenable to us, the least favorable of which would be financial mitigation. Because this is one of the most valuable resources to Nevada and Southern Nevada, considering that our water supply is there for seven out of every ten Nevadans and about three-quarters of the economic output of our state.

HEARING OFFICER FAIRBANK: Thank you.

EXAMINATION

BY ACTING STATE ENGINEER WILSON:

Q. Tim Wilson for the record.

I think my staff asked most of the questions as usual, which is great. But I do want some clarification on the Black Mountains area.

One of your recommendations is that you felt the Nevada State Engineer's recommendation on the Lower White River Flow System boundary was appropriate. Is that still your testimony today?

ANSWER BY MR. BURNS:

A. It is. I think it is appropriate. But, what I'm also saying or what we're also saying is that it's, as Colby mentioned this morning, if there is prospects of moving production from one part of an adjacent basin to the boundary of Lower White River Flow System, and particularly this boundary which I think a little uncertain, we think those applications to change those points of diversion in that regard should be scrutinized. And by that I mean some sort of analysis, or more definition about the boundary itself and what the impacts of new points of diversion would be. I suspect that's part of your process anyway.

But we think that circumstances like that are concerning to us. And I think it should be to others in the basin, in the flow system.

THE STATE ENGINEER: Thank you. I appreciate that answer.

I think I'm going to let the rest of my questions go, let you off the hook.

MR. BURNS: Thank you. It's Friday.

HEARING OFFICER FAIRBANK: Okay. Let's go ahead an take a ten-minute break. We'll get back on the record at about five minutes to 3:00

So, lets take a ten-minute break we can get back on the record.

Thank you.

(Recess.)

HEARING OFFICER FAIRBANK: Okay. So let's go ahead and get back on the record.

Mr. Herrema, you asked how much time you would have.

Six minutes. So we're going to go ahead and open it up for the participants for additional questions. Participants will have six minutes.

RECROSS-EXAMINATION

BY MR. HERREMA:

Q. Brad Herrema on behalf if CSI, for the record.

And Ms. Harrison was asking some questions about slide 37. Would it be possible to bring that back up? That is figure 54, from the Water Authority's Exhibit Number 7. Thank you.

So Ms. Harrison was asking some questions,

about alluvial pumping. And I wanted to ask about the red line here, which shows the MR flow deficit. And when I look at that line from 1993 through roughly 2003, it appears to me that that red line tracks the total production in the Muddy River Springs area wells.

But then after Coyote Spring Valley pumping was initiated 2005, and then on through 2018, the deficit continues to track the non Coyote Spring Valley pumping.

Would you agree?

ANSWERS BY MR. BURNS:

A. I'm sorry. Last tracking part I didn't catch.

Q. Red line is the Muddy River flow deficit?

A. Got that.

Q. Okay from 1993 to 2003. That line roughly tracks the same way that the total red line alluvial and carbonate pumping does. Then in 2005, Coyote Springs production, Coyote Springs Valley production begins in the carbonate. But that line to me, the red line looks like it continues to track the non Coyote Springs Valley production. Would you agree?

A. I agree.

Q. Doesn't this suggest that groundwater pumping of Coyote Springs Valley is not tied to pumping from

the Muddy River Springs area, to the Muddy River Springs area?

A. No. When I presented this slide earlier mentioned when you create a stacked bar chart like this, you have to pick an order. I picked it in four areas that are closest in proximity and that sequence. But really, this would infer that. But our MLR analysis indicates that Coyote Spring pumping is indeed cause and affects at least EH-f which in turn had a proportional effect as I said to the spring discharge.

And that effect was measured during and after the test.

Q. Okay.

A. Pederson Springs and Warm Springs West.

Q. If Coyote Springs Valley pumping affected the flow deficit, wouldn't you have expected it to peak in 2012 and 2013? Wasn't there up to 5000 acre-feet per year of pumping in Coyote Springs Valley at that time?

A. Right. I mean, yeah, if you reached steady state in that quick a time, you would expect that. But, Warda presented earlier, we have not captured all of that, the equivalent volume of discharge from the springs or ET in that area.

Q. Okay. So then doesn't that mean that there is

not a one-to-one relationship between pumping and Coyote Springs Valley and spring flow into the Muddy River?
A. It doesn't mean that. It means in the future, so when we talk about one-to-one from the carbonate system, we're talking about a long time from now. What we've measured are influences at Pederson and Warm Springs.
Q. Okay. But is there then a time lag between the pumping and the impacts at the springs?
A. There is a response lag.
Q. Do you have an estimate of how long that is?
A. Well, it's how quickly the signal from a pumping center affects EH-4. Well, affects the groundwater conditions at the spring locations.
Q. Do have you an estimate of what that time is?
A. Well, Warda mention earlier --
MR. TAGGART: Object as to vagueness. In carbonate or alluvial, lag of carbonate or alluvial or a lag in any pumping.
HEARING OFFICER FAIRBANK: Your objection was objection as to vagueness, as between carbonate and alluvial or the combination there.
BY MR. Herrema:

Q. Carbonate.
ANSWERS BY MS. DRICI:
A. Okay. Well, what I can tell you is from the Order 1169 pumping test --
Q. I'm sorry, ma'am. I don't have a lot of time.
Do you have estimate of what the time is, in either days or months or years?
A. The response gets everywhere really quickly, within a day, but not to the full extent of the effect of pumping. That's what takes time. At first when you are producing from a well, your mostly picking up water from storage, and it takes a while for the cone of depression to extend and grow, and get deeper, and start capturing water from the springs, for example.
Q. So you are saying there's immediate impact but not a one-to-one impact right away?
A. Yeah. The one-to-one then --
Q. Can I ask a question then, about if there is this time lag if we look at -- or it's not yet a one-to-one relationship if we look at slide 8, the hydrograph of the EH-4 well.
When do you think the recovery starts on this particular hydrograph?
ANSWERS BY MR. BURNS:

A. When does it start?
Q. Yes.
A. I can tell you when I think it ends, which is about 2016. But it starts -- recovery starts when the well stops, the well stops pumping, recovery starts.
Q. And you think that this hydrograph shows the recovery starts at that red line?
MR. TAGGART: Objection to red line. Which one.
BY MR. HERREMA:
Q. There is a red dashed line on EH-4 hydrograph, somewhere right after 2013.
A. I think the recovery started, let's see. What's complicated about 2013 record recovery started when the seasonal decline starts. And so the seasonal decline after, you know, the small -- here. You can see that the magnitude of that decline is less than in other years, so I think what's happened here, is that the actual recovery has muted the seasonal decline. And then on the way up to the seasonal high, you can see it keeps going and it resumes this larger amplitude in subsequent years to about 2016, first quarter is what I estimate.
MR. HERREMA: Thank you.

HEARING OFFICER FAIRBANK: Fish and Wildlife Service?
Seeing no questions.
National Park Service.
MS. GLASGOW: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions.
Moapa Band? Seeing no questions.
Moapa Valley Water?
No questions.
Lincoln County/Vidler?
MS. PETERSON: Yes, sir.

RECROSS-EXAMINATION
BY MS. PETERSON:
Q. Thank you.
Karen Petersen again. This question is I believe for the Ms. Pellegrino and/or Mr. Burns, since both of you have talked about what your recommendation is to the State Engineer, your request the State Engineer. And I had heard Ms. Pellegrino state this morning that there should be continuing management of adjacent basins, and a jointly managed boundary, and that that should be in the next phase.
And then I heard -- or on the slides we just

talk about applications on the adjoining basins should be scrutinized. So i want to know what exactly SNWA's position exactly, what the proposal is, because I don't understand it.

ANSWERS BY MS. PELLEGRINO:

A. We're trying to be very respectful of the fact that there is at least two phases of this process. The first, which is technical fact-gathering phase, specific to these four questions. And the next phase which we're told is where all of the water management decisions will be discussed.

The question of what the boundary should be, the point I was trying to make is that from a hydrologic connectivity standpoint, and the range of effects and the degree of connectedness is very technical in nature. But making a recommendation on the boundary implicates a lot of water management decisions and to put a finer point on it. Sort of the rules for how water can move around within the jointly managed basin, have a very real and immediate impact to what that boundary should be.

Because there are areas where there is a degree of connectivity. And if water is allowed to move freely through the basin, you could potentially

accelerate impacts by taking it from somewhere that's less connected and putting it somewhere that's more connected.

So, what we were saying is, for now, we've presented the hydrologic evidence, and we think the boundaries should stay the same pending the water management decisions that will come in the next phase, presumably about how water moves among and throughout this jointly managed area.

Q. Is the jointly managed area, just the Lower White River Flow System?

A. Area that the State Engineer has drawn --

Q. Yes?

A. -- a boundary around today.

Q. Okay. You are not saying like Kane should be jointly manage with the Lower White River Flow System, if for some reason Kane doesn't say in the Lower White River Flow System?

A. Well, and that's where the scrutiny on the boundary occurs that we talked about. The boundary of the Lower White River Flow System doesn't necessarily need to encompass anything that has any degree of hydrologic connectivity. And wherever we choose to draw that line, there is the potential to negative

impacts within the basin.

So I guess my point was, prudent management would suggest that the boundary doesn't matter as much as the way the five basin area and the adjacent basins are managed.

Q. And would one the adjacent basins you're talking about be Kane?

A. Yes.

Black Mountains.

Q. And I don't know exactly who this question goes to. But, it relates to page 4.2 of Exhibit 7, SNWA Exhibit 7.

And you're talking about precipitation data from Winograd, 1998, on that page. Is that you, Mr. Burns?

ANSWERS BY MR. BURNS:

A. I'll take it. Would you point me to that.

Q. Yes, it's page 4-2. And then like the second paragraph, annual precipitation data, do you see that?

A. Yes.

Q. Okay. The next line down says winter precipitation in the Lower White River flow System is understood be dominant source of local recharge, Winograd. Do see all that?

A. I do.

Q. And then winter precipitation is defined as October through June by Winograd for the Spring Mountains in Southern Nevada, right?

A. Correct.

Q. Okay. And then later on, in the next paragraph, on the next paragraph after that, when you talk about the winter months, you've changed it to October to March, October through March as the winter season.

A. Okay.

Q. So decreased the winter precipitation, and increased the summer precipitation. Do you see that?

A. The decrease -- I'm sorry. Say again.

Q. If you go to the next paragraph?

A. Right. I'm on Division for winter season precip?

Q. Go down to the bottom, closer to the bottom?

A. Figure 42.

Q. And even above that you are defining winter months as October through March?

A. Yes.

Q. Do you agree?

So you deviated from Winograd?

A. Correct.
Q. The source that you referenced?
A. Correct.
Q. What was the reason for doing that?
A. The reason is based on these temperatures, what we -- let's see, April, it's basically what we've observed here or at least recognize the high temperatures in the previous sentence, for April through September. And I think others have used October through March. But I can't recollect who that reference was.
Q. And --
A. Rick Waddell brought it up the other day. But I don't have a reference here for it.
MS. PETERSON: Thank you.
Thank you, panel, too.
HEARING OFFICER FAIRBANK: City of North Las Vegas.
MS. URE: We have no additional questions.
HEARING OFFICER FAIRBANK: Saying no further questions. Center for Biological Diversity.
RECROSS-EXAMINATION
BY MR. DONNELLY:
Q. Thank you. Patrick Donnelly with the Center

For Biological Diversity.
Ms. Pellegrino, just to restate, would you say ICS credits are an important component of SNWA's water?
ANSWERS BY MS. PELLEGRINO:
A. Yes.
Q. Does Lake Mead's storage help insure Colorado River Compact define delivery of lower basin water?
A. I'm going to help you out because I don't want to get into the law of the river.
Q. Indeed.
Nor do I.
A. But the compact does not define delivery in the State of Nevada, the decree does.
Q. Thank you.
A. But having more water in Lake Mead keeps us out of shortage, which makes more water available to all of the lower basin water users.
Q. Thank you.
In a general sense are flows in the Colorado River based on among other factors drought?
A. Yes.
Q. Mr. Burns, in a general sense are flows in the Muddy River variable based on drought?
ANSWERS BY MR. BURNS:

A. Yes.
Q. Have we seen significant drought trends over the past 20 years spring discharge in the Muddy River?
A. I don't think so. The drought -- I think because it's a regional spring discharge, it's less sensitive to immediate changes, because of drought.
Q. Thank you.
Ms. Pellegrino, you said the water for the dace and the in water river are related, correct?
ANSWERS BY MS. PELLEGRINO:
A. Yes.
Q. Thus isn't it true the fate of the dace is tied to your ability to store Muddy River ICS flows in Lake Mead?
A. I think you've tried to ask this question twice. Our activity related to ICS has no impact on the dace.
Q. I guess I'm asking the reverse question.
Does the dace and its thriving in the Muddy River Spring area have an impact on your ability to store ICS?
A. Not tributary conservation ICS. Because that's the surface flow of the Muddy River making it to Lake Mead, which is unimpacted by the status of the dace.

It's impacted by the amount of water in the Muddy River.
Q. Which is related to the dace?
A. Correct.
Q. Okay. We can leave it at that?
A. Okay.
Q. Mr. Burns, you stated that alluvial pumping has a one-to-one relationship with river flows?
ANSWERS BY MR. BURNS:
A. That' my opinion, yes.
Q. And I believe you said carbonate is approaching one-to-one or will approach one-to-one over a long period of time?
A. I believe over a long period of time.
Q. In your questioning from City of North Las Vegas earlier, is it true that you said over time as waters levels in EH-4 carbonate system decline, I would expect a proportional decline in spring flow?
A. Yes.
Q. And as you said in my questioning earlier, declining spring flow results in a decline of river flow, correct?
A. Yes.
Q. And you also said that we have to stay above

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3.2 to maintain river flows, correct?
A. I guess by -- depends on what your datum is, what your reference point is. We want to -- if it's acceptable. If conflicts are acceptable, these impacts are acceptable, then yes. Could you repeat the question. You lost me.
Q. Yeah. I believe --
A. Lost myself.
Q. I believe earlier questioning, you stated we need to keep flows Warm Springs West at 3.2 or higher in order to maintain river flows and fulfill senior water rights on the Muddy River?
A. What I mean to say is to make sure that the senior rights are in full, we can't have depletions on the river flow. Now, if the spring flows are reduced by pumping, then by definition the river flows will be too.
Q. Okay.
A. I don't know if that helps you --
Q. I think that's what I was trying to get at.
And then so given that we're at 3.2 now, or close to I think we'll say, somewhere in the ballpark of that. I understand the daily variations and so forth. But and you say carbonate withdrawals will in

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the long term result in discharge capture. Don't we needed to probably cease carbonate withdrawals in order to insure long-term flows stay above 3.2?
A. No, I don't think we need to cease carbonate production. I think we can manage the head levels at EH-4 such that the 3.2 CFS flow can be realized over the long term as we said. And that's the 4- to 6,000-acre-feet that we think is manageable.
Q. I'm sorry, go ahead?
A. We also caveat, that with if the impacts that are existing potential future impacts that we expect, I guess, if those are addressed, then we think the 4- to 6,000-acre-feet is a manageable amount of water.
Q. So it's a manageable amount of water contingent on other actions and other activities?
A. That's correct.
Q. Have you all defined what those actions and activities are?
A. Well, we have not. But they relate to the depletions on the river.
Q. Are those actions or activities ongoing right now, or are they new things that need to happen in order to make 4- to 6000 a sustainable level?
A. I think these will be -- can you repeat the

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question?
Q. Are the actions or activities that you describe which would be necessary in to order make 4- to 6000 the sustainable level, are those happening right now or are those new things we would have to start doing?
A. I think that's the point of this hearing is to figure out what those actions are. But I think there is also an opportunity among stakeholders to potentially solve a problem.
MR. DONNELLY: Thank you.
HEARING OFFICER FAIRBANK: Georgia Pacific?
MS. HARRISON: I'm thinking about it. But Friday afternoon.
So no.
HEARING OFFICER FAIRBANK: Seeing no questions, thank you.
Nevada Cogeneration?

RECROSS-EXAMINATION
BY MR. FLANGAS:
Q. Folks. I just to clarify of just one point. Mr. Wilson asked whether the boundary of the Black Mountains area should be changed. I think after listening to Ms. Pellegrino, I'm very clear on your

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position, boundaries shouldn't be changed. But if we could clarify certainly we can understand, hydrologically, you don't believe the production wells are hydrologically connected to the Lower White River flow system that we're talking about here, is that a correct statement?
MR. TAGGART: Objection as to what production?
MR. FLANGAS: Well, I'm sorry.
BY MR. FLANGAS:
Q. The production wells in the Black Mountain area that we talked about earlier that Nevada Cogeneration owns?
A. We think that those -- I think what we're saying is that boundary's uncertain. And more work is needed to figure out if production -- we think if there is connection --
Q. Connection. I'm sorry, I didn't hear that?
A. Limited. Based on the MLR analysis.
Q. Okay.
A. But we also recognize that the boundary there is uncertain. And we don't -- we haven't investigated the possible factors that would -- that cause that is a structure, is it the completion of the well. Those are things we haven't looked at in detail. That we think

when we talked earlier about scrutinizing points of diversions and changes, those are the types of things that we would -- I would expect to want better understanding of.
Q. Okay. That's all. Thank you.
A. Thank you.
HEARING OFFICER FAIRBANK: Muddy Valley Irrigation Company.
MR. KING: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions. Bedrock.
MR. TAGGART: No additional questions?
HEARING OFFICER FAIRBANK: No additional questions.
Nevada Energy?
MS. CAVIGLIA: No additional questions.
HEARING OFFICER FAIRBANK: Seeing no additional questions, I'll open up to Division of Water Resources staff and State Engineer.

EXAMINATION
BY MS. COOPER:
Q. Christy Cooper for the record. All right. Almost over. Hang in there.

I was going over this 4- to 6,000-acre-feet of carbonate pumpage number in my head. And looking in our order, and appendix B we put this table. Groundwater pumping. Lower White River Flow System and we haven't divvied out alluvial pumping in Coyote Spring and Garnet Valley, but in 2017 there was just a little between Lower White River Flow System Basin pumping 9090 acre-feet total.
So, if you could give an estimate as from your 4- to 6,000 of carbonate, total, would you say the rest could be alluvial, or do you agree that 9,000 may be a little bit much? Give me your opinion on this total pumpage value.
ANSWERS BY MS. PELLEGRINO:
A. I think the answer that we made is what is pumped in the carbonate, because that was based on protecting the dace. So, the total amount alluvial and carbonate together that could be pumped is a conflict question. We were trying to avoid the conflict discussion. But, if the alluvium is conflicting one-to-one, you pump whatever you want in alluvium as long as you make the senior hold. Doesn't effect the dace.
Q. Okay. So, in the testimony did you guys say

that the carbonate and the alluvium pumping, both, have a one-to-one effect?
ANSWERS BY MR. BURNS:
A. The alluvial for certain. Within the year, that year.
Q. On the river, right?
A. On the river.
The carbonate system, as Warda just said, it's not one-to-one right now. But we think out in the future it will be. Because that's the only discharge in the system to capture. And we -- I guess we'll have future debates on what the outflow that could be captured but that's the other source. My opinion is that there is not a lot of -- there is not significant outflow from this system around these pumping centers. Mainly. I think mainly thinking of Garnet Valley, California Wash and across the Glendale thrust. Dr. Waddell mentioned yesterday about what he feels could be contributing to the discharge at Rogers and Blue Point. But I don't think there is much more than that, honestly.
MS. COOPER: Okay. Thank you. No more questions.
HEARING OFFICER FAIRBANK: Thank you.

EXAMINATION
BY MR. BENEDICT:
Q. Jon Benedict for the record. I've got two questions. First one, Page 20. Back on the presentation. I apologize for having to go back to that. Just want to make sure I got this.
So, residuals are equal to observed minus calculated?
ANSWERS BY MS. DRICI:
A. Yes.
Q. So it's really the difference between the blue and the orange curve, right?
A. Yes, it is.
Q. They don't look the same. I'm just curious about that. It looks like the residuals are about half of what that distance is. Is that -- am I misreading that? If you look at like 2006, it looks like maybe one foot of residual, but the difference between the two curves looks like about two?
The relationship looks good. I'm just curious about the -- I think it's reading residual is.
ANSWERS BY MR. BURNS:
A. I think it's a scale issue on the axis.
MS. DRICI: And --

A. So the elevation, on one hand, is two feet; the other, on the residuals is four feet.
Q. Oh, okay. I see.
A. Probably different case.
Q. Okay. Thank you. That clarifies that. Okay. Last question that I have is about these linear relationships. I mean at some point it seems like these relationships can't hold. You've said that, for example, in Warm Springs West, when it flows zero you wouldn't expect Muddy River to have a flow of zero?
A. Correct.
Q. I mean what's your opinion on how -- to what extent you can apply that relationship to the spring flow? Does it go down to .1 CFS or is it like in the two and three range or what is that curve look like? Is it really linear with a -- so it's like MX plus B-type linear or is it just linear over segments or how does that relationship work at different -- how do you think it works I guess at different ranges or can you apply it?
ANSWERS BY MS. DRICI:
Q. I think it's linear as long as all the springs are flowing. And I didn't include that in the report because I didn't think of it until later. But if you

plot, for example, Pederson Spring discharge versus Warm Springs West, you will see that it is linear. And that relationship between those two. Pederson Spring and the gage is similar to the relationship between Warm Springs West and the total discharge to the MRSA.
And the reason they behave that way is because they are all connected to the carbonate aquifer, which will, you know, give them the same, the same head, the same water level. Potentiometric surface goes above the springs orifices all over.
And spring discharge is proportional to the head difference, right. And because the difference in elevation in the big scheme of things, is not really that different if you looking at like the total discharge of the MRSA. You could approximate it like one average elevation, to get an idea of how much might be flowing into that area.
Q. Okay. So then I think what I'm hearing is your answer would be is it would be linear up into the point when the highest altitude spring went dry. At that point any further losses on any springs it would not be linear. Is that about right?
A. Yes, in general. But in this case, because I'm doing the correlation between Warm Springs West and the

total, so I would put the elevation at the Warm Springs West as long as we have flow there, the relationship should hold.
Q. How about for the relationship between water levels and pumping within the various basins. I mean just -- do you feel like that linear relationship has a limit with which you could apply it?
A. You mean the multiple linear regression?
Q. Yeah.
A. (Mr. Burns) A limit.
A. (Ms. Drici) I'm not sure I understand.
Q. Well, for example, one of the curves that was looked at was California Wash, and it was shown that 400-acre-feet of pumpage caused X amount of drawdown. Would 4000-acre-feet of pumpage there create 10 times as much drawdown, that would be linear relationship? Would that apply?
A. I think it should, because drawdown is proportional to pumping, right. So the greater the production from the well, the larger the drawdown.
Q. Okay. Thank you.
A. You're welcome.
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///

EXAMINATION
BY MS. BARNES:
Q. Michelle Barnes for the record.
Maybe I missed it so if I did please let me know. Were any aquifer parameters beyond connectedness considered within the evaluation?
ANSWERS BY MR. BURNS:
A. I think they are implied by that analysis. So by that I mean how they are connected is represented in the water level record and response between this well and that well. And so, whatever the properties are between those wells were represented. I'm not sure if you follow or not. But, I guess how a well responds to a stress, implicit in that response are the high draw properties. So if very tight material you have a lot of drawdown. Big change. If it's -- if it's high transmissivity, or lesser drawdown.
Q. I guess to further elaborate on that question. I understand what you are saying about inferring the properties based on the connectedness and the relationships. Do you think there is anything to be gained by considering the geology or the aquifer properties in tandem with your analysis, going beyond just your tighter empiricals maybe looking or at some

the other analyses we've seen this week combined together?
A. Well, yes. I mean our conceptual model is heavily based on what we understand about the geological framework. What these data show is how that framework influences groundwater response or one-level responses to whatever the stress is. And, for example, CSVM-5 bandied about this week versus other wells in the structural basin. So I forgot what your question was. Sorry.
Q. I think you're getting there. It was more focus is there anything to be gained by considering your analysis and interpretation, and kind of over with the geology and some those aquifer properties that were talked abut?
A. Yeah, that's, I guess, what I was going to say. So, when we look at the framework in some of which has been postulated in permeable boundaries, we receive across those boundaries a response. And so, that informs us on the character of those features in the geologic framework of whether or not they are influencing flows. So, when I looked at CSVM-1, that's the pumping well at MX-5 and the response is CSVM-2, which is across the structural block in Coyote Springs

Valley, which is across several faults we see these identical responses to open endogenous stress or natural stress. So for us the geologic framework is very basic part and fundamental part of our assessment of these conditions. But how to use that numerically, I think you need like a groundwater flow model to represent the framework in that regard. And then you can test these features of that boundary. But frankly I think the analytical data we have is pretty informative already.
MS. BARNES: Thank you.
HEARING OFFICER FAIRBANK: Okay. So we have about nine minutes left for the three and-a-half hours for cross-examination. And there is time left that was reserved by the Southern Nevada Water Authority out of their time this morning. So, I can offer up three minutes. Two to three participants who I think still have questions if they want it take it. That would be Coyote Spring Investments, Lincoln/Vidler and Center for Biological Diversity. I see a shaking of the head from Center for Biological Diversity.
Did we have any interest for an additional three minutes? CSI shaking their head no. Ms. Peterson.

MS. PETERSON: No.
HEARING OFFICER FAIRBANK: All right. Well, then let's go ahead and turn it back over to Mr. Taggert on behalf of Southern Nevada Water Authority in Las Vegas Valley water district.

REDIRECT EXAMINATION
BY MR. TAGGART:
Q. Good afternoon. Let's get this over with. All right.
Couple questions, Ms. Drici. You were asked by Ms. Pederson about using statistics with the data regarding water resource. Do you recall that?
ANSWERS BY MS. DRICI:
A. Yes, I do.
Q. And she asked you about what's been marked SNWA Exhibit 13 and that's a USGS publication that's entitled statistical methods in water resources?
A. Yes.
Q. Okay. And is it true that that document contains a chapter on the obligation of multilinear regression to water resource data?
A. Yes, it does.
Q. Okay. Does that publication also include a

discussion of using simple linear regression with hydrologic data?
A. Yes, it does.
Q. Mr. Barker, would you mind bringing up slide 39 please.
I'm sorry. That wasn't the -- I have it wrong there written down so let's just move on there.
And Mr. Burns, you were asked about the record of water levels at CSVM-4 and the transducer in that hole. Do you recall that?
ANSWERS BY MR. BURNS:
A. I recall questions on that, yes.
Q. Okay. Does the -- does the indication that -- of changing of the transducer in that hole, that information that was provided to you, does it change any of your opinions regarding the reliability of the data you relied upon at CSVM-4?
A. No, it doesn't change my conclusion, which is that that well has measured affects from the pumping at MX-4 and the data fall all, the periodic measurement, alone, can demonstrate that.
Q. Okay. A quick question about the big Muddy Springs. Can you please explain the magnitude of flow at that particular spring and whether the level of

change that you see at Warm Spring West, for instance, could turn up in the flow record for Muddy, for big Muddy Spring? You understand that my question?
A. Not really.
Q. Okay. I'm going to try again.
There's been a lot of questions about why isn't the same hydrograph showing up at the big Muddy Spring versus EH-4, right?
A. Yes.
Q. Okay. And is there anything about the -- well, I'll just say it this way. Because of the magnitude of flow at Big Muddy Spring, wouldn't it be hard to see the kind of change that we're measuring at Warm Springs West?
A. Yes, and for Pederson Springs as well. I already spoke, I think at length, about how sensitive those springs are, and how detectable responses can be at those springs. They are higher elevation, they are more sensitive. Big Muddy Spring is down on the basin floor and it has much more -- the driving force on that is much greater in proportion in relation to Pederson Springs so you might have five or six feet at Pederson Springs, you might have 80 feet or so at Big Muddy. Those are just estimates, I wouldn't say those are the

numbers, but that's what I mean by that.
Q. Okay. And could we bring up on the screen figure 5-4, please?
Okay. There's been a number of questions about this, I think, from CSI as well as someone else, I don't recall.
And the questions centered around this notion of a visual correlation.
And so I wanted to nail this down. Obviously, if you look at the red line on that bar chart and then you look the dark blue or the darkly-shaded bars that are the third set of bars up, I think that is the MRSA pumping, it looks like, you know, the red line is tracking along with those dark blue blocks. Is that the proper way to interpret that?
A. It could be. But I would just caution based on, as I said before, with the multilinear regression analysis that Warda did, we see contributions of the water level response from that pumping in the decomposed water level at EH-4.
So, and I would add, what we've measured -- so I guess this carbonate pumping could be -- let me rephrase it.
Q. Let me ask first again. It's simple. Is this

visual correlation that I heard described, I mean if you changed which pumping was just plotted on this chart to be, you know, the Coyote Springs Valley carbonate pumping was the block down at the bottom of each bar and then it would change how things looked, visually, to what's underneath the red line?
A. Yeah.
Q. And isn't that just an artifact of -- that's my question. Should you draw anything from the fact that the red line seems to track with the dark blue lines or anything other than just that's the way it looks because of how the bars are?
A. That's the way it was assembled. Now what I would say, we're better off relying on this multilinear regression because it forms of the total response measured EH-4 what contribution to the other pumping center throughout this basin, throughout the flow system is. I would put emphasis on that rather than depiction of this based on this chart.
Q. Okay.
Now, back to Ms. Drici. Could you bring up figure A-3. Thanks.
I have a quick question for you here, Ms. Drici. We've looked at this a number of times.

I just want to ask if although you've given the testimony you have about Black Mountain pumping and the decomposition of that stress at the EH-4 water level. But isn't it true that on this particular figure A-3, when pumping begins in 1996, there is a noticeable change in the decomposed PH-4 water level. That's caused by the Black Mountain pumping. It's small but there is a change in the line there, yeah?
ANSWERS BY MS. DRICI:
A. Yeah, this looks like there is a small change. But, I would same it's simply significant. It might be within the level of error so that's why I couldn't say yeah, this does not absolutely does not effect DH-4. It is uncertain.
The Black Mountain production, can I add a clarification?
Q. Yes.
A. So, earlier, I said that the production wells there were EBM-6, RBM-5 and EBP-2. Before 2015, there were two additional wells that have since been promoted to monitoring wells and those are EBM-4 and ETV-4.
Q. Okay. I have just two more questions.
One is you were asked about the table with the proportional flow analysis, and -- and I -- and the

question that came from State Engineer staff about whether the linear relationship between the Warm Springs West flow and Muddy River flow might break down at some point, right?
I guess my question is through the flows rates that are analyzed in your analysis particularly like 2.6 CFS in Warm Springs up to 3.4, do you agree that the linear relationship survives in that range?
A. Yes, it's 2.7, the lower range.
Q. Okay.
A. I think so.
Q. Okay.
A. Yes.
Q. Now, Mr. Burns, there's been some presentations regarding what I might call compartments that some parties believe they can pump from without causing impacts to others or to the Muddy River or to the Muddy River Springs.
And so my question to you is, first of all, do you think such compartments exist?
ANSWERS BY MR. BURNS:
A. They can, yes.
Q. Okay. And what would be necessary, in your opinion, for someone to prove that they can pump from

one of these compartments, if they exist, without causing harm to others or to the river or to the Moapa dace?
A. I think pumping tests on something like Order 1169, that can demonstrate that that possibility exists.
Q. And so, it would have to be at same magnitude and extent as 1169?
A. Or someone looking at the data, that would be preferable.
Q. And just for folks to remember, how large was that pumping stress from Order of 1169? And I ask you that because I would like you put in contrast to aquifer test that might be done at a well, a 72-hour aquifer test. How much bigger was this than just a simple 72-hour aquifer test?
A. Well, it depends on how you view the test, itself. If you view it as a total production from the flow system then it's on the order of ten, over 10,000-acre-feet for couple of years almost. If you are looking at a single well as part of that pumping, like MX-5, then it was about 3,000 or so acre-feet -- 3,000 or so acre-feet over those two years of the pumping test.

MR. TAGGART: All right. No further questions.
HEARING OFFICER FAIRBANK: All right. Well, thank you very much.
We will go ahead and complete today's meeting. But before we do that, actually, let's go ahead and go over a little bit for -- get ready for next week.
So, Monday morning Southern Nevada Water Authority's going to continue their presentation of biological panel then we'll do cross-examination. Then once they're completed we will go ahead and follow with the Moapa Valley Water District. And then basically our plan is within the dace where there is multiple parties scheduled in a day then we'll just go ahead and tail one another right after one another other than the one exception of the Muddy Valley Irrigation Company, who's agreed to go ahead and switch to December 3rd to go earlier or, excuse me, what year is it, what day is it? October 3rd.
We will not be moving parties between dace.
So basically, if we get done early because everybody's super efficient as we have seen as a common thread this week. Which we encourage for the following week. Then we'll just end early and we'll start with the party that's scheduled for the following day.

So, my -- I guess the long and short of it is, if you're somebody who's scheduled after an earlier party in those dace, be prepared to go before the little time slot in the matrix that was intended to kind of be a rough idea.
Otherwise, have a great weekend. We'll see everyone 8:30 on Monday morning.

(End of Proceedings.)

* * * * * * *

CERTIFICATE

STATE OF NEVADA)
)SS.
CARSON CITY)

I, Kathy Terhune, CCR 209, do hereby certify that I reported the foregoing proceedings; that the same is true and correct rough draft transcript as reflected by my original machine shorthand notes taken at said time and place.

Dated at Carson City, Nevada, this 28th day of September, 2019.

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CCR #209

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SE ROA 53418

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SE ROA 53426

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In The Matter Of:

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES DIVISION OF WATER

Vol. VI

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Capitol Reporters

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STATE OF NEVADA
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
BEFORE MICHELINE N. FAIRBANK, HEARING OFFICER

IN THE MATTER OF THE ADMINISTRATION AND MANAGEMENT OF THE LOWER WHITE RIVER FLOW SYSTEM WITHIN COYOTE SPRING VALLEY HYDROGRAPHIC BASIN (210), A PORTION OF BLACK MOUNTAINS AREA HYDROGRAPHIC BASIN (215), GARNET VALLEY HYDROGRAPHIC BASIN (216), HIDDEN VALLEY HYDROGRAPHIC BASIN (217), CALIFORNIA WASH HYDROGRAPHIC BASIN (218), AND MUDDY RIVER SPRINGS AREA (AKA UPPER MOAPA VALLEY HYDROGRAPHIC BASIN (219).
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TRANSCRIPT OF PROCEEDINGS

PUBLIC HEARING

HEARING ON ORDER 1303

VOLUME VI, A.M. SESSION
(Pages 1092-1230)
MONDAY, SEPTEMBER 30, 2019

Reported by: Michel Loomis, RPR

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CARSON CITY, NEVADA, MONDAY, SEPTEMBER 30, 2019, A.M. SESSION

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HEARING OFFICER FAIRBANK: Good morning. Welcome back.

This is the time and place set for the -- regarding the Lower White River Flow System and Order 1303 hearing in the proceedings arising out of that particular order.

And so this morning we want to go ahead and just -- we're going to have a continuation of the Southern Nevada Water Authority's presentation, and then we're going to go ahead and proceed with our next -- with the Moapa Valley Water District, and then this afternoon Lincoln County and Vidler Water Company.

Just as a quick reminder, these proceedings, again, are with respect to those four questions, and kind of that fits with regards to the solicitations of information from the State Engineer in Order 1303.

And so how I'm going to go ahead and do these this morning is Southern Nevada Water Authority has been allocated time for two hours this morning, and so they'll be given an hour for the presentation of their biologic panel, and then there will be one hour for questions of the

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participants and the State Engineer's office, then we'll go ahead and move right into the Moapa Valley Water District.

And so this week is going to be a little bit more fast pace with respect that we're going to have multiple parties on any given day, and on that particular day when we're completed with the party, then we're going to move right next into the next participant.

And so with that, we will go ahead and get started with the Southern Nevada Water Authority.

Mr. Taggart?

MR. TAGGART: Thank you.

Good morning. Paul Taggart for the Southern Nevada Water Authority and the Las Vegas Water District.

For the record, on Friday we did an errata to our Exhibit 7, and we provided a copy of that over on the stand over there. And that's Figure 6-2, page 6-7 of that document.

And so we -- we presented our hydrology experts on Friday. This morning we'll be talking to our biological resource experts.

So with that, I'm going to call our witnesses, Mr. Bob Williams and Mr. Zane Marshall and -- and ask them to be sworn.

HEARING OFFICER FAIRBANK: All right. Thank you.

And real quick before we swear the witnesses, I

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just wanted to go ahead and also introduce. So today we have a different member of our staff with us from our Las Vegas office, John Guillory, and Christi Cooper will be observing from afar this week.

And so go ahead and swear in the witnesses. Thank you.

(Panel sworn.)

MR. TAGGART: And also for the record, both witnesses have been qualified in this proceeding through our prequalification procedure that we developed.

Mr. Marshall in the area of biological resources, including conservation biology, environmental compliance, and environmental monitoring.

Mr. Williams with respect to environmental resources in the Lower White River Flow System conservation efforts to protect the Moapa Dace and ongoing compliance with the MOA and Endangered Species Act; and also both will testify about the report that they prepared.

So, I'm going to start with you, Mr. Williams. Good morning.

DIRECT EXAMINATION

ANSWERS BY MR. WILLIAMS:

A. Good morning.

Q. Could you -- could you just briefly describe for

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the State your background and experience with respect to the Endangered Species Act, compliance with that act, and also with the Moapa Dace in the Lower White River Flow System?

A. Yes. Thank you. I'd like to begin telling you about my career as it unfolded over the last four years. I started in 1979 after graduating from Brigham Young University with a degree in fisheries and aquatic ecology.

I was hired that same year by the U.S. Fish and Wildlife Service in the Salt Lake City endangered species office as their Section 7 biologist -- Section 7 fishing biologist.

I worked there for a couple of years specifically working on Section 7 consultation with the Bureau of Reclamation. I was in the process of completing the Central Utah Project, as well as operation of main stem Colorado River Project, such as Flaming Gorge, Glen Canyon Dam, and the way and Aspen and all that.

The requirements of Section 7 and the regulations that accompanied Section 7 that were finalized in 1978 required the federal agencies to fund research and to conduct or basically go through the consultation process to ensure that their actions and their funding of actions did not jeopardize the species that were occurring in the Colorado River and Duchesne River; that being the pikeminnow, humpback

chub, bonytail chub, and razorback sucker.
    I worked for the Fish and Wildlife Service in that capacity, and then transferred to the Bureau of Reclamation and was the point of -- working for the Bureau of Reclamation I became the point person in developing the Upper Colorado Recovery Implementation Program, which is a three-state and multi-federal agency program to basically continue research on the Colorado River system to better understand the needs of the species, come up with in-stream flow requirements for the species, and formalize the consultation process.
    In 1992, I moved through the bureau and became the State supervisor for the Fish and Wildlife Service in Utah.
    In that capacity, I continued to work on implementing the Endangered Species Act in Utah, completing the Washington County HCP for dessert tortoise, initiated the development of Upper Virgin River Implementation Program, and working with the State of Utah on developing conservations -- species conservation agreements under Section 6 of the act for species such as Bonneville cutthroat and leagues chub.
    In 1997, I moved from Utah, became the State supervisor here in Nevada, and I supervised an office in Reno. I supervised the National Fish Hatchery in Gardnerville --

Lahontan National Fish Hatchery in Gardnerville. That was responsible, and still is, for the recovery of Lahontan cutthroat trout.
    I had an office also in Las Vegas, and I quickly became acquainted with the issue of Moapa Dace and groundwater pumping.
    Again, as I said, I moved here in 1997. I was here in 1998 when Fish and Wildlife Service filed protests for pumping in Arrow Canyon wells, and was the supervisor in charge during the period of time from '97 to 2011, when I retired.
    During that process, I -- or during that time, I was very much engaged with the issues of the Moapa Dace Fish and Wildlife Service filing protests for Coyote Springs pumping and then working on stipulated agreements to work with parties to come up with ways to mitigate those programs and those processes.
    I was in charge when the MOA was developed. I signed the MOA for the regional manager in Sacramento, and I was responsible for developing the biological opinion. By working with staff, we completed the programmatic opinion, as well as the tiered consultations for Coyote Springs Investment and Southern Nevada Water Authority.
    Again, as I said, I retired in January of 2011.

I continued to work on endangered species implementation and compliance. I went to work for a consulting company in California, ICF International, and have my own individual company, Conservation Solutions LLC. And I have a -- I work with National Wildlife Refuge Association in that capacity, as well as a contract with Texas A&M National Resource Institute working on compliance for EOD on desert tortoise issues in Southern California.
Q. Thank you, Mr. Williams.
    So, just quickly from '97 -- 1997 to 2011, you were the head of the Fish and Wildlife Service office for Nevada, and you worked and oversaw environmental compliance, and specifically with the Endangered Species Act?
A. That's correct.
Q. Okay. Mr. Williams, could you -- I mean, Mr. Marshall, could you also describe a brief background of your experience with respect to the Moapa Dace in the Lower White River Flow System?
    ANSWERS BY MR. MARSHALL:
A. Yes. Thank you, and good morning.
    I have a master's of arts and science in biology and statistics from UNLV, which I received in 2006.
    I have 27 years of experience in my field working for the Southern Nevada Water Authority and Las Vegas Valley

Water District for the past 24 years.
    In my capacity there, I have worked as a biologist, supervising biologist, environmental manager, and department director.
    I have participated in field surveys for threatened endangered species, worked in the development of Endangered Species Act compliance programs, like the Lower Colorado River Multispecies Conservation Plan and the Clark County Multispecies Habitat Conservation Plan.
    I participated in the development of Section 7 consultation documents, which included the biological assessment and working with the Fish and Wildlife Service on the BO for the memorandum agreement and the tiered Section 7 consultation.
    I sat on the technical team that worked and developed the triggers and mitigation measures that are embedded within the memorandum of agreement and the biological opinion.
    I've also worked in a team to acquire the Warm Springs Natural Area. And since 2010, as the department director, I've overseen the staff that had worked on the biological advisory committee, which is the biological team that's embedded within MOA and BO.
    I've worked on the management of the Warm Springs

Natural Area, which my team oversees, and the overall implementation of the conservation measures that are included in the memorandum of agreement and the biological payment.
Q. Thank you. Thank you.
Did each of you also work on a report that was submitted to the State Engineer involving the Moapa Dace?
MR. WILLIAMS: Yes.
MR. MARSHALL: Yes.
BY MR. TAGGART:
Q. And did you each also work on a revolved report that was provided to the State Engineer involving that same topic.
MR. WILLIAMS: Yes.
MR. MARSHALL: Yes.
BY MR. TAGGART:
Q. Okay. And through the hearing, officer, we offered Exhibit 7, 8 and 9 into evidence. We've now presented all of our witnesses who are available for cross-examination, and those are the three reports that we submitted.
HEARING OFFICER FAIRBANK: And those reports will be admitted. And also just for purposes of clarification, Mr. Williams was proffered as an expert and without objection. He's not previously been qualified by the State Engineer, and so for the purposes of these proceedings and limited to these

proceedings he will be admitted as an expert.
MR. TAGGART: Great. Thank you.
BY MR. TAGGART:
Q. And have you also -- the two of you also provided documents as part of the record for the State Engineer to consider that support your reports?
MR. MARSHALL: Yes.
MR. WILLIAMS: Yes.
MR. TAGGART: Okay. And for the record, those documents have been identified as SNWA's Exhibit 38 through 57.
BY MR. TAGGART:
Q. Okay. Now, Mr. -- Mr. Williams, I'd like to ask you, what is the, in your view, relevance of the Moapa Dace to the State Engineer's question about the long-term annual quantity of groundwater that can be pumped in the Lower White River Flow System?
ANSWERS BY MR. WILLIAMS:
A. I think the relevance of the Moapa Dace has -- with respect to the question of the long-term annual pumping that's available, has been around a long time, as we all know, and it -- because it's a listed -- federally listed species.
And -- and actions that would cause jeopardy to the species being something considered, I think, you know,

from the beginning -- in my beginning working on the species at issue back in 1998 to today, the issue has been the same: What can we develop in the carbonate aquifer that doesn't jeopardize, you know, the continued existence of Moapa Dace.
And I have to say that I think the State Engineer's office has taken a very good and cautious approach towards that issue. You know, the Order 1169 came out of the conflict between, you know, the parties trying to say how much was available. The State Engineer at that time said, well, let's have a pump test. Let's see what's available.
You know, in 2013 after the pump test, reports were developed and, again, you know, trying to -- each party trying to express what they thought is available.
The question still stands, and it's all about protecting the endangered species while coming up with a volume.
Q. And, Mr. Williams, could you also describe in your view what the role of the Endangered Species Act is with respect to the groundwater pumping in the Lower White River Flow System?
A. Well, the Endangered Species Act being very broad in its scope and requiring, you know, federal agencies, and pretty much everybody -- I mean, the Endangered Species Act, as it was crafted, involved states, involved private

individuals, federal agencies to basically preserve sensitive endangered species.
Nobody has allowed the opportunity to take a species, that be killing it or harming it or harassing it, and "harassing" being defined as, you know, limiting habitat, if you will, you can't do that. You have to be prudent. You can't just go out and take it, take a species.
So, the Endangered Species Act, I think, has driven the processes that we're in to try to understand, you know, what can be developed in the carbonate aquifer without endangering a species, so -- without impacting the Moapa Dace and its habitat. So I think it's played, you know, a pivotal role where we are today.
Q. Now, in your experience with the Fish and Wildlife Service, were there examples of when the State Engineer of Nevada took the Endangered Species Act into account or when the Endangered Species Act affected decisions of the Nevada State Engineer?
A. Yes, and three in particular come to mind. The first was -- that I recall was in 1991 when the State Engineer protected in-stream flow rights on Summit Lake on Mahogany Creek for spawning and recreational purposes for Lahontan Cutthroat trout recovery and protection.
Another was in 1998 when the State Engineer

appropriated -- or basically granted the unappropriated rights on the Truckee River to the Pyramid Lake tribe for the protection of Lahontan cutthroat trout and cui-ui, a sucker that only -- a species -- fish species sucker that only occurs in Pyramid Lake.

The State Engineer said to do otherwise would have jeopardized -- or would have violated the Endangered Species Act.

And the third one, of course, is the Devil's Hole pupfish case, where, you know, a quantity of water has to be protected over the shelf of Devil's Hole pupfish, and that was the first Keeper versus in the United States. And it -- you know, it basically has caused groundwater irrigation development to be curtailed in the years when there's drought to maintain the Devil's Hole spawning and feeding areas for Devil's pupfish.

Q. Thank you.

Mr. Marshall, do you have anything to add to Mr. Williams' testimony regarding the relevance of the Moapa Dace to the question of the long-term annual quantity of groundwater that could be pumped in the Lower White River Flow System?

ANSWERS BY MR. MARSHALL:

A. Yes. I think it's important to understand that

the Moapa Dace depends on flows in the upper portion of the Muddy River, particularly the Pederson Unit.

And to the extent that groundwater pumping in the Lower White River Flow System has the potential to impact those flows, the State Engineer should be concerned and should take that into consideration.

I think it's also important to know that the State has been involved in the conservation and recovery actions of Moapa Dace for a very long time.

And in recent years, since we entered into the memorandum agreement, Nevada Department of Wildlife has been a key player in the actions that we implemented and sets a precedence for -- for I think the State Engineer to consider potential impacts of groundwater pumping on the Moapa Dace and its habitat.

Q. Mr. Marshall, were you present or did you hear Dr. Schwemm's testimony last week?

A. Yes, I did.

Q. And I'm going to ask you some questions briefly about the Dace itself.

Do you agree generally with his testimony regarding the Dace and the -- the biological requirements of the Dace?

A. Yes, I do. I think Dr. Schwemm did a good job in

describing the biological requirements of the Moapa Dace.

Q. Okay. I want to ask you a couple specific questions, but I'm going to put up on the screen a picture of a Moapa Dace.

Is that -- is that what we're looking at right now?

A. Yes, it is.

Q. Okay. And could you briefly, in your view, describe the Dace, and specifically the thermal or temperature requirements in water at the spring heads for this fish?

A. Right. So just physically, Dr. Schwemm mentioned that this fish gets up to approximately 120 millimeters. We're finding smaller fish in the system in recent years.

It's readily identifiable so that the data that we collect in the field through similar surveys is through visual observation of these animals. And like I said, they're distinct and easily to identify in the stream.

They are thermophilics, and they're unique, like Dr. Schwemm mentioned. They require warm water to reproduce, and that range of temperature is between 30 and 32 degrees Celsius. And so they reproduce in the upper portions of the Muddy River tributaries.

But the later life stages may use a broader range of habitat. The larger adults, they are more -- they have

more reproductive potential and will use cooler water down into the main stem.

They are restricted to habitats above the Warm Springs -- I'm sorry -- yes, the Moapa Gage. And I'll show a map in a little bit in terms of where most of the species are.

Q. All right. Let's go to that right now. I think that's Figure 3-1 in your report; is that right?

A. Yes, it is.

Q. Okay. Can you describe what is shown on that particular figure? I think Dr. Schwemm used this as well, but can you describe this figure in your view?

A. So this figure comes from the Warm Springs Natural Area's stewardship plan. And there is an error on this figure that I would like to correct.

On the scale to the left, there are temperatures that are correlating with the colors of the map. The last two temperatures should be 28 degrees Celsius and 27 degrees Celsius. So that's the scale on the far left.

And --

Q. So just to be clear, where it says 27 degrees, it should be 28 degrees, and where it says 22 degrees, it should say 27 degrees?

A. Yes, that's correct.

Q. All right.

A. We've also drawn a box around the Apcar, Pederson, Plummer and Refuge streams to indicate that this is where 95 percent of the Moapa Dace population occurs.
This is approximately one-third of the historical habitat. So it's about two miles of stream length, and the historical habitat was approximately six months.
We've also added the Moapa Gage, which you can see on the lower right-hand corner of the figure, and the Warm Springs West Gage, which is about center and lower third of the figure, which shows where that Gage is located, and it measures the combined flow of the Pederson Unit Springs.
And then the colors represent the different temperatures.
And, again, Moapa Dace breed in temperatures 32 degrees C to 32 degrees C.
Q. Can you describe the recovery goals for the Dace and the progress that's been made towards those goals?
A. So the recovery goal -- so there's a recovery plan for the aquatic species of the Muddy River. In that plan it lays out what the goals are for -- for recovery of the species.
The primary goals are to get the population of adult fish to 6,000 animals for five consecutive years to protect, maintain 75 percent of the historical habitat, and

to have five spring complexes that are providing habitat for the species, and to also remove non-native species and parasites from the system to the extent that the conservation recovery of the species are not impeded.
To date, through efforts of the Fish and Wildlife Service, Nevada Department of Wildlife, and the activities of the signatories of the memorandum of agreement, we have tripled the population from 2008 from 500 fish to 1,500 fish. And that's a total count, not an adult count. But we're on a trajectory to move towards recovery.
We have -- approximately 87 percent of the historical habitat is now in ownership by either the Fish and Wildlife Service, the Southern Nevada Water Authority, the Warm Springs Natural Area acquisition. We've done significant habitat restoration in the Plummer, Pederson, Apcar Refuge streams. And we also have dedicated flows as part of the MOA and water development and water district dedicated one CFS in the Jones Springs, which provides flow to the Apcar system.
And, finally, and probably one of the most important things that's been accomplished is the removal of the non-native species tilapia from the system, which has had a significant positive impact on the population of the Moapa Dace.
Q. Mr. Marshall, let's look at Figure 3-2 of your

report and describe what is shown there.
A. So this figure shows a history of the Moapa Dace population and the occurrence of tilapia. So tilapia were originally introduced in the system. I can't see this number. I can show it here.
So the blue line is -- is pre-tilapia, and I think that number is in the 1995-'96 time frame when tilapia were introduced. And you can see that once tilapia were introduced, the Moapa Dace population fell precipitously.
And Gary Scapatoni produced -- or published a paper in the mid-1990s found that tilapia not only competed with Moapa Dace for habitat, but they also predate Moapa Dace, or they eat them. So this is pretty obvious impact here from tilapia regarding Moapa Dace population.
They sort of stabilized and bounced around into the 2000's. And then by about 2012 through major efforts regarding the MOA and efforts of Nevada Department of Wildlife and Fish and Wildlife Service, the tilapia were removed by building fish barriers in the system, poisoning sections of the stream with -- with a pesticide called Rotenone, and then deconstructing those fish barriers to allow fish passage to occur later.
And so the effect of that was a significant increase in Moapa Dace population after 2012.

Q. And what -- in your opinion, Mr. Marshall, what is the biggest threat to the Dace now?
A. Well, over time there have been a number of significant threats to the Moapa Dace. But after the removal of tilapia from the system, the restoration of habitat today, I think, impacts to the flows in the upper streams are the major, primary threat to the existence of Moapa Dace.
Q. Again, I want to show you a picture up on the screen that's entitled "Pederson Spring." What is this showing?
A. So this is one of the five springs in the Pederson complex, and it's one of the smaller ones.
But the point of this picture is just to demonstrate that these systems are small, and that small, incremental impacts to flows and Moapa Dace habitat can have a significant long-term impact to its ability to reproduce and maintain itself in the system.
Q. Okay. And on the next page, what's there? What's that a photograph of?
A. This is one of the Plummer spring heads in the Plummer system, which is on the Refuge, and just -- just east of the Pederson system. And, again, it's to demonstrate the small size of -- of habitat that this species depends on.
Q. Okay. Now, I'm also going to show you what's

been marked as Figure 5-7 in SNWA Exhibit 7.
Do you see that document? Specifically the hydrograph for the Warm Springs West near Moapa, Nevada hydrograph?
A. Yes. And I understand that Warm Springs West is the second table from the top, the second graph from the top, and this demonstrates the flows at Warm Springs West prior to, during, and after the Order 1169 pump test.
And I think what's important here is that soon after the pump test was completed, that the flows in Warm Springs West got down to a point just above 3.2 CFS, which is one of the triggers in the memorandum of agreement. So just above that.
And then in the last few years, the flows have been bouncing around 3.3 to 3.4 CFS. So, we're close to that first trigger in the memorandum of agreement.
Q. And are you -- are you familiar with the expert reports that were submitted by CSI?
A. Yes, I am.
Q. And to the extent those reports refer to conditions for the Dace in the Muddy River at the Moapa Gage, what is your view regarding focusing on that location for addressing the condition of the fish?
A. So, the Moapa Gage, as I showed earlier, is at

the bottom end of the historical range in occurrence of Moapa Dace. It measures the combined flows of the North Fork, South Fork, Big Muddy, Apcar, Pederson, Plummer Refuge streams. And in my opinion it does not provide sufficient resolution to understand how impacts to those higher elevation springs might have on Moapa Dace population.
That's why the MOA focuses on the Warm Springs West Gage, which measures the flows of the Pederson complex where those numbers matter to Moapa Dace and its ability to reproduce in the system.
Q. Now, Mr. Marshall, I want to ask you about Table 5-1, and I've heard you talk about the Warm Springs West Gage. Can you describe how that Gage is included in this table and also what this table is showing generally?
A. Right. So there are two main components of the memorandum of agreement. One is a set of triggers that are intended to protect and maintain in-stream flows in Moapa Dace habitat, and that is this table here.
But the other component, or the conservation measures or conservation package, we'll talk about a little later.
So, as you can see here, this table shows the signatories to the memorandum of agreement. That is the parties that have water rights. And the triggers are on the

far left column, and -- and then there are the associated actions or pumping restrictions that are tied to those triggers.
Q. Now, how would you characterize the pumping restrictions? Are they voluntary, or are they mandatory?
A. These triggers and pumping restrictions were included in the programmatic biological opinion and the tiered biological opinions for SNWA, the water district, and the Moapa band of Paiutes. And because the compliance documents depend on these triggers and the protection of in-stream flows for Moapa Dace, they are mandatory.
If we didn't follow these triggers, we would be out of compliance with the Endangered Species Act.
ANSWERS BY MR. WILLIAMS:
Q. And to you, Mr. Williams, could you describe in your view what the purpose of the MOA was and who the parties to that MOA are?
A. Yes. The purpose of the memorandum of agreement that was signed by the Moapa Valley Water District, Coyote Springs Investment, Southern Nevada Water Authority, Moapa Band of Tribe as Fish and Wildlife Service was to provide a mechanism for the pump test, the 1169 Order, 1169 pump test.
The MOA was basically again the vehicle or the mechanism by which Fish and Wildlife Service could enter into

an agreement under Section 7A-1. It'd be more voluntary, but it's supposed to be contributing toward conservation of species.
So the MOA basically was a way for us to design a pump test with triggers that allow temporary take, if you will, of the Moapa Dace and habitat.
Q. And what are the key components to that memorandum of agreement?
A. Well, the key components for the MOA is really the conservation measures. And then the triggers and the pumping restrictions are actually after we identified all the conservation measures that would basically offset any impacts to the Dace.
The key to the -- one of the key conservation measures was the dedication of Jones Springs for the Apcar unit on the Refuge. It was, you know, a big part of the recovery effort for the species at that time.
There were restoration as part of the conservation measures. I know removal of, you know, non-natives' funding for recovery implementation program, that was supposed to be designed for continuing the conservation action after the pump test, with the parties, you know, working together for long-term species recovery and management of the system.

Q. And was a biological opinion completed by the Fish and Wildlife Service as part of the approval of the MOA?
A. Yes. It was primarily crafted in the Las Vegas office by staff, and I oversaw it and signed it. It was programmatic in nature; that meaning that we analyzed in the programmatic opinion the full impact of pumping 16,100 acre-feet as ordered or the existing rights.
So the programmatic nature of it allowed us to do a full analysis, look at the impacts of what the triggers would have on the species and its habitat.
From there we were able to then do what they called tiered biological opinions for Southern Nevada Water Authority. Their tiered opinion was about 9,000 acre-feet at that part of the sixteen one, and then they were able to initiate construction of the pipeline from the Coyote Springs Valley down to the Muddy River area.
The other programmatic that was done during my time as supervisor was the tiered consultation for Coyote Springs Investment that allowed them to develop their 4,100 acre-feet.
Q. So, does the MOA provide Endangered Species Act compliance for the parties to that agreement?
A. Yes.
Q. What about parties who are not -- who did not

sign the agreement? Is there ESA compliance for those parties if they affect the Dace?
A. No. Not as part of the MOA or the biological opinions that have been issued to date.
Q. Did the analysis in the biological opinion evaluate the triggers themselves?
A. Yes. From 3.2 down to 2.7.
Q. In the MOA, are the triggers flexible or are they fixed in terms of how the MOA is intended to be implemented?
A. Well, the MOA structure has fixed the triggers, but the pumping restrictions can be modified. That was the purpose of the technical review team, is to look at what was going on hydrologically, maybe even after the pump test, and then adjust the restrictions appropriately based on new information.
Q. And did the analysis in the biological opinion evaluate the 3.2 CFS flow at Warm Springs West Gage and whether that is a requirement for the Dace?
A. Yes.
BY MR. TAGGART:
Q. And to you, Mr. Marshall, was there additional modeling done after the MOA was executed to evaluate the requirement of 3.2 CFS for the Dace?

ANSWERS BY MR. MARSHALL:
A. Yes, there was.
I think it's important, though, to recognize the two modeling efforts that were done during the consultation period and then the two that were done afterwards.
So Fish and Wildlife Service contracted Otis Bay to do a head grass modeling effort to model changes in flow -- how changes in flow impact the habitat quantity. Desert Research Institute was also contracted to do a thermal load model, and so they evaluated how changes in flow impact temperatures in the system.
And then after the biological opinion was completed and as part of the funding commitments in the memorandum of agreement, the USGS was contracted to do an ecohydrologic model by Dr. Hatten, and that's the model that Dr. Schwemm mentioned.
And there was also a stochastic population model that was completed as part of that effort and done by USGS.
Those four models together create the evidence that shows that changes to flow impact habitat quantity and quality, which impacts the biological success in Moapa Dace, and it also impacts the carrying capacity of the stream.
So we have a full connection of flows to carrying capacity of the system with those four studies.

Q. And, Mr. Marshall, I'm going to read you a statement out of an Exhibit that's been provided by CSI and was drafted by Stetson Engineers, which states, "Although the interim order aims to protect existing senior rights in the public interest in endangered species, objected data linking the survival of the Moapa Dace to the flow in Pederson spring has not been provided."
Do you agree with that statement?
A. No, I don't, and because of what I just mentioned. Those four studies build that linkage from the quality -- or the quantity of flows to the success of Moapa Dace in the system.
There's also a couple decades of research that has been done by Gary Scapatoni and other researchers which have found what -- what Moapa Dace need in terms of resources, temperature of water and those type of things to support the -- and end up resulting in the recovery of Moapa Dace in the system.
Q. Mr. Marshall, in your view, was the MOA and the biological opinion that -- that was analyzed -- analyzed the MOA, was it structured to allow for a temporary reduction in flow below 3.2 or for a permit reduction of flow below 3.2?
A. So the MOA does two things. It allows for the development of 16,100 acre-feet of water rights in Coyote

Springs Valley and California Wash. It provides for the Order 1169 pump test.

And there are a couple provisions in there that are temporary, particularly to the Arrow Canyon well within its operation. And then the MOA provides for the long-term development of that 16,100 acre-feet in the associated biological opinion.

The way that the triggers are set up and the actions under those triggers, I believe that the intent of the MOA was to maintain 3.2 CFS in the system. It allows for flows to drop down to 2.7, and the tiered biological opinions allow the flows to drop to 2.78, but the intent was to get the system back to 3. 2.

Q. And, Mr. Williams, from the services perspective, do you agree with that statement?

ANSWERS BY MR. WILLIAMS:

A. Yes, I do. At the time, the MOA and the writing of the MOA and the biological opinion that facilitated the pump test was critical to the Fish and Wildlife Service at that time.

And I think that the -- the conditions below 3.2 to allow the pump test to fully -- for the parties to basically more fully understand what's available was -- was the key, along with all the mitigation of the conservation

measures that came with it.

I think the -- the intent of the MOA was to get more information to make better decisions. It was not the intent of the MOA to go on in perpetuity.

The -- the information for the -- from the pump test, in my view, should be, you know, evaluated in today's time and, you know, potentially, you know, modify the MOA.

MR. TAGGART: Thank you. Just I want to ask the hearing officer, I want to make sure I save five minutes for redirect, if I can.

HEARING OFFICER FAIRBANK: You're at 40 minutes and 20-something seconds.

MR. TAGGART: Okay. Thank you.

BY MR. TAGGART:

Q. Mr. Marshall, in your view what will happen under the MOA if flows fall below 3.2 given the current hydrologic condition with pumping?

ANSWERS BY MR. MARSHALL:

A. I'm not sure I understand the question.

Q. Well, do you have an understanding of the -- of the components of the MOA and the committees that are developed under the MOA and how those committees are supposed to react depending on triggers?

A. Okay. So, the way the MOA and the opinions are

set up, if flows go below 3.2 CFS -- and so that triggers actions by the signatories.

If, as I understand it in the analysis of the results of Order 1169, the -- the flow volumes that are included in the actions under the triggers are not sufficient in returning flows to 3.2 CFS, then the HRT is required to convene and to begin modifying those actions or making recommendations to modify those actions under the triggers, which include, potentially, additional restrictions to pumping.

The HRT, if they don't come to agreement, there's provision in the MOA that they will obtain a third party to essentially make a decision.

Through this entire process, the Fish and Wildlife Service also has the discretion to call for a reconsultation of the opinions and reevaluate those -- those pumping restriction actions that are identified under the triggers.

Q. And do the pumping restrictions apply to permanent uses of water rights?

A. Yes, they do.

Q. And, Mr. Marshall, I want to ask you, what is your recommendation to the State Engineer to protect the Moapa Dace in the long-term quantity of groundwater pumping in the

Lower White River Flow System?

ANSWERS BY MR. MARSHALL:

A. So my recommendation to the State Engineer is to protect 3.2 CFS in -- at the Warm Springs West Gage.

It's my understanding from the research that our hydrologists have done and others that a lesser volume in pumping than was contemplated in the MOA may have a greater impact on the springs.

And so my recommendation is -- like our hydrologists, is to restrict pumping in the Lower White River Flow System to 4,000 to 6,000 acre-feet per year.

And I also think additional hydrologic or pumping studies might benefit our understanding of how long-term pumping in the Lower White River Flow System could impact Moapa Dace habitat in that 3.2 CFS.

Q. And if groundwater pumping is authorized that leads to reduction below 3.2 CFS, what are your concerns about what could happen at that point?

A. So, the memorandum of agreement and the biological opinions contemplate flexibility, they require flexibility, in terms of pumping restrictions.

My concern would be permanent uses, like industrial residential uses, are established and that that flexibility is essentially taken away, where we cannot reduce pumping the impacts that flows and results in something less than 3.2 CFS at the Warm Springs West Gage and causes a significant conflict with the Endangered Species Act and the Lower White River Flow System.

ANSWERS BY MR. WILLIAMS:

Q. Mr. Williams, same question to you is what's your recommendation to the State Engineer regarding protection of the Moapa Dace and how it relates to the long-term quantity of groundwater pumping in this area?

A. Well, my recommendation would be to continue to investigate what is a long-term annual amount. I think that maintaining -- and I agree with Mr. Marshall -- that maintaining 3.2 or above avoids not only jeopardizing the Moapa Dace and adversely modifying its habitat, but you also avoid a conflict with the National Wildlife Refuge as they have a 3.5 to divert for a water right for the refuge, and they, you know, can't arbitrarily, you know, give up a water right. They have reserved that in the MOA to basically, you know, I guess challenge or, you know, ask for a determination on that refuge water right.

So, I listened to testimony last week with respect to the hydrologic analysis information. I specifically listened to Tim Mayer, who over the time -- I met Tim Mayer in 1998 when we were negotiating with Moapa Valley

Water District over Arrow Canyon, and his position has not changed.

I think that being conservative, going slowly with respect to this decision, is by far in the interests of the public and the species, not -- or not putting yourself in the situation where violating ESA would be critical to, you know, the decision.

Q. Thank you.

MR. TAGGART: We have no further questions.

HEARING OFFICER FAIRBANK: Okay. So that leaves you about 13 minutes.

MR. TAGGART: Thank you.

HEARING OFFICER FAIRBANK: And so we will go ahead and open it up for questions. And, again, similar as we did last week, we're just going to go ahead and cycle through. We have an amount of time that's allotted.

And this week we're going to be a little bit more condensed -- or a lot more condensed on our time frame, so efficiency, then, is going to be of the utmost importance.

And for today we have allotted four minutes per participant, and so we will go ahead and start with Coyote Springs Investments.

CROSS-EXAMINATION

BY MR. HERREMA:

Q. Good morning. My name is Brad Herrema, and with me is -- I thought Kent was here. Sorry.

I'm Brad Herrema. I represent CSI, and I just have a handful of questions.

BY MR. HERREMA:

Q. Mr. Williams, I believe you said you retired from U.S. Fish and Wildlife Service in 2011; is that correct?

ANSWERS BY MR. WILLIAMS:

A. That's correct.

Q. So the opinions that you've given today are not the opinions of U.S. Fish and Wildlife Service, but your own; is that correct?

A. That's correct.

Q. All right. Mr. Marshall, in regard to the 3.2 CFS and the amount of carbonate pumping in the Lower White River Flow System that would keep flows at Warm Springs West Gage above that trigger, did you do any hydrologic analysis of your own to determine that volume?

A. No. I'm not a hydrologist, so I did not do that.

Q. Okay. So you're just relying on the folks who testified on Friday for what that quantity is; is that correct?

A. Yes, that's correct.

Q. Mr. Marshall, you said that the Moapa Dace depends on flows in Pederson Springs. Do you recall saying that?

A. Yes, I do.

Q. Table A2, which is on page A3 of Appendix A to your June 2019 report, that shows the Dace counts in Reach 5 over the last 11 or 12 years.

What that shows, when I read it, is that there's been an increase in the Dace counts over the last couple years, while at the same time the water authorities hydrology panel testified last Friday that groundwater levels at EH-4 have been declining.

This seems to indicate as Dace population has increased during that period, there's been a decline at the same time in EH-4 groundwater levels.

Are there successful mitigation measures that were being used that can explain this inverse relationship?

A. I'm sorry. I'm going to need you to restate the time period that you're referencing.

Q. 2017 winter through 2019 winter, Reach 5, which is under Pederson; do you see that?

A. I do.

Q. Okay. The Dace counts have steadily increased during that period at the same time the EH-4 groundwater level was declining.

So are there mitigation measures that have been successfully implemented that can explain the fact that the Dace count has been increasing while EH-4 pumping levels have been -- or I'm sorry -- groundwater levels have been decreasing?

A. So these numbers that you're talking about -- just so that I am sure what you're saying -- winter of 2017 was 29 animals?

Q. Yes.

A. And then 32 and then 49 and then 51 and then 88.

Q. Yep, you got them.

A. Yeah. So, since 2017, I'm not aware of any specific restoration efforts, but I do know that Fish and Wildlife Service is actively doing management in terms of the removal of non-native plant species in that system from one year to the next. And I would submit that this is a relatively small variation in numbers in that specific area.

I also want to caution that comparing summer to winter numbers is not appropriate because the summer numbers include a larval animals and juveniles, where the winter animals is mostly adults.

Q. Okay.

MR. HERREMA: I think I heard my buzzer. Thank you.

HEARING OFFICER FAIRBANK: United States Fish and Wildlife Service? I'm not seeing any questions.

National Park Service?

MS. GLASGOW: No questions.

HEARING OFFICER FAIRBANK: Seeing no questions, Moapa Band of Paiute Indians?

MR. BURLEY: Thank you. For the record, I'm Richard Burley, attorney for the Moapa Band of Paiutes.

CROSS-EXAMINATION

BY MR. BURLEY:

Q. Mr. Williams, I guess and Mr. Marshall, you were both involved in helping to formulate and -- the 2006 memorandum of agreement?

MR. MARSHALL: Yes.

MR. WILLIAMS: Yes.

MR. BURLEY: And at the time it was done, you prepared -- Mr. Marshall, you were involved in preparation of the biological opinion, which indicated that the MOA was sufficiently protective of the Dace at that time; is that accurate?

MR. WILLIAMS: So I was involved in the preparation of the biological assessment, and there was a

period of time when we reviewed and commented on Fish and Wildlife Service -- the Fish and Wildlife Service biological opinion, but the final opinion was a Fish and Wildlife Service product.

MR. BURLEY: Right. Mr. Williams, this was done 13 years ago, 2006. In your opinion, is the MOA still protective of the Moapa Dace?

MR. WILLIAMS: Yes.

MR. BURLEY: Mr. Marshall, would you agree?

MR. MARSHALL: Yes, I do, as long as we maintain those flows in Pederson. The 3.2 CFS.

BY MR. BURLEY:

Q. So you view the MOA as something of a success in terms of the purposes for which this was developed?

ANSWERS BY MR. MARSHALL:

A. Yes, I do.

Q. Are you familiar with an annual process by which the mitigation measures, the pumping restrictions, are reviewed by a hydrologic review team?

A. Yes, I am.

Q. And that team includes representatives of the Fish and Wildlife Service and SNWA and the Moapa Band of Paiutes and Coyote Springs?

A. Yes.

Q. Are you aware that every year, annually, there have been no suggestions thus far to change the mitigation measures and pumping restrictions within -- by the HRT?

A. Yes, I am aware that there have been no recommendations so far. There has been significant -- a significant amount of lively discussion within that team, though, each year.

Q. Fair enough.

Are you aware that the mitigation measures, the pumping restrictions are different in -- for Coyote Springs than for California Wash?

A. Yes, I am.

Q. The proportionalities are different, just the general rates of reduction are different?

A. Yes.

Q. Do you think that was a rational choice by the MOA parties?

A. It was based on the understanding of the hydrology of the system at the time. And so, again, I'm not a hydrologist, but it does seem to be a rational approach.

Q. Do you know the status of temperature monitoring in the springs these days?

A. No. No, I don't.

Q. Do you know if there is any temperature --

ongoing temperature monitoring in the springs?
A. I'm not aware of Fish and Wildlife Services conducting temperature monitoring.
I know that SNWA is looking at installing a network of publications through the system to begin monitoring temperature.
Q. What about chemical or isotopic monitoring?
A. I'm not aware.
Q. Okay. So the only active monitoring that you know about is flow monitoring; is that -- is that fair?
A. Flow monitoring and monitoring of the Moapa Dace population.
Q. Okay. Were either of you involved in the design of the 1169 pump test?
A. I was not.
MR. BURLEY: Is that my time being up?
HEARING OFFICER FAIRBANK: That is your time, but if we have time --
MR. BURLEY: Okay.
HEARING OFFICER FAIRBANK: -- at the end, we'll circle back around. Thank you.
MR. BURLEY: No more questions. Thank you.
HEARING OFFICER FAIRBANK: Next is the Moapa Valley Water District.

MR. MORRISON: Good morning. Greg Morrison for Moapa Valley Water District.
CROSS-EXAMINATION
BY MR. MORRISON:
Q. Mr. Marshall, I just want to clarify one thing. I wasn't sure if I heard it correctly.
Did you say that the MOA was or was not intended to apply in perpetuity?
ANSWERS BY MR. MARSHALL:
A. I believe the MOA was intended for the long-term development of the 16,100 acre-feet of water rights that -- that -- that the parties that signed the MOA had identified at the time.
So, I believe it was for the test. There were elements of the MOA that were specific to the test, but I believe the MOA overall was intended for the long-term development of the -- of the -- of those water rights.
Q. All right. And you're aware of the Moapa Valley Water District's dedication of its join springs water right pursuant to the MOA?
A. Yes.
Q. Was that dedication intended in any way to be temporary or is that a permanent dedication?
A. It's a permanent dedication, and it's very

important to the conservation of Moapa Dace.
MR. MORRISON: Thanks a lot.
HEARING OFFICER FAIRBANK: Next is Lincoln County, Vidler Water Company.
CROSS-EXAMINATION
MS. PETERSON: Good morning. Karen Peterson representing Lincoln County Water District and Vidler Water Company.
BY MS. PETERSON:
Q. Mr. Williams, I had a couple questions for you. I'm showing you -- or I had provided to you Fish and Wildlife Service Exhibit 59. It's a biological opinion dated October 29th, 2008 for Kane Springs Valley.
Do you see that in front of you?
ANSWERS BY MR. WILLIAMS:
A. Yes, I do.
Q. And it was signed on page 50 by Robert D. Williams, Field Supervisor?
A. Yes.
Q. Do you see that?
A. Yes.
Q. Was that you?
A. That was me. Still is me.
Q. Okay. And do you -- sorry. Do you remember --

or if you could turn to page 37, there -- there was a statement there regarding the Dace.
Do you see that?
A. In the middle of -- in the middle of the page?
Q. Yes.
A. Yes.
Q. And it was the service's biological opinion that the action as proposed and analyzed the Kane Springs Valley Groundwater Development Project is not likely to jeopardize the continued existence of the endangered Moapa Dace.
Do you see that?
A. Yes.
Q. And then also implementation of the project's conservation action will minimize any potential impacts.
Do you agree with that?
A. Yes.
Q. And then directing your attention to the other document I provided to you, it's an amended stipulation for withdrawal of protests. It's Fish and Wildlife Service Exhibit 57 and Lincoln County-Vidler Exhibit 16.
Do you see that in front of you?
A. Yes, I see the Exhibit.
Q. Do you remember the negotiations regarding the monitoring, management, and mitigation plan for this

stipulation?
A. Yes, I do. I do remember those negotiations with Vidler and Lincoln County.
Q. And you were involved in those?
A. Yes, I was.
Q. And there's a trigger that set forth the action criteria under page 3 and 4 of Exhibit A to the amended stipulation.
Do you see that?
A. Yes.
Q. And under paragraph 2, do you see that the trigger for the -- for the flows is 3.2 CFS?
A. Yes, I believe that's correct.
Q. And then in paragraph 1 it indicates it's for flow measurements at the Warm Springs west flume.
Do you see that?
A. Yes.
Q. All right. Would you agree -- I think you had a question from your attorney that indicated that signatories to the MOU were compliant, I think -- I think -- I believe you said, with the Endangered Species Act.
Is that what you said?
A. Repeat your question, please.
Q. Did -- you indicate in response to a question

from Mr. Taggart that signatories to the MOU and on the basis of the biological opinion, that those signatories were compliant with the Endangered Species Act?
Is that what you said?
A. I think Mr. Taggart's question was asking me if parties outside of the MOU did not have Endangered Species Act compliance, and I think I said yes.
I would like to correct that statement by saying that the parties of the Kane Springs agreement and stipulation, the biological opinion, are clearly covered under ESA.
MS. PETERSON: Okay. Thank you. No further questions.
HEARING OFFICER FAIRBANK: City of North Las Vegas?
MS. URE: No questions.
HEARING OFFICER FAIRBANK: Thank you.
Seeing no questions, Center for Biological Diversity.
MR. DONNELLY: Good morning. Patrick Donnelly with the Center for Biological Diversity. I'll try to be quick here because I do have a number of questions.

CROSS-EXAMINATION
BY MR. DONNELLY:
Q. I'll start with Mr. Williams.
The definition of "Take" in Section 3 of the ESA is to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect or attempt to engage in any such conduct"; is that accurate?
ANSWERS BY MR. WILLIAMS:
A. That sounds very accurate.
Q. And regulation in 50 CFR Section 17-3 defines that harm includes habitat, modification, or degradation where it kills or injures wildlife by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering; is that accurate?
A. That's correct.
Q. Is it true that Section 9 of the ESA prohibits unpermitted take?
A. Yes.
Q. Might individuals or agencies taking action which result in unpermitted take be in violation of Section 9?
A. Yes.
Q. That you are aware of, are citizens able to file lawsuits to enforce the ESA, including Section 9, suits against entities responsible for an unauthorized take?

A. Yes.
Q. We heard testimony that carbonate pumping in the Lower White River Flow System causes spring flow declines, including on reports you were apart of from the Southern Nevada Water Authority; is that correct?
A. Yes.
Q. And spring declines cause a loss in habitat, correct?
A. Yes.
Q. And a loss in habitat can cause a loss in overall Dace numbers; is that correct?
A. Yes.
Q. Therefore, can we make the connection that carbonate pumping causes take of Moapa Dace?
A. Yes.
Q. And, thus, carbonate pumping would be a violation of Section 9 of the Endangered Species Act if it was not permitted through MOA's and other agreements?
A. If it was not permitted, that's correct.
Q. Would entities authorizing water withdrawals causing take that is not permitted take be in violation of Section 9?
A. Potentially. But I'm not an attorney, nor do I do law enforcement. I've never --

Q. Absolutely. Just asking within your capacity.
A. Within, yes, potentially they could.
Q. Thank you. I guess this will be a question for Mr. Marshall. You stated that the MOA allows for flows to get as low as 2.78; is that accurate?
ANSWERS BY MR. MARSHALL:
A. The MOA has triggers down to 2.7.
Q. Uh-huh.
A. The tiered biological opinions allow flows to get to 2.78 under the incidental take statements that are in those tiered opinions.
Q. Given what we know now, might flows as low as 2.7 have severe impacts on overall Dace numbers?
A. So that analysis was done in the biological opinions and -- and is supported by the modeling efforts that I mentioned that were done as part of the BOs and as part of the mitigation package or conservation package in the MOA, and those -- that analysis stands today.
Q. So, there would be significant impacts on Dace numbers at that pumping level?
A. So, the -- the opinions don't speak to specific numbers. They speak -- they use habitat and habitat reduction as a proxy for take and for Dace numbers.
Q. Okay.

A. And so I can't speak to what the changes in flows would specifically result in --
Q. Sure.
A. -- in the population numbers.
But changes in flows are expected to impact habitat that's important for the Dace.
Q. Does the MOA explicitly state that it applies beyond the duration of the pump test?
A. I -- off the top of my head, I do not know where the specific statement is.
Q. You're not aware of a specific statement, then?
A. I -- I am not, but I -- I -- I do understand the MOA. I mean, I was part of the development of the MOA and I understand it to apply to the long-term development of -- of the water rights that are contained or addressed in the MOA.
MR. DONNELLY: Thank you.
HEARING OFFICER FAIRBANK: Thank you.
Next, Georgia Pacific-Republic?
MS. HARRISON: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions, Nevada Cogeneration?
Seeing no questions, Muddy Valley Irrigation Company?
MR. KING: No questions.

HEARING OFFICER FAIRBANK: Seeing no questions, Bedroc?
MS. URE: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions, Nevada Energy?
MS. CAVIGLIA: Justina Caviglia on behalf of NV Energy, and I just have a quick one.
CROSS-EXAMINATION
BY MS. CAVIGLIA:
Q. Do you consider the MOA alone to be adequate enough to protect the Dace?
ANSWERS BY MR. MARSHALL:
A. Where is the question going?
Q. I'm just asking do you believe the 3. -- well, I'll rephrase it.
Do you believe the 3.2 in the MOA alone to be adequate to protect the Dace?
A. Are you talking to Bob or myself?
Q. Either one of you.
A. So the MOA is protective of the Dace as it relates to the signatories.
There are other water right holders in the Lower White River Flow System that are not signatory to the MOA, and so it is -- well, it doesn't address those other -- those

other entities, so it could potentially be insufficient in terms of protecting the Moapa Dace.
MR. WILLIAMS: Well, I guess if I could add a little bit to what Zane -- or Mr. Marshall said. The -- if you look at, I think, Section 8 of the MOA, it talks about a comprehensive type of a program amongst the parties, and I think that the intent of the MOA was for primarily the period for the pump test, but it was looking for the parties of the MOA to expand and to -- and to look outside just those parties to bring in other, you know, parties that may be impacting the Dace.
So I don't believe that MOA in and of itself, by itself, is enough to achieve recovery or protect the Dace long-term.
MS. CAVIGLIA: Thank you. That answered my question.
HEARING OFFICER FAIRBANK: I will now open it up to questions from the State Engineer Division of Water Resources staff.
Okay. We will go ahead and open it back up for the participants to ask additional questions and go ahead and offer three minutes.
And we'll start with Coyote Spring Investments.
MR. HERREMA: Thank you. Brad Herrema again for

the record.
RECROSS-EXAMINATION
BY MR. HERREMA:
Q. Mr. Marshall -- excuse me -- isn't it true that under the MOA, CSI got two restoration and recovery obligations.
Namely, under Section 3A to dedicate 460-acre-feet per year in water rights for survival on recovery of the Dace; and, number two, under Section 4E of the MOA, to pay $200,000 for restoration of a Dace habitat?
ANSWERS BY MR. MARSHALL:
A. Yes, that's true.
Q. And isn't it true that CSI has fully completed these obligations dedicated to 460 acre-feet per year in water rights in paying the $200,000?
A. Yes, that is my understanding.
Q. Figure A-1 of your June 2019 report shows a diagram of the streams and reaches that are accounted for the Moapa Dace, and you talked a few minutes ago about Reach 5, which is the upper Pederson reach.
In your opinion, is the upper Pederson stream good habitat for the Dace to spawn?
A. The upper Pederson?
Q. Yes.

A. Yes, it is.
Q. Are you aware of any impediments to that particular reach, such as the Warm Springs West Gage?
A. Yes, I am.
Q. Do you know what the drop is at that gage that causes the impediment to reach in that area?
A. No, I do not.
Q. Would 18 inches sound about right?
A. I have no idea.
Q. Are you aware whether a Dace can get through that -- that gage?
A. It's my understanding from discussions of the biological advisory committee that the Warm Springs West Gage is a barrier to upstream movement from Moapa Dace.
Q. Okay. And are there other impediments in that area, such as the outflow from a culvert under the road or fast-moving water upstream of the gage? Any other impediments to Dace reaching that spawning habitat?
A. Not that I'm aware of.
Q. In regard to the gage itself, in your opinion if flows remained constant, what would happen to the population of the Dace if the -- that gage impediment was removed or remediated?
A. Well, the -- the biological advisory committee

has had some discussion about the potential for removing that gage as in order replacing it, as -- or with another gage that would allow fish movement up into the upper Pederson.
There is potential by increasing that fish movement upstream to the upper Pederson to improve total numbers of fish in that area.
MR. HERREMA: Thank you.
HEARING OFFICER FAIRBANK: United States Fish and Wildlife Service? Seeing none.
National Park Service.
MS. GLASGOW: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions. Moapa Band of Paiutes?
MR. BURLEY: Richard Burley for the record for the Moapa Band of Paiutes.
RECROSS-EXAMINATION
BY MR. BURLEY:
Q. I think, Mr. Williams -- or maybe it was Mr. Marshall -- you made a recommendation that the State Engineer looked particularly hard at permanent uses that might affect the springs.
Do you have any similar opinion regarding temporary uses? I assume they're just -- you have just less of a concern?

ANSWERS BY MR. MARSHALL:
A. I do have less of a concern. I think the important thing is that the MOA and the opinions assume that there is some flexibility; that the pumping restrictions can be implemented to return flows back to 3.2 CFS at the Warm Springs Gage.
Q. And do you agree with that? Do you think that assumption regarding flexibility is appropriate and correct --
A. I do.
MR. BURLEY: Thank you. No further questions.
HEARING OFFICER FAIRBANK: Moapa Valley Water District?
MR. MORRISON: No.
HEARING OFFICER FAIRBANK: Seeing no questions.
Lincoln County-Vidler? Seeing no questions.
City of North Las Vegas? No questions.
Center for Biological Diversity?
MR. DONNELLY: Thank you. Patrick Donnelly, Center for Biological Diversity.
I would just offer to the State Engineer's office that I think this section is supposed to go till 10:30. It looks like there will be a little bit of extra time, and this is pretty important to why we're here, so we'd appreciate a few extra minutes after this.

RECROSS-EXAMINATION
BY MR. DONNELLY:
Q. Mr. Marshall, to the best of your knowledge, are there groundwater withdrawals from the carbonate aquifer occurring right now at parties not -- by entities not party to the MOA?
ANSWERS BY MR. MARSHALL:
A. I don't know for sure.
Q. What were the parties to the MOA?
A. The CSI, SNWA, Moapa Band of Paiutes, Fish and Wildlife Service, and Moapa Valley Water District.
Q. So there may be other users of water who are not party to the MOA?
A. There may be, but I'm not aware of the specific -- you know, to your question, I'm not aware of parties that are -- that might be or not.
Q. Okay.
A. Signatory to the MOA.
Q. At 3.2 CFS, what happens?
A. The MOA and the opinions call for the parties to convene, the HRT to convene, and to assess the -- the cause of the decline of flows in the spring.
They are -- if decline continues beyond 3.2, the parties are -- are thought to begin discussing involuntary

actions to return the flows back to 3.2.
Q. In some ways, given that all the MOA participants are in this proceeding and we're having discussions about those very topics, in some way have we commenced the 3.2 action? Not formally but in spirit?
MR. TAGGART: Objection. Calls for speculation and a legal conclusion.
HEARING OFFICER FAIRBANK: I'll sustain the question, if you want to ask the question differently.
BY MR. DONNELLY:
Q. The intent of the MOAs was to commence a discussion about the topics you just elucidated among the parties once 3.2 is reached.
Have we commenced a discussion here similar in scope to that which would have been commenced under the MOA?
MR. TAGGART: Same objection. And relevance.
MR. DONNELLY: I'll just withdraw it.
BY MR. DONNELLY:
Q. With regard to Kane Springs, Mr. Williams, would you say that the pump test provides new information now that wasn't available at the time of that biological opinion?
ANSWERS BY MR. WILLIAMS:
A. The pump tests clearly provide new information for the parties of the MOA.

The biological opinion and the stipulated agreement while -- for Kane Springs Valley was tied to the -- you know, the conditions, basically, that were going to happen, you know, after the pump test, or, you know, information from the pump test.
I don't -- I'm not a hydrologist, and I don't know if the -- the theory, if you will, the Kane Springs water could still be delivered and be counted at Warm Springs West Gage. I don't know if that -- that connection has been proven or disproven, so...
MR. DONNELLY: May I finish the question?
HEARING OFFICER FAIRBANK: We're going to go ahead and circle back around --
MR. DONNELLY: Okay.
HEARING OFFICER FAIRBANK: -- if we have additional time.
MR. DONNELLY: Thank you.
HEARING OFFICER FAIRBANK: Georgia Pacific?
MS. HARRISON: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions.
Nevada Cogeneration. Not seeing any questions.
Muddy Valley Irrigation Company.
MR. KING: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions.

Bedroc? No questions.
Nevada Energy, any additional questions? Okay. No questions.
And I'll open it up to State Engineer and Division of Water Resources staff.
EXAMINATION
MR. WILSON: Good morning, gentlemen. Tim Wilson for the record. I just have one quick question.
Is there any type of expiration date within the MOA that you're aware of?
MR. MARSHALL: No. I'm not aware of any expiration date.
MR. WILLIAMS: And I concur with him.
HEARING OFFICER FAIRBANK: Mr. Donnelly, I will give you an additional three minutes, and then we need to take a -- send it back to Las Vegas Valley Water District and Southern Nevada Water Authority and then have time for a break.
MR. DONNELLY: I appreciate your indulgence. Patrick Donnelly, for the record.
FURTHER RECROSS-EXAMINATION
BY MR. DONNELLY:
Q. I'm just going to finish that question, Mr. Williams, but in a more general sense.

In general, when substantial new information is available, does that trigger a reconsultation?
ANSWERS BY MR. WILLIAMS:
A. It's called reinitiation --
Q. Reinitiation.
A. -- consultation, but, yes, that's correct.
Q. Thank you.
This is for either of you. The term "conservation reliance species" is defined as a species that requires continuing species-specific wildlife management interventions to survive. Does that sound right, Mr. Williams?
A. Yes, I think that's correct.
Q. Do you think that the Moapa Dace is a conservation-reliant species?
A. Very much so.
Q. Would Moapa Dace numbers fall if ongoing conservation actions were terminated?
A. I would say yes to that.
Q. Is there any point at which the Moapa Dace conceivably, in your expert opinion, could be no longer a conservation-reliant species?
A. I think if it reaches -- if we attain the recovery goals, I think at that point it would become, you

know, a species that would rely on constant, you know, management or co-conservation. I think that's what, you know recovery plans are trying to --
Q. Sure.
A. -- to gather.
Q. I'm going to just ask you a straight-up question instead of a number of questions to get there since my time is short.
Is 3.2 CFS a sufficient amount of flow and habitat to meet recovery goals, in particular of 75 percent of historic habitat? Restore it to full function?
A. I think, in my opinion, maintenance and protection of 3.2 for that area, or that portion of -- for the high-elevation springs is sufficient for that area, for that -- for the Pederson Springs.
But to reach conservation goals or the recovery, it requires, you know, a broader look at where the species historically was. At least bring in, you know --
Q. So the bottom-line question is there would need to be more --
A. Yes.
Q. -- water flowing to meet your recovery goals?
A. There would be more -- yeah. Well --
Q. Throughout the system. Not at Warm Springs West,

particularly.
A. Yes. Throughout the system, yes.
Q. All right.
MR. DONNELLY: Thank you. I have no further questions.
HEARING OFFICER FAIRBANK: Thank you. So we'll go ahead and open it back up to Southern Nevada Water Authority and Las Vegas Valley Water District. And you have just shy of 13 minutes remaining.
REDIRECT EXAMINATION
BY MR. TAGGART:
Q. Okay. Again for the record, Paul Taggart for the Water Authority and the District.
Mr. Marshall, do you have your report in front of you?
A. Yes, I do.
Q. And could you turn to Figure 3-3?
MR. TAGGART: And I'm not sure, Mr. Bailey. Get that up on the screen, please.
BY MR. TAGGART:
Q. This should be a bar chart that shows fish counts over a series of years; is that right?
A. Yes.
Q. Okay. There were some questions asked regarding

the counts in a segment of Pederson between 2017 and 2019.
Could you describe, using this figure, the change in fish counts as a result of conservation activities? And specifically whether conservation can lead to benefits in fish counts in subsequent years to those activities.
A. Right. So, the figure -- the bars show different colors, and there is a table in the far right-hand corner which shows the stream reaches that are associated with those colors.
And the period of time that I would like to focus on is soon after the signing of the MOA 2006-'7 through 2015-'16.
During that period, there was significant work being done in the Pederson and Apcar stream reaches which did result in some disturbance to the stream, short-term disturbance, and -- and also there was construction of fish barriers and -- and also poisoning of certain reaches of stream to remove tilapia out of the system.
And I believe during the 2008 through 2012 time period that the amount of disturbance that was occurring related to those activities might be the cause of the drop in population numbers.
But as that restoration matured and the habitat matured in the system and we removed -- or successfully were

moving tilapia out of the system, we then saw the population rebound.
And the Apcar strain, the pink in the lower portion of each bar, is -- provides a good example of that. When there was significant restoration, there were a lot of tilapia in that stream, and by doing that restoration and removing the tilapia, we had a significant improvement in the total numbers of Moapa Dace in the system.
Q. And could those conservation efforts have assisted in fish populations between 2017 and 2019?
A. Yes.
Q. There was also some questions about the HRT meeting. I think this was from the Moapa Band and. And, Mr. Marshall, is it true that you are not part of the hydrologic review team and you did not participate in the determination at Southern Nevada Water Authority participates in with that HRT?
A. Yes, that is correct.
MR. TAGGART: Okay. And just -- just for the record, the State Engineer's files have the most recent annual determination report in it. It was filed in July of 2019. And in that document there is an appendix which is provid- -- each party can provide an appendix to the determination.
And in that appendix the water district indicated

that the annual 2019 termination does not recommend adjustments to the pumping restrictions, but recovery data collected from the State Engineer 1169 aquifer test and analysis presented in this appendix indicate the pumping restrictions may have to be adjusted in future years to maintain the corresponding trigger ranges.
BY MR. TAGGART:
Q. Mr. -- Mr. Williams, you were asked by Mr. Donnelly regarding 3.2 CFS and its relationship to recovery of the fish.
And I just wanted to clarify that the analysis of 3.2 and the biological opinion, the focus of that analysis is on whether take is occurring as opposed to whether recovery of the fish can occur; is that a fair statement?
ANSWERS BY MR. WILLIAMS:
A. Yes, I think that's a fair statement.
MR. TAGGART: And the -- the last question -- I think I'll probably ask both of you this -- but would you -- do you believe that the options that are available to the parties and to the service, if flows go below 3.2, are more restricted now than they were when the MOA was developed?
And specifically the pumping -- the ability to restrict pumping below 16,000.

ANSWERS BY MR. MARSHALL:
A. I'm sorry, Paul. I don't -- Mr. Taggart, I don't --
Q. Okay. Let me ask it a different way.
You provided testimony that when the MOA was developed, there was an understanding that it would accommodate 16,000 acre-feet of pumping; correct?
A. Yes.
Q. Okay. And you heard all the hydrologic testimony regarding reaction at the hydrologic system to the 1169 pumping test; right?
A. Yes.
Q. And I know you're not a hydrologist so I just want you to rely on what you understand their opinions to be, and specifically the SNWA hydrologist.
Does it appear that there's -- you know, that -- that there's less ability to restrict pumping than was anticipated when the parties developed the triggers in the MOA?
A. Yes, I think there's -- that our hydrologic analysis calls into question the -- the -- the volumes of allowed pumping under the triggers and whether or not those changes in pumping volumes will have the intended result of restoring flows back to 3.2 CFS at Warm Springs West.

Q. And, I mean, I guess the obvious point I'm asking about is that the MOA anticipated 16,000 acre-feet of water could be pumped and then pumping restrictions would cut back 16,000. We don't have 16,000 acre-feet of pumping now, right?
A. Right. I think it's important to know that the MOA was entered into prior to order 1169, right? And so the results of Order 1169 is what we're here, I think, partially talking about.
And so the MOA was -- you know, was based on that understanding of the aquifer and how it would respond to that pumping prior to Order 1169.
Q. And so the uncertainty of reaching 3.2 and going below it, now without those pumping restrictions, is it -- is that the type of uncertainty you're talking about trying to avoid?
A. Yes. I think particularly in the situation where the State Engineer were to approve permanent uses, there is significant uncertainty in terms of how you would mitigate impacts from those permanent, that permanent pumping to Warm Springs West to the Pederson Unit.
Q. Okay. Thank you.
Well, Mr. Williams, do you have anything to add to that?
MR. WILLIAMS: Yeah. I -- listening to your

question, I clearly believe that the results of -- and listening to the hydrology reports from the last week -- I clearly believe that the available water is much less than sixteen one in Coyote Springs that were in the carbonate.

So the analysis, and then in looking at the MOA in today's life, I think there needs to be, you know, more done to really look at how to -- you know, look at the finite amount, I think it's 4,000 to 6,000 -- how, basically, to distribute that amongst the parties.

I think a key element of the MOA was a development of the recovery implementation program, and I think that the language in the MOA around -- in Section A that talks about the collaborative, you know, development of the parties to solve problems is -- is kind of what's lacking right now.

I think that there -- you know, there clearly needs to be, you know, a 3.2 minimum to protect the Dace, and I think that, you know, it's incumbent on the State Engineer to really look hard at the numbers and the hydrology and really try to come up with a plan for assessing what's really available and distribution of that. So --

MR. TAGGART: Great. Thank you, very much.

HEARING OFFICER FAIRBANK: Is that it, Mr. Taggart?

MR. TAGGART: It is. Thank you. And that is all that we have as well.

HEARING OFFICER FAIRBANK: Thank you. And I'll go ahead and open it up lastly for any questions from Division of Water Resources staff and the State Engineer.

And just before we take a break, I wanted to go ahead and let everyone know that we have made the video recordings of these proceedings publicly available on our website.

And so if you go to this water.nv.gov, and then in our "Lower White River Flow System" tab, under the "News" tab, there's a subfolder that is Order 1303 hearing documents, and within that, there is a link to a PDF document that contains the links to the video recordings of these proceedings.

So if there's people that weren't able to observe all the dates or all the hearing proceedings thus far, they are currently available, and then we will update that when we get the additional recordings published to us.

And with that, we'll go ahead and take a break. Let's go ahead and take about a 15-minute break, and then we'll come back at 10:25. Thank you.

(Recess.)

HEARING OFFICER FAIRBANK: Okay. Let's go ahead

and go back on the record. And we will go ahead and proceed with the Moapa Valley Water District.

And Mr. Morrison, you may go ahead and proceed.

MR. MORRISON: All right. Good morning, everybody. I'm Greg Morrison. I represent the Moapa Valley Water District. With me today are Joseph Davis, general manager at the district, and Jay Lazarus, our expert witness.

As a preliminary matter that I think is very important, somebody left a really nice pen up here probably want to come back and get.

Thank you to the State Engineer and staff for allowing us this opportunity to present our testimony today.

We do want to start with a little corrective matter, and we've addressed it before, but it bears repeating.

The State Engineer Exhibit marked as NSE244, a graph representation of the triggers from the 2006 MOA is not an accurate Exhibit.

It shows that the district must cease pumping in Earl Canyon if flow levels drop below a certain threshold. In fact, that trigger only applied to the district during the pendency of the Order 1169 pump testing.

I also wanted to state that it seems to us the point of Interim Order 1303 and this hearing is to provide the State Engineer with guidance relevant to the management of the

carbonate aquifer that spans multiple basins.

And although there could be some unique characteristics within that carbonate aquifer, we do not believe that proper management of that basin in any way, shape, or form involves segmenting any of those basins into even smaller sub-basins.

With that, I would like to start our direct examination of Mr. Davis.

DIRECT EXAMINATION

BY MR. MORRISON:

Q. Will you introduce yourself for the record? State your title?
A. I'm Joseph Davis with the Moapa Valley Water District. I'm the general manager. Last name is D-A-V-I-S.
Q. How long have you been at the Moapa Valley Water District and in what capacities?
A. I've worked at Moapa Valley Water District for 35 years, 20 years in a supervisory role, and the last eight as a general manager.
Q. All right. We want to talk really briefly --

HEARING OFFICER FAIRBANK: Mr. Morrison, if I may just interrupt. I apologize. If we can go ahead and have the witnesses sworn.

And then also I'm going to Mr. Davis and Mr.

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Lazarus if you'll make sure that you speak into the microphone. There are people who are listening and observing remotely. And if you're soft-spoken or sitting too far back, it becomes difficult for those remote user or participants to hear what is being said.
(Witnesses sworn.)
MR. MORRISON: Thank you.
All right. So we're going to talk really briefly, just some basic points about the district.
I understand at least one party to this hearing has already objected to Mr. Davis's testimony as beyond the scope of the hearing, but we do believe that these points are crucial to get on the record now, and Mr. Davis's testimony should take under ten minutes.
BY MR. MORRISON:
Q. With that, if you would please go to your first slide, Slide No. 3.
A. (Complies.) This is not projecting.
Q. Mr. Davis's testimony may now take about 12 minutes.
All right. Please tell everybody what this slide shows.
A. This is the service territory for the Moapa Valley Water District. It includes the Warm Springs, Moapa,

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Moapa Band of Paiutes, Logandale, and Overton communities. We have a population of 8,500 with a service area territory of 79 square miles.
We're situated between the headwaters of the Muddy River and the Lake Mead National Recreation area.
Q. All right. Next slide, please.
You're just going to give us a brief history and water development in the area.
A. The Moapa Band of Paiutes is the oldest community in our service territory, and then the European settlements began in January of 1865, and the first recorded water supply gage was completed in May of 1865.
Q. Your next slide? We have one missing. Looks like we have one missing. That's okay. It's just where the district evolution stands today as far as service connection.
A. Currently there are 3,250 service connections serving 8,500 people in the Moapa Valley communities.
Q. All right. Give us a brief overview of the district's water rights portfolio.
A. The MX-6 is the district's oldest permitted carbonate aquifer right from 1983. In 1988 was the first Arrow Canyon permit was filed, and the last filing was done in 1992.
Proofs of beneficial use have been filed on a

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total of 3,147 acre-feet annually.
Q. All right. Now, 2006 -- if you'll go to your next slide, please -- the district entered into a series of agreements with several properties. It's dual goals of restoring and protecting Moapa Dace habitat and allowing water development for human use.
You'll tell us quickly about those agreements, starting with the 2006 MOA, which we've already discussed at length here.
A. The MOA supplied funds for conservation efforts. The district agreed to dedicate the Jones Springs water right. There was dedication of CSI groundwater and habitat restoration and the protection of in-stream flows through the Warm Springs West Gage trigger levels.
Q. All right. So the trigger levels in the 2006 MOA, do those require any action or cessation of pumping on the part of the district?
A. No. Those only apply to CSI, SNWA and Moapa Band of Paiutes.
Q. All right and 2006 MOA is still binding on all of the parties thereto; is that correct?
A. Yes.
Q. All right. Talk about the other agreements that were executed coincidentally with the 2006 MOA.

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A. The Jones Springs agreement was the dedication of the district's oldest water right from increasing water flows in the Apcar stream.
The water settlement agreement, it transferred the Las Vegas Valley Water District to the Moapa Band of Paiutes. There was withdrawal of protest. There were 70 -- or 3,700 acre-feet of -- or the acknowledgement of 3,700 acre-feet of Moapa Band of Paiutes Federal Reserve, Muddy River Water Rights, and a cap the Moapa Band of Paiutes claimed to reserve groundwater rights at 14,400 acre-feet underneath the 1980 edition.
The water settlement agreement was dedication of Las Vegas Valley Water District's 2,500 acre-feet to the Moapa Band of Paiutes in California Wash.
NVAC, Muddy River surface water rights to Moapa Band of Paiutes, and the NVWD dedication of 520 acre-feet of Muddy River rights to Moapa Band of Paiutes in the abandonment of curtailment.
Q. Your next slide. The district has taken steps to address threats to Moapa Dace habitat, hasn't it?
A. Yes. Contribution of water to provide additional direct in-stream flows to critical Moapa Dace habitat. That was equivalent to 724 acre-feet from the Jones Springs. It's the district's most single right, and it's basically a quarter

of the district's certificated water rights.
Q. Okay. To wrap it up, I want to ask you quickly about the district's legal obligations. You have a legal obligation to provide water to your customers, do you not?
A. Yes.
Q. And where does that legal obligation arise from, and what does it require of the district?
A. It arises out of the 1983 Nevada legislature when it created the district under Chapter 477, and it declared that adequate and efficient water service is vital to the economy and well-being of the Moapa Valley area and empowered the district to secure water resources necessary to serve its communities. The Moapa Valley Water community was founded on the resources of the Muddy River.
Q. All right. You have a final slide. Just wraps up your legal obligation?
A. Yeah. The district has a legal obligation to supply a reliable water resource that is beneficial to the economy and well-being of its community.
Curtailment of water resources of a district would prove detrimental to the public safety of the Moapa Valley community.
MR. MORRISON: Thank you, Mr. Davis.
We will move on to Jay Lazarus.

And thanks to everyone for the indulgence. I understand that line of questioning wasn't directly in Order 1303.
Jay, while he's loading that up -- Mr. Lazarus, while he's loading that up --
A. I was trying to make sure it was working.
Q. Would you introduce yourself for the record?
ANSWERS BY MR. LAZARUS:
A. Good morning. My name is Jay Lazarus, and I'm president and senior geohydrologist of Glorieta Geoscience.
Q. Perhaps get closer to the microphone so we can hear you.
A. No one's ever accused me of speaking softly.
My name is Jay Lazarus, L-A-Z-A-R-U-S, Like in the Bible. I am president and senior geohydrologist of Glorieta Geoscience, and I am here today presenting testimony on behalf of the Moapa Valley Water District on State Engineer Interim Order 1303.
Q. Would you just describe how long you've been doing what you do and some of your areas of expertise?
A. I've been -- well, I've been consultant to the Moapa Valley Water District since, I think, 2011. Next month -- I founded the Glorieta Geoscience in November of 1979, and next month is our 40th year in business.

Before that -- I did contract work previous to that. So I have more than 40 years' experience in the areas of geology, hydrology, geomorphology, and related fields.
Q. And you prepared, along with Mr. Davis, both the initial report and the rebuttal reports the District submitted in response to State Engineer Interim Order 1303?
A. Yes, sir.
Q. Will you quickly talk us through the process you used in creating your reports?
A. Well, from the very beginning, Mr. Davis made it very clear to me that we didn't have the kind of budget to do original work like a lot of my other colleagues have had.
And so our work was restricted to looking at and evaluating existing data and statements from the other stakeholders and evaluating their data and conclusions, and at the same time looking at the data and coming up with some of our own conclusions.
Q. And in your opinion, is that an appropriate methodology for the preparation of an expert report?
A. In this case with a limited budget, absolutely.
Q. Okay. Let us start walking through some of the conclusions from your report. Let's go to Slide 3, please. What are we looking at here?
A. So, what we've got here is the current boundary

of the 1303 super basin as proposed by the State Engineer in the Interim Order 1303. And it's a six-basin super basin, which we believe another basin should be added to it, but we can go on.
Q. Okay. Next slide, please. What do you think's wrong with the State Engineer's proposed management area?
A. It's my professional opinion that Kane Springs Valley should be included in the Lower White River Flow System connected groundwater basin and administered as such.
Q. Going to our next slide. Do all the stakeholders participating in this matter agree with the State Engineer's proposed geographic boundary?
A. No. The following entities, as we have up here on the slide, recommend the inclusion of Kane Springs Valley basin. We did the park service, fish and wildlife, Center for Biological Diversity, and Las Vegas Valley Water District, and SNWA.
CSA recognizes the hydrologic connection between Kane Springs Valley and Coyote Springs Valley. You know there's the specific reference of 4,200 acre-feet of groundwater flowing into Coyote Springs basin from Kane Springs Valley basin.
But despite that, despite CSI recognizing the hydrologic connection between Kane Springs Valley and Coyote

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Springs Valley, they did not suggest including it in the super basin.

Q. I want to circle back a little bit. I'd like your statement to be as accurate as possible.

You say SNWA, Las Vegas Valley Water District recommended addition of Kane Springs, is that true for this hearing?

A. Las Vegas Valley Water District and SNWA recommended inclusion of Kane Springs Valley in an October letter from Ms. Colby Pellegrino to Jason King and the report accompanying that letter.

So at that time in October, SNWA strongly stated that Kane Springs Valley should be included in the super basin.

Q. We didn't want to misrepresent their position today.

Go ahead.

A. And in term- -- so these next -- the bulk of these next slides has to do with geographic boundary of Lower White River Flow Systems. Multiple reports have cited differences in heads in Coyote Springs basin valley and northern Coyote Springs Valley, and wells in the southern Coyote -- CSV is a hydrologic barrier. It will flow. And we disagree with this assertion.

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Q. You don't believe that's a valid conclusion based upon the evidence.

A. That's correct.

Q. So I think this slide goes a long way towards explaining why you don't believe that's accurate. What are we looking at here?

A. We're looking at a slide of a hydraulic gradient that we calculated sort of similar to how the park service calculated it. And we're looking at the hydraulic gradient from KMW-1. KMW-1 up here at the north, down to EH-4, and from CSVM-4 to M -- to CSVM-1, which is a proxy for MX-5, and from CSVM-1 over to EH-4.

And previous experts, Andrew Burns and Rick Waddell referred to EH-4 sort of as one of the sentinel or index wells.

So what we did was calculate a groundwater gradient from these -- 1, 2 -- 3 wells to EH-4 right by the Warm Springs area, and the gradient is remarkably flat. And other folks have said there's a lot of structure and faulting and fracturing in the area.

Well, based on how flat these gradients are, the structures have no significant impact on these gradients, and we're looking at gradients of ten to minus four feet per feet.

This is an incredibly flat water table. It was

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shockingly flat to us. Okay? And we really don't see these kinds of flat gradients almost anywhere we work in the western U.S., especially in highly fractured areas.

And based on the work that other parties have done, based on what we've got here, we're seeing this flat continuous gradient from KMW-1 down to EH-4, and continuing these ten to the minus four gradients, working our way to the south, and then back east towards EH-4.

And the most -- I would say the most important thing here is the uninterrupted, continuous, exceptionally flat gradient.

Q. Now, it's not just the hydraulic gradient that shows the hydrologic connection with Kane Springs to the rest of the flow system, is it?

A. That's correct. There are other factors.

Q. All right. Let's go to your next slide.

Miss Braumiller of the Fish and Wildlife Service in her testimony expressed a need for some additional information regarding Kane Springs. You believe you've located some additional information that might help her out; is that accurate?

A. That's correct. And, Mr. Davis, could you please go back one slide? My lovely assistant Joe will go back one slide, please.

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What we're seeing here -- you know, if I remembered Ms. Braumiller's testimony correctly, she was looking for pumping test data in the vicinity of the boundary between Kane Springs Valley basin and Coyote Springs basin. And KMW-1 here was an observation well in a long-term pumping test that Lincoln-Vidler conducted adjacent to it in KPW.

Next slide, please.

So, in 2006, URS Corporation under contract to Lincoln County conducted -- drilled and tested KPW-1. They conducted a seven-day pumping test at 1,800 gallons a minute showing very highly transmissive aquifer without any limiting boundaries.

Q. Do you generally recall who signed that well completion report as both hydrologist and geologist?

A. I believe it was Mr. Red Bushner.

Q. In both capacities?

A. Yes.

Q. Okay. Let's go to your next slide. That URS well completion report, did it make any statements about the well locations in Kane Springs Valley?

A. Whoever located this well, or if Mr. Bushner located this well, they did a great job. Okay?

This well is a really high producer. It's got a specific capacity on the order of ten gallons per minute per foot, which is very acceptable for production a well, especially for municipal purposes.

You know, when we locate wells anywhere, we're always trying to find a fracture intersection because that's where the rock is theoretically more broken up and more transmissive and will transmit water generally or hopefully in higher quantities and at faster rates.

So they located -- so URS did a really great job of locating this well. And these are direct quotes from the report. The well was cited in close proximity to the Willow Springs fault and Kane Springs Wash fault zone in area of extensive tectonic activity leading to significant fracture in the carbonate-rock aquifer.

By locating the well in a highly fractured geologic terrain, the well is drilled in rocks with a secondary permeability that has been enhanced by faulting and fracturing. And like I said, they did a really great job locating this well. It's really in a great location.

Q. Let's go on to the next slide. I think you show that location.

What are we looking at here?

A. So what we're looking at here is just a cut out of the URS2006, report Figure 4, and what this shows is the Willow Spring fault, Kane Springs Valley fault, the

intersection, the location of KPW-1, which was the production well that was tested, and the location of KMW-1, which was the observation well. And for scale on here, these wells are located either 143 or 144 feet from each other.

So KMW-1 was drilled specifically as the monitoring well for KPW-1 pumping test.

Q. The information on this slide, did you alter it in any way other than to blow it up to increase the resolution?

A. No, sir.

Q. Let's go on to your next slide.

That URS report, that had a -- some seven-day pump test results described within it, didn't it?

A. It had a seven-day pumping test result.

Just for a matter of semantics, we conduct pumping tests to test the aquifer. We conduct the pump test to test the pump. So this is a seven-day pumping test to try and determine aquifer characteristics.

Q. And you pulled a couple of statements directly out of that report leading to the results of that pumping test.

A. That is correct.

Q. Talk us through them.

A. So, for the first portion of this, or paragraph,

such as it is or isn't, the KPW-1 seven-day pumping test summary was the carbonate aquifer behaves as a force media and can be analyzed as such, and we agree.

We located, drilled and completed and tested wells in fractured Bedroc environments where the fracturing was so extensive that the fractured aquifer system really behaved as an equivalent porous media. Okay? And, once again, kudos to the folks who located this well from URS.

And they also pointed out that hydraulic barriers to groundwater flow were not encountered during the seven-day aquifer test, and we agree with that.

Q. But you don't agree with everything in that report. Point out a few of the issues you found.

A. Well, actually a couple -- the major issue that we disagreed within the report was that when we assess the seven-day pumping test, we determined that a leaky confined aquifer solution, or Hantush-Jacob in this instant, isn't an appropriate method to analyze aquifer characteristics character.

Q. Mr. Lazarus, can I slow you down for one second just for our reporter's sake? Would you spell Hantush-Jacob?

A. H-A-N-T-U-S-H, hyphen, J-A-C-O-B.

Q. Thank you very much. Sorry to interrupt.

A. Okay. So, URS used a leaky confined aquifer

solution saying that there was leakage coming from the fault zone.

Well, Hantush-Jacob leaky confined solution isn't appropriate for a fracture flow fault zone like this. It's appropriate if you have a confining bed above or below your producing zone and you're getting leakage from above those confining beds, above or below.

The way to determine whether or not you really have a leaky confined aquifer situation in any type of incident is to complete a well test where you've got an upper zone, middle-producing zone, say, or a lower zone, or some combination thereof isolated from each other, and then your pumping well in your screen solely in the production zone and conduct a pumping test on that production well and observe a drawdown in any of the zones that you've done with your nested piezometer, P-I-E-Z-O-M-E-T-E-R.

And that way you can determine if there is leakage occurring from overlying beds or underlying beds into your producing zone.

So, we did a quick calculation of transmissivity, came up with a T of between 200,000 and 380,000 gallons per acre foot. Not unexpected or out of line for this kind of super highly fractured aquifer system.

An average T in between them is reasonable.

290,000 gallons per day per foot is reasonable to represent the aquifer. And a lot of the aquifers I work in, my clients would kill to have transmissivities this high. These are really high T's.
Q. Let's move on to your next slide. What is this slide? What does it show?
A. So, this slide came directly from the Figure 4.4 of the Lincoln-Vidler report. All we modified on this was blowing it up for better ease of reading and looking at the scale.
So, what we're seeing here, this stippled zone here, Lincoln-Vidler has in as the Kane Springs Wash fault zone. You can see that this Kane Springs Wash fault zone, the way they have this right here is the basin boundary -- excuse me -- between Kane Springs Valley basin and the Coyote Springs Valley basin.
This is the basin boundary. Right here in really small font you can see this is KMW-1, which was monitored during the 1169 pumping test as well as being the observation well for the KPW-1 pumping test.
Once again, you can see it's located right at the intersection of the Kane Springs fault and the Willow Springs fault.
Now, and then CSVM-4 is located right here.

Now, what this slide shows is that this fault zone knows no administrative basin boundary. Okay?
You know, the fault zone extends, if we go from southwest to northeast, you know, parallel to the strike of Kane Springs Valley itself.
This fault zone extends from the northeastern portion of Coyote Spring Valley up into Kane Spring Valley and goes right underneath the basin boundary.
So, what this shows to us is that the carbonate aquifer, which is highly transmissive -- and URS's study for Lincoln County showed no limiting boundaries during their seven-day pumping test, it shows that this fault zone, which is highly transmissive, is continuous across the basin boundary now going from northeast to southwest.
Now, coming from -- going back in the opposite direction from south to north, this portion here in Coyote Springs -- Coyote Spring basin and in Kane Spring Valley, this is a continuation of the regionally extensive, highly fractured, confined aquifer system that extends from Kane Spring Valley down to the Muddy River Spring area.
Q. All right. Thanks.
Let's go to your next slide. URS report draws some conclusions from the work it did in the well completion report, and I'd like to hear your opinion of those

conclusions.
A. Well, first of all, for a broad-blanket statement, we ago agree with the four conclusions that are on this slide, and I'll read them as quickly, but slowly enough for the court reporter to get it.
So URS concluded its evident, then, from the aquifer testing of well KPW-1 that the residual recovery data represents fault-induced, high transmissivity. We agree.
The carbonate rock aquifer behaves as a porous media similar to an alluvial aquifer system, and thereby can be analyzed as such. We agree it behaves as an equivalent force media.
Residual draw-down data demonstrate that hydraulic barriers, the groundwater flow, were not encountered during the seven-day aquifer test. We agree.
And S values are on the order of 1.9 times ten to the minus four, which we agree with, and it is a confined S. And it is also two orders of magnitude less than the S value used by Ms. Moran of Stetson when she did her simplified Theis analysis.
Ms. Moran, representing the whole area, used an undefined storage coefficient of .03, or maybe perhaps -- yep. It's a specific yield.
This is a very large, extensive, connected,

confined aquifer system that is very system to -- very sensitive to pressure changes and pressure responses within the system, as evidenced by the drawdowns at some distance from the MX-5 pumping well during that time.
So an S value -- a storage coefficient value of ten to the minus four is a much more appropriate value to use than an unconfined specific yield of ten to the minus three.
Q. Thanks. Let's go onto your next slide here. We've seen this slide a few times in different forms, but will you talk us through what this is?
A. Everybody wants to see this slide again. I know that.
Yeah. So you could probably do the testimony for me. This really is -- these are hydrographs of KMW-1, CSVM-1 and CSVM-4 before, during, and after the 1169 pumping test.
I think the salient -- the thing that we know is that we know their locations. CSVM-1 is located very close to MX-5.
And you can see its response to when MX-5 was turned on and off and there's an instantaneous response in the hydrograph during the pumping test of CSVM-1 when the water level was -- when the pump was shut off in MX-5, water level jumps up. Pump shut off, water level drops, and then it repeats itself.

Now, what we see here is that, you know, other than the, you know, 2004-2005 significant recharge event, water levels before the pumping test were fairly flat. Water levels after the pumping test were somewhat -- they recovered after the pumping test and fairly flat since. The steepest portion of the hydrograph in CSVM-1 occurred during the MX-5 pumping test.

Why do we have these other wells on here? KMW-1 located in Kane Springs Valley, fairly flat hydrograph before the pumping test, some recovery after the pumping test, and a fairly flat hydrograph afterwards. The steepest portion of the hydrograph of KMW-1 occurs during the 1169 pumping test.

CSVM-4 located at the north end of Coyote Spring Valley, fairly flat hydrograph before the pumping test, taking out the recharge event in 2004-2005, some recovery after the 1169, fairly flat hydrograph afterwards, and the steepest portion of the hydrograph occurring during the 1169 pumping test.

So we've got all three of these wells, regardless of any other stresses, are showing the steepest portion of their hydrographs during the 1169 pumping test.

Q. All right. A few of the people testifying here over the last week have suggested that a lot of these responses are directly due to climate influences.

Do you agree with that conclusion?

A. No, I do not.

Q. Why is that?

A. I think we'll get to that in the next couple slides.

Q. Okay. So let's move on.

A. So this next slide, just for ease of correlation and sort of making it easier on the eyes, is just KMW-1 and CSVM-1. CSVM-1, I say, is very close proximity to MX-5.

Once again, you can see the steepest portion of the hydrographs in KMW-1 in Coyote Springs valley located in this highly fractured, very transmissive portion of the aquifer, and CSVM-1 have the same slope -- or the steepest portion of their hydrographs are during the 1169 pumping test.

Next slide, please.

Q. Talk us through what we have here.

A. So, this one, once again for ease of visualization on this, you know, is comparing CSVM-4 to CSVM-1 hydrograph.

Once again, the highest rate of sustained drawdown in CSVM-4, you know, located in this area of highly fractured Bedroc as shown in the URS and shown in the Lincoln County report -- Lincoln-Vidler report, the highest rate of drawdown, the highest sustainment of drawdown in both of them

occurred during the 1169 pumping test. And it mimics the drawdown pattern in CSVM-1 during and after the Order 1169 pumping test.

Q. But do you see any evidence of seasonal fluctuations on these hydrographs?

A. You know, before and after the pumping test there are some seasonal fluctuations in these hydrographs, yes. And, you know, if there are any seasonal fluctuations during the pumping test, the pressure response -- the pressure response from the MX-5 pumping test throughout the highly confined aquifer system, you know, had overridden any type of climate response.

Q. Moving up. So, talk us through what we have here. This is CSVM-4 and the PDSI curves.

A. So what we have here -- and this was taken from Mr. Umstock, Umstock (phonetic) -- I don't now how to pronounce it -- from Daniel E. Stevens as part of the Lincoln County-Vidler report, you know, asserting that water level changes in CSVM-4 are solely climate driven and don't reflect pumping during the Order 1169 pumping test. We disagree with that.

You know, during 2008 to 2010, before the pumping test, you know, water levels were stable despite drought. And -- there we go. That one looks better. It contradicts

the idea that the declining water levels during the test were normalizing after 2004-2005.

And during the 1169 pumping test, you know, we had rapid drawdown in CSVM-4 despite normal or near normal Palmer Drought Severity Index climate indicators here.

So while we're seeing the PDSI rise, we're seeing the most -- you know, the first portion of the most rapid drawdown in the CSVM-4 hydrograph, and that's during the pumping test.

Q. What about since the pumping test has concluded?

A. Well, so since the pumping test has concluded, we're seeing portions of -- I think this more yellow or sort of yellowish-colored line is Region 3 and the black is Region 4, we're seeing the Palmer Drought Severity Index drop while levels in CSVM-4 are increasing, and we're seeing water levels dropping while the drought severity index was -- was showing less severe drought.

Q. So what does that data lead you to conclude?

A. There's no direct correlation between the drought index and water levels in CSVM-4, especially during the pumping test.

Q. Next slide, please?

A. So this is pretty much the same slide as the previous one except we have the hydrograph for CSVM-4 -- I'm sorry -- for KMW-1 compared to the Palmer Drought Severity Index.

Once again, the 2008 to 2010 water levels were stable despite drought, and rapid water level declines above normal or near normal occurred, despite having normal or near normal moisture conditions during the 1169 pumping test.

Q. So, this leads you to the same conclusion about the other well?

A. Yes, sir.

Q. Which was?

A. That drought cannot be identified as the single driver for water level declines in any of these wells during the 1169 pumping test.

Q. All right. I think you summed that up for us in your next slide.

A. So, once again, the title is self-explanatory. You know, the drought severity was less during the entirety of the 1169 pumping test than from 2008 to 2010, but yet the water levels declined more rapidly during any other time.

Really, I think what we have bolted here is that the drawdown observed during the 1169 pumping test cannot be explained solely by drought severity. And water levels began to recover before the drought severity lessened, and that contradicts the assertion that climate is the sole driver.

Q. Thank you. Next slide, please. We've heard a few people talk about State Engineer Ruling 5712 as support for the exclusion of Kane Springs. Does Ruling 5712, when read in it's entirely, really support that conclusion?

A. No, it does not.

MS. PETERSON: Objection. Calling for a legal conclusion.

HEARING OFFICER FAIRBANK: I'm sorry, Ms. Peterson, will you speak up? I could not hear the basis for your objection.

MS. PETERSON: The question was whether the witness agreed with what the State Engineer's opinion says and the ruling, and I don't know -- I'm objecting based on it calls for a legal conclusion. So please restate.

MR. MORRISON: I'd be happy to answer that objection.

Actually, I didn't ask for a legal conclusion. I asked if the data that was relied upon in Ruling 5712 supported the conclusions of fact within that ruling. Not any conclusions of law.

HEARING OFFICER FAIRBANK: Go ahead and answer the question to the extent you understand the question.

MR. LAZARUS: Thank you, Madam Hearing Officer.

MS. PETERSON: Actually, I do have another

objection if you're restating your question like that.

I think there needs to be a foundation laid as to what this witness knows about the evidence in that proceeding, since you and your client were not parties in that proceeding.

BY MR. MORRISON:

Q. Mr. Lazarus, have you read Ruling 5712 in its entirety?

A. I have read Ruling 5712 in its entirety and the stipulation between Lincoln County and Fish and Wildlife Service.

Q. Do you understand the facts in that ruling that the State Engineer relied upon in issuing the conclusions of fact in that ruling?

A. I believe I do.

HEARING OFFICER FAIRBANK: So we will go ahead and allow the line of questions just under the recognition that the State Engineer is the one who offered the particular ruling and understands the bases of the State Engineer's determination, and we'll take it in the weight of the evidence in light of the State Engineer's own determinations.

MR. MORRISON: That's fair.

BY MR. MORRISON:

Q. I just want to ask you what data from Ruling 5712 indicates to you that it isn't, per se, exclusion of Kane

Springs from the management area?

A. Well, you know, what I'm look at here really is the stipulation, and the stipulation is between Fish and Wildlife -- Fish and Wildlife Service and Lincoln-Vidler.

And that stipulation includes a requirement for preparation and implementation of a 3M plan using the discharge at the Warm Springs West Gage. Somewhat as the canary in the coal mine, if you may.

Now, Lincoln-Vidler agreed to trigger levels in the Muddy River Springs area being the guidance for when Lincoln-Vidler would cut back on their pumping.

So one can only infer that if Lincoln-Vidler has applications in the Kane Springs Valley and has agreed to subjecting their pumping to limits based on spring discharge -- or lowering of spring discharges in the Muddy River Springs area, one can only infer that Kane Springs Valley is hydrologically connected to the Muddy River Springs area, or otherwise why would a prudent individual or a prudent group agree to limit their pumping based on impacts to spring flow in the Muddy River Springs area?

And they agreed to the following trigger levels, which I think might have been discussed earlier and we don't have to go through all of them, but I think everyone is familiar with these, and we'll take a minute or so for -- to

make sure the people have read this and see what the numbers are.
Q. Let's move on. This is all going to be on the record.
So, you wanted to quickly summarize your conclusion on Kane Springs. Did you find someone else who summed it up real nicely for you?
A. Actually, I really have to thank Colby Pellegrino because I couldn't have written this better. I wished I would have written it like this. Okay? But Colby won't read it for me, so I guess I will.
So, in her October 23rd, 2018 letter to Jason King, which was a letter of transmittal for a SNWA assessment of aquifer conditions in the Lower White River Flow System, page 1, conclusion from SNWA's letter to Jason, was that Kane Springs Valley should be included as part of the LWRFS administrative unit because the carbonate aquifer extends beneath the basin, recharged derived local within the basin flows in the Coyote Springs Valley, and responses to natural and anthropogenic stresses observed in monitor wells located in northern Coyote Spring Valley, parentheses CSVM-4, end paren, and southwest Kane Springs Valley, parentheses KMW-1, end paren, indicate there is hydraulic continuity within the aquifer system between this area and production wells in

southern Coyote Spring Valley.
And the Moapa Valley Water District agrees with this statement from SNWA.
Q. Let's go on to your next slide. So what are we looking at here?
A. So, what we're looking at really is the summation of my testimony regarding the geographic boundary of the Lower White River Flow System, and the water district proposes, and we believe we have sound science to back it up, that Kane Spring Valley basin should be included as part of a seven-basin super basin and be part of the administrative basin regulated by the Department of Water Resources State Engineer.
Q. So just because there's a little bit of confusion in at least one rebuttal report, how many basins are within the management area that we're proposing?
A. We're proposing a seven-basin management area.
Q. That wasn't a typo?
A. That wasn't a typo.
Q. Okay. Let's move on to the next topic the State Engineer asked for information on, and that would be the 1169 aquifer test and recovery.
What does the data you've reviewed tell you about Order 1169 pumping tests and the recovery of the aquifer since

the conclusion of that testing?
A. You know, the water levels and spring discharge, you know, have remained fairly constant since the cessation of the 1169 pumping, but the water levels and spring discharge haven't recovered the pre-1169 water levels or levels of -- or discharge -- or discharge.
It's possible, and we're not saying -- we're not putting probability on it, but it's possible that the carbonate aquifer system is reaching somewhat of a steady state condition at current pumping rates, but additional data are required to verify this conclusion.
Q. And your next slide kind of indicates where you -- what you relied upon to reach that conclusion.
A. So what we looked at was the discharge from the Pederson -- or Pederson -- and Pederson East Springs.
You know, we can -- we can see here that, you know, somewhat sort of flat discharge between .2 and .3 CFS at Pederson, and then bouncing around .2 at Pederson East.
Before the pumping test, we do see some seasonal fluctuations in these hydrographs, but -- and then after the pumping -- cessation of the pumping test, fairly flat hydrograph in Pederson, fairly flat hydrograph in Pederson East with seasonal fluctuations.
And -- but both of these springs showing the

steepest water level declines in their hydrographs during the 1169 pumping test.
Q. Okay. So the next slide, the data you've reviewed tells you that the State Engineer's current understanding of post-1169 recovery is pretty accurate?
A. Yes. We agree with the statements that the State Engineers made in the Interim Order 1303.
Q. Please go through those statements briefly.
A. Okay. Moapa Valley Water District agrees with DWR IO 1303, parentheses, P10, end paren, quote, the current amount of pumping corresponds to a period of time in which spring flows have remained relatively stable and have not demonstrated a continuing decline.
Although water levels and spring discharge have remained fairly constant since the cessation of the Order 1169 pumping test, water levels and spring discharges have not recovered the pre-1169 test levels or discharges.
Q. Next slide. We can move on.
A. So we're discussing here the annual groundwater that may be pumped in relationship between pumping location discharge, the MRS, and capture the Muddy River flow.
We concur with SNWA and Dr. Johnson that the alluvial wells are in direct hydrologic communication with the Muddy River and directly capture Muddy River flows.

We also believe that additional carbonate pumping in excess of current diversions in the Lower White River Flow System will accelerate spring depletions.
Q. Okay. Next slide. What conclusions did you reach about the State Engineer's fourth question posed in Interim Order 1303?
A. Regarding movement between alluvial and carbonate wells. I think all the parties in the room agree that carbonate aquifer discharge provides Moapa -- provides water for Moapa Dace habitat. Alluvial pumping does not affect Muddy River's spring discharge which is discharging from the carbonate aquifer.
We believe that -- it's our professional opinion that transfer of alluvial rights to the carbonate aquifer will increase and accelerate spring depletions.
Our opinion is that pumping from a carbonate aquifer in greater than current volumes will increase and accelerate spring depletions, and the transfer of carbonate water rights to the alluvial aquifer will reduce flows in the Muddy River.
Q. All right. So we're going to move on to the fifth question the State Engineer posed, which is somewhat of a catch-all on the information relevant to the previous questions.

And you were offered as a witness on water rights, so as an expert on water rights, what other information do you think the State Engineer needs to properly analyze Lower White River Flow System?
A. Well, I think it's really important that the State Engineer and the other parties and stakeholders to this hearing recognize that the district has spent many dozens of years doing water resource planning and acquiring and developing water rights to provide for the health, safety, and welfare of the customers it serves within the district boundaries that Mr. Davis showed, and in responding to enabling legislation that Mr. Davis referred to.
And we also agree and appreciate that the State Engineer in Interim Order 1303 recognizes that we need a reasonable -- reasonably certain supply of water for future pertinent uses without jeopardizing economies, and we are the economy in the area right now in the communities we serve, and the State Engineer IO 1303 recognizes that we need to protect the health and safety of those who rely on that water supply.
Q. Below that you've cited a law that authorizes a mechanism. I don't think we need to discuss it at length. I think the slide speaks for itself. So we can go to the next slide.
A. So, as part of the over -- overall water resource

planning that the district has conducted, we did their 50-year water resource plan, it's all having to do with acquisition of water rights and maintaining those water rights and making sure that they've been put to beneficial use.
So ruling 6259 and 6261 were denied, and they caused the district to seek alternative sources to accommodate the growth scenarios from the integrated water resource plan.
And then curtailment of district's water rights will not only have an effect on the non-Indian communities that Mr. Davis pointed out in his slideshow in the district service area, but curtailment of the water rights will have an adverse effect on the Moapa Band of Paiutes, which in addition to the non-Indians, we have a legal obligation to serve and provide water to.
Q. All right. The next slide is one more thing that you believe the State Engineer needs to know?
A. Yeah. I think, you know, we can't stress enough how much the district has sacrificed to help maintain habitat for the Moapa Dace.
So, you know, in the 2006 MOA, you know, and this was described -- and I forget if it was Mr. Marshall or Mr. Williams who was saying MOA's in perpetuity. You know, that we've dedicated 724 acre-feet, or 1 CFS, 25 percent of our district's water use, for Moapa Dace habitat protection and

enhancement.
And that's a really big deal to the district. It's 25 percent of our water supply. It's our senior right. Infrastructure is already in place to divert it, and the district took a big hit with that. Okay?
You know, and it's our professional opinion and the district's stance that dedication of the pipeline, Jones 1 CFS for base habitat, mitigated any effects we have to Dace habitat 13 years ago, and we have met any obligations to protect the Dace habitat and the senior water rights.
Q. Let's go to our next slide. You talk about what the district needs are in order to comply with its statutory mandate to provide water. Can you talk us through those needs?
A. Right. Yes. And so, you know, the district needs to have a sustainable water supply to provide for the health, safety and well-being of our customers.
Well, you know, right now the district is pumping from the Arrow Canyon wells. We need redundancy in the system. We need additional points of diversion if Arrow Canyon for any reason goes down, or both Arrow Canyon well goes down.
One of my clients in the last couple weeks lost a lot of their main producing wells to a lightning strike, you

know, and we're very sensitive to all of our water suppliers needing redundancy and backup in their systems.

So additional wells are needed as part of the district's long-term plans. You know, we need to protect the communities we serve, you know.

We believe that -- you know, it's really important as we -- outcome of this hearing and the ruling and -- ruling and final order that comes out of this is that, you know, municipal -- current -- current municipal uses of water should be preferred use and most protected and highest use of water in seven-basin flow systems, seven-basin administrative system, recognition of municipal water that's been currently put to beneficial use.

The district requests 6,791 acre-feet for municipal and related uses. Preferred use designation is as we talked about.

And we don't know exactly what this looks -- this last bullet looks like, but we do need and want support for transfers of carbonate water rights from Arrow Canyon to other basins not in the Lower White River Flow System as currently defined.

Q. Okay. So we're getting pretty close to our one-hour limit, so can you briefly talk us through your last few slides, which are just a summation of your conclusions?

A. You know, our conclusions, the hydraulic gradient of ten to minus four feet per feet is effectively flat and is continuous from Coyote Springs Valley to Muddy Springs, Big Muddy Springs area.

KMW-1, CSVM-4 responded to the 1169 pumping test, as well as springs in the Muddy River Springs area responded to 1169 pumping test.

Lincoln-Vidler is willing to curtail Kane Springs Valley carbonate pumping if trigger levels are met or exceeded in the Warm Springs West Gage in the Muddy River Springs area.

Residual drawdown collected during Lincoln-Vidler's KP1 pumping test demonstrate hydraulic barriers to groundwater flows were not encountered during the seven-day pumping aquifer testing.

Water levels and spring discharges have remained fairly constant since the end of the pumping test but have not recovered to pretest discharges of water levels.

You know, additional data required to verify what state or steady state condition that the carbonate aquifer may be reaching.

Alluvial wells are in the direct hydrologic communication with the Muddy River and directly capture Muddy River flows.

And Muddy River spring area spring flows may

increase or accelerate, which would cause adverse impacts to today's habitat as a result of transfer of alluvial water rights to the carbonate aquifer or pumping from carbonate aquifer wells involving use greater than currently being pumped.

Q. We wanted to leave with a couple of recommendations and then we'll turn it over to cross.

So --

A. This is our last slide. So, we recommend that the Kane Springs Valley basin should be included in the super basin to form a seven-basin administrative area.

Existing municipal use should be designated as the most protected and highest use of water in the seven-basin administrative area.

Carbonate pumping should not exceed current rates of diversion.

The State Engineer should recognize water put to beneficial use by the district from its wells and springs and grant the district the right to divert 6,791 acre-feet of water per year.

MR. MORRISON: Thank you. That ends my direct testimony.

HEARING OFFICER FAIRBANK: Thank you. So we'll go ahead and open up to cross-examination. And based upon our

calculations, we have -- we'll go ahead and start out with seven minutes for each of the participants for cross-examination.

MR. MORRISON: Madam Hearing Officer, before we start cross, I neglected to offer our reports into evidence, so if I may please offer those.

HEARING OFFICER FAIRBANK: Mr. Morrison has offered his exhibits -- his expert reports into evidence, and those reports will be so admitted.

MR. MORRISON: Thank you.

HEARING OFFICER FAIRBANK: Okay. Coyote Spring Investment?

CROSS-EXAMINATION

BY MR. HERREMA:

Q. Thank you. Brad Herrema for Coyote Spring Investment.

Good morning, Mr. Lazarus and Mr. Davis.

Mr. Lazarus, you testified that faults don't cause any impact to the occurrence and movement of groundwater in the Lower White River Flow System based on relatively flat water levels; is that correct?

ANSWERS BY MR. LAZARUS:

A. I believe I stated that faults do not change the very flat ten to minus four gradient.

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Q. Do changes in groundwater levels indicate the presence of faults?
A. Changes in groundwater elevations just indicate a change in potentiometric head from higher to lower potentiometric head.
Q. So can water levels themselves be used to identify faults?
A. Water levels would be something one would consider to identify if faults were or were not present.
Q. Can water levels by themselves to be used to identify faults?
A. It all depends how far the water is to a fault. The faults that we have here and the series of faults that I believe Mr. -- that Mr. Reich -- I don't know if it's Dr. Reich, Mr. -- Steve --
Let's make it clear. You know, everyone -- a lot of people have been talking about faults as barriers to flow.
Q. And I just have a very simple --
A. Let me just please finish. We don't have -- these faults, we don't have a 30-foot-wide drought curtain going down to 3,000 feet where there's a barrier-to-groundwater flow. Okay?
All the places where faults have been mapped or inferred are showing that the water is being transmitted

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across the structures.
I believe it was Rick Waddell said that the faults are transmissive enough to transmit heat flow, and Andrew Burns said that the faults are transmitting both anthropogenic and natural changes in the aquifer system across the faults themselves.
Q. Okay. My question was, can water levels by themselves be used to identify faults?
A. And as I said before --
Q. -- you have -- the question --
A. -- it depends on the location of the wells relative to the faults.
Q. Okay. In reviewing the work that was done on behalf of CSI, did you realize that CSI's expert, Ms. Moran, provided a comparative analysis of impacts to an observation point based on pumping in one well compared to pumping in another well?
A. I believe so.
Q. If she had used a lower storativity value, what would have been the results of that analysis?
A. The drawdown would have been greater than she had shown.
Q. Okay. Were you aware of the values of storativity used in the tetradic model?

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A. I don't remember those. I haven't looked at it in a long time.
Q. If I told you that the 2012 report indicated specific storage was E to the minus five expressed in terms of one divided by number of feet, would that sound right to you?
A. You refer to specific storage, and I was talking about a storage coefficient and specific yield. Those are two different numbers and two different calculations.
Specific storage, I believe, is a storage coefficient provided by the thickness of the aquifer, but I would have to check my reference on that.
Q. Okay. Would you agree that if the aquifer was assumed to be a thousand feet, the storage value would be .01 or H to the minus two?
A. I don't understand the question.
Q. Okay. In regard to the Pederson Spring water level data, did you try to determine the impact of Arrow Canyon pumping as opposed to pumping from other carbonate wells in the Lower White River Flow System?
A. No, I did not.
Q. Turning to page 2 of your July 1, 2019, report, right under "Post-Testing water level recovery," there's a statement there. It says: "NVWD agrees with DWR statement in Interim Order 1303 that the current amount of pumping

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corresponds to a period of time in which spring flows have remained relatively stable and have not demonstrated a continuing decline."
Did you do any independent analysis in preparation of your report?
A. No.
Q. So what was the basis for your agreement?
A. Well, I'll rephrase that. This com- -- we prepare an annual report for the hydrology review team.
So all of the hydrographs for Pederson and Pederson East were something that we've been preparing and looking at for several years now.
Q. Page 4 of your report, the first paragraph under heading C: "Moapa Valley Water District agrees with DWR statement in Interim Order 1303." Do you see that paragraph?
A. Yes, sir.
Q. What additional data is required to determine whether the system is in a steady state?
A. Can I have an unlimited budget?
You know, many more years of measuring water levels, spring discharges, pump- -- pumping. You know, really -- and I think Ms. Braumiller referred to it earlier, you know, you really want to look at long-term pumping in different portions of the super basin where wells, some are,

and where wells, you know, could be drilled.
You know, for instance, in the stipulation that was attached Ruling 5712, you know, there was a technical review team that was supposed to have been formed there and two wells were supposed to have been drilled.
One well, I think it was substituted. SNWA substituted. I forget which well it was. But the second well, as part of that stipulation, wasn't drilled, and that's the kind of information that we'd like to see. That would be more additional data.
MR. HERREMA: Did I use my time up?
HEARING OFFICER FAIRBANK: Yes. That was your timer.
MR. HERREMA: Thank you.
HEARING OFFICER FAIRBANK: Thank you.
Next we'll go to Fish and Wildlife Service.
MS. BRAUMILLER: We don't have a solicitor here today, otherwise we have two questions.
HEARING OFFICER FAIRBANK: Okay. So then we'll -- as counsel's not here, we'll move to National Park Service and then Moapa Band of Paiute.
MR. BURLEY: Rich Burley, for the record, for the Tribe.

CROSS-EXAMINATION
BY MR. BURLEY:
Q. Mr. Lazarus, do you believe that all of the carbonate flow that is being taken out of pumps comes out at the Muddy Springs area?
A. I don't understand the question.
Q. Do you think there's any water from the carbonate aquifer that bypasses the Muddy Springs complex?
A. Based on previous investigations, and I haven't verified any of these numbers, but, yes.
Q. Where do you think it goes if it doesn't go to the springs?
A. South.
Q. South towards Lake Mead? Towards Las Vegas?
A. I can't really break those. I haven't looked at it.
Q. Okay. Do you have a sense of how much water we might be talking about within the carbonate aquifer that might bypass the springs?
A. I would have to go back and look at some of the State Engineer numbers, or numbers from SNWA. I'm going to say -- and I want to qualify this by saying I have to check the reference -- specific reference, but possibly as much as 9,000 acre-feet, in that ball park, but I have to check the

specific reference.
Q. Do you think the 9,000 acre-feet goes to the Muddy River or does it bypass -- is there any water that bypasses the river and the springs?
A. I don't know.
Q. Ordinarily do you think it makes sense to move well withdrawals further from a sensitive area if you wanted to do less direct harm to the sensitive area? As a general matter.
A. I was going to say "ordinarily" doesn't describe all the different kinds of aquifer systems I would do it in. So, it may just slow down the time that it takes for the impacts to hit the sensitive area.
Q. You pointed out looking northward that things were relatively non-heterogeneous, I guess, if you want to talk about gradients between Kane Springs through Coyote Springs and then down to the Muddy Springs complex.
Do you see any relevant heterogeneity anywhere within the super basin, or do you think it makes sense to treat the super basin as somewhat analogous to just a bathtub where it really doesn't matter where you take water out of?
A. You have heterogeneities in the system that have been discussed. Previous testimony have to do with structural geologic features.

I think what's been overlooked in this hearing in terms of heterogeneities in this really regionally expensive hunk of aquifer system is you've got K flow in certain areas, and you have Karst flow.
And the Karst flow is so important that the park service hired a guy name Gary Carson to come to this hearing. So we -- we've got all sorts of heterogeneities that move water around within the limestone aquifer, the regional carbonate aquifer.
Q. Okay. If there were carbonate water available within the super basin that had bypassed the springs and that does bypass the river, would that be water that you think could be safely withdrawn?
A. I'd have to look to see what the results were of aquifer tests in those areas and then draw conclusions based on that.
Q. When you talk about that it wouldn't help to move alluvial pumping to ground- -- to the carbonate or carbonate pumping to the alluvium, those are fairly general statements and kind of ignore some of these heterogeneity questions that we're talking about. Isn't this true?
A. The gradients that we calculated from KMW-1 to EH-4 and the other gradients are very flat. Whatever heterogeneities might be there aren't affecting the

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groundwater gradient in these areas.
Q. So you were focused on the particular issues relating to Kane Springs and whether it should be included in the super basin when you made those recommendations and came to those conclusions.
Is that fair?
A. Our focus was on Kane Springs, yes.
Q. So you might have a different focus if the question was whether moving an alluvial right that's very close to Muddy Springs to a carbonate right in a far portion of California Wash, just as an example, would you have to look at the specific questions that might come into play before reaching a conclusion along those lines?
A. No.
Q. Why not?
A. You know, as I stated in my direct, any increase in carbonate pumping will result in increased depletions on the Muddy River Springs area.
So it's a matter of location of your pumping center, and then what you are doing is just something becomes -- the magnitude and the timing of the effects are specifically guided or -- magnitude and timing of the effects is based on the distance from the Muddy River Spring area that a new carbonate well would be located.

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Q. If the water had bypassed the sensitive area, though, if it was in effect down-gradient, wouldn't some of those answers be different? At least in -- in light of the time that it might take for the effects to show up?
A. I don't know. That's why we wanted -- that's what we said in one of our requests that we wanted the ability to move carbonate water rights from Arrow Canyon to other basins outside the super basin.
And I said -- in my direct I said I don't know exactly know what it looks like yet, and to add to that, more testing would need to be done.
MR. BURLEY: Okay. Thank you, very much.
HEARING OFFICER FAIRBANK: Las Vegas Valley Water District, Southern Nevada Water Authority.
CROSS-EXAMINATION
BY MR. TAGGART:
Q. Good morning. For the record Paul Taggart for the water authority and district.
Mr. Lazarus, there was just some questions asked about your opinion regarding moving carbonate to the alluvium, moving alluvium to carbonate, and the question I thought was whether your recommendation regarding that type of movement was restricted to Kane Springs only.
Is your recommendation regarding moving carbonate

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to alluvium and alluvium to carbonate, is it a recommendation that goes throughout the entire Lower White River Flow System?
A. The entire seven-basin flow system, yes, sir.
Q. Okay. You were also asked about underflow. And I think Mr. Burley on behalf of the Tribe asked you some questions about that.
Do you recall that?
A. He didn't use the term underflow, but I believe I understand what you're saying.
Q. Bypass flow is maybe the term that he used, but water that went past the springs. And my question is, have you seen any wells in the Lower White River Flow System that's captured this underflow without impacting the springs or the river?
A. I don't know if I have or haven't.
Q. Okay. You have reviewed hydrographs for groundwater levels in the Lower White River Flow System in California Wash, Garnet Valley, Coyote Spring Valley. Is that true?
A. I'd say I've reviewed the hydrographs from the 1169 pumping test and whatever wells are in our annual reports.
Q. Okay. So, do you know or have an opinion on whether or not groundwater levels in other locations in the

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Lower White River Flow System, specifically Garnet Valley, California Wash and Coyote Spring Valley, whether those groundwater levels are declining currently?
A. I'd have to go back and look at the data.
Q. Okay. There was testimony from CSI regarding some resistivity data.
Do you recall that?
A. Yes, sir.
Q. And do you believe that that resistivity data can be used to identify an impermeable fault in the Coyote Spring area?
A. I'm not a geophysicist. I don't see -- based on the work we've done, I don't see those faults interrupting groundwater flow.
Q. And in -- when you make that conclusion, are you relying on certain lines of evidence?
A. Of course.
Q. Okay. And I'd like to kind of compare the evidence you're relying upon versus that resistivity evidence. Are you relying on water level data when you make that conclusion?
A. We're relying on water level data that has been collected before, during and after the 1169 pumping test, and spring discharges also.

Q. So do you think that information is more reliable and more probative to the question of whether a fault in the Coyote Spring area can be impermeable?
You sounded pretty confident about a grouted 3,000-foot structure?
A. I don't see any of those.
Q. Okay. So, do you think there are any compartments in Coyote Spring Valley that can be pumped without impacting the Muddy River Springs?
A. Based on data available to date, no.
Q. Do you think carbonate pumping should be increased in the Lower White River Flow System?
A. I stated in my direct it shouldn't be increased beyond what's being pumped now.
Q. And did you state in your opinion on page 4 in your report that no new subdivision parcel maps should be approved?
Was that you, Mr. Davis, that said that?
MR. DAVIS: No, it wasn't me. I don't remember making that statement.
MR. MORRISON: Do you need your report to help?
MR. DAVIS: On what page of the report?
MR. TAGGART: Page 4. I can move on to another question.

BY MR. TAGGART:
Q. And back to you, Mr. Lazarus. I'm sorry. Is it Dr. Lazarus?
A. Mister.
Q. Mister. Okay.
There has been discussion of water budgets and the use of water budgets in determining what the long-term quantity of groundwater that should be pumped in this area is.
Can you describe your view of the ability to use water budgets in this flow system versus the other type of empirical data you've been describing?
A. You know, I forget whether it was Rick Waddell or Ms. Braumiller who said we are past the point of relying on water budgets to do these kind of analyses. I agree with that.
MR. TAGGART: Is it -- is it possible to put up slide 26? I'm sorry. Maybe it's the one with the -- could you go up one more? Yeah. Right there.
BY MR. TAGGART:
Q. And my question again for you, Mr. Lazarus, it just involves your opinion regarding whether we're in a declining trend or a steady trend in water levels in the area, and I think you mentioned you'd like to see more data, that that would be of assistance to make a final conclusion.

Is that a fair statement?
A. Yes, sir.
Q. Okay. When -- are you aware that in recent years, pumping at Arrow Canyon declined, and it probably fell by a third of its pumping previously to that. Are you aware of that?
A. I believe so. I'd have to look at the data. But go ahead.
Q. And if it -- if Arrow Canyon pumping had continued at the same rate, do you think that would affect your conclusion about whether there's declining trends at the Warm Springs West Gage?
A. We'd have to look at those data.
Q. Okay.
MR. TAGGART: Thank you.
HEARING OFFICER FAIRBANK: Lincoln County, Vidler.
MR. FREHNER: Dylan Frehner for the record for Lincoln County Water District and Vidler Water Company.
CROSS-EXAMINATION
BY MR. FREHNER:
Q. You just stated that your focus was on Kane Springs Valley with regards to the boundaries?
A. Not the southern portions. Yes.

Q. Just the northern portions?
A. Correct.
Q. Now, in your report -- let's go back -- you -- you also stated that you didn't do any independent data gathering with regards to Kane Springs?
A. That is correct.
Q. So you pick and choose from other people's information and supplied that here today?
A. Well, given the limited budget we have, that's what we are allowed to work with, was what was out there.
Q. And given the slides that you've presented today and gone over, those were not submitted in the report, correct?
Those hydrographs that you referenced and the other data have not been supplied in the report?
A. That's correct, but hydro- -- the hydrographs are out there in the public record, and we've taken, like I said, information from other reports. Yes, sir.
Q. With regards to the Figure 1 from your -- or from your rebuttal report, it goes with -- I believe it's your Slide 7.
Now, the area depicted in this Figure 1, you would agree that this is a geologically complex area?
A. It's geologically complex, but the geology really

doesn't seem to have a huge effect on groundwater flow.
Q. So one of the previous questions, I believe it was on the Tribe, had indicated that you're indicating this is like a flat bathtub, then?
A. I would say it's sort of a remarkably flat.
Q. And so you would agree that your figure is showing that this would be more appropriate in a uniform-like, sandy aquifer?
A. If I remember my direct testimony correctly, it was a report for Lincoln-Vidler says that it be -- the aquifer behaves as an equivalent porous media, which a sandy aquifer would be.
Q. And you're saying this is for the entire super basin?
A. I'd say for the areas that we have depicted here on the map, yes. The rest of the super basin, I'd have to do other calculations.
Q. So the area from the map, you've shown a line from KMW-1 down to I believe it's EH-4; is that correct?
A. Yes, sir.
Q. And you're aware that that line goes directly over the Meadow Valley mountains?
A. Yes.
Q. Now, you've indicated that a part of your focus

on Kane Springs was because there's, I believe, flow from Kane Springs into the northern Coyote Springs basin; correct?
A. Yes, sir.
Q. Now, you also agree that there's flow from the Pahranagat Valley and Delamar Valleys into the northern Coyote Springs Valley?
A. Based on testimony from other parties, they seemed to be in agreement on that.
Q. You're not in agreement with that?
A. I haven't looked at it.
Q. You haven't prepared a water plan for the Moapa Valley Water District?
A. Yes, I have.
Q. And so did you look at the flows from the Lower White River Flow System all the way from the upper right river flow system?
A. When we were doing the report, the Lower White River Flow System administrative boundary area wasn't anything that was conceptualized administratively.
Q. But you would agree there is flow coming in from Delamar?
MR. MORRISON: I object because I don't believe he testified in either of his reports or in his testimony today about flow from Delamar.

HEARING OFFICER FAIRBANK: I don't recall that being part of his testimony today, or was that an analysis in the reports?
MR. FREHNER: They have supplied in the reports their water plan, which does include -- indicate the flows in those areas.
And if we're looking at the overall basin and they want to include flows from one area, we believe it's appropriate to ask questions of flow from all of the areas.
HEARING OFFICER FAIRBANK: I think his testimony was, though, that the water report did not -- wasn't inclusive of the Lower White River Flow System as a joint administrative unit, hadn't been designated at that time.
So I guess I'm trying to wonder what the relevancy to this particular line of questions are to those questions set forth in Order 1303.
MR. FREHNER: Thank you. We'll move on.
BT MR. FREHNER:
Q. So you haven't requested any other basins besides Kane that may flow into this area be included?
A. That is correct. And we limited it to Kane because that's as far out as observation well data were available for order 1169 pumping test effects.
So we went as far as out the data took us, and it

took us into Kane Springs Valley.
Q. I believe it's Slide 33. That's not the one.
You make specific reference that you make a recommendation to the State Engineer's office that you be allowed to take the Arrow Canyon wells and move them to basins outside of the Lower White River Flow System; is that correct?
A. Yes, sir.
Q. What basins are you inferring?
A. I have no idea.
Q. So that can include the Las Vegas Valley?
A. I -- it could, but I doubt we would build a pipeline from there.
Q. Delamar Valley?
A. As I said in my direct testimony, you know, and I believe I was very specific on it, that we like -- we would request that, but we don't know what it looks like yet. We want to have the flexibility.
Q. So you don't know how far you could go to possibly pump those wells if you wanted to move them outside of the basins?
A. That is correct.
Q. If Kane Springs was excluded from this as Lincoln-Vidler have requested, would you consider Kane as a potential spot?

A. I can't speak for the district on this, but I'd say my opinion is that, no, I would not do it from Kane because that would just accelerate the drawdowns at the Muddy River Springs area and accelerate the point at which trigger levels would be hit.

MR. FREHNER: Thank you.

HEARING OFFICER FAIRBANK: City of North Las Vegas.

CROSS-EXAMINATION

BY MS. URE:

Q. Good morning, Therese Ure, representing the City of North Las Vegas, and I have more of a point or a question for clarification.

In -- in one of your slides, you requested as part of your recommendation that the State Engineer grant the right to the district to divert 6,791-acre-feet per year; is that correct?

A. Yes.

Q. Would that 6,79 -- or 6,791-acre-feet constitute an increase of carbonate pumping than what the district is currently pumping?

A. Yes.

MS. URE: Okay. Thank you.

HEARING OFFICER FAIRBANK: All right. We'll go

ahead and take a break for lunch. So, let's go ahead and we'll be pack at 1:00 p.m.

Thank you.

(Lunch recess at 11:58 a.m.)

STATE OF NEVADA)
) ss.
CARSON CITY)

I, MICHEL LOOMIS, a Certified Court Reporter, do hereby certify;

That on the 30th of September, 2019, in Carson City, Nevada, I was present and took stenotype notes of the hearing held before the Nevada Department of Conservation and Natural Resources, Division of Water in the within entitled matter, and thereafter transcribed the same into typewriting as herein appears;

That the foregoing transcript, consisting of pages 1092 through 1230 hereof, is a full, true and correct transcription of my stenotype notes of said hearing to the best of my ability.

Dated at Carson City, Nevada, this 1st day of October, 2019.

____
MICHEL LOOMIS, RPR
NV CCR #228

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In The Matter Of:

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCED
DIVISION OF WATER

Vol. VI
September 30, 2019

Capitol Reporters
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Carson City, Nevada 89706

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STATE OF NEVADA
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
BEFORE MICHELINE FAIRBANK, HEARING OFFICER
---oOo---

IN THE MATTER OF THE ADMINISTRATION AND MANAGEMENT OF THE LOWER WHITE RIVER FLOW SYSTEM WITHIN COYOTE SPRING VALLEY HYDROGRAPHIC BASIN (210), A PORTION OF BLACK MOUNTAINS AREA HYDROGRAPHIC BASIN (215), GARNET VALLEY HYDROGRAPHIC BASIN (216), HIDDEN VALLEY HYDROGRAPHIC BASIN (217), CALIFORNIA WASH HYDROGRAPHIC BASIN (218), AND MUDDY RIVER SPRINGS AREA (AKA UPPER MOAPA VALLEY HYDROGRAPHIC BASIN (219).
_______________________________________/

TRANSCRIPT OF PROCEEDINGS
PUBLIC HEARING
HEARING ON ORDER 1303
VOLUME VI
(P.M. SESSION, Pages 1231 - 1369)

MONDAY, SEPTEMBER 30, 2019

REPORTED BY: CAPITOL REPORTERS
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Hearing Officer

Tim Wilson,
Acting State Engineer
Adam Sullivan,
Deputy State Engineer

Melissa Flatley,
Chief of the Hearing Officer Section
Michelle Barnes,
Supervising Professional Engineer

Levi Kryder,
Chief of the Hydrology Section
Jon Benedict,
Senior Hydrologist

Christi Cooper,
Well Supervisor
Bridget Bliss,
Basin Engineer

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

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-and-
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For CSI: Brownstein Hyatt Farber Schreck
By: Bradley J. Herrema, Esq.
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For Lincoln County Water District/
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By: Karen Peterson, Esq.
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For NCA: Alex Flangas, Esq.
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For Moapa Band of Paiutes: Richard Berley, Esq.

For Moapa Valley Water District: Greg Morrison, Esq.
For Muddy Valley Irrigation: Steve King
For Bedroc: Therese Ure, Esq.
For City of North Las Vegas: Therese Ure, Esq.
For National Park Service: Karen Glasgow
For Center for Biologic Diversity: Patrick Donnelly

I N D E X

I N D E X
(Continued)

CARSON CITY, MONDAY, SEPTEMBER 30, 2019, P.M. SESSION
---oOo---
HEARING OFFICER FAIRBANK: Okay. Let's go ahead and go back on the record. And next up will be the Center for Biological Diversity.
CROSS-EXAMINATION
By Mr. Donnelly:
ANSWERS BY MR. REICH:
Q. Thank you. Patrick Donnelly, Center for Biological Diversity. I will be brief. Mr. Lazarus, if you could take a look at the exhibit I've put there. It is Exhibit 3-3 from SNWA's rebuttal report. It's a series of hydrographs for CSVM-1. I have it written down on my computer which one is there. CSVM-1, Paiute TH-2 and GV-1. There we go. And SNWA put a trend lane on from 2016 until current showing a decline in levels in those wells since then. Do you agree with that trend line and that assessment?
A. I would have to have time to look at this because there's continuous monitoring and periodic measurements. So I would have to look at the individual measurements.
Q. So you're not able to look at this and say whether those charts show a decline in groundwater levels as measured and displayed there?
A. As you have -- As someone drew on there, it shows

decline in groundwater levels. But I would have to go back and look at the data.
Q. If there was a decline in groundwater levels would that indicate that the system is out of steady state? An ongoing decline, I should say.
A. Can you repeat that?
Q. If there were an ongoing decline in carbonate groundwater levels would that imply that the system was not in a steady state?
A. Yes.
Q. And would that then imply that current pumping is too high for a steady state to be achieved?
A. It all depends on the location.
Q. You based your recommendation for pumping on the State Engineer's recommendation. I believe you quoted text from actually Order 1303. Are you saying that the number you've provided is contingent on location as much as the actual number?
MR. MORRISON: I object. I don't --
(The court reporter interrupts)
MR. MORRISON: Greg Morrison, Moapa Valley Water District's attorney. Mr. Lazarus didn't provide a number in his report, so I object to the implication that he did.
MR. DONNELLY: I'll restate.

Q. (By Mr. Donnelly) The report implied that the number from the State Engineer was agreed with. There was an implication in the report that the finding in Order 1303 that groundwater levels were stable and that pumping, current pumping, is sustainable was implied in the report. Is that true?
A. Additional data is needed. That is true, but I also said additional data is needed.
Q. So do you have sufficient data to know whether the current groundwater rights of the water district are a sustainable pumping amount or is additional data needed to even know if that's a sustainable amount?
A. The hydrographs we showed of Pederson and Pederson East showed a flat -- no decline in discharge significantly since the end of the pumping test. And the district has been pumping since then. We use those to make our presentation today.
Q. What do you think about the potential for carbonate monitoring wells declining, given what you just said?
A. Well, we would have to look at each well.
Q. So static levels, relatively static levels, at Pederson is the justification for I believe it was 6700 acre-feet of carbonate water rights?

MR. MORRISON: I'll object again. He never stated a number.
Q. (By Mr. Donnelly) Of the existing Moapa Valley Water District carbonate water rights which were detailed in the presentation just given and it was asserted that that's a sustainable amount of pumping. Is the basis of that statement that there are stable water levels at Pederson East over a given period of time?
A. I believe that inaccurately characterizes my testimony.
Q. Okay. Please recharacterize it for me.
A. At current levels of pumping in the seven basin, super basin, it appears that Pederson and Pederson East have pretty much stable flows for the last several years.
MR. DONNELLY: Thank you.
HEARING OFFICER FAIRBANK: Georgia Pacific and Republic.
CROSS-EXAMINATION
By Ms. Harrison:
ANSWERS BY MR. LAZARUS:
Q. Good afternoon. Sylvia Harrison for Republic Environmental Technologies and Georgia Pacific. Just a question for Mr. Lazarus. Mr. Lazarus, were you present during the presentation of US Fish and Wildlife Service last

week?
A. Yes, I was.
Q. Do you recall Ms. Braumiller's testimony regarding her hypothesis about a separate source for the Big Muddy Springs which would be or which could be different from the Pederson Spring source or the Pederson Springs area source?
A. Vaguely.
Q. I'll refresh your memory. I believe that she testified that there was a significantly different hydrograph for Big Muddy Springs and that she thought the water was notably hotter and testified that there was a potential source from deep carbonates possibly from Lower Meadow Valley Wash. Does that sound correct based on your recollection?
A. My memory is not as good as yours, but I'll take your word for it.
Q. All right. Would you agree that the estimate of about 15 percent of the Muddy River flow being contributed by Big Muddy Springs sound accurate to you?
A. I don't know.
Q. If that were the case would you agree that investigating a possible source for that spring would be a very potentially significant undertaking for the district?
A. Can you maybe simplify that question?

Q. Sure. Would you agree that it's important for the district to understand the sources of water to the Muddy River?
A. I think it's important for all of the stakeholders.
Q. Has the district evaluated the possibility of any other sources to the Muddy River other than the alluvial and carbonate aquifers?
A. A long time ago the district had a cost estimate for a surface water diversion.
Q. But as far as actual natural sources there hasn't been any investigation other than the carbonate aquifer and alluvial aquifer sources; correct?
A. To the best of my knowledge that is correct.
MS. HARRISON: Thank you. That's all I have.
HEARING OFFICER FAIRBANK: Nevada Cogen? Seeing no questions.
Muddy Valley Irrigation Company.
CROSS-EXAMINATION
By Mr. King:
Q. Good afternoon, Mr. Davis, Mr. Lazarus. I'm Steve King for Muddy Valley Irrigation Company. Just several questions and for either one of you who should answer. Are you aware that Muddy Valley Irrigation Company, my clients,

interest in this proceeding is to protect the senior decreed water rights that were adjudicated in the Muddy River Decree?
MR. DAVIS: Joseph Davis. Yes.
MR. LAZARUS: Jay Lazarus. Yes. And we also are shareholders in the MVIC.
MR. KING: Thank you. That was my next question for the record to show that the Moapa Valley Water District is a shareholder in Muddy Valley Irrigation Company.
Then there's been as part of the presentation and the reports that Moapa Valley Water District has filed discussion on the Jones Spring and how important that resource is to the Moapa Valley Water District and that that's been dedicated to support the Moapa case under the memorandum of agreement. Do you recall that discussion?
MR. LAZARUS: Yes.
MR. KING: And then just to, for the record, isn't it also accurate that that Jones Spring right, the base right for that, actually emanates from the Muddy River decreed senior rights that the Muddy Valley Irrigation Company was awarded in the decree; is that correct?
MR. DAVIS: Joseph Davis. Yes.
MR. KING: Those are my questions. Thank you, Gentlemen.
HEARING OFFICER FAIRBANK: Bedroc.

CROSS-EXAMINATION
MS. URE: Good afternoon. Therese Ure representing Bedroc. Did you make any independent analysis of the alluvium water rights in Coyote Springs Valley and their effect on the Muddy River Springs area?
MR. LAZARUS: No.
MS. URE: Thank you.
HEARING OFFICER FAIRBANK: Nevada Energy.
MS. CAVIGLIA: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions, I'll go ahead and open it up to Division of Water Resources staff and the State Engineer.
EXAMINATION
By Mr. Benedict:
Jon Benedict for the record. I would like to go back to the gradient slide, I think it's slide number seven, if you wouldn't mind. So there's relatively limited data with respect to water levels between the various wells out there. And I guess I just want your opinion. You've indicated that the gradients are relatively consistent, suggesting that Coyote Spring Valley is part of this system. And I'm just curious would additional data -- I mean, is it possible that additional data could show gradients that are steeper if you had those data?

MR. LAZARUS: Well, it's going to be hard to get a flatter gradient. But even if -- Yes, it is possible that gradients could be steeper. But, like I said, there's not a 30-foot drop there in 3,000 feet deep. It just means that that flow might be a little slower but it's all connected.
MR. BENEDICT: Okay. All right. Thank you.
EXAMINATION
MS. BARNES: Michelle Barnes for the record. Just to follow up on this slide. I'm just curious if you say the gradients were consistent if you looked at multiple times of year, multiple years, or is this average or a snapshot in time?
MR. LAZARUS: It's a snapshot in time.
MS. BARNES: Do you know for, I guess, what season are all the wells on the same measurement?
MR. LAZARUS: I would have to go back and look.
MS. BARNES: Okay. Thank you.
EXAMINATION
By Hearing Officer Fairbank:
ANSWERS BY MR. LAZARUS:
Q. Mr. Lazarus, Micheline Fairbank. I have one or two questions for you. Do you recall -- Previously you stated that you were present or you were listening to the testimony by the United States Fish and Wildlife Service

earlier in the hearing. And do you recall US Fish and Wildlife Service's recommendation for the inclusion of the Lower Meadow Valley Wash in the Lower White River Flow System basins?
A. I think so.
Q. And did you do any analysis or do you have an opinion regarding the inclusion of the Lower Meadow Valley Wash?
A. I did not. And so, no, I don't.
HEARING OFFICER FAIRBANK: Okay. Thank you.
All right. Given that we have additional time, we'll go ahead and open it back up for additional questions. Coyote Spring Investments, do you have any additional questions?
MR. HERREMA: We just have one topic we want to hit.
HEARING OFFICER FAIRBANK: Okay. So what we'll do is we'll go ahead and given the amount of time that we have left, we'll limit you to not more than five minutes.
CROSS-EXAMINATION
By Mr. Herrema:
ANSWERS BY JAY LAZARUS:
Q. Brad Herrema again for the record for CSI. Mr. Lazarus, on page five of your report under the section

regarding movement of water rights, it's that top paragraph that I'll just read so we have it on the record. It says, the timing and magnitude of carbonate pumping effects on spring discharge is dependent on the volume of water pumped and the proximity of a pumping center to the springs. The closer it is, the sooner it will occur. The further away it is, the longer it will take to show effects. But in any case, all cumulative carbonate pumping in the seven inter-connected basins will eventually cause depletions on the Muddy River Springs.
When you refer here to the magnitude of the effects of carbonate pumping on spring discharge being dependent on proximity of the pumping center to the spring, does the concept of magnitude here suggest that there's a level of pumping that will not affect spring flow?
A. I don't know. As I said earlier, I would like to see more data so that we can suss that out.
Q. Okay. Are there other forms of discharge from the Lower White River Flow System? We've heard that water from the carbonate aquifer supports flow from the Muddy River through the alluvium downstream of the springs. Would you agree that the impacts of the carbonate pumping might be downstream of the springs?
A. Could you give me the first part of that? Can

you repeat the question, please?
Q. Are there also other forms of discharge out of the Lower White River Flow System beyond just the spring flow?
A. Such as?
Q. Evapotranspiration.
A. Yes. Well, limited.
Q. Subsurface flow out of the Lower White River Flow System?
A. Yes.
Q. Could pumping affect those forms of outflow as well?
A. I guess it would depend on the location of the pumping center.
MR. HERREMA: Okay. Thank you.
HEARING OFFICER FAIRBANK: United States Fish and Wildlife Service. Seeing no questions.
National Park Service.
MS. GLASGOW: No questions.
HEARING OFFICER FAIRBANK: Moapa Band of Paiutes?
MR. MORRISON: No questions.
HEARING OFFICER FAIRBANK: No further questions.
Las Vegas Valley Water District and Southern Nevada Water Authority.

CROSS-EXAMINATION
By Mr. Taggart:
ANSWERS BY MR. LAZARUS:
Q. Good afternoon. Again for the record Paul Taggart on behalf of the District and the Water Authority.
Mr. Lazarus, there's been some talk about bypass flow, underflow. You were just asked about it as well. Are you familiar with the 2011 work by the water district and the water authority that conducted some Darcy flow calculations for flow in the Lower White River Flow System?
A. No, I'm not.
Q. Okay. So that's -- those analyses are not part of the support for your opinion about that -- the occurrence of underflow if there is any?
A. Correct.
Q. Okay. And then I just wanted to ask again if you stated in your report that to maintain carbonate diversions at current volumes no new subdivision parcel maps should be approved that will require increased pumping. Did you say that in your report?
A. Yes, that is in there.
MR. TAGGART: All right. Thank you. No further questions.
HEARING OFFICER FAIRBANK: Lincoln County,

Vidler.
CROSS-EXAMINATION
By Mr. Frehner:
ANSWERS BY MR. LAZARUS:
Q. Dylan Frehner for Lincoln County Water District and Vidler Water Company.
Mr. Lazarus, wouldn't you agree that the greatest threat to the Moapa dace is the pumping at the Arrow Canyon wells?
A. No.
Q. You've been asked with regards to whether the Lower Meadow Valley Wash should be included and you said you had no opinion?
A. That is correct.
Q. Isn't it true that the district has applications in the Lower Meadow Valley Wash?
A. That were denied.
Q. Do they have new applications pending?
MR. DAVIS: There is three applications that are pending?
MR. FREHNER: In the Lower Meadow Valley Wash?
MR. DAVIS: Yes.
MR. FREHNER: But no analysis has been done as to the impact of Lower Meadow Valley Wash on the Muddy River

Springs area?
MR. DAVIS: Not to my knowledge.
Q. (By Mr. Frehner) Thank you. Going back to your testimony with regards to KPW-1 in the aquifer test. Is it your only evidence that the KPW-1 aquifer test showed no boundaries the conclusion that is set forth in the URS 2006 report?
A. (By Mr. Lazarus) No. Can you please repeat that? I want to make sure I got that.
Q. Is your only evidence that the KPW-1 aquifer test showed no boundaries the conclusion set forth in the URS 2006 report?
A. The URS 2006 report states there were no boundaries encountered. And I would sort of back that up by looking at the drawdown in KMW-1 during the 1169 pumping test. So no boundaries as a result of pumping stresses from the south or from the north.
Q. When you updated your estimates of transmissivity and storativity for the KPW-1 aquifer test did you evaluate for the presence of faults?
A. No. Because there were none encountered during the pumping test or recovery.
Q. Did you use the CSVM-4 data available during the KPW-1 aquifer test to evaluate the presence or absence of

boundaries?
A. No.
Q. What distance from the KPW-1 well were you able to evaluate with the KPW-1 aquifer test for the presence of boundaries?
A. Well, specifically 143 feet away. But based on the maps that were submitted by Lincoln-Vidler, the fault zones that these wells were completed into was expansive and in to the Coyote Springs Valley.
Q. How long did it take for the effects of pumping at MX-5 well to reach the CSVM-1 well?
A. I would have to go back and look.
Q. You didn't evaluate that?
A. I know we looked at it. I said I would have to go back and look.
Q. How long did it take for the effects of the cessation of the pumping at MX-5 well to reach the CSVM-4 well?
A. We would have to go back and look at the hydrographs. But, you know, in the system like this, and it's straightforward in any system that behaves like this, the further you are from the pumping center, the longer it's going to take for the effects to hit it.
Q. Any time estimates that you calculated were they

consistent with your estimates of transmissivity and storativity from the KPW-1 aquifer test?
A. I didn't calculate any time estimates.
Q. Why don't KMW-1 and CSVM-4 wells respond to fluctuations in pumping at the MX-5 well?
A. They did.
MR. FREHNER: Thank you.
HEARING OFFICER FAIRBANK: City of North Las Vegas? Seeing no further questions.
Center for Biological Diversity. Seeing no further questions.
Georgia Pacific Republic.
MS. HARRISON: No further questions.
HEARING OFFICER FAIRBANK: No further questions.
Nevada Cogeneration? Seeing no questions.
Muddy Valley Irrigation Company.
MR. KING: No questions.
HEARING OFFICER FAIRBANK: No additional questions.
Bedroc?
MS. URE: No.
HEARING OFFICER FAIRBANK: No additional questions.
And Nevada Energy?

MS. CAVIGLIA: No questions.
HEARING OFFICER FAIRBANK: Again, I'll open it up to the State Engineer and staff. All right. Seeing that we don't have any questions, Mr. Morrison, you have some additional time left if you wanted to do any more redirect.
MR. MORRISON: I don't think we need it. Thank you.
HEARING OFFICER FAIRBANK: Okay. Then we will go ahead and conclude the presentation by the Moapa Valley Water District and we'll move on to Vidler. To allow them a little bit of time to get themselves situated, let's go ahead and take about a five-minute break and we'll go back on the record at 1:30.
Actually, let's go back on really quick. One thing I wanted to provide clarification is Mr. Lazarus was proffered as an expert in these proceedings and he was not objected to. He's not -- Mr. Lazarus has not previously been qualified by the State Engineer's office, so his qualification will be limited to these proceedings based upon the absence of any objection. Thank you.
(Break was taken)
HEARING OFFICER FAIRBANK: Let's go ahead and go back on the record. So this is a continuation of the hearing. And next up is the Lincoln County and Vidler Water

Company.
MS. PETERSON: Thank you. Karen Peterson and Dylan Frehner representing Lincoln County Water District and Vidler Water Company. And we have a panel of the five experts that have submitted reports to the State Engineer's office, either initial reports and/or rebuttal reports. And I'm going to have -- We are going to present our witnesses as a panel because we are very concerned that we want to get all the information in in the allotted time that we have. We would like to reserve 15 minutes at the end of our presentation for redirect.
HEARING OFFICER FAIRBANK: Okay. Let's go ahead and have the witnesses sworn in if we may.
(Five witnesses were sworn in)
MS. PETERSON: Gentleman, I'd ask each of you to state your full name and spell your last name for the record.
MR. BUSHNER: Greg Bushner, B-u-s-h-n-e-r.
MR. UMSTOT: Todd Umstot, T-o-d-d U-m-s-t-o-t.
MR. CARLSON: Norman Carlson, C-a-r-l-s-o-n.
MR. BUTLER: Thomas Butler. Butler B-u-t-l-e-r.
MR. MOCK: Peter Mock, M-o-c-k.
MS. PETERSON: And I'll just briefly go through and indicate the witnesses that have been qualified as experts before by the State Engineer and the areas that

they're being offered in today. So Mr. Bushner has been qualified by the State Engineer as an expert in hydrogeology and obviously that would be the qualification we would ask for today. And nobody objected.

Dr. Mock we seek to have qualified by the State Engineer as an expert hydrologist and geologist with a specialty in groundwater modeling in computational hydrology. And no one has objected to that designation as an expert.

Mr. Butler has been qualified by the State Engineer in previous proceedings as an expert in geology and geochemistry. And we would ask for that same designation in this proceeding.

Mr. Umstot has not been qualified by the State Engineer, but we proffered him as an expert in hydrogeology, Beto zone processes, groundwater recharge, and geostatistical techniques. And there's been no objection to his designation in those expert areas.

And Mr. Carlson has been qualified by the State Engineer as an expert in geophysics and testified before the State Engineer near last Monday, I believe.

Gentlemen, I ask you if you prepared reports that have been marked as Lincoln County Vidler Exhibits 1 and 2 in this proceeding? If you could each just state yes or no on the record.

MR. BUSHNER: Yes.

MR. UMSTOT: Todd Umstot. Yes.

MR. CARLSON: Norman Carlson. Yes.

MR. BUTLER: Thomas Butler. Yes.

MR. MOCK: Peter Mock. Yes.

MS. PETERSON: And I should have asked the other one that goes along with that. Were those reports prepared by you or under your direction?

MR. BUSHNER: Greg Bushner. Yes.

MR. UMSTOT: Todd Umstot. Yes.

MR. CARLSON: Norman Carlson. Yes.

MR. BUTLER: Tom Butler. Yes.

MR. MOCK: Peter Mock. Yes.

MS. PETERSON: Thank you. And I would move that Lincoln County Vidler 1 and 2 be admitted in to evidence.

HEARING OFFICER FAIRBANK: They'll be admitted.

And also just for Mr. Mock and Mr. Umstot, for the purposes of their qualification as they have not previously been qualified before this office, but their proffering was not objected to by any party. They'll be qualified in the proffered expertise for the limited purpose of these proceedings.

MS. PETERSON: Thank you. So we presented our case a little bit differently than everybody else. Our power

point presentations were submitted to the State Engineer's office on September 6th. So those have been admitted as exhibits, LCV 08 through 12.

Mr. Bushner is not going to give his presentation today, just in the interest of time, but he is available for cross-examination.

And we are going to go ahead and start then with Mr. Carlson. And so, Mr. Carlson, I would ask you to then please proceed.

Excuse me. Sorry. Sorry. We do have some demonstrative exhibits, slides. And those -- copies of those have been put on the slide desk over there.

NORMAN CARLSON

Called as a witness on behalf of Lincoln County/Vidler, having been first duly sworn,

Was examined and testified as follows:

DIRECT EXAMINATION

By Ms. Peterson:

Q. Thanks, Mr. Carlson. Can you proceed?

A. Yes. Thank you. Well, we can just go ahead and start with slide two, actually. This is the overview of what we were contracted to do by Lincoln County and Vidler Water.

We're looking at the Rowley map again draped on to the USGS digital elevation model. This just gives you a perspective view like you're looking down towards the north on the valley from a high-flying airplane.

And on this, Kane Springs Valley, which we've talked a lot about, is in the upper right. You'll see numerous solid red lines running across that and then one long one running down Kane Springs. Those are geophysical lines that we ran in 2012.

Our main topic today is the lines from 2019, March and April, I think. And those are labeled lines ten, 11, and 12. And those are a less dark red line with little dots on them for some of the stations.

And as I said, Kane Springs is trending to the northeast in that upper right corner. Coyote Spring Valley is the center of the map. It's shaded sort of a very light tan. That's because that's all paternery basin fill. That's covering up all of the bedrock.

The colors on the sides of the valley there in the Meadow Valley range and down in the Arrow Canyon range, those colors represent the bedrock that outcrops in those areas, various limestones and dolomites. A lot of it is the carbonate, the carbonate aquifer, that we're talking about and some of it is volcanics. So this is just to give you a

very big overview of what we're talking about.
If we go to slide three -- Well, actually with the State Engineer's permission, I presented these slides last Monday with CSI. It's just the background of CSAMT, so I'll skip over those if that's okay with everybody up there.
HEARING OFFICER FAIRBANK: That's fine.
THE WITNESS: That saves time.
Slide seven is the layout of the survey lines on an aerial view. The main things that we want to point out here are Kane Springs Valley is in the upper right. It's aiming towards the northeast. Coyote Spring is the center of the aerial view. And, as I mentioned, the red lines crossing Kane Springs we did in 2012. I'll touch on those just for background so you can see what we've seen in this area before and for comparison to lines ten, 11, and 12 there in the center.
Other things just to note, you'll hear us talking multiple times about an outcrop of dolomite near the up -- the center upper right of the map. You can just barely make it out in the aerial view. But that's an outcrop of dolomite right at the mouth of Kane Springs Valley. It's sort of a little island sticking up there of outcrop.
Q. (By Ms. Peterson) And, Mr. Carlson, can you just give another depiction on the map of where that is located?

A. Yes. On the map it's in between the label that says 2012 line one and the 2019 line ten. And it's -- being in the desert, it's just sort of a change in color from tan to gray. But that's where a knob of dolomite sticks out of the ground. It's very close to KSPW-1, the well there. And then CSVM-4, that well was located just to the southwest end of that knob.
So the point to get from -- Well, let's go ahead and go to line eight and we'll make those points. Slide eight is the same image basically, but in this case we've overlaid the Rowley geological map. The important things there are, as I mentioned earlier, the bulk of the map is this light tan background being basin fill. So bedrock in the faults and the folds and whatever else is down there is all covered up.
Out in the outcrop, the colorful rocks out on the outside of Coyote Spring, dolomites, limestones, things like that. You'll notice in all of that outcrop there are numerous fault stone. The faults on the Rowley map are drawn as heavy dashed -- heavy black lines or heavy blue lines. And you can see that anywhere you're in outcrop you're not very far from a fault. It's a heavily faulted-up area, different types of faults, different faults running in different directions.

You'll notice in sort of the lower center right there's a big green area labeled MD. That has black faults, blue faults. Some of the blue faults are at perpendicular angles.
So, anyway, it's a heavily-faulted area, very complex geology. And that's the whole reason that we do geophysics is to try and understand what's out here in the basin fill where we can't see all the faults that are -- that must be in the bedrock out there.
Another point on this slide that is a good place to point out is the orientation of our lines. We have line ten and line 11 that are in the center of this image. They're oriented from southeast towards northwest. They're two parallel lines. Line ten is right at the very mouth of Kane Springs. Line 11 is further out in the Coyote Spring Valley. But the orient of those lines like that because most types of geophysics give the best resolution of subsurface features if you cross that feature perpendicular to the way it's trending.
And you'll see that all of these faults in Kane Spring Valley, all of these blue solid lines that are drawn by Rowley and by the previous geological maps, those are mostly all trending southwest towards northeast along the valley. And that makes sense. It's faulted up and these

faults are along the valley.
So since we are trying to resolve faults, we ran our lines perpendicular to those to give us the best resolution. If we put the faults, if we put a survey line directly on top of a fault and running parallel with it, the image is distorted. You get very ambiguous data. You can't really resolve it. So if we know what direction faults are running. We usually run our lines perpendicular to those faults. So that's why those two, lines ten and 11, are oriented the way they are.
And line 12 is an east/west flow right in the center of the image. And we orient that east/west because we wanted a good high resolution of the faults that Rowley draws out underneath the basin fill. Because he's drawn numerous black dashed lines which indicates a concealed fault. There's a blue dashed line with the triangles on the side. That indicates he thinks there's a concealed trust fault there.
And most of the faults running and up and down Coyote Spring under the basin fill are drawn as north/south. So we oriented line 12 east/west to give us the best resolution of where those are and what they look like.
If we could go now to slide nine. This is just a little bit of background from the 2012 survey that we did

running up and down Kane Springs Valley. This is the one called the axis line. It was that solid red line on one of the first maps that runs along Kane Spring -- Kane Springs Valley. So running right along the valley.

And the main key here is we see in the middle of the line and on the northeast end of the line we see a lot of green shading and yellow shading. That's indicating moderately low resistivities. And then the moderately low resistivities, as we seen in prior discussion last Monday, that's most likely the basin fill material.

But we're seeing the northeast, the right hand part of this plot is over basin fill material in Kane Springs.

But as you go to the southwest towards the mouth of Kane Springs, we see that we have this high resistivity in blue, which we associate it in the prior work with carbonates, coming up from very deep and coming up and almost right to the surface on the very last few stations of the line, which is the far left-hand part of this cross-section. The blue actually does come up to the surface.

So the surprising thing about this line when we first took it in 2012 was the topography of Kane Springs Valley slopes downward from the northeast towards the southwest. But the underlying basement of carbonate rock

slopes in the opposite direction. It's deep on the northeast and becomes shallow on the southwest. So it's actually exactly backwards of what we expected.

But what we're seeing in this access line on Kane Springs Valley is a large block of high resistivity carbonate rock coming up close to the surface as we get towards the mouth of Kane Springs.

Now, if we go to slide ten, this is one of the short cross-lines of Kane Springs just a little northeast of that knob that I mentioned earlier. So this line, the right-hand side of the plot is dominated by the carbonates and the crew did go up on to the carbonates taking some of the data there. So we know that the outcrop is there. We know that that's quite a high resistivity carbonate.

As we get to the center of the line, we see a blue resistant blob coming up from that and it is evidence of a very conductive zone. But that blue blob as you see as we move further towards the mouth of Kane Springs that becomes more shallow. That's sort of part of what we were seeing on the axis line.

And then we also see the Kane Springs Wash fault zone, which is on the right-hand half of this line, looks like numerous blue high resistivity blobs. The carbonates are all broken up there. There's multiple faults. They look

like they're mostly vertical. So instead of one big blue blob, it looks like a bunch of blobs all packed together.

If we go to slide 11, now we're at, this was called line one in 2012. And in this case it actually went over that knob, over that dolomite outcrop that's right in the center of this. And where we go over that carbonate knob just booming high resistivities. So everything is looking good. It's where we can get ground truth it's looking fine. So we have the high resistivity knob showing up very nicely.

Further out on the west side of the plot is also very high resistivities. You see the things are kind of broken up. You see a big red area. That's low resistivity material. It's likely saturated. There may also be a lot of clay there. That also lowers the resistivity. But we're right here very near the mouth of Kane and we're seeing mainly high resistivity features.

The KSPW-1 well is also shown on there. It encountered about 200 feet, 250 feet, basin fill and then went directly in to carbonate there. And I believe that's the one that was discussed earlier, a very good producer. It did go through what a geologist called a fault zone. So some additional ground truth is always good to have.

If we move to slide 12.

Q. Mr. Carlson, was there a correction you needed to

make in the top part of slides 11 and 12?

A. Thank you. Yes. The title on slide 11, it says near the southeast end. I have a little bit of age-related dyslexia or something. But that should say southwest. And then on the next slide it says southeast and it should say southwest. Sorry.

So on slide 12, this is line ten, the 2019 work. This is right at the very mouth of Kane Springs right there at the southwest end of the Kane Springs. It does not cross any outcrop there in the middle. It doesn't cross the knob. It's on the southwest end of the knob. As you can see, it's all blue. I mean, this is all high resistivity ground, very high, thousands of ohm meters in many cases.

We interpret this to be almost entirety carbonate in the subsurface. Very thin veneer basin fill over it. The carbonate is broken up. We do see some low resistivity features at different angles and things. But the gist of it here is that right there at the mouth of Kane Springs instead of seeing a fault and maybe separate it from other faults with low resistivity basin fill, we see all carbonate high resistivity results.

Q. Mr. Carlson, you're about 15 minutes in?

A. Okay. Thank you.

On slide 13, this is line 11. This is the line that is about two miles from the mouth of Kane Springs. And since I like to keep plots as a one-to-one aspect ratio so you can actually see how steep angles are, this one is kind of skinny. So in slide 14, I have just broken this up. The top plot in the south is the northwestern part of the line. And the bottom plot is the southeastern end of the line. So just so we can see some detail a little bit better.

The key features here are, unlike line ten, which is just two miles closer to the mouth of Kane, line 11 is primarily moderately low resistivities, all of those greens and yellows, it's mainly layered. It's not -- The center of the line is broken up, but both of the line is layered. Moderately low resistivity that we interpret as basin fill.

On the far right-hand end of the lower plot, we see solid blue again. And that's where the crew went up on to outcrop and carbonate. So good ground truth there, but we're seeing a big, big change as we come away from Kane Springs, from the mouth of Kane Springs Wash.

We see some interesting things that probably have nothing to do with the hydrologist but interesting layering in this bottom half of the plot. You see some yellows and then bright reds, very low resistivity material. Again, that's probably saturated. There may be very fine grain low resistivity material map.

And if you come from left to right, that reddish layer, it sort of jiggles around, but reddish layer is roughly horizontal and comes to about the middle of that lower plot and then plunges steeply downward.

We see that on other lines here and we also saw that on the Coyote Springs lines on Monday. It's a different interesting feature. I'm sure it's telling us something. But, for the current hearing, what's mainly important is the fact that as we've moved away from the mouth of Kane Springs we're in to low resistivity basin fill, a large amount of low resistivity basin fill. This calculates to be 2500 feet to 3,000 feet of basin fall.

If we can go to slide 15, just a very quick refresher of where we are. We just discussed lines ten and 11. Those are the ones on the southeast and northwest there near the center. And now we're going to discuss line, 12 which is oriented east-west, and we have oriented it that way so that we can get a look at some of the concealed faults that Rowley had on his map.

So, again, so -- it's a very long plot so it plots very skinny if you keep the aspect ratio. So I'm going to break it up. Although first I'm going to show you a slightly different version of that upper plot. We're seeing nice layering. In some ways, this looks a lot like line 11.

Across the bulk of the line we see low resistivity layering. That bottom plot is just the same model but we've added a few layers to get a little deeper.

In one of the earlier testimonies, I think it was Dr. Waddell, he mentioned that he thought that a large fault that we talked about in our reports didn't show up on this because we just weren't seeing quite deep enough to get it. And that's exactly right. The model that we had put in the report was not the deepest model we had. If we show you the deepest model, which is the bottom half here, and if you'll go ahead and skip to the next slide. And actually one more slide to look at the deeper one.

On the lower image here in this cross-section --

Q. And you're on slide?

A. I'm sorry. Slide 19. Sorry. On this slide 19 the lower image is the cross-section of the southeastern half of the line. And you can see at depth high transmissivity the blue material. We would put a fault at the edge of the biggest blue blob you see there and in between the two blobs you see there another fault, a third one actually, on the right-hand side of that mixed blob.

But Mr. Waddell was right. The fault that we talk about a little bit later doesn't show up on line 12 because it just wasn't looking deep enough on that plot.

Other interesting things on here. On the top plot you can see the northwestern half of the line, some very interesting layering in the basin fill material.

At about station 7100 through about, oh, 10,000 -- 11,500, you'll see that the yellow and red well resistivity material gets all the way to the surface. It's saying that the surface there is very low resistivity.

And if you think back to the aerial view, that's where this line crossed a vegetated area. And very near this line is the Coyote Spring, which the valley is named after. So we're seeing the effects of spring water and the vegetation around it and the data here.

It's not terribly important for the discussions here, but it's another ground truth for us, something that you want to see when you're trying to make all of these measurements.

If we go to slide 20, what I put here is just lines ten and 11. Number ten is right at the very mouth of Kane Springs Valley. And then the lower plot is line 11, and that's about two miles in to Coyote Springs. And this is just to point out the radical difference between the two lines. The top line is virtually all high resistivity material, broken up, but high resistivity material.

Whereas, as you move out and parallel out of Kane

Springs Valley, we see all low resistivity material looking like 2500 feet, as much as 2500 feet of basin fill. And there are two wells near line 11 here, near line 12, out in the basin fill. And those indicated a minimum of 1500 feet of basin fill material. So some good ground truth again.
So, if we go to slide 21, this was sort of a summary slide of the results, sort of the gross features of the results on the Rowley map. And we have our lines, ten, and 11 and 12 again, but in between those two lines, in between ten and 11, we've drawn a heavy red dash line that has small down drawn symbols along the southwestern side. But that's indicating that we're virtually certain that there's a large fault roughly parallel to those two lines and it has to be in between those two lines since we see this big change from line ten to line 11.
For graphic purposes, we just put it roughly in the center. But, personally, I believe it's very, very close to line ten. But until we run the line perpendicular to these lines to cross it, we can't place it exactly. But the change in resistivities from line ten to line 11 just demands that there be a big flow right there.
And very boldly we called this the boundary -- northern boundary -- northern boundary LOWRFS, we gave it a grandiose name. In the discussion actually we called it

Dorothy's fault, but we didn't want to put that in the report. So I've heard multiple comments in the past about our name. But that's how we discuss it. It has to be a major fault and it has to -- Since the carbonates and the higher resistivity material on line ten are virtually right up to the surface, almost, but on line 11 they're down at the depth of 2500 feet, that means that that fault has to be a big step downward of 2500 feet some place in between line ten and 11. So very significant fault.
If we go to --
Q. Mr. Carlson, you're at 25 minutes.
A. Great. Thanks. To summarize and to go back to the perspective view, we're looking downward at the geologic map and then we hung the two lines in their appropriate places on the geologic map. And you can see the big, big difference in data as we go from right at the mouth of Kane Springs, solid blue, high resistivity carbonate, to two miles away, low resistivity, a minimum of 2500 feet of basin fill. So that's why we put Dorothy's fault in there and considered a major, major feature as far as hydrology goes.
And the next slide summarizes things. The CSAMT, it showed realistic results where we crossed out known outcrop and we knew what we were on, it matched. The data work, the equipment worked well, no problems. Automatic

calibrations always worked. Automatic checks always worked.
The data did agree with specific locations of some faults that are mapped as concealed. And other -- mapped other faults that Rowley mapped as concealed, we did not see. That's probably because they've been interrupted by the large fault that we did see.
And that's probably the most significant finding is that there is a large fault, very significant change, approximately 2500 feet, in between CSAMT lines ten and 11.
Now we go to demonstrative exhibits; right?
Q. Yes. Please proceed. Yes.
A. Okay. Very quickly, the National Park Service pointed out the geologic report by the USGS. It's in open file report 00-420. And we talked a little bit about it in the CSI discussion further south in the valley. And they did do a couple of gravity lines near the Kane Spring line, so we, of course, looked at that to see how things worked.
On this plot there's very -- you can -- up at the very top in the center right on the edge of the plot is a very faint blue shaded blob. That's the knob that we talked about, the dolomite knob. So the miles of Kane Springs is right at the very top of this map.
Other geology that's shown on this map as faint shading, pink and blue and light green, the bulk of the map

though is just a white background because it's on the basin fill and we don't know what it is.
The contours that you see, all of these lines, parallel lines, kind of swirling around and curving up from -- going from south to north, it's sort of north-south and then veers off to the side. Those are called isostatic anomaly contours. All it's saying is that as we go from the right side of this plot towards the center of the plot we're going from very high density rocks, the granites and things like that, towards low density rocks out in the middle where you see a big oval and a bulls eye in the middle but a big oval all around it. That's the basin center. That's the center of the valley. That's where the basin material is the deepest.
The basin fill material is very low density. It's loose rock. It's sand, gravel, clays, things like that. So the contours are showing from where you're going from high density to low density or from low to high or something like that.
In the upper half of this plot there's some very dense little points. Those are their data points along two lines that we did called the N-1, which is the northern line of points, and N-2, which is the southern line of points. All of the other little dots you see are on the map are

they're gravity stations. But their lines were high density gravity. In the rest of the plot it's very, very low density stations. They were sometimes two miles and three miles between a gravity station. So they consider this -- And they stated in their report that this is a very low resolution look at the valley. But where they have high density, that's a good gravity cross-section.

So if we go to the next slide --

Q. And just to clarify, Mr. Carlson, that is not Rowley's geology on that last slide?

A. You're right. From memory I think they used Page but I'm not a hundred percent sure. That is not Rowley's geology map. Rowley based a lot of his on Page too.

The result of the gravity along these very tightly spaced lines, on the top is that northern line and the gravity line N-1. And they've divided up the subsurface in to just two layers. Along the top you'll see some red dots that look like they have little antennas on them.

Q. And you're on the top plot?

A. Sorry. On the top image on slide 25. Those little red dots that look like they have antennas, that the surface of the ground, that's where they parked and made a measurement.

And then right below those on a line is a very

lightly shaded yellow layer and they label that as the Cenozoics, which is the basin fill in this case.

And then below that, which is the vast majority of the line is light blue labeled PZ for the Paleozoics, and they identify that as the carbonates. They don't differentiate from dolomite, from limestone, or anything like that. It's just that's their carbonate.

So they're saying on line N-1, the northern line which is near our line ten, they see a thin layer of Cenozoic basin fill. And then down to 6,000 feet they see carbonate.

The lower image is their line N-2, which is close to our line 11. And you can see we're now on the bottom image on slide 25. The surface of the ground is those red dots with the antennas. And now we see a very thick zone of the pale yellow labeled CS, the Cenozoic basin fill.

You can see in the middle of their line it's just about 3,000 feet deep. So they're also seeing basin fill clear down to 3,000 feet as they move away from the mouth of Kane Springs.

And then below the basin fill we show the pale blue again as the high density carbonates.

If we go to slide 26, this just for reference shows their plate one again and we've just overlaid our CSAMT lines in blue so you can see where they are relative to each

other. Lines ten and 11 and 12 and then for reference the Coyote Springs Investment line A down at the very bottom give you a reference of where we are in the valley.

So we have line ten in the upper central part of this plot. And you can see that the southeastern half of line ten approximates their line and the gravity line N-1. And then about the southeastern third of line 11 is where they have their gravity line in two.

And if we go to slide 27, very quick refresher, there's line ten, solid carbonates, blue.

If we go to slide 28, there's line 11. And actually let's go ahead and go to the next one. So on this plot, the top image --

Q. You're on 29?

A. I'm sorry. Yes. Slide 29. The top image on slide 29 is that southern half of line ten approximating their gravity line in to N-1. The southern -- The bottom image on this slide is the southern third of our line 11 to approximate their line N-2. Confusing.

And we're seeing the same thing that they were seeing. By coincidence they use blue for their carbonates and we use blue for our high resistivities. Our line ten and their line N-1 are both solid blue because we're detecting carbonates. They see it as a high resistivity -- or they see

it as a high density feature. We see it as a high resistivity.

Go further out on the valleys at line 11 and we're seeing basin fill very deep. You'll even notice that in the middle of this section at line 11 the deepest part of these low resistivities is right about in the middle of the line out here, not in the middle of the valley. And that's exactly what we saw on their line N-2 that they had the deepest basin fill in that part of the line and not in the middle of the valley. So we're in agreement with that.

We go to the next slide. Thereto, again, we see the same thing. As we move from the mouth of Kane out in to Coyote Springs, a great big huge step of carbonates. Everything drops off 2500 feet.

If we go to the next slide. That's really the perspective view again.

So -- But I wish we had seen the USGS report before we laid out our lines. Similar to Coyote Springs, we would have laid things out a little differently, because it's unusual when we get two different data sets from two different groups that are measuring two different physical properties of the ground and you're seeing the same surprising unexpected thing. They see this high density change in low density over a very short distance. We see high resistivity change to low resistivity over a very short distance.

And the only thing I can come up with is a very significant fault in between lines ten and 11. And I think that probably wraps it up from my end.

MS. PETERSON: Thank you.

THOMAS BUTLER
Called as a witness on behalf of
Lincoln County/Vidler, having been first duly sworn,
Was examined and testified as follows:

DIRECT EXAMINATION
By Ms. Peterson:

Q. Now we'll turn to Mr. Butler.

A. Sorry. I'm recovering from a really bad cold, so you might have a hard time hearing.

I was recently hired by Vidler to provide assessment and geochemical data. More specifically, the question I was hired to answer is whether there is geochemical evidence to support the conclusion that there was a significant component of water from Kane Springs entering Coyote Springs or the Muddy River Springs area.

The geochemistry data set that I evaluated was

from CH2M Hill report dated 2006, which is entitled Hydrologic Assessment of Kane Springs, Geochemical Framework and the whole data sets from that report.

I also provided some comments to some findings in some recent reports prepared by Mifflin and Associates from their July 3rd, 2019 report.

And together the conclusion that I draw from this is that we're going to show how KPW-1, Kane Springs pumping well, in the southern portion of Kane Springs Valley and CSVM-4, which is the northeastern well in Coyote Spring Valley, how they are related and how they differ from other wells in the entire system. And that's the Lower White River Flow System.

And we'll do that through a series of Piper plots and Durov plots, the carbon-14 data, the fluoride concentrations, we're going to look a little bit at equilibrium modeling and how things appear to be different in certain areas and we'll talk a little bit about how arsenic is not a very valuable tool in evaluating flow components.

This slide is actually meant to be placed over -- I was never able to get the proper slide. But it shows the same things I showed before. Mainly deep groundwater elevations to various wells.

Other folks that talk about this, this is Kane

Springs Valley up here, Coyote Springs Valley. A groundwater gradient in Kane Springs Valley is presumed to be based on outpatient data to the southwest. And the northern portion of Coyote Spring Valley it's to the south and southeast.

The important thing here I want to draw is gradient alone does not mean flow. You all still have that conduit so it does not necessarily mean the flow is occurring. More importantly, if it is occurring, whether or not it's significant. It's just a potential.

Next slide. Okay. So when I first got this data set, you know, one thing that struck me -- And I got this cold, so I had no idea how the context was going on here. This guy has been involved in this for years.

The similarities you see between CSVM-4 and KPW-1 in temperature. They had very similar temperatures compared to every other well in the basin. So I just did a -- You know, if we got these groundwater gradients coming out in Coyote Springs, this groundwater gradient down in Kane Valley, what's the potential for some mixing going on here?

So I did a very simple mixing model and I calibrated on water from CSVM-7 and KPW-1, the N-members, and see if I could simulate CSVM-4. And based upon that model, I come up with an approximate percentage of water for CSVM-4 of 74 percent. KPW-1, 26 percent. So that's just one

constituent.

So then I took that same mixture and I looked at does it apply to other things that are in this. Does it apply to the fluoride? Does it apply to temperature? How about water isotopes? That's independent of soluble chemistry all together. And the carbon-14. So when I calculate them, model CSV-4 data with all of those different constituents you'll see here, that they actually do compare quite well with temperature being the biggest discrepancy with 15 percent, but most of them plot at a very low percent difference. High probability that these two wells are indeed related. There's a component of the Kane Springs water and there's the component of the Coyote Springs water there.

(The court reporter interrupts)

THE WITNESS: So taking that same percent of each of these N-members, I then applied that to the major cations and the anions for those two water chemistry types to see if I could simulate a similar water type at CSVM-4. And that's what you see in the Piper block here. Actual CSVM-4 data is that purple dot, and the simulation is the teal dot. They do compare. We're able to see them. Just provide some evidence that they are very similar.

Next slide. And we're able to -- we show that KPW-1 and CSVM-4 are related. This plot here is the Piper

diagram that brings in a lot of other data. And I want to point out a couple of errors or corrections. The data shows that the Black Mountain data is in this. It is not. Rogers point or -- I'm sorry. Blue Point and Rogers Spring from Black Mountain Springs would plot right about here.
Q. (By Ms. Peterson) And describe where you're pointing.
A. To the north. To the northeastern corner of the Piper diagram.
Also, the circle area, it says it depicts central CSV water. And it actually depicts Kane Springs water. So, a real quick description of these data. So these diamonds right here in the center portion of the Piper diagram, those represent all of the Coyote Spring Valley water chemistry from basically everything except CSVM-4, everywhere else in the system.
The solid circle indicates -- The blue circle, it's hidden behind the purple circle, is KPW-1 or CSVM-4 --
(The court reporter interrupts)
THE WITNESS: And the black circle is Willow Spring. Willow Spring is also located in the southern end of Kane Springs Valley. The open circles are the northern springs in Kane Valley.
The star up here, the stars are actually all of

the samples. And I should preface this. I can only create this diagram for where we have complete water chemistry. So these are all the water, all the data from that 2006 report. They have complete water chemistry that enable us to make this diagram for these wells.
Star data is from the Muddy Springs, MR -- I'm sorry. MRA --
(The court reporter interrupts)
THE WITNESS: MSRA springs. I got it backward.
And so these are these right here and this one here. This little triangle is actually an alluvial well. It's a railroad well from the Lower Meadow Wash area.
What we can see here is there's a potential mixing relationships between either central Coyote Spring Valley and your in-basin recharge in the Muddy River -- Muddy Springs or the Lower Flow Valley Wash.
In the Kane Springs and the CSVM-4 are chemically unique and do not appear on any of those mixing relationships. That would indicate that they are not a part of that mixing relationship. Not likely a significant component of water to the MRSA.
Next slide. Durov diagram is very similar to the Piper diagram in that it presents featured cations and anions in the system and it also brings in the total amount of those

old substances, TDS as well as another variable of pH.
Again, what we see here is these are KPW-1 springs and CSVM-4 in that northeastern portion of Coyote Spring Valley. Willow Springs they kind of plot along a new relationship with each other. We also see central Coyote Spring Valley water right here. We see the MRSA water here. And we have the railroad well, that alluvial well, out in Lower Meadow Valley Wash area. And what we see is mixing relationship here appears to be between alluvial source and the Kane -- or the Coyote Springs -- the Coyote Spring Valley water. Kane and CSVM-4 and Willow Springs are not along this trajectory.
So, again, these chemistry data suggest that Kane Valley is not a significant component of water entering the MSRA(sic) or is mixing with it.
Q. And Mr. --
A. Oh, I'm sorry.
Q. Mr. -- Mr. Butler, when you were describing the mixing relationship, you were talking about the rectangle on the right-hand side of the slide?
A. Yeah. That's the -- Yeah, this -- And there's a line drawn between the points. There is a straight line.
And just a clarification here. This also shows that the Black Mountain Basin samples are on this. They're

not. If we were to plot them, they would plot about right here way off the graph.
Q. And you're pointing to the text on the right-hand side?
A. Yep. Yeah. Right about where it says recharge in MRSA. And those would again be Blue Point and Rogers Springs.
Next slide. This is really hard to see here. I should blow it up more. This is carbon-14 data. And the main point here is that it's measured in percent modern --
(The court reporter interrupts)
THE WITNESS: Percent modern carbon. And the values here at KPW-1 and CSVM-4 are quite low. The values in central Coyote Spring Valley and the MRSA are quite a bit higher. So what that means is if the presumed groundwater flow path is from Kane to the MRSA, the groundwater would have to get younger, not older, as it flowed along the groundwater flow path. So that can't happen unless there's a vary significant influx of much younger water.
So, again, the data here suggests that Kane Springs Valley is not a significant component of water to the MRSA and that -- that there's probably another source most likely that's coming from Coyote Springs or somewhere else that the percent margin in these areas they jive pretty

nicely.
Q. (By Ms. Peterson) So you have about five minutes left. But don't talk any faster.
A. That's going to be difficult. Okay. So this is just a comment to the Mifflin report. The comments in green, I won't read it for time. But basically it's saying things, arsenic could be used as a tool to define the MRSA capture zone.
I just want to state that arsenic is a horrible indicator of anything because it is extremely transient and variable. It's dependent very much so on the REDOX potential of the groundwater. It's dependent on the pH of the groundwater. It's dependent on whether or not it travels through any iron oxyhydroxides because they effectively damage it.
And, case in point, we showed earlier that KPW-1 and CSVM-4 are likely to replete it and that CSVM-4 from multiple indicators is likely about 76, 75 percent KPW-1 water.
While KPW-1 has an arsenic concentration of 46 micrograms per liter, CSVM-4 has five. If that relationship could hold true, this should be 35.
Q. And what are you pointing to?
A. I'm pointing to the concentration that is on the

figure on the map for CSVM-4.
And if you were to use arsenic, which has been postulated to include Kane, the high concentrations aren't seen anywhere else in the basin. So if you're going to include arsenic, you would use it the exact opposite way. I'm not saying to do that, because it's not good. It would indicate that it should be excluded from the system.
And, finally, I want to go on to the next slide and talk about fluoride. Mifflin also stated that fluoride can help define the capture zone due to high concentrations of fluoride present. Kane, again, has some of the highest concentrations of fluoride. So does CSVM-4. Those concentrations aren't seen anywhere else in this immediate area. Most of the equal concentrations of fluoride up here again. Central Coyote Spring Valley as well as MRSA.
The fluoride is -- The fluoride is a mineral that is temperature-controlled and it will also show in the next slide, I believe, that the temperature is indeed controlling its concentrate, elevated concentration, at the location.
Okay. So this is a simulation. This is a PHREEQC. You're probably familiar with PHREEQC modeling. It's a USGS geochemical modeling program. It's a very simple model that takes the -- basically takes mineral calcite and mineral fluoride and sets it in to equilibrium with

temperature.
We also did a system that involves calcite, gypsum, and fluoride. These are very common minerals. Nothing exotic here. You expect these. Green line, that's the equilibrium model for calcite, fluoride, gypsum. Blue dash line here is the equilibrium model for calcite and fluoride alone.
And what we see is KPW-1 and CSVM-4, they collect right on the concentration of where you expect fluoride to be versus temperature for a system that's dominated by fluoride and calcite, as does this stream. It's only there because that data that was in that data set where they were available and it's in a similar equilibrium of a similar simulation.
All of the other minerals -- All of the other samples throughout that 2006 report where we have fluoride temperature data plot below that equilibrium line and more similar to a plot that would keep that gypsum as also being involved in that system.
So, again, these data suggest that the Kane Valley is not a significant component. It's very unique compared to many of the other samples in the MRSA and elsewhere in the valley.
Water isotopes. So Mifflin again suggests -- states that groundwater captures and could be confined by

water isotopes, a difference to signature that these could be related. Kane and CSV-4 got compared to other isotopic valleys in the area are isotopically light in comparison to most of the samples in central Coyote Spring Valley and the MRSA where they're slightly more depleted, slightly less negative, and very similar to one another.
So these data would suggest, isotope data, would suggest that KPW-1 and CSVM-4 are isotopically different than central CSV water and the MRSA water. So, again, not the same. Different.
So the conclusions here where we looked at several different indicators, not just one mining -- mineral or one parameter. General, slides --
(The court reporter interrupts)
THE WITNESS: We look at several parameters including general mill chemistry. We plotted in Piper and Durov diagrams, that carbon-14 data, we looked at fluoride concentration, and we did some equilibrium models, and we also looked at water isotope data. All of these data, every single independent parameter, independent parameter suggests that the MRSA is not dominated by Kane water but it's more likely dominated by water from central CSV or the Lower Meadow Wash area. And, again, arsenic is still just a horrible thing to use. So don't use it.

MS. PETERSON: So this would maybe be a good time for a break if we were going to take a break this afternoon.

HEARING OFFICER FAIRBANK: We can go ahead and do that. We'll go ahead and take a ten-minute break.

(Break was taken)

HEARING OFFICER FAIRBANK: We'll continue on with Lincoln County and Vidler Water's presentation. Thank you.

TODD UMSTOT

Called as a witness on behalf of Lincoln County/Vidler, having been first duly sworn, Was examined and testified as follows:

DIRECT EXAMINATION

By Ms. Peterson:

Q. Todd Umstot.

A. Hi. My name is Todd Umstot and I work with Daniel B. Stephens & Associates. My talk today is on drought and groundwater positioning.

Q. And I'm sorry. Just briefly could you give the State Engineer's office a little bit of information about your background.

A. I have a Bachelor's degree in environmental science and geology from the University of Massachusetts in

Amherst. And a Master's degree in hydrogeology from the University of Nevada, Reno.

I worked for Dan Ravie and Associates in New Jersey for a good part of the nineties. And I've worked for Daniel B. Stephens & Associates since 2002. And I'm currently employed there as a senior scientist.

So I'm going to talk about how drought has caused a general decline in the groundwater elevations prior to the MX-5 testing.

So the occurrence of drought has increased in recent decades. What I'm showing here is the monthly occurrence of drought decade by decade. So plots bars that are higher indicate higher conditions of drought. Bars that are lower indicate more wet conditions.

So the Palmer Drought Index is a simplified water balance model that takes in to account precipitation, soil moisture conditions, and air temperature. And the data that I used is published by the US agency NOAA, National Oceanic and Atmospheric Administration agency.

And, so, as you look from decade to decade, in the 1920s it was a very dry condition. I mean kind of wetter condition. Thirties, drought. It was very dry. And a little bit wetter. Then a very dry condition again in the sixties. And then a wetter condition in the seventies and

eighties. And then since the eighties there's been a general increase in occurrence of droughts. So the nineties had a higher drought than the eighties. And then the 2000s had a higher drought to the nineties. And the recent decade has been similar to the past decade.

And then you can also see on here I've plotted two different colors. The blue bars represent Nevada Climate Division 3. So when NOAA publishes Palmer drought data, they publish it for different regions of the United States. And so one of the regions is Nevada Climate Division 3. That represents generally central Nevada and it cuts in to the northern portion of Kane Springs and touches on the north part of Coyote Springs Valley.

And then Nevada Climate Division 4 is southern Nevada. And that covers the rest of the lower -- covers the Lower White River Flow System.

So if you look at the time series analysis of drought conditions in Nevada Climate Division 3 since 1960. So the Y-axis here on the left, this shows whether or not they're drought or wet conditions. So for the Palmer drought index, zero represents normal conditions. And pretty much the range from minus two to two is a normal range of drought and wet conditions.

As you get to negative three and negative four,

you start to go in to severe drought and extreme drought.

And then when you go in to positive values of three and four, you get in to very wet or extremely wet conditions.

And so as faintly shown on here for the monthly Palmer drought values from NOAA are shown as the blue line. And then I've taken the trailing 12-month average of that data to kind of show what the general trends are and kind of smooth out the noise that you see in the Palmer drought data.

So the groundwater -- what you're going to see in the groundwater elevations, they're going to see a combination of these different processes, depending on where recharge in the system is sourced. If the recharge is sourced from further away, it's going to be a more dense response that's going to reach the well. If it is recharge that is coming from an arroyo that's right next to the well, then that's going to be a quicker response for the well.

So it's different recharge areas, different amounts of recharge in these areas. Higher recharge in the mountains. Lower recharge in the valley. And different distances from these recharge sources to the wells. And all of these different processes are going to end up making variations in the hydrographs.

And so the Nevada Division Climate 3 showing again over here on the right the climate division, the Climate Division 4 is this southern area divided by the black line. And then Nevada Climate Division 3 is an area to the north.

So the rate run time that the 1169 aquifer testing in MX-5 pumping began there was a general decline. There was a general increase in drought conditions that would expect to cause the decline in groundwater elevation. So if you look at the period, the one-year period, before the MX-5 pumping began, there were drought conditions about 42 percent of the time. And if you look at the period when the 1169 aquifer test took place and the additional time the MX-5 pumped beyond that in to April 2013, drought occurred 82 percent of the time. So you had drought conditions occurring twice as often during the test as you had occurring in the year just before the test started.

You also have in 2005 a very wet period. Precipitation that occurred in 2005 water year is probably the first or second highest precipitation in the hundred years that occurred in this area. So you had a very large recharge pulse to happen in 2005. Smaller recharge pulses in 2010. But overall a general decline in groundwater elevations that occurred to this generally increasing level of drought.

Q. And you were just talking about slide four; is that correct?
A. That was slide four. Now I've moved on to slide five. If you look at Nevada Climate Division 4, this is the southern area, it's very similar to what we just saw. It -- Generally, Climate Division 3(sic) is a little bit drier over the past decade or so than Climate Division 3. But, again, you see a similar effect where there's wet conditions just before the MX-5 pumping began and then increasing the level of drought as you go in to the period of time the MX-5 was pumping.
So now I show comparison --
Q. You're on slide six?
A. Slide six. So now showing a comparison of the Palmer drought index. This is using the trailing 12-month or one-year average for the severity index. I have plotting on the darker line here. I can't quite see the color. That's Climate Division 3. And then the orange line is Climate Division 4. And then the blue line is the monthly average water level that most people here have been using for their analyses for the CSVM-4 hydrograph.
So there's a big jump in groundwater elevations following the recharge event in 2005. Being that it was such an extreme event, you would expect that you will have a

decline back to normal conditions following a very large recharge event, which is not one that you see in the aquifer system in here.

And then you have an increasing amount of drought as you go in to the time of the test.

And then groundwater elevations start -- they decline through the test and continue to decline after the test, after the MX-5 testing.

And so if the -- what you would expect to see here -- And I'll show this on the next slide in a little more detail, slide seven. What this shows on the top I've broken them out. I have the groundwater elevations for CSVM-4 shown on top. I have the pumping amount shown in the middle plot where I have in blue the total amount of carbonate pumping. And then in red I have the amount of MX-5 pumping. And then on the bottom I have the Palmer drought severity index. Again, that trailing one-year average for regions of Climate Divisions 3 and 4.

And so you see due to drought conditions you would expect water levels to decline up in to 2015. And in Division 4 water levels probably start to increase around the end of 2014. In Division 3 that might cause more of them to decline through 2015. Because that's the pattern you see with CSVM-4 is they continue do decline during that whole

period.

Now, if you compare the pumping signal to the hydrographs, you don't see any response to when MX-5 well stopped pumping. So the MX-5 well went through two periods of time where it stopped pumping. And I'll show later on how other wells responded to that cessation of pumping at MX-5. But you don't see any response to CSVM-4 to that change in pumping.

So some had postulated that all of this decline is due to pumping, then this well would have to be very well connected to the location of MX-5. And then even if there's any kind of time shift, you would still expect to see maybe a shift in the time the fluctuations due to when MX-5 stopped pumping.

And then once MX-5, the end of the test, the complete end of pumping occurred, the MX -- the CSVM-4 well continued to climb and there was no recovery signal seen.

So that can be confusing to kind of discern drought and the pumping signals or the potential pumping signals on CSVM-4 during the period of decline. But it's very clear during the period of recovery that you don't have a response to the MX-5. So I think that's very diagnostic that this well is not connected to pumping at the MX-5 location.

Moving on to slide eight. So this will be a very similar story that we see for KMV-1. KMV-1 again it was -- we don't have a record going back to before for this recharge event, but because it's close to CSVM-4 and it shows similar hydrographs, you would expect that this has an increase over what it was in the previous years. And then after that high recharge event you're going to have a general decline. And that's going to be supported by the drying trends that you see in the Palmer drought.

And, again, moving on to slide nine, I show the pumping effects. You don't see recovery responses in KMW-1. So it may be hard to discern drought from pumping effects from the declining curve. But you can definitely see because of a lack of recovery signal that the MX-5 is not connected to the KMW-1 well location.

And so I want to look at some of the other hydrographs in the region and put the focus on that recovery response.

So, prior to the MX-5 pumping, you have wells CSI-1 and CSVM-6 right near the pumping MX-5 well. Prior to the pumping occurring, you had a general decline in groundwater levels. There's some seasonal fluctuations probably due to the pattern of the carbonate pumping from overall in the system.

You'll see a recharge event responding to recharge and then decline from that recharge event to heavy precipitation in 2005 and a response that occurred later on in 2006.

And then during the MX-5 pumping test you see in the CSVM-6 that when the MX-5 well is temporarily turned off that you get these little bump-ups from the well. So you get these little recovery responses.

Moving on to slide 12. So, again, looking at the different wells, this is looking at the CSI wells, one through four, and CSVM-1 at the bottom. You're looking over here at the representative carbonate wells in the system. Again, when you look at wells that are near MX-5 well that are -- it all shows this characteristic bump in January 2012 when the MX-5 pumping was turned off.

Moving on to slide 13. And so if you look at the hydrographs for all of these wells, you also see a general up and down pattern of all of these wells responding to pumping in the carbonate system. So they're all responding. Not only do they respond to the MX-5 test but they're responding -- you see this characteristic seasonal response to the MX-5 pumping. I mean to the carbonate well pumping.

When you look at the hydrographs at KMW-1 and CSVM-4 and you look off at CSVM-1 -- CSVM-1 is right near

MX-5. KMW-1 and CSVM-4 are the wells near Kane Springs. You don't see that seasonal pattern from the carbonate well pumping before the MX-5 test began. And you also don't see any response when MX-5 turned off during 1169 aquifer test or when MX-5 finally stopped pumping at the end of the MX-5 test. And the water levels continued to decline for up to one and a half years after the pumping ends.

So people have postulated different lags for why maybe it just takes a long time for the signal to get up to these wells at KMW-1 and CSVM-4 for the MX-5 pumping. I'll talk later about it looks like SNWA is using maybe a three-month lag. I believe National Park Service expert testified there was a nine-month lag. When I looked at his chart I saw a ten-month lag before water levels started to decline at KMW-1 and then a ten-month lag for what he thought when water levels went up.

So people don't even agree on what's the lag period for when you might see a response at this well. But if you look overall, there's just no -- there's no response to the recovery.

And so another way of looking at this is a special --

Q. And, excuse me, you're on slide 15?

A. Slide 15. So what I'm showing here is I look at

the change in water level between the end of the MX-5 pumping, April of 2013, and January 2014. So I'm showing in blue wells that had a rise in water level. So near the MX-5 pumping you see blue locations as you would expect as they have rising and response to the end of the MX-5 pumping. But if you look up to the north you see red where you still have declining water levels.

So what this plot is showing is that you're not seeing any response to the MX-5 pumping in the vicinity of CE-VF-1 or CE-VF-2 and areas to the north of that.

So now I'm going to talk about some of the other analyses that others have done. Southern Nevada Water Authority has primarily relied on correlation analyses to support hydraulic connection. And then they also use the correlation analyses with a linear regression to estimate drawdown. That's very unusual to me to see people use linear regression to estimate drawdown. Typically you would use Theis equation or some variation of the Theis equation. Or in a system that's this complicated I would use a groundwater flow model. So I'm surprised in the years that they've been working at this that they don't have a groundwater flow model that they're relying on for this. Instead, they're relying on very simple linear regression.

And when I look through the USGS report that they cite, I don't see any support for using linear regression to estimate water level drawdown from an aquifer test.

So when you look at --

Q. You're on slide 17?

A. Slide 17. When you look at hydrographs and you do comparisons, generally in this area they're all kind of responding to similar patterns of climate. But you can also see, you can get kind of spurious correlations. So others that reported that CSVM-5 that's farther to the north in Coyote Springs Valley is not connected to the MX-5 pumping region. And so you could do a regression on that well of KMW-1 and you come up with a fairly high R-squared of .68 and is similar to the type of regression that you get using between EH-4 and KMW-1 without using any type of a lag. So you could find these types of spurious correlations. And I don't think this is enough evidence to show hydraulic connection and it's not sufficient to be used to predict drawdowns from an aquifer test.

And simply having correlation is not proof of causation. Causation is neither proved nor evaluated in a regression analysis.

Slide 18. So kind of an extreme example is you can look at does MX-4 correlate better to a well in Cave Valley as it does to CSVM-4. So if we look at the drawdown

over the MX-5 test or we look at the groundwater elevations, I can get a higher correlation with this well in Cave Valley than I do with CSVM-4. So this is just not sufficient evidence to support hydraulic connection or to estimate impacts from MX-5 pumping at the CSVM-4 location.

And also when I look at the analysis there's no justification given for this use of a three-month lag. And that lag is only applied -- Here you can see they apply it at the beginning of the test but they don't apply it to the end of the MX-5 pumping. So you would expect that to be shifted on both sides there.

And then I heard from the testimony that I guess the purpose of the three-month lag is they didn't know what the lag was. There was no other separate calculation or analysis to support what an appropriate lag was. They just tried various different lags to see what would give them the best R-squared. So this to me it's not appropriate. There's relatively simple equations they could use based on aquifer properties to be estimated from this testing or from modeling that you could use to figure out what the delay would be to reach the -- to see what pressure -- how long it would take the pressure signal to go from the MX-5 well up to KMW-1 or CSVM-4.

And so, again, this lag is used consistently in

different calculations and it's used to estimate the half foot of drawdown from the MX-5 aquifer test in their linear regression analysis. And what I see is that all that lag does is improve the R-squared analysis. And that lag does not apply in the correlation or I don't believe it was tested with any of the other correlation analysis.

Q. And you were just on slide 21?

A. That was slide 21. I've now moved on to slide 22. Looking at the multiple linear regression that was provided in the Southern Nevada Water Authority's rebuttal report. So when you do multiple linear regression, there's typically you can do it two ways. You can start with just one coefficient. Coefficients here are listed on the left. And add one at a time to see how that affects the R-squared and check the P-values. When you look for the P-values you want this probability to be less than .05, less than five percent. Because what that pretty much represents is the chance that your coefficient here is zero.

And so if you look at the P-values that came out of the multi-linear regression, for the Black Mountains area, it's nearly 70 percent. So there's a 70 percent chance that the coefficient here is zero and that this pumping in the Black Mountain area has no effect on the EH-4 water level.

And then, similarly, if you look at the Muddy

River Springs area, there's a ten percent chance that the coefficient is zero. And if you look at the certainty analysis given here for the Muddy River Springs area and the Black Mountain area, the certainty goes from negative to positive. So this multiple linear regression can't tell if the pumping in the Black Mountain area or the Muddy River Springs area will cause a decline in EH-4 water levels or might cause an increase in the EH-4 water levels.

And later on I'm going to go in to demonstrative and I'll go in to some more detail.

But, when I see values, particularly when you look at P-values, they're very small. When you look at the P-values that were published I believe by Fish and Wildlife or maybe it was by National Park Service, they were ten to minus five, ten to minus ten. They were virtually zero as you see here.

When you see P-values around one percent and you have these other high P-values, the next step is to do a step-by progression where you take out the Black Mountain area pumping and you take out the Muddy River Springs area pumping and run the regression again and see how the P-values change.

And, further, you can remove some of these others. And I'll show later on that the only one that

remains significant is Garnet Valley.
So another issue with looking at the response at CSVM-4 is that the water level data are not very accurate. The transducer that was used during the MX-5 pumping interval during the 1169 aquifer test as was described in Southern Nevada Water Authority's report done in June 2013 had a high failure rate due to the high water temperatures in the well so that the data that they got from that transducer data could be off by a foot or less. And then the estimating that the drawdown of this well is a half foot. So the drawdown that they're calculating from the linear regression analysis at this well is less than the amount of air that they're giving in their transducer -- in their transducer measurements. And those transducer measurements will continue to be used in their correlation analysis. So they're included in the monthly average of water level, which is then used in the calculations.
And so another anomaly that I noticed --
Q. You're on slide 24?
A. Slide 24, yes. Another anomaly that I notice is that if you look at the MX-4 well and you look at the groundwater elevations during the MX-5 test, you look at the figure that was published in the June 2013 report, all the water levels are around 1,820 or less.

If you look at the elevations that were used in all of the MX-4 correlation and linear regression analyses, they're all above 1,820. So there's been an offset here of about two feet. I'm not sure why the offset is there. I don't know if a different time interval was selected that was different from the period of time used for the MX-5 test or there was a survey error. But, ultimately, I think what this shows is that there's errors and uncertainty in these groundwater elevations here of two feet. So, again, if we're looking and trying to estimate a half foot of drawdown to CSVM-4 and there's errors in these data of one to two feet, the data themselves are not sufficient to be used to estimate the drawdown and the estimated impact at KMW-1 or CSVM-4.
So if you look at -- This is out of the June report from Southern Nevada Water Authority for the groundwater elevations. Now with this new water level for MX-4 it's much higher than you see than the water elevations that you get from wells around it. So that's really anomaly. That's typically your contour that that would be a source of recharge there.
So this well elevation is off now. I don't know what's the status of the other elevation to wells around it. Do they need adjustment or there's something in the MX-4 that needs to be adjusted back down. So there's a lot of

uncertainty at least within the range of groundwater elevations that were considered in this case and the region of the MX-5 aquifer test. And so it may not be appropriate to use the MX-4 well for any kind of a correlation analysis or a linear regression prediction of drawdown.
So another thing is looking at barriers. We've looked at -- We've generally looked at CSVM-4, KMW-1, and the offset in this region versus the offset in groundwater elevations to the south. I'm on slide 27 now. But you can see if you look here at region CE-VF-2 and CSI-4 that there's a big drop in groundwater elevations just between those two locations.
And so I'm showing on the right I plotted -- I pulled both of these figures from Southern Nevada Water Authority, but I've added the red polygons and the red text and the blue polygons and the blue test and I've incorrectly plotted here CE-VF-W2. It should be just to the east of the highway and more south here. And this red line that I've added should be between CSI-4 and the corrected location of CE-VF-2.
Q. And you were just pointing at the right plot?
A. I was pointing at the right plot. The right plot needs to have location for CE-VF-2 corrected and moved to the east.

But, anyways, you see there's most faults even though they go north-south, you do see evidence of slight slip faults that have more of an east to west direction. We were at the end of a ridge here. Why that ridge terminates near the location of the offset between these two wells is unknown. But that might be an indication that there's some sort of hydraulic barrier, in addition to the hydraulic barrier indicated by the geophysics up to the north.
So, if you look at the hydrographs, moving on to slide 28, these wells that are two miles apart, CE-VF-2, that plot in the top is to the north. CSI-4 is the plot in the bottom is the well to the south. There is an anomaly that happens at CE-VF-2 that I believe there's a hole in the casing or something where the groundwater elevation increased. But if you look at the hydrograph even before that, the groundwater elevation was around 1,856, whereas the groundwater elevation of CSI-4 is around 1,822. So there's a change in head here of over 30 feet over for this area a relatively short distance.
And others have testified that this is more of a bathtub with fairly flat gradient. You wouldn't expect to see this much offset from these two locations that are only two miles apart.
And then you also see -- I do think you see a

little bit of the carbonate pumping signal in CE-VF-2 but you see a much dampened effect than you see on CSI-4. So already because this hydraulic barrier and there's at least another one that is up to the north beyond this, you see a dampening of hydraulic effects as you move to the north.

And now moving in to my demonstrative slides. So I'm going to go in to some details on the polling of regression. So pulling the reference that was used by Southern Nevada Water Authority as a USGS report is Sell and Hersh, 2002. When you do multiple linear regression, abbreviated MLR, you want to choose the best MLR water model. And the way you do that is you use a stepwise procedure. There's some software now that can do that in an automated sense. But if you're using Excel, you have to do it more manually where you have to look at the P-values.

So I replicated Southern Nevada Water Authority's first analysis. I've highlighted here -- And I've moved on to slide 30 demonstrative. I've highlighted here in red --

MR. TAGGART: We would like to just object for the record. My understanding is this is a new analysis. This was not provided in the expert reports. If I'm wrong though, I can be corrected. But my understanding is this is new work that was done since the submittal of the expert reports. And I thought our rule was that witnesses would

testify about the conclusions that they had in their reports and we didn't have a chance to respond to this testimony about the stepwise regression. So if I'm wrong about this being in the reports, I apologize. But I haven't been able to locate it.

HEARING OFFICER FAIRBANK: Ms. Peterson, was this -- is this analysis contained either in the initial July 3rd report or the August report?

MS. PETERSON: Not this specific slide, no.

HEARING OFFICER FAIRBANK: Then I would say that Mr. Taggart's objection is reasonable based upon the fact that the testimony and evidence that was to be submitted was limited to the analysis that was performed and provided within those reports. If this is an evidence and analysis that's contained in the reports, then I think that's fair game. But, unless a participant has an opportunity to review and have it in preparation for the proceedings, that does raise a certain level of concern.

MS. PETERSON: So the stepwise linear regression was discussed in the report and explained in the report. This specific figure was not in the report. And the information comes from the SNWA chart that's in the rebuttal report. I think it's Figure A-1 in the appendix. And so that figure is in evidence, this figure right here on this

demonstrative slide.

MR. TAGGART: Again, yeah, we in our report discussed multi-linear regression. I don't know where they discussed multi-linear regression in their reports nor in any of this analysis on this slide, the next slide, the slide after that, the following slide. So the next four slides are all analysis that was not included in any report that described stepwise linear regression.

MS. PETERSON: Again, stepwise -- the linear regression was discussed in Mr. Umstot's report, his rebuttal report, specifically in response to SNWA's information in their report. These figures -- And, frankly, I don't even have the demonstrative exhibits in front me, so I don't even know what the next slides show. I can't remember what they show. But the figures that are used are contained in SNWA's evidence. And you -- I mean, the witness that just appeared for the irrigation district or the Moapa Valley Water District did a totally different analysis than he had contained in his report and you allowed all of that in.

HEARING OFFICER FAIRBANK: Mr. Herrema.

MR. HERREMA: Brad Herrema for CSI. You know, Mr. Taggart has asked every witness that's come after the CSI witnesses that they thought of that prior testimony provided by CSI witnesses regardless of whether it was in their report

or their rebuttal report. So, if we're striking some of this, then we might want to go back and ask for other things to be stricken as well.

HEARING OFFICER FAIRBANK: So I guess a couple of considerations is one is, Ms. Peterson, is you guys have about 20 minutes, roughly, left within the time allotted for you for your presentation of your evidence today. If this is a manner in which you guys want to go ahead and extend that time, that's certainly within your discretion and we're not micromanaging that. To the extent the State Engineer finds value in it or not find value in it, the State Engineer will make a determination with regards to the analysis and whether or not it's appropriate within the confines of these proceedings and those reports contained.

And so with that I would note Mr. Taggart's objection and we appreciate your response and we'll let you proceed as you see fit.

MS. HARRISON: I just --

(The court reporter interrupts)

HEARING OFFICER FAIRBANK: It's Sylvia Harrison. Ms. Harrison.

MS. HARRISON: Sorry. I just want to echo Mr. Taggart's objection. This is a new analysis that we have not seen before. It's not simply a rendition of previous testimony. It appears to me to be a completely new analysis of other rebuttal testimony. So it's in effect a rebuttal of rebuttal. So we haven't got a chance to analyze it. So I just want to put that on the record. Thank you.

HEARING OFFICER FAIRBANK: Thank you, Ms. Harrison. And for those who are listening remotely, Ms. Harrison echoed Mr. Taggart's objection. And, again, I'll just reiterate that the State Engineer will take -- takes those objections in to consideration and we'll assign the weight to the testimony as appropriate.

MR. TAGGART: We do believe your initial ruling was correct. This is far different than anything else we've seen statistical analysis that's been completed and is now going to be testified about. We have no chance to respond to this. And it's different than someone putting up a hydrograph that everyone has been looking at, like Mr. Lazarus did.

HEARING OFFICER FAIRBANK: And I understand that, Mr. Taggart, and we appreciate that and your objection is being noted and will be taken under consideration. And you'll have your opportunity to cross-examine the witnesses as well.

MR. TAGGART: Okay. Thank you.

Q. (By Ms. Peterson) And, Mr. Umstot, you're going

to proceed ahead; right?

A. Yes. This is Todd Umstot. So what my demonstrative just supports is that if you continue to do the stepwise regression you would find that only Garnet Valley in this regression contributes to the decline or the change in water levels in EH-4. So anyone that did the analysis would find the same thing.

So I'll skip ahead to another demonstrative. This is slide 34, demonstrative slide, where it's the hydrograph for CSVM-4. What I'm showing here in addition that we haven't seen is in green the transducer levels that have an error rate of around a foot. And, blue, manual water level elevations. And then in red, what are described as calibrated manual groundwater elevation data.

So, you can see, you know, the up and down, the kind of jumping around in the transducer data that Southern Nevada Water Authority pointed out in the 2013 report. But what this also calls in to question is the manual measurements. So you can see here the water level went up a foot and went down a foot.

Q. What are you pointing to, what months?

A. If you look after the MX-5 test, you're looking around it looks to be maybe late 2013, the groundwater elevation from month to month changes by a foot. So when

these groundwater elevations are collected manually, this is not easy field work, the depth to water is something around I believe a thousand feet. The tape has to be unspooled and stretched. It could change over the course of a day. It could change depending on who went out that month to take the measurement. It could depend on the person who did the electrical tape that was used to make the measurement, different measurement location. Was it done to the ground? Was it done to the top of the casing? So you can see within the manual measurements there's some jumping around from month to month sometimes on the order of a foot or so. So, again, greater error in the manual measurements than the half foot that SNWA has estimated of drawdown at the CSVM-4 well.

And then the red values, once they start using calibrated tape -- I'm not sure how that was calibrated -- but you see a distinct change in the hydrograph. I mean, it could be that this is just because there's kind of wet conditions that occur around the end of 2014 in the Nevada Climate Division 4 that caused water levels to kind of stop declining. But, again, it's kind of odd to me that the break seems to occur with the change in the water level measurement method.

And you see sort of a similar thing again when you look at the KMW-1 well. Again, there's some up and down

values from month to month. So, you know, there's some error and uncertainty in those groundwater elevation measurements. And then, again, there's a break in the change once there's a switch to using the calibrated measurements. It may be related to climate or it may be related to -- So it's very hard.

In summary, there's too much error in the data to be able to discern drawdown response from the MX-5 test and to determine that there's a hydraulic connection to the southern carbonate pumping in the Lower River Flow System to the location of KMW-1 to CSVM-4 and that climate conditions would explain the general trends, the downward trends, that you do see in the groundwater elevations. So I don't see any evidence, hydraulic connection, to southern Lower White River Flow System.

PETER MOCK

Called as a witness on behalf of Lincoln County/Vidler, having been first duly sworn, Was examined and testified as follows:

DIRECT EXAMINATION

By Ms. Peterson:

Q. Okay. Dr. Mock, so you have about five minutes.

I apologize. Could you just give the State Engineer's office a brief summary of your experience and then just maybe hit the high points of your rebuttal presentation.
A. Sure. Good afternoon.
Q. Turn your mic on, please.
A. I'm sorry. So just to give you a quick overview, I received my Bachelor's degree in hydrology from the University of Arizona. The first two years of my Bachelor's work was in mining engineering where I received quite a bit more geology than you probably would have expected from a hydrology degree.

And then worked as a hydrologist one, two, and three for the Arizona Department of Water Resources. I worked there for three years under a registered geologist, actually several registered geologists. And worked on basin models, regional modeling, and also the Regional Groundwater Pumping Task Force, which is a rather unique opportunity.

I then went to CH2M Hill in Phoenix where I worked both in Arizona and California. My primary work there had to do with the beginnings of the superfund program, the great big flumes of TC that were miles long, finding the potential responsible parties for that and contracting the model.

I also did some work with artificial recharge in

Arizona, in Southern California as well. And I worked for a registered geologist in California at that time. And I when I was at CH2 I became a registered geologist both in Arizona and i California.

And then I went back to school. After working for 11 years, I went back and became a non-traditional student and received my doctorate in hydrology groundwater resources at the University of Arizona. In relevance to this, I was also the teaching assistance for Tom Maddox MODFLOW class. And MODFLOW is just the title actually because he teaches basin dynamics and systems analysis using MODFLOW. And so being in the teaching system I got to work with the students and work on basin responses and how models work.

I received my Ph.D. while doing a minor in applied mathematics. And my particular specialty in that was numerical analysis. And that's the solution of partial differential equations. That's where we use in groundwater we use Darcy's law and we use mass balance.

And I also, in doing that, out of necessity I had to write the code. I've written code for finite difference models. I've written code for the solvers. I've written the code for finite elements. And I'm familiar with how they work on the inside, if you will.

My doctoral dissertation was on the sedimentary architecture and how that affects hydraulic conductivity. So you see a mix of geology in with it. And, in fact, my advisor had to replace Mr. Shariq with Victor Baker on my advisory team to address the geologic aspects of what I was pursuing there.

I finished that and started my own firm for which I've been working about 22 years. I typically work in teams as you see here. I do not work as a loan consultant, but I work with a group. There is generally an overlap in the expertise of the team. And that's where I work and I enjoy that sort of work.

I've done many regional models with my own firm. And I've done some artificial recharge work. I've done water rights work in the Gila River Indian Community. I was in a type of prospect of the Water Rights Ranch Settlement Act of 2004 and the subsequent implementation which has included many factors, also developing artificial recharge projects for the Gila River Indian Community.
Q. So, let's go on to slide two, okay, because I think that's all we're going to get to, okay, Dr. Mock. I apologize.
A. Yes, ma'am. So my summary is that Kane Spring Valley is outside of and distant from the Muddy River Springs

area. The Lower White River Flow System hydrographic areas and the surrounding hydrographic areas are underlain by strongly broken-up arrangement of Paleozoic carbonate blocks.

Kane Springs Valley is in a different structural block of Paleozoic carbonates. I used the term in my report, a labyrinth, a maze. I've tried to find terms. Corridors. I don't think they're tubes. These aren't -- I'm not making analogy of rivers. I'm just saying that the pieces are broken up.

And if you look at -- I depend strongly on the work of Page and Rowley. I've seen very similar features in both of them. But it's critical to look at the structures in the area. So I'm saying that there are structural impediments of the blocks to groundwater flow. I'm not saying that all of them are impermeable. I would think that the East Mormon Mountains are where the actual underlain granite come to the surface, that might be pretty close. But there's no such thing as impermeable in my book. Tratzoky showed that concrete isn't even impermeable.

So there are structural pieces between Kane Springs Valley and the MRSA. And that would include both of what you see today as well as what's in Page and Rowley.

So conjectures about Kane Springs Valley being an effective important place to manage and so as to protect the springs and associated surface flows of the Muddy River Springs area are erroneous. And that's my summary.

MS. PETERSON: Thank you.

So I think we'll end right there. I don't know how much time we have left. The rest of the pages of the slides for Dr. Mock are contained in his report. And, again, they are in evidence because this power point presentation was already admitted in to evidence. So, if we can get back to it, we will. Thank you.

HEARING OFFICER FAIRBANK: Ms. Peterson, you have about five minutes left of the time that you reserved. So if you have time for -- or if you wish after we have cross-examination to come back for redirect, you'll have about five minutes.

MS. PETERSON: For redirect?

HEARING OFFICER FAIRBANK: Yes.

MS. PETERSON: Okay. Thanks.

HEARING OFFICER FAIRBANK: Okay. We'll go ahead and start with the cross-examination. And the participants will have seven minutes for their cross. And we'll start with Coyote Springs Investments.

CROSS-EXAMINATION

By Mr. Herrema:

ANSWERS BY MR. BUTLER:

Q. Thank you. Brad Herrema on behalf of CSI. I'd like to start with a couple of questions for Mr. Butler. Good afternoon.
A. Hello.
Q. Are you familiar with the wells in the Coyote Spring Valley that were used in the carbon-14 analysis? And, specifically, do you know if the analysis differentiated between alluvial and carbonate wells?
A. I would have to go back and look specifically. The data that I circled there was from that report, that 2006 report. I didn't create that. That graphic is showing the carbon-14 data that was specifically from that 2006 report.
Q. You don't know sitting right now if it's differentiated between alluvial or carbonate wells?
A. I'm sure they're a combination of both. If the data were present, they were all plotted.
Q. Okay. For instance, the table on page one has alluvial well CSV-3 which shows a water age of 28,000 years. And the nearby carbonate well, CSVM-2, has an age of 30,500 years. Similarly, in northern Coyote Spring Valley, the alluvial well, CSVM-7, has an age of 21,000 years. And the nearby carbonate well, CSVM-3, has an age of 14,200 years. Would the differences between alluvial and carbonate wells affect your conclusions?

A. I would have to look at them specifically. There's some -- I would have to look -- I couldn't answer that directly. I would have to go look at it independently. I wasn't calculating the years. I was looking at the carbonate water gross difference. But, yes, if there was significant differences, it could.
Q. Okay. When you do this analysis do you have to assume a flow path to -- for the age dating of the water?
A. There was -- In -- When I group the similarities in water chemistry, there is no assumption of anything. It was just similarities. So that was just like gradient indicates potential, it's just similarities in percent modern carbon. For them to be connected there would have to be a flow path. But I did not provide any such evaluation.
Q. Okay. The 2006 Page preliminary report and the July 2019 report, it states, even the current geochemical models cannot really account for the relative amounts of mixing with groundwater of the many different agents.

Given the wide range of ages, the different ages, between alluvial and carbonate aquifers and the potential different flow paths in the Coyote Springs Valley, does your analysis using carbon-14 data represent a unique solution?
A. I was focused mainly on the difference between Kane, which is quite a bit older, quite a bit less percent

modern carbon than Coyote Springs. I was not focused on Coyote Springs per se. It was the difference between Kane as the component of flow coming in to Coyote Springs.
Q. Okay. Thank you.

ANSWERS BY MR. UMSTOT:

Q. Question for Mr. Umstot. One of the attorneys earlier today asked Mr. Lazarus about his review of your work regarding the effect of climate on water levels in the Lower White River Flow System. Were you present for that?
A. Yes, I was.
Q. Do you agree with the hydrographs that Mr. Lazarus presented in his assessment of climate?
A. I don't agree with his assessment. I see a decline in groundwater elevations from climate.
Q. Okay.

ANSWERS BY MR. BUSHNER:

Q. And one question for Mr. Bushner. Although we didn't hear your presentation, we do have your slides.
A. Yes.
Q. Were you able to determine a value of transmissivity for the carbonate aquifer in Kane Spring Valley from the pump test that you performed?
A. Yes. So the transmissivity value that we calculated from our aquifer test for the region localized

there in Kane Springs Valley was about 50,000 gallons per day per foot. It wasn't anywhere near the 300,000 number that Mr. Lazarus had put up. And that's also in my report on page 5-5.

MR. HERREMA: All right. I have no further questions at this time. Thank you.

HEARING OFFICER FAIRBANK: United States Fish and Wildlife Service? Seeing no questions.

National Park Service.

CROSS-EXAMINATION

By Ms. Glasgow:

Q. Good afternoon. Karen Glasgow with the Department of Interior Office of the Solicitor for the National Park Service.

All of my questions, because I'm really kind of stupid about all of this are -- anyone is welcome to answer them, okay. So if I don't call a specific person, just chime in by whomever has an answer, okay.

Earlier I think it was Mr. Carlson or Dr. Carlson, whichever, you talked about the permeability and your CSAMT data. Can you determine the permeability of the carbonate rock from the CSAMT data?

MR. CARLSON: No, not directly. There's so many different things that vary the resistivity results. So

permeability is one of them. But we don't know what else is influencing it.

ANSWERS BY MR. BUTLER:

Q. (By Ms. Glasgow) My next question is about geochemistry, which really I know nothing about. What is the source of the arsenic that had to be removed from the water pump from MX-5 prior to release?

A. I don't --

(The court reporter interrupts)

A. Oh, I'm sorry. Tom Butler. The exact source I don't know. But arsenic is very common in volcanic rocks. It's also -- It's absorbed to iron oxide in subsurface which then can be released under reduced conditions and/or acidic conditions. So any one of a number of those conditions. Being that it's hydrothermal, volcanic signature could be the source.

Q. Do you have -- I'm wondering how much CSVM-7 water is required to mix with the KPW-1 water in order to produce the values that were observed in the central CSV and MRSA, the percent amount of carbon?

A. Percent amount of carbon? CSVM-7?

Q. Yes.

A. I would have to go back and look at the calculation.

MS. GLASGOW: Okay. Thank you.

Could I approach the witness? I would like to give them a -- one of the chart -- one of the power point graphs that came out.

HEARING OFFICER FAIRBANK: Certainly.

MS. GLASGOW: Thank you. And I have more than one, but if you guys could share amongst yourselves. I have for you guys too.

MS. PETERSON: How about for me?

MS. GLASGOW: Oh, I need one -- I do have one for her too. Sorry about that. I forgot all about you. Do you need more than one? There are two pages.

And a second one for you all so you don't have to share as closely. And what I handed to you was -- So I want you to look at on the first or the second page, so it's Figure 5.6 or 5-6. And I want you to look at five down from the top for CM -- CSVM-5. Can you identify the climate signals in this hydrograph?

ANSWERS BY MR. UMSTOT:

A. This is Todd Umstot. You see a large -- You see a general increase in groundwater elevations following the high recharge event in 2005. And then it generally goes up after that. You don't see any variability from any climate or pumping.

You do see, after the MX-5 pumping ended, which was indicated by this vertical dash line, that there is a drop and a change in slope in the CSVM-5 hydrograph. When I looked at the data, that change in slope is due, I believe, to a measurement error. That's when they switched to using the calibrated tape for doing the manual measurements. And previous to that drop they used regular -- a regular tape, I guess, for doing their measurements. So there's some -- there's some variation sloped here. But I believe that's due to measurement error.

Q. So let me make sure I understand. So there's a surrogate for change in the hydrographic signals, what you just talked about? I'm trying to make sure I understand, because I don't see the plotted signals, so I'm trying to figure out --

A. Oh, you see a very strong climate signal. If you look at the period from 2003 to 2005, the water level is flat.

Q. Okay.

A. From the 2005 onward there's a general increase that seems to have a relatively steady slope. That's from the recharge event in very, very wet years. One in a hundred-year, two in a hundred-year recharge event. So you can see a lot of wells, I believe, in Nevada are still

responding to that really extreme event. And the way they respond depends not only on climate but also on the particular hydrogeologic characteristics around that well.
Q. So the recharge event that you're talking about is the 2004-2005 bump that you can see in that same hydrograph?
A. Yeah, it's the bump you see in 2005.
Q. Okay. And so -- And you just testified that you think a lot of wells are -- were responding or still responding to that recharge event as we speak?
A. It depends on hydrogeologic characteristics around a particular well. Some wells, I think, are still responding to that recharge event, as you see a continuous increase in groundwater elevations. Some wells, depending on particular characteristics around that well, kind of increase and then I have a decrease following that recharge event. So now I have a declining trend.
Q. Is this a good surrogate for effects of water levels from climate?
MS. PETERSON: Clarification. Is what?
MS. GLASGOW: The -- This particular hydrograph.
MS. PETERSON: CSVM-5?
MS. GLASGOW: Correct.
MR. UMSTOT: I don't believe it is, in that it

doesn't -- it only responds to long-term climate signals. It doesn't respond to short-term climate signals. So those only give information on the long-term climate signal.
MS. GLASGOW: Okay. Thank you. I appreciate your time.
HEARING OFFICER FAIRBANK: Next is the Moapa Band of Paiutes.
CROSS-EXAMINATION
By Mr. Berley:
ANSWERS BY MR. BUTLER:
Q. Hello. Richard Berley for the record. Mr. Butler, I just want to ask you a question or two about chemistry.
A. Okay.
Q. You talked about fluoride as a chemical marker to try to figure out, you know, how water from one place relates to water from some place else. Where does fluoride come from generally?
A. Mineral fluoride is quite common.
Q. Does it come from volcanic rocks?
A. It's common in volcanic rocks. It's common in carbonate rocks. It's common in a whole sleet of rocks.
Q. Do you have any special opinion about where it comes from in Kane Springs water?

A. I don't know. I mean, Kane Springs water, I don't have an opinion on it. It's got signatures of both. It's in communication with carbonate rocks and in communication hydrothermal activity. It could be all of the above.
Q. And you saw that the chemistry indicated that the carbonate aquifer water in Kane Springs was distinct from what was going on closer to the Muddy River Springs area; is that correct?
A. That's correct.
Q. Where do you see that the water in Kane Springs is going, if anywhere?
A. I don't have an opinion. The -- My scope on this project was to evaluate the chemistry data and see if there was a chemical link. It is clear there is a chemical link between CSV-4 -- CSVM-4 in the northeastern Coyote Valley and Kane Springs. I don't see it anywhere else. I don't see it -- That could mean it's so greatly attenuated you don't see it elsewhere or has some alternate flow path that I'm not aware of.
Q. Did you see any indication that the carbonate water in the Kane Springs was stagnant, that it stayed where it was and didn't go on a flow path?
A. No opinion. I was just evaluating chemistry

dependent of other -- I mean, I did look at gradient. That was all I looked at.
Q. You didn't see any other place other than -- You didn't look to see where this water might go if it didn't go to the Muddy Springs --
A. I was specifically looking at chemical signatures. I wasn't looking at groundwater. I wasn't looking at basin deposits. I wasn't looking at the structure. I wasn't looking at groundwater flow paths particularly, other than just a generalized gradient in the Kane Springs Valley. And the chemical signatures are quite different. I mean, it wasn't -- it's not like we were just looking at one particular chemical signature. We're looking at soluble chemistry, isotope data, everything pointing to the same conclusion.
There is some dissimilarities there that can maybe be explained by either the very small flux through there or alternate flow path. I would be speculating if I say I knew where that was because there's not enough data to support it.
Q. Okay. So your analysis went to the point of where you reached a conclusion that there was a dissimilarity between the water in Kane Springs and in the springs area, but you didn't go further and try to figure out where maybe

the water might have gone if it didn't go towards the springs?
A. Well, if I had the data, I could make that conclusion. But there's not the data to support it. Kane Springs chemistry is unique. It's an N-member. So if it was plotted between some other N-member then I might be able to make a conclusion that there was some mixing or it was traveling somewhere else. There just wasn't the data to support that because it wasn't an N-member.
Q. Okay. Is that true for isotopic evidence as well?
A. The isotopic data for southern Kane Springs is lighter than -- lighter than most of the other samples in Coyote Valley and most of the samples in the MRSA and also lighter than most of the samples in northern Kane Valley. And so that suggests possibly that it was recharged under an even quarter climate, higher elevation, it could be any of those, mixing with another source.
Q. Did you find any basins in the general vicinity that had similar isotopic signatures?
A. I would say surrounding it, it was mostly heavier, mostly -- more S-negative.
Q. And so what do you think that shows? Does that tend to show stagnancy or does that tend to show --

A. I wouldn't make a conclusion on stagnancy. I wouldn't have the data to support that.
MR. BERLEY: Okay. Thanks very much.
HEARING OFFICER FAIRBANK: Las Vegas Valley Water District, Southern Nevada Water Authority.
CROSS-EXAMINATION
By Mr. Taggart:
ANSWERS BY MR. BUSHNER:
Q. Good afternoon. My name is Paul Taggart. I represent the Southern Nevada Water Authority and the Las Vegas Valley Water District. Good afternoon, Gentlemen.
I'm going to read to you a statement from Lincoln County Exhibit Number 13, page 21. This is Ruling 5712. The State Engineer issued this ruling and then the State Engineer made this finding. The State Engineer finds the evidence indicates a strong hydrologic connection between Kane Springs Valley and Coyote Spring Valley, specifically that groundwater flows from Kane Spring Valley in to Coyote Spring Valley. And I want to ask each one of you, each one of you disagree with that statement; is that true?
A. This is Greg Bushner for Vidler Water Company. I'm going to answer for all of the experts. No, we don't disagree with that statement. There is a connection. Groundwater does flow from the Kane Springs in to the Coyote

Springs Valley.
Q. So you agree that there is a strong hydrologic connection between Kane Springs and Coyote Springs Valley?
A. I guess I would attenuate that a little bit. I think with the evidence that we have provided today --
Q. Mr. Bushner, do you agree with the statement or not?
A. I guess I don't agree with the strong connection. But there is groundwater flow. We've never denied that that groundwater flows from Kane Springs Valley in to Coyote Springs Valley, just as it does from Pahranagat Valley in to Coyote Springs Valley, just as it does from --
Q. Thank you, sir. Thank you, sir. I have very limited time.
So you disagree with the statement that there's a strong hydrologic connection; is that fair?
A. Fair.
Q. And is that the same answer for everyone on the panel?
MR. UMSTOT: Todd Umstot. Yes.
MR. MOCK: Peter Mock. Yes.
MR. BUTLER: Tom Butler. Yes.
MR. CARLSON: And Norman Carlson. Yes.
Q. (By Mr. Taggart)

ANSWERS BY MR. UMSTOT:
Q. Okay. Now I have a question for Mr. Todd -- what was your last name?
A. Umstot.
Q. Umstot, thank you. Mr. Umstot, do you have an opinion that thousands of acre-feet of water can be pumped for a permanent subdivision without impacting the Moapa case in the Muddy River Springs if that water is pumped south of the Lower White River Flow System down the fault?
A. I haven't evaluated pumping effects.
Q. Okay. So do you believe thousands of acre-feet can be pumped south of the Lower White River Flow System down the fault without impacting the Muddy River Springs?
A. That's not something I've evaluated.
Q. Okay. So you don't have an opinion on that?
A. I don't have an opinion.
Q. What about anybody else on the panel? Mr. Mock? I'm sorry. Doctor.
MR. MOCK: I haven't evaluated I and I don't have an opinion on it to the question as stated.
Q. (By Mr. Taggart)
ANSWERS BY MR. BUSHNER:
Q. Mr. Bushner, does Lincoln County own the water rights in Kane Spring Valley?

A. I believe so, yes.
Q. You're not aware of it?
A. I'm --
Q. You're not aware the State Engineer granted applications for groundwater to Vidler and Lincoln County in Kane Spring Valley?
A. Yes, I am aware.
Q. Okay. Would you agree with me that it was a thousand acre-feet that were granted?
A. Yes.
Q. And if the proposal that is offered by Vidler and Lincoln County in this proceeding where a boundary is established at the Dorothy fault or the Lower White River Flow System boundary fault, if a boundary is located there then is it true that Vidler and Lincoln County could develop that water in northern Coyote Spring Valley as long as it's north of that boundary fault?
A. No. We would develop the water in Kane Springs Valley.
Q. Okay. So you have no intention of trying to develop that water in northern Kane Springs Valley?
A. No. We do have an intention of developing that water in Kane Springs Valley.
Q. I'm sorry. You have no intention of developing

that water in northern Kane Springs Valley? I'm sorry. Northern Coyote Spring Valley?
A. Correct.
Q. Okay. Now, you also have applications pending before the State Engineer; correct?
A. Correct.
Q. And there may be another 5,000 acre-feet requested in those additional applications in Kane Springs Valley; is that true?
MS. PETERSON: I'm going to object based on relevancy. I don't think our application in Kane Springs Valley have anything to do with this proceeding and I thought water rights were the next phase.
HEARING OFFICER FAIRBANK: I agree, Ms. Peterson.
Mr. Taggart, is this line of questioning related to the five questions that were presented in Order 1303 relating to the geographic boundaries?
MR. TAGGART: Yes.
HEARING OFFICER FAIRBANK: And can you explain that?
MR. TAGGART: Yes. I'll just ask the question.
Q. (By Mr. Taggart) Is it your position that the water rights that are sought by Vidler and Lincoln County in the applications that are before the State Engineer and the

existing water right permits that Vidler and Lincoln County own can be developed north of the boundary fault without impacting the Muddy River Springs?
A. It's our position that we would develop those water rights if awarded out of Kane Springs Valley. I think the boundary fault that we identified is just more evidence to support our assertion that we will have no impacts on water rights or impacts in the Muddy River Springs area and Coyote Springs Valley.
Q. No matter how much water is pumped north of the fault?
A. We would evaluate that.
Q. Well, that's my question. Is there a -- Is it an impermeable barrier, the boundary fault?
A. No.
Q. So there must be some maximum amount of water that you can pump without impacting areas south of the fault; right?
A. Mr. Taggart, we have -- we were on a trajectory to go to hearing on our groundwater right applications until this issue came up before us. And I have these gentlemen here as professional scientists to evaluate that. And we haven't evaluated that yet, so I don't have an answer for you yet.

Q. Mr. Bushner, are you familiar with the Muddy River?
A. Not that familiar.
Q. And does Vidler or Lincoln County own water rights in the Muddy Valley Irrigation Company?
A. I believe we do.
Q. Okay. So are you familiar with those water rights?
A. No.
Q. Okay. Are you familiar with the fact that SNWA owns water rights in the Muddy River?
A. I think I've heard that.
Q. Okay. And are you familiar with the opinion of SNWA's hydrologist that pumping in the northern Kane Springs area will impact the Muddy River Springs, that that's their opinion?
A. I don't recall that.
Q. You don't recall --
A. But if that's their opinion, that's their opinion.
Q. You filed a rebuttal report challenging that opinion. So are you sure you don't recall it?
A. We filed a rebuttal report because SNWA said that Kane Springs Valley should be included in the Lower White

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River --
Q. Okay. Well, my question was, were you familiar with the fact that a witness for SNWA has the opinion that pumping in northern Kane Spring Valley can impact the Muddy River Spring? That was my simple question.
MS. PETERSON: Objection. Asked and answered.
MR. TAGGART: No, it was not answered.
THE WITNESS: I do not recall a witness in this case saying that.
HEARING OFFICER FAIRBANK: Mr. Taggart, you're out of time.
MR. TAGGART: Thank you.
HEARING OFFICER FAIRBANK: We'll move on to the City of North Las Vegas.
MR. MORRISON: Were we overlooked?
HEARING OFFICER FAIRBANK: Sorry. I checked the wrong line on my little sticky note here. Mr. Morrison for Moapa Valley Water District.
CROSS-EXAMINATION
By Mr. Morrison:
ANSWERS BY MR. BUSHNER:
Q. Good afternoon. Greg Morrison for the record for the Moapa Valley Water District. Quickly, I would like to start with Mr. Bushner. Page 2-2 of your report, you make

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the statement that groundwater management is on a basin-by-basin basis and that including that Kane Springs Valley would result in setting a dangerous precedent, kind of a slippery slope argument, if I recall. Does that sound right to you?
A. That does.
Q. All right. Is it your position that any multi-basin management unit is improper in Nevada?
A. No.
Q. So is Kane Springs so unique that only its inclusion would trigger that slippery slope to over inclusion?
A. No. No.
Q. Okay. Let's go to Mr. Carlson.
ANSWERS BY MR. CARLSON:
Q. Did you say that you -- in slide 23 you said you discovered the boundary fault based on analysis of 2019 lines ten and 11?
A. Yes, that sounds right.
Q. All right. Did you state at the beginning of your testimony that situating a CSAMT line parallel to a fault is not an effective methodology?
A. Right. If you're running parallel to a fault or a structure, a fracture zone, you're less likely to see it

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with high resolution.
Q. Yet you found the boundary fault using lines parallel to that boundary fault?
A. Right. One is on one side and one is on the other. So the difference between the two gives us the data that it exists.
MR. MORRISON: Okay. Thanks. This question might be for Mr. Bushner, might be for Mr. Carlson. We've got a page out of your report here and I've got copies if you would like to take a look at it.
May I approach the witness please?
HEARING OFFICER FAIRBANK: Yes, you may.
MR. MORRISON: Thanks.
Q. (By Mr. Morrison)
ANSWERS BY MR. BUSHNER:
Q. All right. First paragraph on the second page there, first full paragraph. First sentence says that the hydrographs for KMW-1 and CVSM-4 are plotted with the same time and water level elevation scale for the combined period of record. The difference in head between these wells is explained due to presence of a fault between those wells. Am I reading that accurately this?
A. This is Greg Bushner. Yes.
Q. Okay. And if you could turn to the next page,

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I've got Figure 4-9, which is your location map showing the northern boundary fault. Is the boundary fault as you've illustrated it in this picture, is that in between those two wells?
A. No.
Q. How is it situated in relation to those two wells?
A. So, again, we're not sure exactly where this boundary fault is, so we basically drew a line between the transect, the physical transect line ten and geophysical transect line 11 and said that there was a fault that occurs in this area.
Q. But that fault finding was based on the difference of head between the two wells. You have not situated the fault between the two wells, did you?
A. You are correct on that.
Q. Okay. Thanks.
ANSWERS BY MR. BUTLER:
Q. (By Mr. Morrison) Let's see. How about Mr. Butler. You had a quote from CH2M Hill on page 39 of your report. Are you familiar with that quote?
A. You'll have to read it to me.
Q. I'm not going to read it to you. It's a pretty expansive quote. So I guess we'll skip over that.

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Do you also recall a statement in the CH2M Hill report that you relied upon that carbon-14 dates are particularly unreliable in carbonate settings?
A. They can be, yes.
Q. Okay. You stated that MRSA flows are not dominated by Kane Springs water but you didn't state that there was no Kane Springs water present, did you?
A. No.
MR. MORRISON: You know, I think we're going to leave it at that. Thanks.
HEARING OFFICER FAIRBANK: Now it's the City of North Las Vegas.
CROSS-EXAMINATION
By Ms. Ure:
Q. Good afternoon. Therese Ure for the City of North Las Vegas. And I think I have just a, more of a clarifying question. On your demonstrative slide number 30 it is entitled stepwise linear regression shows only Garnet Valley pumping effects EH-4 water levels. Does an outcome from this analyses that the responses --
MR. TAGGART: I'm going to object. This testimony was not offered during direct exam.
MS. HARRISON: And --
(The court reporter interrupts)

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HEARING OFFICER FAIRBANK: Ms. Harris said she echoed Mr. Taggart's objection as well. And Mr. Taggart's objection was that this is beyond the scope of the direct examination.
Ms. Ure, will you please repeat the question again because I think if this is relating to what the State -- what we decided the State Engineer would decide what if any weight or value to give to the testimony on these particular slides that were offered for demonstrative purposes in the subsequent analysis that wasn't included as part of the report or rebuttal reports.
MS. URE: I don't think I ever got to the question. But the multiple linear regression analysis was in one of SNWA's reports and so this addresses it. I was just going to ask a question about it.
HEARING OFFICER FAIRBANK: So to the extent that there was testimony with relation to this, we'll go ahead and permit the question. And, again, the State Engineer will decide what, if any, weight to assign to the responses.
MS. URE: So my question is does an outcome from the linear regression analysis that all responses at EH-4 are from Garnet Valley make hydraulic sense?
MR. UMSTOT: If you look at slide 22, which was accepted in to evidence from my presentation, I showed SNWA

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analysis. My opinion is not that Garnet Valley is the sole cause of fluctuations at EH-4. That does not make hydrologic sense. I think my point is that this whole analysis of linear regression as given by SNWA is not useful for any conclusions.
MS. URE: Okay. Thank you.
HEARING OFFICER FAIRBANK: Center for Biological Diversity? Not seeing any questions from the Center for Biological Diversity.
Georgia Pacific and Republic?
MS. HARRISON: We have no questions.
HEARING OFFICER FAIRBANK: Seeing no questions.
Nevada Cogeneration? Seeing no questions.
Muddy Valley Irrigation Company?
MR. KING: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions.
Bedroc?
MS. URE: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions.
Nevada Energy?
CROSS-EXAMINATION
By Ms. Caviglia:
Q. Justina Caviglia on behalf of NV Energy. And this is sort of a follow-up on some questions you've received

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so far. Where do you think the water from Kane Springs Valley goes?
MR. BUTLER: For me.
MS. CAVIGLIA: For any you.
MR. MOCK: This is Peter Mock. Some of it goes in to northern Coyote Spring Valley. And some probably goes in to Lower Meadow Valley Wash. I haven't done a detailed analysis. But that seems reasonable to me.
ANSWERS BY MR. MOCK:
Q. And then what percentage of the water do you think goes to the Muddy River Springs?
A. I haven't done that analysis.
Q. But a portion would?
A. You said would. You're saying in the future?
Q. Or could.
A. You're saying now?
Q. Yeah.
A. Actual water molecules?
Q. Well, I'm just asking -- You stated that some of the water will discharge to Kane Spring, some to Lower Valley Meadow Wash. What do you think that percentage possibly can be?
A. I haven't done that analysis and I want to answer your question. I'm saying that at the boundaries of Kane

Springs Valley it would appear that some flow can go to Coyote Springs Valley and some flow currently, and this is flow currently, could go to Lower Meadow Valley Wash because there are carbonates on the southern boundary of Kane Springs Valley. I don't know what the percentage is though. I haven't done it.

MS. CAVIGLIA: Does anyone else have an opinion? I have no further questions.

HEARING OFFICER FAIRBANK: Okay. So at this point we'll go ahead and open up for questions to the State Engineer and Division of Water Resources staff.

EXAMINATION

By Mr. Benedict:

ANSWERS BY MR. CARLSON:

Q. Jon Benedict for the record. Question for Dr. Carlson. There were several other structures that had been mapped across CSAMT line 12 by previous geologic offers that were concealed and I think were shown on, let's see, page 15. A couple of thrust faults, a couple of normal faults. Did you see any of those in the CSAMT lines?

A. I believe the -- From memory here, I believe on the strike slip fault that you see running through the center of this by a dotted or dashed line, I can't quite see. But it's got the arrows on each side as well that goes from the

southern part of the map, it runs up north and then bends and then goes in to Kane Springs Valley. And it's right on the upper west side of that knob. I believe we see that when we -- I believe we saw that on line ten. I believe it's difficult to distinguish on 11 and 12. It's possible that that was truncated by the large -- the fault that we see between that. But it's just -- it's not blatantly obvious to us, no.

Q. So if we move to slide 21. Maybe this will help better. So on this map a few faults aren't shown. Is that because they weren't interpreted to exist including on the previous slide there was a thrust of blue and then a north-south structure that had normal faulting?

A. Right. Right.

Q. Signature?

A. Yeah, exactly. We didn't see clear evidence of those faults on the lines. So we removed them from this particular image.

Q. Okay. Thank you. Another question on geophysics. On line, I think it was called, it was a long line that went up Kane Springs Valley and I think you showed -- or you called a CSAMT interpretation of that.

A. Yes. We call it the axis line because it runs right up the axis of the valley.

Q. Right. Okay. You indicated that Kane Springs Valley, the basin fill was relatively thick and then it becomes thin from northeast to southwest. And I see that as it shows in here. Did you interpret any structures on that shallow in Kane Springs Valley, just out of curiosity?

A. Yes. I interpreted a fairly significant fault there in the -- There's a label here for line two. That's where one of the lines crossed and then line three across there. I interpret this as a fault. I don't think this is just a very uniformly slope in surface on top of that blue carbonate.

I think in addition to a slope this appears to me to be a fault. So this would be an upthrown side or this is a downthrown side. I see a fault there. We're also seeing a low resistivity layer here in the basin fill. That seems to pinch out and disappear up against some higher resistivity basin fill material. So it's probably dry and coarse probably. It's possible there's another fault in that area.

But there's a lot of interesting changes, especially when you look at it relative to the other cross-lines. But many of those changes the hydrologists don't seem to care about, so I don't get to talk about it.

Q. Okay. So that structure you described at, like, 3900 or 4700, right in there, is that comparable to the kind

of thing that you see on the other side going in to Coyote Springs Valley? Is that analogous to that?

A. Right. If we had done the line parallel to this or just continued this line on further southwest out of Kane Springs Valley, I think we would have seen another big feature like this but in the opposite direction.

Q. Okay. Thank you.

ANSWERS BY MR. BUSHNER:

Q. And I'm not sure who this question is for. But I was curious about the seven-day aquifer test that was mentioned previously that was done on the KPW well and I was wondering if any analysis was done with that to see if that test did or should have ID'd a barrier or two in the boundary in the direction expected in the distance presumed?

A. So this is Greg Bushner with Vidler Water Company. So we did do an analysis. Unfortunately, I didn't put it in my report. I should have. We compared the water levels at CSVM-4 because we had some data as far back as 2006 where that information with the test water levels from moderate flow to KMW-1. And it -- you had to exaggerate the scale for the water levels on CSVM-4 to even show any type of change, otherwise it would have plotted as a flat line. But it actually showed a decline in water levels before the test. And then during the test it showed a rise that started to be in -- Again, this is, like, two-tenths of a foot or four-tenths of a foot change in CSVM-4, according to the data. So virtually there was no effect from the pumping the seven-day aquifer test at KPW-1 on CSVM-4.

The testimony that has been given last week and some today, the response to the Order 1169 aquifer test was pretty much immediate. You saw it immediate in the hydrographs. This didn't show up at all. So, again, it's indicative of not a really high transmissivity area as was testified today. But a structure that would -- or an aquifer system that would transmit up and down Kane Springs Valley more than anything else?

Q. So do you think the test was long enough to have seen that boundary or do you think that the data is just not sufficient to be able to?

A. That's a great question. Probably as SNWA knows and all the people sitting behind me know these tests are extremely expensive things to conduct. A seven-day aquifer test is very expensive. And so at the time what I was trying to do is get through enough log cycles to have a good data set, which I think I accomplished, but could have gone longer. We didn't see any boundary effects again. Not to mean that there's none there. We just didn't see them yet. They just haven't appeared. You could have run it longer and

maybe would have seen something. But there were no -- If there was going to be an effect because it was so highly transmissive, you would have probably seen it immediately.

Peter, I don't know if you want to add anything.

MR. MOCK: This is Peter Mock. I agree with Greg's assessment. I plotted the test and looked at it and I see a standard response to a fissured aquifer, which is a simplification. But there was nothing unusual in the change of slope except compared to Theis it had a flatter response. This might be what it's like to people thinking that there's a very high transmissivity but there's not. That's just the beginning of the S-curve, what happens with the fissured rock test, so I didn't see a boundary and those two days.

Q. Okay. Thank you.

ANSWERS BY MR. BUTLER:

Q. (By Mr. Benedict) On the geochemistry, I'm just curious and I sort of danced around this question a little bit, I think. But curious if you have an opinion on what kind of mixing ratio you could have such that the, I guess, the error in the method would have secured the data. In other words, I'm trying to get a sense of how far you can take the data with respect to saying you can't see this as an N-member. Would a ten-to-one mix make the data insufficient? I know you talked about some when you did a model where you

looked at KPW-1 and CSVM-4 you said that the data suggested something like 26 to 74 percent kind of ratio. And you had some errors of two and three up to 15 percent between the model and the data. And I'm just curious if you have a 15 percent potential error in data mixing what could you not see in those data? Does that make since?

A. Well, I point out that the largest area was the temperature. So --

(The court reporter interrupts)

THE WITNESS: Most of the error occurs when calibrating with TDS. And then we looked at other things in the water that might -- to use to compare that comparison to see if it held through. And fluoride, what was it -- I can't read it. It was four or six percent. Temperature was the biggest area of concern. Deuterium, point-nine. Water isotopes are pretty conservative unless they're being evaporated. And it is 14, 2.4. So it's pretty low error overall I think between the two. But, I mean, it's complex.

Q. Can you give an opinion though I guess on the extent to which you can take those measurements and talk about mixing ratios? Is there some kind of a limit where you talk about this being an N-member but you can dilute things to a point where the data is insufficient to tell you whether there's some mixing or not. So I'm trying to get a sense of

where we are on that --

A. You really need more information because it really is just those two data points in southern Kane and northeastern Coyote Springs Valley, the CSVM-4, just those two data points. And they are chemically unique to everything else that's out there. So there's no other data that shows that they're mixing with something else that would look like MRSA water, so I guess it's hard to quantify it.

Q. Yeah.

A. It's the fuzzy science.

Q. Okay. Thanks.

ANSWERS BY MR. UMSTOT:

Q. In terms of the discussion of climate in response to things like the 2005 wet year, it was suggested, I think, that you expect to see an increase in water levels because of this exceptionally wet year and then the corresponding decline after that. And I'm curious about these kinds of responses and what you really expect to see, whether you expect to see a step-up or pulse-like configuration in hydrographs and if that means anything. And I'm just curious about your experience in terms of describing these responses and I guess what kind of supporting data you have for an expected response from climate?

A. You definitely would see a response of increase

in the hydrograph from the recharge in 2005. And then depending on the local hydrogeologic conditions, you'll see there a pulse response, I think, or you'll see a continued, basically a very long pulse response that we're still seeing maybe a rise from, that exception of a very wet year that was maybe once or twice in a century.
So I think that's -- it depends on, you know, there's a climate effect that kind of gave the pulse. But how that thing was interpreted by the aquifer is going to depend on the aquifer conditions. Where is the source of recharges and where is the source of discharge and the hydraulic connectivity and the storage pump and the aquifer materials.
Q. So seeing responses suggest near source recharge or a very permeable aquifer?
A. Right.
Q. Seeing similar responses on either side of a structure, would that indicate communication or?
A. It's not evidence to know either way.
Q. But it would be supporting the evidence if you did?
A. If you saw the same response to climate, that wouldn't be enough evidence.
Q. I guess this is the last question. I think

you've already answered it maybe, but if you can do it again in a different way. I'm just curious if you could explain the relative lack of correlation between the Palmer drought varying index and other water level measurements and hydrographs that have been provided in previous presentations here that are near but outside of the basin. Were you here for those presentations?
A. Yeah. I forget -- I think you're referring to the National Park Service or Fish and Wildlife?
Q. I think National Park Service had a number, they presented a number of hydrographs that were nearby but outside the basin that didn't show anything similar. And I'm just curious what your thoughts are on that.
A. From what I recall, some of the hydrographs were increasing, some of the hydrographs were flat. And then maybe one or two of them were decreasing. When I looked at the decreasing hydrographs, they were not unsimilar to KMW-1 and CSVM-4. So it seems like it could be in the mix of the types of hydrographs that you see in the basins to the north.
MR. BENEDICT: Okay. Thank you.
EXAMINATION
By Mr. Kryder:
ANSWERS BY MR. CARLSON:
Q. Levi Kryder for the record. My first question is

for Dr. Carlson. And I'm looking at your slide 21 where you're showing the northern Lower White River Flow System boundary fault.
A. Yes.
Q. Well, actually maybe it's in the other slides. So if we look at the sections that were produced for lines ten and 11, what other possible explanation is there for those changes across a two-mile distance other than a fault with 2500 feet of displacement on it?
A. Well, I'm sure there's some really bizarre ones, because if we were in, say, in the over thrust belt and we actually had a high resistivity, high resistivity unit, that has been moved on top of a low resistivity unit and then that has in turn been tilted, what we may be seeing is a contact between high resistivity and low resistivity. It would have to be fairly steep. But it would be a contact between two lithologies but not a fault between two lithologies. So that's going to take some pretty serious over thrust stuff from up in Wyoming and Utah that generally over thrust belt or something.
But when we have a large area of high resistivity material and a large area of low resistivity material then where they meet is either going to be a contact, one was laid down on top of the other and then that contact was rotated to

meet this requirement or there's a fault that's brought high resistivity material in to contact or low resistivity material. So, geologically, yes, you could come up with something exotic that doesn't require a fault by definition.
Q. Okay. Thank you.
ANSWERS BY MR. UMSTOT:
Q. My next question is for Todd Umstot. What do you think is the response time of the groundwater system here to climate or drought?
A. I think there's different signals that some of the wells see. So it looks like it's within a month or two you start to see, especially after the 2005 wet year, you see a fairly quick response to that in many of the wells. And then in some of the drought signals again it's probably in an order of a few months or less.
Q. So, in general, one to several months?
A. Yeah.
Q. For either recharge events or drying signals?
A. That's correct.
MR. KRYDER: Thank you.
EXAMINATION
By Mr. Sullivan:
ANSWERS BY MR. CARLSON:
Q. For Dr. Carlson. The resistivity is measuring

the property of the rock matrix; is that right?
A. The matrix has whatever is in the pores. So it's -- I mean, it's literally how well does this bunch of rock or whatever it is conduct electricity. And the things that influence that to conduct electricity include the matrix and the pore space and the pore fluids and then also how well interconnected those pores are. So the resistivity, if we were doing this would be in, say, a salt water intrusion zone on the coast where we have fresh water in a nice uniform aquifer and salt water coming in because people are pumping out, everything there is uniform, say, the sandstone or whatever the aquifer is, that's all uniform. But we would see a difference in resistivity because fresh water conducts electricity less well than salt water. But in other environments we might have a uniform type of water but the matrix is changing resistivity in this area versus that area. Maybe the matrix is faulted, heavily faulted. And so electricity is conducted more easily because of all of the water in the pores is connected. So, yeah, a lot of variables.
Q. Okay. What I'm getting at is with regard to this structure, that subsurface feature map, what is that -- how informative to us is that about the hydraulic properties?
A. Well, in some environments that tells you a lot.

High resistivity rock often is resistive because it's very tight. Other times high resistivity rock may not be so tight that the matrix is a resister. Some types of rocks are better resisters than others. So we see a high resistivity rock and then it seems to be faulted down and then you have low resistivity material. Just that information all by itself does not tell us the hydraulic properties of either side.
And maybe Greg is going to expand on that.
MR. BUSHNER: Greg Bushner, Vidler Water Company. Yeah, I have a little bit to add to what Norm has just said in response to your question. I think that geophysics is an instructive. But you have to use it in combination with all the other data that you have available. And, again, that's why I tried to bring the robust nature of this panel and look at the geochemistry, look at the water level changes over time. Look at the differences in head between KMW-1 and CSVM-4 and wells to the south.
I think we detected something was there back in 2006 when we went to hearing on our first application for water rights. And here we have a justification for what we saw back in 2006 in the changes in heads. We have an explanation for it. We didn't know we would find this. We went out and collected this data.

But I think you have to look at it all in totality. You can't look at one piece of information and separate it out. I hope that helps.
MR. SULLIVAN: Yes. Thanks.
ANSWERS BY MR. MOCK:
Q. (By Mr. Sullivan) And, Dr. Mock, I realize you didn't get much opportunity to talk about your work. And thumbing through your power point, one of the slides you touch on some of the characterization of the tertiary calderas and the water budget for Kane Springs. Would you mind summarizing that?
A. Yes. The statement has been made many times that the calderas are barriers or just impermeable to groundwater flow or very low flow because I think the thought process for the people is that you've got a magma that has come up and though it's exploded it stayed pretty much together in the subsurface and as it cools it becomes -- it is a just a mass that's very difficult for the water to flow through.
Having worked with Vidler and some of their investigations of the geology of the area, the different calderas, it has been clear to me that the picture that -- I forgot who said it earlier in the week, but their explanation was very good. They said so the magma comes up and it's very solidific and it's very light and it's also encountering a

lot of groundwater and it literally blows the top off and then everything comes settling back down. I, for one, am glad I wasn't around for it in Arizona or in Mexico. But that was a different process than a smooth expulsion of lava. And so you get -- Even though the materials are very hot and the particles are hot when they come down and they can re-welt. I've been taken on some tours and looked at it and discussed it.
There's plenty of room for water to move in these calderas. And what I noticed and I put in as a quick statement as to why I don't and so just for these brief submittals is that Todd Umstot's work in -- where Vidler reflects water level -- I'm sorry. They collect transducer data in the femoral streams, they also then have weather stations they set up. And then Todd does the actual surface water modeling to look at the recharge.
The highest recharge areas, the most intense precipitation areas, are focused on our calderas here in the Delamars and in the Clovers. And my thought is that from working in the general hydrology of the southwest is if that material was granite, I think you would probably have some drought streams on both of those mountains, that you would have intermittent or perennial flows all the time coming off that you would be able to see at the surface. But, instead,

the numbers are pretty large, thousands of acre-feet are going down in to the calderas and then out. And so that's my viewpoint and secondary reason why I don't think they are barriers to flow.

So I think the Delamars are an important recharge area and groundwater flow area and I think the Clovers are as well.

Q. And you really don't have any theories about where that water would discharge?

A. The water discharge from the Delamars, the --

Q. The recharge --

(The court reporter interrupts)

Q. The recharge that you just described.

A. So I think it would join the flow that is generally moving through the area. So I think there could be flow from the north rejoining in the system with northward to southward flow. Flow coming down through Kane and could go through the calderas and the caldera recharge would join it.

MR. SULLIVAN: Okay. Thanks.

HEARING OFFICER FAIRBANK: All right. So we will go ahead and conclude today's hearing. It's 4:30, which is our quitting time. And then we will go ahead and commence -- or reconvene the panel and Vidler and Lincoln County's presentation tomorrow morning for additional

cross-examination. And then we will move -- Once we're concluded with Lincoln County and Vidler, we'll move to the City of North Las Vegas. So we will reconvene at 8:30 tomorrow morning. Thank you.

(Hearing concluded at 4:30 p.m.)

STATE OF NEVADA)
)ss.
COUNTY OF WASHOE)

I, CHRISTY Y. JOYCE, Official Certified Court Reporter for the State of Nevada, Department of Conservation and Natural Resources, Division of Water Resources, do hereby certify:

That on Monday, the 30th day of September, 2019, I was present at the Legislative Counsel Bureau, Carson City, Nevada, for the purpose of reporting in verbatim stenotype notes the within-entitled public hearing;

That the foregoing transcript, consisting of pages 1231 through 1368, inclusive, includes a full, true and correct transcription of my stenotype notes of said public hearing.

Dated at Reno, Nevada, this 1st day of October, 2019.

CHRISTY Y. JOYCE, CCR #625

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In The Matter Of:

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES DIVISION OF WATER

Vol. VII

October 1, 2019

Capitol Reporters

123 W. Nye Lane, Ste 107

Carson City, Nevada 89706

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STATE OF NEVADA
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
BEFORE MICHELINE N. FAIRBANK, HEARING OFFICER

IN THE MATTER OF THE ADMINISTRATION AND MANAGEMENT OF THE LOWER WHITE RIVER FLOW SYSTEM WITHIN COYOTE SPRING VALLEY HYDROGRAPHIC BASIN (210), A PORTION OF BLACK MOUNTAINS AREA HYDROGRAPHIC BASIN (215), GARNET VALLEY HYDROGRAPHIC BASIN (216), HIDDEN VALLEY HYDROGRAPHIC BASIN (217 CALIFORNIA WASH HYDROGRAPHIC BASIN (218), AND MUDDY RIVER SPRINGS AREA (AKA UPPER MOAPA VALLEY HYDROGRAPHIC BASIN (219).
_______________________________________/

TRANSCRIPT OF PROCEEDINGS

PUBLIC HEARING

HEARING ON ORDER 1303

VOLUME VII
(Pages 1370-1498)
TUESDAY, OCTOBER 1, 2019

Reported by: Michel Loomis, RPR

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For Moapa Valley Water District: Greg Morrison, Esq.

For Bedroc:
-and-
For City of North Las Vegas: Schroeder Law
By: Therese Ure, Esq.

For National Park Service: Karen Glasgow

For Center for Biologic Diversity: Patrick Donnelly

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CARSON CITY, NEVADA, TUESDAY, OCTOBER 1, 2019, A.M. SESSION
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HEARING OFFICER FAIRBANK: Good morning. So this is the continuation of the hearing regarding the Lower White River Flow System and Order 1303, and so we're going to go ahead and continue this morning with cross-examination.

We have just under one hour left for cross-examination, and so we'll go ahead and reopen the time period to the participants to ask questions.

And at this point, we're going to go ahead and limit that time frame to five minutes per participant for the continuation of cross-examination, and so we'll start with Coyote Springs Investments.

MR. HERREMA: We have no questions at this time.

HEARING OFFICER FAIRBANK: Okay. So seeing no further questions from Coyote Springs Investments, United States Fish and Wildlife Service.

Seeing no questions, National Park Service.

CROSS-EXAMINATION

BY MS. GLASGOW:

Q. Good morning. Karen Glasgow with the Solicitor's Office, Department of Interior representing the National Park Service.

Good morning, gentlemen. Can we see -- could you put up Mr. Umstot's Slide Number 15. Mr. Umstot. Sorry.

Thank you. On this slide, you indicate that CSVM-2 did not show a response to MX-5 pumping.

Is this why you stated that this well would be a good well to use for seeing short-term climactic events for separating out pumping effects?

ANSWERS BY MR. UMSTOT:

A. I don't recall testifying that you'd use CSVM-2 for that purpose.

Q. Do you recall what well you did identify as being one that would be good for showing short-term climatic effects?

A. At the moment, I don't recall which well I used for it.

Q. Do you recall that you identified a well as being one that would be good for seeing short-term climatic effects for separating out pumping effects?

A. I don't recall.

Q. I'd like to show you -- I don't know if you have them. I've got their Appendix A and Appendix B from our rebuttal report.

MS. GLASGOW: Do you have copies there with you?

MR. UMSTOT: No.

MS. GLASGOW: Well, let me hand these to you. That's just for you to look at, but that's what I'm handing him.

HEARING OFFICER FAIRBANK: Sounds good. Thank you.

BY MS. GLASGOW:

Q. Now, you testified that the MPS provided hydrographs which included records with rising water levels, declining water levels, and some showing the short-term climatic effects.

Can you look through our Appendixes B and A or A and B as I just handed to you and could you tell us which hydrographs for wells in and near the Lower White River Flow System and the USGS PowerPoint that shows many other hydrographs and identify the wells that have a similar hydrograph to the well that you identified as being actually indicative of short-term climatic effects?

MS. PETERSON: I guess I have to ask for clarification because I think he testified that he couldn't remember which well that was.

BY MS. GLASGOW:

Q. Well, how about any well. Any well that you see on any of our hydrographs or the USGS PowerPoint that show short-term climatic effects.

ANSWERS BY MR. UMSTOT:

A. I haven't analyzed all of the wells shown in these appendices. I would need to spend some time to go through and look at these hydrographs and do some analysis to determine which ones have a -- short-term responses to climatic effects.

Q. Okay. Well, unfortunately, they gave me five minutes, so I can't let you do that. Let's move along, then.

Isn't it true that well CSVM-5 does not show effects of the short-term climatic changes that you testified about?

A. Yes, at the scale that is plotted on here, I don't discern any short-term effects.

Q. Isn't it also true that CSVM-5 does not exhibit declining water levels, which is a common characteristic of nearly all of the other hydrographs in the Lower White River Flow System?

A. Yes, CSVM-5 does not show a declining water level.

Q. Are your answers the same for the hydrograph for BMONCO-2, which is located in the Black Mountain area, I think?

A. I haven't analyzed this hydrograph before. It looks a little odd to me, and that is a completely straight

line, but -- so I'm not sure about that.
Q. I want to ask you whether or not --
HEARING OFFICER FAIRBANK: Miss Glasgow, your time is up. We will probably get back to you --
MS. GLASGOW: Okay. Thank you.
HEARING OFFICER FAIRBANK: -- on a second -- a third round.
MS. GLASGOW: Thank you very much.
HEARING OFFICER FAIRBANK: Next is the Moapa Band of Paiutes.
MR. BERLEY: No further questions.
HEARING OFFICER FAIRBANK: Seeing no additional questions, Las Vegas Water District and Southern Nevada Water Authority.
MR. TAGGART: Would you mind bringing up on the screen the first page of the demonstratives from yesterday, please?
MS. PETERSON: Which ones?
MR. TAGGART: The first page of the demonstratives that were handed out.
CROSS-EXAMINATION
BY MR. TAGGART:
Q. All right. Good morning.
First, I want to ask Mr. Umstot: In your

opinion, is there a well, a monitor well in Coyote Spring Valley that can be properly be used to monitor the impacts from 1169 pumping at MX-5?
ANSWERS BY MR. UMSTOT:
A. Yes. The EH-4 well and the MX-4 wells show a response to the MX-5 pumping.
Q. Okay. Yesterday, you testified about the MX-4 well and some concerns about the data gathering at the MX-4 well. You -- despite that, you agree that the MX-4 well is a well that can measure that impact?
A. Yeah, if you look at the data that was presented in the SNWA 2013 report, the MX-4 well showed a response to the MX-5 well pumping.
Q. Now, Mr. Umstot, on your website, it indicates that you're a technical expert for environmental litigation; is that true?
A. I haven't looked at the website in a while. That seems kind of an odd phrase.
Q. Okay. Well, when you click on technical expert under the environmental litigation tab, your name comes up, doesn't it?
A. Yeah. I do a lot of different litigation.
Q. Okay. So you testified as -- my count, at least 50 times in front of a tribunal like this; right?

A. No, I have not.
Q. 25 times?
A. No.
Q. Okay. The website also says that you developed a watershed model that has been successfully used in water rights hearings to estimate the quantity of recharge available for groundwater procreation. The model has been applied in numerous basins in New Mexico, Nevada, and California.
So my question is: What basins has your groundwater model been successfully used in Nevada?
A. The Tule Desert Basin.
Q. And the State Engineer relied on that model in that case?
A. Yes.
Q. Okay. And they didn't modify any of the conclusions that you arrived at based on the model?
A. They -- I can't recall the ruling precisely. They relied on the model and they also relied on other evidence.
Q. Okay. Okay.
Dr. Mock, with this up on the screen, I just wanted to ask you. So there's a fault that you've identified that you believe exists in between line 10 and 11 of your resistivity data; correct?

MS. PETERSON: Is that for Dr. Mock?
MR. TAGGART: I'm sorry. Mr. Carlson. I'm sorry. Thank you.
ANSWERS BY MR. CARLSON:
A. What was the question?
BY MR. TAGGART:
Q. Okay. I have two minutes.
ANSWERS BY MR. CARLSON:
A. I'm sorry.
Q. So the fault that you identified, the boundary fault, the Dorothy fault, whatever we call it --
A. Right.
Q. -- that fault is not on the Rowley map; correct?
A. Correct.
Q. It's also not on the Page map; correct?
A. Correct.
Q. It's also not on the Phelps Gravity work; correct?
A. It's --
Q. The fault that you identified is not shown on this gravity map; isn't that correct?
A. It's shown in the contours.
Q. Sir, I'm not asking you to interpret it.
A. Okay.

Q. I'm asking you if it's marked there on there as a fault.
A. It's not marked on the Phelps map.
Q. Okay. And on your line 10, you did not see the fault; correct?
A. Correct.
Q. And your line 11, you did not see the fault; correct?
A. Correct.
Q. And -- and do you know how much displacement the carbonate rocks show between line 10 and line 11? Would you agree with me it's about 900 feet?
A. No, I think --
Q. -- okay --
A. -- the -- is two across --
Q. All right. Maybe you don't know, so just say you don't know, and then I can move on.
MS. PETERSON: I don't think that was his testimony.
MR. TAGGART: So on this contour map -- I only have a few minutes, please.
BY MR. TAGGART:
Q. And so on this contour map, isn't it true that this shows the interface between the alluvial aquifer and the

carbonate aquifer. That's what the contours show; correct?
A. The contours show the isostatic and gravity anomaly.
Q. But the intent of the document is to show the interface between the alluvial aquifer and the underlying aquifer; isn't that correct?
A. It's intended to show the change in gravity as you go from over --
Q. All right.
A. -- high-density material to low-density.
Q. And isn't it true that this map shows a down thrust in the southwest direction between line 10 and line 11?
A. Downturn in the southwest direction, yes.
MR. TAGGART: Okay. Thank you.
HEARING OFFICER FAIRBANK: Moapa Valley Water District.
CROSS-EXAMINATION
BY MR. MORRISON:
Q. Good morning. Greg Morrison for Moapa Valley Water District.
I want to start with Mr. Bushner. Now, yesterday, at the end of the testimony, you were asked about the transmissivity that was revealed by the seven-day KPW pump test.

Do you recall that?
ANSWERS BY MR. BUSHNER:
A. Yes, I do.
Q. And I think the quote -- and perhaps it's paraphrase. I think it's a quote. You said: "The transmissivity is not as high as was testified to today", and you were referring to Mr. Lazarus's testimony, I believe?
A. Correct.
Q. So I'm looking at a Slide 11 from our presentation yesterday, and it's got Mr. Lazarus's statements regarding his conclusions from the seven-day pump test results summary.
One of his conclusions was, quote, "The carbonate aquifer behaves as a porous media and can be analyzed as such?"
Is that the statement that you disagreed with?
A. Nope.
Q. Do you remember who wrote that statement?
A. Yes.
Q. Was that you?
A. Yes.
Q. Okay. So what about Mr. Lazarus's testimony do you disagree with?
A. Well, I don't believe that the transmissivity

values are as high as 300- or 400,000 gallons per day per foot as Mr. Lazarus presented. They might that high in a fault zone, but that's a very limited storage. So that's going to be drawn down very, very quickly.
What I was talking about from our test was a localized or very local regionalized area of Kane Springs Wash.
As you can see in this diagram, this area over here, here's our well. Here's the Willow Springs fault that has a slight inclination to the -- I guess it would be to the --
Q. This one we're looking at here, any kind of hydrologic data?
A. No.
Q. So it's kind of irrelevant to the question I asked you, so we'll just move on.
I want to talk about in the rebuttal to the Moapa Valley Water District report, referencing page 1, whoever wrote this section -- I'm not sure who it was -- wrote that "there is no direct connection that can be drawn between the change in water levels in KMW-1 and the Order 1169 aquifer test."
They also wrote that the Moapa Valley Water District offers no data analysis or credible science to

support statements made that there was a response seen in well KMW-1 from the 1169 aquifer test.
Do you have a copy of Figure 3-9 from your original report handy, by chance? If not, I've got one here.
A. Let me find it. Yes.
Q. All right. Looking at that Figure 3-9, I think the average water level decline rate there is based on a comparison of the first and last points here that you referred to in your report.
A. There's two graphs on this. I don't know what you're referring to.
Q. The KMW-1, so the top blue line.
A. Okay.
Q. All right. Is that water level decline rate, which I think you calculated as .1 feet per year, has that been constant since the well was drilled?
A. Well, you can see from the hydrograph that it's highly variable, and we've had a lot of testimony --
Q. Okay. Thanks.
A. -- that --
Q. Was the highest rate of water level decline from 2011 to 2014?
A. Yes.
Q. All right. And does that time frame include the

entire period of the Order 1169 pumping test?
A. I don't believe so. I think it's from 2010.
Q. 2011 and 2014 wasn't -- the 1169 pumping test wasn't within that time frame?
A. Oh, yes.
Q. So the greatest declines were coincidental with the 1169 pumping test?
A. Coincidental.
Q. Okay. And finally, Dr. Carlson, I believe -- I think you said you determined your boundary fault line as parallel to lines 10 and 11 from your 2019 analysis?
A. Yes.
Mr. Carlson.
Q. Mr. Carlson?
A. I don't want to take too much credit.
Q. I notice you have a line 12 that transected both lines 10 and 11. Why didn't you rely on line 12 to demonstrate that fault line since it would have crossed it?
A. Line 12 would have intersected -- it should have crossed that fault, yes. And it would intersect it at a 40- to 45-degree angle, and when we're running at a shallow angle like that to a linear feature, the resolution becomes poorer, so we don't resolve it as well.
We do see it in the deep data.

MR. MOORE: Okay. Thanks. My time is up.
HEARING OFFICER FAIRBANK: City of North Las Vegas.
MS. URE: No questions.
HEARING OFFICER FAIRBANK: Seeing no further questions, Center for Biological Diversity.
Seeing no further questions, Georgia Pacific-Republic.
MS. HARRISON: No questions.
HEARING OFFICER FAIRBANK: Seeing no further questions, Nevada Cogeneration.
CROSS-EXAMINATION
BY MR. FLANGAS:
Q. Good morning.
This is for the panel. I'm not really sure --
HEARING OFFICER FAIRBANK: Mr. Flangas, will you make sure your mic is on.
BY MR. FLANGAS:
Q. This is for the panel. I'm not really sure who it will be.
In the rebuttal report at page 2, paragraph 2, the statement is made: There is no local recharge from KSV, Kane Springs Valley, to the Lower White River Flow System. And on page 7, there's a statement that Lincoln and Vidler

agree there is interbasin flow from the Kane Springs Valley to Coyote Springs Valley.
Are those two statements consistent?
ANSWERS BY MR. BUSHNER:
A. So this is Greg Bushner, Vidler Water Company. And, no, they're not inconsistent in my mind. There is much local recharge in Kane Springs Valley. We have been measuring that since probably around 2007 or '8.
We collect precipitation data, runoff data, temperature, groundwater -- or soils temperature data, chloride data. We submit all of this information to the State on a quarterly basis, and we -- our intent is to document what recharge occurs in Kane Springs Valley.
There is underflow that comes -- groundwater flow from Kane Springs Valley into the northern Coyote Springs Valley.
Q. So you don't consider the underflow to be local recharge? That's the distinction?
A. Not in Coyote Springs Valley.
Q. Okay. So what you're -- what your contention is is that whatever is flowing into Kane Springs Valley that's local recharge, when it hits underflow, it goes from Kane Springs Valley to Coyote Springs. That's not local recharge?
A. The local recharge that we're documenting relates

to the perennial yield of Kane Springs Valley.
Q. Okay. So you do agree that there is interbasin flow, and that interbasin flow goes from Kane Springs Valley to Coyote Springs Valley?
A. Yes, just like it is from Pahranagat Valley. Just like it is from Delamar Valley. It can go all the way up the flow system.
Q. All right.
And you're familiar with the CH2M Hill report from 2006, the framework report where it reported 16,000 acre-feet of flow; correct?
A. I -- I don't recall that number, but I am familiar with the report, yes.
Q. At page 12 and 13 of that report, it was done for Lincoln County. It actually states "Local groundwater discharge into Coyote Spring Valley" -- top of page 13 -- "16000 acre-feet a year based on analysis by Walker."
Is that consistent with the position that Lincoln County would have today?
A. Probably not. I think from our data that we've collected in-basin that there's probably less groundwater recharge that occurs than 16,000 acre-feet in Kane Springs Valley.
However, we're going to analyze that and look at

that, and hopefully, Mr. Umstot will run his recharge model on that.
Q. But we do have the CH2M Hill report from 2006 that talks about 16,000 acre-feet, and if that -- if that inflow is coming in, it would be coming in through the carbonate aquifer; isn't that right?
A. Most likely through the carbonate.
Q. Sir, I'm curious. There's another statement that was made in the report: "The effects of pumping from Kane Springs Valley would not be felt for over a hundred years outside of Kane Springs Valley."
What's the basis of that statement?
A. So several years ago, I think SNWA developed a model -- I think the author of it was Dagnisi. I had Dr. Mock evaluate that and look at pumping from Kane Springs Valley of our water rights to give us an idea of what the potential effects would be on the Muddy River Springs area based on that analysis, and he can speak to that, if you would like.
Q. It's based on a different report, not an analysis done at this particular valley?
A. Correct.
Q. So a different report, a different valley?
A. No. A different model that was available several years ago. It was Southern Nevada Water Authority's model.

Q. Thank you.
What month and year, do you know, was KMW-1 completed? Was it October 2005?
A. That -- that --
Q. Sound about right?
A. -- sounds right or it might be -- it was sometime late fall of 2005.
Q. And then water level measurements began for that in April of 2007; is that right, KMV-1?
A. Yes.
Q. How did Lincoln determine the impacts of the extraordinary precipitation event of 2005 if groundwater level monitoring began in 2007?
A. Do you want --
HEARING OFFICER FAIRBANK: Go ahead and answer the question.
MR. BUSHNER: So if you go back to that figure -- what is it you asked me earlier -- I have it right here. That's why it's so important.
So if you go back to the Figure 3 line of my report that we submitted, and everybody wants to compare the water levels between CSVM-4 and KMW-1, and so that's what we did.
And CSVM-4 was constructed, I guess, prior --

obviously, prior to 2003, and so you have a hydrograph from that well that you can compare with the well -- with KMW-1. You have to look at those together. That's what we did.
MR. FLANGAS: Thank you.
HEARING OFFICER FAIRBANK: Muddy Valley Irrigation Company.
MR. KING: No questions.
HEARING OFFICER FAIRBANK: Seeing no further questions, Bedroc.
MS. URE: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions, Nevada Energy.
MS. CAVIGLIA: No questions.
HEARING OFFICER FAIRBANK: Seeing no further questions, we'll go ahead and open it up to the State Engineer and Division of Water Resources staff.
EXAMINATION
MR. BENEDICT: Jon Benedict for the record. A question about hydrographs, and I think maybe the best way to do this is to go to Slide Number 6 of Mr. Umstot's presentation.
Okay. Great. So this is -- this is CSVM-4 hydrograph; correct?
MR. UMSTOT: This is Todd Umstot. That's

correct.
BY MR. BENEDICT:
Q. Okay. So there was a question about what -- what hydrograph might represent the best hydrograph for climate. I mean, would -- you've kind of used this one to demonstrate a relationship with climate.
Would you say that this is the best hydrograph to represent and show climate responses based on their uses and such?
A. Yeah, this would be a good one for looking at climatic effects. There are errors in the water level measurement collections that show probably more variation than is actually occurring, but this does show the response to the 2005 recharge and then a decline as things dry up.
Q. And you've also concluded that it doesn't -- in your opinion, it doesn't show response to the MX-5 test?
A. That's right. There's no discernible response in this hydrograph.
Q. Okay. Another question:
Do you -- you've stated that you see water level declines that continue for about a year and a half after the test period in this one -- I think KMW-1 as well; correct?
A. That's correct.
Q. Do you also see in those two hydrographs declines

from 2016 to present, as others have suggested in other hydrographs?
A. Yeah, I see a decline. It's hard to see from here, but it looks like it starts around 2016.
MR. BENEDICT: Okay. Thank you. Those are my questions.
HEARING OFFICER FAIRBANK: Okay. We'll go ahead and open it back up for questions for cross-examination. And we will go ahead and give you -- you have four minutes.
So Coyote Springs Investments. Seeing none, United States Fish and Wildlife Service.
Seeing none, National Park Service.
MS. GLASGOW: Yes.
CROSS-EXAMINATION
BY MS. GLASGOW:
Q. It's still morning. Good morning. Karen Glasgow with the Department of Interior Solicitor's Office representing the National Park Service. Hello again.
So I had just a couple of questions. Let's start with Mr. Bushner.
Given the differing opinions about the response of KMW-1 and CSVM-4 to MX-5 pumping, do you agree that prior to granting water rights in Kane Spring Valley, the State Engineer should require a long-term aquifer test in this area

to determine the degree of connection between these wells and the Muddy River Springs area?
ANSWERS BY MR. BUSHNER:
A. No, I don't. The State Engineer has already granted water rights in this area, and they qualified that. They allowed 500 acre-feet to be pumped from the southern part of the valley, and we have another 500 acre-feet that can be pumped further into the valley.
And I think we have provided data evidence here today -- geophysical data, an analysis of water levels, climate -- that shows that there's no reason to conduct another long-term aquifer test in this area.
And we've also been collecting in-basin recharge data that we use to support the perennial yield value of Kane Springs Valley.
Q. So was that another long-term or just a short-term test?
A. Was what?
Q. That you were just discussing, that you just explained that you had done to show here.
A. So if you're referring to our tests in 2005 and '6, that was a seven-day aquifer test.
Q. Have you done any tests longer than the seven days that you've described?

A. No, we have not.
Q. Can you use the CSVM-4 hydrograph as an index well for climate and use the same hydrograph to determine that there is no pumping effect from MX-5 pumping?
A. I'm not sure I understand the question. If CSVM -- oh, use the CSVM-5 well?
Q. I'm sorry. CSVM-4.
A. So you would use CSVM-4, which -- if you assume it's all climatic effects and it has no effect of pumping to see if there was a pumping effect, then, in KMW-1?
Q. No, in CSVM-4.
A. Well, CSVM-4, if you assume it's all due to climatic effects, then you can't -- I don't think you would discern any pumping effects.
Q. Thank you.
I think I have one more question. It's about...
With respect to the use of the -- forgive me -- Dagnisi model by Mock, the 100-year delay for pumping effect, was the SNWA model run by Dr. Mock calibrated to the Order 1169 test?
DR. MOCK: This is Peter Mock. I don't recall. I don't think so.
MS. GLASGOW: Thank you.
No further questions.

HEARING OFFICER FAIRBANK: Moapa Band of Paiutes. Seeing no additional questions, Las Vegas Valley Water District, Southern Nevada Water Authority.

CROSS-EXAMINATION

BY MR. TAGGART:

Q. Dr. Mock, just real quickly, you don't recall whether it was calibrated -- well, the pump tests came after the model was completed, so it couldn't have been calibrated to the pump test; right?

ANSWER BY DR. MOCK:

A. That makes sense to me.

Q. Okay. Bushner, so in your opinion, a new fault should be -- or this new fault that's been identified by Mr. Carlson's work should be the boundary between Coyote Springs Valley and Kane Spring Valley; right?

A. I think it provides a good --

Q. Okay. Should it be the boundary or not?

A. Sure, yes.

Q. And so CSI would not be able to file a change application to move points of diversion for its permits that it owns in Coyote Springs Valley to the area in Coyote Springs Valley that's northeast of that fault under your proposal; correct?

ANSWERS BY MR. BUSHNER:

A. Well --

MR. HERREMA: Can I object to this? I don't believe there's been any testimony in the reports or the rebuttal about CSI change applications.

MR. TAGGART: It's a simple question.

MR. HERREMA: It's beyond the scope of the salient conclusions that they either reported about or testified about.

MS. PETERSON: I join in that.

HEARING OFFICER FAIRBANK: I think to the extent that the question is going to -- you know, boundaries and changing of boundaries, that is within the scope. But as to specific water rights and those particular issues, I don't know that that is within the scope or within the particular issues in which have been addressed here today.

So, Mr. Taggart, if you want to rephrase your question in a manner that is within the original scope of testimony and the issues that are subject to these proceedings.

BY MR. TAGGART:

Q. Well, would the fault change the boundary of the hydrographic basin and how could it not if it's not the boundary that you propose, Mr. Bushner?

And I'll strike the question because I don't want

to waste any more time on this.

Under your proposal, a hydrographic boundary would be established at the fault; correct?

A. No, I don't think you'd change the hydrographic boundary. The issue is the administrative unit.

Q. Okay. Thank you.

Now, is it also true that CSI has a contract with Lincoln County Water District to acquire the water rights that Lincoln County has in Kane Springs Valley?

MR. HERREMA: I'm going to object again. I don't think this is within the scope of their reports for water rights, water right contracts, or within in the scope of this hearing.

MS. PETERSON: We would join in that also.

HEARING OFFICER FAIRBANK: So the objection is that you believe it's beyond the scope?

MR. HERREMA: The scope of the hearing --

MR. TAGGART: Excuse me, is it my turn to respond?

MR. HERREMA: -- beyond the scope of the testimony.

HEARING OFFICER FAIRBANK: Mr. Taggart.

MR. TAGGART: It's certainly relevant to the question of subdivision maps and the coordination between CSI

and Lincoln County. There's a contract that's public record.

It was put before the Lincoln County Commission on September 16th, so I think it's important for the State Engineer to understand that there's a contract between these two parties in this proceeding for the water that's being sought.

HEARING OFFICER FAIRBANK: But, Mr. Taggart, how does it relate to the geographic boundaries, the movement of water rights, the amount of water that may be developed on a sustainable basis within that geographic area that has been designated as the Lower White River Flow System?

MR. TAGGART: I think it goes to credibility about the whether the boundary really is a hydrologic boundary or whether it's a place that can be drawn so that applications can be developed in Kane Springs Valley and then water sold to CSI from there.

HEARING OFFICER FAIRBANK: I'm going to go ahead and sustain the objections on the basis that it's beyond the scope of these proceedings.

MR. TAGGART: Okay. Do I have any time left?

HEARING OFFICER FAIRBANK: I'll give you -- I'll give you another 15 seconds. You can ask one more question.

BY MR. TAGGART:

Q. It will be the last question. All right.
I'm not going to ask Mr. Umstot about the Patriots.
So, Mr. Mock -- or Dr. Mock -- or actually, I'll ask Mr. Carlson.
So the deep data that you talked about, none of that deep data was presented in the presentation you shared with the State Engineer yesterday; correct?
ANSWERS BY MR. CARLSON:
A. No. I think it was on a demonstrative slide --
Q. Okay.
A. -- but I'm not sure.
MR. TAGGART: Thank you.
HEARING OFFICER FAIRBANK: Moapa Valley Water District.
Seeing no further questions, City of North Las Vegas.
MS. URE: No additional questions.
HEARING OFFICER FAIRBANK: Center for Biological Diversity. Seeing no further questions.
Georgia Pacific-Republic. Seeing no questions, Nevada Cogeneration.
MR. FLANGAS: Thank you.

CROSS-EXAMINATION
BY MR. FLANGAS:
Q. I have just -- I have just one question for Dr. Mock.
Generally, sir, is it a correct statement that you don't agree with the contention that the -- that the majority or, really, all of the discharge occurs in the Muddy River Springs area from the carbonate but that, in fact, there are other areas where the carbonate discharges water here.
Is that a generally correct statement when I read all of these reports? I think that's what I'm understanding you to say, that there's additional discharge occurring from the carbonate system beyond just the Muddy River Springs area?
ANSWERS BY DR. MOCK:
A. In my rebuttal report, I said that I thought the flow to the Las Vegas Valley was -- was a reasonable discharge point for the Lower White River Flow System.
Is that what you're asking?
Q. I'm just trying understand generally that concept. It seems like the two things that I understood from all of the reports generally, but especially from yours, was that there was additional recharge to the carbonate and additional discharge from the carbonate beyond what many of the other parties were saying occurred, that everybody else seemed to be suggesting that the discharge was really limited to the Muddy River Springs area but that Vidler and Lincoln County were saying, no, there's additional recharge, really, into the carbonate from other areas, and there's additional discharge from the carbonate system that occurs beyond just the Muddy River Springs area that's not being accounted for.

A. I don't recall saying that I thought there was additional recharge. I'm not aware of additional recharge compared to what others have brought to the table.
But I will say that Lincoln and Vidler, as I said, has Mr. Umstot and his firm collecting data and running what I call a land surface model and calculating discharge in some areas, and I'm not sure if that will lead to larger numbers than people have seen before.
But I have agreed in my rebuttal report that I think there's flow out to the Las Vegas Valley just based on the structure, and the residual of what many people put together for a water budget makes that reasonable as well.
Q. Is that based on geology, sir, and things?
A. Quite a bit of this is based on the framework of the geology, there being large carbonate corridors that are pointed toward Las Vegas.
Q. Do your colleagues at the panel agree with you on that basis?

Generally, I don't know if everybody has to nod their head. I don't --
MR. BUSHNER: This is Greg Bushner. I do -- I agree with Dr. Mock on that.
MR. CARLSON: This is Norman Carlson. Yes, based on my understanding of things, yes.
MR. FLANGAS: Okay. Thank you. No further questions.
HEARING OFFICER FAIRBANK: Muddy Valley Irrigation Company?
Seeing no questions, Bedroc.
MS. URE: No questions.
HEARING OFFICER FAIRBANK: No questions.
Nevada Energy.
MS. CAVIGLIA: No questions.
HEARING OFFICER FAIRBANK: No further questions, so we'll go ahead and open it up to the Division of Water Resources staff and the State Engineer.
Okay. So at this time, we'll go ahead and open it up to Lincoln County and Vidler for redirect, and I will go ahead and -- we'll give you ten minutes.
REDIRECT EXAMINATION
BY MS. PETERSON:
Q. Thank you. Karen Peterson.

Mr. Bushner, what did Lincoln County and Vidler do in response to Interim Order 1303?

ANSWERS BY MR. BUSHNER:

A. So in response to the State Engineer's request on this interim order, we went out and collected new data. We collected new geophysical data that has reviewed and presented in this hearing and also discussed in our reports.

Also, it's been stated that we should do additional pump tests or aquifer test analysis on additional wells.

Well, the people that have stated that haven't even reviewed the tests from our 2006 test of well KSW-1, and that data has been publicly available since our hearing in 2006.

Also, we've analyzed geochemistry data throughout the whole Lower White River Flow System for your benefit, and we've brought new scientists here to look at that and to reanalyze and provide opinions on it.

And so all of this information has been provided to you previously, including the new information, the new geophysical data that we collected.

Coyote Springs Investment, Lincoln County Water District, and Vidler Water Company are the only ones, I think, in this hearing that have been responsive to collecting new

information and providing it to the State Engineer to help him address the four questions that are outlined in Interim Order 1303.

The Moapa Band of Paiutes have provided a new analysis, a peat flow model. However, that's not based on any new data as near as I can tell, but that is a new way of looking at the flow system.

The other thing that CSI and Lincoln County Water District and Vidler Water Company have done is contributed to the Fish and Wildlife Service for the Moapa Dace habitat restoration.

We've contributed a significant amount of money of which we don't know how that has been spent. We don't know what has come of that. We've not received any information on what habitat has been restored for the monies we have agreed to give them. So -- and we have given them.

Finally, I just want to say we've been very responsive -- we've tried to be very responsive to your requests in this Interim Order 1303.

We've focused our analysis on the issue most germane to Lincoln County Water District and Vidler Water Company, which is the boundary of the Lower White River Flow System, the administrative boundary. And that's our new geophysical evidence that we've brought to the terrible.

We don't think that Kane Springs Valley should be -- it's not in Order 1169. It's not one of the Lower White River Flow System basins, and we don't think it should be included.

But thank you. That's all I have to say.

BY MS. PETERSON:

Q. Thank you, Mr. Bushner.

Dr. Mock, could you please explain the difference between flow paths and impacts.

ANSWERS BY DR. MOCK:

A. Just briefly -- yes. Just briefly, the -- there's been a lot of discussion about flow paths through the system, and I think that is valuable in understanding how water interacts with the structural geology of the area.

And certainly, that's important, and we'll continue to learn from that. But the impacts as I understand it are to the springs and the surface water features of the Muddy River Springs area is the focus of this.

And what causes impacts, I think, is -- are drawdowns, and I haven't seen anyone bring to the table their estimates of drawdowns based on recent information at Muddy River Springs due to pumping at the Kane Springs Wash that would cause the engineer -- the State Engineer to reconsider what they're doing.

So how is that different? And if you read my rebuttal report, you'll see my specific responses to these specific comments where I think this happens.

But a drawdown from a well does not only go focused running downstream to the -- down the flow path, and it is allowed by the porous mediad or the fracture system to go off in all variations until it encounters variations in permeability that cause it to be modified. But it has a lot of other places to go besides capture, the downstream capture zone or the current steady flow.

Q. And then one last question, Dr. Mock. You've listened to the evidence. I think you've been here since the start of the proceedings.

And in your professional opinion, is there any basis for the State Engineer to change his previous determination that Kane Springs Valley should be excluded from the Lower White River Flow System or the Order 1169 proceedings?

A. Well, just to correct you, I arrived at 1 o'clock on Monday, but I don't think I've missed anything else.

I don't think there has been evidence that would cause the State Engineer to change the boundaries that have been set and -- and put into place for the Lower White River Flow System as an administrative unit. And let me explain why

I think that.

I think the most prominent assertion that I have heard is that the 1169 test led to us seeing a drawdown response in response to that specific pumping at CSVM-4 and KMW-1, and you certainly know what I'm talking about. You've seen this over and over and over again.

And I don't think that that is a reliable basis for the State Engineer to make his decisions about the boundaries. I love aquifer tests. I teach aquifer tests and practical analysis at seminars. And I think it's a great way to characterize aquifer parameters in the vicinity of the well. The closer the better, and I can go into that in more detail.

When you're working at the edges, I think it can give you unreliable information. In this specific case, let me line up what I think makes this an unreliable measure of what the boundaries should be.

First of all, let's just realize what we're talking about. We're measuring waterways that are a thousand feet below land surface. I personally have never done that. My deepest water level is 750, and it was quite a physical exertion. So I'm quite impressed with everyone's work here in taking water levels at a thousand feet and working with them.

We're talking about what people have projected or

seem to be looking at and thinking they see a half a foot or a foot and a half of drawdown due to pumping caused by the 1169 test. So we're measuring one foot at the bottom of what is essentially a hundred-story building in depth.

There are notes of the sounders sticking to the side of the casing. Certainly, this is going to happen, and you have to give them a jerk to keep it loose and moving around, and people are doing the best they can. And I think that's fine. But, again, I'm talking about the reliability of being able to see drawdowns in this measure.

Near the end of the pumping, we have three kinds of data. There were transducer data that were averaged, and there were sounder data and there were calibrated sounder data. And I'm not casting aspersions on this. I'm just saying that there were changes that were going on, and we're looking at different pieces of data. And we're again talking about a foot of change -- approximately -- people are talking about.

There were sudden one-foot swings that Mr. Umstot showed near the end of the test in the data, and you see swings when he compares the transducer data to the sounder data. And we must wonder what would cause these sudden swings at such a great depth, you know, in support of the aquifer.

And finally, SNWA says -- and we've seen this in

the testimony yesterday -- that there's a one-foot variability, approximately, in some of their data for various reasons, and they've answered for that.

Finally, in another group, there are no seasonal signals that I see, not the clear seasonal signals of pumping in the KMW-1 and CSVM-4 hydrographs that we see further south.

I don't see the multi-marked substantial recovery and renewed decline in approximately January 2012. The MX-5 pumping was shut down for a while, but that signal is a beautiful aquifer test signal farther south into the system.

And finally, this is the most important thing to me is that you can't have a very short response time between the start of the pumping and the start of the aquifer response, say a few months at the beginning and then have more than a year for it to respond with the cessation of the pumping.

The way the physics of well response is of a sharp, clear, focused impulse on the system is that when you make a change, the timing of those responses as they go out is the same.

So you can't have a few months going out of the pumping response and over a year's response to a recovery response because the pump has been shut off. And shutting off a pump is just as powerful as turning it on.

Finally, I think there's a reasonable inference of a decadal scale decline. We've heard all the arguments here today, but if you look at SNWA's many -- almost every graph, they have a nice plot at the bottom of the percentage above precipitation above and percentage below.

If you look at the last 20, 21 years, 14 of them are less than. Seven of them are higher than, and that's all I want to go into with that.

And I think the drought continues declining that I have been associated with elsewhere in the southwest. There's a stronger opinion that there is a decadal spin on it, set of drought persistence since 1999 or 2000.

And, finally, I think there's a reasonable inference that there's a multiyear recession from a rise due to the big recharge event of 2005. I think those are two reasonable things people can say about what happened during this test.

I would say from being a person who runs aquifer tests I want some long ones. I avoid long ones because these things can happen. You can have a recharge event. You can have people turn wells off during your time of your test. All these things happen. So I understand it completely. But this is not the sum total.

This is not a reasonable -- this is not a strong foundation for the State Engineer to make changes to his decisions that are based on a bigger set of data. So I do not think the 1169 test helps you with the far edges of response.

And in fact, I think the data, especially that timing issue, indicates that it did not make it into the CSVM-4 KMW-1 winter.

So if I'm so tough on sounders and aquifer testing, I tell you why I like those things. But what is reliable here? And what I see that is reliable and what I think is the core of the boundary delineation.

There is a catch from water level elevations of about 1800 to 1820 that we first saw in the CH2M Hill report from 2006, and I've seen persistently since then. It's this patch of water levels. It's plus or minus five feet that is remarkable, and I think that's something that's reproducible. I think it is reliable.

I think you can go out with a sounder and a drill rig and a survey crew any time you want. My only suggestion is you have one surveyor go and do all of these well heads because this is not much a change, but this is the core of the five and a half or six or seven -- six and a half -- six-basin selection.

The selection engineers make of core depth, I think, is just plus or minus five feet or 10 feet between 1800

and 1820. That's where something is -- very interesting is going on in the system, and it makes a lot of sense that that's the core of this. And I would say that is reliable, and I would stick with that. And that's something you can work with.

Now, we know that the water levels go up over 20 feet as you head into northern Coyote Springs Valley, and if you head up another seven or eight feet as you go up to Kane, and I'm convinced by the geophysical data that's been shown of that normal fault -- I think that's a basin and a range fault that's -- that Mr. Carlson has found in his fieldwork.

It's just an idea of why would there be a water level drop? Well, there are these faults and these juxtapositions that mature.

So if you were to make a change to this, you might want to look at northern Coyote Springs Valley because of that water level distance and that it doesn't quite fit with this area of very uniform water levels.

But as it stands, the current basin configuration, I think there's support for it. I haven't seen reasonable evidence against it.

MS. PETERSON: Thank you. Thank you.

HEARING OFFICER FAIRBANK: Thank you. All right.

So, next, we will go ahead and move to City of North Las Vegas and to allow some time for everyone to move around and shift. We'll go ahead and take a quick ten-minute break.

(Recess.)

HEARING OFFICER FAIRBANK: Okay. We'll go ahead and go back on the record and start with the City of North Las Vegas, Ms. Ure.

MS. URE: Good morning, Tracy Ure appearing for the City of North Las Vegas. And today Dwight Smith is going to be testifying on behalf of the City, so if we could have him sworn in.

DWIGHT SMITH,
called as a witness in this matter,
having been first duly sworn,
testified as follows:

DIRECT EXAMINATION
BY MS. URE:

Q. Thank you, Mr. Smith. Do you have a copy of the City's exhibits in front of you have?
A. Yes.
Q. Can you briefly describe your background which is presented in your CV at Exhibit 1?
A. I'm the principal hydrogeologist with the interflow hydrology. I have been practicing for a little over

30 years. The majority of my work has been in Nevada throughout my tenure.

And it's been my privilege to have testified before the Nevada State Engineer on 15 prior occasions. So this is my 16th -- 16th time to be here before you.

Q. And have you been previously qualified as an expert in hydrogeology?
A. Yes, in those prior hearings.
Q. Okay. And did you submit reports in this case at Exhibits -- or City of North Las Vegas Exhibits 2, 3, 4 and 7?
A. That's correct.
Q. And for Exhibit 5, did you assist in drafting of this report letter as well?
A. I did assist Mr. Duval with that cover letter.

MS. URE: Okay. Mr. Smith is available for cross-examination, we will go into his testimony, but we would like to offer the City of North Las Vegas exhibits.

HEARING OFFICER FAIRBANK: And the exhibits are so admitted.

(Exhibit 2 admitted into evidence.)
(Exhibit 3 admitted into evidence.)
(Exhibit 4 admitted into evidence.)
(Exhibit 7 admitted into evidence.)

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BY MS. URE:

Q. Mr. Smith, did you prepare a presentation for this hearing?

A. I have.

Q. And can you take us through that, please?

A. With pleasure. The presentation I've compiled today is going to take us through just a few key aspects. I'll have -- up front I just want to get all the key points that we'd like to convey to the Nevada State Engineer and staff this morning.

I would like to briefly present an overview on the water supply strategy that the City of North Las Vegas has for the Apex Industrial Center in Garnet Valley.

Our technical work has been in support of advancing that water supply strategy. And then we'll use that technical work to then provide some additional data, additional interpretations from which the State Engineer can address some of the questions posed in Interim Order 1303.

The -- the tables and figures in this presentation are all from our Exhibits 3 and 4 unless otherwise noted on the overview.

My key points for today. The -- the administrative boundary as proposed by the State Engineer we feel are appropriate. Our work has concentrated on just the

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southern part of the administrative area that's proposed.

Our technical analysis has not incorporated northern aspects that have been discussed in detail in this proceeding. So our work is really focused on the south.

I will point out a few uncertainties about the southern boundary, but as a general position the City of North Las Vegas supports the basic boundaries as defined in the interim order.

One issue that we feel is critically important is permitting the opportunities for transfer of water rights from in between alluvial and carbonate aquifer systems.

And in particular, I'll convey how this relates to the City's desire to lease or potentially acquire some of the senior most water rights in this administrative area that have historically been pumped from the alluvium, transfer those down to Apex in Garnet Valley.

We think that's a prudent thing to propose and I would also suggest that that opportunity needs to be left open for others because I touch briefly on how there are examples that transfer water rights between those two aquifer units could have positive water management implications.

So every application needs to stand on its own merits, I think it would be premature to draw any limitations or conclusions about potential transfers between the two

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aquifer systems.

I'll touch briefly on my opinions regarding water level trends. And we have not offered, because we have not studied the entire system in my recent work here, I'm just concentrating on the southern end.

I'm not going to offer an opinion on why a perennial yield would be except for I would offer the advice that we shift to a safe yield management scheme in the system rather than perennial yield. And safe yield, I'll talk a little more about that. Really what's safe, what can be safely established as pumping in perhaps different geographic areas.

And what is safe for the Muddy River Springs area. I think that's the key here. The levels of drawdown that we've been observing are long-term trends we've been observing are not all that critical to anything except for the high altitude springs that supports the Dace habitat. So everything's got to be framed around that.

So that I would encourage moving forward that this certainly needs to be tied more to a safe yield concept.

Just briefly now, I'd like to kind of encapsulate the water supply strategy that's been brought forth by the City of North Las Vegas. And that that is basically four principal components.

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The first component is to complete a water supply pipeline from Las Vegas Valley up to Garnet Valley into the Apex area.

As planned, it's currently a six-phase project to build the pipeline, 36-inch diameter pipeline, it's a large pipeline project.

Phase 1 is under construction, it's bringing the pipeline up along the I-15 corridor. It's scheduled to be completed in April of 2021 under construction currently.

The second phase of the pipeline extends another three, three and a half miles and gets into Garnet Valley and into the southernmost portion of the Apex Industrial Center. That's not planned to be completed until April of 2022.

So this will enable delivery of Colorado River source water from the greater Las Vegas area water system to be brought up into the Apex area and provide water service for the City of North Las Vegas and their municipal service area.

Now, pipeline construction takes time and a lot of financing. In the interim the City owns two municipal wells, the Playa Well, the very north end, and I'll have a few maps to look at the locations here, and the Kapex Well, both of these are in northern Apex area. Currently there is a lease agreement with SNWA to utilize some of their water rights that have been granted in Garnet Valley at these wells leading into the future.

But as I will express, the City is interested in giving senior water rights down to these wells to be utilized into the future. Temporary water right transfers of a junior status water right are not the optimal situation that a water municipality wants to be in. And I think the reasons are clear for that.

Then the other two components here, the City is interested in pursuing an AR concept, artificial recharge. That could be implemented as soon as the phase 2 pipeline is completed. And I haven't -- I won't be discussing that in detail, but I certainly can discuss that in more detail if the State Engineer and staff would like. We've done some conceptual testing on that. It appears to be a reasonable proposal to bring forward.

This could have some -- some great -- or facilitate some wise water management in the southern part of the basin, it could facilitate pumping and support pumping in the northern part of Apex for an interim period if needed. It might become a long-term strategy if needed.

And also I would suggest that, you know, we've talked about having the stress and test aquifer systems, quite difficult to do to put a large pumping stress on if you don't have anywhere the water can be used or place of use.

But let's flip this around, do a long-term injection test of a high rate, we can do that fairly easily. If we get the pipeline up and into the valley and we have an artificial recharge well, injection well or several wells, whatever is required, you can do long-term testing at large magnitudes. And we can do that, technically it's synonymous to doing a pumping test.

So I think there's a lot of advantages to pursuing that and advancing that concept.

And then the final component is just the wise utilization of reclaimed water in the basin, the centralized wastewater treatment plant is planned, it's not present today, but how do we utilize those resources to conserve water and conserve the amount of water that needs to be brought into the valley or pumped.

So that's the -- that's the strategy for water supply that the City has for Apex.

And just briefly how -- how this looks and planned, the dashed black line along the bottom of the overview is the approximate basin boundary between Las Vegas Valley and Garnet Valley. You see at the very bottom of that, this overhead, there's a green line that comes up, that's the tail end of the phase 1 pipeline.

And then advancing on up across the basin

boundary and the red line is the phase 2 pipeline. Just about right in the center just at the lower center part of the overuse at blue point. That blue point is the approximate location of a proposed artificial recharge well.

Q. And, Mr. Smith, when you referred to the basin boundary are you talking about the black dotted line and that's the basin boundary between Las Vegas Valley and Garnet Valley; is that correct?

A. Yeah, that's the approximate hydrographic basin boundary.

Then as the pipeline -- you'll see it continues on north in different phase and segments to the northern end of Apex. This next overview shows the loop system for the pipeline around the northern end of Apex end.

So you'll notice the two wells that I've referenced, Playa and Kapex. Kapex is at the southern part of that loop, the blue point inside that loop. And then up on the northern edge of the loop there's a blue point that's labeled the Playa Well. So that's where those two existing wells are today.

Just to give some geographic context here, on the right-hand figure it shows in pink shading the Apex area, extends from the east, northeasternmost edge of Las Vegas Valley and then on up into Garnet Valley and into the central

south part of Garnet Valley.

And above to the north is Hidden Valley and above that to the north is Coyote Springs Valley, Muddy River Springs area northeast and directly to the east of Garnet Valley is California Wash. To the south is Black Mountains.

This may not be shown up too well on the overview, but it should show up on your figures. The green shaded area, I think we need to take note of that. That is the Desert National Wildlife Refuge. So that the constitutes a large amount of area and incorporates the westernmost arm of Garnet Valley.

I think there are obvious limitations to any disturbance of any type or development of water resources over in that arm of Garnet Valley because of its land use designation. Apex is otherwise surrounded by mostly public lands, BLM, with some utility corridors cutting through it and I-15 forming the southern boundary and U.S. 93 forming the northern boundary.

So the geologic context that we're in, this is just an overview of the regional geology and of some of the primary fault zones. The blue shading are the carbonate rocks. The yellow is the alluvial -- alluvial materials. And you can see the band of bluer rocks that stem from north -- northward up from the Las Vegas sheer zone through Garnet

Valley.

So we certainly do agree with the interpretations of Garnet Valley being incorporated in this regionally connected carbonate system.

The one thing I would like to point out is that hydrologically and from a modeling perspective, we use the Las Vegas -- we -- I should say most scientists have used the Las Vegas sheer zone as a southern boundary, so that then results in incorporation of that northern tip of the Black Mountains area.

One thing that I have not heard discussed at all is there is that part of Las Vegas Valley on that edge above the Las Vegas sheer zone that possibly should be considered for inclusion, but I don't suggest that we do that now, because as you'll see as we go through this presentation there's a lot of uncertainty there about the boundary between Garnet and Las Vegas Valley. But we certainly need to keep in mind for the future what the actual hydrologic boundary might be for the flow system.

Q. And, Mr. Smith, so you're on slide 8, and I just want to make it clear for the record that the Las Vegas Valley sheer zone is labeled on your side and it's on the bottom left-hand corner of your demonstrative exhibit; is that correct?

A. Yes, that's correct. Just a couple other regional faults I'll touch briefly on. On the -- running through the eastern side of Garnet Valley is the Dry Lake Thrust, but also a number of normal faults that are run generally parallel to that fault feature. So we have a series of faults along the east side of Garnet Valley.

It is possible that those are somewhat of an impediment to the eastern flow. We're lacking any data to from which to interpret that. So any data that will be further east, it's just not available.

Until we get all the way over near the Muddy Mountains Thrusts, which I think most people recognize as a major geologic continuity for the carbonate aquifer.

So for now I guess I would also pose the question is that part of California Wash in the southernmost part is really part of the system.

I think for now we have to say yes because of the interpreted geology and presence of substantial carbonate rocks extending through that. I will note these are two -- these are zoom-ins on two of the geologic cross sections by page numbers --

Q. And you're on slide 9 -- sorry, slide number 9?
A. Slide number 9.
Q. Okay. Thank you.

A. So you can see the bluish shades or the principally carbonate rock types and the greener shades are the plastic rock types and a major discontinuity across the Muddy River Fault.

You'll notice in the bottom cross section there's a little derrick symbol, it's labeled Grace Petroleum, Arrow Canyon number 1. So right in the Apex area there was a deep petroleum exploration well drilled in 1982. It's over 17,000 feet deep.

So the only geologic real subsurface -- deep subsurface lithologic control we have in these sections is that one petroleum exploration well. But there it is, it has defined a substantial thickness of carbonate rocks exceeding 17,000 interpreted to be on the order of 20 to 25,000 thick in Garnet Valley.

Just as a quick note, there's some testimony by Rick Waddell from the National Park Service about concerns over potentially impacting flows of Rogers and Blue Point Spring.

The concerns are duly noted, but you can see through these cross sections, on the upper cross section you'll see Blue Point Springs labeled. And the considerable geologic discontinuities in the carbonate aquifer would have to exist for that to be the regional source of water to those

springs. Not that we shouldn't still acknowledge those concerns, but from a geologic perspective it's rather difficult to conceptualize that flow system.

So, regarding flows to and from Garnet Valley, and what we understand based on the data we have, and I will note that there are certain areas where we really don't have any data from which to make interpretations, but as we understand it, and this has been the -- really the conceptual flow system.

Q. And you are on slide 10?
A. I've advanced to slide 10.
Q. Thank you.
A. So, since the earlier studies, all the way back to Rush 1968, it's been interpreted that there's a southern component of flow down through Hidden Valley and down into at least the northern portion of Garnet Valley. And then from there out to California Wash. That's been a conceptual flow path that's been -- that has existed for many decades based on the available data.

So water levels in Garnet Valley are all lower than water levels in the Muddy River Springs area and are all lower than water levels in Coyote Spring Valley. So this is supported by water level data that we have.

I believe I have an overview coming up that will zoom in on water levels in Garnet Valley, but the lowest water level in the basin occurs at the GB-1 well. And I think we'll -- I'll save that section so we can zoom in a little more.

But water levels are relatively flat in that 1808 to 1814 altitude range, so consistent with -- with that band of water levels that was discussed in just the prior testimony.

Q. And, Mr. Smith, going back to slide number 10, did you discuss why you had a question mark going from Las Vegas Valley into Garnet?

A. Yeah, thank you very much. So, question mark there, we've interpreted based on our data evaluation back there is potential flow from Las Vegas Valley into Garnet Valley. And I'll look into that, discuss that in more detail.

And also we have an arrow going out to the Black Mountains based on that -- that really deserves a big question mark there also because it depends on which water level you're trying to tie that to, certainly the water levels are within a few feet of each other, so...

But the highest water level, I just mentioned the lowest water level tying in the northern arm of -- or the northernmost part of Apex is the lowest occurring water level, that's been the case for decades.

The highest water level over the decades that

we've monitored has occurred in that southernmost -- southernmost tip of that arrow is GB-2, that's consistently been the highest elevation water level in Garnet Valley, higher than the water levels of Seradep at Moapa down in Paiutes area included. So why is that the highest water level? That's going to lead us down the -- my path investigation on this.

So advancing to slide 11. One thing that we do have, you know, we're always finding sparsity of data in this flow system in general, but we have -- we have about 50 well logs on record for this southern central portion of Garnet Valley along the I-15 corridor, some of the wells on record are done in the logs, about a third of them.

So we have at least 30, 35 logs, plus or minus, with geologic information, water level information, some production information.

And on these two overviews I'm going to zoom in on the right-hand side, the blue, dark blue points are logs of production wells, red are abandonment logs and lights, light green or light blue shade are logs for wells drilled for monitoring purposes.

You'll see -- I mentioned the GB-2 well, you'll see that that as a light green color point in the south central part of Apex.

And up in the northern tip of the diamond or triangle for Apex that's shaded pink you'll see the upper tip of that and right on the basin boundary we put in Hidden Valley is well GB-1.

So using the well log data, we looked at a variety of things including depths to water and depths to top of limestone that's recorded, et cetera, most all the wells are completed into the top of the carbonate aquifer. There are a few that were completed -- reported to be completed only in the alluvium.

Q. And you are on slide 12; is that correct?

A. Yes, correct, I advanced to slide 12.

So, using the specific capacity data, so that's just the production data reported on the well log and the drawdown associated with that production, we can apply some simple equations to estimate aquifer transmissivity.

So for all the available logs that had this information, I believe it's 17 logs, we have computed the estimated transmissivity.

So one thing that becomes immediately apparent is that the transmissivity of the majority of the wells in Garnet Valley is about two orders of magnitude lower than the transmissivity estimated for up in the MX-5 area and the Arrow Canyon area.

So, the transmissivity in general, we're not privileged to have wells that can produce several thousand gallon a minute with only a couple feet of drawdown, but those type of wells do not exist.

For reference to Playa Well that the City owns now was drilled to 2,000 feet. As a static water level it's down around 800 or 850 feet in depth. It's been tested at 600 gallons a minute. And the Kapex Well to the south there has a production capacity of about 200 gallons a minute. And it's completed down to 1145 feet. That Kapex Well was drilled in 1990. It was called the Krut (ph.) Well for a long time.

Kapex -- what the City calls the Playa Well has also -- has also been called the Solar Well, it was drilled recently in 2006 -- '16, excuse me, 2016.

So you will notice all of these points are scaled based on the transmissivity, the calculate transmissivity value. So in the southernmost part you will notice a fairly large blue point with a value of exceeding 50,000 feet squared per day.

So that is about one-third or, you know, it's starting to approach the types of transmissivities that are -- that have been determined up north, it's not quite as high, but it is getting high.

Now, that is the well owned by Georgia Pacific.

On the well log it's reported that it was pumped at 140 gallons a minute with ten inches of drawdown. So, we have not done anything to confirm that that ten inches is not ten feet or we're trusting that that information on the well log is accurate. If it is, then that is a higher transmissivity well. And there's one well up along the I-15 corridor in the northern area there that GBR-1 also had a notably higher transmissivity.

And those perhaps not coincidentally are located along fault and structure that projects along the east side of Garnet Valley.

Q. So, Mr. Smith, is it your opinion that the transmissivity in Garnet Valley is modest or moderate besides these two outliers?

A. Yes. The average transmissivity in Garnet Valley is I would just say moderate. It's not extremely high.

Q. And you're moving to slide 13 now?

A. Yes. Thank you. So just a little more on potentiometric water levels, I think I've touched on this already. These are water level information, some -- there's a number of wells being monitored in Garnet Valley, which is a good thing, but a substantial number of them are actually pumped wells.

So we have a mix of the static water levels from

monitoring wells and then also wells that have both static and pumping water levels. And that's fine and it's good to be reflecting both types of data in the basin.

You'll see circled in black dashed lines on the right-hand pane is the two wells that I've already discussed, the GB-1 well to the north with water level elevation and average water level elevation year 2015 of 1,808 feet as contrasted to the water level at GB-2 at 1,114 feet. So about six feet of water level difference between those two wells. And again, GB-2 being the highest water level that's observed.

The reason I've presented 2015 ties into the test boundary modeling that we did which will be coming up shortly in my presentation.

Advancing to slide 14, so the fact that GB-1 -- GB-2, excuse me, has the highest observed water level and it's down in the southern boundary of Garnet Valley kind led us to want to inquire further about why this could be.

We began with looking at water levels just outside the basin boundary in Las Vegas Valley. So in the overview on slide 14 you'll see in the upper right-hand corner there is a black line where the basin is labeled, that's the Garnet Valley/Las Vegas Valley boundary, hydrographic boundary.

And then you'll see two wells that I've circled

there with a dashed line, one is labeled Diamond Construction, the other is labeled Diamond Apex.

And I was hoping to gain some insight, but looking at these two wells they're both drilled to approximately 900 feet in depth. And they have water rights so we can reasonably accurately determine where their location is. This was all an office exercise. So I think for me to understand water level elevations we have to understand the land surface elevation and then use the log data for depth of water, we can draw elevation for the water tables. So this was strictly an office exercise.

But unfortunately what we got out of those two wells was about a 60-foot difference of predicted water elevations, one of them being higher than Garnet Valley and one of them being lower. So generally answered the questions is could groundwater be coming in from Las Vegas Valley and the Garnet Valley?

So we then expanded our search further out into Las Vegas Valley. And I should note that this geographic region is still north of Las Vegas sheer zone.

But there's quite a few well logs, and like domestic well logs, other logs, we tried to ferret through and find well logs that are associated with water right points of diversion. So we know it would be lance our elevation more

accurately. And deeper -- deeper well logs.

At the end of the day we compiled about 20 well logs with estimates of water level elevation from the reported depths to water. And the average of all of those values places us a little lower in Las Vegas Valley than Garnet Valley or GB-2. The median places us a little above, about ten feet above.

So, my preliminary interpretation is I relied more upon the median because we have a few outliers in this dataset and the median probably more accurately represents potential water level.

So, a very preliminary assessment is that there appears to be a gradient between the two basins from Las Vegas Valley and the Garnet Valley. This -- this really can only be answered with a more accurate on the ground data. Ideally water level measurements from monitoring wells, not pumped wells. And completed into the carbonate aquifer.

So this is an area that I -- for now I can't advance this any further just using office techniques, that is something that we need to understand better, especially for composing to try some AR just north of this boundary.

We need to understand artificial recharge water, where it's going to go, is it going to stay in Garnet Valley like we would hope or is it going to leak out in the Las Vegas

Valley? What are the gradients or how do we affect that interaction that may exist in that inflow by doing -- by proposed actions.

Now, advancing to my next slide, 15, I'm going to touch briefly on a test model that we did. We put together specifically to -- for me to try to gain a better understanding and hopefully for the State Engineer staff to gain just a better understanding on the magnitude of potential fluxes through Garnet Valley.

So now that we have an idea on the transmissivity, and the transmissivity is relatively moderate, we have water level elevation data, we can start to assess groundwater inflow and outflow from Garnet Valley.

So, this is really -- really I've turned this and I want to be careful, this is a test modeling exercise, this is not anything more than really just a modeling exercise is what this was.

So we assigned eight different boundaries along the periphery of Garnet Valley where we hypothesize there there potentially could be inflows and outflows of the water. And they're all assigned general head boundaries.

We then anchor that general head to water level elevations at matching points outside the basin. And for Garnet -- for the potential flow that we just spoke of, Las

Vegas Valley into Garnet Valley, I -- I used the median water level. So I have a higher water level represented outside the boundary there.

And then I'll go through the effort of wanting to calibrate the models. So I want to have a transmissivity, this is a two-dimensional model by the way, it's just a single layer that represents the upper thousand saturated feet of the carbonate aquifer, that's all that it represents in a two-dimensional manner.

So we have our water level dataset, I used 2015 because the pumping for the decade prior to 2015 is fairly constant in Garnet Valley at about 1500-acre-feet annually.

And years 2016 and 2017 water pumping increased for construction activities, I'll touch on that a bit briefly, but pumping was up around 2,000-acre-feet for those two years. So I didn't want to pick a snapshot in time that may have more dynamic influences than necessary. So 2015 was my -- my index year for this test.

In the model you'll see the reporting on the model in the -- in the document, I'm not going to dwell on that, but it did calibrate reasonably well to the water level date that we have.

It calibrated to both static water levels and average pumping water levels, if that was the type of data

that was collected. And we got reasonably good fit after adjustments to the model boundaries and some adjustment to hydraulic parameters. We got a pretty good fit to the water level data that's available.

And the results -- let's see the results slide. Just staying on slide 15 for a minute, the results of this, we used PEST to calibrate the boundaries. So I wanted to find the optimal with the boundary conductances that regulate flow into or out of the model. We used PEST to calibrate them. And we also attempt sensitivity of each of those boundaries.

And there's a summary table in our report that goes through each of those boundaries, what are our assessment on the sensitivity of that boundary is.

So a boundary that has low sensitivity, really could be open to a number of different inflow, outflow scenarios, conversely a models boundary with high sensitivities probably does not have as much latitude to adjust deviate beyond what we have established as the calibrated inflow or outflow.

So -- oh, I'm sorry, this is maybe a little out of sequence, I just -- no, no, this is fine. I advanced to slide 16. To take up messages as our boundary's on the east side of the model going into the southern part of California Wash here have a higher sensitivity and suggest -- actually

the model wanted to take no flow out of that boundary.

So minimal flow out to the east across that boundary seems to result in the best fit to existing data. Inflow from Las Vegas Valley around 700-acre-feet was derived at a good model solution, a good match to the data.

Inflow into northern Garnet Valley and across the Moapa Paiute area and then out to California Wash was simulated, and that's the northern part of -- northwestern part of California Wash for the outflow.

That model boundary has lower sensitivity. We had modest amounts of flow coming in at about 500-acre-feet or 450-acre-feet. And with an outflow, also a modest outflow of about 100-acre-feet. So -- but as noted a lower sensitivity threshold on that boundary. So the fluxes could be higher or lower, certainly that is the case.

One unexpected outcome is the inflow from southern Hidden Valley into Garnet Valley into the Apex area, I was thinking that that would be a source of inflow to the model, but the model wanted to suggest that it didn't need or necessarily want inflow coming in from Hidden Valley given that GB-1 is the most opportune water right in the system.

So again, this was just an exercise, this was a test and I don't want to convey this as being anything at all definitive, but it was trying to help me assess through as an assess what are the probable magnitudes of flow in that uppermost carbonate aquifer that the wells are currently developed in the uppermost thousand feet. And that was basically the outcome.

Shifting to slide 17, part of the input we mentioned was pumping on the right-hand pane as shown in the distribution of 2015 pumping.

But on the left-hand bar -- bar hydrograph, bar plot, you'll see the data from the State Engineer's pumping inventories, which have been published for the time frame of 2001 through 2017, I did not find that 2018 has been published yet.

And there are some notes, you know, this is -- by the way, Exhibit 4 was an addendum to the original plot presented because we had not noticed that in the year 2016 there was notes that added in pumping from Las -- Southern Nevada Water Authority's permits in 2002 through 2005.

So I assume that my -- the interpretation on that 2006 pumping inventory was that that needed to be added back in. I might ask the State Engineer's Office could possibly amend those earlier pumping inventories to reflect that, because I wasn't a hundred percent sure if those should be added in, but it appeared to be that that was what the note was referencing in 2006.

So, the colors for the bars on this, the yellow and the blue is -- yellow is industrial, blue is commercial. And that's a history that predates the period we have for a history of water use in Garnet Valley that predates the pumping inventory start of 2001. It's -- as I'll discuss coming up here, it's that industry has been present in Garnet Valley really began in earnest in the 1980s, came into presence in the early 1990s and persisted on -- has persisted on through actually, you can tell current and you'll notice that those water uses are very similar year to year.

In 2016, 2017, at the base of the bar plot you'll see some orange bars, those are construction water supply for the I-15 interchange construction and the widening of Highway 93 in the fairly huge super pad construction site, which is a 700-acre super pad.

All those construction activities are consuming additional water. That was -- that water was done under temporary transfers of SNWA's rights that were granted in Garnet Valley in 2001.

The green bars on the top that we have stacked on top of what I would say is the older historic usage in the valley, that is the use of water rights that were granted to SNWA in 2001 in Garnet Valley. 2,280-acre-feet.

And there's a history of those water rights being

transferred to power facilities in Garnet Valley, primarily power facilities. I think the -- well, there's several different power facilities that are using this water, I believe that Chuck Lindsey facility is using the most of those water rights. But all the green is the newer leased at the newer lease granted to SNWA in Garnet Valley.

So, water level pumping, pumped amounts in 2016, 2017 approached 2,000 plus or minus acre-feet. Prior to that, for about ten years was a plus or minus around 15,000.

Prior to 2006, which we had additional power generate facilities come online in that time frame. The pumping was also plus or minus 1,000-acre-feet. And then the older historical pumping, we'll take a look at the 2001 pumping inventory data.

I'm going to skip ahead to slide 19. And this is just the state's 2001 pumping inventory, it's slide 19 and 20. And you'll see the total is 911-acre-feet of permitted rights being placed to use.

And then I have a number in the bottom, 805-acre-feet, that would be taking out chemical line and western gypsum pumping, which I believe are some wells completed on the alluvium, at least that's what my understanding is.

So historically those older rights were being

placed to use at somewhere between 800 -- well, 900-acre-feet, but from the carbonate aquifer source probably about 800-acre-feet.

And I'm going to skip back now to slide 18. This is just a summary table of records on file from your office. This was compiled from EWR's electronic database online. And this shows the history of some of the permits issued to facilities in Garnet Valley.

You'll see going all the way back to the permit granted in 1959 the completion of work and beneficial use in 1961. That's for a small amount of water right, three-acre-feet.

But you can gauge from this table the history of water development and water use and the beginning of water use and -- in Garnet Valley. And it spans back to the late '80s -- well, some water -- additional water use came into play in the 1960s. But then -- in the '70s. But then probably more of the modern facilities still -- and so the water rights being used today are for industrial water uses are -- stem back to the late '80s, early '90s and most of them were being placed to beneficial use by the mid-'90s.

Q. And, Mr. Smith, these are all from water rights in Garnet Valley; is that correct?
A. Yes, that's correct. That's correct. Again,

from records of the State Engineer's Office.

So this is going to lead me to one particular criticism that I have to offer today. It's to my colleagues at SNWA, it's regarding the multiple linear regression analysis that was submitted as a rebuttal analysis. And what you'll see is that the input pumping for Garnet Valley is quite different than the records we have for water rights and water use in Garnet Valley.

The pumping input was -- the input values were indicated to be from the NDWR pumping inventories. But pumping inventories weren't published until 2001. So this early history of pumping portrayed as being until 1996.

And then ramping up to approaching the 2001 NDWR level, they're not quite there, but ramping up over that late '90s time frame. That is not the history of pumping in Garnet Valley that is known based on water rights and proof of beneficial use filings in the basin. That is inaccurate.

So, unfortunately -- and just some other inconsistencies, that is a big issue, that early history and how that's been input into their multiple linear regression model is a big issue and I'm going to discuss that in a minute.

Also of note is all the values and input in are not consistent within NDWR pumping inventories. And what I

believe has happened is I looked at the datasets that are available from -- from reporting 1169 in agreements that they have from the facilities, but I don't believe they've accounted for everybody.

So you have two sets of data out there, so scientists beware. There's two sets of informational data out there, there's the NDWR pumping inventory data and then there's datasets that are available on NDWR's website reporting under 1169 that have different values. And I believe the 1169 dataset is incomplete.

Q. And you're referring to slide 22 now?
A. Yes, I'm sorry; right. Slide -- is that slide 22? Thank you.

And of course the bottom value, 2018, we don't have published inventory data yet, so that leads me to believe it's all from the Order 1169 agreements from reporting our pumping totals.

Where that leads us. Coincidentally, unfortunately, coincidentally, with that input interpretation of zero pumping in Garnet Valley ramping up in the late '90s up to a significant amount, which is inaccurate, also corresponds with the observed beginning of declines of water levels at EH-4.

So what that does in this type of analysis, now

you have an explanatory variable that has been incorrectly input and it has an association that the process is going to want to match with that corresponding water level decline.

So, what that leads to, and I think this has been borne out by observations by others, is all a sudden there's a high association of Garnet Valley pumping influence coordinated with EH-4 water level. And what does that do to the other variables? Unfortunately, it doesn't just affect Garnet Valley relationship defined, it affects all the relationships defined in that analysis.

Because if you shifted and placed a lot of the explanatory -- a lot of the explanation for that observed water level turned to one variable. Well, that affects the assignment of the weighting for explanatory variable to the other variables. And these are all inter-tied in the analysis.

So at the end of the day the erroneous input of historical Garnet Valley pumping basically invalidates this method. Not the method, it invalidates the results of this analysis for all the relationships defined.

Q. And that was your summary on slide 23; correct?
A. That's correct.
Q. Okay. And you're moving to slide 24?
A. Yes. Slide 24. Now, a couple other notes. Now,

perhaps not to the level of invalidating a particular analysis, but the inconsistency that's further propagated through the analysis for the pumping inputs not being consistent with NDWR inventory data, it is also an issue, but another issue that I take exception to in particular is not having a climate variable in that analysis.

I think it was entirely inappropriate to suggest that that was the error or to presume that the error accounts for an explanatory variable that you believe has some relationship to the analysis.

And also you'll find -- I've just made some citations from the reference that SNWA cited. And their prejudgment of the outcome of the climate variable was also not in keeping with the scientific methods for this type of analysis.

If you have an explanatory variable that you think or you suspect could be explained some of the relationship, then you put it in and you -- you run through the analysis and you look at the statistical parameters that define whether it is an explanatory variable or has significance or not, and then you leave it in there or you take it out accordingly. That procedure was not reported to have been followed in that analysis.

Okay. So I'll move on to maybe somewhat

constructive input to the State Engineer and staff.
One thing I would like to point out. Yes, we see similar water level trends throughout Garnet Valley as we do elsewhere in the Lower White River Flow System basins. We have this decline in trend about 23 feet per year.
It is a concern obviously. I will note that prior to the late '90s water levels at EH-4 were stable. And that is the time frame that coincides with the beginning of development in pumping in Garnet Valley. So there was significant pumping throughout the '90s in Garnet Valley through the time period where a lot of those are stable at EH-4. I think we need to note that.
From my perspective I see that water levels are stabilizing again at EH-4. There are different opinions on that whether it could be declining or stabilizing, but from my perspective I see that as stabilizing. I think there is possibly a systematic explanation for that.
I'll elaborate a little more on a following slide.
Q. And you're now moving to slide 26?
A. Yeah, slide 26, the base plot is borrowed from Tim Mayer's presentation and his report. And I -- I still believe that we have both a mixture of pumping and climbing in our hydrologic records and our water level trends. I think at

this point we can't argue that there is a wet climate signal when we have recharge.
But my position is pretty fundamentally that there's an equal and offsetting dry response to the wet response. If you don't have an equal and offsetting dry response then you're not maintaining dynamic equilibrium in any system.
So to suggest that there's only a wet response doesn't set well with me. I think it's much easier to see the wet responses because they're so dramatic in the record. Because dry responses are more subtle and spread over multiple years.
But one thing that I believe, and this was climate -- Climate Drought Severity Index for climate zone three, which is to the north, the northern part of the White River Flow System that I see in this record that you have a dominance of negative values. So moving into the dryer regimes for the last two decades as contrasted to the decade prior.
So I haven't -- I haven't expended a lot of time trying to parse through this. And I have done work on this in the past. You know, I've published along with authors at SNWA examinations looking at climate variables and indices and potential mix of pumping and climate signals.

And while I do believe it's a mix, I think we're going to be debating this for a long time as scientists. And I'm not necessarily sure that we need to absolutely answer that for broader water management in Jackson Valley. The fact remains is that water levels are declining at EH-4. And that's associated with the high altitude spring discharge.
So regardless of how the weighting of climate versus pumping dominates in -- in the record doesn't override the fact that water levels are declining and we need to manage accordingly. So yes, there's scientific value in trying to continue to parse through this.
But at the end of the day maybe for some broader water management directives we can move beyond this and just focus on -- on the fact that what the water levels are and what is within our abilities to do to help address that. So, okay. One other issue here --
Q. Mr. Smith, we're moving to slide 27; correct?
A. Thank you. Advancing to slide 27. I've heard quite a few professionals over the past week here trying to draw some conclusion out of the seasonal water level trends. And what they've inferred to be pumping signals, I believe Dr. Waddell also mentioned that ET signals and pumping signals, seasonal signals.
One thing that we definitely need to take note

of, all of us here, all of us scientists and engineers is that there is a seasonal barometric pressure cycle and it's significant, it's in Nevada.
So SNWA has been directing barometric pressure data to a number of different margin points. And the -- and the plot on the right is I've just picked one -- one that -- there wasn't any reason why I picked CSVM-1. I just picked one where it was being recorded. And you can see that fluctuation is over a foot, foot and a half of barometric pressure change seasonally that reoccurs every year. Okay. It's coincident with rising and falling water levels. So each well out in the system has a unique barometric efficiency.
So what I mean by barometric efficiency, some of the wells mentioned would be the ones that have the lower storage coefficients more confined will respond greater to barometric pressure change.
And how we define the barometric efficiency is by looking at the daily or hourly barometric pressure -- pressures with water level responses. So you pick a window of time that there's been a barometric change and you can go and determine the barometric efficiency of each well in the system. I've done this for a handful of wells. I believe some are presented in the appendices for the Order 1169 testing.

But the barometric efficiencies range from near zero, some wells do not show a barometric response, they tend to be the ones that have a higher storage coefficient. But some have sufficient barometric efficiencies. Some as high as 60 percent.

So 60 percent of the barometric -- seasonal barometric trends is going to be reflected in a seasonal variance in water levels.

So, before you can go anywhere with trying to make a case that you do or do not see a pumping signal, first we have to factor out what we know. And we've done this -- by the way, this is commonly done when we're looking at trends in water levels, it's been done for published water level studies in Death Valley Regional Flow System. This is -- there's public domain software available to filter out barometric and earth tide responses.

And in an aquifer system where we're dealing with very subtle, very small fluctuations in water levels from wells that do have a barometric efficiency and do respond to barometric pressure changes and earth-type changes, you need to filter that out first.

You filter it out and then you're left with okay, what -- what is the additional response in the system from pumping, from ET, from recharge, whatever it may be.

But I've seen quite a few people trying to make arguments based off this absence of presence of a "pumping signal" when they haven't first factored out the barometric efficiency of the well and barometric response.

So anybody that has offered that opinion and has not taken that step it's not a terribly difficult thing to accomplish, needs to do so and then build their case from there. Is there still a season of cycle or not.

In some cases you'll see that you will resolve out all of that seasonal variation simply by filtering for barometric pressure change.

So, that is just a note for the State Engineer and for hopefully everybody that's working in the system.

So again, I think I've made these notes, but I'll just briefly go through my bullet ones here. Pre-1998 water levels at EH-4 were stable and there was a history of pumping in Garnet Valley.

I believe this suggests that there is a manageable amount of pumping in Garnet Valley that can occur without detrimentally impacting the EH-4 water levels and therefore, high altitude spring discharges.

EH-4 water levels appear to be leveling off in my opinion. I believe this may be result of starting to collaborate to pumping near the Muddy River Springs area. And

I'll have a little more to say on that.

And again, my opinion is that we have been in a dryer climate regime. There's been some attempts to contrast with other geographic areas, but, you know, as the Death Valley Regional Flow System is dominated by a much more arid and southern weighted geographic area down the White River Flow System far north in latitude.

As we understand the flow system to the desert again is just a southern arid basin. So you have to be careful when you're trying to contrast one basin to the next because they all have their unique characteristics and their unique geographic extent.

Q. And you were just reviewing your professional opinions on slide 28; correct?

A. That's correct.

Q. Okay. And you're moving to slide 29?

A. Yeah. Just a brief observation here. Sometimes the simplest explanations are the best. I think what SNWA's work in both in their prior analysis and -- and in the current analysis being brought forward.

It's pretty clearly demonstrated that pumping right in proximity to the Muddy River Springs, so pumping from the alluvium and the carbonate aquifer in the immediate proximity of the springs has a pretty clear capture of Muddy

River Spring flows -- excuse me, Muddy River flows.

And I think -- you know, there's some attempt to say that well, it's just a matter of how you stack the bars, but let's not lose sight of just practical hydrology here.

You know, you're pumping some alluvial wells that are within a hundred -- a few hundred feet of the river in some cases. You're pumping from carbonate wells that are likewise in pretty close proximity to the springs and the headwaters of the river. Just fundamental hydrology here. Those near a pumping center are going to have a more immediate impact on the river system.

So I would suggest that the capture that we've seen from the Muddy River to date has been overwhelmingly dominated by pumping that has occurred proximal to the Muddy River itself. And I think that's clearly shown in the data and their analysis.

So where does that leave the regional pumping that has occurred in those lighter blue bars stacked in Garnet Valley. I don't think we felt much, if any, effect to reduction of the Muddy River flows from those distant pumping centers. Not to say that there isn't some small fraction and over long periods of time that's going to increase. That would be a traditional captured theory for wells that are say 25 miles away in Garnet Valley.

But let's not lose sight of just fundamental hydrology in the proximity of pumping to the river it explains a lot of a capture that's been presented.
Q. And now you're on slide 30?
A. Yes, slide 30. I think I've touched on that, again, duration, location magnitude all factors into capture of river flows. I will note that some of the alluvial pumping has been in place, you know, water rights going back to the 1940s. So this has been seven decades worth of pumping that's probably affected the flows of the river. It is some senior most groundwater pumping rights that we're dealing with.
I believe that, you know, there's been a really strong emphasis from SNWA about capture river flows. And certainly it needs to be considered, we're grappling with this issue up to the north in the Humboldt River system and elsewhere.
There are appropriate approaches to this that the State Engineer is implementing in other areas. We have a screen flow capture issue here, but it's not just related to the Lower White River Flow System.
There are wells pumping along the entire reach of the Muddy River all the way down to its headwaters in the Moapa area. And there are groundwater rights issued throughout that area, I haven't examined them in detail, but

this is not solely Lower White River Flow System basin issue.
This is an issue that needs to be carefully worked through, you know, and the future for rivers in Nevada and stream flow capture, we do have to really quantify, have a mechanism to quantify how much capture is occurring today, how much capture is occurring tomorrow, where are we headed with this, how can we mitigate this, does this mean that impactors have to buy and relinquish dedicated decreed water rights possibly, is there financial compensations, does it mean we need some curtailments in pumping? All of the above. You're going to have approach this as a regional issue just like you are on the Humboldt River flow system.
So, while there's been a lot of emphasis placed by SNWA on this issue, I view it as being two issues here and for stream flow capture, but it's a much broader area. It's the Lower Meadow Valley Wash. It's the areas along the Moapa and Gilbert's Park. And, you know, we've got to consider the whole system and treat this appropriately.
Again, separate issue in my mind, right now what we're trying to understand is should we combine the Lower White River Flow System, if so, what might be some safe yields.
The safe yield is really associated with water levels at Pederson and EH-4 of the high altitude springs,

that's the driver for water granting decisions. Stream flow capture does need to be addressed and we need to start moving down that path. But again, it encompasses a broader geographic area and it's going to have a different set of management outcomes.
So I just want to emphasize that. So I mentioned up front and thank you for your attention, I'm just about through here.
But according to the City of Las Vegas, they have what I think is a really great water supply strategy. You know, it's injunctive use bringing in multiple sources, it's redundancy, has the ability to adapt and manage. Having the Colorado River source, groundwater AR, put all this into action, really do something sustainable in Garnet Valley.
But, it's going to happen incrementally in steps, that's just the way it has to happen. And for now, the City of North Las Vegas wants to secure senior water rights on their municipal water supply lists.
They need to depend on those at least for the bridge period while development occurs and while the pipeline is being completed up into the valley, maybe that's ten years, maybe it's 15, I'm not sure, it depends on the -- you know, how things get built out.
But there is I think a need to -- and there's a

desire to transfer through lease or acquisition senior water rights and get down to those rights.
Senior is important because the future and how we're going to manage these basins is unclear. I mean, could there be curtailments in water rights based on priorities, I'm not asking you how to answer that question today.
But from a municipal water conveyor perspective that gives them a little extra assurance that they're offering them senior groundwater rights for the water supply rather than certain transfers of junior most water rights, which is kind of presently how they're situated.
So the merits of transferring I think really needs to assessed, we can't be prejudging with any of these possibilities to transfer water rights in or out of -- and I think they need to be considered on an individual basis by the State Engineer and how the administrative policies are set up for this Lower White River Flow System. You need -- you need to keep that flexibility that we have in any other basin in Nevada to make -- to have the opportunity to apply to transfer water rights around and then judge the merits as they come forth.
You know, I'm going to flip this around for just a minute. What about transferring carbonate pumping into the alluvial aquifer? I think you want to keep that option open.

Because, you know, if we have issues with water levels at the springs and sustained high altitude springs, boy, you know, the future may be we have to shift pumping out of the carbonate aquifer, especially the local pumping occurring near the springs and shift it into the alluvium.

At that point you accomplished a situation where we relieve some of the burden on the carbonate aquifer local to the springs. Now, we have the flip side issue, we have to address the decreed water rights in the Muddy River, but that can be addressed. You know, entities could buy the leased water rights, whatever -- there's paths to look forward on that.

From a modern maverick perspective, again, I think you need to keep these options open to go either way on these. I think you're prejudging potential beneficial transfers of water rights at the end of the day.

So let's -- I would encourage you to -- to administer this basin like you would any other, allow transfers based on their individual merits as they're considered and brought before you.

Q. And you were discussing your information on slide 31; was that correct?

A. Yes. Thank you.

Q. And you're now moving to slide 32?

A. Okay. Conclusions. Again, it's our opinion and again our focus has really been on the southern end of the flow system that the boundaries as proposed for the Lower White River Flow System are sufficient, are adequate.

We just discussed transfers from the alluvium carbonate should not be generically limited, should be considered on the merits on a case-by-case basis. And I think the City of North Las Vegas is going to want to bring forward an application for consideration at some point in the future, it's part of their water supply strategy. And we think it has merit. So we would like to have the opportunity to bring that before the State Engineer.

Capture of the Muddy River flows needs to be managed as a separate issue. Yeah, all the basins that are involved, you know, there's going to be interactions of management strategies, et cetera, but this is a broader issue than just the Lower White River Flow System, this includes the lower basins also all the way down to Lake Mead. There are existing groundwater permits issued along the river corridor and in these other basins.

So there's a need to be managed and you probably need to initiate that process, but that's a separate issue.

Again, I've given you my opinion that I think we're still dealing with the effects of the climate. But

again, how much that bears on -- on water, broader water administration issues is that's not as necessary to define as one would think.

Perennial yield, I would encourage the State to shift to a safety overload approach. In fact, maybe, you know, shift to a safety overload approach.

For Garnet Valley, that means let's do the testing you want to do in Garnet Valley, let's pump additional but also let's flip this around, let's do injection testing in Garnet Valley.

Let's view these different types of stresses. We can figure out, okay, what is -- what is causing effects to water levels at EH-4, that's -- water level effects elsewhere are just not relevant, EH-4, the high altitude springs.

Now, where can we find this threshold is that really an amount of development 900-acre-feet, maybe that was the sustainable amount, maybe that was the amount that was captured some of the southern flow through the system.

I mean, capturing some of the Las Vegas Valley inflow, maybe that was a balance that is really having minimal effects propagating north to the spring area, maybe that was it. Maybe it can be higher, maybe it has to be lower. Certainly very stressing scenarios, complimented with additional monitoring. I meant to touch on that, but we do

need some additional monitoring in place.

We really have no good monitoring levels in Hidden Valley that SHV-1 down in the north I believe is completely alluvium. We need some additional monitoring. There's Las Vegas Valley.

Perhaps an additional monitoring well on the east of the Dry Lake Thrust, maybe on that western edge of Southern California Wash to then further assess and address the National Park Service questions that are all in this testing that's needed also needs to be augmented -- needs to have augmented monitoring.

Let's move forward with this and let's figure out what is the safe amount to pump from Garnet Valley. It can be done. And the City's water management strategy will facilitate that happening. Thank you.

Q. And, Mr. Smith, it's your opinion -- or I guess you didn't have an opinion as to the total quantity of groundwater, your opinion was that we should just simply look at it from a safe yield concept; correct?

A. That is correct. I have not offered an opinion on the potential safe yield from the entire system, I've really just focused on the south end.

MS. URE: Okay. Thank you. We would like to reserve the remainder of our time for redirect. And I also

don't know if I was clear that Mr. Smith was being offered as an expert witness and he was not objected to.
HEARING OFFICER FAIRBANK: Thank you. And Mr. Smith has previously been qualified before our office. We appreciate that.
Let's go ahead and take a quick ten-minute break and then we'll go ahead and proceed with cross-examination.
(Recess.)
HEARING OFFICER FAIRBANK: Okay. Let's go. Take two. All right. We're back on the record, and we will go ahead and start with cross-examination.
And first is Coyote Spring Investments, and our time allotment is seven minutes per participant. And as we've been doing, if there's additional time, then we'll allow -- reopen that time up for continuation of questions if you weren't able to get everything done in the first go-around.
CROSS-EXAMINATION
BY MR. HERREMA:
Q. Thank you. Brad Herrema on behalf of CSI.
Just a first question, and I don't know if this is properly addressed to you, Mr. Smith, or to your counsel, Ms. Ure.
But would it be possible for us to get a PDF copy, an electronic copy of your presentation? The color from

your slides doesn't show up on the copy. So if we could -- if that would be possible, we would appreciate that.
And I'm not sure if the State Engineer is thinking of putting a folder together with all these presentations, but that would be a request that we have as well.
HEARING OFFICER FAIRBANK: Thank you.
CROSS-EXAMINATION
BY MR. HERREMA:
Q. Mr. Smith, on Slide 25, during your testimony, you suggested that there was no relationship between pumping in Garnet Valley and groundwater levels at EH-4 during the late 80's and early 90's.
Does that sound accurate?
ANSWERS BY MR. SMITH:
A. Yes. I will say that if there was an effect, it's really not recognizable in that flat trend water levels.
Q. Is it possible that this would suggest heterogeneities in the aquifer or compartmentalization that might exist within the flow system due to faults or folds?
A. For -- for the southern end of the flow system, I do not think that is the case. As I mentioned, there are -- there's a -- some amount of groundwater flow that's coming down to the south end. I believe there's a flow of water

coming in from the Las Vegas Valley.
There is some amount of outflow, we believe, from the southern end. So the degree that we were pumping and predominantly capturing those flows, we do not need a compartmentalization theory to explain that.
Q. Okay. When you reviewed the transmissivity in the Garnet Valley, did you find higher values of transmissivity near fault zones and lower values farther away from fault zones?
A. Not in general. However, you will note that on the transmissivity slide, the two highest values were along that projection of the faulting that runs along the east side of Garnet Valley. You also note that there's some low transmissivities in there too.
It didn't point out, but, you know, there's a lot of faulting all through that portion of Garnet Valley, a lot of it kind of north-south trending.
But those two examples I noted are potentially along the fault zone that runs along the eastern side, but other than that, I could not make that inference.
Q. In regard to Slide 10, the model results in your written report discuss inflow to your model from northern Hidden Valley along the Arrow Canyon Range.
Do these results suggest a preferred flow path

along the north trending normal faults parallel to the Arrow Canyon Range?
A. I'm not certain I can make that association.
There is a general north to south flow, and at some point, that flow system is interpreted to turn to the east.
Q. You suggest the Dry Lake Thrust Fault might act as an impediment to eastward groundwater flow. Is that a general comment regarding the impact of thrust faults on groundwater flow or was that specific to Dry Lake Thrust Fault?
A. Well, that was more specific to the Dry Lake.
And I should have noted, if I didn't, that there is an -- a number of significant normal faults that are coincident with that thrust fault.
So, again, the boundary testing suggests that there is very little outflow there to explain the water levels at least in that upper slice of carbonate aquifer, and whether it's normal faulting or the thrust fault, I -- I can't go that far to define that.
Q. Okay. Thank you.
MR. HERREMA: I have no further questions at this time.
HEARING OFFICER FAIRBANK: United States Fish and Wildlife Service.

Seeing no questions, National Park Service.
CROSS-EXAMINATION
BY MS. GLASGOW:
Q. Let's see. Good morning still. I'm Karen Glasgow with the Department of Interior, Office of the Solicitor representing the National Park Service. And good morning to you, Mr. Smith. I just have a few questions.
Your Slide Number 10 shows an arrow heading northwest or northward in southern Coyote Springs Valley based on the measured water level in CSVM-2.
What does that imply about the movement of large amounts of water moving southward from Coyote Springs Valley into Hidden Valley and eventually, into Las Vegas Valley?
ANSWERS BY MR. SMITH:
A. Well, we do have a -- a higher than normal water level there that defines a gradient to the north back to Coyote Springs Valley. I don't think we have enough data over there to really make broader interpretations.
I'm not precluding that there is north to south movement of water, and I also have questioned in the past whether there is some -- some fault influence on those -- those water levels as in the fault being between the -- probably north-south fault.
But between them and the -- the lower elevations

of the valley floor in Coyote Springs Valley, some of these more south-turning faults. So really, I don't have enough data -- I don't have enough data to really offer an opinion of whether that would, say, preclude southern flow. I think that is still a possibility. We're really lacking data to define that.
Q. Thank you.
So, with respect to your modeling, was it a steady-state model?
A. That's correct.
Q. In a steady-state model, doesn't all the water move into and out of the model through the boundary conditions, and no water is derived by lowering water levels in the model?
A. I didn't mention, but we also have some local recharge applied as a specified flux on the western edge of the model representing recharge in the Las Vegas Range.
So there is a recharge source, internal, and then all the other water is derived from the boundary flows in and out.
Q. And that's a boundary condition; correct?
A. That's correct.
Q. Would the steady-state assumption affect the calculated boundary flow rates?

A. Yes, it could. Some.
Q. Okay. Do you have information to indicate that water levels throughout Garnet Valley are at a steady state?
A. Well, until we're able to clearly parse out climate versus pumping, you know, we do have a declining water level trend.
Pumping can't occur without some storage depletion, so I don't think the water level record is devoid of pumping influence. I think it is embedded in it.
Does that answer your question?
Q. Thank you.
So another question. In his rebuttal report, Dr. Mock disputes your characterization of the Las Vegas Valley Shear Zone.
Do you agree with his inference that groundwater in Garnet Valley flows largely south to an entrance of the Las Vegas Valley at a rate of somewhere between thousands to tens of thousands of acre-feet per year?
A. So that is a hypothesis that, in my opinion, really is not based on any information. So, you know, to answer that, we would need to have monitoring wells drilled, defined water levels, but I have not represented that in the model strictly because I don't have any data to really suggest its presence or its magnitude.

Q. Thank you.
So similarly, were you here for Dr. Johnson's testimony?
A. I was not.
Q. Okay. Then I will -- if I -- if I told you that Dr. Johnson stated that somewhere on the order 48,000 acre-feet of water flows into the Las Vegas Valley across the Las Vegas Shear Zone, would you agree with that assessment?
A. I would not have any data to really support that assessment. I would be looking for water level data along that shear zone in the carbonate rock.
You know, this is part of what happens when we're not constrained by having much data or any data is, you know, it's still open to all kinds of hypotheses. Those hypotheses can certainly be tested if one is willing to expend the effort to go and collect data and drill wells.
But --
Q. Thank you.
MS. GLASGOW: I appreciate your time.
HEARING OFFICER FAIRBANK: Moapa Band of Paiutes.
MR. BUSHNER: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions, Las Vegas Water District and Southern Nevada Water Authority.

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CROSS-EXAMINATION
BY MR. TAGGART:
Q. Good morning, Mr. Smith.
A. Good morning.
Q. There are a couple preliminary questions.
First of all, the -- North Las Vegas is a member agency of the Southern Nevada Water Authority; correct?
A. That's correct.
Q. Okay. Is it true that none of your presentation or your expert reports were coordinated with the Southern Nevada Water Authority and their presentation of information?
A. That's correct.
Q. You started your discussion indicating that the water that is under a legal agreement with the Southern Nevada Water Authority, you referred to it could be considered junior; right?
A. That's correct.
Q. Would you agree that if the basins in the Lower White River Flow System were managed on priority based on by basin instead of all in one unit, if Garnet Valley was just its own valley and it was managed on priority, the SNWA water rights would actually be more senior?
A. The SNWA rights would still be junior in Garnet Valley. They were basically the last, you know, appropriation

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granted in Garnet Valley. So all of the appropriations prior to that would be senior.
Q. Okay. Now, in some of your testimony -- and let's find a slide, Slide 30. You indicated that pumping in the proximity -- immediate proximity of the springs is -- and I think you said based on basic hydrologic principles, the pumping more proximate to the springs is having more effect on the springs.
A. I agree.
Q. And when you talked about the immediate proximity, does that immediate proximity include Coyote Spring Valley?
A. No, I was really referring to the pumping from, for example, the Arrow Canyon wells.
Q. Okay. Do you believe that pumping in Coyote Spring Valley effects EH-4?
A. Yes, I think we've demonstrated that in Order 1169.
Q. Okay.
MR. HERREMA: I'd like to object. I know he's already answered the question, but he said at the beginning of his testimony that his focus and the conclusions in his report were all focused on what was happening in Garnet Valley, not on Coyote Springs.

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And so now, we've exceeded kind of the salient conclusions of his reports and his testimony.
HEARING OFFICER FAIRBANK: So the objection was whether it exceeded the salient conclusions of his report by extending outside of the Garnet Valley region --
MR. HERREMA: Right.
HEARING OFFICER FAIRBANK: -- just to summarize your objection?
MR. HERREMA: Yes. You did very well. Thank you.
HEARING OFFICER FAIRBANK: Thank you.
BY MR. TAGGART:
Q. The testimony you gave regarding moving water from one point of origin to another --
Do you recall that?
A. Yes.
Q. Okay. And first of all, do you understand that when the five basins that are now considered the Lower White River Flow System, when they were separate basins, alluvial water rights in the Muddy River Springs area could not have been moved to Garnet Valley; right?
A. That's my understanding.
Q. Okay. So it's really just a function of this new Lower White River Flow System that's allowed for alluvial

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rights to be moved elsewhere; right?
A. Alluvial rights or any rights to be moved from one hydrographic basin to the next.
Q. Right. And you agree that alluvial pumping in the Muddy River Springs area does affect the Muddy River; right?
A. I agree.
Q. Okay. And do you believe that any conflict between that pumping of alluvial water in the Muddy River Springs area and senior decree rights in the river should be addressed before any of that alluvial water rights can be moved?
A. No, I wouldn't agree with that. You know, the structure and framework to address streamflow capture is going to require a process of its own. But to the degree that we can -- to transfer those water rights from the alluvium elsewhere, as proposed by the City, down to Garnet Valley, I think the merits of that will have to bring forward on its application, maybe, for the State Engineer.
Q. Okay. Now -- now, in your recommendations regarding safe yield, do you agree that maintaining a certain flow at the Warm Springs West Gage should be a control that the State Engineer maintains in determining how much groundwater pumping should be allowed?

A. I do.
Q. Okay. And do you agree that the -- well -- well, let me strike that, please.
You had some criticism of the MLR analysis at SNWA; correct?
A. Yes.
Q. Okay. And you also are aware that SNWA did an analysis of how much groundwater can be pumped from the carbonate system while maintaining a 3.2 flow at the Warm Springs West Gage; correct?
A. I recall that testimony.
Q. Okay. Do you recognize that that analysis and the MLR analysis are two distinctly separate analyses?
A. Yes.
Q. Okay. So your critique of the MLR approach does not apply to the approach that SNWA used to determine the control in order to protect 3.2 CFS in the Warm Springs West Gage; is that true?
A. That's true.
Q. Okay. And most -- your -- your testimony indicated that the -- the conclusions and analysis that you conclude -- that you prepared were based upon the idea that additional carbonate pumping in Garnet Valley by the City of North Las Vegas would be temporary until a pipeline is built

to bring water to North Las Vegas from the Las Vegas Valley; is that correct?
A. I would say initially. I think ultimately, through additional stress testing, whether it's pumping or injection testing, will arrive at the proper amount to perpetuate from the carbonate aquifer from Garnet Valley. I don't think we've established that yet.
Q. Is the City of North Las Vegas prepared to pay for the costs of those types of stress testing that you have described?
A. I can't answer that.
Q. Okay.
MR. TAGGART: Thank you.
HEARING OFFICER FAIRBANK: The Moapa Valley Water District.
CROSS-EXAMINATION
BY MR. MORRISON:
Q. Greg Morrison for Moapa Valley Water District for the record.
Good morning, Mr. Smith. How are you?
ANSWERS BY MR. SMITH:
A. Good morning.
Q. I just got a couple questions about you spoke about the City's long-term strategy, and one of those

strategies was bringing in senior groundwater rights.
A. Correct.
Q. Does -- has the City identified or targeted any specific senior water rights to date?
A. Yes. The senior -- excuse me. The City has entered into a Memorandum of Understanding with the Church of Jesus Christ of Latter-Day Saints, the LDS Church, to initiate discussions on leasing with possible long-term option to purchase water rights from -- that are utilized along the alluvium in the Muddy River Springs area.
Q. And are those -- are those rights currently being pumped?
A. Since the decommissioning of the Reid Gardner Station power plant in 2017, these water rights were under lease for the past few decades to the power company for -- to Nevada Energy for that -- that facility.
So since the decommissioning in 2017, I do not believe they've been pumped, or if they have been, they have not been pumped to a great amount.
Q. Okay. And you said those were alluvial rights?
A. The -- they are water rights at wells that have historically pumped from the alluvium.
Q. Okay. The City's Kapex and Playa wells, are those alluvial rights or are those carbonate right -- or

wells, excuse me?
A. The wells are completed in the carbonate aquifer.
Q. Okay. So would it be fair to say that the movement of the senior permit rights that the City currently has targeted for acquisition, beginning to pump those would increase pumping in the carbonate aquifer?
A. That's correct.
MR. MOORE: Okay. Thanks.
HEARING OFFICER FAIRBANK: Lincoln County-Vidler Water Company.
CROSS-EXAMINATION
BY MS. PETERSON:
Q. Hi, Mr. Smith. Karen Peterson --
ANSWERS BY MR. SMITH:
A. Good morning.
Q. -- representing Lincoln County Water District and Vidler Water Company. I just had a couple questions for you.
Is there any recommendation by your client to include Kane Springs Valley into the Lower White River Flow System?
A. No. Again, we have not done any assessment on the other regions of the flow system.
Q. But in this proceeding, there is no recommendation by your client based on the work that they've

done to include Kane Springs Valley; that is correct?
A. Yes, that's correct. We support the basins as delineated in the Order 1303.
Q. And that would include the northern basins also?
A. That's correct.
MS. PETERSON: Okay. Thank you.
HEARING OFFICER FAIRBANK: Center for Biological Diversity? Seeing no questions, Georgia Pacific-Republic?
MS. HARRISON: We have no questions.
HEARING OFFICER FAIRBANK: Seeing no questions, Nevada Cogeneration?
Seeing no questions -- oh, okay.
CROSS-EXAMINATION
BY MR. FLANGAS:
Q. Good morning, Mr. Smith.
I think it's your Slide Number 15 and 16.
HEARING OFFICER FAIRBANK: Mr. Flangas, will you turn on your microphone.
MR. FLANGAS: Sorry.
BY MR. FLANGAS:
Q. I think it's your Slides 15 and 16. If you could explain just a little bit your understanding of the -- kind of the boundary condition and the -- really, the boundary at the Black Mountains area a little bit better because I wasn't

clear on that during your direct testimony.
A. I'm going to refer to my exhibit, Exhibit 3. So we did include that boundary as a separate segment, and I'm -- bear with me here. I'm just looking for the outcome.
So the model simulation shows a very small flux of water across that boundary and was testing of about seven and a half acre-feet.
The sensitivity -- if I recall correctly, the sensitivity was not high on that model boundary. So that would imply that -- let me just confirm, please.
Yeah, the sensitivity was low on that model boundary, so that would imply that there certainly could be a notably different flux of water back and forth along that model boundary and still produce a satisfactory solution.
Q. The comment here on Slide 16 when you say the Las Vegas Shear Zone as a physical boundary incorporates a portion of Las Vegas Valley similarly to incorporating a portion of the Black Mountains area, what exactly does that mean?
A. Let me go to overhead. Let's see. Let's look at Slide 8. So you'll notice that if that carbonate corridor that's coming down to the south and butts up against the Las Vegas Shear Zone, then it would incorporate that corner of the Black Mountains area that has been included in the

preliminary area for the Lower White River Flow System.
But also, you would incorporate a similar sized area that's bound by the Gas -- Gas Peak Thrust Fault on the west, the Las Vegas Valley Shear Zone on the south, and then extends over to the Black Mountains area.
So there would potentially be a small corner geographically that should be included also.
Q. I'm sorry. A small corner that could be --
A. Small corner of Las Vegas Valley that should be incorporated.
Q. And with regard to that shear zone, what is it telling us as far as is it a corridor for water? Is it a boundary fault or what?
A. The hypotheses are that that is a boundary, and I believe in some of the prior modeling efforts, it's been interpreted as a no-flow boundary.
Again, we really don't have sufficient data to define that, but I would agree that conceptually, it is likely some type of terminal boundary to the flow system.
Q. But we don't have enough data in that area to verify one way or the other; right?
A. I don't think we can absolutely conclude that.
MR. FLANGAS: Okay. Thank you very much. That's all we have.

HEARING OFFICER FAIRBANK: Muddy Valley Irrigation Company.
MR. KING: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions, Bedroc.
MS. URE: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions, Nevada Energy.
MS. CAVIGLIA: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions, I'll go ahead and open it up to the State Engineer and Division of Water Resources staff.
EXAMINATION
BY MR. BENEDICT:
Q. Jon Benedict for the record.
I have a question about the concept of capture in Garnet Valley and the potential for additional sources of capture there, and I guess that question is pretty general.
What do you see as being capturable commodities? I mean, if there is water that flows, for example, from Las Vegas to Garnet Valley, how is that captured?
I mean, is it really just a loss of storage in Las Vegas Valley that's actually occurring there or is that a physical capture of a -- of water, in other words, and

inducement of flow or a reduction of discharge?
A. Yeah, we -- you know, I -- first off, I think we need to start with the defining is this flux real or not and is it really occurring. And if it is, then we can perhaps start to investigate further, is this the result of rising water levels, artificial -- or aquifer recharge in Las Vegas Valley? Was this fundamentally present throughout the history? You know, has it always been a flow source in that direction? We have to understand that further.
But as far as it relates to capture, yeah, I think there are -- there's a certain amount of flow in Garnet Valley that has bypassed -- I'll use the word bypass -- the Muddy River Springs. There's a certain amount of flow just based on gradients that continues south. We know that by the gradients.
Now, based on the transmissivities that we're able to find to date, it appears that that flow is fairly modest. But to the degree it's present, we can begin to pump and capture that with wells.
Now, can you do that without absolutely having other effects that you're trying to avoid? Well, it's usually not an absolute scenario, you know. You're going to pump and you're going to capture maybe an inflow source that was then continuing out on out to the east.

I think any eastern flow that makes it out, which appears to my eye to be modest, but I know the regional flow modeling authored by the National Park Service, you know, has at least 1,500 acre-feet flowing by and out through to the waters of Dupont Springs, but possibly deeper.
But, yeah, you can capture a part of that. Can you do that absolutely without having other far-reaching effects? Probably not. It's not an absolute scenario, but the degree that we can be pumping and harvesting a few of those sources of water that were not flowing out and flowing upgradient, obviously, to the Muddy River Springs, that is what we need to try to achieve in Garnet Valley.
And we need to do so with minimum -- you know, if you end up in a scenario where you're pumping three, four times that manageable amount of water, then you're going to see a preponderance of drawdown propagating far beyond where you are intending it to. So we've got to find that right -- that right amount.
And I think we can get there. It's going to take time and effort. But we can find that. I don't think we found it today. I think the evidence we have do have is that that really, pumping doesn't appear to be affecting EH-4 water levels.
So I would suggest that that early pumping --

when I say early, the 1990s into the 2001 time frame before the additional power facilities came on or were born out there in that area. It sure looks like the pumping that it was doing was not creating any difficulties with water levels propagating the EH-4.
How far we can go beyond that, you know, we pumped at 2,000 acre-feet in 2016 and 2017. It looks likes EH-4 water levels, you know, had stabilized. Now, we can't reach that far yet. We need to do more testing and observations to figure out where we can land in Garnet Valley and maintain the water levels we want to preserve at EH-4 and at the springs.
MR. BENEDICT: I think that was my only question. Thank you.

EXAMINATION
BY MR. SULLIVAN:

Q. Adam Sullivan for the record.
Your recommendation for safe yields, are you -- are you recommending a distinct safe yield concept for the Garnet Valley area that would be separate from a safe yield for the northern portion of the Lower White River Flow System?
A. Yeah, I think that's what should be considered. You know, how accurate is the water budget and how accurate can it ever be?

You know, say, for example, the computations where there's 10,000 acre-feet flowing through the system somewhere, it's kind of irrelevant. You know, we need to define how much we can safely pump in different geographic areas and maintain levels at EH-4. That's what we need to find.
It's going to be different for different geographic areas. Some areas might be quite a bit more sensitive. You may find compartments, you know, through further testing to where you can sustain greater amounts of flow. I don't want to preclude that as being a possibility.
But, yeah, so I think you need to be looking at this for a perspective because this is a -- this is a large area.
Yes, there are some connections and commingling of effects that need to be considered, but I think we can boil this down to the southern area, we have some amount of southern flow in the system, some amount that we can pump and harvest and not get be getting into trouble, not be getting into trouble with EH-4.
And I think that philosophy could apply elsewhere in the basin also. It's kind of irregardless of what the perennial yield and the water budget is.
Q. Okay. Thanks.

And one clarification on Slide Number 14, which is -- you might not even need to look at the slide. It was where you showed various water levels at the north end of Las Vegas Valley.
A. Yes.
Q. Did you say those are to the north of or to the south of the Las Vegas Shear Zone?
A. Well, we know for certain that Diamond Construction, Diamond Apex wells are north of the Las Vegas Shear Zone.
Where that structure would cut through, I believe, is also south of those wells that are plotted on that figure or at least south of some of them, but we're certainly getting right in the area of the shear zone in there.
MR. SULLIVAN: Okay. Thanks.
EXAMINATION
BY MS. BARNES:
Q. Michelle Barnes for the record.
Can we go to your Slide 27. If the groundwater elevations are already corrected for barometric pressure, would you still expect to see this barometric response that you talked about?
A. So to be clear here, and you'll have to let me know if I've answered your question. But quite commonly, we

have an instrumentation correction for barometric pressure, and I believe mostly interpretation of this area are vented, so we don't have to do that atmospheric correction. But that's an equipment accuracy issue. If they're sealed, then you have to then -- then have to process the data for barometric correction to get a true water level.
So what I'm talking about is actually true water level response, not an instrumentation type of correction or adjustment. This is a true observed when the barometric pressure rises, the water levels fall in the aquifer, physical -- it's actually a physical process that takes place.
Does that clarify?
Q. That does answer my question, yes. Thank you.
HEARING OFFICER FAIRBANK: Okay. Seeing staff has completed their questions, we'll go ahead and reopen it for additional questions.
Coyote Springs Investments, do you have any further questions?
MR. HERREMA: Not at this time.
HEARING OFFICER FAIRBANK: Seeing no further questions, Fish and Wildlife Service?
Seeing no questions, National Park Service. I'll go ahead and give you five minutes.
MS. GLASGOW: Thank you.

CROSS-EXAMINATION
BY MS. GLASGOW:
Q. Karen Glasgow, Department of Interior for National Park Service. Hello. Still morning, Mr. Smith.
A couple more questions. Your model has general head boundary conditions along your reaches 4 and 6 between Garnet Valley and the Black Mountain area leading to Rogers and Blue Point Springs with a hydraulic conductivity of approximately ten to the minus five feet per day. Isn't this orders of magnitudes smaller than other boundary conductance values?
A. It is, and I pointed out that the solution to the calibration wants to make that a tight and practically a no-flow boundary, and that's the reason the conductance is calibrated to such a low value.
Q. Do you have data that supports these values?
A. Well, the model calibrated to match the water levels in the basin.
And I'll add, though, you know, you have to keep in mind this is the upper thousand feet that we've represented of a very thick section of carbonate rock.
So that certainly -- and I would say this testing is certainly not definitive by any means, and it doesn't exclude deeper flow systems out.

Q. But would this affect any model-based conclusions on the amount of water flowing across this boundary to Rogers and Blue Point Springs, making the discharge rate very small?
A. I don't think we can use this model in that manner. It's really just judging internal to Garnet Valley. I think you do need to stick to a regional platform such as Dr. Waddell's model to start examining that regional sort of question on detail.
MS. GLASGOW: Okay. Thank you.
HEARING OFFICER FAIRBANK: Moapa Band of Paiutes.
Seeing no questions, Southern Nevada Water Authority, Las Vegas Valley Water District.
MR. TAGGART: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions, Moapa Valley Water District.
MR. MOORE: No questions.
HEARING OFFICER FAIRBANK: No questions.
Lincoln County-Vidler? No questions.
Center for Biological Diversity? No questions.
Georgia Pacific and Republic?
Seeing no questions, Nevada Cogeneration?
Seeing no further questions, Muddy Valley Irrigation Company? No questions.
Bedroc?

MS. URE: No questions.
HEARING OFFICER FAIRBANK: No questions.
And Nevada Energy?
Seeing no questions, again, I'll open it up to Division of Water Resources staff and the State Engineer. Are there any questions?
FURTHER EXAMINATION
BY MR. BENEDICT:
Q. Jon Benedict. A really simple question. You suggested again that there's been pumpage in Garnet Valley. It's not in the record, and you alluded to the proof of beneficial use.
Do you have any numbers on what you think the pumpage had been in the 90's just out of curiosity? Do you have those records yourself?
A. Yeah, from the records I have observed -- and, again, this is just a criticism of the input values in the model. I believe that that -- if you looked at the hydrograph --
Let me see if I can pull that up. So the yellow bars and the blue bars represent those older water rights, predominantly, that, again, were similarly appropriated very early, in the 60's and earlier that are fairly modest, and those initial water rights were in the alluvium also.

But commencing in the 1980's, you started to see the new appropriations, the new developments occurring in the Apex area, and that -- the evidence we have based on the water right records is those facilities were up and operating through the 1990's.
You know, their proof of beneficial use filings, if we just look at the table, you know, were occurring in the early 90's time frame just in general. Some of them are extended out longer like that -- the Assignment Company rights down there, you see the file proof of beneficial use until 2001. But, yeah, in general, I think these facilities were operating pretty much through the 1990's.
Now, the early 1990's, they may -- you know, it would have been a -- possibly some type of introduction of water pumping, but I think you could probably take your 2001 pumping inventory and project it back in time to the early 90's and look at when the proof of beneficial use filings were made and proof of completion of where funds were made and then integrate that pumping -- and reconstruct that pumping history back to the 1980's.
Q. So you say the best data for that would then be the water rights files, for example; correct?
A. Well, it's a source of information that I've used in other basins to reconstruct pumping. Sometimes with

agricultural, we can find old photography and things like that, but that's not the case here. It's all industrial.
Certainly, you could go through and scrutinize this carefully and really try to put a detailed reconstruction of an earlier time. You might look at when the facilities were actually built, things like that.
But, yeah, I think you can get a reasonable approximation of that early history of pumping based on the water rights data, and I've successfully done that in quite a few basins that I've tried to reconstruct.
MR. BENEDICT: Okay. Thank you.
HEARING OFFICER FAIRBANK: All right. Well, it looks as though we've concluded our proceedings today, so -- oh, I'm sorry, Ms. Ure. You've reserved time for redirect.
MS. URE: Yes. We have no redirect.
HEARING OFFICER FAIRBANK: Okay. Thank you.
All right. So now we've officially concluded our proceedings for today.
So tomorrow, we will go ahead and start again at 8:30 in the morning commencing with the Center For Biological Diversity and then in the afternoon or then once we're concluded with the Center for Biological Diversity move on to Georgia Pacific and Republic and Dry Lake.
Again, as a reminder, on Thursday, October 3rd,

we will be starting later in the day, and depending on how things go and how far along we'll be moving, we'll make a determination as to whether or not we're going to start at 11 as noted or we may start a little bit later.
And then on Thursday, we will have the continuation of Dry Lake, Georgia Pacific, and Republic, if necessary, the Nevada Cogeneration and then Muddy Valley Irrigation Company.
And then on the morning of October 4th, we'll proceed with Bedroc and Nevada Energy and then conclude with public comment.
So we will see everyone tomorrow morning, and thank you very much.
(Proceedings concluded at 11:47 a.m.)

STATE OF NEVADA)
) ss.
CARSON CITY)

I, MICHEL LOOMIS, a Certified Court Reporter, do hereby certify;

That on the 1st of October, 2019, in Carson City, Nevada, I was present and took stenotype notes of the hearing held before the Nevada Department of Conservation and Natural Resources, Division of Water in the within entitled matter, and thereafter transcribed the same into typewriting as herein appears;

That the foregoing transcript, consisting of pages 1370 through 1497 hereof, is a full, true and correct transcription of my stenotype notes of said hearing to the best of my ability.

Dated at Carson City, Nevada, this 1st day of October, 2019.

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MICHEL LOOMIS, RPR
NV CCR #228

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In The Matter Of:

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES

Vol. VIII
October 02, 2019

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STATE OF NEVADA
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
BEFORE MICHELINE FAIRBANK, HEARING OFFICER
---oOo---

IN THE MATTER OF THE ADMINISTRATION AND MANAGEMENT OF THE LOWER WHITE RIVER FLOW SYSTEM WITHIN COYOTE SPRING VALLEY HYDROGRAPHIC BASIN (210), A PORTION OF BLACK MOUNTAINS AREA HYDROGRAPHIC BASIN (215), GARNET VALLEY HYDROGRAPHIC BASIN (216), HIDDEN VALLEY HYDROGRAPHIC BASIN (217), CALIFORNIA WASH HYDROGRAPHIC BASIN (218), AND MUDDY RIVER SPRINGS AREA (AKA UPPER MOAPA VALLEY HYDROGRAPHIC BASIN (219).
______________________________________/

TRANSCRIPT OF PROCEEDINGS
PUBLIC HEARING
HEARING ON ORDER 1303
VOLUME VIII
(A.M. SESSION, Pages 1499 - 1596)

WEDNESDAY, OCTOBER 2, 2019

REPORTED BY: CAPITOL REPORTERS
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A P P E A R A N C E S

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Hearing Officer

Tim Wilson,
Acting State Engineer
Adam Sullivan,
Deputy State Engineer

Melissa Flatley,
Chief of the Hearing Officer Section
Michelle Barnes,
Supervising Professional Engineer

Levi Kryder,
Chief of the Hydrology Section
Jon Benedict,
Senior Hydrologist

Christi Cooper,
Well Supervisor
Bridget Bliss,
Basin Engineer

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

For SNWA: Taggart & Taggart, Ltd.
By: Paul G. Taggart, Esq.
Carson City, Nevada
-and-
Tim O'Connor, Esq.

For CSI: Robison, Belaustegui, Sharp & Low
By: Kent R. Robison, Esq.
Reno, Nevada

For CSI: Brownstein Hyatt Farber Schreck
By: Bradley J. Herrema, Esq.
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For NV Energy: Justina Caviglia, Esq.
Reno, Nevada

For Lincoln County Water District/ Vidler Water Company: Allison MacKenzie
By: Karen Peterson, Esq.
Carson City, Nevada

For NCA: Alex Flangas, Esq.
Reno, Nevada

For Moapa Band of Paiutes: Richard Berley, Esq.

For Moapa Valley Water District: Greg Morrison, Esq.
For Muddy Valley Irrigation: Steve King
For Bedroc: Therese Ure, Esq.
For City of North Las Vegas: Therese Ure, Esq.
For National Park Service: Karen Glasgow
For Center for Biologic Diversity: Patrick Donnelly

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I N D E X

CARSON CITY, WEDNESDAY, OCTOBER 2, 2019, A.M. SESSION

---oOo---

HEARING OFFICER FAIRBANK: This is a continuation of the Order 1303 hearing regarding the Lower White River Flow System and the administration of the basins as a joint administrative unit.

And we will continue our presentations by the participants starting today with Center for Biological Diversity. And so we'll go ahead and kick it off with Mr. Donnelly.

MR. DONNELLY: Thank you. Good morning. Patrick Donnelly for the Center for Biological Diversity. And our expert witness today is Dr. Tom Myers, a hydrologist, who has appeared in front of the Nevada State Engineer in numerous proceedings. His CV is available on CBD Exhibit 1.

We appreciate the opportunity to present today. The Center for Biological Diversity was founded in 1989 and our mission is very simple. It's to save life on earth. In particular, we focus on the protection of endangered species and the habitats upon which they rely.

And I just want to provide the briefest of remarks about the context of Dr. Myers' presentation. We have been advocating for the protection of the Moapa dace for over a decade, focusing on securing a long-term permanent

water supply for the fish. And as parties in this room are doubtless aware, we unsuccessfully litigated Fish and Wildlife Services section seven consultation on the MOA some ten years ago.

As we've been eliciting in cross-examination over the past two weeks, we believe that withdrawals from the carbonate aquifer that cause a reduction in habitat quantity for the dace are a take under the Endangered Species Act and thus prohibited.

And while that implies that individual pumpers may be potentially violating the Act, we believe that responsibility lies with the Division of Water Resources.

Rather than running to court to litigate this, we're participating in this proceeding because we believe that the State Engineer's office is taking the right approach to addressing this matter. With almost 40,000 acre-feet of groundwater rights and 37,000 acre-feet of surface water rights, the basin is extremely over-allocated and the dace's habitat is in danger of drying up, even at current pumping levels, as Dr. Myers will demonstrate.

Order 1303, Section 6-2-C asks about the long-term annual quantity of groundwater that may be pumped from the Lower White River Flow System. While this is a technical evidentiary proceeding we're involved in involving

scientific experts presenting and interpreting data, Order 1303 asks a subjective question. What is the amount that may be pumped? And the question that's implicit there is that may be pumped within what constraints.

Different parties have had different conceptualizations about what the constraints on pumping are and thus have reached very different conclusions.

We feel that the Endangered Species Act is the primary limiting factor on the overall quantity of allowable pumping within the Lower White River Flow System and thus we geared our analysis toward that goal of protecting the dace.

However, other testimony has made it clear that certain types and locations of pumping will also impact senior surface water rights. As such, while our report focuses on what actions are necessary to save the dace, our report should not be considered exclusive of conclusions raised by other parties as to requisite actions to protect senior surface water rights.

The findings in our report and other reports instead may compliment one another, which is, of course, up to the State Engineer's office to determine.

Dr. Myers presents in his conclusion a number of potentially allowable alluvial pumping. However, if the goal of this proceeding's outcome is both to protect the dace and

to protect in-stream water rights, we all need to consider that the idea that all pumping must cease or at least that needs to be part of the evaluation.

We would respectfully request of the State Engineer's office the opportunity to present a brief written closing argument after the termination of this hearing.

I'd like to move to have our Exhibits 1 through 4 admitted for the record.

HEARING OFFICER FAIRBANK: Those exhibits will be admitted.

MR. DONNELLY: Thank you. I want to note for everyone that our presentation today differs slightly from the presentation provided to the parties as CBD Exhibit 4. We chose to highlight a couple of different elements from our reports to ensure it's relevant to the ongoing discussions we've had, but we haven't reached any new substantive conclusions or anything in the presentation today.

Could we please swear in the witness?

(The witness was sworn in)

TOM MYERS

Called as a witness on behalf of the Center for Biological Diversity, having been first duly sworn

Was examined and testified as follows:

DIRECT EXAMINATION
By Mr. Donnelly:
Q. Thank you. With that I will turn it over to Dr. Myers to present the Center for Biological Diversity's report and rebuttal.
A. Good morning, members of the panel and everyone in the room. Thank you for this opportunity to present our analysis and our conclusions.

My name is Tom Myers. That's M-y-e-r-s. I've been working as a hydrologic consultant for about 25 years now, and, as Patrick mentioned, working this is my sixth or seventh time before the Nevada State Engineer. I've also done this in three other states, Arizona, Montana, and New Mexico. So I've got some background doing this.

The outline of my presentation is pretty simple. I'm going to summarize the direct evidence report which is submitted as technical memorandum, groundwater management in the Muddy River Springs. And I'm also going to present a summary of my rebuttal report, which was titled technical memorandum groundwater management in the Muddy River Springs, rebuttal and response to stakeholder reports filed with respect to Nevada State Engineer Order 1303.

I also note I'll try to speak slowly enough. I actually already realize I'm doing that. Sorry. Just throw

something at me.

On my presentation there will be page numbers and that is frequently is a reference to where in the report if I'm referring -- if I'm in the first part of it is in the direct evidence report or the second part the page numbers are where I've addressed this. I mean, it's not a direct quote, usually. It's often where I paraphrase something from my reports.

The first section I'm going to go over is analysis of the Order 1169 pump test and subsequent data and I'm going to consider climate, water level changes by well, water level changes over the area, and spring flows. While some of this will, no doubt, be repetitious of what we've already been seeing, you know, with some small variability perhaps in interpretation, I'm going to try not to dwell on this because we have seen this so many times going forward.

First, regarding climate -- And I've chosen to consider precipitation trends primarily. This is the -- This is data. We've already seen this a couple of times, but it's from the Western Regional Climate Center and it's the extreme southern division. This is a 12-month running average of the precipitation for the southern zone in Nevada. It shows a seasonal variation. I see no evidence of a 20-year drought in this data. You'll see that it went the lowest right

around January 2002. The highest was in 2005, as we've heard many times. There was a slight upward trend beginning somewhere around 2010. And, as we've seen in other graphs by other presenters, 2017 and even the winter of 2018-19 also had some reasonably high precipitation amounts. And that is important as we go forward here.

As an aside, I realize both in listening last week and reading lots of reports that, you know, what is best to consider when we think of recharge in an arid region. Is it precipitation or is it PDSI, the Palmer Drought Severity Index. And I recently -- I thought a lot about this in both listening to the data here and also in realizing I do a fair amount back east and have recently moved back east. And I realize that PDSI is more appropriate in areas that have a lot of soil cover. The PDSI tracks evap precipitation and evaporation and it simulates evaporation based on temperature and a couple of other variables.

Precipitation, however, especially in arid regions, drives the runoff and that is even during a dry period. For example, I mean, runoff can occur in an arid region before the moisture deficits as represented by Palmer Drought Severity Index are even made up. I mean, recharge can occur due to runoff on pervious outcrops like carbonate rock. It occurs as mountain-front recharge. I think if you

looked at some research that has been done, it's been referenced earlier by other people. For example, the research Scott Tyler at DRI did in runoff in desert washes. It's just one event that causes a recharge slug.

And so I think my point here is that for the type of area that we're looking at here, rainfall, like in the previous graph that I presented, is a better thing to consider for climate trends and for recharge slugs, considering recharge, than is the Palmer Drought Severity Index. And at that may be especially true going forward as temperatures warm.

And I guess the point is that any year, even a very, very wet year, the soil moisture is dissipated by the end of the water year. And so you start almost every year on a -- at the beginning, if you will.

Now, to consider a few of the well trends here. This is a graph of the Coyote Spring carbonate wells that even back in Order 6254 the Nevada State Engineer found that the reduced pumping completed during the aquifer test, but I am repeating the fact that it wasn't the full amount that had originally been ordered in Order 1164, satisfied the goals and the pumping in Coyote Spring Valley cause impacts north in Coyote Spring Valley and then -- And this is a quote -- at least to Kane Springs Valley south to Hidden Valley and

Garnet Valley and southeast to the Muddy River Springs area and California Wash.

The water levels in the carbonate monitoring wells in central and southern Coyote Spring Valley have varied in parallel since the early two 2000s. The trend has been downward except for the brief increase that occurred around 2005. And then all of the carbonate wells in central and southern Coyote Spring Valley decreased at least two feet during the pump test period and they have all recovered by less than half that amount by 2016.

Most carbonate monitoring wells show a continued lowering of water levels since 2016. And I think it's important that that's even with the wet winters in 2017 to 2019. That's why I mentioned that was important on the precipitation graph I showed before.

And this lack of recovery shows that -- it indicates that, I mean, that an increase gradient caused by the drawdown is that it has not drawn substantially more water from beyond the boundaries of the higher transmissivity zone, that the broad two-foot drawdown cone or -- I guess you would call it a cone. The broad drawdown levels throughout the five basins is reached up to the boundaries and thus it doesn't pull -- it hasn't really begun to pull substantially more water from beyond the boundaries, which is partly why

we've seen so little recovery.

The basin fill groundwater levels in the southern portion of Coyote Spring Valley have also trends downward since the late 1990s, with the exception being during the wet period around 2005. Well CSV3011M water levels increased from its installation in 2008 until the aquifer test after which it began to climb as well.

And then well DF-1, which is a basin fill well in the middle of southern Coyote Spring Valley, not shown on this particular graph, however, had water levels of about 200 feet higher than other wells in the area.

Carbonate monitoring wells in the Muddy River Springs area also show long-term downward trend commencing in the 1990s with the familiar uptick in 2005.

The report, the USDOI 2013 report identified several wet year responses. That's -- The graph at the bottom is from that particular report. They identified several wet year response in groundwater levels including 1992, '93, 2005 and to a lesser degree in 1998 and 2011.

I'm not sure I can prove this. But the small seasonal fluctuation that we see in many of the carbonate wells, and it was discussed a little bit yesterday, I could see that it could relate to the pumping in the basin fill aquifer, which is seasonal, and in cases varies by as much as

ten feet seasonally. And that could change the gradient between the connection in the carbonate and basin fill wells and that could allow the carbonate wells to go up and down, the water levels to go up and down, by half a foot like we see.

1169 aquifer test accelerated the decline in the monitoring wells with a decrease of as much as two and a half feet.

And I want to go back -- Yesterday we heard that the well EH-4 may have been, you know, was steady, had steady water levels during the nineties and even the late eighties when pumping had begun in Garnet Valley and the idea was that Garnet Valley pumping may not affect it at all.

Well, if you -- there is a, I interpret, a slight downward trend here in the late eighties and early nineties until we get to the -- until we get to a wet period in '92 and '93. And I also interpret a slide down at least steady if not slight downward trend in the late nineties. So I'm not really sure that we can say that Garnet Valley pumping has had no effect at all on the carbonate water levels in the Muddy River Springs area.

And I want to show two of the same graphs that I've already shown but up close and in a little more detail. And that is just to show that from late 2016 from the EH-4,

EH-5b, and UMVM wells, all of them show a slight downward trend with time especially starting in late 2015 and added that this time period where there is a slight upward trend in the precipitation. So this is occurring, this downward trend in the last several years occurs, even though there has been a slight uptick in the precipitation.

And then basin fill wells in the Muddy River Springs area, both of these graphs are from -- I mean, show some basin fill wells, basin fill wells in the Lewis Field portion of the Muddy River Springs area have, you know, have been steady but with a slight decline more recently. And this is where you actually see the almost ten-foot seasonal variation. So if you go back to my previous statement about potential seasonal variability in the carbonate aquifer possibly being related to pumping that occurs in the alluvial aquifer.

And I realize I may go back and forth and say alluvial and basin fill interchangeably, and it probably shouldn't. But I recognize that I refer to them interchangeably. And these tend to be more alluvial than basin fill in this area.

All wells in the Lewis Field portion of the Muddy River Springs area exhibit a drawdown of several feet during and then just after the pump test. Basin fill wells near the springs, and that's in the bottom graph, have declined, other than during the uptick in 2005 since the 1990s, far more than the Lewis Field wells, that declined, it accelerated through the aquifer test period. And although it is mostly completely recovered, however, most of that recovery is probably due to the very significant decrease in alluvial pumping that I'll show in a slide or two here.

Now, overall, the groundwater levels at the end of the pump test show the very flat potentiometric surface from midway up Coyote Spring Valley through the Muddy River Springs area. On this graph you can see almost all the way from the middle of Coyote Spring Valley. And I realize that you can't read the -- indeed these elevations are not extremely readable. But there's only a several-foot variability all through the 30-mile area or 30-mile distance here. I mean, and during pumping, the water levels responded. And, literally, it responded to the aquifer of the pond. And you pull water at one end and it reduces throughout the whole area very quickly.

Carbonate water levels in northern Coyote Spring Valley they are several tens to almost 400 feet higher than in the southeast portion of Coyote Spring Valley. But the water levels at least at CSVM-4 did decline during the aquifer test.

I just mentioned the groundwater level at CSVM-4, which is near the southern end of Kane Springs Valley, it's just four to five feet lower than well KMW-1, which is further north in Kane Springs Valley. And that does suggest that there's a connection of transmissivity, the high transmissivity, of carbonate rock that extends in to that valley. And I'll allude to this area and this several times. And I'm not denying that there is a fault in -- there is probably a fault between those two wells. But with only a few feet of variability and the fact that KMW-1 did vary during the pump test, the fault cannot be providing a huge impedence. And I will probably come back and say that several more times, probably in response to questions later too.

Carbonate groundwater levels drop from the Muddy River Springs area they -- down to the far to the southeast here they drop almost 250 feet. These levels down in this area here at very, you know, south and east of the Muddy River Springs are about 200 feet lower than they are at the springs themselves. And that observation -- I mean, the fact that there's a fair drop in the carbonate aquifer at that point reflects some impedence in the carbonate, which probably is partly responsible for the location of the springs.

Basin fill water levels in the Coyote Spring Valley are substantially higher than they are in the carbonate. That's most apparent in well CE-VF-2, which is about 50 feet higher than in the carbonate.

Basin fill well DF-1 exceeds 2,000 feet while the underlying carbonate wells are a good 200 feet lower.

Now, I suggest that because of the aridity of the area that this doesn't so much reflect a substantial recharge from the basin fill to the carbonate but it suggests that there could be a hydrologic disconnect due to a low conductivity zone or something between the carbonate and the basin fill in Coyote Spring Valley.

In the Muddy River Springs area, carbonate water levels exceed those in the basin fill, which reflects the upward movement of water from the carbonate to the -- in the to alluvium, and that also helps to provide water to the springs and to the alluvium in the Muddy River Springs area.

And then just as a note, in the Lower Meadow Valley Wash area, which is outside of the pump test study area, these three wells up here, I believe those are, like, MW-1 or something like that, they demonstrate sort of an upward gradient from depth in what's a very thick basin fill aquifer.

And then this graph here is a profile of the

water levels at different wells from Muddy River Springs in EH-4 in the far right up to CSVM-4. And these are water levels before and after the pump test period. And the profile, first off, it demonstrates the flatness of the potentiometric surface. You can see an almost 20-mile area there where the water level varies from 1820 to about 1814 -- or 1813. And during the aquifer test, the level there consistently dropped about two feet.

Further north of CSVM-4, the groundwater level change was less than a foot. And further north, the carbonate water levels are about 200 feet higher. This is off of my graph. But carbonate water levels continue up for about -- they're about 200 feet higher. And that definitely reflects the fact that there is transmissivity in northern Coyote Spring Valley is lower and as reflected by the steeper gradient. And also inflow to Coyote Spring Valley from Pahranagat or Delamar Valley. It flows through the lower transmissivity area -- It flows through this lower transmissivity area to reach southern Coyote Spring Valley and well MX-5 and of course then the Muddy River Springs area. The point being that inflow to Coyote Spring Valley, I mean, there may be a lower transmissivity in the north. It's still passing all of the water needed for the Muddy River Springs area.

And then if we consider discharge from Warm Springs West, it decreased from the nineties, you know, through the mid-2000s from about four to 3.4 CFS. It upticked in 2006 and then during the wet period. And then during the Order 1169 pump test it dropped to almost 3.2 CFS. That was a decline of about nine percent during the period of the pump test and it recovered just a little bit more than 3.4 CFS since 2012.

Since 2016, it has decreased a little bit and become steady at -- steady or slightly decreasing at less than 3.4 CFS since a brief increase that occurred during the wet 2017.

I would point out that although the data is provisional, yesterday morning the flow at Warm Springs West is 3.23 CFS. I checked it. Very close to that 3.2 CFS. I mean, obviously it's provisional and I don't know how much they've changed over the years until they go finalize them. But it's been 3.23 CFS for over a week. So it's pretty steady right now.

At the Pederson Springs, the flow is about half of what it was in the mid-2000s right now there from this first part of the graph to the second part. Much of the decrease occurred during the pump test. There was some minor recovery especially in the Pederson Springs, especially at

Pederson Springs. At Pederson Springs the flows had declined about 63 percent. And at Pederson East Spring about 45 percent during the test. And the USDOI 2013 report they found that had the rate of drawdown continued, Pederson Spring would have gone dry in about a year and a half. And that Pederson Spring East would have gone dry in another two and a half to three years had the pumping as observed during the pump test had continued.

Kane Springs Valley should be added to the Lower White River Flow System for management purposes. That's based on there being high or at least relatively high transmissivity up through Coyote Spring Valley to at least CSVM-4.

The fact that the groundwater level in KMW-1 is just four to five feet higher than at KMW -- than at CSVM-4. I apologize. That looks like a minor typo. That second KMW-1 should say CSVM-4. And that is on slide 16.

The groundwater level lowering that occurred during the pump test did propagate in to Kane Spring Valley. It's pretty obvious from the water level data that it did. There are large expansions of carbonate rock with no structure hydrogeologic barriers. I'm not saying there's not a structural -- that there's not a fault there, but it doesn't appear to be having much of a hydrogeologic impact.

And then, also, whatever groundwater flow originates in Kane Springs Valley probably is limited to local recharge, but it does come in to Coyote Spring Valley at some point. It has to come in to it. And so there's evidence that pumping in Coyote Spring Valley will draw flow from Kane Spring Valley, there's no limit to -- there's no reason to not consider it, quite honestly.

And I also mention here no reason to separate out northern Coyote Spring Valley. I can't remember which report I read that suggested that maybe Coyote Spring Valley should be considered differently. But the fact that all of the flow in Pahranagat Valley and Delamar Valley has to flow through that area, there's really -- and intercepted, it's going to have effects in southern Coyote Spring Valley, you know, similar to pumping down there. There's really no reason to separate out northern Coyote Spring Valley from the flow -- the Lower White River Flow System.

Here's the conclusion that I think stems from this. And I'll come back to it several times in the remainder of my presentation. But going forward in to the future there can be no carbonate pumping if the objective is to keep flows at Warm Springs West and at all of the springs at the level that is necessary to support the Moapa dace and quite honestly the water rights to further downstream.

The figure I have here is actually I think was prepared by the State Engineer for one of the Lower White River Flow System meetings last summer or two summers ago and it kind of shows, you know, the different trigger points for consultations and things that occur as a part of the MOA.

But, you know, Warm Springs flows almost 3.2 CFS during the aquifer test. And at the current much, much reduced levels, they're at 3.23 CFS, and for reasons I will go in to will probably continue to go down.

The Muddy River Decree, the 1920 Muddy River Decree, has a total water rights of about 37,000 acre-feet per year. The Muddy River near Moapa is downstream of all the area springs and downstream of some irrigation diversions. Based on the gage that this discharge from Eakin in 1964 estimated discharge from the Lower White River Flow System to be about 36,000 acre-feet per year from all of the springs that supply the Muddy River Springs area.

From about 1943 to 1960, the recorded flow was just less than 34,000 acre-feet per year. After 1960, it decreased to less than 24,000 acre-feet per year. And after the wet year in 2005, it began to increase and reached a little over 30,000 acre-feet per year. And it's been relatively steady just above 30,000 since then.

The trends there are likely due to groundwater and surface water development upstream from the gage. That would include a diversion of 9.2 CFS to the Reed-Gardner electrical generating station.

Carbonate pumping which began in the 1990s and an increase -- the increase began in 2005 due to the high precipitation year. It also should be noted that in 2010 there was a fire somewhere in that vicinity that Southern Nevada Water Authority identified as increasing, you know, eliminating about a thousand acre-feet of a evapotranspiration. So that would have had some effect on this rising limb at the gage. And then -- But it's important to realize that the flow hasn't met the requirements of the decree, almost it's entire -- almost since 1940.

The pumpage shown -- Now I'm going to talk a little bit about pumpage. This graph shows pumpage in the both total pumping and total carbonate pumping both on a monthly and on a 12-month average basis. And this is for the entire Lower White River Flow System not -- as defined by the State Engineer. It has -- It has been -- There have been variable sources. Monthly pumpage, you know, it varied a fair amount between 2000 and 2010 from around 9600 to 12,000 acre-feet per year. A total carbonate pumping varied from about 4800 to 7200 acre-feet per year. And that, of course, increased a lot during the 1169 aquifer test. After the

test, it has dropped to just over 8,000 acre-feet per year.

Since 2015, alluvial pumping has dropped to close to zero, as can be seen in the far right side of this particular graph. And it's the gray. The gray line represents Muddy River Spring area alluvial pumping. The blue represents Coyote Spring Valley carbonate. And the reddish is Muddy River Spring area carbonate pumping.

Carbonate pumping in Coyote Spring Valley began in 2005. So the flow in the carbonate system upstream from the springs has only been pumped for 14 years. I think that when considering the trends at EH-4 and considering the trends in the springs, it's important to realize that pumping hasn't been going on for all that long.

Muddy River Spring area carbonate pumping has been steady or slightly decreasing at a range from 100 to 400 acre-feet per month. And, of course, the production is mostly from Arrow Canyon wells. And during the aquifer test, Coyote Spring Valley carbonate pumping dominated pumping from the carbonate aquifer. But since then it's been about half that in the Muddy River Spring area.

Then carbonate pumping mostly removes water storage as evidenced by the general downward trend around the carbonate aquifer. That can be seen in this graph, which I -- which is the source of the graph is USDOI report 2013.

It generally -- You know, until -- until the pumping captures, you know, until pumping equals captured discharge, it's going to continue removing water from storage. And that's evidenced by the general downward trend in water levels even since 2016 around the aquifer. Drawdown will only stop when the pumpage equals captured discharge and induced recharge or inflow.

The carbonate system has not yet reached any semblance of an equilibrium for any rate of pumping. And with carbonate pumping it's only a matter of time before the spring flow decreases significantly or is completely lost. And that is due to pumping in the carbonate capturing -- capturing the discharge.

And I circle back to my recommendation a few slides ago. The Nevada State Engineer should not allow carbonate pumping in the Lower White River Flow System to prevent those further decreases.

One of the questions we were asked to consider is the conjunctive use of alluvial wells. And I did have a couple of statements here. I think the carbonate water discharges in to the basin fill and supports the basin fill aquifer. Secondary recharge, which is once the water discharges from the carbonate springs, it does support alluvial water levels. So that secondary recharge, which

probably includes both direct spring flow and maybe even some irrigation recharge, supports the basin fill water levels.

Some basin fill pumping could be acceptable in the Muddy River Springs area because as secondary recharge the water has already been used in the spring channels that support the dace.

I've also suggested, and I don't have a recommendation for the amount, but it's possible there could be some basin fill pumping in Coyote Spring Valley that could be sustainable. I think there's very little there now. There's two wells in the far north end. I say that because basin fill and carbonate water may be separated, like I suggested before, by potential disconnect.

But before any water really starts being pumped from that area, there needs to be some study. I'm recommending more -- we have a better understanding of that potential connectivity so that you're not actually reducing water that would otherwise flow in to the carbonate. And I think there's a good possibility it doesn't. But if it does ultimately support carbonate groundwater, I don't think it could be pumped. I mean, it shouldn't be pumped. But that is subject to a recommendation for additional study.

And then in conclusion for my direct evidence, there is a broad highly transmissive carbonate aquifer underlying Coyote Spring Valley, Muddy River Springs area, Garnet Valley, Hidden Valley, California Wash. The aquifer is interconnected so much among basins that it's necessary to manage groundwater through all basins as if they were part of a whole basin.

And then jumping down to my third conclusion here. Kane Springs Valley should be added to that or be managed as part of the Lower White River Flow System based upon the observed relative flat carbonate water level extending in to that valley and the response of Kane Spring Valley wells to pumping.

There seems a high likelihood that water pumped from Kane Springs Valley would quickly contribute to the depletion of carbonate aquifer in Coyote Springs Valley and Muddy River Springs. But, of course, there's not been any pumping and so that is -- I mean, that's sort of applying reverse logic. If you're affecting Kane Springs by pumping in Coyote Springs, it makes sense that the effect would go the other way.

Back up to conclusion number two. The Nevada State Engineer should not allow any pumping of the carbonate aquifer to avoid continued decrease in spring flow in the Muddy River Spring area. Again, this conclusion results from the direct correlation of carbonate pumping and carbonate

water level and spring discharge decline.

Until all pumping is captured from spring discharge, carbonate water levels will continue to decline. And as we've seen -- And I'll discuss a little on the rebuttal section of my presentation -- that linear relationship between EH-4 and spring flow definitely shows that the, you know, shows that spring flow will continue to decline along with that. And then preventing carbonate pumpage -- Maybe I should say may also be necessary for protecting downstream water rights on the Muddy River.

Some basin fill pumping could occur without significantly affecting the spring flow. A preliminary estimate is difficult. But the pumping that occurred prior to significant carbonate pumping were about 4,000 acre-feet per year seems a decent level to start.

But it's also important to, you know, to verify that doing so is not going to affect the Muddy River flow rights.

And then I have one slide here that shows the references I've been using and gives me the opportunity to take a breather before I start my rebuttal.

Q. Dr. Myers, you've gone 45 minutes.
A. I'll finish, no problem, in two hours. Thank you. That is unless I have a slide that I can't remember

what I meant to say. No, I'm just kidding.

I've outlined the rebuttal section of my presentation by stakeholder. Detailed reference should be made to my rebuttal report, which is one of the exhibits we've provided. And because I have no chance at all of covering all of the rebuttal that I've written about in this presentation and I would also note that there's an overlap in rebuttals for the various -- for the various stakeholders because it all -- we're all interpreting the same data. It's just a matter of different variations and different conclusions on that interpretation.

My first bit of rebuttal is Coyote Springs is on the Coyote Springs investment report and specifically I believe that the estimated recharge from the Sheep Range is inaccurate. And that is because of, as I'll explain in the next couple of slides, that is because of the way they did the calculations.

First off, you can see they divided the Sheep Range in to 15 different basins that come off the east side of the Sheep Range. And this table on the right side here show -- And both of these figures are from the Coyote Spring investment report. It shows how they applied four different recharge estimate methods to these 15 different sub-basins. Three of those sub-basins are in Hidden Valley and 12 of them

are to Coyote Spring Valley. And, for example, you can see the Maxey -- the original 1949 Maxey-Eakin method applied to 1966 Eakin precipitation that I'll talk about. You know, I'll mention that a little bit later. And then we have Maxey-Eakin apply to 2015 PRISM data. And then Nichols and Epstein both from 2001, 2004 also applied to 2015 PRISM data.

Nichols and Epstein methods are based on the methodology of Maxey and Eakin 1949, by which I mean they utilize -- they estimate recharge which is based on a coefficient that is a percent of the total precipitation volume which falls within a precipitation interval in a basin. For example, if you want to consider the greater than 20 inch per year zone which has a 0.25 coefficient, if whichever method you use for estimating precipitation tells you that there was 10,000 acre-feet of volume of precipitation in that zone, the methodology would then tell you that 2500 acre-feet of it would become recharge at some point within that basin.

Unfortunately, the application of the methods showed a misunderstanding of this methodology. The methods were originally, all of these methods, all four of them, were derived by equating precipitation bands within entire basins to discharges from the entire basin. And that is an important assumption. Because when you consider an entire basin, you have a blend of the geology, you have a blend -- You know, recharge can occur anywhere in the basin. And these methodologies were determined using the blend over the entire basin.

It is not -- I mean, the method in general does not consider specific geology. For example, precipitation runs off granitic soil or maybe it runs off granitic outcrops and much off of volcanic rock but it infiltrates carbonate rock. And the method does not specifically take that in to account. But by virtue of considering basins that have a mixture of outcrops, it blends them. Because of the Maxey-Eakin method and the other -- and then these more recent similar methods where we're derived using outflow estimates in precipitation zones for entire basins, it's not appropriate to estimate your recharge for small sub-basins, and thus the subdivision of the Sheep Range it introduces a level of granularity, if you will, to the analysis which is not appropriate, like I showed here of all of these broken-down basins. These methods are not intended to estimate recharge for each of those individual little subdivisions.

I would also say the method depended on using the same source of precipitation estimates as was done for developing the methods. For example, it's not appropriate to

use Maxey-Eakin coefficients with PRISM-estimated rainfall as described. The method of precipitation estimates were considered more scientifically sophisticated. That doesn't make the estimate better. I mean, I think experience has shown that PRISM actually estimates a lot more precipitation for a basin than some of the older maps do. And in using PRISM with this methodology is fine as long as the coefficients were estimated using PRISM.

Thus, my conclusion there is that the estimated recharge of 5,280 acre-feet is not accurate. I can't say whether it should be higher or lower based on this analysis. It just is not accurate and should not be given any -- and not be used for estimating how much flow or how much recharge there is on the west side of the Coyote Spring Valley.

Then evapotranspiration. CSI had said something in their report that was actually rather troubling when we read it initially. This report recommends and supports an initial estimate of groundwater available for appropriation should be based on capturing all evapotranspiration and groundwater outflow from the Lower White River Flow System. But there's no evidence that all ET could possibly be captured. And in doing so there is no consideration that this ET supports functioning ecosystems. There's no evidence that all ET from this extensive groundwater system that it

does support functioning ecosystems. There's no evidence that it could be feasibly captured.

And then, second, the report makes no showing that any of the estimated amounts of evapotranspiration is available for capture.

And then, third, the report doesn't consider down gradient water rights that could depend on some of that capture.

The ET in the hydrographic areas in the Lower White River Flow System, I mean, it supports functioning ecosystems including dense and moderate meadowland, woodland, shrub land vegetation as well as agriculture. And includes this table, which is from, I believe it's from the DeMeo, et al. report, which estimated ET for a variety of the -- for many of the valleys down there. And I include it because it did show the amount of ET that comes from different functioning ecosystems in the Muddy River Springs area, the California Wash area, et cetera. And thus showing that these are potentially valuable wetland ecosystems. And, thus, capturing that ET would effectively make those ecosystems go away or transition. Thus, the proposal to include all ET as available water to be captured is unsupported and should be rejected.

And, also, there's a claim that ET in Coyote

Spring Valley is a thousand acre-feet per year. And it was a reference to Thomas, et al., 2001. The problem is that reference and neither the reference nor Stetson says where would that ET occur. I mean, I've been in Coyote Spring Valley. I do not know where you're going to found a thousand acre-feet of potential evapotranspiration out there. But I'll point out that this table, DeMeo, et al. which I pulled from the Coyote Spring investment report, shows the estimated ET from Coyote Spring Valley to be zero.

And, just the other thing to consider, in Coyote Spring Valley, the depth of the water in the basin fill is quite high. It's not going -- It's not capturing -- If there's much -- I guess there's a bit of very -- There may be a little shadscale that has a little tiny bit of evapotranspiration. But for all intents and purposes, the ET from the Coyote Spring Valley should be considered zero.

The next rebuttal is of the Moapa Band of Paiutes report. And I list the name of the report there, which I refer to throughout as the Johnson-Mifflin report.

As I went through before, there is no evidence of a 20-year drought. There was no direct analysis of climate data in that report. So there was really no way to make a conclusion of using just climate data that we were in a drought period.

And then, as I stated before, the Climate Division 4 data showed, you know, does not provide evidence of drought.

Discharge from the Big Muddy Spring increased by one CFS from 2010 to 2014 as shown on the right side of this graph.

But Johnson-Mifflin claimed that the flow increased during the aquifer test. And increase after the test demonstrates a climate dominance rather than pumping as a forcing agent for water level change within the MRSA and perhaps a complete absence of Order 1169 pumping effects.

The problem with that analysis is that it ignored the fact that there was a burn of over 600 acres which could have contributed a great deal to the failure to see pumping effect in the Big Muddy Springs.

The 40 -- Johnson-Mifflin estimated 40,000 acre-feet of flow from the Lower White River Flow System to the Las Vegas Valley. And I would just initially say that it should be given no credence because it is highly dependent on undocumented, unverified assumptions.

It was based on a Darcy's law analysis using a transmissivity that was based on a report published for a pump test a long time ago, back in 1992. I did not see that report. Perhaps the State Engineer has had that report. But

I was unable to review it.

I also found -- And just yesterday, Dwight Sawyer with the City of North Las Vegas, presented transmissivity values in the area for which this flow would occur. I recall them being in the hundreds to low thousands as opposed to, I think, 300,000 for the transmissivity being used by Johnson-Mifflin here. So a great deal of difference in transmissivity. I mean, just one order of magnitude difference would turn 40,000 in to 4,000, which is a hugely different number.

There was also a lot of talk about the anisotropic, the form of the model, anisotropic, that somehow in this area the transmissivity along the flow path would be ten times greater than the transmissivity transverse to the flow path. I never did see evidence for that ten-to-one ratio.

And I guess the other thing that I would point out is that yesterday Sawyer, with Dwight Sawyer, also pointed out that that water, you know, to the south end of this flow path was actually, the water levels were a little bit higher than they were further to the north. So, for this to actually occur, water would have to go uphill.

So I believe that there's really no evidence for a 40,000 acre-foot per year flow from Lower White River Flow

System to the Las Vegas Valley.

And then, plus, there was really no evidence given that the water is available to begin with. I mean, it was based on flow path from a groundwater model. And if memory served, I'm not sure where there would have been enough water to support the Muddy River Springs of all of the water that was shown in that model ran down in to the Lower White River Flow System. Excuse me. In to the Las Vegas Valley Wash.

And then a correlation analysis in the Johnson-Mifflin appendix four does not prove correlation between the EH-4 levels and pumping at the Arrow Canyon wells. This table is from that appendix. And I've circled the T-value and the P-values for the coefficients that resulted from that analysis. And I'll point out that only the intercept and lag zero have statistically significant coefficients at the .05 level. Everything else is much higher than that, which suggests that, if anything, the average -- And, I mean, if this means anything, it basically means that the current pumping is most responsible for the -- is most responsible for the drawdown. But it also points out that -- The report also pointed out that eight percent of Arrow Canyon well pumping is captured at the springs, which adds further credence to my concept earlier that continuing

to pump from the carbonate aquifer is pulling from storage which will eventually capture spring flow.

And I'm not sure what -- I'm curious what the 92 observation -- I'm not sure whether this meant 92 weeks of data or whether it meant daily data for 13 weeks. If it was the latter, the data was so -- wasn't very independent as is necessary for statistical analysis.

The Lincoln Vidler report, the primary argument is that Kane Springs Valley should not be added to the Lower White River Flow System.

Lincoln County present water level data -- However, they presented water level data that supported managing Kane Springs Valley as part of Lower White River Flow System. They did this graph here is adapted from the Lincoln Vidler report, Figure 3-9. And it clearly shows, you know, there's a long-term decline in both of them in parallel, a decrease in both of the wells just after the pump test.

There is not a significant difference in the delay either. I mean, there's a delay at the start. But between the two wells, there's not a huge different -- hugely -- a huge difference in the delay. And then both can go on to continue their decline after a brief recovery.

So, to my mind, this is just further evidence that Kane Springs Valley should be managed as part of the Lower White River Flow System.

And I think it's -- there is a bit of lower transmissivity between the point of the pump test and the mouth at Kane Springs Valley. There was about a 40-foot increase in the profile going up Coyote Springs Valley. The additional lag would be -- The additional lag would be partly due to that. Now, yesterday, we actually heard some comments that physics should make recovery commence as fast as the initial drawdown. I would beg to differ with that comment. Because physics would make -- that concept would make -- would apply in an incident aquifer. But this very definitely is not an incident aquifer. And indeed these are close to, these two wells are pretty close to the boundary. And it would not -- it would not recover at the same time in all directions as was implied yesterday, I do not believe.

There was evidence presented that different geochemical data should show that these come from different areas or it's different segmented groundwater sources. So the groundwater from KPW-1 has total dissolved solids of about 774 milligrams per liter, which is a little higher than the groundwater at CSVM-4 at 682. I mean, but the fact that water from Kane Springs Valley is a little higher than that at Coyote Springs Valley is just evidence that it's starting

to mix with water in Coyote Spring Valley. Because the other wells -- I mean, wells further up gradient in Coyote Spring Valley will probably or possibly have lower value. So what you see is a bit of mixing.

When I look at these tables, I don't see vastly different groupings of data. And in my experience over the years is things like TDS vary by 20 percent for reading the reading for no particular reason. So there is overlap between a lot of these readings.

And then there's also this discussion of flow paths through Coyote Springs Valley. And, for one, the water at KPW-1 has been shown to be the oldest at 29,000 years and the hottest at 136 degrees Farenheit of the wells in the area. And that is saying that, well, for one, if the water at that well originated in Kane Springs Valley as recharge, it should certainly -- it circulated very deeply. If it didn't originate in Kane Springs Valley, it means that we don't know where the inter-basin flow to that valley is coming from, because I haven't seen any evidence here that there's flow coming in to Kane Springs Valley from somewhere else.

But, once the water from KPW joins water in Coyote Springs Valley, it begins to mix. And so the average age is younger. So this does not stand out as showing that

Kane Springs Valley is a completely separate flow system. And these flow paths along here, the blue one over to the west of highway -- to the west of the highway, for example, is drawn to show similar temperatures.

What is -- The travel time between these two points is probably many, many years, if not decades. I would expect, if anything, the temperatures to decrease with that flow time, not be the same. I don't interpret these as being the same flow path, necessarily. I mean, you're going to end up with mixing out here. And rather than finding, you know, connecting the dots of two wells or two wells that have the same -- that have the same temperatures.

US Fish and Wildlife Service, I agree with almost everything in that report, except they argue for too much pumping from the Lower White River Flow System. They state that the average pumping of years 2015 through '17, which is a little over 9300 acre-feet per year, should be the long-term, allowable, you know, should be the long-term allowed pumping rate from carbonate and alluvial aquifers. The claim is that flows and levels were steady during that period. I, as I pointed out in several graphs a little while ago, that just isn't, you know, they are continuing to go down, and that's including during a relatively wet period, especially 2018 and '19.

Although the flow briefly recovered to almost 3.6 CFS, the Warm Springs West flows have been decreasing since. And that includes during a wet period. Most of the ongoing carbonate pumping is removed from storage. And as it continues, more will be captured from discharge, and spring flow will continue to decrease to critical levels.

I mean, I guess the basic argument here is primarily just based on first principles of water balance. Initially, pumping -- pumping removes water from storage and that causes drawdown. That drawdown either captures discharge or induces recharge. And in this system with a possible exception of some flow coming in up around Panaca -- I think someone mentioned that. I don't remember who. Actually I think it was Fish and Wildlife. As long as the pumping rate exceeds the rate of captured discharge, water levels will continue to decline. It's not a matter of if but when the pumping the carbonate aquifer fully captures discharge from the springs. And that may ultimately result in spring flow below critical rates.

National Park Service they presented simulations that were completed by Tetra Tech that considered several different pumping scenarios with basically different locations of pumping but they use the same total pumping rate. I really wish they had used about 10,000 acre-feet per year less than that on these scenarios just to show how long it might take.

But, I mean, the differences among those scenarios were during the initial years. The only point I really want to make here is that there was not a great deal of difference in the long term between moving this amount of pumping around the Lower White River Flow System and so there's really no outcome -- I mean, the lack of difference among the outcomes presented by the Park Service show evidence that there is not some perfect scenario that would allow pumping to continue at a much higher rate.

And then, finally, a couple of words about Southern Nevada Water Authority's presentation. They showed that using the same data that I had used in my original report, they showed no significant climate trends since 1895. And they pointed out that since 2016 heads in the carbonate aquifer and discharge measured at Pederson Spring and Warm Springs West have declined. I mean, SNWA's analysis supports the concept that any carbonate pumping anywhere in the Lower White River Flow System will lead to a decrease in critical spring flow.

And I will quote from SNWA's report. In the long term it is expected that any groundwater production from the carbonate system within the Lower White River Flow System

will ultimately capture discharge to the Muddy River Springs area, e.g. spring discharge, subsurface inflow to the alluvial reservoir, and consequently, Muddy River Spring flow because of the high aquifer diffusivity and hydraulic connectivity throughout the flow system and because the MRSA constitutes a majority, if not all, of the discharge from the flow system. I agree with that totally.

However, SNWA recommended 4,000 to 6,000 acre-feet of carbonate pumping based on the relationship between Warm Springs West flow and Muddy River Spring area flow. And this was a table that I have presented to show that the Muddy River Springs area discharge at several different white -- west -- Warm Springs West discharge rates.

And I believe that these are based upon an assumption that the system is at steady state, when previous evidence has shown the system is not at steady state. So while this may seem like an appropriate estimate for right now, as the water levels go down -- And we're already at 3.23, that's if indeed the provisional data is correct -- it is suggesting that this estimate based on steady state conditions will allow ultimately the springs to fall below critical levels.

And then the Figure 6-3 from SNWA's report shows very direct -- very specifically that the aquifer is not at

equilibrium. The relationship shows that pumping is still removing groundwater from storage. The light blue here is showing that as pumping continues, over half of the water by SNWA's estimate is removed -- is being removed from storage. And, as that is removed from storage, it continues to lower the groundwater levels. And the bottom graph here simply shows the relation that they had provided of the water level at EH-4 and discharge at Warm Springs West. And as we get down -- And it's a very linear relationship at this point. And it shows that as the head continues to go down, so will the flow rate. And, thus, I believe the analysis here does not support the recommendation of 4,000 to 6,000 acre-feet per year can be developed from the carbonate aquifer.

And then my last slide is just a quick little reference to the Nevada Energy rebuttal report, which basically states that, you know, recent water levels are steady. And I guess I would just say I kind of differ with that because we're drawing a straight line through some data here at the very end of the -- at the very end of the -- Is that EH-4? Yeah -- it's right at the end of the EH-4 graph when really we should be drawing from the same time of year to the same time of year. It's just a minor interpretation of what we see here. But I believe that really, as I've shown on several previous graphs, that it's not -- that we

can't say it's steady but that it is going down.

And, with that, I've finished my slide presentation.

MR. DONNELLY: Thank you, Dr. Myers.

We have nothing further for our presentation.

HEARING OFFICER FAIRBANK: So that leaves you about 46 minutes. Do you wish to reserve that time for redirect?

MR. DONNELLY: We'll take -- Yeah, we'll hold on to it.

HEARING OFFICER FAIRBANK: Okay. Great. Thank you.

At this time we'll go ahead and open it up for cross-examination. And we'll start with Coyote Spring Investments.

And, for the record, the division of time for today is seven minutes.

MR. HERREMA: Thank you.

CROSS-EXAMINATION

By Mr. Herrema:

Q. Good morning, Dr. Myers.

A. Good morning.

Q. Brad Herrema on behalf of CSI. I wanted to start with some questions on the Sheep Range recharge estimates.

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A. Okay.
Q. Did you review CSI's entire July 3, 2019, Order 1303 report?
A. I think I reviewed most of it, yeah. I mean, yes, I did review the report.
Q. Do you know which method Stetson relied on to recommend the 5,280 acre-feet per year of recharge from the Sheep Range?
A. If memory serves, it was sort of a blend. It was a middle one. It wasn't the highest one. I know that. It was -- I don't remember specifically which one it was, no.
Q. The Epstein method evaluated both the Maxey, M-a-x-e-y, Eakin, E-a-k-i-n, method and the Nichols method and developed a new model using algorithmic optimization and created four different recharge zones. And there's a table, it's Table D-4, which supports the report. And it indicates that the Epstein method was used to estimate recharge and two coefficients of recharge were used. 1.9 percent for mountain areas with greater than -- at greater than 6,000 feet that receive fewer than ten inches of rainfall and 4.9 percent for mountain areas that receive between ten and 20 inches of rainfall. Does that sound familiar?
A. That does sound familiar. But it doesn't take in to account the different geologic differences nor the fact

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that it should consider an entire basin.
Q. Okay. Do you believe that Epstein performed an independent analysis of recharge zones or do you believe that the Epstein recharge is only based on the 1949 Maxey-Eakin methodology as was stated in your rebuttal slide?
A. I did not review Epstein's original report for this -- at this time. I read it ten years ago. And it's a similar methodology to Maxey-Eakin. I believe that he -- I believe that he did consider basin discharge and --
Q. So, if you believe it's based on Maxey-Eakin, how do you explain why the recharge coefficients of Maxey-Eakin are more than three times of those that were used by Epstein as relied on by Stetson? For example, Epstein uses 4.9 percent recharge between 15 and 20 inches of precip and Maxey-Eakin suggests a 15 percent recharge rate.
A. Well, when I say it's based on Maxey-Eakin methodology, it means it's based on the same type of method where you were estimating -- I mean you just described it. It's -- What did you say -- 4.9 percent for that particular zone. It's still a methodology of determining precipitation by zone. I didn't say they were the same regression coefficients. I mean, they came up with new coefficients.
Q. And you've reviewed that Figure 15 of the CSI July report that showed the recharge zones in the Coyote

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Spring Valley by elevation?
A. I don't remember it by number. I would have to -- I would have to look at it right now to verify that I specifically looked at that. I assume that I did because I reviewed the report. I don't remember what Figure 15 is.
Q. Are you aware whether those discrete basins that Stetson used to calculate recharge were used for accounting?
A. Used for -- I'm sorry. For accounting?
Q. And that recharge bands were actually used to develop the amount -- the estimated amount of recharge?
A. Recharge bands within each sub-basin, I presume?
Q. Throughout the entire area.
A. By -- By -- You mean throughout the entire area meaning just the east side of the Sheep Range?
Q. Correct.
A. But by 12 different sub-basins.
Q. Did you review the text on page 40 of the Stetson report that states if the Maxey-Eakin related methods investigated in our analysis are ignored since they rely on older precipitation maps and use runoff coefficient that should not be applied to newer rainfall maps, then the range of recharge in Coyote Spring Valley is between 5,280 acre-feet and 7,380 acre-feet per year. And we suggest the lower value be used for sustainability planning?

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A. I remember that, yes.
Q. And turning to the concept of precipitation, did you review the entire period of record for the Division 4 rainfall data beginning in 1895?
A. I looked at it as part of rebuttal when I saw -- when I considered the SNWA's plot, yes.
Q. Do you believe it's important to review that entire period of record to determine relative wet and dry periods?
A. I believe I was reviewing -- I focused on the most recent 30 years because that's pretty much what almost all of the reports here were referring to. And then we have no pumping data that goes prior to about 1990, so there's nothing to really directly compare it to.
Q. Do you know what the average precip is for the period of record for the Division 4 rainfall?
A. Off the top of my head, no.
Q. If most of the years after 1990 were below the long term, and that's the period of record average, would you draw the same conclusion that there's no evidence of a 20-year drought?
A. If they were -- If -- Do you want to say that again? I'm sorry. The average after 1990 is less than the long term --

Q. Can I restate the question?
A. Sure.
Q. Thanks. If most of the years after 1990 were below the long-term average, would you draw the same conclusion that there's no evidence of a 20-year drought?
A. It depends on the significance of being below. I mean, if you're talking 01 inches, no. If you're talking a couple tenths of an inch in this area, yeah.
Q. If most of the years after 2010 were below the long-term average would you continue to suggest a slight upward trend starting in 2010?
A. Well, based on my -- based on what I said about Palmer Drought Severity Index and the fact that I believe it is the rainfall that is the more important value. I mean it shows an upward tick in the trend. I think you should ask that question again. Because I don't think I understood your question.
HEARING OFFICER FAIRBANK: Did he answer your question?
MR. HERREMA: I had one question that follows up on the last couple.
HEARING OFFICER FAIRBANK: I'll permit you one additional question and then you're done.
MR. HERREMA: You haven't done that comparison

though to see where the years after 1990 or 2010 fall in relation to the long-term average.
THE WITNESS: With the long-term being from 1895?
MR. HERREMA: Correct.
THE WITNESS: No, I have not.
MR. HERREMA: Okay. Thank you.
HEARING OFFICER FAIRBANK: Next will be United States Fish and Wildlife Service? Seeing no questions.
National Park Service?
MS. GLASGOW: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions.
Moapa Band of Paiute Indians?
MR. BERLEY: No questions.
HEARING OFFICER FAIRBANK: Stating no questions.
Southern Nevada Water Authority and Las Vegas Valley Water District?
CROSS-EXAMINATION
By Mr. Taggart:
Q. Good morning, Dr. Myers.
A. Good morning, Mr. Taggart. We meet again.
Q. Yes. Not as much time this time though. Could you please turn to page nine of your power point slides. And on that slide I think that shows EH-4, the hydrograph for EH-4; correct?

A. Yes.
Q. So what's the basis for your opinion that the EH-4 water level is continuing to decline at this time?
A. Well, I mean, there's a trend from -- that is higher than that and that is slightly higher than that. I mean, the peak between 2015 and 2016 is slightly higher than the peak in 2017. And, thus, there's a -- I mean, if you just look at the top -- But I'm also comparing it -- It's almost more obvious up here in UMVM-1 and it seems more obvious also in EH-5b, but you can see it in all three of them which are all very closely parallel.
Q. Are you familiar at all with the pumping that was occurring during this time from the Arrow Canyon well?
A. I believe it was just a similar -- similar to what it's been through time.
Q. Okay. If there had been a reduction in Arrow Canyon pumping in the last couple of years of your hydrograph would that influence your view on whether there is a continuing declining trend at this location?
A. If there had been a decrease in Arrow Canyon pumping, I would have assumed that there should be a slight uptick in the flows and a slight uptick in the water levels, yes.
Q. Okay. On page 15 of your slides, you indicated

in your testimony that there was a lack of recovery after the pump test at some of these locations that are shown in this slide. Am I accurate in what you said there?
A. Well, after the pump test -- These are the two Pederson Springs. I believe I said that Pederson East showed very little recovery because you don't -- if you -- I mean, the Pederson Springs in blue went down and it did jump back up, whereas the Pederson East Springs show very -- I mean, there's a slight recovery, but it's very, very slight.
Q. But not back to the pre-aquifer test levels?
A. Oh, no. The pre-aquifer test levels are above .2 CFS and now they're below, generally below .15.
Q. Now, you indicated that recent flow measurements were at Warm Springs West gage, I mean in the last day, were, did you say 3.23 CFS?
A. That is correct.
Q. And what's the basis of that statement? Where did you get that information?
A. US Geological Survey water science center realtime flow data on the web.
Q. Okay. Were you present during the testimony of the panel for Lincoln County?
A. I think so, yes.
Q. Were you present during the testimony regarding

the resistivity data that Mr. Carlson presented?
A. Wait. Was that on Monday this week?
Q. I think it was yesterday, but I can't keep track of the days. And I think yesterday was Tuesday.
A. Well, that was only rebuttal, I thought. I am generally familiar with what you're saying, but I don't think I was there for the whole testimony.
Q. All right. On page 23 and in your conclusions there's one, two, there's a sub-bullet under your second conclusion about until all pumping is captured from spring discharge. So do you believe that spring flows at Warm Springs West gage could continue to decline even if current pumping remains at current levels?
A. Yes.
Q. And why?
A. Because we have not yet captured -- Because current pumping is not yet at a point of having captured all of -- it has not yet captured itself from spring discharge. It is still removing water from storage. I have shown quite honestly best by the one slide that SNWA put forth that I used.
Q. Okay. And then in your last bullet you indicated during your testimony -- I just want to get you to clarify what you meant by a comment that you made. Is it your belief

that even if you moved alluvial pumping to carbonate wells -- Let's see. This last sentence -- that it's probably not possible to increase that pumpage by transferring carbonate rights to basin fill wells. Is it your view that that would affect Muddy River decreed rights if that occurred, if moving alluvial rights to carbonate rights occurred?
A. If you move -- I'm arguing there should be no pumping at all from carbonate. So if you move alluvial to carbonate, that's the opposite of what I'm suggesting. I mean, I am suggesting that some alluvial pumping could possibly continue if it's not completely reducing Muddy River flows to the point of affecting downstream rights on the Muddy River.
Q. And do you also agree with the conclusion that others have reached that the pumping of alluvial wells in the Muddy River Springs area captures Muddy River flow on a one-to-one basis?
A. It captures it, but I've had this question of is it consumptively used or was some of it possibly ending up back in the Muddy River. In other words, you pump alluvial water and you irrigate with it -- And I'm not an expert on where all of the irrigation is occurring. But some of it could end up back in the Muddy River as a result of return flow.

Q. But if it was pumped for industrial purposes without -- that's fully consumptive, would that help you in clarifying your estimate?
A. It's fully consumptive and it's in a different basin where it's not going to recur in two of the rivers, yeah, that would be a one-to-one.
MR. TAGGART: Thank you.
HEARING OFFICER FAIRBANK: Mr. Taggart, you're out of time. Thank you.
Moapa Valley Water District.
CROSS-EXAMINATION
By Mr. Morrison:
Q. Good morning, Dr. Myers.
A. Good morning.
Q. I'm Greg Morrison with Moapa Valley Water District. Looking at your slide 13 on your presentation, I believe you, like the district's expert, Mr. Lazarus, examined the gradients throughout the Lower White River Flow System?
A. I did.
Q. All right. And you were aware of Mr. Lazarus' testimony on Monday that the gradient throughout the system is remarkably flat?
A. It is Monday that I did -- I mean, two days ago

that I did miss. But I agree with that statement, yeah. I believe I have it in my report somewhere.
Q. That was my question. Thank you.
You recommend that carbonate pumping in the Lower White River Flow System be zero; is that accurate?
A. To protect the spring flow, yes.
Q. You said you weren't here for Mr. Davis and Mr. Lazarus' testimony on Monday, but did you review the reports submitted by the district?
A. I believe so, yeah.
Q. Do you recall Mr. Davis' map that showed the location and the communities that this district serves?
A. I don't specifically recall that. I stuck with mostly hydrogeology. And, admittedly, I didn't have time to read every word from every report we have here, so I don't -- If you could show it to me though.
Q. That's understandable. Let's just say Mr. Davis stated the district serves approximately 8500 people, including the reservation of the Moapa Band of Paiutes. Do you recall reading anything like that?
A. I don't recall reading it, but I'm familiar with that fact. I mean, I do know approximately your service area or understand approximately where it's at.
Q. Okay. And you're aware that the district serves

its customers entirely using groundwater from the Arrow Canyon wells?
A. Yeah, I think I know that.
Q. So I guess my question for you is what should those 8500 people do for water?
MR. DONNELLY: Objection. That's not relevant to the facts and data and interpretation that Dr. Myers prepared.
HEARING OFFICER FAIRBANK: Can you relate your question to the four critical issues, the boundary, the flow of --
MR. MORRISON: We're talking --
HEARING OFFICER FAIRBANK: I understand that this is a policy issue as far as I'm understanding your question, so if you can relate it to those four questions or how within that five catch-all it relates back to those four specific questions, then --
MR. MORRISON: I'll try.
Q. (By Mr. Morrison) Dr. Myers, did you see Dr. Schwemm's presentation for the Fish and Wildlife Service?
A. Yeah, yes, I did.
Q. Do you recall seeing his slides detailing the number of Moapa dace month over month and year over year?
A. Yes.

Q. Do you remember seeing month over month and/or year over year increases in dace numbers during certain months and years?
A. Yes.
Q. Was carbonate pumping occurring during those months of increase?
A. There was -- I mean, those increases -- there were increases that occurred during the last 15 years. And, yes, there was carbonate pumping, so yes.
MR. MORRISON: All right. Thank you.
HEARING OFFICER FAIRBANK: Lincoln County, Vidler Water Company?
CROSS-EXAMINATION
By Ms. Peterson:
Q. Hi, Dr. Myers.
A. Good morning.
Q. Good morning. Karen Peterson representing Lincoln County Water District and Vidler Water Company. Did you calculate drawdown to the Muddy River Spring area from pumping Kane Spring Valley wells?
A. No.
Q. You indicate on page 19 of your original report that Kane Springs Valley pumping will reverse the gradient and draw water from Coyote Springs Valley. Do you recall

that?
A. Can you refer me to a section? I've got my report right in front of me.
Q. It's on page 19.
A. Okay.
Q. Middle paragraph.
A. Okay. And what was the statement again? I'm sorry.
Q. That Kane Springs Valley pumping will reverse the gradient and draw water from Coyote Spring Valley.
A. I say pumping in Kane Springs Valley that decreases that gradient would decrease flow in the CSV. Do I then say --
Q. About middle of the way, middle of the way down.
A. Well, I would say -- I would say that pumping in Kane Springs Valley, considering it's only five feet higher than in Coyote Spring Valley, if it pumped enough could reverse the gradient, yes.
Q. And did you -- how much pumping?
A. I don't know.
Q. So you didn't run any kind of model or do any kind of analysis to support that conclusion; is that correct?
A. There is not sufficient transmissivity data with which to run a model of that.

Q. Did you look at the information that Lincoln County and Vidler have supplied with regard to their pump test?
A. I don't recall looking at that, no.
Q. Do you have the URS report from 2006?
A. I didn't review the URS report.
Q. And then going to slide 23. The conclusion that Kane Spring Valley should be managed as part of the Lower White River Flow System. And you conclude with there the high likelihood that water pumped from Kane Springs Valley would quickly contribute to the depletion of the carbonate aquifer in Coyote Spring Valley in the Muddy River Springs area. Do you see that?
A. Yes.
Q. And, again, did you run any kind of model or do any kind of analysis to support that conclusion?
A. The analysis I did was qualitative because we are talking -- I mean, the overall results of the Order 1169 pump test were that we were removing water from a carbonate well that showed a drawdown of over about a five-basin area and thus my analysis of what -- of Kane Springs Valley affecting that is that -- is just another way of removing or preventing water from being in that five -- in that really high transmissive zone in the Lower White River Flow System.

Q. And you were relying on the State Engineer's findings in Ruling 6254; is that correct?
A. And as verified by almost every report here including the one I did.
Q. Right. But your report -- I mean, you don't have any -- you didn't do any modeling or you didn't do any independent analysis. It's just qualitative you just said; right?
A. I did independent analysis of the water levels and showed that we have a five-basin area, they all went down as a result of removing water from the carbonate.
Q. And what was your analysis? Tell me what your analysis was.
A. Observation of the water levels in comparison to the carbonate pumping that occurred throughout Lower White River Flow System. Now, I am clearly qualitatively moving that removal of groundwater from the carbonate to the mouth of Kane Springs Valley and assuming -- and at least making a leap of logic that indeed that would have a similar effect.
Q. In Kane Springs Valley?
A. Because the flow has to come from Kane Springs Valley in to Coyote Spring Valley. The removal of flow -- That interception of flow from Kane Springs in to Coyote Springs has to have an effect on the water levels in Coyote

Springs. It's based on simple water balance. It doesn't matter whether you're taking it out as a part of pumping down at MX-5 or pumping up at KPW-1.
Q. And you understand that in 2006 when the Kane Spring Valley applications of Lincoln and Vidler were approved that there was a proposal to put Kane Springs in to the Order 1169 basin area and that was objected by the State Engineer. Do you recall that?
A. I was not -- I did not participate in that particular hearing. I am aware of what you said, however. And I would just point out that was before all of the pump test data that we're analyzing here.
Q. Right. But after Order 1169 are you familiar with all of the pumping results and the State Engineer's determinations after Order 1169 and the 1169 pump test?
A. I am encouraging the State Engineer to consider adding it. I am aware that the State Engineer has included -- has recommended a certain number of basins. And I and a few other organizations -- us and a few other organizations think KSV should be added.
Q. Right. And there's no difference in the information that the State Engineer had when he issued his Order 1169-A, which was a different State Engineer, Jason King, on December 21st, 2012, and the information that you're

presenting today; is that correct?
A. Except we have the analysis of water levels at -- at the well in Kane Spring Valley.
Q. Did you look at the water levels?
A. Yes.
Q. What's the range, the period of time, that you looked at the water levels for the Kane Springs Valley well?
A. I considered the hydrograph for its entire period of record. I believe it started in 2,000 -- What did someone say yesterday? It started -- It was constructed in 2,000 -- Is that the one that started in 2005?
Q. That's about right.
A. Okay. And data started being collected about 2007, I believe. And so that whole time period on it.
MS. PETERSON: Thank you.
HEARING OFFICER FAIRBANK: City of North Las Vegas?
MS. URE: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions. Georgia Pacific Republic?
MS. HARRISON: No questions.
HEARING OFFICER FAIRBANK: Not seeing any questions.
Nevada Cogeneration Associates? Seeing no

questions.
Muddy Valley Irrigation Company?
CROSS-EXAMINATION
By Mr. King:
Q. Good morning, Dr. Myers. Steve King for Muddy Valley Irrigation Company.
A. Good morning.
Q. I would like to first turn to your slide 18. The fourth bullet down reads, trends at the Muddy River gage are likely due to surface and groundwater development upstream from the gage. Do you see that?
A. Yes.
Q. And that Muddy River gage would be the -- Is that the Moapa gage?
A. The gage that's presented here in this figure, yes.
Q. And then when you -- where it's written groundwater development upstream from the gage, would that be -- include ground, alluvial groundwater development in the Muddy River Springs area upstream from the gage?
A. Yes.
Q. Then turn to your slide, page 22, please. All right. The second bullet. Some basin fill pumping could be acceptable in MRSA because as a secondary recharge the water

has already been used in the spring channels most important for the dace. So this is related to the question just that I raised on slide 18. This pumping -- It's impossible alluvial pumping in the Muddy River Spring area upstream from the gage. Could that be accurate?
A. Yes. Yes.
Q. All right. And this statement, would it be fair to say that this is in relation to protecting the health of the dace?
A. Our -- The primary focus of my client has been sufficient flow in the springs and Muddy River for the dace. And so that's been my primary focus.
Q. Thank you. Then slide 23. And that's in conclusion slide. And here with the last bullet, and it's talking about some basin fill pumping could occur without significantly affecting spring flow. I'd like to go to the last sentence which reads, it is probably not possible to increase that pumpage by transferring additional carbonate rights to basin fill wells because of the observed long-term decline in Muddy River flows.
My next question in that regard is that I thought when you were testifying and answering a question I think relating to the slide you used the term Muddy River flow rights. I might have been wrong. So when you say Muddy

River flows I think you testified or in answering a question of flow rates, would those be what I would characterize as Muddy River decree rights?
A. Well, the Muddy River Decree, which I believe has about -- is about 37,000 acre-feet. And I was referring to Muddy River flows that was on those previous graphs. And there's been a decline but not -- I mean, recently it has come up. I mean, it's gone up and down based on a few management changes.
Q. And then in answer to one of Mr. Taggart's questions, I think it might have been his last question, and I'm paraphrasing. I think Mr. Taggart asked if there was a fully consumptive use of an alluvial groundwater well that was pumped in the Muddy River Spring area would that affect downstream senior decree Muddy River rights?
A. At a one-to-one ratio was ultimately the question and ultimately what I agreed with, yeah.
Q. Well, thank you. The reason I wanted to clarify that because I think that -- your answer I thought you might have -- you might have brought in an analysis in a different basin. But I think his question had to do with the Muddy River Spring area. Would that be right?
A. My recollection of the question was that it was pumping in the Muddy River Spring area of alluvial -- of

alluvial water. And if that was then take being to an inch have industrial use which I believe he's referring to outside the basin. Then there could be no return flow. I was just opening up the idea that some pumping could have lead to return flow. I honestly don't know whether there is any or not in that area.
MR. KING: Thank you. I think I understand better. And I think just for my understanding of some of the permitted alluvial pumping rights were for recharge or power plant uses which are in if not the spring area then directly in to the Lower Meadow Valley Wash. Okay. Thank you.
HEARING OFFICER FAIRBANK: Bedroc?
MS. URE: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions. Nevada Energy?
MS. CAVIGLIA: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions, I will go ahead and open it up to Division of Water Resources staff.
EXAMINATION
By Mr. Benedict:
Q. Jon Benedict for the record. Going back to slide 13, I think. On this legend you provide information about hydraulic gradient in a different way than was provided

previously but you also state that the gradient is remarkably flat throughout the area?
A. That's correct.
Q. You show a gradient above 50 feet and ten miles or tenth of a percent. Does that refer to that flat gradient or is that -- What does that refer to?
A. That is referring to going upstream from CSVM-6. There's not a 50-foot drop -- There's -- Over 20 miles there's only a couple of feet plus or minus. But when you go from 1820 to about 1870 up to CSVM-4, that's referring to -- to about a 50-foot drop over what appears to be about a ten-mile area, excuse me, a ten-mile distance. I should have labeled that better. I don't think I actually talked about it when I was presenting.
Q. So that area that you consider to be flat is more the area around CSVM-6 through EH-4 and then --
A. Yeah. I mean, the relative flat area is from, yes, from CSVM-6 to EH-4. That's the area that acts kind of like a pond or a reservoir.
Q. Do you think the gradient between CSVM-4 and CSVM-6 has any implication to how we consider management?
A. Part of the reason for showing that gradient is in a lot of basins -- 0.1 percent would not be considered a steep gradient. It would really not be considered a steep

gradient in a lot of places I've worked over the years. But in contrast with this lower, you know, the lower 20-something miles, which is practically flat, it seems steep. It has a lower transmissivity than we have down here in what I'll call the pond there, yeah, which may be -- you know, then in the relatively flat area. But it's not an extremely high gradient and the flow -- and you do have flow coming from the northern part of Coyote Spring Valley through to, you know, down to the MX-5 area in the pump test area. And so you're going to continue to manage that. Because drawdown did propagate to CSVM-4, up that 50 feet.
MR. BENEDICT: Thank you.
THE WITNESS: You're welcome.
EXAMINATION
By Mr. Kryder:
Q. Levi Kryder for the record. Dr. Myers, what do you think the hydrologic boundaries of the Lower White River Flow System are?
A. What the State Engineer has stated and plus the Kane Spring Valley. I mean, basically all of Coyote Spring Valley, California Wash, Hidden Valley, Garnet Valley, and that portion of the Black Mountains, and then Kane Springs Valley. And I suppose we can argue whether there's some part of Kane Springs Valley to the north that's too volcanic to be

part of it. But I would include Kane Springs Valley with what otherwise the State Engineer is considering as part of the Lower White River Flow System.
MR. KRYDER: Thank you.
EXAMINATION
By Mr. Sullivan:
Q. Adam Sullivan for the record. Dr. Myers, thinking about your characterization or your discussion about steady state capture and observation that water levels are -- continue to decline, I'm wondering if you think, would it follow that you could have some lesser amount of carbonate pumping that would reach a steady state at Warm Springs West that would be higher than 3.2 but somewhat less than pre-development flows at that point, so thereby protecting the dace?
A. There may be a very small amount. But since we're already at 3.23 it would be very -- it would not be very -- it would not be very much. It would -- I mean, ultimately, if you go to complete steady state and you neglect recharge and you neglect other changes in inflow either from Pahranagat Valley or from Kane Springs Valley, if you neglect other changes like that, you could -- there would be a point at which the pumping equals the decreased discharge from previous steady state, from steady state

levels.
And I don't -- I've said, you know, there's no drought -- I don't think there's a huge drought effect going on here. There could be multi-decade or even multi-century changes that ultimately have to be considered going forward. I mean, a lot of this water is pretty old. It could be it's recharge from a long time ago. Did that answer your question?
Q. Yes, it did. And then early on you mentioned a distinction between alluvial pumping inn Coyote Spring Valley as an example of something that might be able to be developed without long-term impacts to the Muddy River Springs area. Do you have a similar feeling about alluvial pumping at other places within this Lower White River Flow System?
A. Well, I mean, there is only alluvium -- saturated -- I'm not even aware of saturated alluvium in Garnet or if you're asking me about other parts of the system, I'm not aware of any in Garnet and Hidden, for example.
Q. Yeah. Maybe I should just say wells that are not completed in carbonate where we observe very similar water level trends?
A. I'm not -- I'm not aware of any, but I would clearly -- if you don't -- if you didn't see a major impact

during the pump test -- I mean, part of my reason for saying this about the basin fill in Coyote Springs is that the basin fill seems to have substantially higher water levels than is in the carbonate and that's suggesting to me that there's not a whole lot of connectivity between the two and therefore that may be a separate source. But it would also be local recharge. And there's not a whole lot of, as I've said before, there's not a whole lot of local recharge in Coyote Spring Valley either.
That requires more study, but it's just a suggestion that you might -- that the State Engineer might consider for additional water in this area.
MR. SULLIVAN: Thanks.
THE WITNESS: Sure.
EXAMINATION
By Ms. Barnes:
Q. Earlier in your discussion you mentioned that you're recommending additional study to investigate the connection between alluvial and carbonate aquifers. I guess what data or what information would you think is necessary for that recommended study.
A. Well, if you're talking about Coyote Spring Valley, I think we would be doing a pump test that has monitoring wells both in carbonate and in basin fill. And

also probably -- And this may have already been done, but there needs to be some down-hole geophysics. Is there an unsaturated or a very low transmissivity zone between the saturated basin fill and the underlying carbonate? When I see as much as 200 feet of difference, it's telling me that there's a clay layer or something that does not allow much water to flow in to the deeper carbonate aquifer.

And, thus, I don't know if it needs to have any holes drilled or just a reconsideration of well logs. I didn't do that, but that would be one way of getting at what you're asking.

MS. BARNES: Thank you.

HEARING OFFICER FAIRBANK: Okay. We've been going about two hours, so let's go ahead and take a ten-minute break. And we'll see everyone back here at 10:40. Thank you.

(Break was taken)

HEARING OFFICER FAIRBANK: So we'll go ahead and open it back up for cross-examination again. And Coyote Spring Investments?

MR. HERREMA: No questions at this time.

HEARING OFFICER FAIRBANK: Seeing no further questions.

US Fish and Wildlife Service. Seeing no

questions.

National Park Service?

MS. GLASGOW: No questions.

HEARING OFFICER FAIRBANK: Seeing no questions.

Moapa Band of Paiute Indians?

MR. BERLEY: No questions.

HEARING OFFICER FAIRBANK: No questions.

Southern Nevada Water Authority, Las Vegas Valley Water District?

MR. TAGGART: Yes, we have a couple.

Good morning, Dr. Myers. For the record, Paul Taggart for the water authority and then Las Vegas Valley Water District. I just have -- How many minutes do I get?

HEARING OFFICER FAIRBANK: Five.

MR. TAGGART: Thank you.

CROSS-EXAMINATION

By Mr. Taggart:

Q. Dr. Myers, I put in front of you SNWA's hydrologic exhibit, which I believe is SNWA Number 7, and I've asked you to look at a figure there which is the Warm Springs West gage hydrograph. Do you see that? It's in Figure 5-7.

A. Yes, I see that.

Q. Okay. Are you aware that the State Engineer

asked for reports after the Order 1169 pumping test to be submitted by all parties and that you yourself submitted a report at that time?

A. Yes.

Q. Do you -- Just for the record, I -- Well, do you remember when that was? Was it mid-2013, does that sound right?

A. It was -- Yeah, it was just -- it was within a few months after the pump test. I don't remember the exact date.

Q. Okay. And in those reports are marked by the State Engineer as Exhibits 245, 46, 47, 48, there's a CBD Order 1169 report in it's 248 and CSI has a report at Exhibit 247.

So at the time those reports were submitted was part of the data that's shown in that hydrograph in Figure 5-7 available, particularly the data that comes after 2013?

A. Well, it would depend. I mean, I don't remember the exact date of that, but, yeah, there would have been some additional data available.

Q. Okay. But, I mean, is it fair to say that we have an additional six years of hydrologic data since all of those reports were submitted?

A. Oh, absolutely, there's six more years.

Q. And is that data -- And I'm asking because there's been this statement -- And I guess I'll ask you whether you agree with it. But do you agree with the statement that the only new evidence presented at this hearing is the recharge calculations from Mr. Reich and the resistivity data that was presented by Mr. Carlson for CSI and Lincoln County. Do you agree with that statement?

A. Well, that's not the only new data. We still have all the continued water level data and spring flow data.

Q. Okay. And what I want you to ask you about is that particular data. Is that data important to understand effects of climate on the water levels in the Lower White River Flow System since 2019?

A. Since?

Q. I'm sorry. Since 2013.

A. It is important to -- If I understand your question, it is important to understand the effects of climate. I mean, yes, climate is a part of what we have since 2013. Neither extreme drought nor extreme wet. I mean, neither extreme dry nor extreme wet. But that's why I did focus on it a fair amount.

Q. Okay. And obviously the analysis of the six additional years of water level data and stream flow data the analysis of the National Park Service, the Fish and Wildlife

Service, SNWA, CBD, the City of North Las Vegas, all of their analysis was not available in 2013; right?
A. That's correct.
Q. And are you also familiar with the statistical analysis that SNWA performed and specifically the linear regression between MX-4 and other monitor locations in Coyote Spring Valley and the Lower White River Flow System during the 1169 pump test?
A. I'm aware of -- Yes, I am aware of the linear regressions.
Q. Okay. Well, do you know if that statistical analysis of the relationship during the pump test of certain water levels in monitor wells, I should say, that analysis was not available in 2013 either; correct?
A. Not the analysis that you presented or that SNWA presents that includes data to date, to 2019, no.
Q. Well, and the recovery of the system to the pump test, what's your view on the importance of the additional six years of data to analyzing the recovery of the system to that pump test?
A. Well, in addition to just being additional data for the regression analysis, I mean, I would think in terms of it being -- I mean, recovery data in a relationship like this can be a little different than the initial drawdown. I

mean, there can be a bit of a hysteresis effect, meaning that a lag in -- which I think actually explains -- I mean, there's a bit of a scatter around all the plots that SNWA present. And I've thought about that. Some of it is when water is going up and some of it is when it's going down. It makes a site difference and it adds to the scatter, but it doesn't take away from your overall linear regression results.
MR. TAGGART: Thank you.
HEARING OFFICER FAIRBANK: Thank you.
Moapa Valley Water District? Seeing no further questions.
Lincoln County, Vidler.
CROSS-EXAMINATION
By Ms. Peterson:
Q. Hi, Dr. Myers. Karen Peterson again.
A. Good morning.
Q. Did you consider including Lower Meadow Valley Wash in to the boundaries of the Lower White River Flow System?
A. Very briefly. And I don't think I reached a conclusion. I just failed -- I just stopped considering it because there's not much data. There wasn't much reaction from the -- I think, overall, if you were to ask me I would

probably not include it.
Q. And you testified earlier today that your client's purpose was to protect the dace. Do you recall that?
A. That's correct.
Q. Would you agree that the US Fish and Wildlife Service is also the agency responsible for protecting the dace?
MR. DONNELLY: Objection.
HEARING OFFICER FAIRBANK: And what's the basis for your objection, Mr. Donnelly?
MR. DONNELLY: A hydrologist may or may not be familiar with the purpose of federal agencies.
HEARING OFFICER FAIRBANK: I think it's a fair question to the extent of his knowledge.
THE WITNESS: I'm aware that Fish and Wildlife is responsible for managing the dace.
Q. (By Ms. Peterson) And you are aware that the Kane Springs Valley project received a biological opinion from Fish and Wildlife? Are you aware?
A. I'm not aware. Though it doesn't surprise me.
Q. Okay. All right. That the service found that the project was not likely to jeopardize the continued existence of the endangered dace?

A. I'm sure that's what it said. Although I'll point out that it was prior to the pump test.
Q. And you agree that there was a stipulation that was entered in to with Lincoln County, Vidler, and US Fish and Wildlife on the Kane Springs applications that had triggers, the 3.2 trigger, action trigger?
A. I'm familiar with the 3.2 action trigger. I don't recall exactly what you just -- I'm sorry. I don't recall exactly that description.
Q. Okay. So I'll represent to you that for the Kane Springs pumping for the applications that have been approved and for future applications there is an amended stipulation and the triggers are included in that stipulation, all right.
A. Okay.
Q. So did you also hear the testimony of Mr. Williams that with the biological opinion and the triggers in place that Lincoln and Vidler are in compliance with the Endangered Species Act?
A. I believe Mr. Williams was on Monday when I wasn't here.
Q. All right. Well, I'll represent to you that's his testimony, all right.
A. Okay.
Q. So we're in compliance with the law; right?

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MR. TAGGART: Objection. This is all outside the scope of any direct that was asked of this witness.
MS. PETERSON: It goes --
HEARING OFFICER FAIRBANK: I tend to agree with Mr. Taggart's objection on the basis that this is outside the scope of his original testimony today. And I don't know that it is contemplated within the reports proffered by Center for Biological Diversity. So if you could relate the questions to those particular issues then I may entertain the questions.
Q. (By Ms. Peterson) Your recommendation to the State Engineer today on behalf of your client is that there is no further carbonate pumping; is that correct?
A. That is correct.
Q. And I'm telling you that Mr. Williams testified on Monday -- Sorry. The day that you weren't here -- that with the biological opinion and the amended stipulation and the triggers in place, Lincoln and Vidler are in compliance with the Endangered Species Act. I'll give you that premise. Is that correct? I'll give you the premise. Sorry.
A. Okay.
Q. So I'm giving you that premise and your position is that they're in compliance with the law but they should not be able to pump their water rights?

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A. My hydrologic analysis is that continued pumping of the carbonate will continue a drawdown and that will cause it to go below 3.2 and will cause it to go below further trigger points in the MOA. And I believe in the stipulated agreement you were referring to.
Q. And you haven't done any kind of modeling or any kind of Theis equation or any kind of hydrologic analysis like that to support your conclusion that Kane Springs carbonate pumping is going to impact the dace?
A. Well, a Theis analysis would be inappropriate for these conditions. But what I have done is a water balance analysis that takes in to account -- I mean, I've done a qualitative water balance under assessment that shows we have not yet captured all of the spring -- I mean, pumping has not captured spring flow. I mean, it has to eventually capture spring flow. It's the first principle. And so -- And it's continuing to go downward and, thus, eventually pumping. And I do think continuing in Kane Springs Valley will contribute to that, yes.
MS. PETERSON: Thank you.
HEARING OFFICER FAIRBANK: City of North Las Vegas?
MS. URE: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions.

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Georgia Pacific Republic?
MS. HARRISON: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions. Nevada Cogeneration and Associates? Seeing no questions.
Muddy Valley Irrigation Company?
MR. KING: No questions.
HEARING OFFICER FAIRBANK: No further questions. Bedroc?
MS. URE: No questions.
HEARING OFFICER FAIRBANK: No questions. And Nevada Energy?
MS. CAVIGLIA: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions, I'll open it back up to Division of Water Resources staff.
All right. We'll open it up one last time. Coyote Springs Investments, do you have any further questions?
MR. HERREMA: No.
HEARING OFFICER FAIRBANK: US Fish and Wildlife? National Park Service?
MS. GLASGOW: No questions.
HEARING OFFICER FAIRBANK: No further questions. Moapa Tribe? No further questions.

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Southern Nevada Water Authority? Seeing no further questions.
Muddy -- or excuse me. Moapa Valley Water District? No questions.
Lincoln County Vidler? No further questions.
All right. I'm assuming that then everyone else who hasn't asked any questions doesn't have any questions. So I'm not going to go through the list name by name unless anybody really expects me to do so.
All right. Now, let's go ahead and take about a five-minute break and then we'll transition -- Oh, I'm sorry. Mr. Donnelly, do you have any redirect?
MR. DONNELLY: Just a minute or two.
REDIRECT EXAMINATION
By Mr. Donnelly:
Q. Thank you. Patrick Donnelly for the record. I will not be using our full 46 minutes. Just a couple of quick questions.
Would you say that, Dr. Myers, that the pump test, Order 1169 pump test, presented substantial new information to our understanding of the hydrology of the Lower White River Flow System?
A. Yes.
Q. You were evaluating this system prior to the pump

test with the Center for Biological Diversity; is that correct?
A. I began essentially working with the center on Lower White River Flow System at the beginning of and assessing the MOA at the beginning, as I recall. So, yes, right at the beginning of the pump test.
Q. So would you say that the substantial new information you just said was presented by the pump test would influence or otherwise shape your understanding of the system as presented in your report here?
A. Yes, it would.
Q. And would you think it reasonable for any hydrologic models developed to understand the system to incorporate that 13-year set of data since 2006?
A. Oh, yes. I mean, there is -- I mean, the pump test provided a substantial stress to the system, which is, when you're calibrating a groundwater model you like stress, preferably beyond the point of which your future uses are going to occur. I mean, it's great calibration data.
MR. DONNELLY: Okay. Thank you. No further questions.
HEARING OFFICER FAIRBANK: Okay. Then with that we'll go ahead and take a five-minute break. And then we'll be ready to start with Georgia Pacific, Republic Industries,

and Dry Lake starting at 11 a.m. Thank you.
(Break was taken)
HEARING OFFICER FAIRBANK: We will go ahead and get started now with the Georgia Pacific, Republic, and Dry Lake water. And so we will go ahead and turn it over.
MS. WILLIAMS: Good morning. I'm Paulina Williams with Baker Botts. I'm here on behalf of Georgia Pacific. And with me is my co-counsel, Sylvia Harrison, with McDonald Carano, who is here on behalf of both Georgia Pacific and Republic Environmental Technologies.
And we have with us today John Bell. And so I would ask that he be sworn in.
(The witness was sworn in)

JONATHAN BELL
Called as a witness on behalf of Georgia Pacific and Republic, having been first duly sworn, Was examined and testified as follows:

DIRECT EXAMINATION
By Ms. Williams:
Q. Mr. Bell, would you please state your full name and the spell it for the record.
A. Jonathan Bell, J-o-n-a-t-h-a-n, Bell, B-e-l-l.

Q. And can you state your affiliation and title?
A. I'm an associate hydrogeologist with Broadbent Associates.
Q. And are you here on behalf today of Georgia Pacific and Republic Environmental Technologies?
A. I am.
Q. And, just for the record, I know the report is written also on behalf of Dry Lake. But are you here today on behalf of Dry Lake?
A. I am not.
Q. Are you familiar with Exhibit GP-REP01, which is called Broadbent July 2nd, 2019, initial report?
A. I am.
Q. And did you prepare GP-REP01?
A. I did prepare that.
Q. And is GP-REP01 a true and correct summary of your review and opinions?
A. It is.
Q. Are you familiar with Exhibit GP-REP02, which is called Broadbent August 16th, 2019, rebuttal?
A. I am.
Q. And did you prepare GP-REP02?
A. I did.
Q. Are there any corrections you would like to make

to GP-REP02?
A. I do have one -- two corrections, actually. On page six, the last paragraph, the response paragraph, the final sentence. And I incorrectly list it as eastern portion of the basin moving eastward. And it should be western portion. And the final word in that sentence, basin, should be removed also. That's a typo.
Q. With those corrections is GP-REP02 a true and correct summary of your review and opinions?
A. It is.
Q. Are you familiar with GP-REP03 which is called the --
(The court reporter interrupts)
Q. (By Ms. Williams) CV, curriculum vitae?
A. I am.
Q. And did you prepare GP-REP03?
A. I did.
Q. And is GP-REP03 a true and correct copy of your CV summarizing your qualifications?
A. It is.
MS. WILLIAMS: So we'll note that there were no objections to Mr. Bell's qualifications as an expert or to these exhibits. And we offer GP-REP01, 02 as corrected, and 03 in to evidence.

HEARING OFFICER FAIRBANK: And we will go ahead admit Exhibits GP-REP01 through 03. And with respect to the qualification, what is the scope and disciplines in which you're proffering Mr. Bell as an expert in?
MS. WILLIAMS: Geology and hydrogeology.
HEARING OFFICER FAIRBANK: Okay. And off the basis of that, Mr. Bell was not objected to. Mr. Bell will be qualified for the limited purposes of these proceedings, given that there was no objection. And that qualification will be such limited in any further proceedings he would have to be requalified.
MS. WILLIAMS: With that we're prepared to pass the witness, but we would like to reserve the opportunity for redirect.
HEARING OFFICER FAIRBANK: All right. We will go ahead and open it up for cross-examination of Mr. Bell. And so we will go ahead and start with Coyote Spring Investments.
CROSS-EXAMINATION
By Mr. Herrema:
Q. Good morning, Mr. Bell.
A. Good morning.
Q. Brad Herrema on behalf of CSI. I just have one question. The last sentence of your July report, which I believe is your Exhibit Number 1, says, we believe that

treating all of the Lower White River Flow System as a single heterogeneous basin and correcting any imbalance in groundwater diversions by a priority date is not supported by the current science.
My question is whether the word heterogeneous is correct or whether that should say homogenous?
A. That, in fact, should be homogenous.
MR. HERREMA: Okay. Thank you.
HEARING OFFICER FAIRBANK: United States Fish and Wildlife Service? Seeing no questions.
National Park Service?
MS. GLASGOW: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions.
Moapa Band of Paiute Indians?
MR. BERLEY: No questions.
HEARING OFFICER FAIRBANK: Southern Nevada Water Authority?
MR. TAGGART: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions.
Moapa Valley Water District? Seeing no questions.
Vidler and Lincoln County? No questions.
City of North Las Vegas?
MS. URE: No questions.

HEARING OFFICER FAIRBANK: No questions.
Nevada Cogeneration Associates? Seeing no questions.
Muddy Valley Irrigation Company?
MR. KING: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions.
Bedroc?
MS. URE: No questions.
HEARING OFFICER FAIRBANK: No questions.
And Nevada Energy?
MS. CAVIGLIA: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions.
All right. Well, given the fact that there are no further questions, we will open it up for Georgia Pacific. Do you have any additional questions or presentation?
MS. WILLIAMS: No, we do not.
HEARING OFFICER FAIRBANK: All right. Seeing nothing further -- Oh, and just one last comment -- Do we have any questions from staff?
EXAMINATION
By Mr. Benedict:
Q. I believe in your report you stated that the exclusion of Las Vegas Valley is arbitrary based on some of the inferences that were made about flow between the two. Do

you suggest that the geographic boundaries should be something different than that's been proposed by the State Engineer.
A. I believe that boundary needs to be further investigated. There's some evidence I think with some of the groundwater elevations that were collected that there's potential that there could be inflow from Las Vegas basins. So I just think it's a spot where we probably don't have enough data to understand that relationship, that boundary relationship.
Q. Do you have any other opinions on other boundaries that exist from the study that you've done?
A. Not -- No, not at this point.
MR. BENEDICT: Okay. Thank you.
HEARING OFFICER FAIRBANK: All right. I'll open it again. Does anybody else have any questions? Seeing lots of shakes of the head, I'm going to take that as a no.
All right. Well, then let's go ahead and wrap this day up. And based upon our time schedule, we will go ahead and to allow additional time for lunch tomorrow, since we've concluded today early and gotten through the initial scheduling for tomorrow morning, we will start at 12:30 tomorrow with the Muddy Valley Irrigation Company. Excuse me. Let me rephrase that. We will start at 12:30 tomorrow

with Nevada Cogeneration and Associates and then we will finish the day with Muddy Valley Irrigation Company. And so we will start tomorrow at 12:30 and we will see everyone then. Thank you.

(Hearing concluded at 11:15 a.m.)

STATE OF NEVADA)
)ss.
COUNTY OF WASHOE)

I, CHRISTY Y. JOYCE, Official Certified Court Reporter for the State of Nevada, Department of Conservation and Natural Resources, Division of Water Resources, do hereby certify:

That on Wednesday, the 2nd day of October, 2019, I was present at the Legislative Counsel Bureau, Carson City, Nevada, for the purpose of reporting in verbatim stenotype notes the within-entitled public hearing;

That the foregoing transcript, consisting of pages 1499 through 1595, inclusive, includes a full, true and correct transcription of my stenotype notes of said public hearing.

Dated at Reno, Nevada, this 2nd day of October, 2019.

____
CHRISTY Y. JOYCE, CCR #625

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SE ROA 53646

JA_18043

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In The Matter Of:

DEPARTMENT IF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURSES

Vol. IX
October 03, 2019

Capitol Reporters
123 W. Nye Lane, Ste 107

Carson City, Nevada 89706

Original File 100319finalWater.txt

STATE OF NEVADA
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
BEFORE MICHELINE FAIRBANK, HEARING OFFICER
---oOo---

IN THE MATTER OF THE ADMINISTRATION AND MANAGEMENT OF THE LOWER WHITE RIVER FLOW SYSTEM WITHIN COYOTE SPRING VALLEY HYDROGRAPHIC BASIN (210), A PORTION OF BLACK MOUNTAINS AREA HYDROGRAPHIC BASIN (215), GARNET VALLEY HYDROGRAPHIC BASIN (216), HIDDEN VALLEY HYDROGRAPHIC BASIN (217), CALIFORNIA WASH HYDROGRAPHIC BASIN (218), AND MUDDY RIVER SPRINGS AREA (AKA UPPER MOAPA VALLEY HYDROGRAPHIC BASIN (219).
_______________________________________/

TRANSCRIPT OF PROCEEDINGS
PUBLIC HEARING
HEARING ON ORDER 1303
VOLUME IX
(P.M. SESSION, Pages 1597 - 1712)

THURSDAY, OCTOBER 3, 2019

REPORTED BY: CAPITOL REPORTERS
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(Continued)

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-and-
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For CSI: Brownstein Hyatt Farber Schreck
By: Bradley J. Herrema, Esq.
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For Lincoln County Water District/
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By: Karen Peterson, Esq.
Carson City, Nevada

For NCA: Alex Flangas, Esq.
Reno, Nevada

For Moapa Band of Paiutes: Richard Berley, Esq.

For Moapa Valley Water District: Greg Morrison, Esq.
For Muddy Valley Irrigation: Steve King
For Bedroc: Therese Ure, Esq.
For City of North Las Vegas: Therese Ure, Esq.
For National Park Service: Karen Glasgow
For Center for Biologic Diversity: Patrick Donnelly

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I N D E X
(Continued)

CARSON CITY, THURSDAY, OCTOBER 3, 2019, P.M. SESSION

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HEARING OFFICER FAIRBANK: This is the continuation of the hearing regarding the administration of the Lower White River Flow System in Order 1303. And today we are going to go ahead and hear presentations from Nevada Cogeneration Associates and then from the Muddy Valley Irrigation Company. And so we will go ahead and get started this morning.

And so, Mr. Flangas, you have one hour for the presentation of your evidence and testimony from your experts and witnesses with respect to the Order 1303 matters. And then after the expiration of the hour or if you finish earlier, then we'll go ahead and open that up for cross-examination.

MR. FLANGAS: Just for clarification, I thought we had -- Yeah. I thought we had two and a half hours total, so I was thinking we had an hour with a little bit of time for redirect. Was I wrong on that?

HEARING OFFICER FAIRBANK: We divided it up in to two hours.

MR. FLANGAS: Okay.

MR. COACHE: The order says two and a half.

MR. FLANGAS: I'm sorry. I was -- We just wanted

to make sure that we had our time down so that -- We had sort of prepared to do a one-hour presentation with a ten-minute redirect. But if I have it wrong, that's fine. We'll just have to speed it up. I just want to make sure.

Okay, guys.

HEARING OFFICER FAIRBANK: Well, it looks like I made a typographic error, so hopefully we can try to work around it. But we'll make sure that we give everybody an equal opportunity. Because all of the other participants who submitted rebuttal reports were allotted two hours. And so that's what happens when you give lawyers calculators.

MR. FLANGAS: Okay. Guys. Would you do me a favor then, if you can just let us know when we're at 50 minutes so we don't go over our time, so we can reserve just a little bit of time.

HEARING OFFICER FAIRBANK: We'll do that. And we'll also work to accommodate. I think we can probably have a little bit of time to accommodate due to that error in the state hearing notice.

MR. FLANGAS: No problem.

HEARING OFFICER FAIRBANK: We didn't recognize that prior to this moment. Thank you.

MR. FLANGAS: Thank you very much. Well, thank you. Nevada Cogeneration Associates Number 1 and 2. I'm

here with three witnesses that are all authors of the NCA report. And we will use NCA as an abbreviation. I have with me here today Mr. Hugh Ricci, Mr. Jay Dixon, and Mr. Bob Coache. I'll begin with Mr. Dixon. Mr. Dixon, could you tell us --

(The court reporter interrupts)

(The three witnesses were sworn in)

JAY DIXON

Called as a witness on behalf of Nevada Cogeneration Associates, having been first duly sworn, Was examined and testified as follows:

DIRECT EXAMINATION

By Mr. Flangas:

Q. Mr. Dixon, could you give us a little bit of your background, please.

A. My name is Jay Dixon for the record. So I've been a practicing hydrologist for over 25 years. I've got a Master's degree in civil engineering from the University of Nevada, Las Vegas. And, specifically, I've been working on various projects in what is now the Lower White River Flow System for about 15 years in the capacity of a consultant.

Q. Mr. Dixon, were you one of the authors of the NCA

rebuttal report in this matter?
A. I was. I wrote specific sections on my own and I reviewed and contributed to all sections included in the report.
Q. Did you work -- Who did you work with in regards to that report?
A. Bob Coache and Hugh Ricci.
Q. With regard to Mr. Coache and Mr. Ricci, did they have input in to your sections prior to becoming finalized?
A. Yes, they reviewed, edited, and approved my sections as necessary.
Q. And with regard to their sections, who else was involved in drafting?
A. Bob Coache drafted specific sections on his own and then Hugh and I reviewed and edited as necessary.

ROBERT COACHE
Called as a witness on behalf of
Nevada Cogeneration Associates, having been first duly sworn,
Was examined and testified as follows:

DIRECT EXAMINATION
By Mr. Flangas:
Q. Okay. Mr. Coache, could you give us a little bit

of your background, please.
A. Yes, sir. This is Robert Coache --
HEARING OFFICER FAIRBANK: Mr. Coache, will you make sure your microphone is on.
THE WITNESS: Robert Coache, C-o-a-c-h-e. I have a Bachelor of science degree in watershed science from the University of -- Utah State University. I'm also a registered professional engineer.
My experience, personal experience, with the White River flow system goes back to 64-65, starting with the Division of Water Resources in '81. I have approximately 35 plus years of experience in hydrology, water rights, the Lower White River Flow System, and other basins in that area.
Q. (By Mr. Flangas) Could you bring the microphone just a little closer to you. That will be better. Thank you.
You heard Mr. Dixon's response with regard to how the report was prepared. Is that consistent with your understanding?
A. Yes, sir.
Q. Thank you.
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HUGH RICCI
Called as a witness on behalf of
Nevada Cogeneration Associates, having been first duly sworn,
Was examined and testified as follows:

DIRECT EXAMINATION
By Mr. Flangas:
Q. Mr. Ricci, could you give us a little bit of your background, please.
A. My background, I was the -- I worked for the Division of Water Resources -- Let me back up. I have a Bachelor of science degree civil engineering from the University of Nevada. I worked with the Nevada Division of Water Resources for 26 years from 1981 to 2006. From 1991 to 2000, I was the Deputy State Engineer. And from 2000 to 2006, I was the Nevada State Engineer.
Q. And you heard Mr. Dixon's response with regard to how the report, the NCA rebuttal report, was prepared. Did you have input with regard to the editing and input in regard to how that final report was made?
A. Yes. My role mainly was under the review and editing and suggestions dealing with some of the issues that they stated.
Q. Thank you. Okay. Mr. Dixon, did you prepare --

Did the team here prepare a power point for today's presentation?
A. Yes, we did.
MR. FLANGAS: Okay. At this time we would like to, if we could, turn on the power point, if we know how.
HEARING OFFICER FAIRBANK: May need to go ahead and open or get the projector warmed up.
MS. PETERSON: Just before we start the power point, because I don't want to take up too much of your time. But we, Lincoln and Vidler, have an objection to page 27, 29, 30, 31, 36, and 39 of the power point because it's additional analysis and reasoning and additional opinion not contained in the reports of these experts.
HEARING OFFICER FAIRBANK: Karen, can I have you do that on the record, just because I am not going to summarize -- Can you do it on a microphone so that we can make sure that those who may be appearing and attending from afar.
MS. PETERSON: Okay. Thank you. Karen Peterson on behalf of Lincoln and Vidler. We would object to the power point pages 27, 29, 30, 31, 36, and 39, because they contain additional analysis, additional opinions, that are not contained in the rebuttal report.
HEARING OFFICER FAIRBANK: And just so I'm clear,

that was 27, 29, 30, 31, 36, and 39?

MS. PETERSON: Yes.

HEARING OFFICER FAIRBANK: Mr. Flangas, do you have a response?

MR. FLANGAS: Part of our response would be that some of our power point is a response to testimony that we've had in this case already and the experts in this matter have heard the testimony from Vidler's experts in this case. I think it's appropriate for my experts to show up at this point in time and respond to the testimony they've heard in this case.

If part of our power point responds to the Vidler responses in this case, the fact that it wasn't contained in our response or report is appropriate testimony. These experts are here responding to testimony that occurred just days ago from Vidler's own experts. That's a completely appropriate response from experts in this case.

I don't know -- I haven't reviewed every single matter. But when I went to the very first page, 27, this is just a direct response to what was in Vidler's report. And I don't think this is, the second bullet, was one of the cross-examination questions that I asked of Vidler's experts, which was the CH2M Hill report.

I haven't reviewed every other page. But my

response would be if this is in response to their testimony, I think my experts are perfectly appropriate to testify to things that they've already testified to in this case.

HEARING OFFICER FAIRBANK: Mr. Flangas, so the scope of the testimony and the purpose of this hearing is limited to those reports and for the experts to opine and provide the State Engineer with the salient conclusions of the reports in which they submitted before the State Engineer's office. Vidler and other participants have all submitted reports. And their testimony thus far, presentations to the State Engineer, have been confined to those particular issues which were memorialized within their reports.

I do find that some of these slides are beyond the scope of the report that was submitted by Nevada Cogeneration and Associates and I do believe that it would be inappropriate and improper for that testimony to be provided, as that would be supplemental to the rebuttal reports. And we have precluded such analysis and testimony by other participants in these proceedings.

So I will go ahead and limit the testimony to that to which is the subject of the report that was submitted by Nevada Cogeneration and Associates. For the purposes of the power point presentation, we'll go ahead and address that

when we get to those particular slides.

Ms. Peterson, your objection is noted and to that extent it's sustained. However, we also recognize that the power point presentation is not -- is not necessarily evidence of which will be considered by the State Engineer in making determinations. The State Engineer is relying on the reports that have been submitted. And, again, the purpose of this hearing is for the experts to provide their salient conclusions and to point the State Engineer to the evidence that supports those conclusions.

And so the weight of any that's assigned with respect to the power point presentation that's been provided and which will be contained within the hearing record is not necessarily -- will not necessarily be given -- the State Engineer will make the determination as to what if any weight based upon this objection and our determination.

MS. PETERSON: Thank you.

MR. FLANGAS: If I could respond to one thing so that I can put this on the record. If I understand correctly, if witnesses have testified in this hearing to certain points that my experts have a rebuttal point to make and the State Engineer does not want to hear that rebuttal point simply because it wasn't contained in earlier report, I would respectfully submit that you're deciding not to hear

evidence from qualified witnesses that would be helpful to the State Engineer to reach a decision.

It is my experience that especially in civil matters exclusion of relevant evidence is a slippery slope. So I'm just pointing out to this panel that if you decide not to accept relevant evidence, especially when other witnesses have already testified to certain things, you're excluding evidence that could be helpful to the decision maker. And I would put my objection right out there right up front.

HEARING OFFICER FAIRBANK: So, Mr. Flangas, number one, this is an administrative proceeding and the State Engineer has invited expert analysis to help inform him in terms of making particular decisions with respect to the management of the Lower White River Flow System. This is not a civil proceeding.

MR. FLANGAS: Understood.

HEARING OFFICER FAIRBANK: So, in that particular scope, it is up to the State Engineer to make a determination as to what evidence is relevant. Mr. Flangas, you've had the opportunity to cross-examine witnesses and address these particular issues. Furthermore, you're making an assumption that there may not be an opportunity to address these particular issues. And those are things that are still under consideration. There's been requests by participants to submit closing statements and there's also been a request by participants for an opportunity to submit draft orders.

And so on that basis there's not an ignoring or a rejection of consideration of particular evidence. The evidence is before the State Engineer and his staff. The staff is qualified to understand and analyze the evidence and to make a determination based upon the totality of the information before him.

And so I appreciate your feedback. However, I want you to understand that this is a different proceeding. And so on that basis, I will again sustain the objection offered by Ms. Peterson on behalf of Lincoln County and Vidler and you may go ahead and proceed.

MR. FLANGAS: That's fine. That's fine. Okay.

MR. TAGGART: Excuse me. Are there any more copies of the power point?

MR. FLANGAS: I put all the power point copies I had over there.

MR. TAGGART: Okay.

MR. HERREMA: If I may. Brad Herrema on behalf of CSI. We have a similar objection to one of the points on slide 41 regarding the presence of faults and whether they act as a conduit to flow or impediment to flow. I don't believe that is in the rebuttal report either. I'll check

before we get to slide 41, but I believe it is not.

HEARING OFFICER FAIRBANK: So I will note the objection. And, likewise, if it's beyond the scope of the rebuttal report submitted then we'll address that at the time. But your objection is noted and we'll take that under consideration.

MR. HERREMA: Thank you.

MR. FLANGAS: Mr. Dixon.

MR. COACHE: Actually it's going to be Mr. Coache that begins.

Q. (By Mr. Flangas)

ANSWERS BY MR. COACHE:

Q. Okay, Mr. Coache. Thank you.

A. We're here to present a hearing that may be a little bit shortened power point presentation to you on the five matters of interest to the State Engineer. And each one of those matters shown on slide two will be addressed to route the presentation with regards to each of the matters that we discussed.

About 18 years ago, Mr. Ricci and I were actually sitting right where you guys are at when the original Coyote Springs Valley service began. And hearings were conducted for a matter for almost four weeks. And a tremendous amount of water was looked at as being appropriated within this flow

system. And at the time it wasn't really considered a flow system. Even though we believed it was, we were still looking at Coyote Spring Valley individually.

After nearly four weeks of hearings, hundreds and hundreds, if not thousands, of pages of documents, a lot of internal discussion between Mr. Ricci and myself, it became evident to us that there was insufficient data available to proceed with any action regarding the applications that are before us in the Coyote Spring Valley.

Slide four, please. What came of those four weeks of hearings was the issuance of Order 1169. And I know this has been beat to death on some issues. But it basically was required to pump 50 percent of the existing rights in Coyote Springs Valley. It was looked at over multiple basins. And, after eight years, it finally started in November of 2010. And this became the largest scaled aquifer test in Nevada. Tens of millions of dollars were spent on this test by the participants, mainly SNWA. Hundreds of thousands, if not more, data points were collected, I mean some of those wells were collecting data every 15 minutes for a couple of years.

It became clear that the responses to pumping stress imposed during the Order 1169 aquifer test were very apparent and significant.

ANSWERS BY MR. DIXON:

A. We're on slide five now. Jay Dixon for the record.

So, as indicated in our rebuttal report, NCA disagrees. The next two sections cover the boundary issue and Item E in the State Engineer's interim order in the other matters. Specifically to the boundary issue regarding the Park Service's recommendation to include the entire Black Mountains area basin in the LWRFS. So I'm going to walk through some slides that deal with that issue and our perspective on it. Specifically, obviously a big question is where is the appropriate southeastern LWRFS boundary and is the proposed location correct.

Q. Now, Mr. Dixon, in dealing with -- in dealing with the boundary issues and that, did NCA prepare a rebuttal report in this matter that was submitted to the State Engineer?

A. Yes.

Q. Is that NCA 1, Exhibit 1?

A. Yes.

MR. FLANGAS: We would offer that exhibit at this time.

HEARING OFFICER FAIRBANK: NCA Exhibit 1 is so admitted.

MR. FLANGAS: Thank you.
Q. (By Mr. Flangas) Go ahead, Mr. Dixon.
A. And one of the things that came out of this hearing that we have taken a closer look at is the issue of pumping in the Black Mountain area and whether or not it contributes or the extent to which it may or may not contribute to effects observed at the Muddy River Spring area.

Also, in explaining this issue, I'm going to touch on some geology, some map geology. This is all information that's been presented previously. However, my focus is obviously going to be in that part of Black Mountains basin.

Slide six, please. All right. So this question of NCA, Nevada Cogen Associates, pumping and the extent to which it affects or may not affect the springs. The area I'm talking about, obviously, is shown in the southwestern corner of the current proposed boundary, just this little area right here. The NCA wells are shown here, the blue dots. There's also a couple of monitoring wells included in that cluster of wells.

So, you know, right now, the State Engineer has included NCA pumping which averages about 1500 acre-feet a year, again, based on perfected water rights in that initial

suggest pumping limit of 9318. So, if any portion of NCA's pumping should be excluded, then is this initial pumping limit maybe too high?

Slide seven, please. So you've seen this several times throughout this hearing. This is the representative portion of the Rowley geologic map. The purple line drawn across here is actually a section that was included in the Page publication, Page 2011. I just added it here because of its location and proximity to the geology that has been encountered where these wells are constructed.

And of specific particular interest is the presence of this extension of a Dry Lake regional thrust fault just to the west of these wells. And then as you move to the east, the geology shown here is -- of particular interest is the Muddy Mountains regional thrust. That's the south end of that thrust.

These wells were purposely, intentionally, sited by Marty Mifflin. At that time in the early nineties, he was a consultant to the owners of Nevada Cogen. And he sited these wells in a perfect location, obviously, but it was intentional. He was aware of a series of strike slip faults and you can see coming off the east side of the Dry Lake Range.

Slide eight, please.

Q. Is Siri helping out, Mr. Dixon?
A. I guess. I don't think she's qualified though.

Again, still staying on this recommendation regarding this boundary and focusing on the geologic section GG that I pointed out in the previous slide. The NCA wells, as you can see, are put right in the middle of those strike-slip faults. That's where Marty purposely sited them.

And referring back to the larger question should the entire basin be included? As you continue to the east, you see a complete different map geology on this side. There is no apparent consistency in the geology on the other side of that Muddy Mountain thrust fault, at least relative to this pumping.

Slide nine, please. So this is kind of zooming in on the area getting a little closer, and you're going to hear me talk about these series of wells. To the south is EBP-2. That is the third of the three pumping wells furthest to the south. It is not a very productive well. They use it sparingly. The water chemistry is a little challenged compared to the other two.

And the nice thing about that is there is right within 300 feet of it was when Marty had drill rigs out there poking around trying to find the sweet spot, this is one of the first holes he drilled or oversaw, EBM-3. This has a

monitoring record that goes back to 1993 and it's continuous. The problem with that record, though, is when you look at the data, it's hard -- you have to acknowledge that there appears to be some pumping influence. The company tries very hard to make sure that their water levels -- They're all recorded manually. They don't use transducers. But they try to get their levels when that well has been off for a certain amount of time. Unfortunately, when you look at that record, you can tell that hasn't always been the case. And we are acknowledging that. It's very obvious.

So, moving ahead, recent -- So the next wells to the north, EBM-6, is the new well that replaced EBM-4 in 2015. And then further to the north is the third well, EBM-5, which replaced EGV-3. Those wells were replaced within a couple hundred feet of each other. And the reason is because they're in carbonate rock and the chemistry is pretty tough on low carbon steel. And those casings failed. However, when we completed the wells, we converted the wells to monitoring. And, for reasons you're about to see, we waived the requirement to plug them. Because anything we pump down those wells to plug it we're going to pull out in the pumping well due to the karst features.

So we did a little investigation, obviously, we spent a lot of time reviewing Marty Mifflin's work. He did a very good job of documenting what he saw when he was out there in the early nineties.

So three things that caught my attention from his completion report in 1992 from the wells that we replaced. He made reference to the upper 600 feet of the borehole having a hang wall on the northerly trending high angle fault. That's the strike-slip fault that they were targeting. He saw evidence of that in his cuttings.

He also noted a series of high angle fractures penetrated below 600 feet, abundant fractured limestone.

He also -- And this is really important. Confirmation that he was in the fault. Bottom hole samples indicated travertine and collapsing blocks, large open solution structure.

Slide 11. So, we've been talking about this carbonate rock for the last two weeks and I wanted to show you a picture. The picture on the left is the well -- the borehole for the well we replaced in 2015. This is -- Marty couldn't see it at the time. But this is what he was drilling through, large caverns, right in that strike-slip fault area. That's what it looked like before we -- That's what it looks like today.

The picture on the right is the borehole after we drilled the replacement well and more modern image. Also we

went a little deeper, 1400 feet. This picture is from 1366. That's what the carbonate rock looks like, the aquifer.

So, you know -- I'm on slide 12 now. And regarding -- We want to -- The following slides summarize -- I want to be very clear about this. These slides, the next series of slides, summarize our review of data and provide our opinions as to how SNWA may have arrived at this conclusion regarding Black Mountain area pumping and the current location near these NCA wells. This is not -- We did not -- This is something we weren't looking at when we wrote our rebuttal report. This was made -- This was put in to their rebuttal report. And the exact quote is BM-DL-2 -- And I'll show you where that is in a moment -- is undoubtedly within the carbonate aquifer of the LWRFS but the current production wells are probably not.

So the next few slides just simply -- We wanted to obviously in the last couple of weeks we took a closer look at this and all we're doing now is stating our opinions because we think it would be very helpful for the State Engineer to have this information. SNWA didn't look at it beyond what they have. We agree with them, we need more information to confirm this. But all I'm doing now is providing our opinions as to how SNWA may have arrived at this conclusion. We're not speaking for them.

I'm on slide 13 now. So let's take a closer look at this table from their rebuttal report. This was put in the appendix. So I've called out the Black Mountain area. And first let me explain what these values mean, and specifically the P-value. We heard a little bit about it. Tim Mayer talked about it earlier and you heard Mr. Burns and Mr. Drici talking about it last Friday as well. But I want to try to tie this -- give it a little more color, if you will.

So let's talk about this P-value because this is very important. A predictor, which is the EH-4 water levels, that has a low P-value, in other words less than .05, means that changes in the predictor value, again, EH-4 levels, are related to changes in responsible variable -- the response variable. Sorry. In this context, the response variable is pumping. Okay. P-values that are greater than .05 are not statistically significant.

And what's interesting here, whether or not this is right or not, it's significantly higher than the other four basins. And that really caught our attention, obviously. You heard Mr. Smith for the City of North Las Vegas talk about the issues that he found in Garnet Valley. Okay. We're focusing on Black Mountains area. And relative contributions of observed water levels in EH-4 as a result of

pumping from these individual basins.

So I want to go to slide 14, Hugh. So this is right out of the SNWA rebuttal report. I apologize. I forgot to put the figure caption for the plot on the right. But I want to be very clear it's not Garnet Valley. It's Coyote Spring Valley. So the plot on the left is the Black Mountains area. And all this shows is that we're examining -- they were examining a proportional response of the system, EH-4 representing the system, that is the Muddy River Springs area, that are attributable to pumping from each individual basin. So each incremental component, this is a small part of the EH-4 water levels that can be attributed or correlated to pumping in the Black Mountains area. Very small in comparison to pumping in Coyote Spring Valley that portion of the EH-4 water level observation responded fairly significantly to pumping in Coyote Spring Valley.

Slide 15. So, again, going back, the two wells that -- We took SNWA's regression analysis. I reproduced it to make sure I could get the exact same results. And for these two wells I did. I also took it a step further and that's what I want to talk about.

BM-DL-2, this is not an NCA well, but this well is only 3600 feet north northeast of EBM-3 down here. The period of record for this well only goes back to 2002, but there's several months of water levels. It's a really good data set for BM-DL-2. I've already told you the issues with monitoring data for EBM-3. I'm not trying to work around that. It's very evident. There's noise in it and it's from pumping.

So next slide, 16. This is my reproduction of SNWA's result regression analysis on BM-DL-2 versus EH-4 .95, that's the same result that they got. That's this plot on the left.

So I took it a step further. Even though, again, I'm acknowledging the pumping noise in EBM-3, especially early on, the correlation to EH-4 is .52. Significant -- Whether or not that value is correct, it's just significantly lower than BM-DL-2. These wells are only 3600 feet apart, so what's going on? What is causing this response.

Q. Mr. Dixon, both of those wells are approximately 30 miles?
A. From EH-4, that's right.
Q. EH-4. But they're less than two-thirds of a mile apart?
A. That's right.
Q. They're 3600 feet apart?
A. Correct.

Q. So very close together but 30 miles away from the other well and one of them correlates almost one to one?
A. Pretty close.
Q. And the other one significantly different?
A. Right.
Q. Okay. Thank you.
A. Slide 17. So this is a section from -- Now I want to move beyond this boundary and talk a little bit about the rest of the basin, specifically to the south, and to demonstrate the significant difference in geology that exists.

This is line HH that you see on here from Page 2011. And I'm extending it to the south in to the Las Vegas shear zone near Lake Las Vegas. So, again, this is that section HH. The NCA well is located within that strike-slip fault zone. As you move to the south, we go through the shear zone, Las Vegas shear zone. And then once you get in to that Lake Las Vegas area, the east side of the Black Mountains basin, there's a completely different geology. In fact, you know, there's a formation over there that's being targeted for groundwater exploration. And the thing is, those water rights would have been developed years ago if there were a carbonate rock aquifer there. It's not there. And that's why, you know, their efforts are being made to

develop that resource now.

This is the Las Vegas Valley -- Excuse me -- Lake Las Vegas test wells that were installed in the early nineties. Even though it wasn't a successful development program, there's a lot of good information that came out of it regarding the Horse Springs formation.

Slide 19. So this is another issue that we identified in our rebuttal report and it's regarding, again, boundary, boundary primarily, the boundary question. And it's relative to Lower Meadow Valley Wash.

So four things I want to review real quickly. Carbonate aquifer is deep. And the potential for development is low. There's no effects from the LWRFS pumping observing groundwater levels in that basin. Current pumping in that basin is minimal. And, as Colby Pellegrino mentioned last Friday for SNWA, you can't look at this boundary issues in changing boundaries in a vacuum with only hydrology. There's management implications to adding basin to this. And I want to talk about the ramifications of inactive water rights in that basin if it were to be included.

So this is a cross-section from some surface geophysics gravity mapping that was done and reported in USGS Open File Report 2006-1396. I've shown the location of the current LWRFS boundary coincident with the southern end of

Lower Meadow Valley Wash. And our contention is carbonate aquifer is very deep here. The bottom of the Cenozoic fill has been estimated at approximately 5,000 feet. That matches the geology interpretations as well.

And the point I want to make is we think the State Engineer already has the authority to prevent a deep carbonate production well from being constructed here.

As far as responses, this is the south end of the basin. You see Moapa Valley here, Muddy River Spring area. There are three nested monitoring wells were installed and they've got a really good monitoring record. And what I'm showing here is the portion of that record when the Order 1169 pump test occurred. And, as you can see, there's no response there. This particular borehole was encountered consolidated material at 1600 feet but it was only screened down to 829. Again, no response from 1169 pumping.

Slide 22. Moving down to the south end, this is a hydrograph from EH-8a, the monitoring well near the south end of the boundary. And what you see here is the response from intense pumping that ceased in the late eighties. That response has been continuous with some cyclical variations every year as you would expect.

This particular well is completed. It's a dual completion Muddy Creek formation, which is an aquitard below

the sediment, alluvial sediment, in that area.
Slide 23.
Q. Again, no response?
A. No response. Third point here, current pumping in the basin is minimal. I pulled this right out of the 2015 statewide pumping inventory. Even though there's 25,000 acre-feet of underground rights appropriated in this basin, as of 2015 only about 1800 is being pumped. There's no reason to include it.
And in terms of -- If this basin were to be included, there's a substantial quantity of inactive underground rights with a priority date in the 1960s. Adding Basin 205 in to LWRFS would reactivate these senior rights elsewhere. And right now where they're at, they're not usable at their current location. The wells are shallow and the water quality is pretty bad. TDS 3,000 milligrams per liter. That's not usable. So that might sound like a great idea, but that changes -- that really has a huge effect on future management decisions if it were to be included. And that's my point. This goes beyond just looking at the hydrology.
Slide 25. And we'll turn it over to Mr. Coache.
ANSWERS BY MR. COACHE:
A. Robert Coache for the record. This part of the

presentation will be looking at Kane Springs Valley. And NCA disagrees with the following key findings from the Lincoln-Vidler report. Each one of these points we're going to discuss individually.
26, please. Lincoln-Vidler key finding number one was that the effects of pumping from Kane Springs Valley would not be felt for over a hundred years. And then Lincoln County makes a number of claims in their rebuttal report states the following three items at the bottom that were found in Ruling 5712 and Ruling 6254.
Go to slide 27, please.
MR. FLANGAS: Now, in slide 27, I would like to respond to Ms. Peterson's objection. At pages 12 and 13, we specifically discuss Lincoln-Vidler's comment that there would be no significant effect felt for a hundred years. And if the State Engineer takes a look at our report at those pages, the comment was rebutted at those pages and the discussion was had about that.
The portion of the slide that I think Ms. Peterson is objecting to is the CH2M Hill report portion, which is what I discussed earlier. I don't know if she's objecting to the whole slide because there's that portion in it. But there was a specific discussion about the fallacy that the State Engineer made a determination specifically

about that there was a comment from the State Engineer that there would be no effect in Kane Springs Valley for a hundred years. That was discussed in our rebuttal report.
MS. PETERSON: If I may. The objection is to that second bullet. The first bullet was in the report.
HEARING OFFICER FAIRBANK: I'll sustain the objection as to the second bullet.
Q. (By Mr. Flangas) So don't talk about the CH2M Hill report.
A. Fine. What I'm going to do at this point is jus pass over 29 and 30 so I can go for a little bit and then if I have time at the end we can discuss those. Is that fine? Okay.
MR. DIXON: Which slide?
MR. COACHE: 29 and 30. So we're on 27 right now.
Q. (By Mr. Flangas) Mr. Coache, do you want to skip -- There's no objection to 28. Do you want to use slide 28?
A. Oh, I just took out 29 and 30.
Q. Oh, okay. We're going to use 28?
A. Yes, sir. Okay. Lincoln-Vidler was asked questions about this on cross. And, if I remember right, they -- the response was that the basis for this finding was

the effect of -- the finding that the effect of pumping from Kane Springs Valley would not be felt for over a hundred years outside of the Kane Springs Valley was the result of an SNWA model. However, in their report, they state otherwise.
And they quote specifically that the State Engineer found that where no significant effects would be felt for hundreds of years, the up gradient water could be appropriated. And that's from pages 2-2 to 2-3 of the report.
And, unless I've missed something, I wrote some of this stuff. And to my knowledge the State Engineer has never stated that Kane Springs Valley groundwater can be developed because there will be no significant impact, if any, from appropriation of groundwater for hundreds of years.
Go to slide 28, please. In fact, with all the limitations that are on the State Engineer's at the time with regards to legislation that hadn't been passed yet and no information that was obtained from the carbonate pumpage, the State Engineer still found that in Ruling 5712 that the applicant's pumping, being Lincoln-Vidler, supports the -- pumping test supports the conclusion that there is considerable potential for groundwater flow in the carbonate rocks in the vicinity of well KPW-1.
The State Engineer also found the evidence

indicates a strong hydrologic connection between Kane Springs Valley and Coyote Springs Valley, specifically that groundwater flows from Kane Springs Valley in to Coyote Spring Valley.

And, lastly, given the unique hydraulic connections between the Kane Springs Valley hydrographic basin and the Coyote Spring Valley hydrographic basin, the development of groundwater within the Kane Springs Valley will ultimately affect water levels and the flow in the White River regional carbonate rock aquifer system.

All right. So we're blowing through the next two.

Q. Did you go to --

A. I didn't realize the next one was one she was objecting too also.

MR. FLANGAS: 29. I don't think you're objecting to 30?

HEARING OFFICER FAIRBANK: 30 and 31.

MS. PETERSON: If you go through those then I have to be up here.

MR. FLANGAS: 31 I have a response to as well if I could, Ms. Fairbank.

HEARING OFFICER FAIRBANK: Go ahead, Mr. Flangas.

MR. FLANGAS: Specifically, once again, I'm not

sure about -- the comment, everything on 30 is discussed in -- pardon me -- on 31 is discussed in our rebuttal report. Specifically at pages 13, 14, 15, and 16, virtually everything on that slide is discussed in our rebuttal report almost verbatim, in fact, in some places. The fact that there were effects showing a high correlation between the carbonate wells plotted against EH-4 is at the bottom of page 13. Based on this -- I'm quoting now. Based on this high correlation between EH-4 and spring discharge -- I'm looking at page 14. I'm looking also on page 15 are the hydrographs. And page 16, once again, references the high correlation between carbonate wells plotted against EH-4 with a correlation of CSVW-4 and EH-4.

I'm not sure what the objection is to this. The comment at the very top, NCA believes there's a discernible trend pattern, is nothing more than a conclusion of our entire section there in the rebuttal report.

HEARING OFFICER FAIRBANK: Ms. Peterson.

MS. PETERSON: Thank you. The first two bullets, those opinions are not contained in the rebuttal report. Obviously, the first dash under the second bullet is commenting, I guess, on all the other reports that have been submitted related to CSVM-4 and KMV-1 and is not in the report.

And then, yes, the last dash on the bottom of that slide, that comes from the rebuttal report of SNWA. So, of course, it would not have been in the rebuttal report of Nevada Cogen because they were submitted at the same time.

MR. FLANGAS: I suggest you read it directly from our rebuttal.

HEARING OFFICER FLANGAS: Just a moment. Mr. Flangas, please.

MR. COACHE: Robert Coache for the record.

HEARING OFFICER FAIRBANK: One moment, please. Based upon a review of the report, as well as the hydrographs and other tables contained within the report, it appears to me that the contents of slide 31 is maybe a restatement but is a summarization of those findings and conclusions set forth in the report. So to the extent the objection is that this is new analysis, I'm going to go ahead and overrule that objection and allow the content -- the experts to go ahead and provide their analysis with respect to those opinions stated on slide 31.

MR. COACHE: Robert Coache again for the record. Okay. The first two bullet points are basically points two and three that we previously discussed or stated that we were going to discuss. And NCA believes that there's a discernible trend pattern in water levels over time between

production well KPW-1 and pumping trends. And NCA also believes that there is correspondence between the water level trends in the wells in Kane Springs Valley, northern Coyote Spring Valley, and wells located in southern Coyote Spring Valley.

Additionally, SNWA, Fish and Wildlife Service, National Park Service, Center for Biological Diversity, and ourselves all found that monitor well CSVM-4 and KMV-1 showed effects resulting from the Order 1169 pump test. The values for several wells, including CSVM-4, were then plotted against EH-4 for various periods, based on the record that was available. There were high correlations between all carbonate wells plotted against EH-4 with the correlation of CSVM-4 and EH-4 resulting in the R-squared value of .82.

And I do need to make a statement for the record. There seem to be some software issues on our end. Wherever in our report you see R2, lower case or regular, that's R-squared. Something happened in the conversion. So if you see R2 in our report, read it, please, as R-squared.

These high correlations between carbonate wells in the Lower Right River Flow System indicate a high level of hydraulic connectivity across the basins within the Lower White River Flow System.

Page 32. For example, you've seen this before.

I believe this was in SNWA's presentation. But this is a simple scatter graph with a correlation coefficient between CSVM-4 and the one I was talking about in EH-4 with the R-squared value of .82.
Q. (By Mr. Flangas) That was also contained at page 15 of our NCA Exhibit 1; correct, Mr. Coache?
A. Yes, sir.
Going to slide 33. SNWA did not calculate a correlation between EH-4 and KMW-1, therefore a direct visual comparison of the hydrograph of CSVM-4 and KMW-1 wasn't done. The visual comparison was done because at the time I could not locate the data to actually do the actual analysis. And I'll talk about that a little bit later also.
But the visual comparison found that the hydrographs for CSVM-4 and KMW-1 are virtually identical with an estimated R-squared value greater than .9, which indicates a high correlation between KMW-1 and carbonate wells in the Lower White River Flow System with a high level of hydrologic connectivity across all of the basins within the Lower White River Flow System.
34. Lincoln-Vidler also claims that there was no effect ascribable to the start and stop of the Order 1169 aquifer test. NCA believes that the contrary is true and that there is a high correlation between KMW-1 and carbonate

wells in the Lower White River Flow System with a high level of hydraulic connectivity across all of the basins within the Lower White River Flow System including Kane Springs Valley.
Below is statements from the following agencies which all make various references that are supportive to the inclusion of Kane Springs Valley within the Lower White River Flow System.
And I want to make it clear that not every one of these agencies specifically state that Kane Springs Valley should be in the Lower White River Flow System. But they do make statements that indicate that there is a connectivity between Kane Springs Valley and the Lower White River Flow System.
The purpose of this slide is to discuss -- We've been discussing item A in the State Engineer's questions. And this is also going to go in to item E a little bit with other things that are of interest. And the reason that this is important is that in the event that Lincoln-Vidler develops water from KPW-1 and the State Engineer excludes pumpage from that well, from the management of the Lower White River Flow System, there would be detrimental impacts to existing senior right owned and controlled by NCA and other senior water right holders, users within the Lower White River Flow System.

The Lincoln-Vidler groundwater rights are junior in priority to approximately 98 percent of the groundwater rights within the Lower White River Flow System and during any curtailment of pumpage within the Lower White River Flow System. Assuming that Kane Springs Valley was included, the Lincoln-Vidler rights would be among the first in the subject to curtailment.
HEARING OFFICER FAIRBANK: And excuse me really quick. Just to let you know, Mr. Flangas, you're at 40 minutes.
MR. COACHE: We're at 40?
HEARING OFFICER FAIRBANK: Yes.
MR. FLANGAS: This is the next slide. Hold on, Bob.
MS. PETERSON: So we objected to slide 36, which is all new analysis as to why the inclusion of KSV is important.
HEARING OFFICER FAIRBANK: So, based on my review of the report, it appears that the first bullet point is contained within the report. But based upon my review of the substance of the analysis relating to the inclusion of Kane Springs Valley, the second two bullet points don't appear to be directly contained within the report. Mr. Flangas.
MR. FLANGAS: They're not essentially contained

within the report. They're an analysis. I mean, to the extent that they're -- They are essentially just analysis. They're not really contained in the report. They're just an analysis --
HEARING OFFICER FAIRBANK: Can you explain to me? Because this appears to me to go beyond the scope of the Order 1303 limitations, which is really the scientific analysis, and this seems to extend more in to the policy analysis.
MR. FLANGAS: It's a little bit of the other matters.
HEARING OFFICER FAIRBANK: So on that basis, on the basis that both it's not contained within the rebuttal report doesn't necessarily seem directly related and outside of the scope, I'm going to go ahead and sustain the objection as to the second two bullet points but overrule the objection as to the first bullet point.
Q. (By Mr. Flangas) Okay. Just limit it, if you would, Mr. Coache, to the very first bullet point.
A. And we apologize. There was a little bit of a different interpretation of E on your key points that you're interested in.
So sticking with the first bullet point, assuming that the Nevada State Engineer determines that the maximum

long-term annual quantity of groundwater that may be pumped from the Lower White River Flow System is 9318 acre-feet. Lincoln-Vidler would maintain the right to pump 500 acre-feet from KPW-1 and an additional 500 acre-feet from a separate site in Kane Springs Valley, which equates to an additional 11 percent of pumpage for a total potential of 10,318 acre-feet of pumpage actually impacting the Lower White River Flow System.

Slide 37, please. NCA disagrees with Lincoln-Vidler's key finding that the trend in water levels in both KMW-1 and CSVM-4 indicate that waters levels are still being affected by the 2005 precipitation event. Lincoln-Vidler well KVW-1 was completed in October of 2005 and the first depth-to-water level reading was collected sometime in April, approximately sometime in April 2007.

The next slide, number 38, is simply a diagram showing the area in red that encompasses -- encompasses the exceptional 2005 precipitation event. And the middle graph is the KMW-1 showing that they were unable to collect any water level samples during that period.

And then I believe she objected to the next one.

MS. PETERSON: She did.

MR. FLANGAS: Thanks.

MS. PETERSON: 39. So this slide appears to be

related to cross-examination during the hearing of the Lincoln-Vidler witnesses. And it would be, you know, inappropriate sur-rebuttal to rebuttal or sur-rebuttal, I guess.

MR. TAGGART: And can I be heard on this? I mean, it's been common throughout this hearing for us to ask witnesses did you hear what so and so said yesterday and do you agree or do you disagree. So I think we're getting a little bit in to the weeds on some of these objections.

HEARING OFFICER FAIRBANK: And, Mr. Taggart, thank you for your comments with respect to the objection. And based upon our analysis, while it may not directly be contained within the report, it is within the scope of much of the testimony that has been asked as these proceedings have gone on. So certainly I recognize and will assign the weight that we give to the testimony within the discretion of the State Engineer. But I'm going to overrule the objection.

MR. FLANGAS: Go ahead, Mr. Coache.

MR. COACHE: I was going to ask you if we can do the objection to slide 41 because I think I know the section that she's talking about. I'm going to drop that out if that will be okay.

HEARING OFFICER FAIRBANK: That's fine. If you're comfortable doing that, Mr. Coache, we'll accept that.

MR. HERREMA: Actually we object to both of the bullets. I don't think either of them are contained in the rebuttal report. And it's a little bit difficult to determine because the rebuttal report is framed in terms of the eight or nine conclusions. It's not really framed in terms of answers to the five questions. But I don't believe either of these two points are made in the rebuttal or these conclusions.

HEARING OFFICER FAIRBANK: Thank you, Mr. Herrema. Your objection is noted and I'll go ahead and proceed with how I responded to Mr. Coache with respect to overrule the objection to the extent that those other bullet points but sustain the objection as to that which Mr. Coache is willing to go ahead and move on from. Okay. Thank you.

MR. COACHE: Okay. We're on slide 39 now. Robert Coache for the record.

On cross, Lincoln-Vidler stated that they determined the effects of the extraordinary 2005 precipitation event on KMW-1 was made by correlating the hydrographs of CSVM-4 and KMW-1. And NCA, we agree, that there's a strong correlation between CSVM-4 and KMW-1 and it was proper for Lincoln-Vidler to determine the effects of the extraordinary event in 2005 on KMW-1 by correlating the hydrographs at CSVM-4 and KMW-1. However, a correlation

between CSVM-4 and KMW-1 cannot be relied upon to determine precipitation impacts and disregard the correlation between CSVM-4 and KMW-1 when considering hydrologic impacts from the Order 1169 pump test.

40. So now we're going to get in to the basis of why we're here. And these are the points that the State Engineer put forward. And I'm hoping we're clarifying what -- We wanted to address these directly and we've taken our conclusions and tried to address them directly in to your questions of concern.

So, question A, our responses are, as shown earlier there's a basis for SNWA's statement that the NCA current production wells are probably not within the Lower White River Flow System.

NCA believes that additional work needs to be done to validate SNWA's multi -- multiple linear regression analysis with regards to the attributable impacts to the Muddy River Springs area resulting from groundwater pumpage from NCA's production wells in the Black Mountain hydrographic basin.

And I say in here it's important -- And I got to correct that. I think it's very important for the Nevada State Engineer to know if the NCA pumpage within the Black Mountain hydrographic basin is impacting the Muddy River

Springs area. If this pumpage is not affecting the Muddy River Springs area, we readily admit that's obviously good for NCA. But, more importantly, that means that the actual impacts to the Muddy River Springs area are being caused by less pumpage than initially thought. So this is a very important question that we need to address.

Therefore, NCA supports SNWA's position that the current boundary of the Lower White River Flow System should stay the same pending the water management decisions in the next phase.

Q. (By Mr. Flangas) So, in other words, Mr. Coache, if the 9318 includes NCA's production well pumping, that's one number. But if the 9318 is calculated and NCA is not in that number then, in fact, that number might be lower?
A. That's correct.
Q. Okay. Thank you.
A. Question B. I told you I would slip by the first one. The various structures within the Lower White River Flow System with lower transmissivity values result in a lag of measurable impacts in some areas but not the overall impact. These delayed impacts can even be more detrimental to the Muddy River Springs area, as the impact will take longer to identify and benefits of any subsequent corrective action will also take longer to be -- to begin recovery from

the impacts.

Slide 42. Point C, this deals with the amount of groundwater that can be pumped from the Lower White River Flow System. There has been substantial discussion regarding the amount of underflow out of the Lower White River Flow System. And NCA agrees that there is some amount of underflow. However, NCA is not aware of any location where the underflow can be captured by carbonate pumpage within the Lower White River Flow System without detrimental impact to the Muddy River Springs area.

While NCA does not completely agree with the current pumpage goal of 9318 acre-feet a year, NCA understands the complexity.

And I, you know, since I worked there for 30 plus -- almost 30 years and Mr. Ricci worked there for almost that amount of time, we completely get how complex this is, okay. And so we understand the complexity of the determination and potential fluency of the proposed pumping limit and urge the State Engineer to proceed expeditiously but with extreme caution.

And our last bullet point with regards to our question C. NCA is concerned that a delayed decision with regards to the management of the Lower White River Flow System could result in federal action resulting in a

Cappaert-type decision to manage spring flow through minimum groundwater hydraulic head levels, thus preventing the State Nevada the ability to manage its own resources.

D. I tried to make this one as clear as I could and it seems to get a little complicated sometimes. But this is with regards to the effects of moving alluvial water rights and carbonate water rights and the deliveries of senior decreed rights on the Muddy River.

NCA does not support the transfer of a senior alluvium groundwater rights within the Muddy River Springs area to the carbonate system within the Lower White River Flow System as the supply source for new uses.

NCA does support the transfer of senior alluvium groundwater rights within the Muddy River Springs area to the carbonate system within the Lower White River Flow System to upgrade the priority date of existing carbonate pumpage within the Lower White River Flow System but on a one-to-one basis.

If someone has a hundred acre-feet of carbonate water but let's say a 2000 priority date and they're going to be curtailed and they want to go buy some water rights, they could buy a hundred acre-feet of senior alluvium rights and transfer those to the carbonate on a one-for-one basis to upgrade their priority.

That would create no additional new effects on the Muddy River Springs area. And that indeed would create a shuffling of priorities, but it would not create an impact on the water rights -- I mean, on the spring. Sorry.

NCA believes that simplified guidelines should be established for the movement of groundwater within and near the Lower White River Flow System as part of this process but not necessarily through the issuance of an order at this time. I just don't see -- other orders that, you know, we have worked on in the years when I was there, it's almost impossible to foresee all the things that could pop up and the little nuances that you didn't think of.

So I think we would have guidelines at first, let those mature, address some of these issues, and then at some point issue an order that's going to limit pumpage or move in water within the basin.

And NCA also supports the change in place of use of Muddy River Spring alluvium rights -- And that could be manner of use too -- when associated with a conjunctive use agreement between a holder of Muddy River decreed rights and the user of the pumped Muddy River Spring alluvium rights. So if somebody wanted to go change those alluvium rights and impact the flow of the Muddy River, which is obviously impacting senior decreed rights, and they wanted to have an

agreement with a holder of these decreed rights and take the water out of the ground instead of the river, we're okay with that.
Am I doing 44?
Q. We're almost done.
A. E. Okay. NCA does not believe that the State Engineer should proceed with any new aquifer test within the Lower White River Flow System. New aquifer test. To see verifiable results, any aquifer test would require pumpage in the thousands of acre-feet over a period greater than six months. It makes little sense to do and conduct an aquifer test for less than a six-month period when it's known that some impacts in the Lower White River Flow System are delayed by a period of three to four months.
And given the lack of full recovery from the Order 1169 aquifer test, the pumpage required by additional aquifer test may cause detrimental impacts to the senior water rights holders. And that concludes our presentation.
MR. FLANGAS: I have a procedural question.
HEARING OFFICER FAIRBANK: Yes.
MR. FLANGAS: We submitted a significant number of exhibits, all of which were utilized in the preparation of the report. There was simply no time go through, mark, address, and talk about each one. We had 40-some-odd

exhibits. If we had tried to do that, we would have run out of time. I would like to offer those exhibits in to evidence. I'm not exactly sure how to do that.
HEARING OFFICER FAIRBANK: So all of the exhibits that have been submitted by the participants, except for their reports or rebuttal reports, were admitted in to evidence by the State Engineer.
MR. FLANGAS: Thank you.
HEARING OFFICER FAIRBANK: But the rebuttals -- the reports and rebuttal reports required the presentation of those witnesses for cross-examination.
MR. FLANGAS: Thank you. That's a weight off my shoulders.
HEARING OFFICER FAIRBANK: All right. So we'll go ahead and proceed with the cross-examination. And we have allotted seven minutes. And we'll go ahead and start with Coyote Springs Investments.
CROSS-EXAMINATION
By Mr. Herrema:
ANSWERS BY MR. DIXON:
Q. Good afternoon. Brad Herrema on behalf of CSI, for the record. Just a couple of questions. I think this is most appropriately addressed to Mr. Dixon. Before you -- When you prepared your portions of the NCA rebuttal report,

did you rely on the Southern Nevada Water Authority correlation analysis to assess connectivity within the Lower White River Flow System or did you perform any of your own analysis?
A. Both. I reviewed their analysis. I have access to the same data that they do. It all came from DWR and it was made available for this hearing for this study. I wanted to make sure that I could reproduce their results. And in certain areas I did my own regression analysis where I -- where they didn't, to help inform some of the conclusions that we arrived at.
Q. Okay. If you were to -- When I use the word disaggregate, do you know what I mean?
A. No.
Q. Disaggregate, kind of pull apart the different pieces?
A. Sure.
Q. Okay. If you were to disaggregate each of the hydrographs in to a climate response, pumping response, and barometric response, do you think a correlation analysis on those individual responses as opposed to the aggregate observed water level changes would yield a better correlation analysis?
A. I did not perform that analysis. I focused on

the data and used it in the same manner that they did. I have a high level of confidence in their experts. I know them very well and I trust the information that they put in their report.
Q. I understand that that's not what you did. My question is if you had done that to disaggregate climate response, pumping response, barometric response, and then do a correlation analysis on those individual responses, those individual pieces, do you think that would yield a better correlation analysis than using that aggregated observed water level?
A. Perhaps in some areas. But I didn't -- I didn't do that, so I can't comment beyond that.
Q. Do you know whether the Southern Nevada Water Authority analysis that you -- that you reviewed, whether they disaggregated those impacts or whether they performed it within an aggregate hydrograph?
A. I do not.
Q. Could the degree of correlation between two wells in the system be predominantly due to pumping while the correlation between two other wells in the flow system be predominantly due to climate?
A. No.
Q. So you believe then that correlation between EH-4

and EH-4 or 5B in the Muddy River Springs area would be due to the same responses as the correlation between EH-4 and a well in the Black Mountains area?
A. If it's BM-DL-2, that correlation, that R-squared value is .95. That's what SNWA got and that's what I got. That particular well, absolutely. And I talk about EBM-3 and I don't have a high level of confidence in that R-squared value of .52 because I acknowledge that there's some noise in those water levels. They're obtained manually. They are reported sometimes to the nearest foot. So there's some issues there. And I acknowledge that.
Q. Was it your testimony or is it your testimony that groundwater wells located in or near fault zones are higher-producing wells than those located further away from fault zones?
A. In some cases, yes.
MR. HERREMA: Okay. I have no further questions at this time. Thank you.
HEARING OFFICER FAIRBANK: United States Fish and Wildlife Service? Seeing no questions.
National Park Service?
MS. GLASGOW: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions.
Moapa Band of Paiute Indians? No questions.

Southern Nevada Water Authority and Las Vegas Valley Water District?
CROSS-EXAMINATION
By Mr. Taggart:
ANSWERS BY MR. COACHE:
Q. Good afternoon. For the record, Paul Taggart for the water district and the Southern Nevada Water Authority. I want to start with Mr. Coache. And my questions are going to center around whether new evidence exists for the State Engineer to consider since the issuance of Ruling 6254 through 59. And do you know what those rulings were?
A. I believe those were the rulings that denied -- Hold on. Let me double-check. No, I'm not. Let me put it that way.
Q. Okay. Just Ruling 6254 through 60, are you familiar with those at all?
A. Give me the numbers again. I'm sorry, sir.
Q. 6254 through 60, which came out after the reports were issued on the 1169 pump test.
A. Yes. These are the rulings that denied all the applications.
Q. Okay. Since that time has the State Engineer acquired any additional statutory powers with respect to groundwater and surface water?

A. Yes, he has.
Q. And what is that?
A. That was SB-47 in 2017.
Q. And what's the significance of that, in your opinion?
A. That legislation cleared up the issue of whether or not the State Engineer could look at the impacts of a water right application in one basin on other basins.
Q. Okay.
A. And allowed him to conjunctively manage the water. And I believe it says conjunctively manage the water from any and all sources.
Q. Okay. Now, I started by asking you about the ruling in 2014, 6254 through 60. Since that time there's been new data collected, new hydrologic data, collected in the Lower White River Flow System; correct?
A. Yes.
Q. And do you believe that, the data since that time, since 2014, is significant in the analysis of the four questions the State Engineer is reviewing today?
A. Yes.
Q. Okay. And I want to ask you specifically -- Well, first, why?
A. Because it continues -- One, it continues the

increase of knowledge and data known in the Lower White River Flow System. Two, it's another four or five years of data since the pretty close to the max recovery of the 1169 pump test. And it's showing now what's happening in real world conditions of the impacts to the springs since we've recovered over that four or five-year period.
Q. And you mentioned recovered a few times there in your answer. What's the significance of having an additional five to six years of data to understand and recover?
A. It takes out any question of what the actual recovery was and the impacts from the pumping test. The farther you go, the better you can determine what the actual impacts of the pumping test was.
Q. And have you developed an opinion on whether, for instance, Warm Springs West flows have recovered to their pre-test levels as of today?
A. Yes, I have.
Q. And what's that opinion?
A. The Warm Springs West flows spring test levels it is not recovered to anywhere actually near those pre-test levels.
ANSWERS BY MR. RICCI:
Q. Okay. And my question is to Mr. Ricci. Good afternoon, sir.

A. Good afternoon, Mr. Taggart.
Q. Mr. Ricci, do you have an opinion on whether the State Engineer when he issued the groundwater rights to parties, including rights that are owned by the Southern Nevada Water Authority, in Coyote Spring Valley, whether the State Engineer retained the power to limit those water rights in the future and reduce the ability of those water right owners to pump that water?
MR. HERREMA: Brad Herrema for CSI. I would like to object on relevance to the scope of this proceeding.
HEARING OFFICER FAIRBANK: Mr. Taggart, can you relate your question to those four primary issues as set forth in Order 1303?
MR. TAGGART: I think it relates to the long-term quantity of groundwater that be can be pumped in the five basins and whether the State Engineer maintains the ability to use that control, use that long-term quantity of water in these basins.
HEARING OFFICER FAIRBANK: I'm going to sustain the objection, because I think the question as to the authority of the State Engineer over any individual water right is beyond the scope of these particular proceedings.
MR. TAGGART: Okay. I think I'm out of time or do I get anymore?

HEARING OFFICER FAIRBANK: You still have a little more time.
MR. TAGGART: Oh, I do? I thought I heard a buzzer. I'm sorry.
HEARING OFFICER FAIRBANK: Not mine.
Q. (By Mr. Taggart) Mr. Ricci, to you again. Do you believe that the protection of senior water rights on the Muddy River is a matter the State Engineer should use to determine how much groundwater can be pumped in the Lower White River Flow System. Should that number be based upon not inflicting with senior water rights in the Muddy River?
A. Hugh Ricci. I believe the State Engineer is required, I believe, as Mr. Coache mentioned with SB-47 that he has to look at all sources of water and what the impacts are as a result of any pumping.
MR. TAGGART: Okay. Thank you. No more questions.
HEARING OFFICER FAIRBANK: Moapa Valley Water District.
CROSS-EXAMINATION
By Mr. Morrison:
ANSWERS BY MR. COACHE:
Q. Greg Morrison for Moapa Valley Water District. Just a question of clarification for Mr. Coache. I'm looking

at your slide 40. And your final bullet point there says that it's your position that the current boundary of the Lower White River Flow System should stay the same. And I'm looking more at your slides 25 through 39. I know some were objected to. I'm not going to ask you about the substance of those. Just the heading of each one of those slides is inclusion of Kane Springs Valley, is it not?
A. Robert Coache. Yes, it is, sir.
Q. Okay. So I just want to be clear. Are you recommending the inclusion of Kane Springs Valley in this management area?
A. Initially, yes, we are. But we don't think that this is the -- because this was supposed to be mostly for hydraulic data that this was the proper venue to do that. And then we also recognize the importance of getting additional data for Black Mountain. And so I felt that if we made -- if we went against what the hydraulic -- what the significance of this was with collecting hydrologic data and those opinions and then also recommended Kane Springs be brought in but give us more time for Black Mountain, I thought that was pretty hypocritical.
Q. Okay. I appreciate that.
ANSWERS BY MR. RICCI:
Q. There's a substantial amount of institutional

knowledge up there at the table right now. I'll start with Mr. Ricci. If you were the State Engineer October 2019 faced all the evidence we've been looking at for the last couple of weeks, would you include Kane Springs in the management area?
A. Hugh Ricci. I would have another option. I could retire. But I will have to go back to 2002, actually 2001, when the hearing was held on Coyote Springs Valley as far as the Southern Nevada Water Authority applications in Coyote Springs Investments. And when that order was written, it did not include Kane Springs at that time. And the reason I think was that there was nothing going on in Kane Springs. Had I had the knowledge that I would today as of a result and had to issue Order 1169 again, Kane Springs would have been included.
Q. Okay. Thanks.
Mr. Coache, what about you, if I posed the same question. If you were sitting where Mr. Wilson is today, would you want to include Kane Springs in this management area?
MR. COACHE: Yes, I would.
MR. MORRISON: Thanks. That's all I have.
HEARING OFFICER FAIRBANK: Lincoln County, Vidler Water Company.
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CROSS-EXAMINATION
By Ms. Peterson:
ANSWERS BY MR. RICCI:
Q. Gentlemen, Karen Peterson here representing Lincoln County and Vidler Water Company.
So, Mr. Ricci, just following up on that last statement that you made. Mr. Coache indicated that I guess it was his recommendation that Kane not be included right now in terms of the boundary at this stage. So you disagree with that?
A. Hugh Ricci. No. What I said had I -- if I were to issue Order 1169 again and had the information that I had available then as there is enough information today I would have included it.
Q. Right. But is it your testimony today that the boundary should not be changed? As we are now in this proceeding, the last bullet point on slide 40, says that the recommendation is, I assumed of Nevada Cogen, that the boundaries not be changed.
A. You know, when we -- Hugh Ricci again. When we did this, this was a collaboration among the three of us, and there were certain things that we thought of and two to one or whatever, however it was ruled, we put it in it. But the answer to my question originally that you asked is what I

would do then if I knew what I do know today.
Q. So do you support that bullet point or not?
A. Since my name is on the report I would say yes.
Q. Did any of the three of you calculate drawdown to the Muddy River Springs area from pumping Kane Spring Valley wells?
MR. COACHE: I first want to clarify the bullet point, the previous bullet point. My position hasn't changed in that I believe Kane Springs Valley should be included. I don't believe this is the venue for which to discuss that. And that's why that bullet point says what it does in relation to the next phase.
The answer to your question is that I did not calculate drawdowns of the Muddy River Springs area from Kane Springs pumpage.
MS. PETERSON: Mr. Dixon?
MR. DIXON: So.
MS. PETERSON: Did you calculate drawdown to the Muddy River Spring area from pumping Kane Spring Valley wells?
MR. DIXON: No. And that wasn't the purpose of that regression analysis.
MS. PETERSON: Mr. Ricci?
MR. RICCI: No.

MS. PETERSON: All right. Did any of the three of you calculate drawdown to the wells owned or controlled by NCA from pumping Kane Spring Valley wells?
MR. DIXON: No.
MR. RICCI: You're asking each us of us again, Ms. Peterson?
MS. PETERSON: Yes.
MR. RICCI: No. The answer to that question is no.
MR. COACHE: I'm sorry. I didn't follow that question.
ANSWERS BY MR. COACHE:
Q. Mr. Coache, did you calculate drawdown to the wells owned or controlled by NCA from pumping Kane Spring Valley wells?
A. No, I did not.
Q. Mr. Coache, did you review the hydrograph of the KSVM during the Kane Springs pump test? KSVM-4, sorry, well.
A. I'm sorry. What did you ask?
Q. Sorry. It was bad. Did you review the hydrograph of the KSVM-4 well during the Kane Springs pump test, the aquifer test?
A. I did.
Q. And do you agree that the pump test was for 1800

gallons per minute?
A. I can't -- I believe that's the number but I can't say for sure.
Q. And do you agree that from that well where the pump test was conducted that Lincoln-Vidler was awarded 500 acre-feet which when pumped would be much less than the 1800 gallons per minute?
A. Well, it depends on over what time you pump the water.
Q. Well, do you understand that 1800 gallons per minute that was a continuous pump test?
A. Yeah, absolutely. But if you want to take your water out over a one-month period it might be 1800 gallons a minute.
Q. Right. But you would have no idea what the plan is for the development of the water out of that well, the 500 acre-feet, do you?
A. But you didn't ask me that.
Q. Do you have any idea?
(The court reporter interrupts)
THE WITNESS: No.
Q. (By Ms. Peterson) And you indicate on pages -- page 18, I think, Mr. Coache, you wrote this section of the report, NCA number one. The last sentence there right before

the footnotes start, that the aquifer test, the 1169 aquifer test, clearly indicates that carbonate pumping from the northern portion of Kane Springs Valley and -- Sorry -- Coyote Spring Valley and KSW-1 within Kane Springs Valley will impact carbonate aquifer, hydraulic head within the LWRFS, which in turn will increase impact to spring flows within the MRSA and be detrimental to the existing groundwater rights held by NCA. Do you see that?
A. Yes, I do.
Q. And so you're indicating that our pumping will impact the springs and then will impact Nevada Cogen; is that correct?
A. That's correct.
Q. So do you agree then that the Nevada Cogen wells have a direct hydraulic connection with the springs?
A. To reach my conclusion on that, they don't have to have a one-to-one direct impact. The issue is in the whole picture of the management of the system, if NCA has a priority of water rights, as many other people do in this whole system, so when you look at where the line is going to be drawn by the Nevada State Engineer -- There's a numbering issue on the well, I understand that. But if the KPW-1 is pumped and the pumpage from those wells in that northern Kane -- from Kane Springs Valley and/or northern Coyote

Springs Valley impact the spring area and have a detrimental impact that requires the State Engineer to lower the bar, then that subsequently has a detrimental impact to our client because that could be an impact on their priority and result in them having to curtail pumpage. So it doesn't have to be a direct impact from well to well if the bullseye is the Muddy River Springs area.
MS. PETERSON: Thank you.
HEARING OFFICER FAIRBANK: Thank you. City of North Las Vegas?
CROSS-EXAMINATION
MS. URE: Good afternoon. Therese Ure representing City of North Las Vegas.
Mr. Dixon, did you complete an independent analysis for Garnet Valley carbonate pumping as related to the Muddy River Springs area?
MR. DIXON: So, to answer that question, I performed an independent analysis on the carbonate system as a whole with a specific focus on Coyote, Kane, and Black Mountain area. I did not focus on Garnet Valley specifically.
MS. URE: Okay. Thank you.
HEARING OFFICER FAIRBANK: Center for Biological Diversity?

CROSS-EXAMINATION
By Mr. Donnelly:
ANSWERS BY MR. COACHE:
Q. Thank you. Patrick Donnelly for the record. I'm not entirely sure who to direct my questions to, so I will start with Mr. Coache. But perhaps you can point me in the right direction. There are some things in your report that you didn't present here today. Did you reference Center for Biological Diversity's Order 1303 report prepared by Dr. Tom Myers on slide 31 and 34 of your presentation today?
A. Yes, I did.
Q. And did you reference our reports in order to provide evidence in favor of your arguments?
A. Yes, we did.
Q. Did pages one to two of your written report, rebuttal report, recommend excluding non-governmental organizations from this proceeding?
A. Yes, it did.
ANSWERS BY MR. RICCI:
Q. I guess this is a question for Mr. Ricci. Have citizen or non-profit groups been party to Nevada State Engineer proceedings in the past? It's a yes or no question.
A. Yes.
Q. Are you aware if the Center for Biological

Diversity or the Great Basin Water Network has previously been party to Nevada State Engineer proceedings?
A. Yes.
Q. Does Order 1303 expressly limit the proceedings to water rights holders?
A. I don't recall if it does or doesn't.
MR. DONNELLY: Mr. Coache, do you have an answer to that question?
MR. COACHE: It does not. And I would like to put some perspective in that if I could. If not, then let's go to the next question.
MR. DONNELLY: I would like to finish my question. Thank you.
MR. COACHE: Fine. Excellent.
MR. DONNELLY: I would ask which one is it? Should we be excluded from these proceedings or should our data be utilized by you to bolster your arguments?
MR. DIXON: It wasn't our decision to include NGOs. Since they're included, there's some information in that report that we happen to agree with.
MR. DONNELLY: Which of the four questions raised by Order 1303 does section one of your written report address?
MR. DIXON: That would be item E in the order, in

the other matter.

MR. DONNELLY: I would like to move to the State Engineer that you exclude from the record section one of the Nevada Cogeneration Associates rebuttal report. It is not pertinent to the questions asked by the Nevada State Engineer in Order 1303 and, thus, is outside the scope of these proceedings.

MR. FLANGAS: Do I need to respond to that?

HEARING OFFICER FAIRBANK: You may, Mr. Flangas.

MR. FLANGAS: There's no basis to exclude it. I'll come back on a rebuttal question and ask a very simple question, have non-governmental organizations been excluded on the basis of standing. And I'm sure the answer is going to be yes.

HEARING OFFICER FAIRBANK: So, Mr. Flangas, the response was that there's no reason to exclude it and you're going to address it on redirect. I've admitted the report. And while we're trying to maintain the focus within those four issues, the fifth issue was somewhat broad. And for the purpose of admitting the report in its entirety we're going to do that. We're not going to alter that, this determination.

MR. DONNELLY: Thank you. No further questions.

HEARING OFFICER FAIRBANK: Bedroc?

MS. URE: No questions.

HEARING OFFICER FAIRBANK: Seeing no questions. Nevada Energy?

CROSS-EXAMINATION

MS. CAVIGLIA: Justina Caviglia on behalf of Nevada Energy. And I have a question for Mr. Coache or Mr. Ricci. If regulation of groundwater rights is deemed necessary in the Lower White River Flow System, state law requires regulation by priority. Are you recommending the State Engineer regulate senior certificated alluvial groundwater rights in favor of junior carbonate water rights?

MR. COACHE: Well, unless he makes, the State Engineer, makes a ruling and/or there's some other statutes available to him, there's no difference with regards to the alluvium rights in the Lower White River Flow System and the carbonate rights in the Lower White River Flow System with regards to priority.

And, so as they sit right now, that's how it is. And it's unfortunate, because there's also people that are using their water and spent hundreds of millions of dollars to develop projects that, you know, could be in jeopardy because of this stuff.

So, you know, if the State Engineer wants to make a ruling order or have the statute changed that he can split

the difference between alluvium groundwater rights and carbonate groundwater rights, until that time they're one in the same.

And that's also said with the understanding that the State Engineer probably has the right to limit the depth of wells, of alluvium wells, so they don't tap to carbonate. But the water rights themselves at this time as they sit are a different thing.

MS. CAVIGLIA: Mr. Ricci?

MR. RICCI: If the boundary stays exactly the same and the State Engineer does nothing with those water rights that haven't been used in the past that are senior to some of those that have been used, possibly the State Engineer would have no recourse except to go based on priority.

Again, getting back to what Mr. Coache says, is if you look at the 50,000 plus acre-feet that is appropriated in these basins, about 9,000 has been used over the last four or five years, that's 20 percent. So what have those junior right holders that have used the water for continuous for 20 years, such as the client for which we work, what are they to do because they are way down the list?

So that's a tough decision that the State Engineer is going to have to make. If he makes it based on

priority, he's going to have to do that.

MS. CAVIGLIA: Thank you. I have no further questions.

HEARING OFFICER FAIRBANK: At this time I'll go ahead and open it up to the Division of Water Resources.

Oh, I'm sorry.

MR. KING: Madam Hearing Officer, Steve King, Muddy Valley Irrigation Company. We have no questions.

HEARING OFFICER FAIRBANK: And my apologies for skipping over you. I think I was looking ahead when I was putting together my little checklist. Thank you, Mr. King. Muddy Valley Irrigation Company has no questions.

So at this time I'll go ahead and open it up to the Division of Water Resources staff and the State Engineer for questions.

EXAMINATION

By Mr. Benedict:

ANSWERS BY MR. DIXON:

Q. Jon Benedict for the record. I think my first question is probably for Mr. Dixon. You guys, I guess, would be the local experts on your own wells and the information that you've collected there in terms of that I guess what I call a connection that exists between those wells. And I just wanted to drill down a little bit deeper with respect to

that discussion. You've suggested that the production wells may not be directly connected to the well to the north that is a monitoring well and you've shown some geologic slides for some of those wells that suggest they're all in carbonate. Am I correct about that?
A. Yes.
Q. And yet you've also suggested that the data is not conclusive with respect to that connection. From a geologic perspective you've also shown some maps. But you didn't necessarily tie that together. So I just want to get your opinion on whether you think that the potential for disconnections between some of those wells is due to structure, due to lithology? Do you have any data that suggests explanation?
A. Jay Dixon. So the structure, the map geology and the structure out there, provides one piece of information that suggests it is possible. But relying on geologic maps in cross-sections where structures have been identified alone is not enough.
And I'd like to add, water level information, pumping water level, you know, these wells pump, drawdown is minimal, there doesn't seem to be much of a response at BM-DL-2. But the key thing is that EBM-3 monitor that's by the southern most production well it just has too much

external influence from pumping at that particular well because that's an area where the transmissivity appears to be lower, the specific yield, specific capacity is lower. And there's just too much uncertainty with that data. So I wish I could tie it together more confidently, but I just can't.
Q. Do you think the question or the unanswered question, I guess, could be answered with a test other than 1169 type test to be able to determine those connections or do you think those issues with regard to that uncertainty are also compounded by the need to have a high volume and long term test to be able to diagnose the problem?
A. Well, here's the thing. We got -- We got a 25-year test at NCA. Particularly those two northern most wells they've been pumped. They use all of their water rights every year.
If I could make one recommendation, and I'll talk to them about this, I think we need to get transducers in the two wells that we converted to monitoring wells. I think that would help at least provide an opportunity to decipher some of that noise from pumping and maybe resolve what the actual response is with more confidence.
Q. Okay. So what you're saying is you've got -- you don't have the data collected during that pumping to be able to resolve that out. So you need --

A. The periodic hand measurements, yeah, that's right. It is a long period of record but it's fairly noisy.
Q. Fair enough.
ANSWERS BY MR. COACHE:
Q. Next question. This may be for Mr. Coache. I think you suggested that measurements perhaps of both water levels but certainly of Warm Springs West discharge or measurements there show a lack of recovery from the 1169 aquifer test; is that correct?
A. A lack of recovery --
Q. A full recovery.
A. -- to the pre-test levels.
Q. Okay. That's what I was wondering. I was wondering if you can characterize whether you think that lack of recovery is a consequence of the test itself or other factors or if you have an opinion on them?
A. Well, I have lots of opinions. I think -- I do think it's a direct result, the impacts for a direct result of the pump test, I believe that. And I believe that's clear.
The lack of recovery to the pre-test levels I believe is a direct response from the very low storativity in the system and that a chunk of that water, whatever percentage you want to assign to it, a chunk of that water

for the pump test was taken out of storage. That storage then reduced the hydraulic head that feeds the spring system in the Muddy River Springs area. And since that water was taken out of storage, it hasn't recovered sufficiently from inflow to boost that level up significantly to increase that hydraulic head to the point to increase the flows of the springs.
Q. Is that the same as saying it hasn't reached equilibrium yet?
A. Well, I don't believe the system has reached equilibrium. And I don't know if you could ever -- This is kind of going in the weeds of this a little bit. But I'm not sure -- When you're looking at a system that's as big as the Lower White River Flow System and all the things that are occurring around it, I'm not sure you can ever reach equilibrium. I think you can manage around a line or an area. But I don't think you're ever going to get to a point of pure equilibrium in that system.
Q. Got it. I guess maybe a better way to say that is, so you think the impacts from the 1169 test continue on after what we've seen as a recovery at this point. Are there some influence that exists still from that?
A. I don't think the impacts are continuing. I think -- I think the impacts have leveled off. What I think

has happened is that the ability for the system to recover because of the amount of the water that was taken out of storage has limited to the recovery. So I don't think that the water level is still going down from the 1169 aquifer test. So I think we've leveled off there.

It's a continuation of how much water is flowing in to the system to get the carbonate level up to increase the hydraulic head in that alluvium to drive that water out.

MR. BENEDICT: Okay. Thank you.

EXAMINATION

By Mr. Kryder:

ANSWERS BY MR. DIXON:

Q. Levi Kryder for the record. The first question is for Mr. Dixon. On your slide 16, the right-hand panel where you're showing the correlation between EBM-3 and EH-4, what are the linear horizontal features that are present in the scatter data?

A. That is a reflection of hand measurements that don't have a lot of resolution in them. And I looked at that and it's -- they rounded it to the nearest foot. So there's several months where it's the same level.

Q. Okay. Thank you. And in your -- in any of the analyses that you did here, did you look at the response time of the system or the delay time in response across the

system, the pumping signals?

A. When I did this simple regression analysis for CSVM-4 versus EH-4, first of all, I tried to reproduce SNWA's results to make sure I could reproduce that. And then I saw the three -- It could have been five months. It could have been two months. Whatever. I did not disagree with their assessment that there was three months. That was a reasonable explanation for why that -- why that water level CSVM-4 responded with a bit of a delay. So only there. I didn't see that type of delay anywhere else when I was looking at these correlations.

MR. KRYDER: Okay. Thank you.

EXAMINATION

By Mr. Sullivan:

ANSWERS BY MR. DIXON:

Q. Adam Sullivan. In your rebuttal report, one of your sections is responding to the National Park Services discussion or recommendation to include the entire Black Mountains area. And I'm wondering if -- Well, first, you use the geologic analysis and then you refer to a water chemistry data that would support not including Black Mountains area. And just a specific question is do you have another citation that's not referred to here that this water chemistry data came from?

A. I relied on other stakeholders' reports regarding that information. Those are the references I provided. And I'm familiar with the statements that they made. And it seemed reasonable to me. So, no, I don't have anything beyond that though, unfortunately.

Q. Are you -- Is it your belief that all the water from Rogers and Blue Point is sourced from recharge in the Muddy Mountains?

A. A portion perhaps. But, you know, I think other stakeholders commented on the fact that the response at those springs from Order 1169 pumping wasn't there. I don't deny that a portion of that water is definitely coming from carbonate rock, just like the pumping wells at NCA are coming from carbonate rock. That's carbonate rock that the wells are starting to drill in. But that doesn't mean necessarily that the water that's there is being removed from the same system that we are talking about in the LWRFS because of the geologic structures and features between, such as the Muddy Mountains.

HEARING OFFICER FAIRBANK: Okay. So we are nearly out of time. So I'm just going to quickly go through and see if there -- We can do just a couple of minutes for recross if there are anybody. Coyote Springs Investments, any additional questions? Seeing none.

US Fish and Wildlife? Seeing none.

Let me do it this way. Are there any participants that wish to have about two minutes for recross? Okay. So I see Lincoln County and Southern Nevada Water Authority. I'm not seeing any other participants.

So we'll go ahead and start with the Southern Nevada Water Authority and Las Vegas Valley Water District. And, given our time frame, I'm going to go ahead and give you two minutes, Mr. Taggart.

CROSS-EXAMINATION

By Mr. Taggart:

Q. I have to think about my questions first before the clock starts. So this question I think is to Mr. Ricci but also Mr. Coache. A proposal has been made by my client to use the Warm Springs West gage and the 3.2 flow at that gage as a control on how much groundwater can be pumped. Do you understand that my client has made that proposal?

MR. COACHE: Yes, sir.

MR. TAGGART: And I heard in your testimony you alluded to a case called Cappaert or Cappaert, depending on how it's pronounced. But I want to just ask you to explain a little bit more about why is -- why is the -- do you believe the need to utilize a control at Warm Springs West of a certain flow rate as a control on groundwater pumping, is

that comparable to what needs to occur at Cappaert at Devil's Hole.
MR. COACHE: In my belief absolutely. And I believe it's actually even more relevant than what happened at Devil's Hole. At Devil's Hole the water didn't flow at all, doesn't flow. They didn't have any water rights. And it's simply a -- It's not even a water right. It's a water elevation maintenance above -- below the washer. And so they were given that right to maintain that water level at level X to maintain water on the shelf to where the Devil's Hole pup fish can breathe. There's, let's say, a one-foot decline in water level just like it would be detrimental to the Moapa dace, one-foot level in Devil's Hole eliminates probably 50, 60 percent of the breeding area for the fish. And that's why I put it in there. I really believe that they're directly related on what can happen if we don't get our hands around this and manage this system.
MR. TAGGART: And Mr. Ricci, do you have anything to add to that?
MR. RICCI: No.
MR. TAGGART: Okay. One other question is in Cappaert was the State Engineer required to do what he did or did he have the choice ahead of time to manage the system itself?

MR. COACHE: In Cappaert he was required to do what they did. There was an opportunity to manage some of the rights beforehand. They didn't take that complete opportunity. But Cappaert took all decision making out of it for the State Engineer.
MR. TAGGART: All right. Thank you.
HEARING OFFICER FAIRBANK: Lincoln County, Vidler.
CROSS-EXAMINATION
By Ms. Peterson:
ANSWERS BY MR. COACHE:
Q. Gentlemen, if you could turn to page 19 of your report, section six. I think, Mr. Coache, you said you wrote this section. Do you have that in front of you?
A. I'm sorry, ma'am. Did you say section six?
Q. Yeah, section six on page 19.
A. I did not write this portion.
ANSWERS BY MR. DIXON:
Q. Okay. So who ever wrote this portion, the question is addressed to them. There's a recommendation there that the Moapa dace will be protected if there is certain management of the Lower White River Flow System and sustainable levels of pumping and the decreed rights also on the Muddy River will be protected. And then the section ends

with, if these obligations are met within the Muddy River Springs area, there is no evidence suggesting impacts would propagate north of and beyond the Lower White River flow boundary as currently proposed by the State Engineer. Do you see that?
A. I do.
Q. Okay. And, Mr. Dixon, you wrote that?
A. Yes.
Q. All right. And are you aware that in Kane Springs Valley in Ruling 5712 the State Engineer granted a thousand acre-feet of water rights to Lincoln and Vidler but he required that the pumping of those water rights, 500 be at the existing production well, and 500 acre-feet be pumped from a future well to be developed under the applications, which is about seven miles away. Were you aware of that?
A. Yes.
Q. And would you agree that that's reasonable management by the State Engineer of the Kane Springs Valley hydrographic basin?
A. No. Because in that same ruling he also said there was a hydraulic connection with Coyote Spring Valley.
Q. And there are some questions to Mr. Coache about new evidence in the record before the State Engineer. And I'm wondering where the SNWA model is with all that new

evidence in it?
MR. TAGGART: Objection.
(The court reporter interrupts)
HEARING OFFICER FAIRBANK: Mr. Taggart's objection was as to the --
MR. TAGGART: Vagueness. What model exactly?
HEARING OFFICER FAIRBANK: Yes. Question as to vagueness regarding the use of the term SNWA model.
MS. PETERSON: I can rephrase. There's new -- There's -- Do I get to rephrase?
HEARING OFFICER FAIRBANK: Yes. Finish your question.
MS. PETERSON: Thank you.
You had questions from SNWA about the new evidence that had been developed -- Yes, to you, Mr. Coache -- since I guess 2012. Do you recall that line of questioning?
MR. COACHE: I recall that line of questioning. I do not remember them mentioning a model.
MS. PETERSON: Right. Do you know if SNWA has developed any kind of model with all of that new data?
MR. COACHE: I do not.
MS. PETERSON: Okay. Thank you.
HEARING OFFICER FAIRBANK: All right. Given the

fact that I haven't seen any other participants express an interest for additional questions, we'll go ahead and open it back up to -- Oh, I'm sorry. I'm going to open it back up to the Division of Water Resources staff.

EXAMINATION

By Mr. Sullivan:

ANSWERS BY MR. DIXON:

Q. Just one point of clarity in your rebuttal report on page six and also on page seven. On the Y-axis on both of those charts, it appears that there is a typo and the decimal point was removed from the units on the Y-axis; is that correct?

A. Feet above main sea level, is that what you're talking about?

Q. Feet above main sea levels. So from the bottom goes 1562 and then 1563 and then 1563 again. Should that be 1563.5?

A. Point-five, yep. I cut off the decimal.

Q. Okay. That was done on Figure 4 and also Figure 5?

A. Yep. Good catch.

HEARING OFFICER FAIRBANK: Okay. So we'll go ahead and open it up to Mr. Flangas for redirect. And I'm going to give you seven minutes. It's a little bit more but

there was some delay with respect to the objections.

MR. FLANGAS: I won't need that. Just a couple of questions hopefully.

REDIRECT EXAMINATION

By Mr. Flangas:

ANSWERS BY MR. DIXON:

Q. Let's just clarify a couple of points. Mr. Dixon, is it the position of the three members up there that Kane Springs should be included in the State Engineer's consideration of the Lower White River System?

A. Yes.

Q. And why is that?

A. There's a hydraulic connection based on observations made before, during, and after the Order 1169 test that clearly demonstrate it. At that location, at KPW-1, very specific at that location. I don't know what would happen if they pumped up the north end of the valley. I don't have any information up there.

Q. Okay. Thank you. In response to Mr. Benedict's questions you commented that there was noise in the well at EB-3. Do you remember that?

A. EBM-3 yes.

Q. I realize there's noise and I realize you said you don't have a great degree of confidence. But can you

explain -- You still provided data, so I need you to explain to this panel here, are you telling them to ignore the information on EB-3 or are you saying that the findings in EB-3 are important? What's your point with regard to EB-3?

A. I believe they're important. But I -- I can't draw any conclusions on the data with a hundred percent certainty because of the obvious influence from pumping in the manner in which the resolution in the water levels that are being reported. So that -- those two things right there definitely affect the R-squared value in the regression analysis.

Q. Can you ever draw anything with a hundred percent certainty in hydrology, sir, really?

A. Well, I guess not.

Q. So I guess what I'm asking now, this is important, this is an important point. I don't mean to make light of it. But I just want to make sure that we're clear here. When you say that you don't have a high degree of confidence, those of us who are lay persons wonder if that means should it be disregarded or should it be considered?

A. You know, if that R-squared value was .7, .8, you know, I would -- The fact that it's so much different. I did put the hydrograph in here, you know. The water levels definitely show response to pumping, but there is overall

trends. This is a more diagnostic tool. And it's because of the dramatic difference between the results, you know .95 versus .52. By definition .52 does indicate some correlation, but it's significantly different than the nearby well, you know, three quarters of a mile away BM-DL-2, which is a high correlation to EH-4b. It's the difference between those two.

Q. So the entire difference can't be explained just by, because there's hand measurements and just because there's a rounding, is that what you're saying?

A. Right. There's something different between those two wells, something causing the response to be that much different.

Q. Last question. And this is a question for the panel generally. Are you aware of circumstances where non-water right holders have been excluded from hearings on the basis of standing? Mr. Ricci, in your experience? Is the question clear?

MR. RICCI: I can't -- I can't recall that I -- I couldn't say with a hundred percent certainty one way or another.

MR. FLANGAS: Okay. Mr. Coache?

MR. COACHE: Yes. Water right holders that do not file protest and try to get in to the hearing process

subsequent to the -- not subsequent to, but after the protest period is expired, have been excluded all the time.
Q. (By Mr. Flangas)
ANSWERS BY MR. DIXON:
Q. Mr. Dixon, have you ever experienced a situation where folks who do not have water rights in the area in the basin that is subject to hearings have been excluded on the basis of standing?
A. Not beyond the situation that Mr. Coache just mentioned. You know, our process is transparent. It gives people a right to protest, right. And it doesn't matter who you are, you have that right.
Q. But isn't that the reason why we had .1 in our rebuttal report?
A. Right. We feel that the stakeholders who have the most on the line here are the people who have invested to resources, the people who rely on that water to run their business or to -- The 8500 people in Overton and Logandale, the Moapa Valley Water District is required by law to deliver water. Those are stakeholders. The public interest is by law protected by the Fish and Wildlife and the Park Service. That's their job. And it's also the job of the State Engineer.
Q. Okay. And that is the reason for the inclusion of the .1 in the rebuttal report?

A. It was.
Q. Okay. We don't have any -- We don't have anything -- We're not out to get the NGOs in any particular reason. And I say we meaning Nevada Cogeneration Associates.
A. That's correct.

MR. FLANGAS: Okay. Thank you. I have no further questions.

HEARING OFFICER FAIRBANK: Thank you. So we will go ahead and take a ten-minute break. We'll get started around, make it 2:45-ish, a little bit thereafter. And we'll get started with the Muddy Valley Irrigation Company.

(Break was taken)

HEARING OFFICER FAIRBANK: We will continue with the Muddy Valley Irrigation Company.

MR. KING: Thank you. Good afternoon. Steve King here for Muddy Valley Irrigation Company. This afternoon I'm going to present for the hearing Mr. Todd Robison, who is the chairman/president of the Muddy Valley Irrigation Company.

The company filed one exhibit in its August 15th, 2019, rebuttal report. And Mr. Robison will be going over that for the proceeding this afternoon.

So, in order to begin, if the witness may be

sworn in.

HEARING OFFICER FAIRBANK: Thank you, Mr. King.

(The witness was sworn in)

TODD ROBISON

Called as a witness on behalf of Muddy Valley Irrigation Company, having been first duly sworn Was examined and testified as follows:

DIRECT EXAMINATION

By Mr. King:
Q. Good afternoon, Mr. Robison. Can you please state and spell your name for the record.
A. Todd Robison, T-o-d-d R-o-b-i-s-o-n. I'm the president of the Muddy Valley Irrigation Company here representing the shareholders.
Q. Thank you, Mr. Robison. And did you prepare or direct the preparation of the Muddy Valley Irrigation Company Exhibit Number 1?
A. I did.
Q. Are there any changes to that exhibit that you would like me to identify for the record?
A. There is. There's a couple of typographical errors.

MR. KING: And, if it please the hearing officer, I would be prepared to identify those specifically. On page one, paragraph two, at line six, there is a missing word, specifically after the words State Engineer's options in view of, the word that is missing should then be inserted and that word is what. And that will then complete that sentence.

And then there is another clerical error, typographical error, that the company is aware of. And that would be on page three. And that is in Roman numeral section two at sub three. The first line, which reads, the long-term annual quantity of groundwater that may be purged from the Lower White River Flow System. The word should be pumped, not purged.

So with the permission of the hearing officer, we would like those to be entered in to the record. Are there any other corrections that you're aware of, Mr. Robison?

THE WITNESS: Those are the corrections, yes.

MR. KING: Okay. Thank you.

HEARING OFFICER FAIRBANK: Those exhibits -- Those exhibits will be admitted.

Q. (By Mr. King) And was Muddy Valley Irrigation Company's rebuttal report filed pursuant to State Engineer Interim Order 1303?
A. Yes.

Q. And is Muddy Valley Irrigation Company's participation in this proceeding to confirm its status as a holder of senior decreed water rights relative to the questions presented by the State Engineer regarding consideration of conjunctive management plan for the Lower White River Flow System and the fully decreed Muddy River?
A. Yes.
MR. KING: Madam Hearing Officer, I would move that the Muddy Valley Irrigation Company Exhibit 1 be admitted in to evidence.
HEARING OFFICER FAIRBANK: It's so admitted.
MR. KING: Thank you.
Q. (By Mr. King) Mr. Robison, could you please provide a brief history of your membership and board of director responsibilities as president/chairman in relation to the Muddy Valley Irrigation Company?
A. Yes. I currently serve as president and chairman of the board of directors of the Muddy Valley Irrigation Company. We're a non-profit Nevada corporation that operates an irrigation system in the Lower Muddy River Basin. And I've served in the capacity of board of director for close to 30 years and been a chairman for the last 15 or 16 years, something like that.
Q. For clarification, you just mentioned that the

company is a non-profit. I think if I'm recalling, the company is incorporated under the laws of the State of Nevada 1895 and in its articles of corporation it said it will be a not for profit company. Would that be accurate?
A. That's correct.
Q. And so I just wanted the record to reflect that it's not the specific more recent, within the last several decades, section of the Nevada Revised Statutes which allows for, quote, non-profit corporations to be incorporated in the state; is that correct?
A. That's correct.
Q. Thank you. So approximately how many shareholders are there in the Muddy Valley Irrigation Company?
A. Approximately 250.
Q. Are Muddy Valley Irrigation Company shareholders the beneficial owners of the Muddy Valley Irrigation Company's decreed water rights in the Muddy River and entitled to the water according to their individual proportionate interests and their shares owned?
A. Yes.
Q. As a member of the board of directors and president of the company, do you believe that the Muddy Valley Irrigation Company has a duty to preserve and protect

its corporate assets, specifically, its senior decreed water right for the use of Muddy River water?
A. Yes.
Q. This is the first day you've been here attending these proceedings that have been going on since Monday of last week; is that accurate?
A. That's correct.
Q. Okay. With that being said, are you aware of other participants in this proceeding who own shares in Muddy Valley Irrigation Company? If you do, can you please identify those shareholders for the record?
A. Yes. CSI, Vidler Water, Moapa Valley Water District, Southern Nevada Water Authority are all shareholders.
Q. Thank you. So you named -- Two of those four are Nevada political subdivisions. Do you recall if there are any other Nevada local government/political subdivision entities owning Muddy Valley Irrigation shares and who are those shareholders?
A. There is Overton Power District, Clark County representing the Township of Overton and Logandale.
Q. All right. And how about are there any State of Nevada agencies or entities that are shareholders in Muddy Valley Irrigation Company?

A. I believe there's two. Nevada Department of Wildlife and also the University of Nevada Reno Board of Regents.
Q. All right. And so for all of those shareholders and all the shareholders in the combined 250, from what I understand your testimony, is your responsibility as one of the board of directors president the governing body of the Muddy Valley Irrigation Company to protect those valuable senior decreed water right interests in the company; is that accurate?
A. That's correct.
Q. All right. And is that -- would that protection interest, that obligation, be about with regard to how many shares an individual shareholder owns or whether they are a private or a public entity?
A. It has no bearing on that.
Q. Thank you. Now let's -- May I turn your attention to the Muddy Valley Irrigation Company rebuttal report. In the rebuttal report is just a four-page letter that you signed as the chairman, it should also have identified you as the president, I believe. Is that accurate?
A. Yes.
Q. And MVID did not present an independent

hydrologic or related scientific analysis report with respect to the four specific Lower White River Flow System issues and questions identified in Interim Order 1303, did it?
A. That's correct.
Q. So can you please tell us how Muddy Valley Irrigation Company's rebuttal report answered those questions?
A. Yes. We believe that as an irrigation company that the senior groundwater rights take precedent over any other rights --
Q. Excuse me, Mr. Robison. May I interject? I believe you said senior groundwater rights. Did you mean to say surface water?
A. Surface water rights. I apologize for that. Yes. We believe that the senior adjudicated rights in the decree take precedent over any other rights in the system.
Q. And that is your understanding that at least one of the central purposes of these 1303 proceedings is to determine whether depletions caused by junior groundwater right development may impair or affect the senior decreed surface water rights?
A. That is correct.
Q. Thank you. So, on the specific questions, I believe the first question had to do with the geographic

boundary of the State Engineer's Lower White River Flow System. And the Muddy Valley Irrigation Company did not disagree with the State Engineer's determination as set forth in Order 1303, did it?
A. We did not.
Q. Okay. Thank you. Then as to the next three questions. Can you just please identify, just in a summary way, the concurrence that Muddy Valley Irrigation Company raised in its rebuttal report?
A. Yes. I think, I believe to answer the next three points, our concern is driven from the reduced stream flows in the Muddy River, which the end result is at our point of diversion that we have a reduced flow. And the concern is, is that the upper rights have a great impact on our lower rights. And being able to identify the problems that are risen from that is outside the scope of our ability, and we rely heavily on the State Water Engineer to assist us with that.
And, clearly, we're a small company that is an end right user. And we do not have any hydrological expertise in the upper basin to make any kind of determination as to what's causing the reduced stream flow. So our purpose in our letter today I think clearly spells out that our concern is protecting our senior water right.

Q. And when you say the upper rights, I want to just see if I can get you to clarify that a bit. So in the Muddy River decree, that's entered in 1920; is that correct?
A. That's correct.
Q. And as I'm just recalling in these provisions that all the water rights that were determined, the relative rights adjudicated to determine that decree were found to be found -- found to be appropriated, placed to beneficial use before 1905; is that accurate?
A. That's correct.
Q. And do you also know that under the decree the river is divided in to two sections, the upper and the lower; is that accurate?
A. That's correct.
Q. And when you say the upper rights, you're not necessarily referring to the decreed rights in the river. Are you more accurately referring to any possible depletions by spring flow?
A. Yeah. That's our only gage that we have is actual flow that shows up at our diversion point. And any diminished flow from that is a concern to us.
Q. And is it true that in the decree the Nevada district court judge determined that as to all the water that reaches the diversion point, as you said, and I think that

would be at wells siting, that the Muddy Valley Irrigation Company is entitled to take and divert all of that water for the benefit of its shareholders and others?
A. That's correct. I think it actually has a little stronger language than that. It says we're obligated to take it.
Q. Obligated to take it. I think you're right.
A. And put it to beneficial use.
Q. It's a long decree. It incorporates the relative determinations of the State Engineer. It actually has a Supplemental Exhibit B to it that confirms the rights of all the holders in the Muddy River.
Now, as I remember also, that decree has some specific language that states that the Muddy River by the appropriation and placing to beneficial use of the holders of the rights determined in the decree has been fully consumed and exhausted and that it's fully appropriated; is that correct?
A. That's correct.
Q. I think there's some language in the decree that talks about that there's a prohibition on any further development on the sources or the spring heads. Is that your recollection?
A. Yes, it is.

Q. And so that would be kind of consistent then with the language about fully consuming and exhausting. And so that language, does that tell you that any -- there would be no further appropriations available for river or spring flows in the Muddy River system?
A. That's my understanding.
Q. All right. Thank you. And is that the way since your tenure and association with Muddy Valley Irrigation Company the company has operated with regard to the water rights adjudicated to the company?
A. That's correct.
Q. And is it not also true that below the division between the Upper and the Lower Muddy River that the company is actually directed to effectively manage those flows and all the water that reaches the diversion point for the benefit of the shareholders?
A. That's correct.
Q. But you're not an attorney so you don't know how -- you just understand how the decree works and as a president of the company?
A. That's correct.
Q. And this is an unusual company in some ways in Nevada, would you agree that it's a shareholder company that owns water rights for the benefit of its individual

shareholders; is that accurate?
A. Yeah, the irrigation company does hold those rights.
Q. Okay. Thank you. So can you explain, and I think you have, that the company is relying on the State Engineer to enforce the rights that were decreed by the Nevada District Court in 1920 to the Muddy Valley Irrigation Company, as to why the company joined -- not joined, but concurred with some of the analysis that was presented in actually certain sections in the July 3rd, 2019, report by Southern Nevada Water Authority. I think you already mentioned one reason for us as far as budget and surface water assets of the company unrelated to groundwater assets. Would that be accurate?
A. That's correct.
Q. I think you stated that as the president of the company, one of the board of directors, that there's an obligation to protect the assets of the company which for the benefit of the shareholders?
A. That's correct. We represent all shareholders.
Q. So that being said, would it be a fair statement that the decision to concur in the specific technical scientific hydrologic positions that were -- that SNWA had in particular sections of its July 3rd report were done as a

conservative and a cautionary way to protect those assets?
A. That's correct.
Q. Because the company has no independent hydrologic or scientific technical analysis, does it?
A. No, we do not.
Q. And the company doesn't own any groundwater rights, does it?
A. No.
Q. So the company's interest are for the State Engineer to always keep those rights as a baseline that are necessary to be protected in these proceedings as it considers the questions presented in the possible conjunctive management of the Lower White River Flow System; is that correct?
A. Yes.

MR. KING: Thank you, Mr. Robison.

Madam Hearing Officer, I believe this would be the -- conclude the direct examination for Muddy Valley Irrigation Company of Mr. Robison. And we would like to reserve whatever time might be appropriate for redirect after cross-examination.

HEARING OFFICER FAIRBANK: Thank you, Mr. King. And you have approximately an hour and 40 minutes remaining, so we'll go ahead and reserve that for you.

MR. KING: Thank you.

HEARING OFFICER FAIRBANK: All right. We'll go ahead and open it up for cross-examination. And for this we'll go ahead and limit it to seven minutes per participant. And we'll start with Coyote Springs Investments.

CROSS-EXAMINATION

By Mr. Herrema:
Q. Good afternoon, Mr. Robison. I'm Brad Herrema, counsel for CSI.
A. Okay.
Q. Just a few very quick questions for you. You signed the irrigation company's rebuttal report; is that correct?
A. I did.
Q. Were you qualified as an expert witness in these proceedings at all?
A. I think as stated we don't have any expert witnesses, per se. And as a representative of the company I signed it.
Q. Okay. Did the irrigation company engage in the services of any technical expert in preparing its August 15 rebuttal report?
A. No.
Q. You mentioned earlier that a number of parties to

these proceedings are shareholders in the irrigation company. Do you recall that?
A. Yes.
Q. Okay. Who is the irrigation company's largest shareholder?
A. By actual certificates, Southern Nevada Water Authority.
Q. Okay. And the others that you mentioned, CSI, Vidler, Moapa Valley Water District, they are all minority shareholders; is that correct?
A. Yeah, they own a portion of the shares. To my knowledge, exactly how many, I'm --
Q. None of them are majority shareholders?
A. No.
Q. You mentioned the irrigation company's points of diversion. Do these points of diversion include points downstream of Glendale?
A. Yeah. Downstream of the Glendale gage.
Q. And you also talked about or you distinguished between an upper basin and a lower basin. Can you tell me what the point of demarcation is for --
A. When we talk as long-time residents, we talk about the Upper Muddy and the Lower Muddy.
Q. And what separates those two?

A. The freeway. The Glendale gage.
MR. HERREMA: Thank you very much. No further questions.
HEARING OFFICER FAIRBANK: United States Fish and Wildlife Service? Not seeing any questions.
National Park Service?
MS. GLASGOW: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions.
Moapa Band of Paiute Indians? No questions.
Southern Nevada Water Authority and Las Vegas Valley Water District?
CROSS-EXAMINATION
By Mr. Taggart:
Q. Good afternoon. For the record, Paul Taggart for the water authority and the district. Just to clarify, SNWA is not a majority shareholder either; correct?
A. That is correct.
Q. All right. So I might have to repeat a few things just to set up this next question. So I heard your testimony to be that there's a decree and the decree divides the water in the river at the Glendale gage. So do you consider any water that gets to that point to be the company's water?
A. Yes.

Q. Okay. And so do you consider any groundwater pumping that depletes water from the river or water that could have gotten to the river to be a conflict with that surface water right?
A. It can be, yes.
Q. Okay. Now, I think you mentioned to me one time that a shovel in one share at the head waters is better than ten shares at the tail waters.
A. Yeah, I did.
Q. Can you describe what you mean by that specifically with respect to the Muddy River?
A. Yeah. That's kind of an old farmers wives tail that if you control the water at the head of the ditch you'll get all of your water and the guy at the end of the ditch a lot of times gets what's left over. And, you know, a lot of this is in the same regard to potential over pumping or usage of water beyond the ability to maintain the stream of the river. It can happen. If during the test pump we've seen a decrease in the stream flows. And in regards that's what I mean by that is the person that's upstream of us can definitely control what happens to us.
Q. And when you say the test, do you mean the 1169 pump test?
A. That's correct.

Q. Okay. And in this situation though, that one share and a shovel upstream could be somebody with a well in the groundwater system; right?
A. That's correct.
Q. So do you think the State Engineer can determine the long-term quantity of groundwater that can be pumped from the Lower White River Flow System without taking in to consideration MVIC's water right?
A. No.
Q. You're aware, are you not, that in the last few years there's a power plant that's not operating anymore in the Overton area; right?
A. Yes, I'm aware of that.
Q. And so there was alluvial pumping for that power plant for a series of years from what we sometimes in these proceedings have referred to as the LDS water and the power company water; right?
A. That's correct.
Q. Now, in the years since that water has stopped being used for the power plant, have you seen a change in river flows?
A. Yes.
Q. Could you describe that?
A. Yeah. A little bit complicated. When the river

flow in the summer months decreased that well siting, we -- Well, let me back up. In the early 1960s, the irrigation company took on a huge task of creating a reservoir to store water that was not mostly benefitted in the winter months to be able to supplement the summer months. And over the period of time, as the stream flows diminish or go back up, we constantly are adjusting from an operational standpoint the flow coming out of Bowman Reservoir to maintain a level of consistency for our shareholders. Obviously it was shareholder water that went in there and the benefit was back to the shareholders.

Since the pumping, the alluvial pumping, has stopped, then that frequency of adjustment seems to have leveled out a little bit. Did I answer your question?

Q. Yes. I mean, do you think there's more water in the river now?

A. No.

MR. TAGGART: Okay. Great. I have no further questions. Thank you.

HEARING OFFICER FAIRBANK: Moapa Valley Water District? Seeing no questions.

Lincoln County, Vidler? Seeing no questions.

City of Las Vegas?

MS. URE: No questions.

HEARING OFFICER FAIRBANK: Center for Biological Diversity? No questions.

Georgia Pacific Republic? Seeing no questions.

Nevada Cogeneration Associates? Seeing no questions.

Bedroc?

MS. URE: No questions.

HEARING OFFICER FAIRBANK: And Nevada Energy?

MS. CAVIGLIA: No questions.

HEARING OFFICER FAIRBANK: No questions.

I will open it up to the Division of Water Resources staff and the State Engineer. Okay. Seeing no questions on our end, Coyote Springs Investments, do you have any further questions?

And Southern Nevada Water Authority?

All right. Well, thank you very much. We'll conclude the proceedings with the Muddy Valley Irrigation Company.

Before we conclude for the day, I wanted to go ahead and address a couple of just kind of procedural administrative matters. So tomorrow morning we will go ahead and get started with Bedroc. And then at the conclusion of the two hours allocated for Bedroc and for cross-examination, then we'll get started with Nevada Energy. And then if we

are done before lunch, then we'll go ahead and open it up for public comment. If we're not done until the lunch time, then we'll return after lunch for public comment. But public comment will follow the conclusion of the presentation by stakeholders who have submitted rebuttal reports. And at that time then we'll also address any other administrative or procedural matters that we have remaining. And so we'll see everyone tomorrow morning. Thank you.

(Hearing concluded at 3:19 p.m.)

STATE OF NEVADA)
)ss.
COUNTY OF WASHOE)

I, CHRISTY Y. JOYCE, Official Certified Court Reporter for the State of Nevada, Department of Conservation and Natural Resources, Division of Water Resources, do hereby certify:

That on Thursday, the 3rd day of October, 2019, I was present at the Legislative Counsel Bureau, Carson City, Nevada, for the purpose of reporting in verbatim stenotype notes the within-entitled public hearing;

That the foregoing transcript, consisting of pages 1597 through 1711, inclusive, includes a full, true and correct transcription of my stenotype notes of said public hearing.

Dated at Reno, Nevada, this 4th day of October, 2019.

____
CHRISTY Y. JOYCE, CCR #625

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In The Matter Of:

DEPARTMENT OF CONSEVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES

Vol. x
October 04, 2019

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123 W. Nye Lane, Ste 107

Carson City, Nevada 89706

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STATE OF NEVADA
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
BEFORE MICHELINE FAIRBANK, HEARING OFFICER
---oOo---

IN THE MATTER OF THE ADMINISTRATION AND MANAGEMENT OF THE LOWER WHITE RIVER FLOW SYSTEM WITHIN COYOTE SPRING VALLEY HYDROGRAPHIC BASIN (210), A PORTION OF BLACK MOUNTAINS AREA HYDROGRAPHIC BASIN (215), GARNET VALLEY HYDROGRAPHIC BASIN (216), HIDDEN VALLEY HYDROGRAPHIC BASIN (217), CALIFORNIA WASH HYDROGRAPHIC BASIN (218), AND MUDDY RIVER SPRINGS AREA (AKA UPPER MOAPA VALLEY HYDROGRAPHIC BASIN (219).
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TRANSCRIPT OF PROCEEDINGS
PUBLIC HEARING
HEARING ON ORDER 1303
VOLUME X
(A.M. SESSION, Pages 1713 - 1823)

FRIDAY, OCTOBER 4, 2019

REPORTED BY: CAPITOL REPORTERS
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(Continued)

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For Moapa Valley Water District: Greg Morrison, Esq.
For Muddy Valley Irrigation: Steve King
For Bedroc: Therese Ure, Esq.
For City of North Las Vegas: Therese Ure, Esq.
For National Park Service: Karen Glasgow
For Center for Biologic Diversity: Patrick Donnelly

I N D E X

CARSON CITY, FRIDAY, OCTOBER 4, 2019, A.M. SESSION
---oOo---
HEARING OFFICER FAIRBANK: Good morning. So this is the continuation of the hearing regarding the administration of the Lower White River Flow System and Order 1303. And this morning we're going to go ahead and proceed with our final two participants and their presentations as well as cross-examination of those participants.
And we'll start the day off with Bedroc. And so at this point I'll go ahead and turn it over to Ms. Ure.
But before we get started, when we're concluded with the presentation of the participants, we'll go ahead and address some final administrative matters before we proceed to public comment.
So, Ms. Ure.
MS. URE: Thank you. Good morning. Thank you. Therese Ure representing Bedroc. And today Mr. Dixon is also here with me, so if we could swear him in, that would be great.
(The witness was sworn in)
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JAY DIXON
Called as a witness on behalf of
Bedroc, having been first duly sworn,
Was examined and testified as follows:

DIRECT EXAMINATION
By Ms. Ure:
Q. Good morning, Mr. Dixon. Can you please, turning to Bedroc Exhibit 1, give us a brief background of yourself?
A. As I mentioned yesterday, I've got a Master's degree in civil engineering from the University of Nevada, Las Vegas. Over 25 years experience as a hydrologist here in Nevada. I got a Nevada PE, a Nevada hydrologist, and I only work on Nevada projects.
Q. And, Mr. Dixon, were you offered as an expert in hydrology and waters rights in this proceeding?
A. Yes.
Q. Have you been qualified before the State Engineer?
A. Yes.
MS. URE: Okay. And so we would offer to qualify for this proceeding Mr. Dixon as an expert in hydrology and water rights.
HEARING OFFICER FAIRBANK: And as there were no objections, I think we've resolved all of that, and so he'll be admitted.

MS. URE: Thank you.
Q. (By Ms. Ure) Mr. Dixon, turning to Bedroc Exhibit 2, did you assist in preparing the report on behalf of Bedroc?
A. I did.
Q. Okay. And did you prepare a presentation for today's proceeding?
A. Yes.
Q. Can you please walk us through that?
A. Yes. Turning to slide two. I want to start off by tying this presentation to the rebuttal report issues that were identified in the Bedroc rebuttal report. I'll go in order as they are listed in the report.
First off, exclusion of the White River Flow System north of Coyote Spring Valley. I'm not going to spend much time on that. It's been discussed by plenty of other stakeholders. I think it's pretty clear that there's no reason to include. Hydrology data doesn't support it. I think that was a recommendation based purely on an agenda to impede the SNWA project. There's really no basis for it.
Moving on to the content that I'm going to spend most of my time talking about today in this presentation, as

identified in my rebuttal report. Number two, management considerations for certain areas with access to alluvial aquifers. Alluvial pumpage in the Muddy River Springs area versus basin fill alluvial pumpage in north Coyote Spring Valley. There is a difference and I will discuss that.
Effects from carbonate in Muddy River Springs area alluvial pumping on basin fill alluvial wells on north Coyote Spring Valley.
And, finally, I'll mention just in closing, I'll discuss in closing, movement of water rights between the Muddy River Spring area alluvial and carbonate wells in the LWRFS.
Slide three. Quick overview for Bedroc. In terms of location, it is located just north of the Clark County line. We're in Lincoln County. Three parcels totalling 560 acres, obviously in Coyote Spring Valley, what we consider the northern part. Specifically it's situated near the western edge of the Pahranagat Wash about a thousand feet north of the confluence of Pahranagat and Kane Springs Washes.
Slide four. Overview map. You see where we are relative to the northern part of the LWRFS, Coyote Spring Valley, specifically. And you'll see the magenta-colored outline. That is the three parcels totalling 560 acres

associated with Bedroc down at the -- You can see at the mouth of the Kane Springs Wash just off of US 93.
Slide five. So, to begin with, we thought it was important to acknowledge why Bedroc is here. Bedroc was not a participant in the working group meetings that preceded this administrative order. I think the reason for that is Bedroc has the most senior underground rights in the LWRFS with a priority of 1919.
A hundred percent of Bedroc's Coyote Spring pumping is within the basin fill alluvium. That's very clear. It's a fact.
Bedroc's water rights are a critical asset for their business, multiple businesses. The business is thriving and expansion plans are underway. So decisions that are made in the LWRFS because of where this project is situated could potentially impact Bedroc. And they really need to have a seat at the table.
The outcome of management decisions in the LWRFS may affect their ability to obtain additional water resources. I want to be very clear about that. The business is thriving. And, in order to expand, they're going to need more water.
Next slide, slide six. So the image on the left is a current aerial. And this ties in to the historical

information that was filed on the vested claim. This claim has not been adjudicated, so it is a claim. You can see remnants of the historical tunnel that is described on the proof, pipeline conveying water to a golden pond that is there today. Image on the left is from August 1945. This is the historical Butler Ranch from the old US 93, so it's a little east of where the current US 93 is. But what you can see there is land being worked, producing. Those are large trees and those large trees got water from somewhere.
Q. And, Mr. Dixon, the image on the right is the 1945 picture; is that correct?
A. Correct, yes. Real briefly, the claim identified on that proof is underground percolating water Sheep Range Mountains. Claim diversion rate of .5 CFS.
Moving on to slide seven. So getting in to the specifics of the groundwater conditions that I alluded to at the beginning. I will spend most of the rest of the time discussing north Coyote Spring Valley groundwater conditions based on -- This is not based on any fancy modeling. This is based on real data that is publically available to anyone. Bedroc pumping and water level responses locally. And then Bedroc's groundwater source, capture, and impacts.
Slide eight. Okay. The image on the left is the LWRFS basins. You can see where we are within Coyote Spring

Valley. In this area that I've outlined right here is where I'm going to spend pretty much all of my time discussing groundwater conditions.
Moving over to the image on the left, you can see all the dots are the various -- And consistent throughout this presentation, green dots represent alluvial monitoring wells. The labels here, it's difficult to see, but those are groundwater elevations. Blue dots are carbonate monitoring wells and pretty decent coverage. There's very extensive coverage of alluvial monitoring wells at the site. There's more than 20 wells there, monitoring wells. And those wells are associated with compliance requirements for their land fill.
Wells, carbonate and alluvial monitoring well to the north, that's CSVM-7 that we've heard a lot about. And then carbonate and alluvial monitoring well a few miles to the -- about five miles to the south right along US 93. So that's the extent of where I'll be discussing groundwater conditions today.
Q. And, Mr. Dixon, when you said this area, you're talking about the dotted blue line that's delineated on the left-hand side of the map and then it's blown up to the right; is that correct?
A. That is correct. And I also want to point out

that using as a base map the Rowley 2017 geology map that we've seen throughout this hearing. I'll reference several times during this presentation the Gass Peak Thrust fault and its effect on groundwater conditions here as well as the now infamous highway fault, normal fault that's mapped parallel to US 93 here. The Delamar thrust and the Kane Springs fault zone coming down this way.
Slide eight -- or nine. Excuse me. This was some information that was presented in the CSI July 2019 report. And I got to acknowledge I did not confirm their delineation of recharge zones and their calculation of elevation ranges pertaining to certain recharge coefficients. So I just took their information as it was presented. I focused -- This is the entire extent of their recharge calculation. I focused on zones one, two, three, and four. Just intuitively, it looks like those are the four zones that could contribute recharge in this area of Coyote Spring Valley. And, again, the magenta boundaries are Bedroc.
Moving on to slide ten, this is a table from CSI's report. I've highlighted the four zones shown here. I'm also showing the four methods used to estimate recharge. I focused on Maxey-Eakin 1949. I assumed based on their description and testimony, that it is, indeed, the Maxey-Eakin recharge coefficients based on 1936 Hardman maps.

That is a valid method for calculating recharge. That's how Eakin did it back in 1946. I ignored these two methods here. And CSI did acknowledge this, their experts acknowledged this during their presentation.
Q. And, Mr. Dixon, when you say you ignored these two sets of data here, that's the middle that's been crossed out on the table; is that correct?
A. Yes. So the first one that I ignored is Maxey-Eakin 1949. And the reason I ignored it is because it appears, based on what they put in here and what I heard them say, that the precipitation was calculated using PRISM and it's been widely accepted that that's not an acceptable method for estimated recharge in the great basin.
Also, the second method that I ignored is Nichols 2001. That work has been discredited. It generally overestimates, in some cases grossly overestimates, recharge in some basins. So I ignored it.
I did include the Epstein. So it's still a pretty wide range. And all I did, as you can see on the right, is I just took the average for those four zones, Maxey-Eakin, Epstein, 2004. It's 750. That seems reasonable. But I want to tie it in to groundwater conditions in the forthcoming slide.
So let's move on to slide 11. Okay. So the

image on the left is the same general area I've been discussing, north part of Coyote Spring Valley. What I've done here is put -- incorporated using the GIS data that was published in the Wilson 2019, this is Bedroc Exhibit 21. He mapped carbonate potentiometric head throughout Clark County. Unfortunately, he stopped at Clark County. I wish he would have gone further north, but he didn't.
So the image on the left was my interpretation. All I did was simply, I took his contours and extended them north. I didn't just do it blindly. As I mentioned earlier, there is a carbonate monitoring well right here, there is a carbonate monitoring well right here, and there's one to the north. So I used that data current carbonate water levels to influence where I terminated these contours.
Q. And that's the image on the right, the --
A. Correct. Yes, that's right. The labels as shown are carbonate groundwater elevation.
All right. Moving on to slide 12. Again, this is the Rowley geologic map. You can see where the Bedroc property is relative to section LL. I'm going to talk a lot about this section.
But before I get to that, I want to focus your attention to about 18 miles south, section FF and section EE. So the conceptual model here is that the recharge coming --

that we see that we are capturing that is driving the groundwater conditions that we observed at Bedroc is originating from the Sheep Range. There's reasons for that and I'll put that altogether in the coming slides. But there is -- based on groundwater observation.
But there's also a geologic reason for this. And going back in time, you know, the first question I asked myself is why would someone develop this land here. If you've been in Coyote Spring Valley, there's not much evidence of water, natural, except here. That's what they saw in the early 1900s. There's a reason they stopped here and settled here and worked this land. And there's a reason it continues today. This is where shallow groundwater is visibly present and obviously shown in the observation data that is widely available.
Q. And here is being the area at Bedroc; is that correct?
A. Correct.
Q. Okay.
A. So going back to section FF, what I've circled here is this -- It's shown as a -- These are sedimentary rocks. And basically, essentially, it's a lower clastic confining unit and sedimentary rocks consist of quartzite and shale. It comes out like a shelf. Now, if you remember,

there was a lot of discussion last week about CSVM-5. It's a little further south of here and it is on the other side as mapped here the Gass Peak Thrust. But this shelf that's sitting out could be the reason why alluvial waters are rising by seven feet down there since that well was put in. It's capturing recharge and it's just sitting there. It can't get through this shelf down in to the carbonate rocks. That's very obvious down here.
As we move to the north, section EE, this shelf is still present.
Q. And, Mr. Dixon, when you talk about this shelf are you referring to the cross-sections and the area that's shown in green?
A. Shown in green. It's identified as sedimentary rocks.
Q. Thank you.
A. So, moving on to slide 13, this is section LL. It goes right through Bedroc. This is the Sheep Range. This shelf doesn't go out into the -- This is alluvial fill. This shelf does not extend out to here. So the same processes are occurring here as they are further to the south. But when the recharge, mountain block recharge, gets in to the alluvium, it has only one way to go, down and to the east. And when it goes down, it doesn't encounter this relatively

impermeable confining unit. As it gets further to the valley margin, it daylights or almost daylights and it actually -- There are springs. There have been springs through time. And this is where the Bedroc site is. This is where the water, alluvial water, daylights.
Now I want to focus on groundwater conditions. I'm kind of building the conceptual model here, recharge from the Sheep Range, near surface groundwater at Bedroc, because of geologic conditions. This is a zoomed-in version of that, again, the Rowley base map, Wilson 2019 carbonate extended carbonate groundwater contours.
Q. And you're on slide 14?
A. Sorry. This is slide 14, yes. Again, the green dots are alluvial groundwater elevations. Blue dots are carbonate groundwater elevations.
And the thing to note here is that carbonate groundwater elevation as mapped here is on the order of 2100 feet above main see level. However, at the Bedroc site, the alluvial groundwater lip, there's a sharp gradient in the alluvium and there's a reason for that and I'll get to that, 25 to 2400. It's about a 350 foot difference. Alluvial groundwater levels are 350 feet higher than the underlying carbonate aquifer levels. Water doesn't go up.
So let me advance to slide 15. Staying with this

theme of our conceptual model Sheep Range recharge west to east. These are alluvial, the red lines are locally derived alluvial groundwater levels, contours. And, as you can see, 25 to 2400 feet over this short distance, a hundred-foot drop in alluvial groundwater levels. The reason -- And then once you get on the other side of US 93, they drop precipitously, a sharp drop. The reason is that water is hitting that highway fault and falling off west to east.
Moving on to slide 16, these are groundwater contours that I generated from the 20, 25 or so, alluvial monitoring wells at the Bedroc site. And you see how they tie in with the regional level water levels. Again, 25 to 2400 feet. Image on the left. And as you move to the right, 350 feet higher groundwater elevation in the alluvium than the carbonate.
Let's move on to slide 17. So now I got all of this groundwater contours, I've used existing information. I didn't create anything new. It was all data provided to me by Bedroc and publically available sources from DWR, generally. So I just drew two simple profile lines.
The first one we'll talk about I call the north/south line. I started at CSVM-7 because I had known data. I take it through an old stock well, CS, Inc., they actually had water levels on DWR's site. It's only a hundred

feet deep. Through the Bedroc site, obviously. And then I continued south and I terminated this line down here at CV-VF-1 where there is an alluvial monitoring well and a carbonate monitoring well right next to each other.
The second profile line goes from west to east. Obviously I don't have any alluvial groundwater elevation information here. So I had --
Q. And here is the far west side of that line; is that correct?
A. Yeah. From west of Bedroc. So I didn't try to interpret it or I just didn't show any alluvial water level elevations in that area. Of course I got a vast amount of data here and I connected it to two SNWA monitoring wells located on both sides north and south of the Kane Springs Wash fault zone. These are alluvial monitoring wells.
Let's go to slide 18. This is, again, this is the north/south profile line. I started it at CSVM-7. So to the north we have the Pahranagat shear zone at the north end of Coyote Spring Valley. This is not a model. All I did was connect dots. It's really simple. Alluvial groundwater elevation. It goes up. Water does not flow uphill. Recharge is not coming from Pahranagat to the north in this area. It does not flow uphill. It can only be coming from one place. And I'll show you in the next profile.

The blue line is the carbonate groundwater level. Relatively flat, indicative of the very high transmissivity that has been well-documented here. But it flows from north to south. It's a fact that carbonate recharge comes from the north and goes to the south, generally. But the flow direction, as you saw in those contours, are from west to east. But this is a north/south line.
Alluvial groundwater here at the Bedroc site very close to the surface. We cross the highway normal fault south of the site. And then it starts dropping off when you get down to the south end of that line where the two monitoring wells are. Again, I want to highlight 350 feet difference between alluvial and carbonate water levels.
Go to slide 19. Same image. Just as a reminder I want to talk about the west line now. It starts here. It goes from west to east.
Let's go to slide 20. I don't have any data on the alluvial water levels here, so I didn't connect any dots. I did extend the carbonate line from the Sheep Range. We get to the -- we cross the Gass Peak Thrust. I have water level information once we get to the Bedroc site starting to note the sharp drop in gradient. We cross -- This is a typo. This actually is the highway fault at the Kane -- not the Kane Springs. Not the Kane Springs strike slip is not even

what it is. It's just a typo. But there is a fault between the Bedroc site and this SNWA monitoring well. And you can see as a result the gradient gets even steeper as we go across that fault.

It is very important to note what happens here. So, obviously, alluvial water is recharging carbonate across that Kane Springs and Delamar thrust fault zone.

Q. So, Mr. Dixon, just for the record, you had on your slide where it said highway normal fault and then you had Kane Springs strike-slip fault. So is your testimony that where it says Kane Springs strike-slip fault should be deleted?
A. Delamar thrust.
Q. Oh, it should be --
A. Yeah. That's a typo.
Q. Okay. And then the area that you're focusing on is delineated in red around the horizontal distance around 25,000l is that correct?
A. Yes. So, obviously, I forgot to mention this. The X-axis is distance from the start to the end of each profile line in feet. Groundwater elevation or surface elevation in this case and groundwater on the Y-axis.

Okay. So let's move on to slide 21. This is an oblique view of Coyote Spring Valley just south of the Bedroc

site. And this simple Google Earth profile from west to east. And I'm going to talk more about this feature, this topographic feature on the west side of the site. It's important because it plays a role in their water management system, their ability to move water around. It's an elevated area, embankment, natural embankment, where they put storage ponds, two storage ponds. The first one was put in around 2004, 2003 time frame. It's unlined. So remember that, unlined storage ponds, up here on this embankment. This is the storage pond that I showed earlier about in the center of the site at the toe of the embankment, moving to the east where it becomes relatively flat until it goes up the other side of 93, which I'm not showing here.

Okay. So let's -- One more thing I want to point out. Note this area of white surface soils and green right here. These are phreatophytes. And the white soil is an indication of shallow groundwater evaporating. And these are evaporites, the residual from shallow groundwater evaporating. This is natural ET.

So let's move on to slide 22. Zoomed-in view of what I just explained. This is, it's hard to see here, but this is a huge pond. When it's full, it stores about 13.7 feet of water. That's the head in it. And the other older, unlined, storage pond right here known as Lake Lindsey, east

to west -- or west to east. Excuse me.

Let's move on to slide 23. So now I'm focusing on groundwater conditions locally at the Bedroc site. This is Bedroc's pumping over time at the bottom. The hydrographs are a composite of their observation wells for the industrial facility with the longest period of record going back to 2003. So something happened between 2003 and 2006. Water levels rose in the order of ten feet or so. Unfortunately there's no data between '03 and '06. But there's two reasons for this, I believe. You've heard one, throughout this hearing, this 2005 recharge event.

Going back to what I talked about earlier, I mentioned CSVM-5, that alluvial monitoring well, and it responded to that 2005 event. There was, I believe, it was two or three foot rise in water level from that event in the alluvium. And it's located about the same distance from the Sheep Range as we are. So there's no reason -- I believe that could have had an effect. But I think the other reason for this is 2003 is when they put that unlined storage pond. It's not a very good way to manage water. Because not only was it evaporating, it was also infiltrating back in to the ground. So they're recycling their water. But it probably contributed to this sharp rise in water levels.

But more importantly here is how the water levels

have responded as the system has essentially reincorporated. Over the last five years it's been relatively stable even though their pumping has been fairly constant.
Q. Okay. So for the record it looks like you have two data sets for, like, one for 2004 and one for 2006. And then the gap of data is between 2006 and 2011-ish; is that correct?
A. Yes.
Q. Thank you.
A. There are a few water level readings in 2005. You know, that pond had been constructed in 2003. And then, of course, the wet year of 2005. I think these water levels were already rising because of the infiltration introduced from the up gradient side of the site. But I can't rule out that the alluvium didn't respond to that recharge event at the same time. And we're just simply reaching -- going back in to equilibrium from continued pumping as a result of those two events, a wet year and an installation of an unlined storage pond.

Okay. Slide 24. Close-up view of the Bedroc site again. Same wells. Now I want to focus your attention to this well right here, CSV-3000M. That's the SNWA monitoring well north of the Kane Springs fault zone. And then CSVM-4, this is a carbonate well. You've heard a lot about it on the other side. It's located right here. These wells are pretty close to each other, as you can see.

So the orange plot is a hydrograph. And pay no attention to this early data. That's when I was actually as a consultant for SNWA, I oversaw the construction and development of this well. We did a development test at the beginning. And it had a very noticeable response, as you can see. But it's continued to rise. But, again, it's on the other side of the Kane Springs fault wash zone. Continuous rise in water levels. No response, no obvious response, to Order 1169 pumping.

CSVM-4 here. And you can see a completely different response in the alluvial water levels on that side of the fault versus carbonate water levels on this side of the fault.

Q. And what is that and this?

A. This side is -- The monitoring well on the left is the alluvial monitoring well. And then I guess that side would be CSVM-4 carbonate well on the right.

Okay. Let's move on to slide 25. Same image on the left. Now I'm showing CSVM-4 levels just like the previous slide. Order 1169 pump test. CSVM-4, sorry. It's blue shown right here. It's the bottom hydrograph. Obviously this response has been well-documented and

discussed extensively in this hearing. What I'm more interested in is what happened up at the north. This is CSVM-7, an alluvial monitoring well. It actually rose during the test. Probably, you know, there's -- this well was put in in, I think, 2004. You don't see much there in terms of the wet year in 2005. But it rose and it looks like it's pretty level since the end of the Order 1169 pump test.

Let's move on to slide 26. This is another oblique view looking south at Coyote Spring Valley, US 93, from north to south you can see Bedroc here just west of US 93 and extensive evaporites -- evapotrans -- ET is occurring here near surface groundwater. A lot of salt residual here basically encompasses the Bedroc site.

And I've mapped, just did a rough estimate of the area that I believe is influenced by this evaporation and the phreatophytes, 2200 acres. That's just a rough estimate in GIS.

Let's move on to slide 27. So in terms of a water budget at this local level, I explained how I arrived at that 750 acre-feet from zones one, two, three, and four in the CSI report.

Estimated current land area. As I mentioned with phreatophytes and shallow groundwater that is evaporating based on physical evidence at the surface, 2200 acres. I

used an ET range for phreatophytes incorporating the influence from shallow groundwater evaporating .2 to .3 feet per year, pretty low. If you were to multiply that range by 2200, you come up with an estimate of groundwater that could be potentially captured without pulling water out of storage. That's ET capture we hear a lot about, four to 600 acre-feet of that 750 acre-feet of recharge. So that's my rough water budget for this area.

Again, current and additional potential basin fill alluvial pumping in north CSV would capture ET. It's clearly demonstrated here. If we were pumping more than just the ET, we would see water levels dropping west of Bedroc. Excuse me. East of Bedroc. It's not happening. Water levels are actually rising.

As soon as pumping exceeds what can be captured with ET, you start pulling water out of storage, those water levels down gradient will start declining. But they're rising.

So let's -- I'll wrap up with my summary and conclusions, slide 28. Again, the entire White River Flow System should not be included in the LWRFS. I don't need to spend any more time on that.

What I want to focus on is numbers two and three. So, as indicated in Bedroc's rebuttal report, our position is

that transfers of senior alluvial rights from the Muddy River Springs area should only be considered on a case-by-case basis so as to not impact senior existing rights. So in theory, transfers could occur here. But, remember who has the most senior rights. Location matters. And I'm talking about alluvial basin fill. I'm not talking about carbonate.

Number three, alluvial pumping from north Coyote Spring Valley does not appear to be connected with the Muddy River Springs area. That was -- I didn't talk much about it, but that should be obvious from the information that I presented. Other stakeholders have indicated the same.

A significant portion of alluvial pumping captures ET not recharging the carbonate aquifer. We demonstrated why that is so. And if it weren't the case, water levels would be dropping. And they're not. So I'll conclude there. Thank you.

MS. URE: Thank you, Mr. Dixon. With that we would move to admit all of Bedroc's exhibits.

HEARING OFFICER FAIRBANK: The exhibits outside of Mr. Dixon's initial report at NCA Exhibit 1 have already been admitted. And NCA Exhibit 1 rebuttal report is admitted.

UNIDENTIFIED SPEAKER: Bedroc.

HEARING OFFICER FAIRBANK: Excuse me. Bedroc.

Thank you.
MS. URE: And one final matter, Mr. Dixon, before this hearing started there was some notation of an objection to your reports related to the differences in your opinions for Nevada Cogen versus Bedroc. Can you explain how they are not in conflict?
THE WITNESS: Yes. So obviously, as you heard yesterday, and as you saw on the Bedroc -- Excuse me -- NCA rebuttal report, we focused on carbonate pumping, carbonate monitoring, and the effects in the Muddy River Springs area. I didn't spend much time on that here because it's irrelevant. I focused on the alluvial basin fill alluvium in north Coyote Spring Valley, specifically how that affects Bedroc's pumping now and in to the future. So there's no conflict. In fact, I didn't even sign Bedroc's report. I was busy with NCA. I didn't have time. I did review it and edit it. I contributed to it, absolutely. And I support a hundred percent what was put in that report.
MS. URE: Thank you. And with that we will reserve the remainder of our time for redirect.
HEARING OFFICER FAIRBANK: Okay. You have about 39 minutes left. So with that we will go ahead -- And just as a -- just for a correction on the record and make sure that the record is clear. It is Bedroc Exhibit Number 2,

which was the rebuttal report that's been admitted.
MS. URE: Thank you.
HEARING OFFICER FAIRBANK: And so we will go ahead and move on to cross-examination. And first is Coyote Springs Investment. And there's seven minutes.
CROSS-EXAMINATION
By Mr. Robison:
Q. Good morning, Mr. Dixon. My name is Kent Robison. I'm co-counsel for CSI.
A. Good morning.
Q. Could you bring up slide 15, please. Well, I've got 15 as a map showing a Sheep Range recharge. There we go. Would you tell us, Mr. Dixon, how close neighbors we are by depicting where CSI development is relative to Bedroc property?
We just lost the map. There you go. Your property is basically on the northwest corner of the CSI development? There we go.
A. There we go. Jay Dixon for the record. So Bedroc is located right here. Are you talking about the current development for CSI?
Q. Yes, sir. The Lincoln County corner northwest.
A. Well, the golf course is down here.
Q. Right. And CSI property goes up to the north?

A. Oh, yeah. Lincoln County line is, it might be right around in here.
Q. I think you got it. And then the northern portion of the CSI property almost comes up to the Bedroc properties; correct, sir?
A. Actually I do not know that.
Q. All right. The red arrow reflecting the Sheep Range recharge, it's true, is it not, that the highway fault, as it's been called, causes an impediment to the groundwater flow in an east/west direction?
A. It definitely influences groundwater flow. Our groundwater levels drop off precipitously as they go across that fault. So it definitely affects groundwater flow.
MR. ROBISON: Thank you. I would like to show you exhibit, State Engineer Exhibit 50. May I approach?
HEARING OFFICER FAIRBANK: Yes, you may.
MS. URE: Do you have one for me?
Q. (By Mr. Robison) Are you familiar with State Engineer Exhibit 50?
A. Yes, sir.
Q. And turning to page 12 of that -- And the numbers are hard to read on the bottom -- it's the groundwater pumpage inventory, Coyote Springs Valley, number 210, do you see that, sir?

A. Yes, sir.
Q. And the acres or duty allotted to Bedroc is 315?
MS. URE: I'm going to object to this line of questioning as it's outside the scope of his presentation.
MR. ROBISON: We've been talking all day about the pumpage from Bedroc and that's what I'm addressing.
MS. URE: We did not talk about the water rights or the duties.
HEARING OFFICER FAIRBANK: So the objection is based upon it being outside the scope of the direct examination on the basis that the specific question is relating to specific water rights and duties?
MS. URE: Correct.
HEARING OFFICER FAIRBANK: Mr. Robison.
MR. ROBISON: Excuse me. I believe the witness has testified extensively about the pumpage at the Bedroc facility with regard to alluvial wells and this is directly pertinent to that testimony.
HEARING OFFICER FAIRBANK: I'll go ahead and permit it based upon that association.
Q. (By Mr. Robison) Does State Engineer Exhibit 50 indicate that there's been some over pumping by about 200 acre-feet per year?
A. So that's water pumped based on meter readings.

We -- We believe our duty from the unadjudicated vested claim is 343. And we -- Some of that, you saw those fields there.
Q. Yes, sir.
A. There is a net irrigation there. That's not what we consume. That's what we pump. The State Engineer's office has the results of a water balance model showing what the net consumptive use is.
Q. Is that the 559.5?
A. No, it's not. That's what's pumped. That includes recycled water from the ponds as well as what is going back in to the ground.
MR. ROBISON: Very well. Thank you much. That's all we have.
HEARING OFFICER FAIRBANK: Thank you.
United States Fish and Wildlife service? Seeing no questions.
National Park Service? Seeing no questions.
Moapa Band of Paiute Indians? No questions.
Las Vegas Valley Water District and Southern Nevada Water Authority?
CROSS-EXAMINATION
By Mr. Taggart:
Q. Good morning, Mr. Dixon. My name is Paul Taggart. I represent the Southern Nevada Water Authority and

the Las Vegas Valley Water District.
A. Good morning.
Q. Do you consider the alluvial system that your client's wells are located in to be a separate aquifer from the carbonate aquifer?
A. I do.
Q. And do you -- have you heard discussions in these hearings about the use of water budgets to manage the carbonate aquifer?
A. Yes.
Q. Do you believe that water level data and response data is a more appropriate type of evidence to use than water budget data for the carbonate aquifer itself?
MR. HERREMA: Brad Herrema on behalf of CSI. I don't believe Mr. Dixon particularly in his testimony for Bedroc touched on anything other than the alluvial aquifer in the Bedroc area. He didn't get in to carbonate aquifer water budgets.
MS. URE: And on behalf of Bedroc I'll join in that objection.
HEARING OFFICER FAIRBANK: So the objection is that the question was outside the scope of the direct examination in that it is discussing water budgets of the carbonate aquifer, whereas the original testimony or the

direct testimony was relating solely to the water budget of the alluvial aquifer.
MR. HERREMA: I think both the direct testimony and his rebuttal report, the scope.
HEARING OFFICER FAIRBANK: Mr. Taggart.
MR. TAGGART: Yes. I'll rephrase and I think it will be clear. How much time do I get?
HEARING OFFICER FAIRBANK: You have five and a half minutes right now.
MR. TAGGART: Okay. Thank you.
Q. (By Mr. Taggart) Mr. Dixon, part of your testimony was the estimates of recharge in the Sheep Range and how much of that recharge hinders the alluvial system; is that correct?
A. Yes.
Q. And that information that you talked about, that recharge value was based on a water budget approach to determining the availability of water in that alluvial basin; is that correct?
A. Yes.
Q. And so I guess my question is do you think that same water budget approach that you used and are relying on in the alluvial system should also apply in the carbonate system or shouldn't the carbonate system rely on water level

data?
MR. HERREMA: Same objection.
MS. URE: And we will join in that.
MR. TAGGART: I think it goes directly to your question about the impact of the 1169 pump test on the aquifer, the second inquiry that you asked.
MR. HERREMA: Whether the question is relevant to the four questions is not what our objection is in regard to. Our objection is that this is beyond the scope of what his rebuttal report and his testimony here today cover.
MR. TAGGART: Well, and this is not a death penalty case. It's an informal proceeding that I'm asking the witness a simple question that we're wasting more time on objections than we are on simple answers.
HEARING OFFICER FAIRBANK: So to the extent that Mr. Dixon can go ahead and answer the question, I'll permit the question.
THE WITNESS: So the reason I talked about geology before I arrived at that number is because geology matters. And recharge in some areas contributes more to alluvium than carbonate rock. I think I laid the foundation for that. I have no opinion on a basin scale what influence Sheep Range recharge may or may not have on the regional carbonate system. I focused on this area because the water

specifically observable its measurements support it. And I'll leave it at that.
Q. (By Mr. Taggart) Thank you. Do you believe there's sufficient water in the alluvial system for the quantity of water rights that your client owns?
A. Yes.
Q. Do you believe there's more water in the alluvial system than what your client owns or requires?
A. Yes.
MR. TAGGART: Okay. That's all I have. Thank you.
HEARING OFFICER FAIRBANK: Moapa Valley Water District? Seeing no questions.
Lincoln County, Vidler Water Company?
CROSS-EXAMINATION
By Ms. Peterson:
Q. Hello, Mr. Dixon.
A. Hello.
Q. So this is just a housekeeping matter. Are you signing the report for Bedroc under your PE? I thought all expert reports had to be signed.
A. Did you see the report?
Q. I did.
A. I didn't sign it.

Q. I know. So I'm just kind of wondering why you are allowed to, I guess -- You're not going to sign the report on your opinions that you expressed today?
A. If I were asked to sign it now I would.
Q. Okay. And then you just had a question from Mr. Taggart about if there was more water in the alluvial than what your clients needed. Do you remember that?
A. Yes.
Q. And would you say that that water supply, I guess, or source in the alluvial is an adequate and sustainable supply of water?
A. It appears to be, based on water levels.
Q. For Bedroc's use and possibly other uses?
A. Correct.
MS. PETERSON: That's all I have. Thank you.
HEARING OFFICER FAIRBANK: City of North Las Vegas?
MS. URE: No questions.
HEARING OFFICER FAIRBANK: No questions.
Center for Biological Diversity? No questions.
Georgia Pacific Republic?
MS. HARRISON: Good morning, Mr. Dixon. This is actually a question for counsel. Sylvia Harrison on behalf of Republic and Georgia Pacific.

Is it Bedroc's intention to have this presentation admitted in to evidence?
MS. URE: I believe all the presentations, the slides, were admitted as demonstrative exhibits and that the reports are in as exhibits. And then Mr. Dixon's testimony will be part of the record. That's my understanding of these proceedings.
MS. HARRISON: So this will simply be considered as demonstrative?
HEARING OFFICER FAIRBANK: The -- As with all of the power point presentations that weren't submitted in advance of the hearing and marked as exhibits, those will be retained in the hearing record. And these are the proceedings of the State Engineer and for the purposes of either the testimony or presentation of information will be considered by the State Engineer. And what weight to assign to it will be within his discretion.
MS. HARRISON: Okay. Thank you.
HEARING OFFICER FAIRBANK: Nevada Cogeneration and Associates? Seeing no questions.
Muddy Valley Irrigation Company?
MR. KING: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions.
Nevada Energy?

MS. CAVIGLIA: No questions.
HEARING OFFICER FAIRBANK: No questions.
So at this time I will open it up to the State Engineer and Division of Water Resources staff.
EXAMINATION
By Ms. Barnes:
Q. Michelle Barnes for the record. Can we go to slide 24. And I just want to make sure that I heard you correctly when you were talking about this slide. I believe you mentioned CSVM-4 in your testimony, but the graph on the right is labeled CSVM-7.
A. Yes, you are correct. It's the next slide that was CSVM-4. This is, right, the blue line is CSVM-4. CSVM-7 up here north of the site. Thank you for allowing me to clarify that. Obviously it's in the alluvium, as we have seen throughout this hearing, carbonate levels generally decline during this time. The only levels rising are in the alluvium and certain areas like this.
Q. Looking at your figure on the left, the CSVM -- Okay. That is alluvium.
Can we go to slide 25? Thank you for clarifying that. Did you happen to compare CSVM-3 to CSVM-4 in your analysis? I was just curious since they're both alluvium -- or they're both carbonate.

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A. Carbonate. I did not. I recall seeing CSVM-3 shown in other presentations during this hearing. And it showed a similar response, although rather muted and delayed.
Q. Okay.
A. Because of the structure between it and Muddy River Spring area. And there's a lag present in both wells.
MS. BARNES: Okay.
HEARING OFFICER FAIRBANK: All right. So we have time still available. We'll open it back up for additional questions by the participants. Are there any other participants, rather than going through the list? I see Southern Nevada Water Authority and Las Vegas Valley Water District. Are there any other participants that have further questions?
Not seeing any other, so Mr. Taggart.
MR. TAGGART: How much time?
HEARING OFFICER FAIRBANK: I'll give you five minutes.
MR. TAGGART: Okay. Thank you.
CROSS-EXAMINATION
By Mr. Taggart:
Q. Good morning again, Mr. Dixon.
A. Good morning.
Q. Slide 23 of your power point, do you have that?

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A. Yes.
Q. So this depicts the wells in the alluvium that are pumped by your client; is that correct?
A. Yes. These are not pumping wells. These are observation wells, shallow observation wells, associated with the commercial operation.
Q. What would you consider to be the average annual amount of groundwater depletion from your client's wells?
A. Groundwater depletion?
Q. I want to get past the question that you were asked about pumpage versus secondary recharge. What do you think that pumping is actually taking out of the system at the moment?
A. At the moment?
Q. In net.
A. Yep. So based on my water balance model total consumed 349 acre-feet. And that is because they took 20 acres out of production.
Q. Okay. But groundwater levels in the alluvial are declining during that time period; correct?
A. This goes up through 2018. The last label on the X-axis is 2019. But that's a shift. I don't have 2019 pumping data in there yet.
Q. Okay. But from 2013 to 2019 there's declining

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water levels in the alluvial aquifer; correct?
A. That's right.
Q. Okay.
A. Do you want to know why?
Q. No. And then let's go back to page ten. And I would love to, but I only have five minutes or probably three now. The original estimate of recharge of Maxey-Eakin for the recharge zones that are where your client is was 130 acre-feet; is that right?
A. That's right.
Q. But you believe that a reliable recharge estimate for that same area is ten times that amount, 1370 by Epstein?
A. No. I think that's a bounding range. I think the Maxey-Eakin numbers are probably too low. If that were the case, we would see water levels dropping.
Q. Okay. So 750 is your -- you've averaged the two?
A. Yeah. Because I think Epstein is too high and Maxey-Eakin is too low.
Q. Okay. And so 750 is the maximum amount of recharge you think is available in the area where your client's pumping could occur; is that true?
A. That's my estimate, yes.
MR. TAGGART: That's all. Thank you.
HEARING OFFICER FAIRBANK: At this time I will go

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ahead and open it back up to Division of Water Resources staff and the State Engineer.
MS. COOPER: Christi Cooper for the record. Can you guys hear me okay?
HEARING OFFICER FAIRBANK: We can hear you, Christi. Thank you.
MS. COOPER: Okay.
EXAMINATION
By Ms. Cooper:
Q. Did you look at any other alluvial well water levels in the Lower White River Flow System to see if those water levels may be declining or not?
A. I mentioned CSVM-5. It's about 16 or 17 miles south on the west side of 93. I know you know where that is. It's an alluvial well and it has rising groundwater levels. I didn't put it in here. It's pretty far from the site. But that's another area that I looked. Beyond that, I didn't look at -- There's not much alluvial monitoring beyond this area in the LWRFS right now.
Q. CSVM-5 is carbonate?
A. No. It's alluvium, I believe.
MS. COOPER: Okay. Thank you.
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EXAMINATION
By Ms. Barnes:
Q. Michelle Barnes for the record. Can we go back to slide 24. Based on our previous questions I just want to make sure I'm still on the same page as you, Mr. Dixon.
A. Sure.
Q. So now understanding that this graph is for CSVM-7 and CSV-3009M and slide 24 is CSVM-4 and CSVM-7, you're trying to demonstrate that -- I guess, are you trying to demonstrate that flows on the west side of the fault are trending similarly as opposed to wells for groundwater elevations on the east side and west side of the fault?
A. Showing a disconnect between the alluvium and the carbonate there.
Q. Okay.
A. And a connection similar responses on that side of the fault in north Coyote Spring Valley for the alluvium.
MS. BARNES: Okay. Thank you for clarifying.
HEARING OFFICER FAIRBANK: All right. Ms. Ure, I will go ahead and open it back up to you for redirect if you have any.
MS. URE: Can I have a moment to confer with my co-counsel?
HEARING OFFICER FAIRBANK: You may.

MS. URE: We have no further questions on redirect.
HEARING OFFICER FAIRBANK: Okay. All right. Well, then let's go ahead and take about a ten-minute break and we will reconvene at 9:40 with the Nevada Energy presentation. Thank you.
(Break was taken)
HEARING OFFICER FAIRBANK: Okay. We will continue the hearing with Nevada Energy. Ms. Caviglia.
MS. CAVIGLIA: Justina Caviglia on behalf of NV Energy. May I please have Mr. Felling sworn?
(The witness was sworn in)

RICHARD FELLING
Called as a witness on behalf of
NV Energy, having been first duly sworn,
Was examined and testified as follows:

DIRECT EXAMINATION
By Ms. Caviglia:
Q. Mr. Felling, can you state and spell your last name for the record?
A. Richard Felling. Last name F-e-l-l-i-n-g.
HEARING OFFICER FAIRBANK: Mr. Felling, will you redo that with your microphone on?

THE WITNESS: Thank you. Felling, F-e-l-l-i-n-g.
Q. And, Mr. Felling, were you retained by Nevada Energy to complete a rebuttal report?
A. Yes, I was.
Q. And in preparation for this hearing did you create a power point?
A. Yes, I did.
Q. Can you please go through your power point?
A. Yes.
Madam Hearing Officer, State Engineer staff, I'm happy to be here at the end of this very long hearing. I know you've heard a lot of evidence. Most of it I think very, very good. I'll try to be succinct and clear in presenting my four answers to your questions.
The questions were, the geographic boundary of the flow system, what was the information that was obtained from the Order 1169 aquifer test, the effects of movement of the water from the alluvial to the carbonate aquifer. And at the end of it the total amount of groundwater that could be pumped manually from the Lower White River Flow System.
So I'll start with the geographic boundary of the connected groundwater surface water systems compiled in the Lower White River Flow System. I'll talk about the pros and cons for Kane Springs Valley, Lower Meadow Valley Wash, and the Black Mountains area in the Las Vegas Valley shear zone.

This is an image modified from SNWA Exhibit 22. This is Rowley geologic map and my modifications here. This shows Kane Spring Valley. And all I did here was I drafted on top of the existing geologic map the Kane Springs Wash fault zone. And then I also drafted in this basin bounding fault that was basically interpreted from the two geophysical surveys, the CSAMT survey, which had lines that ran parallel to the northeast and to the southwest of that inferred fault. And then there was a gravity survey that showed that there was a gravity well just to the southwest of the mouth of Kane Spring Valley. And I agree that that evidence is fairly compelling that there is a range front structure there.
To the succinct figure I added this big blue arrow. This is the direction of groundwater flow in Kane Springs Valley pretty much agreed to by all the experts. Vidler's expert agreed to it. Other experts agree that water flows from northeast to southwest and that would be the recharge in the basin. It would flow in carbonate rocks. It would flow in the volcanic rocks. It might flow in the alluvium.
We have range-fed boundary structures on both sides of Kane Springs Valley clear down to the center of the

valley. The geologic map indicates that many of them also have left lateral strike-slip fault like the Kane Springs Wash fault.

The basin boundary is down here just at the edge of this last outcrop on the southwest part of Kane Springs Valley. And that's where Vidler-Lincoln County's production well is.

So the question is, is this recharge in Kane Spring Valley flows from northeast to southwest. And however much flow that is, it ultimately makes it in to Coyote Spring Valley where it joins the regional flow and heads southward towards the Muddy River Springs.

And this cross-structure here, it may impede flow, but it's not a barrier to flow. Whatever the recharge is in Kane Springs Valley is going to make it over, around, or through that fault. There's no other option. It doesn't go anywhere else. No one is suggesting that it goes anywhere else. So that water ultimately makes it in to the Lower White River Flow System.

So in terms of pros and cons, can Kane Springs Valley -- can it be managed without including it in to the Lower White River Flow System joint management area? And in our rebuttal report, I suggest that yes, it could be.

Alternatively, we've heard a lot of evidence this

week that is, you know, fairly compelling evidence to include it in to the White River Flow System joint management area, considering that it's in a shared carbonate aquifer, it responded to the 1169 aquifer test, it's right on the boundary, and pumping there would in fact, we could argue, ultimately capture water that flows south in the Lower White River Flow System. So there's some compelling arguments both ways.

I want to talk about the Lower Meadow Valley Wash. Now, this figure is from the base map that I got off of NDWR's website. And I just -- I needed to have something that had basin boundaries on it and kind of showed where things were. So this is Lower Meadow Valley Wash is this basin here bounded by this green line. This big spring symbol is the headwaters at the Muddy River springs area. And water flows from north to south.

And in the water budget that the State Engineer accepted for the Delamar, Dry Lake, and Cave Valley hearing, it was recognized that there is some flow from Lower Meadow Valley Wash that flow south and ultimately probably contributes to the Muddy River above Glendale to the extent that that water contributes to the Muddy River, capture of that water might conflict with existing rights.

There was also discussion about whether or not

there was flow in the carbonate. And although it's hard to see on this slide, this area here from where I have this blue area and my laser, to the west is carbonate. And it has been suggested that there might be flow from north to south in the carbonate in the Lower Meadow Valley Wash and that might contribute to discharge of the Muddy River.

Now, there is a monitoring well north of the Muddy River Springs. That is CSV-2. And water levels there are about 18 feet lower than at Pederson Spring. But still those water levels are higher than the Big Muddy Springs. So is there a potential for a flow? Yes. Are we certain that flow exists? There's really nothing close to enough evidence.

But if one of the parties that owned the water rights in the Lower Meadow Valley Wash wanted to go up on the carbonate and pump water, then the State Engineer would have to then consider would that be conflicting with existing rights.

These are very old groundwater rights relative to the Lower White River Flow System, as the expert for Nevada Cogen pointed out, including the joint management area could bring about some issues.

Finally, the Black Mountains area and the Las Vegas Valley shear zone. So this is the same basin map. I

got it from the State Engineer's website. And it shows in blue, carbonate rocks. In tan, sedimentary rocks. And then in very light color, alluvial rocks.

I also drafted on, liberally, the basin boundaries. So the north center part of the slide, and this is slide ten, that's Garnet Valley. To the southwest Las Vegas Valley. To the east is California Wash. And to the southeast is the Black Mountains area. And then I also drafted on the Dry Lake thrust fault and the Las Vegas Valley share zone, which isn't exposed because it's covered by alluvium.

I have shown on here BM-DL-2 and that's the monitoring well near Nevada Cogen's pumping center. BM-DL-2 tracks very well with the rest of the carbonate. Many of the other carbonate wells, including EH-4, clearly shows that at BM-DL-2 you're part of the Lower White River Flow System.

KBN-4, that data it's difficult to determine really what they're measuring. I would not recommend that you separate that pumping center from the Lower White River Flow System unless somebody could prove to you that it was not connected. And that evidence doesn't exist.

As far as the carbonate rocks in Las Vegas Valley, I'm not recommending that you extend the system down to Las Vegas Valley shear zone, but there really is no data in the carbonate terrain in Las Vegas Valley. Now, should someone with a water right in the Las Vegas Valley want to move it up in to these carbonates, then you would have some data and you would have to make a decision on what to do here. Now, again, you could manage it without including it in the Lower White River Flow System management area. But at this point in time I don't think that it's necessary. But it's something that we may -- you may need to look at in the future.

So now I'll get in to the information obtained from the aquifer test and subsequent to the test and the Muddy River headwater spring flow as it relates to recovery since the completion of the test.

So I have six bullets here. I'm going to kind of talk about all of them together. I agree that maximum recovery to the extent that it could occur was reached two or three years after completion of the aquifer test, certainly by 2016. Water levels continue to decline in most areas. Coyote Spring Valley, Garnet Valley, California Wash, the Black Mountains area, the water levels continue to decline. Water levels in the Muddy River Spring area or at least at EH-4, which is most closely tied to surface water discharge, are approaching or have reached steady state at least for a period of time. And we'll look at that in detail because

that's been discussed quite a bit.

Warm Springs West over that same period of time approaching steady state. Muddy River Spring area total discharge steady or in the last few years for measurements increasing. All of that said, we need more time to observe the system to really be certain that we are in fact reaching equilibrium in the Muddy River Springs area. There is evidence, but it's not compelling one way or the other. But we'll go through it and take a look at it.

So this is a hydrograph of EH-4. That's the blue line. And this extends all the way back to 1987. And then the orange bars, that's carbonate aquifer pumping. And so this is the hydrograph. And then I took the liberty of drawing line segments through portions of this data. And I'll talk about -- I'll talk about each of those segments.

So this first segment, this flat line here, that was before there was really any significant pumping. We'll call that -- I call it dynamic equilibrium. Dr. Myers thought that there was a decline early and then we had a recharge event and then it recovered. And dynamic equilibrium, more or less pretty flat.

Pumping really accelerated in about 19 -- I believe that's 1990. And then for ten years we see a decline in EH-4 and a decline -- I drew a line through the data and

you can judge for yourself whether that line matches the data steeper at first and then lowering out a little bit at the end.

Then we have 2005 recharge event where water levels recovered and then you basically have a recovery from that impulse. But over the next five years water levels continued to decline. And I drew a line through that data. But I think that line is that west steep angle than the first line. Then we have the Order 1169 aquifer test and 2011-12 finished in early 2013. And then a couple years of recovery. And then we have this last few years of water levels at EH-4 that we've had so much discussion about. The staff can judge for themselves whether those water levels are rising, falling or flat. But we'll take another closer look at it.

So I drew these line segments in here and discussed what were the main effects on the system. By no means is this everything that's gone on. We have other recharge events. We have pumping that has -- We have pumping that is not steady. We have pumping locations that are moving all over the place. But, nevertheless, these line segments pretty much match that data.

So, just for curiosity, I plotted flows at Warm Springs West. And I just laid it on top of that same hydrograph. You know, these line segments. I did not -- I

did not change those line segments. I just laid the data on there and I scaled it so that it would not be -- so it scaled appropriately.

And, you know, the data, it matches fairly well. We see initial pumping. We see recovery from the recharge event. We see another decline. Although here we see quite a bit of deviation between 2005 and 2012 than the Order 1169 aquifer test and you see recovery and now you see Warm Springs West with the same line segment I drew through EH-4 and it matches that data fairly well also.

So then I said, well, what is this telling us. So I just -- I took those line segments and I said, well, what if I just lined them up. So I took the steady state segment prior to pumping, the initial pumping signal between the recharge event of 2005 and the Order 1169. I did -- I simply took my mouse and copied that segment and I dragged it down to kind of line up with the previous segment. I did the same for the post Order 1169 aquifer test. I simply copied that line and I dragged it down and then I drew that dashed line that kind of mimics all of that data. To me that looks like, you know, that looks like the drawdown from a long-term aquifer test. And in effect I think that's what we're seeing.

I'm not saying that this represents all the data.

But it does match fairly well with the data. And I think in the long term it tells us something very important about capture.

We had a long discussion about EH-4 since completion of the test. In the upper right corner I have taken a screen shot from SNWA's Exhibit 81. And you can see that there is a trend line that was drafted by SNWA through that same data. And counsel made a point of asking many of the expert witnesses whether that showed a decline. And many just said, yeah, yeah, that looks like a decline. Well, I'm saying that I don't think that that line represents that data for a couple of reasons. There is high annual periodicity here, almost a foot from annual highs to annual lows. And it's a short record. It's just a few years. But if you want to draw a line through that data, you have to start it and end it in the same month because of that annual periodicity.

This little line segment starts in April, April of 2016. April is the high point in each and every one of these years in water levels. But at the end of that line, and it's shown in this little legend up here, that was January. January isn't the low. But January is about midway. So if you wanted to draw a trend line through these data, you need to start it and end it in the same month. And that line doesn't. But, again, staff can see the data and

they can see whether or not they believe that that trend line or my trend line adequately represent the data.

So we see that, I believe anyway, that water levels and the Muddy River Spring flows look like they're kind of equilibrating. This figure is from SNWA's Exhibit 22, although I think it's in their primary exhibit as well, their initial report. And it shows flow of the Muddy River at the Moapa gage. And what they did is they simply measured flow at the Moapa gage and then they added to it what the diversions were to get at what the real discharge of the system is. And a lot of those diversions were groundwater pumping by NV Energy and exported from the region so that there is no recharge. It's literally taken straight out of the system.

And we can see here that since 20 -- since the end of the Order 1169 aquifer test, flows recovered like we would expect, but then they kept recovering so that in 2018 flow of the Muddy River at Moapa when you consider diversions was 32,000 acre-feet compared to the long-term average of 34,000 acre-feet. So that's just 2,000 acre-feet less than pre-development. So this also supports the other data that, you know, maybe we're getting close to steady state. Again, it's a short record. And I think we need more time to know for sure. All of these data are telling us the same story.

Finally, we had a lot of talk about drought and climate signals. I think in the Lower White River Flow System all of our climate signals are due to precipitation just in Climate Division 4 and not in Climate Division 3. Climate Division 3 supplies most of the water to the Lower White River Flow System. But because in Climate Division 3, which is in Pahranagat Valley and Delamar Valley, the heads there are about 900 feet higher than they are at our northern most well in Coyote Spring Valley. So there's a 900-foot head gradient between Climate Division 3 in Pahranagat Valley and in Coyote Spring Valley. So we've got 900 feet of head.

Now, let's say we have a drought in Climate Division 3 and water levels drop two feet, let's say. We have water level data and we don't see that. But if it did drop two feet, well, then instead of having a 900-foot gradient, there would be an 898-foot gradient. If water flowed through that whole section uniformly, then we would see whatever that is, two over 900, that would be the loss of contribution from the northern basin, which is essentially nothing.

This figure shows -- And this is out of a previous hearing. But it's in the Nevada State Engineer Exhibit 250. SNWA also had a similar exhibit and they showed just winter precipitation, which I think even -- works even

better. But this is EH-4 again. This is precipitation in the orange bars. And you can see in wet years you have a rise in water levels. In dry years you don't see that much of a decline or any I think measurable decline. But you do see a wet year signal. And I think that explains, you know, all of the climate signal in the Lower White River Flow System. That is precipitation in the Lower White River Flow System.

So the third question -- I think this is the third one -- is the effects of moving the water rights between alluvial wells and carbonate wells and deliveries of senior decreed rights to Muddy River, verbatim that's the question. Many parties answered this question and said, oh, you can't move these alluvial wells, we'll have too much pumping. But that's not the question.

The question is what will happen when you move the alluvial wells to the carbonate and its effect on senior decreed rights. We agree that alluvial pumping captures river flows quickly, almost one to one, but certainly not totally one to one. That just hardly ever occurs. Alluvial pumping lowers the water table in the alluvium in the ET areas and so some ET is captured. But I don't want to dwell on that point. It's a small amount.

But the model simulations and our observations indicate that carbonate pumping captures less river flow than alluvial pumping at all points in time. That's the question and that's the answer. The effect of moving water rights from alluvial wells to carbonate wells will have a less -- will have less of an effect on senior decreed rights.

So I have worked and evaluated many of these when I was a staff of the State Engineer's office and our criteria was always the same. What is the effect of pumping at the current point of diversion and compare it to pumping at the proposed point of diversion and affects our existing rights. That was the criteria. That's what we used.

So the answer to this question is moving alluvial pumping to the carbonate will have less of an effect on senior decreed rights in the Muddy River. We're not talking about flows in, or contributions to, or endangerment of the habitat of Moapa dace. That's not one of the questions. We're not talking about having more pumping than there was before. That's not part of the question.

Anyway, our observations on the effects of flow also support this conclusion. So I'll look at the modeling result of Dr. Waddell. He had three simulations: Simulation one on the left, simulation two in the middle, and three on the right. And I'll just go through it briefly.

In simulation one, most of the pumping was in

Coyote Spring Valley and the Muddy River Springs area. But, most importantly, 6900 acre-feet of that pumping was alluvial.

In the middle simulation, the alluvial pumping was reduced to 2200 acre-feet. And then simulation number three, alluvial pumping was 1300 acre-feet. And most of the pumping was moved south in to California Wash, Garnet Valley, and the Black Mountains area.

And for each of these simulations in the model, flow of the Muddy River at Glendale increased with when you go from simulation one to simulation two to simulation three. So these simulations support my conclusion moving water to the carbonate will have less of an effect on senior decreed rights.

And just, you know, on the X-axis, this goes out to 500 years.

So, the long-term annual quantity of groundwater that may be pumped from the flow system, including the relationships between the location of the pumping and discharge of the Muddy River Springs and the capture of the Muddy River flow.

So the state has always had a perennial yield. We have one for every basin. Unfortunately, perennial yield is no longer applicable in the Lower White River Flow System.

And I think you've heard that from many of the experts. Water can't be pumped without impacting senior rights, so really the perennial yield approach no longer works. Conjunctive management approach could work. Others have proposed a safe yield or a system yield. But I think conjunctively you have to look at how much water is there. And at some point you have to ensure that senior water rights are protected. Water budgets still matter. And I'll talk about that quite a bit.

All carbonate pumping will capture spring discharge and Muddy River flow. There is no getting away from that.

Counsel asked several of the experts can you capture -- can you capture discharge without affecting the Muddy River? And they said no. I absolutely agree. I don't know how one would go about capturing any subsurface discharge to the extent that it exists. I wouldn't know where to place it. I don't know where it occurs. All carbonate pumping is going to capture some Muddy River flow and spring flow as well.

Current pumping regime may have reached equilibrium in the Muddy River Springs area. I think we need more time for sure to know, because we just don't have any room for error at this point in time.

So I want to talk a little bit about --

HEARING OFFICER FAIRBANK: Mr. Felling, if I may interrupt you for just one moment.

MR. HERREMA: Brad Herrema on behalf of CSI. If we go back to slide 21, there are a couple of bullets at the bottom there which Mr. Felling didn't touch on but you can read them on the handouts that have been passed out. They get in to the 3.2 CFS trigger under the 2006 MOA. And there wasn't anything in Mr. Felling's rebuttal report that talked about that the MOA or the 3.2 CFS trigger or even pumping in the carbonate beyond current pumping. His opinion was that if pumping continued at the levels that, it related to pumping continuing at the levels it's at right now.

HEARING OFFICER FAIRBANK: To summarize your objection for those that are listening remotely and from afar, it was that the last two bullet points on slide 21 are beyond the scope of the analysis and opinions proffered in the rebuttal report; correct?

MR. HERREMA: Yes. And I think we get to those points at slide 34 as well.

HEARING OFFICER FAIRBANK: Okay. So, at this point, your objection is noted and we'll address those when we get to those further slides. Thank you.

MR. HERREMA: Thank you.

THE WITNESS: Okay. So the question of whether all groundwater discharges at the Muddy River Springs, if that is in fact the case, this hydrograph shows this is really the source of water to wells. And when you only have only a river to capture that waterfront and on the Y-axis it's the fraction of pumping and on the X-axis it's time. And we can see here that when water is initially pumped, all of the water comes out of storage and that's this red line. And that over time water captured from storage decreases until essentially water levels maintain, they're steady. And that over time inversely you have groundwater -- you have river capture. That's water from capture. And that would be in this case the Muddy River.

If all the water that discharges in the White River Flow System discharges at the Muddy River Springs area and the Muddy River, this is -- this is -- this is the hydrograph that one would use. You would have a one-to-one capture. There would be no getting away from it. Absolutely no way around it. It would be one to one and just be a matter of when.

However, I think the data is showing us that there's something else going on. This hydrograph, which is a little bit difficult to read. Again, it shows storage capture in the line that starts on the top and it goes to the

bottom. And then there are three lines that start in the lower left and go to the upper right.

The top line is total capture from all resources. And this is just demonstrative. It's not intended to represent our system. It's just to show you what I think could be going on.

The next, the middle line that rises from the lower left, that's river capture. And on this particular figure, it says evapotranspiration, but it could be any other capture. It could be capture of subsurface outflow. It could be induced recharge. It could be, you know, whatever else is there to capture. The sum of the captures will add up to the total capture. And that's the top line.

What I believe is that the evidence is showing us that there is more than one capture occurring.

So let's just look and see what kind of evidence do we have for subsurface discharge in the Lower White River Flow System. So this figure is from Dr. Waddell's groundwater flow model that was submitted as State Engineer Exhibit 280. But it was for a previous hearing. And it shows the segments. And they would be Lower Meadow Valley. There's a Virgin River Valley. And then Black Mountains area, one, two, three, four, and five. And for each of these segments Mr. Harrill estimated boundary flux.

I do want to point out that this is not the boundary of the Lower White River Flow System. The boundary is up here around -- at the east side of California Wash.

But the Recon recharge at least in the Black Mountains area is less than a hundred acre-feet. So there's really not a lot of local contribution.

So down here at the lower end of this table from the same exhibit, Mr. Harrill estimates what the discharge is. So for the Lower Meadow Valley it's a thousand. For Black Mountain area one, three, four, and five. And that would be one here is north of Rogers and Blue Point and then three is most of the eastern end. Four is the southeast. And five is southwest. He estimates essentially no boundary flux, just from local recharge.

And these were -- these were data that Dr. Waddell tried to match in his groundwater flow model. That's why he included them in his molding report. So these are the boundary fluxes from Dr. Waddell's model. They don't match one for one. He doesn't label them the same way. But it's in the same area.

So for the Muddy River he estimates 580 acre-feet. We'll ignore the Virgin River. East of Rogers fault, 250. Rogers fault to Black Mountains, 560. East of Black Mountains, that big area was only 47. South 1200. And

bottom of lake is 300. And the total number is 3,000 acre-feet. It's not a big number, but it doesn't quite match Harrill's estimate.

But you can see that the model shows that there's some water discharging. He did not believe it was significant. And perhaps it is not. We really still don't know.

This figure, and I'll touch on this, we're just looking at -- I just want to point out what kind of evidence we've seen in the past. This is from SNWA's report four, the Delamar, Dry Lake, and Cave Valley hearings.

And just as a background, in order to try to estimate recharge in all of the basins, first SNWA went and to the extent that they could, they measured discharge and estimated discharge and then had a discharge water budget. And then from that they distributed recharge based on a precipitation and a recharge coefficient that they felt was appropriate for the White River Flow System, and the state agreed.

As part of that hearing, they introduced a -- evidence to support flow south from the Muddy River Springs and the Muddy River area, south from the Muddy River Springs area to California Wash and bypassing the Muddy River. And they brought in evidence. They had a number of wells in the

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area. They had a transmissivity estimate, not so much from the local wells because they didn't really have that data. So they brought in estimates from elsewhere. So they had transmissivity, they had width, they had a thickness, and they had a gradient. And that's all you need to estimate flux. And they estimated 9900 acre-feet.

Andrew Burns testified last week and I think he kind of walked it back a little bit and said he wasn't that confident with the transmissivity estimates. I don't disagree. But the state accepted that discharge. And this discharge was then in the recharge estimate spread out through the Lower White River Flow System.

Ironically, to the west of that segment, there is a section of carbonate rock with a lot of north/south structure. And I thought, and I think now, that if subsurface flow occurred, it would have occurred through the carbonate rock. But there's no data there, so there's nothing to support how much flow that might have been. So, anyway, that was the number was 9900 acre-feet.

I just want to look here at -- this is the south and eastern boundary of the Lower White River Flow System. I drew this red line in on top of the Harrill boundary fluxes. That red line -- There's a scale bar. That scale bar is 30 miles. That red line is 35 or 40 miles long. There's a head

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difference from the Lower White River Flow System carbonate to Lake Mead. Heads in the Lower White River Flow System carbonate are about 1800 feet above sea level. Lake Mead is about 1100 feet above sea level and dropping. Nobody has -- So that's 700 feet of head differential.

MR. TAGGART: We're just going to lodge an objection that none of this information is in the report. This exhibit is not in his report. The line that he's drawn on it is not on the report. The section on Harrill is not in the report. None of this information is coming from his report. It's all been generated for this power point. So on this particular slide we object to testimony being offered with respect to opinions that are opined in the report.

HEARING OFFICER FAIRBANK: Thank you, Mr. Taggart. So your objection is that the slide and the testimony associated with the slide is beyond the scope of the report that was submitted. And your objection is noted. And the State Engineer will assign the weight of the testimony when the totality of the evidence is considered in this matter.

THE WITNESS: Okay. I'll continue. Anyway, there's 700 feet of head differential. There's no evidence that the rocks around the periphery of the Lower White River Flow System are impermeable. There's no reason to believe

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that there wouldn't be some subsurface outflow. We don't know how much it is. Nobody knows how much it is. But there is likely some. And I think that our water level and flow data are telling us that perhaps there is -- at least there's something else that's being captured.

So, again, these were the figures. This is capture. Currently, we're still losing water from storage in the Lower White River Flow System. As we lose more and more water from storage, we capture more and more subsurface outflow. That's -- That's what these hydrographs tell us.

We have -- This upper figure, it doesn't match our observations. Our water levels -- Our water level trend in EH-4, we're down here, we're down here, which tells us we should have captured most of our pumping from discharge but we don't. What we see is that the discharge capture is leveling or even decreasing. We've seen an increase in flow of the Muddy River. That's not the way the system should behave, according to these rules.

What I am suggesting is that we're perhaps out in -- I'm showing the lower right figure. We're showing water levels at least in the Muddy River area leveling out but our capture of the river isn't up here at this high number. It's somewhere else. It's something less.

So this is the hydrograph. This is EH-4. It

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shows that our capture, at least in the Muddy River Springs area, which is our area of primary concern, is leveling out. Our river flow of the Muddy River at Glendale, we're not seeing that -- Our pumpage is seven or 8,000 acre-feet a year. We're not seeing that capture. In the Muddy River our waters levels are leveling out, but we're not seeing the capture and we should be seeing it. Something else is being captured.

There is a time factor here. But we do see that the system has responded relatively quickly. And I don't think that we're seeing something happening in one area and not seeing it in another area.

Other areas are still -- Our other areas are still losing storage. So in the top we've got Coyote Spring Valley. In the top figure we see -- we are seeing continued decline. The next line down, that's EH-4. We can argue about that forever. The middle line of that is TH-2. Then we see Garnet Valley and then BM-DL-2 in the Black Mountains area. And we still see a bit of a decline. We're still losing storage in those areas.

These are two figures from SNWA's report and I'll just touch on them real quickly. The bottom one is a computed capture of the Muddy River based on Warm Springs West discharge. So they use their regression analysis to try to estimate what capture of the Muddy River would be. And in their evidence they showed a very high correlation between Warm Springs West flow and Muddy River flow. And you can see that capture, which is this green part of the Muddy River, is increasing over time.

So I actually went to their table and I saw what that capture was computed at. And I typed them on here. And you can see from 2010, 2,000 acre-feet. In 2011 it's 3,000. And then as you get up to 2015, it's 5,000, 5,000, 5600, 5400. And that's capture. That's computed from Warm Springs West flow.

But when you look at their actual measurements, that's not what you see. So I agree that the regression has a high correlation, but the computed numbers don't match the measured numbers. And when you have that disagreement in information, I would always go with the measurement over a calculation.

And this is the -- SNWA's multiple linear regression. This goes to the question that none of the party -- none of the other parties tried to answer this question. So they tried. And I think there are issues with it. But, nevertheless, it still needs to be done. And nobody else tried to do this.

So I'll -- There was an issue with it and we

brought it up on cross and I just want to get it on the record here. This is the multiple linear regression for California Wash. It shows 1.7 feet of decline in 2015 when pumping the California Wash was 411 acre-feet. The regression line on the bottom shows water levels in EH-4 to flows of the Muddy River Spring. And there's a slope here. That slope is .157. So you simply multiply 1.7 times 1.7. And that number .267 would be the expected decrease in discharge at Warm Springs West.

Well, they have another regression for Warm Springs West flow to Muddy River flow. And they have it in their table, 6.1 in Exhibit 7. And the ratios are here on the right and they range from .074 I think to .081. But in their own analysis they ended up using Tom Eakin's ratio of .076. And that's what I used here.

So, when you add it all up, this .267 decrease in flow at Warm Springs West should translate in to 2500. 3.51 CFS decrease or 2500 acre-feet of decrease in discharge of the Muddy River due to that 400 acre-feet of pumping. Well, we know that can't happen. The capture can't be more than a hundred percent. So there was a mistake somewhere. I don't know where. I don't know about any of the other regression analyses or about any in the other basins. However, I will say that this is approach is important and it would -- it's

important for the state to answer that question about what are the effects of pumping in all of these different areas. Because right now we really don't know.

Q. (By Ms. Ure) Mr. Felling, you're about 45 minutes in.

A. Thank you. Okay.

MR. HERREMA: Brad Herrema for CSI. These are the conclusions that we think are beyond the scope of Mr. Felling's rebuttal report.

HEARING OFFICER FAIRBANK: Ms. Caviglia.

MS. CAVIGLIA: While we don't say the 3.2 CFS, we do in our report on page seven state that Nevada Energy does not rebute the arguments of SNWA and US Fish and Wildlife Service and it's likely that all pumping in the Lower White River Flow System, perhaps Kane Springs, and Lower Meadow Valley Wash will ultimately impact the springs.

So, the spring number of 3.2 is not in our report, however, the impact to those springs has been stated in our report.

MR. HERREMA: The conclusion at the bottom of page five is that future pumping at current rates and location will result in minimal future water level decline in the Muddy River Springs area or significant decrease, and it's minimal significant decrease in the flow of Warm Springs

West or in Muddy River. The MOA is never mentioned nor is the 3.2 trigger.

HEARING OFFICER FAIRBANK: Well, I agree that the MOA or the 3.2 trigger is not specifically addressed in the report. There's been some liberty in terms of participants testifying as to particular matters. And, again, as I stated before, the State Engineer will make a determination as to what, if any, weight to assign to this.

So for the purposes of this particular line of testimony, we'll permit it and any weight will be determined whether or not it's assigned any value by the State Engineer.

MR. HERREMA: Thank you.

HEARING OFFICER FAIRBANK: Your objection is noted. Thank you.

THE WITNESS: Okay. So I'll continue. Currently flows at Warm Spring West are just a little more than 3.2 CFS. Those are provisional data. And we are at a low time of the year. So we would expect them to increase. But there is really not much more room to decrease flow at Warm Springs West. And we think that any significant additional pumping from the carbonate aquifer will likely result in that trigger being reached. And it's possible that with the current pumping that trigger will be reached. That we don't know for sure.

That 3.2 CFS trigger may not be appropriate if pumping occurs from less well-connected areas. Some of the parties have various that are probably less well-connected. If your trigger is at your discharge point, by the time you reach that trigger and your pumping has taken a long -- your signal has taken a long time to get there, that trigger is not properly placed. It's too late.

Finally, the memorandum of agreement probably needs to include all water users to be of real benefit in the future.

So I'll just go to my summary. There are pros and cons to adding the various basins to the joint management in the Lower White River Flow System. There has been a lot of evidence on Kane Springs Valley. We put in our report that the State Engineer could manage Kane Springs Valley without including it in the Lower White River Flow System. There has been an abundance of very compelling evidence. And we now say that we should include Kane Springs Valley in the joint management area.

As far as the Lower Meadow Valley Wash, that evidence is less compelling. Recovery from the Order 1169 aquifer test was complete within two or three years after pumping. Water levels continue to decline every where except perhaps in the Muddy River Springs area, where that water

level decline is imperceptible, we'll call it, over the last two years.

Flow at Warm Springs West and the Muddy River appear at the time being to be stabilized under this current pumping regime. There have been changes. But for the most part it's been fairly steady at about 8,000 acre-feet of carbonate pumping.

We agree that more time is needed to make sure. Pumping from the carbonate anywhere in the Lower White River Flow System will capture Muddy River flows. With that, we also agree.

Subsurface outflow is likely, given the vast extent of the southern and eastern perimeter of the flow system.

No evidence has been put forward that rocks bounding the Lower White River Flow System are impermeable. The subsurface flows exist. It is possible to capture a portion of this outflow resulting in less than a drop-for-drop capture of the Muddy River.

And I think our data is actually showing us that. We have many lines of evidence. And I think they're showing us that maybe that drop-for-drop capture of the Muddy River is not occurring.

Observed water levels in the Muddy River Spring

area and flow data are telling us that we're not having one-to-one capture. But I want to put it in to context of the big picture. SNWA has made an argument that perhaps the most that you could pump is 6,000 acre-feet and keep the trigger level at Warm Springs West about -- above 3.2 CFS. Our current pumping is rate is whatever, 7500 to 8,000 acre-feet of carbonate pumping. That's not a lot more. I don't think that these data disagree with SNWA's conclusion all that much. But I do think that we need a little more time to know for sure.

If future pumping occurs in less well-connected areas along the periphery of the main carbonate aquifer, pumping effects, drawdown, and stream capture will be delayed in the Muddy River Spring area as will recovery.

We need to continue to monitor flows and water levels during under the current pumping regime for at least a year or more. Warm Springs West flows are just over 3.2 CFS. There is no room for additional stresses in the system at this time.

Lastly, it is in the state's interest, contrary to the opinion of an expert for US Fish and Wildlife Service, it is absolutely in the state's interest and all of the water users to protect the Moapa dace. I think it's very important to honor that 3.2 CFS trigger at Warm Springs West. And it

is very much like the Devil's Hole issue. Water levels in Devil's Hole dropped. The habitat of the Devil's Hole pup fish was imperiled. And a federal district court judge decided how much water needs to be in Devil's Hole. We could very easily have the same situation in the Muddy River Springs area if flows in the Muddy River Springs dropped and imperiled the Moapa dace. And then we would have a federal district judge managing water in Nevada and not the state. And I think it's for the benefit of all of the users that the state continue to manage these water resources and not a federal court judge. And that's all I have. Thank you.

MS. CAVIGLIA: We would request that Nevada Energy Exhibit 1 be admitted in to evidence.

HEARING OFFICER FAIRBANK: Exhibit 1 is so admitted.

MS. CAVIGLIA: And we would also echo SNWA's request for additional briefing. As Mr. Felling indicated, one of our opinions has changed through the course of this hearing.

HEARING OFFICER FAIRBANK: Excellent. Thank you.

All right. We'll go ahead and commence cross-examination, starting with Coyote Spring Investments. You have seven minutes.

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CROSS-EXAMINATION
By Mr. Herrema:
Q. Thank you. Brad Herrema with CSI for the record. Good morning, Mr. Felling.
A. Good morning.
Q. A few questions. Hopefully I'll be brief. Figure one of your rebuttal report.
A. I don't have that report.
Q. I think you do if you just scroll down. It's slide 12.
A. Okay.
Q. This shows carbonate pumping in the Lower White River Flow System. Does this include carbonate pumping in Garnet Valley that occurred in the 1990s?
A. It may not. We heard evidence earlier that there might be some pumping in Garnet Valley. I took this pumping data from SNWA's exhibit.
Q. Okay. Based on your statements that climate doesn't play a large role in groundwater level decline, do you have an opinion as to the drop in groundwater levels at EH-4 prior to pumping in Coyote Spring Valley?
A. I'm sorry. But I don't see a drop. Oh, beginning -- And I'll point to -- This is slide 12. At this point in -- I'm sorry. But I can't read the date, but

it's 1996. This drop that starts in 1996?
Q. Yes.
A. I believe that's from all regional carbonate pumping.
Q. Whatever pumping was happening at that time including pumping in Muddy River Springs area?
A. Absolutely.
Q. If the EH-4 declines prior to 2005 were due to that existing carbonate pumping, do you have an opinion as to whether steady state conditions existed prior to 2005?
A. Yes, I do have an opinion.
Q. And what is that?
A. I don't believe steady state conditions had been reached prior to 2005.
Q. Based on the impact of pumping Arrow Canyon wells on groundwater levels in spring flow, did you determine the relative impact of groundwater level decline due to pumping in Muddy River Springs area versus pumping in Coyote Spring Valley?
A. No.
Q. In Muddy River Springs area versus pumping in Garnet Valley?
A. No.
Q. In your opinion should location and magnitude of

pumping in other portions of the Lower White River Flow System with respect to the Muddy River Springs area be considered when assessing impacts to groundwater levels in the Muddy River Springs area?
A. I'll say that -- I'll say that ultimately they should, but that evidence is not in existence at this time.
Q. Could we go to your hypothetical hydrograph. This is figure three in the rebuttal report. Based on the dotted line shown in this figure and the groundwater level declines that occurred prior to 2005 -- And 2005 is an important demarcation here because that's when pumping in Coyote Spring Valley began. It appears that steady state is being reached due only to carbonate pumping in the Muddy River Springs area. Would you agree?
A. No.
Q. And why is that?
A. I think that -- Well, the way you stated the question, it was due to pumping only in the Muddy River Springs area. If that question is as you posed it, I think it's due to -- I disagree. I think it's the effect in the Muddy River Springs area due to pumping every where.
Q. Whatever carbonate pumping there was in the Lower White River Flow System at the time?
A. Yes.

Q. Okay. And so then would you answer then that if you look at all of the Lower White River Flow System carbonate pumping that steady state was being reached at that time?
A. Only in the Muddy River Springs area.
Q. And how does this conclusion or this what we've just discussed here, how does this relate to your opinion that all carbonate pumping, or your disagreement, I guess, with the water authority's conclusion that all carbonate pumping in the system will have a one-to-one impact on springs in the Muddy River Springs area?
A. To the extent of the one-to-one impact, I disagree that the evidence does not support that at this time.
Q. Okay. And I'd like to shift gears a little bit to the quantity of water that is leaving the system as subflow.
A. Okay.
Q. Your statement in your report is that it's possible that 10,000 acre-feet per year could exit the system to the Las Vegas Valley or to lower portions of the Black Mountains area or Lake Mead. Do you recall that?
A. I do.
Q. Does that statement also support your opinion

that not all pumping has a one-to-one impact -- not all carbonate pumping within the Lower White River Flow System has a one-to-one impact on the springs in the Muddy River Springs area?
A. Yes. That was part of the basis for that conclusion.
MR. HERREMA: Thank you. No further questions.
HEARING OFFICER FAIRBANK: United States Fish and Wildlife Service? Seeing no questions.
National Park Service? Seeing no questions.
Moapa Band of Paiute Indians? No questions.
Southern Nevada Water Authority and Las Vegas Valley Water District?
CROSS-EXAMINATION
By Mr. Taggart:
Q. Good morning, Mr. Felling.
A. Good morning.
Q. I understand your opinion regarding the system and whether it's in equilibrium or not. Is the increasing flows or decreasing flow deficit in the Muddy River in recent years one of the factors that you used in making that determination?
A. It was one of the pieces of evidence, yes.
Q. Okay. And if you could turn to slide 16, please.

Would you agree with me that the declining MR flow deficit in 2017 to today is depicted on that chart where the red section gets smaller towards the right end of the graph; correct?
A. Correct.
Q. And you're aware that the -- your client, the power company, has decommissioned a power plant and there's significantly less pumping in the alluvial system during that time period; right?
A. Yes, I am.
Q. So would you agree with me that part of the reason for the increased flows in the river or the decreased flow deficit is the reduction in the pumping in the alluvial aquifer by the power company?
A. I really wouldn't -- I think that you've taken that diversion in to consideration. And that is that blue area. So I don't -- I don't agree with that as a factor in those estimates of discharge of the Muddy River at Moapa.
Q. Okay. Do you agree that the reduction of groundwater pumping for the power plant has resulted in increased Muddy River flows?
A. Yes, I do.
Q. And would you agree with me that -- Were you present during Mr. Robison's testimony yesterday for MVIC?
A. No.

Q. Okay. I want to ask you about a statement that you made regarding the standard that was used when -- This was about moving alluvial rights to carbonates, okay.
A. Uh-huh.
Q. So the standard that was used when you move a water right is to look at the impacts from pumping at the existing point of diversion versus impacts at the proposed point of diversion. And I think you said that moving some alluvial rights to carbonate pumping may have less of an impact on existing rights than the existing pumping. Is that a fair statement?
A. Yes.
Q. Okay. And isn't it true though that the standard for a -- standard in Nevada is whether there is an impact to existing rights at all, not whether there's less of an impact?
A. I don't believe so.
Q. Okay. When you were talking about the 9900 acre-feet of underflow or subflow or whatever we call it -- I'm looking for a slide here -- you're aware, are you not, that the analysis that SNWA did at the time and the one that you're relying upon, and it's shown on page 26, slide 26, that was a water budget approach for the entire White River Flow System in order to determine the recharge and discharge

amounts in 15 plus groundwater basins; correct?
A. Yes.
Q. And so it was not an analysis that was done to determine the impact of the 1169 pump test; correct?
A. It was not.
Q. Okay. And at that time there were two separate Darcy flow calculations that were proposed by SNWA, one that was accepted by the State Engineer and one that was rejected; correct?
A. Yes, that's correct.
Q. And the 9900 acre-foot cross-section that you described in Darcy flow calculation, that was based upon an alluvial transmissivity calculation; correct?
A. Uh-huh, yes.
Q. And the cross-section that was postulated by SNWA to be a carbonate subflow with carbonate transmissivity of 8600 acre-feet, that was denied by the State Engineer; correct?
A. Yes. That was flow from the Coyote Spring Valley to Hidden Valley. And the evidence showed that there was a water level at the south end of Coyote Spring Valley that was higher and it looked like there was a groundwater divide. So it wasn't accepted.
Q. All right. Do you -- New topic now. What is

your view on whether the State Engineer needs a groundwater model constructed now in order to make the determinations that are required or that are asked under Order 1303? Can the 1303 increase be answered without a groundwater model and just based upon the stress data from the Order 1169 pumping test and the recovery data from that pumping test?

A. So there is a groundwater flow model that was constructed by federal agencies. And, try as they might, they really weren't able to replicate the system very well. They underestimated a lot of the effects. And it wasn't because they didn't try. I just think it's a very difficult system to model. I think at this stage our observations are enough to make future decisions. And so, no, I don't agree that a model is necessary.

Q. Okay. Could you turn to slide number 32, please. And just quickly, you made a comment during your testimony that the -- And I don't remember exactly what it was. But I wanted -- it had to do with the difference between these two charts and the values depicted on the charts. Do you recognize that in the lower pane, which is Figure 6-3, there's a symbology there that indicates MRSA discharge capture. And so this is showing discharge, which is more than just stream flow. And then do you notice that up in the top panel that that is just showing stream flow? Does that

make sense?

A. I see that.

Q. One last question at least for now is on the slide before that. Do I get to ask it?

HEARING OFFICER FAIRBANK: Ask your question.

MR. TAGGART: Okay.

You testified about slide number 15 and I want to ask you, you indicated that a trend line should be based upon a -- using the same value from each month if you want to develop a trend line. And so I have two questions, I guess. Well, I can't have two questions. Did you do that and did -- and would it be appropriate in your view if the high point in the hydrograph in a given year were used as the recovery point, if you will, in that year and then the trend line based upon that high point in the data set in a given year?

THE WITNESS: So, I'll answer the first question first, did I do it. I drew the line in general through the middle of the data. Perhaps I should have angled it up more I think to match that data.

And your second question, could you draw a line across the high point is no more valid than drawing a line across the low point, in which case you would have opposing trend lines. So you can draw the line anywhere you want. When you have a short period of record and a high period of

estimates like this, I think the actual data are somewhat ambiguous and then you need a longer period of record.

MR. TAGGART: Thank you.

HEARING OFFICER FAIRBANK: Moapa Valley Water District? Seeing no questions.

Lincoln County, Vidler?

CROSS-EXAMINATION

By Ms. Peterson:

Q. Thank you. Mr. Felling, Karen Peterson representing Lincoln County Water District and Vidler Water Company. Did you calculate drawdown to the Muddy River Spring area from pumping Kane Spring Valley wells?

A. No, I did not.

MS. PETERSON: Thank you. That's all the questions I have.

HEARING OFFICER FAIRBANK: Center for Biological Diversity?

MR. DONNELLY: Thank you.

CROSS-EXAMINATION

By Mr. Donnelly:

Q. Patrick Donnelly, Center for Biological Diversity. Mr. Felling, is there a commonly-accepted definition of steady state?

A. I have never really thought about it in those

terms of whether there's a commonly-accepted definition or not.

Q. Is there any definition that you use to define steady state?

A. Well, I would use the definition of that things are steady, that they are neither increasing nor decreasing.

Q. What things would be neither increasing or decreasing?

A. Whatever is -- Whatever you're trying to assign that term to.

Q. So, in this case in your usage of it, in your presentation, what did you mean?

A. That in this particular case of the Warm Springs West area that we were no longer seeing the change in water levels, we were no longer seeing a change in Warm Springs West discharge, and we were no longer seeing a appreciable change in flows of the Muddy River over the last two or three years.

Q. How long of a steady measurement would be necessary to qualify as steady state?

A. I don't know.

Q. But it is less than three years worth of data? Let me rephrase the question. You were using less than three years worth of data to say this system is in a steady state?

A. I am saying that a system appears to be reaching steady state over -- and over the last two or three years is roughly at steady state. But that is not to say that it will continue that way in the future. And that's why I say I think we actually need to observe the system for a bit longer.
Q. So, I mean, I guess I'm a little confused. If it's in a steady state that implies that the decision is made, it's steady and will not be changing based on current conditions. But you're saying we need to get more data to ascertain that?
A. I'm saying that if we want to be certain that steady state conditions are in fact occurring now and forever in to the future under the current pumping regime, two or three years of observations aren't enough.
MR. DONNELLY: Thank you. No further questions.
HEARING OFFICER FAIRBANK: And I neglected to ask City of North Las Vegas.
MS. URE: No questions.
HEARING OFFICER FAIRBANK: No questions.
Georgia Pacific Republic?
CROSS-EXAMINATION
By Ms. Harrison:
Q. Sylvia Harrison for Republic Environmental

Technologies and Georgia Pacific. Good morning, Mr. Felling. I think it's still morning.
A. Good morning.
Q. Just one quick question. Referring to your summary of conclusions and recommendations, I think slide 35 and 36. 35, you note that subsurface outflow is likely. So my question is hypothetically if pumping captured only at that subsurface outflow how would that square with your final conclusion in the previous slide that pumping from the carbonate aquifer anywhere in the Lower White River Flow System would capture Muddy River flows?
A. So I'll answer that question strictly as it was posed. If pumping could just capture subsurface outflow, then that's what it would capture and it wouldn't capture anything else.
MS. HARRISON: Okay. Thank you.
HEARING OFFICER FAIRBANK: Nevada Cogeneration Associates? Not seeing any questions.
Muddy Valley Irrigation Company?
CROSS-EXAMINATION
By Mr. King:
Q. Hello, Mr. Felling. Steve King for Muddy Valley Irrigation Company.
A. Hello.

Q. Slide 11 of your presentation, the first bullet, maximum recovery reached in 2016.
A. Yes.
Q. So I have a question. I think it's a clarification in answer to a question to your presentation on this slide. And I believe what I heard was along the lines that after the 1169 pump test the maximum recovery was reached in 2016 to the extent it could recover or to the extent it could something else. And I wasn't clear as to that, the latter part of that sentence. And could you please tell us what you meant by that statement, please?
A. Yes. And I'll use slide 12 to explain. We see a long-term trend of decline beginning in 1996 or 1995 continuing through today. And that is due to, I believe, regional carbonate pumping. We have the Order 1169 aquifer test. And the Order 1169 aquifer test couldn't recover the pre-pumping levels because there's a regional decline. So you have to superimpose your recovery on the regional trend. So we can't -- You basically -- We don't go above that line. And that helps us define that regional trend. So full recovery didn't occur and couldn't occur because we have this regional decline.
MR. KING: Thank you.
HEARING OFFICER FAIRBANK: Bedroc?

MS. URE: No questions.
HEARING OFFICER FAIRBANK: Seeing no questions, then we'll go ahead and open it up to Division of Water Resources staff and the State Engineer.
EXAMINATION
By Mr. Sullivan:
Q. Regarding some of the uncertainties about bypass flow and the potential for capturing that versus the effect on the Muddy River Springs area, how important do you think it is to know exactly the amount and the location of this subsurface that started out in the Lower White River Flow System for the State Engineer to effectively manage the LWRFS over time?
A. Well, I don't think it's important, and that is in part fortuitous, because I don't think one will ever know the amount or the location. It's just simply -- The studies that would be required would be prohibitive. I don't think we'll ever know.
We may know that some occurs if with more time we see that capture is not at one to one. It's just something that we could observe. And in that case we could just simply say it looks like we're capturing something else. The evidence I think currently supports that. But I wouldn't go -- go too far afield with it. I just think that would

be -- we need to be certain, and particularly in this flow system where we're already right at the limit of what we think, you know, we can pump just based on the Warm Springs West.

MR. SULLIVAN: Okay.

EXAMINATION

By Ms. Barnes:

Q. Michelle Barnes for the record. On slide 18 you show a figure with I believe the Division 4 Climate. And I had a question for you. In your opinion and experience do you think it's better to identify impacts of climate and precip using the annual totals or, you know, intensity and duration of specific storms, understanding we have data limitations with that?

A. We've had evidence presented in previous hearings and in this hearing a little bit about that very issue. And there's been, I think, good evidence presented that a winter season precipitation may be a better indicator than annual precipitation just in terms of the observed effect on water levels.

MS. BARNES: Thank you.

HEARING OFFICER FAIRBANK: Ms. Cooper.

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EXAMINATION

By Ms. Cooper:

Q. Hi. Christi Cooper for the record. Mr. Felling, I have a couple of questions, please. On slide four of your presentation, you overlaid what you agree with as evidence for the Kane Springs range front fault. Is that true?

A. That's correct.

Q. Sorry. I didn't hear the response.

A. Yes.

Q. Okay. Thank you. What is your opinion on the so-called highway fault?

A. I'll just have to say that I didn't really research it, so I really don't have an opinion.

Q. Okay. So going to slide 31, please. You say in your presentation that water levels in general in the Lower White River Flow System have continued to decline in most areas. Could you just walk me through these five hydrographs to tell me your opinion on each one and what you think?

A. Well, I can't read my slide, so I'll have to look up here. And, as I recall, the upper -- the upper hydrograph I believe is Coyote Spring Valley. And I just look at the last four years since the recovery of the Order 1169 aquifer test. And I think that there is a decline there. From this figure, the scale is really not good for making these small

determinations. But we've also seen hydrographs that other scales saw. So I'm actually using that knowledge to make this description. So we have Coyote Spring Valley. I think we see a continued decline in water levels.

The next panel down is EH-4. We've had that discussion. Hard to see a decline over the last few years.

The next one is TH-2. TH-2 compares so closely with EH-4 that it's scary. I don't know that I see a decline in the last few years at TH-2. But I think we have looked at other California Wash levels and we still see that decline.

The next one down that's Garnet Valley. I don't think there's any question that we see a continued decline there.

And the last one at the very bottom, that's BM-DL-2. I actually had it in my presentation, BM-DL-2 and EH-4 hydrograph on the same figure. And one can really see they separate after the Order 1169 aquifer test where BM-DL-2 is continuing to decline. Even if you don't see it that well here, when you place this hydrograph, BM-DL-2, on top of EH-4, you can really see that they separate after the test. And it's still declining.

Q. So follow up to the same question, GV-1 and BM-DL-2 still declining, what is your opinion on the reason for that?

A. I think that water levels are declining everywhere because of groundwater pumping.

Q. Carbonate and alluvial pumping?

A. I don't think that alluvial pumping is having any effect on the carbonate aquifer, at least not in the Muddy River Springs area. I think that Coyote Spring Valley it could be a little more complicated.

Q. Okay. My last question kind of going and tying all of this in, so in your report you talk about this carbonate pumping rate of seven to 8,000, maybe you mentioned differently in your presentation, but something similar to that. Do you have an opinion on your -- the total alluvial and carbonate pumping that should -- that should be nearly steady state as you would say?

A. Well, in terms of pumping from the alluvium in the Muddy River Springs area, evidence is that that pumping doesn't affect the Muddy River Springs but it does affect the Muddy River. And the evidence is also very clear that it captures river flow. And to the extent of, you know, how much you can pump, I think you could pump as much as you're prepared to mitigate. I think mitigation ultimately is necessary.

Q. Well, like, the 9,000 in the order from, total, the Lower White River from 2017, do you believe that the

total number needs to be drastically lower than that?
A. I'm sorry. I didn't really understand that question.
Q. So in the Order 1303 there's the appendix table that shows in 2017 there was a little over 9,000 total acre-feet --
A. Yes.
Q. -- of pumpage in the Lower White River. So would your number total be drastically lower than that or is that -- is that number okay at this point?
A. Well, there's two areas pumped. So, again, the pumping is from the alluvium. It shows -- conflicts in very short order with senior certificated rights. And to the extent that that conflicts with those rights, ultimately I think it may need to be mitigated.
Carbonate pumping also will need to be mitigated to the extent of that conflict. Like I said, I don't think you can pump anything without basically capturing river flow. So, to the extent that there is that conflict, it would need to be mitigated.
I think ultimately the amount of water that can be pumped isn't so much a function of conflict. It's a function of what effect will it have on habitat of the Moapa dace. So to that extent I don't know. I don't think we have

that number yet. We have an estimate from SNWA that's it's four to 6,000. We have my evidence that suggests it might be a bit more. And I think we need to observe the system longer and try to make the right call.
MS. COOPER: Thank you. That's all.
HEARING OFFICER FAIRBANK: Okay. We have a little bit of time for recross. Coyote Springs Investment, do you have any recross? Seeing no.
US Fish and Wildlife Service? Seeing none.
National Park Service? None.
Moapa Band? None.
Southern Nevada Water Authority, Las Vegas Valley Water District?
MR. TAGGART: One.
HEARING OFFICER FAIRBANK: That's it. You get one.
MR. TAGGART: Did I just say that? How will I build this in to one question?
HEARING OFFICER FAIRBANK: To be fair, I'll give you four minutes.
MR. TAGGART: I don't think I'll need that much time.
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CROSS-EXAMINATION
By Mr. Taggart:
Q. I just want to pick up on what's on the screen, Figure 5-5. You were asked about Garnet. And that was compared to Muddy River Springs area. There is a significantly different pumping stress in those basins in recent years, specifically in Garnet. There's continuing to be pumping for power generation whereas in Muddy River Springs area there's been a considerable decrease in pumping; right?
A. Well, as I recall, pumping in the Muddy River Springs area decreased last year. That's carbonate pumping. And I'm not -- I'm addressing alluvial pumping. But in Garnet Valley I think the number has been -- it's bounced around a little bit. But I think it's been fairly steady the last few years or several years. There was an increase maybe four years ago. But since then I think it's been relatively steady.
Q. Okay. And in your report you make a statement that picks up on some of the things that were just being discussed. This is on page eight. And it has to do with depletions of the Muddy River. It says a depletion of the Muddy River with this amount of pumping, and it's reflecting the seven to 8,000 acre-feet of carbonate pumping that you

just talked about. The depletion of the Muddy River with this amount of pumping appears to be on the order of 2300 to 3750 acre-feet and is not increasing. And my question is, one, is that -- would you agree with me that that value is, even if at steady state, that would be a consistent impact or conflict with water rights on the Muddy River and that it has to be mitigated?
A. I do agree.
MR. TAGGART: All right. Thank you.
HEARING OFFICER FAIRBANK: Moapa Valley Water District? Seeing no questions.
Lincoln County, Vidler? No further questions.
City of North Las Vegas?
MS. URE: No questions.
HEARING OFFICER FAIRBANK: Center for Biological Diversity? No questions.
Georgia Pacific Republic? No further questions.
Nevada Cogeneration Associates? Seeing no questions.
Muddy Valley Irrigation Company? No questions.
And Bedroc?
MS. URE: No questions.
HEARING OFFICER FAIRBANK: No questions, okay. And then I'll just open it back up to Division of Water

Resources and staff.
EXAMINATION
By Mr. Sullivan:
Q. You mentioned in your testimony about using EH-4 as a trigger and the possibility that it's, in a sense, too late to use that as a trigger because it's too close to the area to be protected. But looking at the hydrographs and the close hydraulic connectivity throughout the region, there is -- EH-4 is no closer in a sense than, say, TH-2 or some other sites. So do you have any more thoughts on that comment to elaborate on the effective triggers?
A. So I think that EH-4 or Warm Springs West flow and the trigger at 3.2 would still work under the current pumping regime whether -- I think all the wells that we currently pump from they were in areas that had an immediate effect or impact seen from the Order 1169 pumping test. And I think the reverse is also true. That pumping affects the Muddy River Springs area in a relatively and equal amount of time.
That said, I think that pumping in less well-connected areas, it might be appropriate to have triggers that are wells that measure water levels that are between Warm Springs West and where those pumping centers might be so that you then do have an advanced warning instead

of waiting until the effects are seen at Warm Springs West, at which time turning off the wells may not have an immediate effect and those effects might be delayed for some period of time.
So that you want to put your -- you want to put your trigger level or your monitoring point somewhere between that pumping in Warm Springs. Did that answer your question?
MR. SULLIVAN: Yes. Thank you.
HEARING OFFICER FAIRBANK: Okay. We'll go ahead and open it up for redirect if there's any further. So no further redirect.
All right. Well, then we will go ahead and conclude the taking of presentation and information from the participants in these proceedings. And so we'll go ahead and address a few administrative matters.
First, we -- And one of those administrative matter is, Mr. Felling, you were proffered as an expert, without objection. And so on that basis you've been qualified as an expert in these proceedings. And so that qualification will be limited to these proceedings based upon the fact that there was no objection.
So we also want to address that there is a new exhibit, Nevada State Engineer Exhibit 335, which is an Excel solver for the White River Flow System. That was the version

of the solver used by and replied upon by the Division of Water Resources and the State Engineer in Ruling 6165 through 6167. This exhibit serves to replace Nevada State Engineer Exhibit 222, which we've removed, as that was an earlier version of the Excel solver but it was not the actual solver utilized by the Division of Water Resources in making those decisions relating to those particular rulings.
Additionally, the sign-in sheets from these proceedings for the last ten days will be marked as Nevada State Engineer Exhibits 336 through 346, which will include today's sign-in sheet from Las Vegas.
And then also all the presentations, all the power point presentations that were provided as demonstrative exhibits, will be on line in the State Engineer's website at water dot NV dot gov under the news tab. And then there under the Lower White River Flow System tab. And then it will be contained within the folder Order 1303 hearing documents.
And, finally, there were requests that, by the Southern Nevada Water Authority and Las Vegas Valley Water District, that were joined by the Coyote Springs Investments participants and the Nevada Energy seeking permission for the State Engineer to entertain written closing statements and proposed orders.

So the State Engineer will accept written closing statements, not to exceed 20 pages, from the participants. And the State Engineer will further accept written public comment from members of the public whom have not participated in these proceedings. And any closing statement or written public comment must be received by the State Engineer by the close of business or 5:00 p.m. on Monday, November 4th, 2019. So that's essentially 30 days from today. The State Engineer is got going to solicit or accept proposed draft orders.
MR. HERREMA: Thank you. One question on that. Do we know when the transcripts will be final?
HEARING OFFICER FAIRBANK: I anticipate the transcripts will be final -- I don't have a final question or final answer to that question, but I estimate that they should be available within the next couple of weeks. And it sounds like it might be as soon as the end of next week.
MR. HERREMA: Thank you.
MR. TAGGART: Would the State Engineer be willing to consider at all 60 days? We have an argument in Ely of the groundwater project on the 15th of November that we're going to be spending a lot of time getting ready for. And so I would just like to make that request.
HEARING OFFICER FAIRBANK: That will be fine. We'll be similarly-situated. We're not going to be writing

anything.
MR. DONNELLY: Did you say there's archive video available that I can look up?
HEARING OFFICER FAIRBANK: Yes. So the video archives from these proceedings are also available on that same folder where the power point presentations will be located. So that's the LWRFS tab under the news tab in the Order 1303 hearing documents folder. And that document is titled LWRFS recording links. And it's a PDF document. And then imbedded in the PDF document are hyperlinks to the video recordings.
And 60 days. So that will extend the time for the submission of the written closing statements to December 3rd. So close of business on December 3rd. And we'll do that for both written public comment as well as those written closing statements.
And so, finally, before we conclude this proceeding, we will go ahead and open it to public comment. Ask we'll start by asking Ms. Christi Cooper in Las Vegas if there is anyone present in Las Vegas for public comment.
MS. COOPER: There is no one present.
HEARING OFFICER FAIRBANK: Is there anyone present in Carson City for public comment? Not seeing anybody jumping up for such.

Then we will go ahead and conclude these proceedings. And we thank everyone for their cooperation and participation and we appreciate the time. Thank you.
(Hearing concluded at 11:18 a.m.)

STATE OF NEVADA)
)ss.
COUNTY OF WASHOE)

I, CHRISTY Y. JOYCE, Official Certified Court Reporter for the State of Nevada, Department of Conservation and Natural Resources, Division of Water Resources, do hereby certify:
That on Friday, the 4th day of October, 2019, I was present at the Legislative Counsel Bureau, Carson City, Nevada, for the purpose of reporting in verbatim stenotype notes the within-entitled public hearing;
That the foregoing transcript, consisting of pages 1713 through 1822, inclusive, includes a full, true and correct transcription of my stenotype notes of said public hearing.

Dated at Reno, Nevada, this 4th day of October, 2019.

____
CHRISTY Y. JOYCE, CCR #625

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Laura A. Schroeder
Oregon, Idaho,
Nevada, Washington & Utah

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February 18, 2020

VIA US MAIL

Capitol Reporters
123 W. Nye Lane, Ste. 107
Carson City, Nevada 89706

RE: 9/23/2019 – 10/3/2019 NDWR Hearing Transcript Corrections

To Whom it May Concern:

Our office represents the City of North Las Vegas ("City") in the matter currently before Nevada Division of Water Resources and titled ***In the Matter of the Administration and Management of the Lower White River Flow System Within Coyote Spring Valley Hydrographic Basin (210), a Portion of Black Mountains Area Hydrographic Basin (215), Garnet Valley Hydrographic Basin (216), Hidden Valley Hydrographic Basin (217), California Wash Hydrographic Basin (218), and Muddy River Springs Area (AKA Upper Moapa Valley Hydrographic Basin (219)).***

A hearing was held by the Nevada Division of Water Resources from September 23, 2019 through October 4, 2019 to which your office provided transcription services. Our client's expert, Dwight Smith's testimony was taken on October 1, 2019. Mr. Smith offers corrections to the transcript relating to his testimony as outlined in Attachment A.

If you have any questions, please contact our office at (775) 786-8800.

Very truly yours,
SCHROEDER LAW OFFICES, P.C.

Therese A. Ure

TAU:lmg
Enclosures
cc: NDWR – *via US Mail*
Clients – *via email*
Courtesy Copy to Service List – *via email*

Attachment A

Page No.	Lines	Currently Reads	Suggested Changes[1]	Clean Copy
1420	6-7	I'm not going to offer an opinion on why a perennial yield would be…	I'm not going to offer an opinion on ~~why~~ **what** a perennial yield would be…	I'm not going to offer an opinion on what a perennial yield would be…
1420	23-24	And that that is basically four principal components.	And that ~~that~~ is basically four principal components.	And that is basically four principal components.
1421	8-9	It's scheduled to be completed in April of 2021 under construction currently.	It's scheduled to be completed in April of 2021 **and is** under construction currently.	It's scheduled to be completed in April of 2021 and is under construction currently.
1422	2-3	But as I will express, the City is interested in giving senior water rights down to these wells…	But as I will express, the City is interested in ~~giving~~ **getting** senior water rights down to these wells…	But as I will express, the City is interested in **getting** senior water rights down to these wells…
1422	21-23	…we've talked about having the stress and test aquifer systems …	…we've talked about having the stress ~~and~~ test **of** aquifer systems …	…we've talked about having the stress test of aquifer systems …
1423	1-2	…do a long-term injection test of a high rate, we can do that fairly easily.	…do a long-term injection test ~~of~~ **at** a high rate, we can do that fairly easily.	…do a long-term injection test at a high rate, we can do that fairly easily.
1423	11-12	…utilization of reclaimed water in the basin, the centralized wastewater treatment plant…	…utilization of reclaimed water in the basin, ~~the~~ **a** centralized wastewater treatment plant…	…utilization of reclaimed water in the basin, a centralized wastewater treatment plant…
1423	18-19	…how this looks and planned, the dashed black line along…	…how this looks and **is** planned, the dashed black line along…	…how this looks and is planned, the dashed black line along…
1424	2-3	…just at the lower center part of the overuse at blue point.	…just at the lower center part of the over~~use~~**view** at blue point.	…just at the lower center part of the overview at blue point.
1424	14	…pipeline around the northern end of Apex end.	…pipeline around the northern end of Apex ~~end~~.	…pipeline around the northern end of Apex.
1425	6-7	This may not be shown up too well on the overview, but it should…	This may not be show~~n~~**ing** up too well on the overview, but it should…	This may not be showing up too well on the overview, but it should…

[1] Suggested deletions are noted with strike-throughs and suggested additions are noted in bold.

{P0488764; 1577.00 LMM }

Page No.	Lines	Currently Reads	Suggested Changes[1]	Clean Copy
1425	9-10	So that the constitutes a large amount of area and incorporates…	So that ~~the~~ constitutes a large amount of area and incorporates…	So that constitutes a large amount of area and incorporates…
1427	4-5	…also a number of normal faults that are run generally parallel to that..	…also a number of normal faults that ~~are~~ run generally parallel to that…	…also a number of normal faults that run generally parallel to that…
1427	8-9	We're lacking any data to from which to interpret that.	We're lacking any data ~~to~~ from which to interpret that.	We're lacking any data from which to interpret that.
1427	20-21	…two of the geologic cross sections by page numbers --	…two of the geologic cross sections by ~~page numbers—~~ **Page and others, 2011.**	…two of the geologic cross sections by Page and others, 2011.
1428	2-3	…and the greener shades are the plastic rock types and a major…	…and the greener shades are the ~~plastic~~ **clastic** rock types and a major…	…and the greener shades are the clastic rock types and a major…
1428	13-15	…rocks exceeding 17,000 interpreted to be on the order of 20 to 25,000 thick in Garnet Valley.	…rocks exceeding 17,000 **ft** interpreted to be on the order of 20 to 25,000 **ft** thick in Garnet Valley.	…rocks exceeding 17,000 ft interpreted to be on the order of 20 to 25,000 ft thick in Garnet Valley.
1428	16-17	…there's some testimony by Rick Waddell from the National Park Service about…	…there's some testimony by Rick Waddell ~~from~~ **for** the National Park Service about…	…there's some testimony by Rick Waddell for the National Park Service about…
1428	22-23	And the considerable geologic discontinuities in the carbonate…	And ~~the~~ **that** considerable geologic discontinuities in the carbonate…	And that considerable geologic discontinuities in the carbonate…
1430	2	…level in the basin occurs at the GB-1 well.	…level in the basin occurs at the ~~GB-1~~ **GV-1** well.	…level in the basin occurs at the GV-1 well.
1430	4-5	…levels are relatively flat in that 1808 to 1814 altitude range…	…levels are relatively flat in ~~that~~ **the** 1808 to 1814 altitude range…	…levels are relatively flat in the 1808 to 1814 altitude range…
1430	12-13	…our data evaluation back there is potential flow from Las Vegas Valley…	…our data evaluation ~~back~~ **that** there is potential flow from Las Vegas Valley…	…our data evaluation that there is potential flow from Las Vegas Valley…
1430	20-21	…the lowest water level tying in the northern arm of…	…the lowest water level ~~tying~~ **lying** in the northern arm of…	…the lowest water level lying in the northern arm of…
1431	2	…southernmost tip of that arrow is GB-2, that's consistently…	…southernmost tip of that arrow is ~~GB-2~~ **GV-2**, that's consistently…	…southernmost tip of that arrow is GV-2, that's consistently…

Page No.	Lines	Currently Reads	Suggested Changes[1]	Clean Copy
1431	4-5	…higher than the water levels of Seradep at Moapa down in Paiutes area included.	…higher than the water levels of ~~Seradep at Moapa down in~~ **the center of the valley and the** Paiutes area included.	…higher than the water levels of the center of the valley and the Paiutes area included.
1431	12-13	…some of the wells on record are done in the logs, about a third of them.	…some of the wells on record are ~~done in the~~ **plugging** logs, about a third of them.	…some of the wells on record are plugging logs, about a third of them.
1431	22-23	…I mentioned the GB-2 well, you'll see that that as a light green…	…I mentioned the ~~GB-2~~ **GV-2** well, you'll see that that as a light green…	…I mentioned the GV-2 well, you'll see that that as a light green…
1432	3-4	…right on the basin boundary we put in Hidden Valley is well GB-1.	… right on the basin boundary ~~we put in~~ **with** Hidden Valley is well ~~GB-1~~ **GV-1**.	… right on the basin boundary with Hidden Valley is well GV-1.
1433	5-6	For reference to Playa Well that the City owns…	For reference ~~to~~ **the** Playa Well that the City owns…	For reference the Playa Well that the City owns…
1433	6-7	…to 2,000 feet. As a static water level it's down around 800 or 850…	…to 2,000 feet~~.~~ **,** ~~As~~ **and** a static water level ~~it's~~ **that's** down around 800 or 850…	…to 2,000 feet, and a static water level that's down around 800 or 850…
1433	10-11	That Kapex Well was drilled in 1990.	~~That~~ **The** Kapex Well was drilled in 1990.	The Kapex Well was drilled in 1990.
1433	11	It was called the Krut (ph.) Well for a long time.	It was called the ~~Krut~~ **Kerr Mcgee** (ph.) Well for a long time.	It was called the Kerr Mcgee (ph.) Well for a long time.
1434	3-4	…confirm that that ten inches is not ten feet or we're…	…confirm that ~~that~~ **the** ten inches is not ten feet or we're…	…confirm that the ten inches is not ten feet or we're…
1434	4	…trusting that that information on the well log…	…trusting that ~~that~~ **the** information on the well log…	…trusting that the information on the well log…
1434	7	…northern area there that GBR-1 also had a notably higher…	…northern area there that ~~GBR-1~~ **GV-RW1** also had a notably higher…	…northern area there that GV-RW1 also had a notably higher…
1434	9-10	…located along fault and structure that projects along the east side…	…located along fault ~~and~~ structure**s** that project~~s~~ along the east side…	…located along fault structures that project along the east side…

Page No.	Lines	Currently Reads	Suggested Changes[1]	Clean Copy
1434	15-16	…in Garnet Valley is I would just say moderate.	…in Garnet Valley is I would **say** just ~~say~~ moderate.	…Garnet Valley is I would say just moderate.
1435	6-7	…the GB-1 Well to the north with water level elevation and average water…	…the ~~GB-1~~ **GV-1** Well to the north with water level elevation**,** ~~and~~ **an** average water…	…the GV-1 Well to the north with water level elevation, an average water…
1435	7-8	…elevation year 2015 of 1,808 feet as contrasted to the water level at GB-2 at 1,114 feet.	…elevation **in** year 2015 of 1,808 feet as contrasted to the water level at ~~GB-2~~ **GU-2** at ~~1,114~~ **1,814** feet.	…elevation in year 2015 of 1,808 feet as contrasted to the water level at GU-2 at 1,814 feet.
1435	10	And again, GB-2 being the highest water level that's observed.	And again, ~~GB-2~~ **GV-2** being the highest water level that's observed.	And again, GV-2 being the highest water level that's observed.
1435	14-15	…fact that GB-1 - - GB-2, excuse me, has the highest observed…	…fact that ~~GB-1~~ **GV-1** - - ~~GB-2~~ **GV-1** , excuse me, has the highest observed…	…fact that GV-1 - - GV-2, excuse me, has the highest observed…
1436	10	…water, we can draw elevation for the water tables.	…water, we can ~~draw~~ **determine the** elevation for the water tables.	…water, we can determine the elevation for the water table.
1436	15-16	So generally answered the questions is could groundwater be coming…	So ~~generally~~ **this did not** answer~~ed~~ the questions ~~is~~ could groundwater be coming…	So this did not answer the question could groundwater be coming…
1436	16-17	…in from Las Vegas Valley and the Garnet Valley?	…in from Las Vegas Valley ~~and~~ **to** ~~the~~ Garnet Valley?	…in from Las Vegas Valley to Garnet Valley?
1436	24	So we know it would be lance our elevation more…	So we know ~~it would be lance our~~ **the land surface** elevation more…	So we know **the land surface** elevation more…
1437	5-6	…Las Vegas Valley than Garnet Valley or GB-2.	…Las Vegas Valley than Garnet Valley or ~~GB-2~~ **GV-2**.	…Las Vegas Valley than Garnet Valley or GV-2.
1437	14-15	…really can only be answered with a more accurate on the ground data.	…really can only be answered with ~~a~~ more accurate on the ground data.	…really can only be answered with more accurate on the ground data.
1437	20-21	…understand better, especially for composing to try some AR just…	…understand better, especially for ~~composing~~ **proposing** to try some AR just…	…understand better, especially for proposing to try some AR just…
1438	14-15	…really I've turned this and I want to be careful, this is…	…really I've ~~turned~~ **termed** this and I want to be careful, this is…	…really I've termed this and I want to be careful, this is…

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Page No.	Lines	Currently Reads	Suggested Changes[1]	Clean Copy
1438	19-20	…where we hypothesize there there potentially could be inflows…	…where we hypothesize there ~~there~~ potentially could be inflows…	…where we hypothesize there potentially could be inflows…
1439	4-5	…effort of wanting to calibrate the models.	…effort of wanting to calibrate the model~~s~~.	…effort of wanting to calibrate the model.
1439	22	..water level date that we have.	..water level dat~~e~~ **data** that we have.	.. water level data that we have.
1440	8	…the optimal with the boundary conductances that regulate flow…	…the optimal ~~with the~~ boundary conductances that regulate flow…	…the optimal boundary conductances that regulate flow…
1440	10	And we also attempt sensitivity of each of those boundaries.	And we also ~~attempt~~ **present** sensitivity of each of those boundaries.	And we also present sensitivity of each of those boundaries.
1440	16	…scenarios, conversely a models boundary with high…	…scenarios, conversely a model~~s~~ boundary with high…	…scenarios, conversely a model boundary with high…
1440	22	…slide 16. To take up messages as our boundary's on the east…	…slide 16. ~~To take up~~ **The take home** messages ~~as~~ **on** our boundary's on the east…	…slide 16. The take home messages on our boundary's on the east…
1441	4-5	…was derived at a good model solution, a good match to the data.	…was derived ~~at~~ **as** a good model solution, a good match to the data.	…was derived as a good model solution, a good match to the data.
1441	20-21	…given that GB-1 is the most opportune water right in the system.	…given that ~~GB-1~~ **GV-1** is the ~~most opportune~~ **lowest** water ~~right~~ **level** in the system.	…given that GU-1 is the lowest water level in the system.
1441-1442	24-1	…definitive, but it was trying to help me assess through as an assess what are…	…definitive, but ~~it~~ **I** was trying to ~~help me assess through as an~~ assess what are…	…definitive, but I was trying to assess what are…
1442	18-19	…the interpretation on that 2006 pumping inventory was that…	…the interpretation on ~~that~~ **the** 2006 pumping inventory was that…	…the interpretation on the 2006 pumping inventory was that…
1443	6-7	…in Garnet Valley really began in earnest in the 1980s…	…in Garnet Valley**, it** really began in earnest in the 1980s…	…in Garnet Valley, it really began in earnest in the 1980s…
1443	9	…on through actually, you can tell current and you'll notice…	…on through actually, ~~you can tell~~ **until** current and you'll notice…	…on through actually, until current and you'll notice…

Page No.	Lines	Currently Reads	Suggested Changes[1]	Clean Copy
1443	17-18	…that water was done under temporary transfers of SNWA's..	…that water was ~~done~~ **pumped** under temporary transfers of SNWA's..	…that water was pumped under temporary transfers of SNWA's..
1444	5-6	…all the green is the newer leased at the newer lease granted to SNWA in…	…all the green is the ~~newer leased at the newer lease~~ **use of water rights** granted to SNWA in…	…all the green is the use of water rights granted to SNWA in…
1444	7-8	So, water level pumping, pumped amounts in 2016, 2017 approached…	So, ~~water level~~ **groundwater** pumping, pumped amounts in 2016, 2017 approached…	So, groundwater pumping, pumped amounts in 2016, 2017 approached…
1444	9	…for about ten years was a plus or minus around 15,000.	…for about ten years was ~~a~~ plus or minus around 15,000.	…for about ten years was plus or minus around 15,000.
1444	10-11	Prior to 2006, which we had additional power generate…	Prior to 2006, ~~which~~ **when** we had additional power generate…	Prior to 2006, when we had additional power generate…
1444	20-21	…be taking out chemical line and western gypsum pumping, which I…	…be taking out **C**hemical ~~line~~ **Lime** and **W**estern **G**ypsum pumping, which I…	…be taking out Chemical Lime and Western Gypsum pumping, which I…
1445	6	This was compiled from EWR's electronic database online.	This was compiled from ~~EWR's~~ **NDWR'S** electronic database online.	This was compiled from NDWR'S electronic database online.
1446	23-24	…all the values and input in are not consistent within NDWR pumping…	…all the values and input ~~in~~ are not consistent within NDWR pumping…	…all the values and input are not consistent within NDWR pumping…
1447	2	…available from - - from reporting 1169 in agreements that they…	…available from - - from ~~reporting~~ **order** 1169 **reporting** in agreements that they…	…available from - - from order 1169 reporting in agreements that they…
1447	9	…reporting under 1169 that have different values.	…reporting under **order** 1169 that have different values.	…reporting under order 1169 that have different values.
1447	10	…believe the 1169 dataset is incomplete.	…believe the **order** 1169 dataset is incomplete.	…believe the order 1169 dataset is incomplete.
1447	16-17	…agreements from reporting our pumping totals.	…agreements from reporting ~~our~~ **of** pumping totals.	…agreements from reporting of pumping totals.

Page No.	Lines	Currently Reads	Suggested Changes[1]	Clean Copy
1449	17-18	…suspect could be explained some of the relationship...	…suspect could ~~be~~ explain~~ed~~ some of the relationship...	…suspect could explain some of the relationship...
1450	5	…decline in trend about 23 feet per year.	…decline in trend about ~~23~~ **0.3** feet per year.	…decline in trend about 0.3 feet per year.
1450	11-12	…period where a lot of those are stable at EH-4.	…period where ~~a lot of those~~ **water levels** are stable at EH-4.	…period where water levels are stable at EH-4.
1450	23-24	…mixture of pumping and climbing in our hydrologic…	…mixture of pumping and ~~climbing~~ **climate** in our hydrologic…	…mixture of pumping and climate in our hydrologic…
1452	4	…for broader water management in Jackson Valley.	…for broader water management in ~~Jackson~~ **Garnet** Valley.	…for broader water management in Garnet Valley.
1453	2-3	…pressure cycle and it's significant, it's in Nevada.	…pressure cycle and it's significant~~,~~ ~~it's~~ in **southern** Nevada.	…pressure cycle and it's significant in **southern** Nevada.
1453	4-5	…has been directing barometric pressure data to a number of different margin points.	…has been ~~directing~~ **collecting** barometric pressure data ~~to~~ **at** a number of different ~~margin~~ **monitoring** points.	…has been collecting barometric pressure data at a number of different monitoring points.
1453	15	…storage coefficients more confined will respond greater to…	…storage coefficients**, are** more confined**, and** will respond greater to…	…storage coefficients, are more confined, and will respond greater to…
1454	3-4	But some have sufficient barometric efficiencies.	But some have ~~sufficient~~ **significant** barometric efficiencies.	But some have significant barometric efficiencies.
1454	13-14	…water level studies in Death Valley Regional Flow…	…water level studies in **the** Death Valley Regional Flow…	…water level studies in the Death Valley Regional Flow…
1454	20	…pressure changes and earth-type changes, you need…	…pressure changes and earth-~~type~~ **tide** changes, you need…	…pressure changes and earth-tide changes, you need…
1455	2-3	…based off this absence of presence of a "pumping signal"…	…based off this absence ~~of~~ **or** presence of a "pumping signal"…	…based off this absence or presence of a "pumping signal"…
1455	8	Is there still a season of cycle or not.	Is there still a season**al** ~~of~~ cycle or not.	Is there still a seasonal cycle or not.
1455	23-24	…this may be result of starting to collaborate to pumping near the…	…this may be **the** result of starting to ~~collaborate~~ **equilibrate** to pumping near the…	…this may be the result of starting to equilibrate to pumping near the…

Page No.	Lines	Currently Reads	Suggested Changes[1]	Clean Copy
1456	4-5	…geographic areas but, you know, as the Death Valley Regional…	…geographic areas**. B**ut, you know, ~~as~~ the Death Valley Regional…	…geographic areas. But, you know, the Death Valley Regional…
1456	6-7	…geographic area down the White River Flow System far…	…geographic area**.** ~~down~~ **T**he White River Flow System far…	…geographic area. The White River Flow System far…
1456	8-9	As we understand the flow system to the desert again is just a…	~~As~~ **And** we understand the flow system ~~to~~ **of** the **Tule D**esert ~~again~~ is just a…	And we understand the flow system of the Tule Desert is just a…
1456	18-19	I think what SNWA's work in both in their prior analysis and…	I think ~~what~~ **that from** SNWA's work in both in their prior analysis and…	I think that from SNWA's work in both in their prior analysis and…
1456	20-21	…analysis being brought forward. It's pretty clearly demonstrated that…	…analysis being brought forward~~.~~**,** ~~I~~**it's** pretty clearly demonstrated that…	…analysis being brought forward, it's pretty clearly demonstrated that…
1457	10	Those near a pumping center are going to have a more…	Those **wells** near a pumping center are going to have a more…	Those wells near a pumping center are going to have a more…
1457	19	I don't think we felt much, if any, effect to…	I don't think we**'ve** felt much, if any, effect to…	I don't think we've felt much, if any, effect to…
1458	2-3	…river it explains a lot of a capture that's been presented.	…river it explains a lot of ~~a~~ **the** capture that's been presented.	…river it explains a lot of the capture that's been presented.
1458	6	…duration, location magnitude all factors into capture…	…duration, location**,** magnitude all factors into capture…	…duration, location, magnitude all factors into capture…
1458	8-9	…you know, water rights going back to the 1940s.	…you know, water rights go~~ing~~ back to the 1940s.	…you know, water rights go back to the 1940s.
1458	13	…emphasis from SNWA about capture river flows.	…emphasis from SNWA about capture **of** river flows.	…emphasis from SNWA about capture of river flows.
1458	14-15	…grappling with this issue up to the north in the Humboldt…	…grappling with this issue up ~~to~~ **in** the north in the Humboldt…	…grappling with this issue up in the north in the Humboldt…
1458	18-19	We have a screen flow capture issue here, but it's…	We have a ~~screen~~ **stream** flow capture issue here, but it's…	We have a stream flow capture issue here, but it's…
1459	4-5	…we do have to really quantify, have a mechanism to quantify…	…we do have ~~to really~~ **the ability to** quantify, have a mechanism to quantify…	…we do have the ability to quantify, have a mechanism to quantify…

Page No.	Lines	Currently Reads	Suggested Changes[1]	Clean Copy
1459	16-17	…along the Moapa and Gilbert's Park. And, you know, we've…	…along the Moapa and ~~Gilbert's Park~~ **Overton Arm**. And, you know, we've…	…along the Moapa and Overton Arm. And, you know, we've…
1460	1	…that's the driver for water granting decisions.	…that's the driver for water ~~granting~~ **management** decisions.	…that's the driver for water management decisions.
1460	9	But according to the City of Las Vegas, they have…	But according to the City of **North** Las Vegas, they have…	But according to the City of North Las Vegas, they have…
1460	10-11	You know, it's injunctive use bringing in multiple sources, it's…	You know, it's ~~in~~ **conj**unctive use bringing in multiple sources, it's…	You know, it's conjunctive use bringing in multiple sources, it's…
1460	17-18	…water rights on their municipal water supply lists.	…water rights on their municipal water supply ~~lists~~ **wells**.	…water rights on their municipal water supply wells.
1461	2-3	…down to those rights. Senior is important because the future…	…down to those ~~rights~~ **wells**. Senior**ity** is important because the future…	…down to those wells. Seniority is important because the future…
1461	6	…not asking you how to answer that question today.	…not asking you ~~how~~ **now** to answer that question today.	not asking you now to answer that question today.
1461	7-8	But from a municipal water conveyor perspective that gives them…	But from a municipal water ~~conveyor~~ **purveyor** perspective that gives them…	But from a municipal water **purveyor** perspective that gives them…
1462	10-11	…entities could buy the leased water rights, whatever…	…entities could buy ~~the~~ **or** lease~~d~~ water rights, whatever…	entities could buy or lease water rights, whatever…
1462	11-12	…there's paths to look forward on that.	…there's paths to ~~look~~ **work** forward on that.	…there's paths to work forward on that.
1462	13-14	From a modern maverick perspective, again, I think you need to keep…	From a ~~modern maverick~~ **groundwater management** perspective, again, I think you need to keep…	From a groundwater management perspective, again, I think you need to keep…
1463	5-6	…from the alluvium carbonate should not be generically limited…	…from the alluvium **to** carbonate should not be generically limited…	…from the alluvium to carbonate should not be generically limited…

Page No.	Lines	Currently Reads	Suggested Changes[1]	Clean Copy
1464	4-5	…encourage the State to shift to a safety overload approach. In fact, maybe, you know, shift to a safety overload approach.	…encourage the State to shift ~~to a safety overload~~ **from the perennial yield** approach. ~~In fact, maybe, you know, shift~~ to a ~~safety overload~~ **safe yield** approach.	…encourage the State to shift from the perennial yield approach to a **safe yield** approach.
1465	2-3	…levels in Hidden Valley that SHV-1 down in the north I believe is…	…levels in Hidden Valley ~~that~~ **other then,** SHV-1 ~~down~~ in the north I believe is…	…levels in Hidden Valley other then, SHV-1 in the north I believe is…
1486	16-17	…that we're able to find to date, it appears that that flow is…	…that we're able to ~~find~~ **define** to date, it appears that that flow is…	…that we're able to define to date, it appears that that flow is…
1487	4-5	…out through to the waters of Dupont Springs, but possibly deeper.	…out through to the ~~waters~~ **Rogers and** ~~of Dupont Springs~~ **Blue Point Springs**, but possibly deeper.	…out through to the Rogers and Blue Point Springs, but possibly deeper.
1489	18-19	…can pump and harvest and not get be getting into trouble…	…can pump and harvest and not ~~get~~ be getting into trouble…	…can pump and harvest and not be getting into trouble…
1491	2	…and I believe mostly interpretation of this area are vented…	…and I believe mostly ~~interpretation~~ **instrumentation** of this area are vented…	…and I believe mostly instrumentation of this area are vented…
1491	9-10	This is a true observed when the barometric pressure rises…	This is a true observ~~ed~~**ation** when the barometric pressure rises…	This is a true observation when the barometric pressure rises…

{P0488764; 1577.00 LMM }