



A Virtual Forum: Navigating Through Crisis

Symposium Proceedings

September 23, 2021



Water Education Foundation

Preface

Due to the ongoing COVID-19 pandemic that limited the ability to hold in-person events, the Water Education Foundation was unable to hold its regular biennial Colorado River Symposium in Santa Fe in 2021. Instead, the Foundation's Colorado River Symposium Supplement, *A Virtual Forum: Navigating Through Crisis*, was held online on Sept. 23, 2021.

The Colorado River provides water to 40 million people and more than 4 million acres of farmland in a region encompassing some 246,000 square miles. Yet storage in key reservoirs has dropped to less than 30 percent of capacity because of a drought that began in 2000. While drought management has dominated the conversation in recent years, equally important is how interested parties throughout the Basin can move forward to address current and future challenges on the river.

At the 2021 Symposium, participants heard a multitude of perspectives on policy and politics of the river and what needs to be done to make decisions on current and future challenges. Discussions included on-ground impacts – from hydrology and hydropower generation to salinity and the environment – from the two-decade drought gripping the West, what additional actions may be needed to address drought impacts, preparations for renegotiating the river's operating guidelines and the U.S.-Mexico partnership on the river.

Camille Calimlim Touton, then-Deputy Commissioner of the Bureau of Reclamation, kicked off the Symposium as the opening keynote speaker, and Tanya Trujillo, Assistant Secretary of the Interior for Water and Science, offered closing remarks from Santa Fe's Palace of Governors, where the Colorado River Compact was signed in 1922.

This proceeding is a written account of a tape-recorded transcript of the 2021 Symposium. The transcript was sent to speakers for review prior to publication. Although some minor editing was done for space and to clarify grammatical and factual statements, the final product remains "true to the spirit" of the discussions that occurred that afternoon.



Acknowledgements

The Colorado River Symposium Supplement, *A Virtual Forum: Navigating Through Crisis*, was developed by the Water Education Foundation, whose mission is to inspire understanding of water and catalyze critical conversations to build bridges and inform collaborative decision-making.

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A Virtual Forum: Navigating Through Crisis

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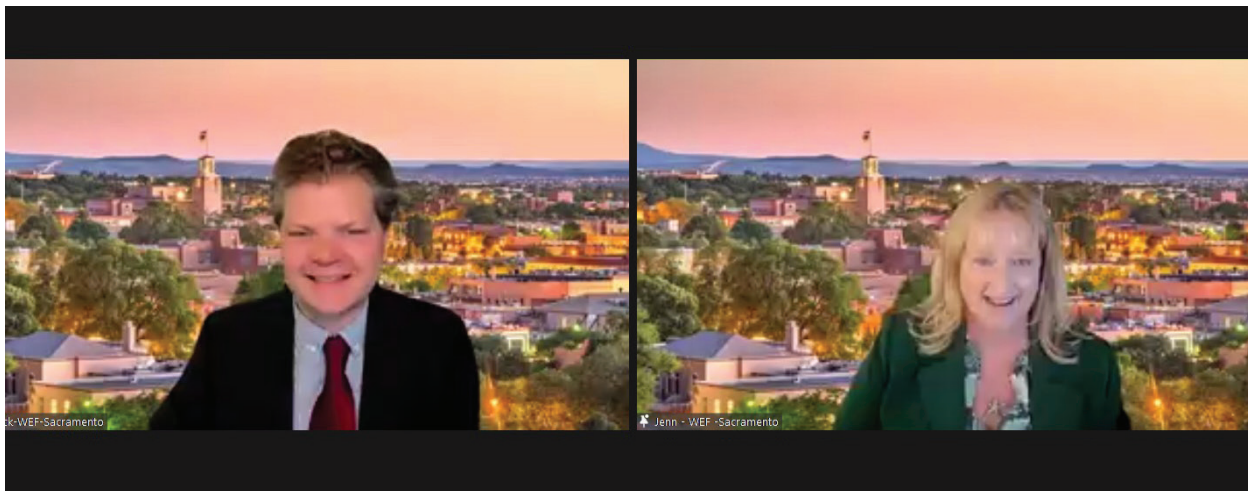
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From left, Nick Gray, Programs Director, Water Education Foundation; Jenn Bowles, Executive Director, Water Education Foundation.

Nick Gray, Programs Director, Water Education Foundation: I'd like to officially welcome you all to the Water Education Foundation's Colorado River Symposium Virtual Forum. My name is Nick Gray, the programs director here at the Foundation, and I'm going to jump right in with a bit of housekeeping. We're not hosting this as a one-way, one-sided webinar format because we want it to be interactive at times. So that means there isn't a Q&A button that you might be accustomed to seeing in the bottom of your Zoom window. Instead, you're going to chat-message unique questions you have for the speakers over the course of the afternoon.

We'd also like to take a moment to thank the Bureau of Reclamation for their funding assistance with this event. We can never offer the quality experience the Foundation is known for during our in-person Symposium in Santa Fe without their support. That's no less true as we've pivoted to this virtual format. So, thank you so much.

And now, I'd like to hand things over to the Foundation's executive director, Jenn Bowles, for some opening remarks. Over to you, Jenn.

Jennifer Bowles, Executive Director, Water Education Foundation: Thanks Nick, and welcome everyone to beautiful Santa Fe, albeit virtually in this online forum, which is serving as a supplement to our long-standing biennial Colorado River Symposium that began in 1997. Our hope is that we can all join together in person in 2022 to mark the 100th anniversary of the Colorado River Compact in Santa Fe, where that document was negotiated

and signed. We are planning the event as we speak, so I want everyone to mark your calendars now for September 21st through the 23rd for the in-person event next year in 2022. But we didn't want to wait until next year with all the pressing issues right now in the Colorado River Basin, such as the first-ever shortage declaration. We felt it was important to host these discussions today. Plus, it gives us an opportunity to hear from some of the new federal leadership involved in water, among them, Tanya Trujillo, Interior's assistant secretary for water and science and a long-standing participant of our Symposium as well; and Camille Calimlim Touton, Reclamation's Deputy Commissioner, who has been nominated to be the Commissioner.

We have big plans in store for next year's Santa Fe event as well as some other plans for our work across the Basin, thanks in part to former Interior Secretary Bruce Babbitt, who gave me a challenge at the last Symposium in Santa Fe. Some of you are aware of our Water Leaders program in California, which takes up-and-coming engineers, scientists, policy wonks, farmers and environmentalists, and deepens their water knowledge and teaches them to solve water issues collaboratively. Next year marks the 25th, believe it or not, 25th anniversary of our California Water Leaders. So in 2022, we are going to launch a Colorado River Water Leaders program, taking candidates from the Upper and Lower Basin and eventually Mexico. The water leaders will actually plan a panel for the Santa Fe gathering next year. I say, let's get those fresh eyes looking at some of these tough challenges and see what they come up with. But I'd like to urge you all to start

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thinking about those early to mid-career professionals who might make good candidates. And I'll definitely let you know when the application will be out. Keep in mind we will also be assigning mentors for the class members, so I may be calling you up to volunteer for that role.

Now, back to the Symposium. It is a key part of the Water Education Foundation's Colorado River Project, which is a public education program serving a broad audience. The project also includes our annual lower Colorado River tour, which is the tour that Nick leads, our popular Colorado River Basin map, our Layperson's Guides and ongoing coverage of the Colorado River Basin from our journalism team in *Western Water* news, which has been online for a few years now and is much easier for everyone to access.

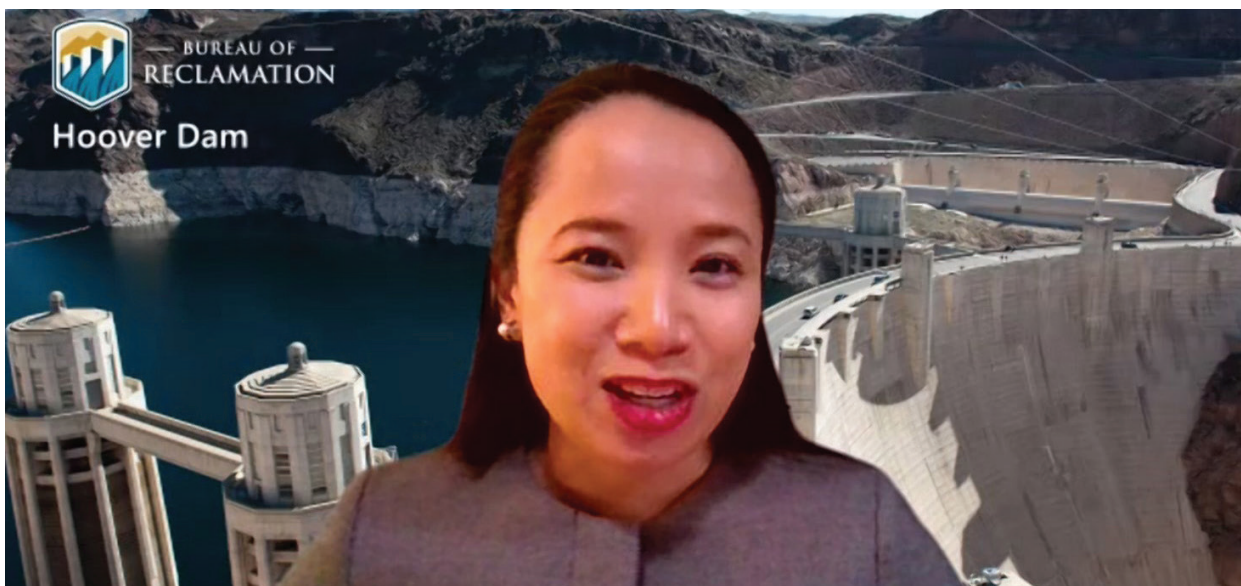
The Colorado River, as you know, is a critical resource for water, hydropower, recreation, fish and wildlife. It serves some 40 million people and more than 5 million irrigated acres across 7 Western states, Mexico and nearly 30 tribal nations, but the river is undergoing extraordinary and historic turmoil right now. Already plagued by more than 20 years of drought, officials and water users are experiencing unprecedented conditions fueled by climate change. Of course, snowpack and extreme dryness have sent Lake Powell and Lake Mead plunging to record-low elevations, prompting the first-ever shortage declaration to occur in 2022. So despite Drought Contingency Plans enacted just a few years ago, experts agree urgent actions will be required before the current set of operating guidelines expire in 2026. Many of you in this Zoom room play key roles in decisions about the river, and I really can't think of a more important role than making decisions and negotiating compromises about the most important natural resource in the West. Water sustains all life, the environment and it grows our food. It's why we do what we do at the Foundation every single day.

I would like to acknowledge our past president, Bob Johnson, who is here with us today, along with board members Bart Fisher of Palo Verde Irrigation District, Yung-Hsin Sun of Stantec, who we just saw, Leslie Moulton-Post of ESA and Pete Silva of Silva-Silva International. I'd also like to acknowledge previous Reclamation commissioners who are here today, including Brenda Burman, Estevan Lopez and Mike Connor, who of course was also deputy Interior secretary who has been nominated, as you probably know, for assistant secretary of the Army for civil works. And of course, I can't neglect to acknowledge former Interior secretary and Arizona Governor Bruce Babbitt. Both Brenda and Bruce gave keynote speeches at our last Symposium in 2019.

Turning to this afternoon's program, you will hear a multitude of perspectives on the Colorado River, as panelists discuss today's most pressing issues and provide insight into where the Basin is making progress and where more is needed. We hope that, through these conversations today, we can bring reflection upon the theme of this year's Symposium, Navigating Through Crisis. In light of this theme, we will hear panels that will look at on-the-ground impacts and ask whether the drought contingency plans will be enough as we move forward. We'll also meet new leadership at the federal level, along the border and in Mexico.

As we do with our in-person events, we will be doing an audio recording of today's discussions, which we'll publish as a proceedings. Of course, we'll make sure to let everyone know when that publication is ready. As a reminder, please submit your questions via chat to the window labeled "Questions for Speakers," and we will call on people at the appropriate times. Also, I want to remind you that we have a virtual reception with happy hour chat rooms immediately following the event. Make sure to have your beverage of choice handy, just like in Santa Fe. So now let's get on with the program, shall we? And I first want to remind everybody that full bios of all the afternoon speakers can be found on the events webpage, and you can find a link to that in the chat room.

New Federal Administration's Priorities for the Colorado River Basin



Camille Calimlim Touton, Deputy Commissioner, U.S. Bureau of Reclamation

Jennifer Bowles, Executive Director, Water

Education Foundation: I'm going to briefly introduce Reclamation Deputy Commissioner Camille Touton, who is returning to Interior after serving as the department's deputy assistant secretary for water and science under the Obama administration. Before her current appointment earlier this year, she served as professional staff for the U.S. House Committee on Transportation and Infrastructure. She was also the staff lead on the resiliency provisions enacted as part of the Water Resources Development Act of 2020. Her congressional experience also includes serving as professional staff for Interior's authorization committees, the Senate Energy and Natural Resources Committee, and the House Natural Resources Committee. But perhaps most importantly, she was born in one of the river Basin states, Nevada. Thank you so much for joining us, Camille.

Camille Calimlim Touton, Deputy Commissioner, U.S. Bureau of Reclamation:

Good afternoon, Jennifer. Thank you for the invitation to join you today. And it's great to see so many friends and colleagues throughout the year on a couple of Zoom screens. Also, I want to recognize the honorable Bruce Babbitt. I know we have several assistant secretaries on the line as well. And commissioners, as you mentioned, it's great to see you all. And I want to extend my congratulations to Commissioner Giner, the new IBWC commissioner for the U.S. Section, so congratulations to you. My name is Camille Calimlim Touton and I am deputy commissioner for the Bureau of

Reclamation, as Jenn mentioned. I am honored to have been nominated the commissioner for the Bureau of Reclamation and my hearing was earlier this week, so I don't think there's a more appropriate engagement since appearing before the Senate than to be here with you today to talk about our home Basin.

There was a line in the Colorado State Capitol that always comes to mind that I know speaks to the people of Colorado, but also speaks to me, that on those walls it says, "Here is a land whose story is written in water." And for me the Colorado River Basin is my story. Now, we moved to Nevada – I'm actually not a native Nevadan – but we moved to Nevada when I was very young, when my dad was stationed to Las Vegas to Nellis Air Force Base. I remember making that drive and we were children being terrible, you know, "are we there yet" type of situation. So, my dad, trying to get himself out of the car, pulled up on one of the lookouts in the Black Canyon. That was the perfect vantage point for Hoover Dam. And recognizing now, as a parent, that my dad was just using a tactic that you have to use with children, he immediately said, "Do you see that? That's Hoover Dam. You know who built that? Engineers. You know what's behind that? Lake Mead. And do you know what lives in Lake Mead? Mermaids. It's the only place that they live in the continental United States. Everyone knows the engineers made that happen. And that's why you should be an engineer."

So, you know, there's a little bit of a white lie there, but that was the start of my love affair with water and with Reclamation and really growing up in Nevada.

I looked up to leaders of the river at that time, people like Pat Mulroy, and Reclamation leaders like Bob Johnson, like Larry Walkoviak. So I'm just really humbled and honored to have the opportunity to lead Reclamation, and if confirmed, get to work with all of you again in this new capacity.

Let me tell you about some of the challenges that we're seeing this year. When Assistant Secretary Trujillo and I walked into the door on January 20th, we were chasing a really tough hydrology. Snowpack was good in some places, and it was terrible in others. We also recognize that there were drier soils and hotter temperatures. And so places like the Colorado River where we had a decent snowpack – 89 percent of normal – the dry soil, the hotter temperatures, lower snow water equivalent content, resulted in less inflow into our reservoirs. At Lake Powell we saw 26 percent of the average, the second-lowest unregulated inflow into that reservoir. And that pattern unfortunately wasn't just in the Colorado River Basin. It followed us in almost every single basin across the West. It was the same thing that we saw in the Central Valley Project and certainly the same thing that we saw in the Klamath Project. And so what we had forecasted on April 1st, and what we actually saw into our reservoirs was a significant difference. In the Central Valley Project, it was close to a million acre-feet. In the Colorado River, it was a million and a half between April 1st and May 1st. Same thing with the Klamath Project, 75,000. So when you're starting off with less water and recognizing that it was just continually getting worse, it poses a challenge – an operational challenge – from day one. And that's exactly what we saw across the West, the magnitude and the scale of the drought is something that we've never seen before.

We like to look at the drought monitor every day, and it's Thursday, so there's a new one today and it showed 94 percent of the West is in moderate to exceptional drought, up from 23 percent a year ago. And these are significant challenges, and the likelihood is this is what we're going to see moving forward. So as Jenn mentioned, we declared the first shortage in the lower Colorado River Region in August. And we're in the middle of the 22-year drought, and I don't have to go into the details because there are experts across the Basin who recognize what we're dealing with right now.

I think what's important is our ability to make a shortage declaration rested on a foundation of hard work and trust that was built upon in the Basin over decades and is the model that I intend to pursue as it is the best path for the

Basin moving forward. I think some of the challenges that we've had can also be coupled with some of the successes that we've had. And when I had my opportunity to speak with the senators this week, it was something that I wanted to highlight.



If the hydrology continues to deteriorate, there are additional actions that we'll have to consider in the future."

- Camille Calimlim Touton

We absolutely have a declared shortage, but because of the actions we've taken, because of the deals as part of the 2007 guideline, as well as the Drought Contingency Plan, shortage could have happened sooner. And what we're doing now is executing a plan that many in this virtual room helped to build and helped to move forward and is exactly what Reclamation is now implementing.

But I think the challenge that we have is, those deals and agreements may not be enough. And if the hydrology continues to deteriorate, there are additional actions that we'll have to consider in the future. These are very hard conversations that we're starting to have now, just looking into water year 2022, but I know many of you are anxiously waiting for what might happen and what the conversation might be for post-2026 guidelines. What I've committed to and what the assistant secretary is committed to is an open and transparent dialogue with all of our partners, with all of our stakeholders, and that includes the updated release of the 24-month study that we released last week, along with the five-year CRSS model that we released on Wednesday, and the new product that we also released on Wednesday which is the two-year forecast. They constantly remind us that the five-year CRSS and the two-year model are forecasts on what could happen, right? But it's an opportunity for us as a Basin. It's an opportunity for Reclamation to go eyes wide open on the possibility that the main problem is not the minimum possible.

In that light, what are we doing about it? There are several things we're doing. First, we really had to manage in the moment this year. Chasing a hydrology, having the challenges that we had, we recognized that we needed to be able to have some look at operational flexibility, look at financial assistance, and look at technical assistance. In the

Colorado River Basin, one of the things that we did this year was a \$100 million reprogramming of our fiscal '21 budget. Twenty million dollars of that is for drought contingency planning. We also included \$7 million for the completion of the 242 wells project in Arizona so that we can get water online as early as next year through that project. But that's just one component. In the Central Valley, we looked at operational flexibility. We worked closely with the Department of Water Resources in the state of California to see what flexibilities do we have in our reservoirs – putting in temporary barriers, buying water where we could, and finally just making assistance available through technical assistance and Drought Relief Act funding.



If we can just get back together and recognize the rich history that we're building from, there's nothing that we couldn't do in the future."

- Camille Calimlim Touton

So, as we move into fiscal year '22, and as we move forward, these are still very much priorities for us: How do we continue to contribute to the Drought Contingency Plan? How do we support tribes as well as our irrigation districts with Drought Relief Act funding, with technical assistance, and then utilizing hopefully what will be enacted into law, the bipartisan infrastructure framework, which in there has \$8.3 billion in investments for the Bureau of Reclamation? Some of those have direct – all of it has direct impact on the Colorado River.

There's a couple of provisions that I wanted to point out there for you that I know many of you worked on. One of them is the large-scale water recycling. This is an effort that would certainly benefit some of the activities that are being pushed in the Basin, including by the Metropolitan Water District and Southern Nevada Water Authority. This is a nearly half-a-billion-dollar investment that, if enacted, would make a significant difference. And there's a provision in there that's \$300 million for drought contingency planning, also a significant investment. Along with new storage and new water recycling projects, and water smart and aquatic ecosystems, this \$8.3 billion is a generational investment in Reclamation. And I know next year, the Colorado River will be celebrating our 100-year anniversary of the signing of the compact, and Reclamation will be celebrating its 120th

birthday. So, it really is a point where we can say, here's who we are going to be for the next 120 years.

And finally, one of the other things that we are doing to get ready is not just operational/financial, but building up our human capital for our own internal processes. I think many of you know some of our amazing leaders at Reclamation already, Deputy Commissioner David Palumbo. Also, we have our regional directors, Jaci Gould, who just started with us in that position in July. Wayne Pullan in the Upper Colorado River Basin, we've also got leaders like Leslie Meyers and certainly Carly Jerla, who has graciously accepted our position as program manager for the Colorado River to start the conversations about post 2026. I saw Amy Witherall on here too who helps to lead our Mexico negotiations. We've got a rock-star team and we've got a solid foundation, but are looking at how do we continue to build and support all of the needs within the Basin?

A lot of it is really, for me, especially in the Colorado River Basin, is I grew up seeing what success looks like. I am a product of that, right, I mean the deal that was the shortage this year was thought about in 2007. Moving forward, this Basin has always been in the spirit of collaboration, communication and working together and it's not every Basin that's like that. The Drought Contingency Plan – Commissioner Burman was on here and was actively engaged and intimately involved in getting that enacted into law. Standalone bills like that don't happen in Congress. You're usually a part of a big package of bills. The only reason that bills like DCP go on their own is because all of you come together and say this is what we need, this is what's important, and this is what needs to get done.

And that's what we have to keep in mind. Things are going to get harder, conversations are already tough and I would like to be able to have some reprieve of a rainy year so that we can have some breathing room. But the operational challenges from year to year will just be a part of our everyday conversations but also our conversations about the future. If we can just get back together and recognize the rich history that we're building from, there's nothing that we couldn't do in the future. I know this conference has always been the gathering point for all of us in the Basin to exchange information and to enjoy each other's company. It's unfortunate that we aren't able to be together today, but I certainly look forward to seeing all of you next year, to seeing all of you in person, and to continue to celebrate our successes together. So it's just an absolute privilege to be back in the Basin to be with all of you today. Thank you for the opportunity.

BOWLES: Thank you, Deputy Commissioner. It was very nice to hear from you and to highlight your new team, a lot of women on that team. That's always a good thing.

On-the-Ground Impacts: Hydrology, Hydropower, Salinity & the Environment



Panelists, clockwise from top left: Jennifer Pitt, Director, Colorado River Program, National Audubon Society; Co-Moderator Nick Gray, Water Education Foundation; Jim Prairie, Hydrologic Engineer, Bureau of Reclamation; Adam Arellano, VP of Power Marketing, Western Area Power Administration; Bill Hasencamp, Metropolitan Water District of Southern California and Chair, Colorado River Basin Salinity Control Forum; Co-Moderator Jenn Bowles, Water Education Foundation.

Nick Gray, Program Director, Water Education Foundation: All right, welcome back everyone. Our first virtual panel of the afternoon will be a round-robin to provide updates on hydrology and the impacts it's having on hydropower, salinity and the environment. And so a reminder that full bios for all of our speakers are available on our event web page and a link to that can still be found in the chat. Our first speaker will lay the groundwork by giving us the status of the basin's current hydrology and what we can maybe expect going forward. Joining us to do that is Jim Prairie, hydrologic engineer with the Bureau of

Reclamation since 2000. He's stationed at the University of Colorado Center for Advanced Decision Support for Water and Environmental Systems where he leads applied research in mid-term operations and long-term water resource planning, climate variability and decision support under uncertainty, which makes him the perfect guy to take this first stab at hydrology. So take it away, Jim.

Jim Prairie, Hydrologic Engineer, Bureau of Reclamation: Thanks, Nick. So today, I'd like to discuss our current hydrologic conditions and the hydrology

outlooks that we've been providing, and Commissioner Touton spoke to some of these. I'd also like to speak a little bit about the range of effects these are going to be having potentially on Reclamation's operations.

The figure I have up right now is illustrating the impacts of the drought that we all know began in 2000, as well as the impact of putting in place the 2007 Interim Guidelines, which have been helping us to keep Lake Powell and Lake Mead from falling to critical elevations even lower than what we're seeing today. Lake Powell and Lake Mead were essentially full beginning in 2000 on the left-hand side of this plot, and because of five back-to-back below-average years, we've resulted in the combined storage in these reservoirs falling just below half-full in those five years. And during this time seven Basin states began working on developing a new set of operating criteria, the drought contingency plan, along with Mexico signing Minute 323, adopting the binational water scarcity contingency plan, which both together help provide a more robust operation under this drought.

It's important to note from 2000 to 2021 that only five years had about an average runoff, and they've been happening infrequently. The present forecast for next year, given the continued warmth and dry conditions, is projecting a 76 percent water year in 2022 or 8.2 million acre-feet of unregulated inflow into Powell with a minimum probable of 4.74, or 44 percent of average, and a max probable of 16 million acre-feet, or 148 percent of average. And this only spans 80 percent of the range of possible forecasted inflows to 2022. There's 10 percent higher and 10 percent lower around these inflow possibilities. Right now, we're still sitting with significant uncertainty regarding what's going to happen with next year's flows since we have not received all our other precipitation and we're still awaiting to see the winter snowpack. And we all recognize that we're having difficulty in skillfully predicting that snowpack, even at this time or in January. As an example, this last year, and Ms. Touton spoke to this, we forecast the error for 2021 unregulated flow to Powell, when comparing the January forecast of the water year with the August, was a 40 percent error. We projected January forecast volume of 53 percent of average flow versus a projected August forecast value of 32 percent. And this is just some of the difficulties we're going to have to think of as we move towards the next year.

What I'd like to do is just, again, present these two-year probability projections that Ms. Touton spoke about and just think about those in light of the information that's driving these. They're coming from our Colorado River mid-term modeling system. This system relies on 35 ensemble streamflow prediction inflow traces from the Colorado Basin River Forecast Center, and these projections

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It's important to note from 2000 to 2021 that only five years had about an average runoff, and they've been happening infrequently.”

- Jim Prairie

are built looking at current conditions on the ground today and then resampling the precipitation and temperature from the '81 to 2015 period. We all are recognizing that that period may be a little rosier than what we're really experiencing, and the CBRFC will be moving to the 1991 to 2020 period hopefully in the next month. These forecasts generate unregulated flows and they produce results through our operations model of what we see is the range that can happen at the reservoirs Powell and Mead.

So here, I'm looking at figures of pool elevation. On the left-hand side, you can see the pool elevations, on the bottom, you're seeing the months from February 2021 through August of 2023. This particular simulation is the one that was released yesterday and begins in September of 2021, with the stored data before that. The key thing we can see here is we can see those most min and max probable lines in the dotted colored lines. And then we see a range of the results from the new figures that are being presented, showing the 35 projections from the ensemble produced by the Colorado River Basin Forecast Center. And what we can see is that at Powell, that 10th percentile range is a significant range that can show us hitting levels of minimum power pool even in 2022 when we saw the min probable only showing it occurring in 2023. Our goal here was to present more results for folks to understand that range of hydrology. And these are now all available on the website that Reclamation made live yesterday.

We have similar results at Lake Mead. Again, at Lake Mead, we don't see quite a difference from the mean probable versus the bottom of these ensemble streamflow prediction traces. That makes sense since Powell's regulating the outflow range that Mead is seeing while Powell itself is receiving a much broader range of possible flows over the next two years. Beyond that, we also have the five-year projections. They're coming from the Colorado simulation system, and I'd like to speak about what's driving some of those as well. Right now, a key piece that we're watching

is the information coming from precipitation variability. Here, on this figure, I'm showing streamflow in the blue line and then in the gray line, precipitation, and we're looking at the years 1906 through 2020. And what we're seeing is that for these, they're highly correlated, but we're not seeing a significant shift in streamflow precipitation even in this drought period. It's definitely lower than what we've seen in some years, and really the change is that we're not seeing the frequency of those high flows that can come in but we're seeing low flows that we've seen in the past.

Where it's different is when we start looking at temperature. Temperature is showing a significant trend that began in the mid-80s, and that significant trend is something we're really wanting to capitalize on as if it was telling us something about what's happening with this drought. So, what we've been working to do is move a little bit from what we have done in the past. When it comes to hydrology driving that five-year projection for really up to this year, you've seen us using the full hydrology, 1906 to 2019. And then along with that the stress-test hydrology, which is capturing that warming period, and that's a hydrology we use from 1988-2019. Well, for the last rollout yesterday, we've dropped that full hydrology, recognizing that that's not informative right now. It's that stress-test hydrology recognizing that warming that we know is going to continue, and we want to be able to bring that into those projections so we understand how they can impact operations. We don't want to bring in the impacts of these wet flows we saw in the early part of the 1900s that really are probably one in a thousand-year reoccurrence, not one in a hundred.

Recognizing that, we've shifted the way we're working with hydrology. And then again, we're highlighting that 20-year period where we're seeing these low flows in the drought. Relying on that stress test we can then look at Mead elevations again. And in this figure we're looking at annual data historical from 2016 through 2020, and then we're looking at the 2021 through 2026 projection. And in the solid line, yellow, we're seeing the median of that stress test-based hydrology. We're seeing the 10th and 90th in the darker yellow, and we're seeing the max and min range of those results in the lighter yellow. And we're seeing that at Powell we're getting two levels well below minimum power potential for that, even at the 10th percentile and the minimum. At Mead, we see a little different picture, where adding that information below the 10th and 90th is really informative to understand. We have some very low conditions that are possible given the stress test (that you have last year's from 1988-2019): it's not highly probable. But again, we have to use caution when thinking about this because we basically have a moving window of probability with hydrology and what's happening.

And that's the next thing I want to bring up is when we think about hydrology, it's going beyond the five years and looking at post 2026. Now, here, I'm looking at different scenarios that we could have for hydrology in the future. The full hydrology is what you've seen before, what Reclamation used in the 2007 Interim Guidelines. Then we have many new hydrologies we've been developing. One removes that wet period in the 1900s. Another is the stress test. You've got paleo data from tree rings, and then we even got information coming from global climate models and a couple of modeling and comparison projects 3 and 5. What this figure is showing us is the range of possible flows under each of these scenarios. The range varies significantly from each scenario. And the key thing we have to understand now is we no longer can pick a scenario and have confidence that's what's going to happen in the future. All these scenarios are plausible. We can't say one is more likely than the other. We have to start thinking about operations and decision-making under that picture, which is very different than what we've done historically.

So what this figure here is showing, what I would call "shifting risk." It's the risk of Lake Powell dropping below 3,490 in any month. And what we can see in this gray line is the risk that we believe would occur based on the 1905-2005 hydrology. And this was the risk we made our decision about the 2007 guidelines on. And then on top of that, we laid some information: We've got in green the full hydrology – that's that full record, 1906-2018. And then we've got the stress test, the orange line, which is this drought period. And then we've got the information from the global climate models that we presently have, CMIP 4 and CMIP 5, and we can see that each of those come up with a different risk. There's a range of risk now.

There's not one risk you can make a decision off of. And now, if we extend that going out to 2050, which we'll be doing over these post-2026 reviews and the decision work, we're seeing that that risk is just continuing to evolve and change as we move through time. And this is a key piece that we're going to have to consider. We're going to need to build an operation and a set of alternatives that can work across all these risks. We can't pick one and say, "This is the risk we can expect." I think that's a key piece of why at Reclamation, we've been shifting our view of how we are going to make this decision. And we're really trying to work under a new paradigm of looking at what we call "deep uncertainty," and what deep uncertainty really represents is when you have a situation where probabilities of any given set of futures can't be estimated with confidence. It's really saying we can't pick a scenario and say this is what's going to happen and we can build our choices on that one possible set of risks.

So now we're basically going to have a suite of risks and that choice of a hydrologic ensemble should not be something we're going to try and do. It's going to be controversial because people would have different choices of what they think the future is going to look like. We're going to have to move away from some of the statistics-based analysis we've done. We've said, we have one risk profile that we can make a decision on. I would say now we don't have one risk profile. What we're going to have to do is we're going to have to work under this deep uncertainty framework. There are academic frameworks that are developed under this we've been working to build in hope of being able to use these during the post-2026 effort. This will shift us away from this statistics-based risk analysis, and it's going to allow us to focus on robustness, which is this idea of: Can we find operations that can work under that wide range of potential risks and understand what the propensity of us is to be towards any of these is to look at vulnerability in the system, understand what is the vulnerability of getting below power pool at Mead or Powell? What is the vulnerability of not being able to make deliveries and then look for signposts or markers that we can kind of learn through the data that will tell us we're heading toward one of those vulnerabilities. It's a different way of thinking about setting up a set of alternatives. It's really what we believe the hydrology is telling us we need to head towards. I think that's all I wanted to present on my side.

GRAY: All right. Thanks so much, Jim. Really appreciate that laying the groundwork for the rest of the panel. Joining us now to discuss the impact on hydropower is Adam Arellano, vice president of power marketing for Western Area Power Administration's Colorado River Storage Project Management Center in Colorado. Before his current leadership role, Adam worked in WAPA's Office of General Counsel, and in 2009 was selected to solely represent the Colorado River Storage Project Management Center through many issues. The floor is yours Adam.

Adam Arellano, VP of Power Marketing, Western Area Power Administration: Thank you. So Jim started off on mute and I'm starting off with my computer telling me it's going to restart on me. So hopefully, I could get through this before that happens. I'm going to share my screen real quick and hopefully that works. Okay, so understanding that we're the odd person out at most water conferences, I was going to start off by speaking a little bit about WAPA and what we do. So before 1977, Reclamation used to kind of be a one-stop shop: They would operate the hydropower dams, they would generate electricity, they would take that electricity and market it and deliver it to end-use customers. In 1977, Congress created the Department of Energy, and when that happened they kind of separated the functions. So now Reclamation owns and

operates the dams and they generate the hydroelectricity, but WAPA, now we take it and we market it and sell it and deliver it to end-use customers.

The Colorado River Storage Project, a lot of you folks already know a lot of this information, but there's 12 power plants on the CRSP project with 27 generating units. If all generators were working and operating and full of water right now, we would be able to generate 1,827 megawatts of electricity. Yearly, that the average is about 5,700 if all the reservoirs were full and everything is working properly. From that, 75 percent comes from Glen Canyon Dam, so Glen Canyon Dam is really important to us. CRSP also has about 3,000 to 2,500 miles of transmission lines that we use to deliver the electricity that's generated.

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As the elevation of Lake Powell goes down, the efficiency of the generators on the reservoir also goes down.”

- Adam Arellano

Our customers span the western United States. We have 54 Native American tribes as customers, 64 municipalities as customers and various other customers ranging everywhere from Nevada, Colorado, New Mexico and Nevada, Nebraska all through the western United States. So, WAPA is kind of unique in the way that we operate most federal agencies. We rely on appropriations from Congress. What Congress established when they established the CRSP Act is they created what's called the Basin Fund. So it's a revolving fund that takes the money that's generated from the CRSP project, puts it in the Basin Fund and then the money that's in the Basin Fund gets put out so that it could be used to defray the cost of operating and maintaining the dams, the transmission facilities – a number of all of the expenses from the CRSP project.

So just wanted to give you that background, and I don't think I need to talk about hydrology much. I did want to show on this slide here: In June of '98 Lake Powell was almost full, and fast forward now to where we're at, September of '21, and we're hovering above 3,500 feet in elevation, but we're not close to full. So the reason that's important for CRSP here is when Lake Powell is full, we can generate 4,303,000 megawatt-hours of electricity. As the elevation of Lake Powell goes down, the efficiency of

the generators on the reservoir also goes down. So if you fast-forward to an elevation of 3,515, we lose 25% of our efficiency to generate hydropower at Glen Canyon Dam.

So what that does to us is when the reservoir is down, we have less water going through it. It's kind of a double whammy for us. Not only can we generate less because there's less water, but we generate less because there's not enough head pressure to generate as much as we normally would. So at the beginning of 2020, we estimate how much electricity we're going to generate or will be generated at Glen Canyon Dam. We use that number to estimate how much we're going to have to buy to make up shortfalls in generation. In some years, when water was good, we used to have excess generation. We would be able to sell that and help pay down the project costs. When there's not enough water, we have to do the opposite: We have to purchase to fulfill our contractual obligations to our customers.

So in April 2020, we were estimating that we needed \$3.7 million dollars to meet our contractual obligations, and that's an average number for us, it's not difficult. Through the year, as we watched hydrology decline, that number continued to grow. Every month it was going from \$3.7 million to \$5.5 million to \$6 million. Right now, when we projected how much we would have to spend to replace electricity that we're not generating at Glen Canyon Dam, we looked at a price of \$103 million and that's not something that we can sustain. So when we looked at that \$103 million, we realized that we had to adjust our rate, and if we use those calculations that we use, that \$103 million number our rate to our customers would have risen 40 to 50 percent. Right now, it's set in actually a little bit higher, but we would be looking at a 40 to 55 percent rate increase if we went ahead and increased our rates that way.

So, instead what we did, we worked with our customers and we've reduced the amount that we're going to be responsible for providing them. They're going to be getting less power from us. We've offered to purchase that power, but that's going to be passed through on a one-to-one basis so if we're buying it for \$40 or \$50 dollars a megawatt on the market, we're going to pass that through directly to them. So one way to think about this is that although WAPA's rate is increasing by 40 to 50 percent, the power customers rate on the CRSP power is still going to see the rate increasing by 40 to 55 percent based on hydrology. And that's all that I had.

GRAY: All right. Thank you very much, Adam. We're going to now turn to the issue of salinity with Bill Hasencamp, manager of Colorado River resources for the Metropolitan Water District of Southern California. In addition to developing and managing water supply programs to

augment Metropolitan's Colorado River supplies, Bill is one of California's representatives to the Colorado River Basin Salinity, Control Forum. So over to you, Bill.

Bill Hasencamp, Chair, Colorado River Basin Salinity Control Forum:

Thanks, Nick. It's a pleasure to be part of this distinguished group. I'm coming to you from in front of Bishop's Lodge, checking it out in advance of your conference next year. Looks great! I'm sure that it is going to be a wonderful event for the anniversary of the compact. So I am the current chair of the Salinity Control Forum. I was re-elected for another term, I don't know if that's an endorsement or what exactly that means, but I will be the chair for another year or two. The Forum focuses on salt, and salt is commonplace today. Throughout history, it's been rare and it's played a key role in the development of human history. The ability to preserve food contributed to the development of civilizations. The word salad means salted and comes from the Roman practice of salting leafy vegetables to enhance and protect them.

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The salinity program, along with the entire Colorado River Basin, is facing challenges that will take a unified front to address.”

- Bill Hasencamp

Salt was bartered for goods, traded for gold, even equivalent weight for gold at times, and in some places used as currency. Wars were fought over salt. Venice invaded Genoa over the product, and the spoils were the salt mines that were there. And of course, salt is necessary for life, but in the right balance.

Too much salt leads to high blood pressure, heart disease, stroke. Too little salt can exacerbate diabetes, strain organs, or if you're LeBron James in the NBA Finals, it can cause cramps that forced you to get out of the game early. And our municipal water supplies also need the same balance. The years 2019 and 2017 were wet years in California. We delivered pure snowpack from the Sierra Nevada into our service area. Fresh snowmelt, we thought "what a great water supply for our region," but the water was so pure that it eroded the pipes, caused brown

water to go throughout our service area and customers complained. To resolve the problem, we added salt. We diverted water from the Colorado River to blend with the pure State Water Project down to a level that no longer cause corrosion, and met our customers' needs. Likewise too high salt can be a problem, and many problems can occur when the water is too salty. Water recycling activities can be curtailed as the process of recycling water increases the salt content. Here in Southern California, 10 percent of our demands are met through recycled water, and we are embarking on plans to recycle even more water in the future. But if the source water is too salty, we have to curtail some of those recycling activities.

Agriculture also is impacted by salt. Salt builds up in the soils, and the more salt that's there, the more water is needed to flush those salts out. Whether you're an avocado farmer in Northern San Diego County or an alfalfa grower on the Colorado River, saltier water requires more water to grow crops. Salt also accumulates in the groundwater basins over time, making some groundwater basins unusable. Historically, the Central Arizona Project and the Colorado River Aqueduct imported about a million tons of salt per year from the Colorado River into their regions. In the case of Arizona, all that salt would stay in the groundwater basins. In California, some of the salt would make it to the ocean, some stay in the groundwater basin. But as we recycle more water, more of it stays in our regions. So why the salt? Why is the Colorado River so salty compared to the other rivers in at least our region out here in the West? Well, of course, over time, the oceans submerged and then receded over the Colorado Basin leaving salt layers over the eons underneath the central part of the Four Corners regions. And then the natural salts would seep into the Colorado River through hot springs and salt seeps. The largest source of natural salt in the Colorado River is Glenwood hot springs. And over the last hundred years, the salinity has increased as agricultural production in the Colorado Basin has, through flood irrigation, leached down into the soil and added salt to the river, and upstream diversion has taken away fresh water that could dilute the salt to a lower salinity. In the 1970s, the salinity peaked. Mexico, partly because of the filling of Lake Powell, complained about the salt. The Environmental Protection Agency was considering state line water quality mandates at each state.

So the states banded together and took control of their destiny, forming the Salinity Control Forum and the Colorado River Salinity Control Program in partnership with the federal agencies. And under the Salinity Control program, the states and the feds partner to fund programs to keep salt out of the river. They address both the natural and the anthropogenic sources. There are brackish water wells in the Paradox Valley that keep highly

saline water out of the Dolores River. And there are programs to work with farming communities in the Upper Basin to line ditches and put in sprinklers so that the soil isn't deep-percolated and salt stays out of the river. The program has been very successful. To date, the water quality at Lake Havasu is 100 milligrams per liter less salty because of the program. It's 170 milligrams per liter less salty than it was in 1970, so a tremendous success that the Colorado River today is much less salty than it was not too long ago. As a result, CAP and the Colorado River Aqueduct diverted about 200,000 tons less salt into the regions than they did 40 years ago, 50 years ago, and that is preserving the life of groundwater basins in each of those regions.

And while the program has been a success, it is facing challenges at the moment. The first is that it does not have a sustainable funding source. The state share is paid for by power revenue generation from Hoover and Glen Canyon dams. Of course, the power generation in recent years has been decreasing because of the lower head in the reservoir and lower releases. And there is no inflation factor on the adjustment, so the revenue is coming down. If we wanted to keep the Forum going at the same funding level to keep the program in place, we need an additional source of funds or we have to scale back the program. Currently, Nevada and California pay 85 percent of the total cost of the state share of the program. The states have been in discussions about developing a new funding source, a more equitable plan that would provide sufficient revenue to keep the program going at its current level. It's important that the states make that a high priority right now as the salinity of the Colorado starts to go up so we can continue the Forum funding programs in the future. And of course, Congressional authorization will likely be needed to approve that new funding plan.

The second challenge is with the Paradox Valley program. Paradox is the single largest salinity control project. Historically, it controlled 110,000 tons of salt, keeping it out of the river. It was doing that by capturing highly saline brine water 2 to 300,000 TDS, many times saltier than the ocean, keeping it out of the river and injecting it 2 miles under the surface. However, a number of earthquakes occurred from that operation. Each time there was an earthquake the program was scaled back a bit, but in 2019, an earthquake was large enough to be felt in Moab. The project was shut down and it's been inoperable ever since. At the same time, Reclamation concluded an EIS to look at a long-term solution to salt control in the Paradox Valley, but concluded that any of the alternatives were too damaging or too environmentally impactful. It recommended no action alternative and instead seeing if the existing program could be expanded with the farming community to offset the loss of Paradox.

So what we've seen is – try to share my screen here, let's see – so what we see now is that Dolores River, with such low flows, has black, briny muck flowing into the Dolores River. This photo was from earlier this year. We've seen that the brine tends to pool up and then come in a flood flow when the rains occur. One day measured a salt load to the Dolores River of over 7,000 tons of salt. That's equivalent to seven total projects per year for an on-farm project. So pretty big impacts, and downstream we're seeing impacts to the fish and wildlife of the Dolores River from these salinity spikes.

The short-term news on the Colorado River downstream is not good either. Due to the drought and the well being off, Reclamation has estimated – the black line here is the salinity forecast at Lake Mead. Lake Havasu would be higher than this – but forecast that the salinity will go up by 70 parts per million by the end of 2022. More concerning is that increased spike at the end of '22, and what we really don't know is what's going to happen if the reservoirs get to these really low levels. The models are not good at forecasting the salt, so we could see a salt spike that we haven't seen in many, many years. That high salinity could counterbalance some of our drought response efforts that you hear about in the next panel. The saltier the water is, the harder it is to reduce your use.

So in closing, the Salinity Control program has been very successful in reducing salt impacts of the river. Pat Tyrrell once said that the program is a great example of how seven states can work together to achieve successful outcomes. When sometimes the states argue, the Forum is always a shining example of our collaborative success. But now the salinity program, along with the entire Colorado River Basin, is facing challenges that will take a unified front to address. Even if we're successful on addressing the issues I laid out, the program cannot rest on its past successes and must evolve as management of the river evolves. I've been advocating for many years for the salinity program to adopt the changing conditions and take a greater role in addressing the drought by focusing on projects that control both salinity and conserve water. I'm concerned that if the program doesn't adapt and become part of a holistic solution for the Colorado River, we won't have the full backing of all seven states and the program might not survive. I believe the key to success of this effort and any effort is continuous improvement, adapt to changing conditions and build a consensus approach. Based on our track record, I'm confident that we will accomplish that goal. Thank you for your time.

GRAY: Thanks so much Bill. And finally, we're now joined by Jennifer Pitt to address hydrologic impacts to the environment. Jennifer is the Colorado River Program director for the National Audubon Society, where she advises the

organization on strategies to protect and restore rivers throughout the Colorado River Basin, and she also continues to work on United States-Mexico collaboration to restore the Colorado River Delta. So welcome Jennifer.

Jennifer Pitt, Colorado River Program Director, National Audubon Society: Hi, thank you, Nick and thank you Water Education Foundation for hosting us. And yes, I too decided to join you from Santa Fe on the deck outside Bishop's Lodge, where I wish you all could join me because those are some of the best times at those conferences. I'm going to share some slides with you. I wanted to start off by reminding you all of something that I'm sure you already know well, which is that freshwater dependent habitats on the Colorado River have been experiencing drought for a long time because of how the system was developed.

Here's a picture of the river: Yuma, on the left in 1900, on the right in 2012. It's nice repeat photography: You can see the mountains in the background confirming you are looking at the same spot. To state the obvious, the river is lot smaller today than it was back in 1900. Critically, it's missing the vast riverbank forest that formed from the river's seasonal flood cycle, those snowmelt flows. Those forests were important culturally to the original inhabitants of these lands and also to the wildlife that evolved to depend on them. With the disappearance of those forests, the tribes have experienced tremendous impacts to their cultural traditions, and also we have seen quite an impact on wildlife.

At the Salton Sea, declining flows in the wake of the QSA transfers resulted in increasingly exposed playa, and that's creating significant air quality impacts for neighboring communities that already suffer high asthma rates. The shrinking lake also has impacts on wildlife. The colonial seabirds began abandoning nesting sites en masse in 2013 and shallow marshy habitats at the Sea's edge have really begun to vanish.

As less water is flowing into the Sea, it's becoming more saline and less hospitable to birds and fish that formerly relied on that habitat.

In the Colorado River Delta, the full development of the Colorado River's water effectively eliminated an ecosystem that we think was about a million and a half acres, a near-complete elimination of that ecosystem.

As freshwater-dependent habitats are lost, the species that rely on them have become imperiled. I want to show some pictures of birds, because I represent Audubon these days. Clockwise from the top left: the yellow-billed cuckoo, which thrives on cottonwood and willow trees on those

riverbanks; the sandhill crane, which uses open water on the lower Colorado in the winter; the yellow warbler, another riparian-dependent; and the Yuma Ridgway's rail, a secretive marsh bird that likes to hang out in those desert wetlands.

The bad news is that I have shown you examples of what has already happened to freshwater-dependent habitats in the Colorado River Basin. The good news is that, as climate change is keeping the Basin in the grip of drought, we actually have some experience working on how to address these challenges. We can't necessarily stop all the losses that we're facing in the future, but we know that with effort, we can avoid eliminating these critical habitats and the worst outcomes for these birds and other species. In general, we work to ensure that infrastructure does no additional damage. We work with water managers to commit flows to the environment and to invest dollars in habitat restoration. As warming takes its toll, we're starting with a bit of a playbook already in hand. But as you'll see, we're facing some new challenges and we're going to need some new solutions.

So what is it looking like on the ground right now? Well, our forests have been impacted by beetles for a couple of decades, and we're learning that the incidence of fire days is increasing significantly. Here's a map published by Climate Central showing how fire days, which come about with heat and low humidity and winds, are increasing significantly in the Basin. In 2020 in Colorado, we saw fires all over. A particular example I wanted to talk about is the Grizzly Creek Fire just upriver from Glenwood Springs, burning some 32,000 acres on the Colorado River. What that meant this year, when we had some particularly flashy storms, was tremendous mudslides repeatedly landing on I-70, closing the interstate and dumping ash and sediments into the river, and that impacts all water users downstream. So, I think this is a dynamic that is certainly not unprecedented, but its severity and frequency is something we need to be concerned about as a new dynamic in the Basin.

We also saw this year in Colorado repeated voluntary and mandatory fishing closures because as water temperatures warm above 70 degrees, fish have trouble with oxygen levels in the water. That also impacts not just the trout fisheries, but also the native fish because the warm water is actually allowing the non-natives, the bass and the pike, populations to increase and they are preying on the natives. That's actually giving us some concern about Fish and Wildlife Service's proposed delisting of a couple of native fish because we're facing unprecedented conditions throughout the Basin.

Finally, this year we saw the Dolores River completely dry below McPhee. That, of course, is not friendly habitat for fish of any kind. We know that climate change is water change and this is a sobering and scary time for everyone and everything that depends on the Colorado. We're learning that we cannot ignore the health of the watersheds that supply the river. On the next panel, my colleague and friend Season is going to talk about solutions. So, I'm simply going to leave you with a thought that as climate warming impacts freshwater-dependent habitats already degraded by legacy water development implemented at a time without much care for impact on nature, as well as water users in cities and rural areas experience unprecedented shortages, we are all going to need to work together on solutions. Basin management needs all stakeholders at the table, and that includes the tribes and that includes environmental organizations. We are, of course, going to need unprecedented financial resources to invest in these solutions, and we are going to need to work, I think, a lot faster than we might previously have anticipated. Thank you.



As warming takes its toll, we're starting with a bit of a playbook already in hand." - Jennifer Pitt

GRAY: Thank you so much Jennifer. All right, now we're going to field some of the questions you fine folks have been submitting for our panelists. Our Executive Director, Jenn Bowles, is going to rejoin us now to handle those duties. If you are called upon to ask your question, just make sure that your camera is on, that you've unmuted yourself, and go ahead and introduce yourself by saying your name and your affiliation first. So over to you Jenn.

Jennifer Bowles, Executive Director, Water Education Foundation: Well so far we have one question and it's from one panelist to another so, Jennifer Pitt, do you want to ask your question?

PITT: Sure, it was a question for you, Jim, I'm sorry to put you in the hot seat. I remember years ago hearing about the model called the VIC that you were using to take the downscaled GCM data and put it into CRSS. It seems like we're facing a lot of uncertainty right now in what happens on the Earth's surface between where the snow

falls on the mountaintops and where it hits the river, so I'm wondering what the Bureau is doing – are you investing in new models? I saw recently some announcements about new, big research efforts, but I'm wondering what you're doing right now to try to better account for that changing dynamic on the land surface in your modeling and forecasting.

PRAIRIE: Thanks for the question, Jennifer. So we've been doing a lot of different pieces. I mean, when I talk about the hydrologic model, that's just one component of that process going from what comes out of the global climate models to what we need at the scale that is required for running a model like the cover simulation system. One of the key things we've been doing is we've been tracking a project that actually Arizona State University and CAP have been doing along with a NASA grant, and they have worked to redevelop the information for land surface cover in the VIC model and it actually has an impact on results of the model. The other piece that we've been doing is we've been working with NCAR here in Boulder, Colorado and they have a group there that has been helping us to relook at VIC and calibrate it again, because the last time it was calibrated was by Dennis Lettenmaier in 2004. Those are two examples of where we're working to improve the results we're getting out of VIC, but I think the other thing you're speaking to: there is work out of that same team, out of NCAR, that are developing a new hydrologic model called SUMMA, which allows you to kind of pick and choose algorithms to move through the hydrology process. And again, that's another thing that we're hoping to invest some energy into in the near future, but we're kind of still sitting behind this knowledge that the deep uncertainty framework should be more important to us because we're not going to pick one single ensemble set, say from VIC or another hydrologic model. We're going to be picking a range. We're working on a project with Dave Tarboton out of Utah State University to consider a catalog of supply scenarios that you can put through CRSS, and kind of developing why you would choose different ones and what their range would need. Those are all pieces of work we're actively trying to do to address that issue: that we need to get more information of what can be happening on the ground.

BOWLES: Hey, does anyone else have any questions for our panelists? Don't be shy. Nick, you got a question? Well, we do have a question from Linda. Let's see. Linda, would you like to ask your question?

Lynda Lo-Hill, Director, Las Virgenes Municipal Water District: Sure. Sure. It's for Bill Hasencamp, and I'm just wondering what kind of measures you specifically take to remove a hundred milligrams per liter of salt from the Colorado. If you don't have the injection wells, what kind of measures are you looking at now?

HASENCAMP: Yeah, so the injection well is one component of a large portfolio. Most of the program focuses on agricultural efficiency: putting in sprinklers, lining ditches, putting in pipes. Small programs throughout three states have reduced that salt loading. So the rest of the program is in good shape, but the biggest chunk of it is Paradox with that offline coupled with conditions is the extra concern right now.

LO-HILL: So are you looking for funding to replace Paradox? Or are you looking at smaller measures with the portfolio? Running for the smaller measures?

HASENCAMP: Well, it's ultimately Reclamation's decision, but we are confident that the current well could be operated at some lower-level capacity safely. While we look for a long-term solution, we have been approached by some private entities in the region up there that are interested in collecting the salt and actually harvesting the salt and using it. So we're hopeful that Reclamation will do a supplemental EIS to evaluate that alternative and see if that alternative is acceptable. So we're still trying to push Reclamation to operate the well at some safe level in the near term, and still look at long-term salt control in the Paradox Valley. We still think that is the best solution in addition to everything else.

LO-HILL: And one more question, there's a lot of new technology coming up about salt removal, centrifugal. Any ideas of using some of that new technology?

HASENCAMP: The biggest problem is what to do with the salt. So what we try to do is keep it where it is. Keep it in the ground and keep it out of the river. Once you try to collect it, either through a well or some other process, then you have to figure out how to get rid of it and that is not an easy solution either. So really, our focus is keep the salt where it is, and then because we're far from any ocean, there's just no place that this all can go on an easy basis. So, keep it where it is or inject it in the ground where it can't interact with the groundwater and surface water. Yeah. It's a technique.

LO-HILL: Salt is an issue all of us are starting to deal with, so it's fascinating.

HASENCAMP: Absolutely. And it's going to get more challenging in the future. For sure. Certainly. Thank you for the question.

BOWLES: Thank you, Linda. Anybody else? Do we have any other questions? I'm not seeing any other questions. All right. What do you want to do, Nick?

GRAY: Yeah, we can just – we’re going to take another break. I’ll add another couple of minutes to it. And, again we’ll pause, no need to leave the call.

PRAIRIE: I did see another hand raised.

BOWLES: Oh, you did? Your name is Eric? Eric, come on. Eric, you’ve got to put your camera on. Are you there Eric?

ERIC KUHN, AUTHOR: Yes, I’m here. I have a question for Jim Prairie.

BOWLES: Let’s spotlight Jim for a second. Okay? Okay, there we go.

KUHN: 2020 and 2021 look like they’re going to be if not the driest, among the driest two-year back-to-back years on the Colorado River Basin. When will these two years be added to the 1988 to 2019 modeling capability, let’s put it that way? When will you have that information available?

PRAIRIE: No, thanks, Eric for the question again. Yes, so the 2020 data will have – you know, the first step is getting the consumptive use and loss estimate, and we’ll be getting that this next month, so in October. And the hope will be by end of October, early November, we have a natural flow estimate through 2020. The 2021 estimate we likely would not have that finalized, we’re behind this year. We usually like to have our estimate out by July/August. So the hope would be by July/August of 2022, we would have the 2021 estimate added to the record.

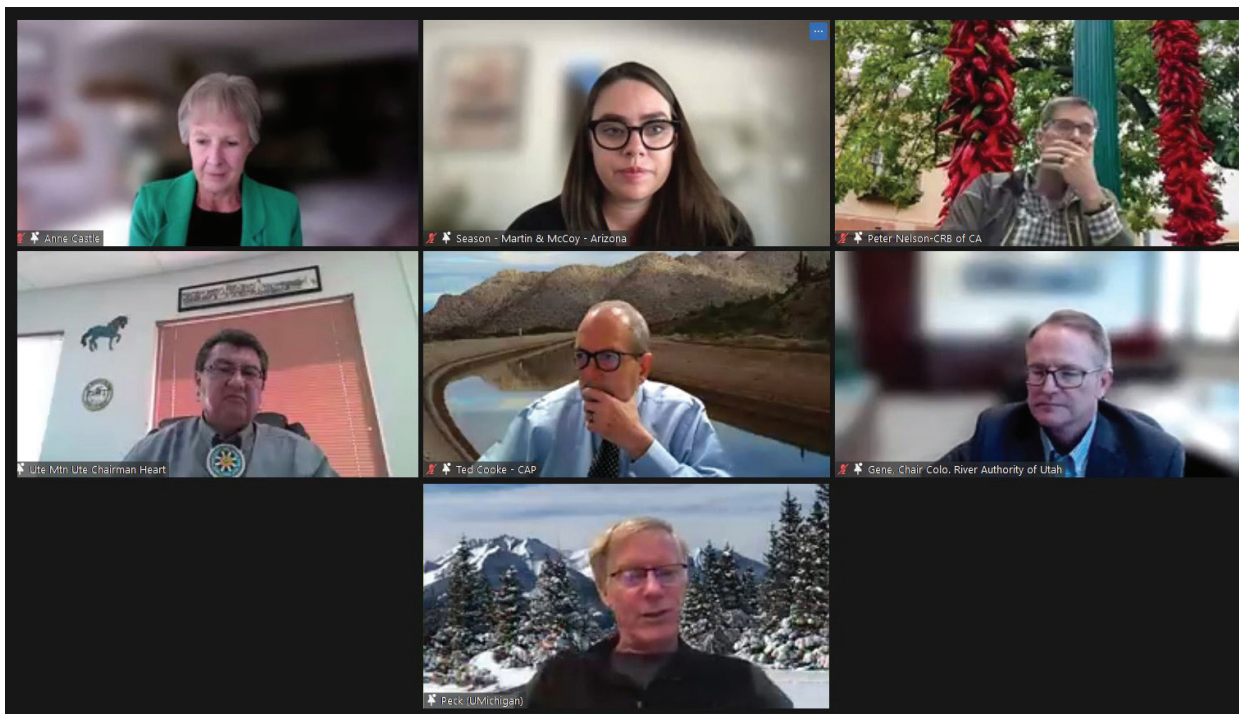
KUHN: Just one further question. You have your preliminary estimates available, have you made those for 2020 and 2021?

PRAIRIE: We did, and they’re actually now, Eric, finally posted on the natural flow and salt website. We now make them every time we do a CRSS official release. We also release a new provisional estimate of natural flow. And I can send you the link if you don’t have it, Eric.

KUHN: No, I’ve got it. Thanks.

BOWLES: Okay, any other questions? Any other hand raises? I don’t want to cut anybody off. I think we’re good.

Charting a Course Through Drought - Will the DCPs Be Enough?



Panelists, from top left: Moderator: Anne Castle, Senior Fellow, Getches-Wilkinson Center, University of Colorado; Season Martin, Partner, Martin & McCoy; Peter Nelson, Chair, Colorado River Board of California; Manuel Heart, Chair, Ten Tribes Partnership; Ted Cooke, General Manager, Central Arizona Project; Gene Shawcroft, Chair, Colorado River Authority of Utah; Jonathan Overbeck, Interdisciplinary Climate Scientist, University of Michigan.

Jennifer Bowles, Executive Director, Water Education Foundation: Welcome back everyone for our second virtual panel. We are lucky today to have Anne Castle, former Interior assistant secretary for Water and Science and now senior fellow at the Getches-Wilkinson Center at the University of Colorado, who will be moderating our panel examining how we will chart a course through the drought – so, very important topic obviously. Joining Anne today will be a representative from the Lower Basin, Ted Cooke, general manager of the Central Arizona Project, which is Arizona’s largest water provider transporting and delivering approximately one-half of Arizona’s Colorado River apportionment into the interior of the state each year. Then we have a representative from the Upper Basin, Gene Shawcroft. Gene is chair of the Colorado River Authority of Utah. That’s a new organization that represents Utah on all Colorado River issues. He is also on the Upper Colorado River Commission. Again, you can see the whole bio on our website on the web page. We also have Peter Nelson, chair of the Colorado River Board of California, which receives the largest allocation of Colorado River water. He’s also on the Coachella Valley Water District board, as well as

many other things. And again, you can see his bio on the website as well. And then Manual Heart, Chairman of the Ute Mountain Ute and the Ten Tribes Partnership, which is a coalition of Upper and Lower Basin tribes that have come together to participate in the management of the Colorado River. We also have Season Martin, partner with Martin & McCoy, who co-authored a recent report looking at 10 strategies for climate resilience in the Colorado River Basin. So, welcome to all of our panelists and Anne take it away.

Anne Castle, Senior Fellow, Getches-Wilkinson Center, University of Colorado: Okay. Well, thank you, Jenn, and hello everybody. It’s really nice to see faces and names at least. So many friends and colleagues. On behalf of all of us, I want to thank Jenn and Nick, and the Water Education Foundation for putting on this Symposium during trying times. It’s great. So, thank you very much. So, as Jenn said, this panel is going to focus on charting a course through a drought and where we go from the DCPs. And you’ll notice that I’m saying that a little bit differently than what’s printed in the program,

which is “Are the DCPs Enough?” because during the organizing call that this panel had, we had consensus that the answer to that question was, no. And I think that has become obvious from the previous panel and Camille’s remarks. We’ve just got more to do. So, to kick this off, I am going to provide a brief and high-level overview of the DCPs just to ensure that we’re all starting from the same position with the same information.

So the DCP agreements were executed a little over two years ago in 2019, and they were based on the recognition that the 2007 guidelines and the operational provisions weren’t sufficient to deal with the hydrology that we were seeing. They were executed in May of 2019, but it had taken almost six years to get there. There are components for both the Upper Basin and the Lower Basin, and I’ll talk a little bit about both of those.



It’s obvious the hydrology has turned on us and that conditions are deteriorating quickly.” - Anne Castle

In the Upper Basin, the DCP agreement has a new shortage sharing and contribution schedule. There’s more opportunity for the storage of surplus in the form of ICS, or intentionally created surplus. And I think it’s important to point out that with all the work that the states have to do to come together around an agreement that shares the burden of the hydrology that we’re facing, that’s just the first step. And then those decisions and commitments for reduction in deliveries and contributions have to be allocated within the states. And so, in addition to the Lower Basin DCP agreement, there are multiple side-agreements that were necessary within the states of Arizona and California in particular to make this work out. This is the table from the Lower Basin DCP agreement, and it shows the new DCP contributions from the states of Arizona, Nevada and California. The column to the left is what was in the 2007 guidelines. The highlighted column is the new DCP contributions. So those are added on top of the shortage sharing from the 2007 guidelines. A couple of things to notice here: First is that there are now multiple additional gradations between levels 1025 and 1050. At Lake Mead, every five feet has a different line for contributions that changes California’s contribution. And that’s an effort to really go after the problem and make sure, at least to the extent we can, that Lake Mead doesn’t fall below those

significantly low levels. And of course, another change is in the California column. Whereas California was not experiencing shortages under the 2007 guidelines, under the DCP, California is making significant DCP contributions.

So this is the chart that shows the whole thing. The previous chart was just the U.S. Lower Basin states, but that’s just part of the component of the whole DCP. And this is a chart, thanks to CAP and Arizona DWR, that shows the full picture. The first addition is where the red arrow is showing the Bureau of Reclamation. Part of the Lower Basin DCP agreement is the Secretary of Interior agreed to take affirmative action to either conserve or create 100,000 acre-feet a year that would be a contribution to Lake Mead. And then there’s also Mexico’s contribution. Some of that was in place through minutes 319 and 323. There’s the additional contribution that is part of the Bi-National Water Scarcity Contingency Plan. And then there’s a total for Mexico.

So you can see when all of this is implemented, the total at the lowest level in Lake Mead below 1025 is almost 1.5 million acre-feet. Just a couple of particular provisions: In the Lower Basin DCP, we talked about DCP contributions. Those are kind of a different animal from the shortages that are specified in the 2007 guidelines because DCP contributions can be recovered under specific circumstances that are detailed in the agreements. There are limits on ICS volumes. Those limits have been increased as a result of the DCP, but there are still limits and those limits can be expanded by the secretary. And finally, consultation around the DCP is triggered by a projection of Lake Mead at elevation 1030 within the next 24 months. And that’s a projection that is the minimum probable projection. Jim Prairie showed us what those projections look at, so this minimum probable is a 90% exceedance projection and that has happened. That happened in August, when the 24-month study projected Lake Mead at the minimum probable forecast to be less than elevation 1030 within the next 24 months. So that consultation is ongoing, and the purpose is to determine what additional actions can be taken by the states and by Interior to reduce the risk of Lake Mead going below elevation 1020.

The Upper Basin DCP is often described as a three-legged stool. The first leg is continued weather modification, cloud seeding, that’s been going on. That’s not new. The next two legs of the stool are new drought response operations of the Upper Basin reservoirs and demand management investigation, and I’ll talk about those. There’s a specific drought response operations agreement. It provides for releases from the federal reservoirs above Lake Powell, and they’re shown on this map: on the right, Flaming Gorge, Blue Mesa, Navajo – and the purpose of those releases is to maintain a target elevation of 3525 at Lake Powell. That’s

the elevation that is thought to provide a good buffer to ensure that hydropower generation continues. Again, Jim's slides showed that we lose hydropower generation at elevation 3490. 3525 gives us a 35-foot buffer above that and also ensures that the Upper Basin can continue to meet Compact obligations.

The drought response operations are initiated in a couple of different ways. One is through a plan that is put together by the states and the secretary. There's a lot of detail in the drought response operations agreement about what that plan has to contain, and one of the things is that it has to consider all of those different three reservoirs as possible candidates for releases. And if they've already released water, the plan has to consider storage recovery for those reservoirs. So that collaborative plan is one way that these operations can be initiated. Another way is that the secretary takes emergency action, and that has happened, and it's happening as we speak, actually. There are releases being made from all three of those Upper Basin reservoirs. A total of a 188,000 thousand acre-feet is going into Lake Powell to prop up the levels there. And then finally, there's a component of demand management storage and there's a separate agreement for that. It provides that demand management program will be explored. It doesn't create one, it provides for investigation. That program would allow for the storage of voluntarily created conserved water to be stored in Lake Powell. That storage could occur free of charge, and it's not limited to Lake Powell but all the Upper Basin reservoirs. No charge, not subject to the balancing releases that would otherwise be required by the 2007 guidelines, and there is a 500,000 acre-foot maximum on that demand management storage account. So that is the DCPS at 30,000-foot level. And now we're going to hear from our panelists about their perspective on where we go from here, and the perspective of their organizations. We all recognize that each of these panelists has an obligation to protect the interest of their constituents, and that's the perspective that you'll be hearing about. We're going to start with Gene Shawcroft.

Gene Shawcroft, Chair, Colorado River Authority of Utah: Thank you, and it's a pleasure to be with you. And with all of you. This is a very esteemed group, and I have for years followed many of you in my capacities in the water world and I can tell you that I have great respect for all of you. It's an honor and a privilege to be with you today. Unfortunately, we're not in person, but we all look forward to that as we prepare for next year's wonderful celebration of 100 years of a Compact that has served us all very, very well. What I would like to just quickly do is cover a couple of things that have to do with the DROA, the Drought Response Operational Agreement. Then Jennifer Pitt made a comment a few minutes ago about the speed at which we need to react, and if there was ever

a case of that, it happened with our Drought Response Operation Agreement.

We knew in April that within 24 months we could reach that critical elevation at Lake Powell. So for a few days, we assumed we had 24 months or 2 years to put a plan together. By the first of May, that was gone. We obviously knew at that point that that critical elevation could be reached as early as March of next year. And so that immediately then created some angst with all of us, particularly the Bureau of Reclamation. We shifted from the calm and collective ability to spend 24 months creating a plan, to "What in the world are we going to do this summer?"

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We shifted from the calm and collective ability to spend 24 months creating a plan, to 'What in the world are we going to do this summer?'"

- Gene Shawcroft

And so, as has been mentioned, these emergency actions have taken place. Water is being released from those three units now, and the hope is that that will help bolster those elevations. All of the states and Reclamation are working closely together and working very feverishly to make this happen. We just keep our fingers and toes crossed that Mother Nature will participate. We lost, as Deputy Commissioner Touton indicated earlier today, about a million and a half acre-feet in our forecast between April and May. And so we have our fingers crossed that some way Mother Nature will help make part of that back up next year, and we look forward to that. Part of our concern as we talk about releasing this water from the Upper Basin – the DROA requires this to happen – is that it also requires that we look at some things, one of which is recovery as Anne mentioned. A couple of other things that are critical, though, along with recovery, have to do with shepherding or accounting of this water. One hundred and eighty one thousand acre-feet of water will be released this fall among the three reservoirs, and we're not quite sure today exactly how that's going to be shepherded or accounted for since there are still diversions going on in some of the rivers which are receiving some of the storage

water. One of the other things that is unfortunately fairly obvious with the critical nature of these reservoirs at this point is the futility. How do we really define futility? Does it really make sense, and at what point do we say, "It does not any longer make sense to release water from these upper reservoirs"? If by doing so we still miss these critical elevations – 3,490 for example – if it becomes obvious that even if we did release large amounts of water from these three upper reservoirs, Flaming Gorge, of course, being the largest with about little under 4 million acre-feet, that that's really not a lot of water when you think about the 24 million acre-feet capacity. So those are some things we're working on. We're working with Reclamation closely. We appreciate very much our coordination with the federal team that has worked tirelessly to put this together. We have a number of teams, groups, committees, if you will, working together to try to answer some of these specific questions we've talked about with regard to shepherding and accounting, recovery and futility. And so those folks are starting at 7 a.m. multiple times a week and I know they're not finished by 5 p.m. multiple days a week, so my hats off to all of them that are working hard. So I'll leave it at that. I think I was supposed to take five minutes. I don't know how much I took but I've rambled for a while, so I'll quit. And if there are questions after, of course, we'll handle them. However, Miss Castle would like us to do that. So thank you.

CASTLE: Thank you Gene. Yeah, and I think you took just about five minutes. That's wonderful. And thanks for raising the shepherding and futility issues. I think we'll be coming back to those. Next, we're going to hear from Ted Cooke with Central Arizona Project.

Ted Cooke, General Manager, Central Arizona

Project: Good afternoon, and thank you Anne and fellow panelists. I'm glad to be here among you and everyone else, that, of course, is on today's virtual Symposium. I can't wait till next year to see everyone in person again. So as we were preparing for this panel, our moderator Anne Castle asked us some pretty thought-provoking questions. I don't want to get too far ahead of what she wants to do with this panel but in particular she asked us to think about those in conjunction with the changing title of this particular panel's topic, "Is DCP enough?" Probably not. Definitely not in the case of the Lower Basin, because our 1030 consultation that is part of our Drought Contingency Plan was triggered in the August 24-month study. So we have to do something else just to meet the terms of our agreement.

One of the questions that she asked was, "If there was one thing that you could concentrate on that really needed to happen, what would that be?" She asked some other questions too, so I'm actually going to take advantage of

that and focus my introductory comments on that particular thought. I think the one thing, and maybe this is obvious, but the one thing that we have to do is find a way to reconcile – that's what I'll call it, is reconcile – the existing apportionments and contracts on the Colorado River, including the treaty with Mexico (and I recognize that's a treaty), and also contemplate new uses that reconcile that to the quantity of the water that the Colorado River is actually able to reliably produce. And I realize that that latter thing is subject to quite a bit of debate. And I think this reconciliation needs to apply to both the structural deficit – and some of you, I think, maybe most of you know what that means in the Lower Basin – which is the over-allocation in the Lower Basin even without any kind of shortages, or reductions in flow from climate change. That exists. It's permanent. That needs to be part of the reconciliation, and also then the impacts of declining precipitation and runoff and climate change and drought conditions and all the other things that we've heard about earlier this afternoon. How much water is available and how much we think we are allowed to use: those things do need to be reconciled.

We have made, all of us, extraordinary progress in a series of temporary or interim programs over the last couple of decades. Those have been very successful. They never seem to end, we always have to do something else, and we can continue to do things that way. And I know at the last Symposium, that was a big topic of discussion there in a couple of the panels about the incremental approach or the Big Bang to kind of fix everything at once. So we can continue to do this incremental thing and have a 3-5 year plan every 3-5 years indefinitely. But that takes a lot of resources. We're constantly working on this all the time. We really have to face the facts at some point. That being said, I don't think that the way to achieve this reconciliation that I'm talking about is by scrapping the Colorado River Compact or any of the rest of the Law of the River and just start over. While the Law of the River is not perfect, I believe that it contains a lot of wisdom and a lot of value, and it's the product of decades of thoughtful work by many dozens of dedicated and talented individuals. They're not just your stereotypical water manager or Colorado River contract folks, like myself. They're also not just the Bureau of Reclamation in the Department of the Interior, but lots of other awesome other walks of lives: Indian tribes, NGOs – kind of like our attendance today. So lots of people put a lot of work into that, and it has lots of value in my opinion.

I think that the path forward, the best path forward, is for interested parties to continue to collaborate and negotiate, and discuss how this reconciliation might occur within, supplemental to and respectful of the existing Law of the River. Anything could be on the table and like any other

kind of negotiation, proposals and alternatives that are identified that are reasonable and achievable are going to gain the support that they deserve. Other things that don't, won't. For this reconciliation process to work the best way it can, we also need to simultaneously continue to work on and focus on, and we will hear more about this augmentation, conservation, reuse, recovery etc. These things are expensive, a lot of them, and they take a lot of time to supplement our dwindling Colorado River supply. It's never coming back, at least not to the levels that we were used to in the past. I appreciate that there are many things in the Law of the River that some people don't like, or they think it could have been done a different way, or that maybe we should just do them over, and those conclusions are fine after a century of hindsight. But I believe that it's extremely unrealistic to assume that anything of that magnitude can be accomplished in a reasonable period of time or without an excessive amount of litigation, and frankly, we don't have time to do something like that – where the perfect becomes the enemy of the good.

As for the assumption that, however long the process like that might take, the result would somehow be better than the existing Law of the River: I think that's pretty ambitious right there, quite subjective, and a little bit hubristic that somehow we can do this over better. The really tough nut there is, who gets to make those decisions? Who gets to decide what's fair and what's not, and who gets to order the relinquishment and redistribution of available water among various parties? So that's just a practical consideration that leads me back to my view that continued collaboration and negotiation is the best path forward. Whatever we do is going to be complex, painful and disruptive. But again, building upon what we have is vastly preferable for my point of view, than kind of knocking everything down and putting it back together, brick by brick. So thank you for the opportunity to make some introductory comments, and I'm looking forward to the rest of our panel and the rest of the day. Thank you.

CASTLE: Thanks Ted. Yeah, and thanks for starting us off with what's the one thing that has to be in the next set of guidelines or agreement? Next, we're going to hear from Chairman Manuel Heart. He's the chairman of both the Ute Mountain Ute Tribe and the Ten Tribes Partnership. Thank you, Chairman Heart for being here with us today. We're anxious to hear your perspective.

Manuel Heart, Chair, Ten Tribes Partnership: Thank you. It's good to see you, Anne, back in Washington, D.C. I just want to say thank you to all the panelists. I appreciate all the concerns and then what's been put on the table today. My name is Manuel Heart. I'm the chairman for the Ute Mountain Ute Tribe in Colorado, our land expands into

Utah and New Mexico. And also, I'm the chairman for the Ten Tribes Partnership. A question that came out is, "If we must address something in the future operating guidelines for the Colorado River, what would it be?" The next set of interim guidelines needs to fully consider and account for all tribal water rights in the Colorado River Basin. As many of you aware by now, Indian nations collectively have federally reserved water rights to over 20% of the Colorado River Basin. Still not all tribal water right claims are fully resolved.

Ute Mountain Ute Tribe, for instance, has yet to resolve its water right claims in the state of New Mexico and Utah. We have worked something out with state of Colorado. Other tribes are in a similar situation. Yet despite those figures, tribes were historically absent from the critical conversations that have impacted our water resources and have further limited our participation in how our water right is accounted for and categorized, and thus has affected how we may participate or not participate in various programs. That would enable tribes to better assist the Basin in this current historical drought. Whether the people at home or here today realize it or not, the current drought crisis has impacted us all and has served as a stark reminder that the upcoming renegotiation to interim guidelines will be a critical conversation for everyone in the Upper and Lower Basin.

We at Ute Mountain Ute Tribe have a farm project and we receive about 23,300 acre-feet. And this year – this is for irrigation ag water – we only got one tenth of it, which really impacted our revenue sources. And that's just one example of what's going on and impacts to our employment, to our revenue for the tribe. So in response to what the drought has brought onto the farm and ranch operation for the Ute Mountain Ute Tribe, it has requested that Reclamation bear the annual costs which is written into operation and maintenance. That's what I'm pointing out, the O&M cost, as some tribes have to pay for on some of these major projects. So it did really have an impact on some of this stuff and it's laid out in the Colorado Ute Water Settlement Act. This request has been denied by the Bureau of Reclamation.

So with that in mind, when discussing considerations of water equity and the operation guidelines of the Basin, this alarming experience for the Ute Mountain Ute Tribe has illustrated that tribes must be at discussion at the table at every level when our water rights are the topics, especially when discussing at the broader Basin level. That being said, it is difficult to predict whether the current DCPs are sufficient. The best solutions come about when a broad range of perspectives and concerns are involved at the earliest onset. It makes sense to avoid the same mistakes of the past and try to retrofit and account for everything at

a later point. While tribes have a significant share of Colorado River water, much of our water remains undeveloped for a number of reasons, including legal and institutional barriers that go beyond today's conversation. There still remains much concern that underdeveloped tribal water is being increasingly relied on but goes unaccounted for and uncompensated.

Speaking for the Ute Mountain Ute Tribe, we intend to fully develop our water resources for the use on our reservation lands. When that day comes, a system needs to be resilient enough to withstand that evolution of the changing climate, reoccurring unexpected drought and other changes that may be unforeseen at this time. Until then, we intend to fully participate in every level to protect these resources and overall Basin for future generations to come. And I really am grateful to the hydrology tests that come about, and I met with Senator Romney and Senator Bennet last Saturday, over in Moab, Utah, and we had the Lieutenant Governor. We're looking at climate change and what impacts it has, and the discussion we're having today not only affects us as human beings and tribal water rights, but also as was mentioned, the birds and the fish and wildlife and plants. They, too, all play a role, especially as you start to look at national conservation areas and critical habitat restoration. There are impacts from what some of the people are doing in groundwater, and injections of certain things come back out on surface waters or things like that.

So there's a lot of things that are impacting us as we have had this drought. As was mentioned, up in Glenwood when they had the fires and mudslides, there are impacts from the mudslides coming down and the sediment that's actually going into the rivers and from the ashes. The Dolores on the lower side, the McPhee Reservoir and a lot of the Upper Basin is really habitat to a recreational site for fishing. Utilizing some of these higher education universities for more data collection I think is something that we should also take a look at. The quality of the water that we always talk about – we always say, "water is life." It helps us to move forward, but not only as human beings, but for all of us. And we really need to take a look at things that are coming about right now, with all this hydrology and things that we talk about, the future forecast – change is something that people sometimes are used to and sometimes change comes because it's inevitable. And we're at that point right now where we really have to look at having everybody at the table, including tribes. They are the ones that have these senior water rights, and to be able to relook at where we're going into the future, we, too, work with the federal government as federally recognized tribes in the Colorado River Basin. We have these water rights that really need to be looked at and added into the formula as we start to look at how we project our future.

Granted that people might not agree with this and there will be discussion about this at the table, and we might agree on some things. But we need to come with the unified voice in how we're going to move forward.

But I ask respectfully to each one of you that we need to also respect the tribal water rights, that these tribes have been left out when they first negotiated some of these things. So we need to be brought to the table on all levels, whether it's federal, state, tribal and even right down to the local municipalities. So at that end, I'll leave it there. Thank you.

CASTLE: Thank you very much, Chairman Heart, and thanks for reminding us of the volume and the importance of tribal water rights in the overall system, and I'm sure there will be questions about that. So just as with the rest of the panelists, we'll get to your questions after everyone has spoken in the beginning. So now we're going to go to Season Martin with Martin & McCoy, author of a recent report on 10 strategies to bring the Colorado River into sustainability. Season.

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I don't think that the way to achieve this reconciliation that I'm talking about is by scrapping the Colorado River Compact or any of the rest of the Law of the River and just start over.”

- Ted Cooke

Season Martin, Partner, Martin & McCoy: Thanks, Anne, and I'm happy to be joining you all virtually today to share our Ten Strategies report. Well, I'm the one discussing this report today. I want to first acknowledge the many authors, contributing researchers, editors and advisors who were instrumental in this project.

Right now, the Basin is at the epicenter of how climate change is water change. As Jennifer said earlier, the progressive increase in temperatures is having real-time

impacts on water supply. 2021 has undoubtedly been a trying year for all of us across the Basin, but it may be nothing compared to the potential conditions that the Basin could experience as early as next year if hydrology does not improve. While the 5-year projections are not a guarantee of what's to come, they highlight a markedly increased probability of reservoirs to decline below critical elevations. These critical conditions are no longer in the future. They are now. I also want to acknowledge that we've known demand outstrips supply for decades, and that the gap has been growing bigger. We've been relying on our emergency reserves in the reservoirs to cover this gap until now. The Basin no longer has the privilege of time. Concerted action must be taken to ensure that the Basin is resilient to drought and to climate change. While we've leaned into our built system, we haven't leaned into making our whole watershed resilient because we haven't had to out of necessity until now. The good news is we have significant untapped opportunities at our fingertips, which brings me to the Ten Strategies report. In July, Martin & McCoy and Culp & Kelly released the Ten Strategies for Climate Resilience in the Colorado River Basin on behalf of American Rivers, Environmental Defense Fund, National Audubon Society, The Nature Conservancy, Theodore Roosevelt Conservation Partnership, Trout Unlimited and Western Resource Advocates. If you haven't seen it yet, you can find the report and supporting materials at www.tenstrategies.net.

We identified 10 on-the-ground strategies that can help us adapt to ongoing climate shifts: reduce pressure on existing water supplies, mitigate climate change and strengthen economic resilience in our communities. As we face the near-term impacts of drought, we should be encouraged by the fact that we know what to do. We've been doing this work for decades. And what we need to do today is to invest in these strategies to adapt to, respond to and mitigate the steady, compounding and extreme risks of climate change. I want to quickly highlight a couple of these strategies.

We need to invest in forest management and restoration. By prioritizing forest management and restoration to maintain system functionality in biodiversity, we ensure that our forests are working for us instead of against us. We also need to invest in natural distributed storage. Restoring highly degraded natural meadow systems to improve local aquifer recharge water for water retention, reconnect historic floodplains and support productive meadows and riparian ecosystems that will embed resilience in our watersheds to withstand ongoing drought climate change impacts. We also need to invest in our agricultural systems by investing in upgrading agricultural infrastructure and operations. By upgrading diversion, delivery and on-farm infrastructure and operations,

including irrigation systems, we can also improve water conservation. We also need to think about adopting regenerative agriculture practices. By promoting voluntary farming and ranching principles and practices that enrich soils, enhance biodiversity and restore watershed health, we can also improve overall ecosystem function and economic resilience. We also need to think about new cropping alternatives and new market pathways. Developing on-farm operational shifts and market and supply chain interventions that can incentivize water conservation so it's a shifting to lower water-use crops. For agriculture, some of these changes might be challenging, but they're intended to preserve the viability of agriculture into the future.

We have experience implementing these solutions in the Basin, but what we need to do now is to scale up these solutions. We need robust federal investment and efficient programming in these strategies to mitigate current impacts and establish the resilience needed to adapt the Basin and the uncertainty that we're going to see in the years to come. Focused attention should be dedicated to securing necessary federal funds to address drought, climate change and the natural disasters that we see within the Colorado River Basin. Funding, however, is only the first step. Equally important will be the means for efficiently implementing the broad range of federal investments in programming to effectively mitigate the ongoing drought and establish the resilience we need for the Basin. I think we can use these Ten Strategies as a road map for implementation to build a more resilient future.

CASTLE: Thank you, Season. That's great. And we'll come back for more detail on some of those strategies. Our final panelist is Peter Nelson with Colorado River Board of California and Coachella Valley Water District. Peter over to you.

Peter Nelson, Chair, Colorado River Board of California:

Thank you, Anne, and thank you for your leadership over the years and leading our panel today. I appreciate you, and I appreciate the Water Education Foundation for holding the event today. Here I sit at the plaza cafe in Santa Fe and I can see Nick over there at the Governor's Palace, but I'm enjoying the outdoors waiting for my table. And so that's good.

So I'll start from California's perspective. Just this afternoon, there's 20 million people that are rooting the Dodgers on in a 5-4 loss against Colorado. There's another 20 million people that are watching the Giants lose to the Padres, and there are 2 million people rooting for the Padres. Quite a day in baseball, but we have 40 million people in California. It's a huge population, and we have a great need for water supply. Water supply and demand: That's really what we're talking about today. It all comes down to water supply and

demand, and I do appreciate the new methodologies and thoughts that all the states are putting into the models. What Reclamation is doing with the science and using more up-to-date periods of record: I think that that goes to show that we are getting drier because the percentages of potential low lake levels is increasing, and I think we're having a come-to-Jesus moment in that respect. We're recognizing the real reality of where we are today. From California's perspective, 2020 marked the year of 4.2 million acres of wildfires in the state that have caused terrible damage, impacting watersheds for years to come. 2021 has seen two fires go from the west side to the east side of the Sierras, marking continual devastation of the forest. It's a very hot and dry climate.



The next set of interim guidelines needs to fully consider and account for all tribal water rights in the Colorado River Basin.”

- Manuel Heart

When we look at what we need in terms of precipitation for next year at normal runoff, we need 144 percent of precipitation in snowpack just to equal a normal year of runoff. And then, when you look at a little bit of the historical facts, from the late 1990s to the early 2000s, California used about 5.2 million acre-feet of water on an annual basis. In fact, in 2002 was 5.37, and that's compared to our water use in 2019 which was 3.85. So that's a one and a half million acre-foot of reduction of water use over that time.

Beginning in the late 80s, California's Colorado River water-users began taking real meaningful steps to reduce those annual demands of the supply and diversify our available supply portfolio, pursuant to California's Colorado River water use plan that was developed by the California agencies and the Colorado River Board of California. Those activities culminated in the 2003 quantification agreement that was the nation's largest agriculture-urban transfer program, and it provided some mitigation to Salton Sea impacts. With the QSA in place, Imperial Irrigation District typically conserves about a half a million acre-feet of water per year, and since 2003 has saved over 6 million acre-feet

of water. The Coachella Valley Water District since the 70s has banked 4 million acre-feet of water. And then the Metropolitan Water District of Southern California, which is amazing that they have developed over 6 million acre-feet of storage capacity since the 1980s, which is a 15-fold increase. Two-thirds of this storage is outside of Metropolitan's service district in the Colorado River Basin, Coachella Valley basin, the Central Valley, with other State Water Project contractors. As of Jan. 1, 2020, Metropolitan has stored over 3.5 million acre-feet, some on behalf of IID and Nevada, the largest amount to date. In Lake Mead, I think there's right now 1.375 million acre-feet of ICS water. So California has really stepped up to the plate in reducing water demand over the years.

The 2001 interim surplus guidelines were intended to help California ratchet down its average mainstream water use from the 5.2 to the 4.4 in this millennial drought. And we also had allocations from our California State Water Project, which in 2020 were 20 percent of allocations, and in 2021, it's only 5 percent of allocations. So when you relate that to volumes, the State Water Project is roughly 4 million acre-feet, and so this year, a 5 percent allocation is only 200,000 acre-feet of water. It's just phenomenal how dry it is. Last year at the 20 percent it was 844,000 acre-feet of water. And if we had a wet year, a few years back when we were able to store quite a bit of water there was a 65 percent allocation, which is 2.7 million acre-feet of water. So from 65 percent to 5 percent is 2.5 million acre-feet of water lost because of the lack of rainfall. Camille also talked about the Central Valley Project, which is a reduction of 1 million acre-feet. So there's 3.5 million acre-feet of water less in the state of California from the State Water Project and the Central Valley Project. That's a tremendous amount of water this year, and the only way to deal with that loss of surface water is with stored water and groundwater. California in 2014 has new legislation SGMA, a groundwater sustainability act, and all across California, basins are dealing with that as well. Setting minimum thresholds on pumpers and trying to determine what their needed yields are, what their sustainable yields are – many areas are suffering from reductions now. And within the next two or three years, those regulations will be more prominent in more basins, so you'll see less reliance on groundwater in dry years as well.

So, California: 40 million residents, 2.5 million acre-feet less of the State Water Project, a million acre-feet [less] of CVP and now we're looking at drought contingency planning contributions, which could happen very soon. You all know the numbers on that and so we're looking at that very closely. Well, I'll just probably leave it at that. And you know, that's all the bad news from California. I will say that our meetings within the Lower Basin, Nevada, Arizona and California: We've had a general consensus that the

'07 guidelines are not enough. The DCP is not enough, and we have to take additional action and additional conservation measures to make sure the future is sustainable for our residents and the residents of the whole basin.

CASTLE: Thank you, Peter. I'm going to pull one theme out of the remarks of many of the panelists and in Gene Shawcroft's words, "the need for speed." It's obvious the hydrology has turned on us and that conditions are deteriorating quickly. And I just think about the DCP agreements that were put together, finally executed, a little over two years ago, and there are provisions in them for emergency measures. Two of those have been activated already and that's just another data point emphasizing the urgency of the problem. And I think a lot of the panelists spoke to that. So I did ask the panelists to think about if they had to name just one thing that absolutely had to be addressed in the next set of operating guidelines, what would it be? And we heard from Ted about his thoughts there, but I want to give the other panelists a chance as well. And so why don't we go back, Gene, to you and get your thoughts.

SHAWCROFT: Thank you. One of the one of the thoughts I have with regard to one of the things we really need to deal with: As Chairman Heart mentioned, the hydrology impacts, on a real way, those who are diverting from the river. This is above storage. They're higher in the system in storage. And I think one of the things that we need to understand is that, as Peter mentioned very, very well, with the shortages that have been occurring in California over the last couple of years, and over the last 20 years the Upper Basin has been experiencing shortages, simply because the hydrology hasn't been there. Mother Nature hasn't provided that. And I think we need to understand and recognize that as we move forward, how we balance that out as Ted very well mentioned, how we deal with that is something we'll have to wrap our heads around. But I think something that's critical for me is to recognize that shortages are here, and we have been experiencing them for a number of years.

CASTLE: Okay, thank you. Chairman Heart I think your overall message to us was the absolute necessity to include tribes in the discussion. Is there anything else that you would emphasize needs to be addressed in the next set of rules?

HEART: Thank you Anne. And I thank again the panelists. Science is the thing that we really rely on based on the hydrology reports that we're getting. It's reality too that we're just not getting enough snow. We've moved two degrees based on climate change and global warming, and we've actually started to see these hydrology projections from way back, today. We're here at a point that we have to look at where we're going into the future, and science is

what's going to help us in a sense of looking at everything across the board. The Upper Basin is facing these supply and demand shortfalls with these tributaries that are coming into the Colorado River. And based on the three storage reservoirs that we have and the releases we have, we, too, up here in the Upper Basin are also facing these same things, but we have to be able to come to the table and come up with solutions. It's great that we've identified it over the years and decades, but now we're at a point that's so crucial for each one of us to start discussing how we're going to start to move forward and coming up with solutions, and we all need to be at the table. So I'll leave it there, Anne. Thank you.



Right now, the Basin is at the epicenter of how climate change is water change." - Season Martin

CASTLE: Thank you. Season, why don't we go to you?

MARTIN: I think, as we move forward in the Basin, we need to adopt a resilience framework that assures we can adapt to the short-, mid- and long-term risk we're going to continue to face moving forward. From my perspective, this means we need to invest in four categories of solutions because there is no silver bullet, and they either need to be incorporated into or established in parallel to any future operating guidelines. We need flexible operational rules within the system, and we have some of these already. There are solutions like the interim guidelines shortages, DCP contributions, coordinated Powell-Mead operations and the drought response operations agreement. We also need on-the-ground climate resilience strategies, everything I mentioned previously and ideas that are outlined in the Ten Strategies report. We need flexible water conservation management mechanisms to manage our short- and mid-term risk, like intentionally created surplus, demand management, and system conservation. We also need to reduce new demands on the system and learn to live within our means. I think overall resilience framework is going to be essential to ensuring that we can adapt to the uncertainty that we're going to see moving forward.

CASTLE: Okay, great. Thank you. And Peter, your turn. I know you were having trouble limiting yourself to one so you can feel free.

NELSON: Okay, very good. I would say, I'll name two, Anne. So I can't just stick to one but I'll name two. One is incentivize for conservation and storage. You know, I really believe that we're going to see these big wet years and the dry years. So if we can conserve in the dry, and store in the wet, we're much better off. And conservation means a lot of different things. This recycling program that Arizona, Nevada and Metropolitan Water District are putting together in Southern California is a big project, but there's a lot of recycling going on in California. San Diego has its One Water program. So these types of conservation programs, they don't just include urban or agriculture, but it's the recycling programs and the desalination programs that can replace Colorado River water. So, it's incentivizing those through our states and agencies and the federal government to make that happen. Then the next one will probably be a bit controversial. California does have a lot of water and its biggest water user in the state is the Imperial Irrigation District. They have said a number of times that they're willing to help this situation out with the dry hydrology. And I listened to a farmer's group the other day down there that was willing to conserve water.

At the same time, there really does have to be a recognition that impacts on the Salton Sea would be important to that region, and it was brought up earlier, I think by Jennifer Pitt, about the asthmatic rates and so forth. The state is working through its Salton Sea management program and, quite frankly, they need to get on the stick and make things happen because there's no reason to ask for more money from the feds if the state is not spending their money. So those programs need to go on hyper-gear. Metropolitan and IID just completed a new agreement by which IID can have a sub-account in their ICS program. So that's moving forward, and they'll be able to conserve some additional water, but it's really some of those impacts that we believe that the federal government has a place there since they are the largest landowner underneath the Sea. And that's an issue. So I have those two issues that I think are vitally important to the future of saving water and managing the Basin sustainably.

CASTLE: Great, thank you. So I can see a couple of questions in the chat. I'm going to start off with one of them and just throw it open to the whole panel. And the question comes from Dan with IBWC: "In order to facilitate demand management, are there prospects for making water pricing reflect actual value?" So to incentivize conservation, I think, in line with Peter's last point, what do you think about true cost water pricing?

COOKE: I'll take a shot at that. This is an interesting idea and it's been talked about a lot about: How do we make more folks aware of the value of water? Because it is very low priced in the West. For those who are not familiar with

this, the cost of the diversion of the Colorado River from the Bureau of Reclamation is a tiny number, like 25 cents an acre-foot or something like that, if I recall correctly. And so the real cost of getting the water to customers is basically the electricity, the O and M of the infrastructure to transport it and that's about it. Some folks like us are constrained by our contracts that are cost-of-service contracts, and so even if we wanted to, we wouldn't be able to do it. But set that aside for a second and the real question is, if we could do it, how much would that need to be to get people's attention? Lots of folks blanch when we talk about a \$2,000 an acre-foot or more ocean desalination water compared to the maybe \$200 or \$300 or \$600 or \$800 per acre-foot that folks are paying for raw water. So the real question is what is the price elasticity for water? And what is the true value of water? An economic study performed by Arizona State University showed that the average value of a delivery of an acre-foot of Colorado River water into central Arizona was \$60,000 an acre-foot. That's the value to the economy in aggregate. But that doesn't aggregate to one person or one entity that you could say, "I need to charge you \$60,000 an acre-foot because that's what the delivery of this is worth in the economy with all the secondary and tertiary effects of that water delivery." So there are definitely some challenges in being able to do that. I think if we could define or figure out how much that needs to be to get people's attention, where they would voluntarily cut back, and then discuss: How is that practical? And is there a way to do that?

CASTLE: Yeah, thanks for that information on the study, Ted. That's really interesting. Other thoughts from any of the panelists? One of the things I think about in response to that question is, how do you do that in an equitable way, implement higher cost pricing? So anybody can respond to that.

SHAWCROFT: And I'll take it. I'll just maybe be more confusing than helpful. But if you look across the West, there are a multitude of various federal projects and other projects, private as well, but focusing just on federal projects, for example, some have been completely paid off. Some will likely take another 40 years to be paid off. Some are in a geographical situation. Unlike Ted, much of Utah's portion of the Colorado River water does not have to be pumped. And so that makes a tremendous difference in the cost. Like Ted, those federal contracts have been in place for a number of years. Depending on when the project was built, some of the water cost is significantly less than it is on others. And then you have the issue of pricing across state boundaries. What price makes sense in Wyoming versus what price makes sense in California and all of the states in between is another level of complexity that would have to be wrestled with at some point in time, simply because of the geography and location of the water.

So a couple of other question marks as we try to talk about a price for water, but I do know that I've seen many, many times when I go into a convenience store, people paying \$2 to \$3 dollars for a half liter of water. Is that the true value of water? I mean, that's a real question mark on that. And some of that, of course, is a little bit facetious, but in reality, it becomes very complex very quickly based on a few simple constants that have been in place for a number of years.

CASTLE: Yeah, absolutely. More complications. Go ahead Peter.

NELSON: Yeah, and I would just add that it's a real conundrum because as far as water equity goes, everyone deserves clean water for drinking and for living. I mean, there's so many in our Basin that don't have that. And yet for an equitable price of water, the cost to get there is the challenging obstruction. It costs so much to get that safe, reliable drinking water to some of these areas, and so that's the conundrum we're in. I do know in the urban setting that when we implement tiered rate pricing on water that the tiered rates do incentivize conservation in a number of ways. That has been helpful for us in an urban setting. In the agricultural setting, it's that the equity sometimes revolves around the long-standing water rights that folks have that have been running businesses and supporting agricultural communities that are paying for the distribution and delivery of the of the water systems. Those sometimes occur in great volume. And so that's a challenge to overcome some of those priorities and contracts because there are a number of people that are dependent on those as well. And I do know that that growers in large part are willing to participate in programs and others are or not. But to have conservation programs that reimburse growers for conserving water is a part of that pricing element in itself.

CASTLE: Chairman Heart.

HEART: Yes. Thank you, Anne. I appreciate the question. It's a question about really looking at the geographical portion, as Peter mentioned – urban areas and the need for that. But also we need to take into consideration the roles of tribes, for instance. A lot of the tribes don't have a lot of infrastructure, so the cost of water's different in a way versus in the urban area based on supply and demand. And then the cost of trying to just get that water from point A to point B, and then also looking at – and I liked what Peter mentioned – incentives. If we start to look at finding ways to do incentives for conservation programs, farmers are also trying to produce food and they too need this portion, but depending on what kind of product they're producing, then these incentives come into play on how much of your water usage. So it's really about infrastructure, costs, funding rural areas versus urban areas, Upper Basin, Lower Basin. There's a lot of variables that could come

into play that really identifies what the value of water is and the equity of trying to get it out and finding a true number to really meet the needs of everybody across the board. So I'll leave it there. Thank you.

CASTLE: Thank you. Yeah, I was thinking about the equity issue in the context of clean drinking water access for tribal communities. And that's a real problem in the Basin and it's one that pricing could be a barrier to as opposed to a solution. So as Gene said, there's a lot of different factors involved here. Season?

MARTIN: Just quickly, I think that pricing and cost is one side of the coin. I think the other side of the coin that I've been thinking a lot about is, how do we translate hydrologic risks into economic risk? And what does that mean about how that then drives incentives that we can create to change the systems that we have in existence today? I think there's another side of this coin that also is really interesting and could be a robust conversation about driving the incentives that have been mentioned so far.

CASTLE: Yeah. Thank you. Let's go to another question. We have a question from James Eklund about demand management and James, I'm glad you asked this. He says, "Given the need for speed, can the Upper Basin afford to delay demand management any longer? Can't demand management serve as a vehicle to compensate tribes for their water?" Who wants to weigh in on that one first? Don't be shy.

NELSON: James, I couldn't agree with you more and I don't want to get myself in hot water with Gene up there in the Upper Basin, but I think that demand management is – I'm still struggling with the concept from the Lower Basin perspective to the Upper Basin – but we put some committees together with real goals of how much additional water savings that we want to put together in 2022. Now we may not reach those goals, but we're working together as three Lower Basin states and saying, "We've got a target number and that's what we want to hit." And I think clear and measurable objectives are how we're going to manage the Basin through this dry hydrology. If that helps.

CASTLE: Yeah, Ted. And I do think we need to hear from Gene on this one. Go ahead.

COOKE: Yeah, so I am going out on a limb a little bit too like Peter is. We're from the Lower Basin and this is really an Upper Basin question, so I'm sure everybody is holding their breath waiting to hear from Gene. But I'll make a side comment here, is that this illustrates another one of these – I don't know if you want to call it an equity issue or a conundrum – that's kind of built into all of the

problems that we have with solving this Colorado River reconciliation issue that I highlighted earlier, is that tribes really want to be involved. We really want them to be involved. And we're doing everything that we can certainly in Arizona and elsewhere in the Basin to do that. And so it's a very insightful question by James: Wouldn't demand management be a good way to compensate tribes for their water? Inherent and implicit in that question is to the extent that a tribe has to be using water to have a demand to be able to manage. So we have a lot of tribes that are using their water, and they have been very productive contributors in Arizona and elsewhere by reducing their consumption so that we can leave water behind in Lake Mead like that. At the same time, we have other tribes who are not using their water who would like to. And so, this is a fairness, equity and balancing problem that we have to deal with, as well. It's difficult for me at least, and maybe other folks can help me, to conceptualize about how do we involve the tribes that are not using their water and the rest of us not using water on the Colorado River? It's a conundrum.



We have to take additional action and additional conservation measures to make sure the future is sustainable for our residents and the residents of the whole basin.”

- Peter Nelson

SHAWCROFT: And is this the time? I can't find my undo mute button.

CASTLE: I think we can all hear you just fine.

SHAWCROFT: Okay, and Ted and Peter, don't worry about hot water. It's okay. I'm more than happy to address this and happy to chat with you. I appreciate the relationship we've developed over the last several months. But let me just say collectively, and I obviously can't speak for all of the Upper Basin states, but the issue of demand management has been much, much more complex than I

think anyone ever thought it would be. The other reality is that the majority of the water that's used in the Upper Basin is for agricultural purposes. And a lot of the agricultural community is very nervous about buy and dry. They're concerned about their historical use of the water. They're concerned about the culture. More and more we're finding even urbanites that are supportive of maintaining our agricultural communities. The economics of the trickle-down effect of an agricultural or a rural community that no longer has as much agriculture as it has had in the past has significant social and economic impacts. And I think those are the broader issues we're recognizing have to be dealt with as we talk about demand management when the majority of that demand would come from our agricultural community. And so there's no question it's been more complicated than we ever anticipated. It's something that we have to continue to focus on and there is urgency to do that. And yet at the same time we're finding that, as with many things with water, they get more complex the more details you drill into. And so yes, we are working on those things. Some of them are more productive. The biggest challenge is: How do we generate real wet water from demand management? And that's obviously water that has been going to some location, and as was very well said, if the demand wasn't there and we try to deal with demand management but it really doesn't generate any additional water. And then shepherding is an issue. And so all of those things are on the table, and again, complexity is how this has shaken out. I think those that were around the table at the time felt like demand management might not be as difficult of a challenge as it's turned out to be. So I'm happy to drill down a little deeper, but those are the initial thoughts off the top of my head. When we've tried to figure out how to handle this demand management challenge. Great question, though.

CASTLE: Thank you Gene, and Chairman, I know we'd all be interested in your perspective on this question and particularly the part about whether demand management is a way to compensate tribes. And I will tell you that the idea has been put in the chat that forbearance agreements are another tool for compensating tribes for unused water.

HEART: Thank you for that Anne. As I mentioned earlier, when I first talked about water rights we had our Colorado water right quantified in the state of Colorado. But the releases sometimes cross state lines and compacts come into play. So to quantify our water right in the state of New Mexico, we're still going through the process of that. Also Utah, as our land base goes into three states. And I think the measurement of how much water were losing – we do have a water right on the San Juan River and we have not utilized that – that is going downriver into the Colorado River Basin. And we have no way of being compensated for it or even acknowledging what that

measurement is for how much water we're losing down-river. And that's being used by probably somebody on the river Basin through a tributary, whether it's Upper or Lower Basin. So I think tribes are based in this process of just trying to quantify their water right and get it on a legal document saying, "this is how much of a water right I have." So that's been one of the things that we're facing right now.

CASTLE: Thank you. Season?

MARTIN: I think I just wanted to talk a little bit about the equity that's part of this conversation to one of the things you asked earlier and to Ted's comment about what reconciliation would look like in the Basin related to demand management or other mechanisms for tribal water. I keep thinking about climate leadership as water leadership, and the concept of a just transition in the energy space right now. I think the challenge and associated opportunity that we face in the Basin is that there's going to be less water to go around, and we've been talking a lot about that, which means we have to start using less water. But we also really need to think about what that just transition looks like from the Basin we've had in the past to the Basin we're going to have in the future. To me, equity is at the center of that transition always and in every single conversation all the time. And I think the ground has shifted for us as we look toward a resilient future, and it's essential that we think about and address both the historic and current inequities in the system that we currently have as we move forward and think about what reconciliation looks like.

CASTLE: Yeah. I'm interested in the comparison of this reconciliation to the reconciliation discussions that are going on in Washington right now, which are just as tough, I think. So I know there are questions that have been submitted that I can't see. I'm going to turn it over to Jenn to call on people to ask their questions.

BOWLES: Hi Anne, thanks. Yes, you know I'm really thrilled to have some climate researchers, Jonathan Overpeck and Brad Udall here. And they've been listening to the discussions this entire time. One of the things we do at the Water Education Foundation is try to bridge science with policy. Anyways Peck, as he's known, has a question. So Peck, you want to go ahead?

Jonathan Overpeck, Interdisciplinary Climate Scientist, University of Michigan: I do have a question. Well, I think we've talked about it. I mean, it was more of a comment in the chat about how we price water. I think we've had some good comments around that space. But of course, the more important thing from a climate scientist point of view (I'm a climate scientist), is that we've been talking about the drought, but we've heard some interesting facets of what that means. I think Ted Cooke

said it very well when he said a big part of the drought is permanent, the climate change component. And I think we've heard some other really good comments about how the whole system is being impacted by climate change and we better build that in. And Season just emphasized that, but I think Chairman Heart also emphasized it in a really good way.

The implication of this, of course, is that the cost of water, or the price of water, is surely to rise. Another implication of this though from a climate science point of view is that when Brad and I wrote our paper now four years ago emphasizing the impact of temperature increases on Colorado River flows, it wasn't like we were the first. But we were the first to clearly and graphically show what that means. And what's happened since then is that a consensus has built around those ideas. So now, the climate science, the hydroclimate community, and I heard it here today, is thoroughly convinced that as long as warming continues, flow reductions will also continue. There are still holdouts in not necessarily the climate science community but a little maybe, that precipitation will for some reason magically go up to compensate. And indeed some models show that. But I like what Jim Prairie did at the very beginning because he highlighted that there are a lot of ways to look at this. And probably looking at that part of the record that came before substantial climate change is not one of the safe ways to do it other than to say, let's look at the paleo record where we had gigantic flow reductions for decades. It's okay, but that was a different world, with a different climate, than we have today.

The world we're in now is, as long as we put CO₂ and other greenhouse gases in the atmosphere, it will get warmer and warmer and that will knock back the flows of the Colorado maybe 35 percent or 50 percent by perhaps even mid-century. And if you don't think that's possible, just realize that they've already been knocked back 20% since the start of this drought. Now, the other thing to realize is that with this precipitation component, precipitation has been going down on average, as well. And there is not a consensus on what's happening there. Is it natural variability? Is it multi-decadal variability that has made the drought worse now, and will make the drought less worse in the future? And again, I would rather use the term aridification. It's not a drought the way we had a drought as when we were kids, or when we were in grad school or even 20 years ago. This is aridification, and in the U.S., the Southwest is just aridifying faster than everywhere else. It also is important to realize, as a climate scientist, that there is good theory now that suggests that the dry zones of the planet, of which the Southwest is in, have poleward edges that appear to be expanding further poleward. That means that the storm tracks in the winter that give rise to the snow we need are preferentially

moving poleward. You see this in the Southern Hemisphere a lot more clearly than in the Northern Hemisphere. In the Southern Hemisphere, the storms are being pulled south by the ozone hole and other dynamics down there. But the point is, is that there is, as climate change proceeds, this signal, if it really exists, which seems to be getting clearer. The last thing I want to mention from the science is that things seem to be happening faster now than most climate scientists, myself included, really believed they would. The consensus was they would go a little slower. This summer was a great example of how climate changes are not going slow. So, I'm a little worried as I listen to this overall conversation that we're all tiptoeing around the elephant in the room. Some people like Season have been making it really clear that there are these strategies that are beyond what we've been talking about that are really important. I totally agree. I think some of them will really help with fighting climate change, but the bottom line here is if we don't all get together and start shouting from the rooftops about climate change and what it's doing to this river, about the fact that this is the decade climate change has to be solved, then we're consigning the river to a potentially really dark future. Okay? And if we don't shout from those rooftops, we will perhaps not solve it this decade because we have politicians in Arizona, my old home for 20 years, in Utah, elsewhere in the southwest, who are just for political reasons denying climate change and the need for action on climate change. Yeah, they're not denying climate change, but they're denying the action on climate change, let's be honest.

And if we don't solve this problem in this decade, what's at stake? Well, what's at stake is what is the reason behind the Paris Agreement having a goal of 1.5 degrees Celsius warming above pre-industrial levels. We've already warmed the planet 1.1 degrees Celsius, so it's right around the corner. And some folks are saying "well, maybe we've got to go to 2 degrees." But if you're really listening between the lines, we can go to 2 degrees, but we'd better treat that as an overshoot and come back down. Why? It's because the climate system has thresholds or tipping points that we don't fully understand. It's like we don't fully understand what's going on with precipitation in the Southwest. The same thing holds true with these tipping points that are global in nature. What is one of these tipping points that you all probably can relate to? The melting of the Arctic and the warming in the Arctic. Unbelievable what's happening there. This summer blew the doors off of that warming, melting all the way to the top of Greenland, it rained at the top of Greenland.

What does that mean? It means that there's a lot less reflective sea ice in summer, and a longer season in the spring and fall where there's less reflection of sunlight. That means the warming gets amplified. Well, that warming is

already starting to melt permafrost at an ever-increasing rate and that releases more CO₂ and methane depending on the dryness of the permafrost. And that is going to accelerate the warming. And it's also, we have horrible wildfires in the West. You guys are all breathing that toxic smoke. I was out West, I have still the place in the Basin where I spend my summers. It's bad. I'll tell you, all around the circumpolar region now is burning. And some of those fires are literally burning through the winter. They're not going out anymore. And that's releasing tons of carbon. So the point is that there are other types of tipping points where the natural system will start to amplify in a positive feedback manner, the warming. And if we cross those thresholds, and we don't know exactly where they are or how big they are, it will prevent us from stopping the warming at 2 degrees or 1.5. It'll force us to forever on human timescales deal with four or five degrees C warming of the planet, four to five times what we've had already.

BOWLES: We're running late, I don't want to cut you off. I know what you're saying is so, so super important and we're going to invite you to next year in Santa Fe to have this discussion.

OVERPECK: Might be too late though. So I'm just going to say think about it.

BOWLES: No, no, it's good Jonathan but thank you so much. Okay. So at this point, Anne do you want to wrap up your panel?

CASTLE: Well, I want to say thank you to all of the panel, and just call out that we were able to get in a climate science discussion, even though that wasn't exactly scheduled, but from one of the leading climate scientists in the country. So everybody, would you join me? You could unmute and clap or just clap like this and thank our panel for the really good discussion.

IBWC Leadership Introductions



Panelists, clockwise from top left: Pete Silva, Silva-Silva International; Maria-Elena Giner, U.S. Commissioner, International Boundary and Water Commission; Adriana Reséndez, Mexico Commissioner, International Boundary and Water Commission.

Jennifer Bowles, Executive Director, Water Education Foundation:

Thank you, Anne, for moderating. You did an awesome job, as we knew you would. So, thank you very much. Now we're going to turn to the border. We also have new leadership at the border. In fact, very recent new leadership at the border and across the border. So I want to take a quick second here to acknowledge Jayne Harkins, former IBWC commissioner, who has been on our Zoom meeting in the audience. Hi, Jayne. And then, here to make introductions of the new leaders on both sides of the border is Pete Silva, President of Silva-Silva International. Welcome, Pete.

Pete Silva, President, Silva-Silva International:

Hi Jenn, thank you so much. And yeah, this is quite an honor and a privilege for me to be able to present and introduce the two new commissioners of the U.S. and Mexico sections of the International Boundary and Water Commission. And for the first time in history, both commissioners are women, which will be a great binational team, I think, for all of us. For the U.S., Dr. Maria-Elena Giner. And for Mexico, Adriana Reséndez. It was an interesting day last week. On the 15th, Dr. Giner was sworn in as U.S. commissioner, and that very same day Mexico announced that Adriana

Reséndez was going to be the new commissioner for the Mexican section. So a really exciting day.

First, I want to introduce Maria Giner, a really good friend of mine. Let me go through her resume really quickly. She has an impressive resume, a B.S. in civil engineering in 1990 first from Loyola Marymount University. She actually worked for Metropolitan Water District for five years, 1990-1995, and then for Carollo Engineers for a few years. Then something very important happened: I was able to hire Maria-Elena when I was at the border as operation commissioner and manager, and I hired her as one of my engineering staff. What can I tell you, they're just great people – super smart. And the best thing is she is just very dedicated to the border. I think that'll help us a lot as we move forward with all the issues on the Colorado. She actually started as staff as I said, and then she stayed there 19 years. She actually wound up as deputy general manager and then became general manager in 2007 and was there for seven years as manager. Then after that, she went to work for Parsons up until today. And then the last thing I want to say is, she got her doctorate from the University of Texas at Austin just last month, so congratulations for that. And with that, it's really my great pleasure

to introduce a great friend of mine, Dr. Maria-Elena Giner. Maria, if you can give us a few words.

Maria-Elena Giner, U.S. Commissioner, International Boundary and Water Commission: Thank you, Pete, for the very gracious introduction. Well, first of all, I'd like to give my greetings to Commissioner Jayne Harkins, as well. She was the first woman to hold this position, so she set a great groundwork for me. I'd also like to say hello to Commissioner Touton. I know we've been trying to set a meeting, but we have been unable to do it. But definitely I've been listening to the entire conference and it has been very, very interesting for me to learn so many details about the Upper Basin and some of the challenges that are going on. My background is in water resources, and my dissertation did focus on the impacts of water pollution on health. And so I'm very excited about this opportunity to lead this institution of the IBWC and to continue the good work that they've been doing. I do have about 25 years of experience of working along the border, so I'm really hoping, as Pete described, I'm really hoping that I'll be able to leverage all of the relationships that I developed with over 100 communities and be able to advocate and advance the mission of the institution. Thank you.

SILVA: Thank you, and we look forward to working with you. Next, it's again my pleasure to introduce the new commissioner for the Mexican section of the IBWC today, Adriana Reséndez. She has a master's degree in hydraulic resources from the Universidad Autónoma de Chihuahua, and also a bachelor's degree in civil engineering where she was actually the head of her class there. She has 23 years of experience at CILA in the areas of operations and engineering as chief engineer of operations and is deputy director of the Colorado River in the engineering area. During her career – I think actually quite a few of you probably know her – we've had the pleasure of working with her during the minute process, especially Minute 319 and 323, which she's been very instrumental, and a lot of the work groups, too. So a lot of us are familiar with her. I'm very pleased that she's the commissioner because she has all that background that will serve her well. As I said, she is the first woman to head the Mexican section of CILA. So without further ado, Adriana if you can give us a few words. Thank you.

Adriana Reséndez, Mexico Commissioner, International Boundary and Water Commission: Thank you, I'm happy to be with you all. I was for 20 years working on the Colorado River. And some years ago, I had the opportunity to participate in this Colorado River Symposium in Santa Fe. On that occasion, we were talking about the lining of the All-American Canal. Nowadays, we are talking about operations, environmental restoration,



We have challenges to face and now we know that we can face them together, we will continue in a sound manner in this direction.”

- Adriana Reséndez

new water sources, the national requirements to conserve water, and about cultivating a system of conditions for the Colorado River Basin. Actions on the Colorado River system are examples of cooperation. We have challenges to face and now we know that we can face them together, we will continue in a sound manner in this direction. I hope to see everybody soon in person. Thank you very much for the invitation.

SILVA: Thank you, Adriana, that's great. And I think I can speak for the whole group here that we wish you all the best and good luck in the world as you start your new positions. Obviously looking forward to working with you on all the Colorado River issues we have before us. So thank you again, and good luck. And Jenn, I'll send it back to you.

BOWLES: Thanks, Pete. Great to meet everybody, all the new leaders.

Gearing Up for 2026 Negotiations



Carly Jerla, Senior Water Resources Program Manager, Bureau of Reclamation

Jennifer Bowles, Executive Director, Water Education Foundation: With negotiations for the 2026 guidelines expected to begin soon, parties across the Colorado River Basin must consider next steps and possibilities for addressing big questions, such as the structural deficit. In fact, I should mention that we have for Reclamation both the Upper Basin Regional Director, Wayne Pullan, and the Lower Basin Regional Director, Jaci Gould, on the meeting with us this whole time as well. I'm glad they've been here as well. Here to give us a peek into how the negotiations are going to unfold, though, is Carly Jerla, senior water resources program manager at Reclamation, who was recently chosen to lead Interior's efforts to develop the updated operating rules for Colorado River reservoirs. Carly, what can you tell us?

Carly Jerla, Senior Water Resources Program Manager, Bureau of Reclamation: Well, good afternoon or evening, depending on where you are. And thank you, Jenn and Nick, for organizing this [virtual] Symposium and for the opportunity to speak. It's really good to be here. As you've heard from our previous speakers throughout the course of the afternoon, these are challenging times. As Deputy Commissioner Touton noted, our August 24-months study declared the first-ever shortage in the Lower Basin. Under our 1944 treaty the hydrology we planned for years ago, that we hoped we would never see,

is here. And as if the times are not challenging enough, enter the fact that we have just five more annual operating plans under the current operating guidelines for Lakes Powell and Mead. So we're in a situation where we find ourselves working to address the current challenges brought on by drought and dry hydrology with an uncertain future regarding future operating policies.

The Interim Guidelines, Minute 323, the DCPs – they get us a solid foundation for our current short-term operations, but only through 2026. And as soon as we start to work together to develop those future operating policies, we very well may find ourselves doing so simultaneously addressing additional challenges that the drought and dry hydrology bring upon us. It's quite difficult to wrap your mind around. It is a massive task that's upon us to develop these post-2026 operations even in good times, and these are not good times, hydrologically speaking.

So how do we move forward in a way that sets us up for success? To answer that, I think it's worth revisiting the input we received from the broad set of stakeholders in the Basin during our 7-D-review process. These comments helped shaped our understanding and findings regarding the effectiveness of the guidelines. There were many comments received that were outside of the retrospective scope of the review, but it expressed

important perspectives on ways that our approaches and previous processes can be improved to help guide how we move forward in the post-2026 process.

To summarize these comments, they fall into three general themes. The first is with respect to stakeholder engagement. The comments emphasized the importance of expanded, robust and meaningful stakeholder engagement and operational decision-making. Modeling approach was another theme. We heard comments that emphasize the importance of utilizing the best available science and tools to inform decision-making. And also to take a broad approach and consider multiple future scenarios and outcomes. And then resource analysis: We heard an emphasis on the importance of a thorough analysis of the impact to resources under current and future operations, and stakeholder involvement in those analyses. So taken together, these comments express a core set of principles and approaches' desire for transparency, inclusivity and the incorporation of the best available science to guide the development of post-2026 operations.

So while the 7D review is the most recent documentation of these comments and sentiments, they are not new by any means. And with respect to stakeholder engagement, anyone who was at the Symposium in 2019 will recall the emphasis that was put on greater tribal involvement and participation. We've seen an increased role by the NGO community and their recent key role in helping to land the DCP. Our leaders have consistently called for greater inclusivity and the Basin states have recognized this as well. And anyone who was at the Symposium in 2017 cannot forget the historic signing of Minute 323 and what we have accomplished with Mexico. So as we designed past processes, these themes – again, thoroughness, inclusivity, transparency, science-based – have always been our guiding themes.

That's not to say there is not room for improvement. These concepts have evolved over the years with increased public awareness, technology and scientific advancements, heightened partner and stakeholder interest, and desire for meaningful involvement. And while there are some aspects worth carrying forward from past processes, the design of the post-2026 process needs to be updated, modernized and expanded in a thoughtful way to reflect the current times. In one fundamental way, we need to adapt our practices as how we meet and work together if it's going to be a long while before we're back in the groove of carefree face-to-face meetings and traveling, if we're ever to get there again. We learned some things about this in the recent months, what works and what doesn't. And honestly, we may have suffered a little without the usual in-person meetings. We've gained some important experience trying out new methods of engagement, in particular with the 7D review, and we'll need to find new ways of engaging that will meet all of our needs.

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It's our commitment and my personal commitment in this new role to be transparent, inclusive and to use the best available science.” - Carly Jerla

And so while I'm not here to announce anything specific regarding timelines or processes for the post-2026 effort, I can tell you that it is very important to us that we design a process, both engagement and technical, that meets the expressed desires and addresses the challenges ahead. We do not intend to design a process without outreach to key partners to ensure its workability. It's also important to us that we set up a successful process that does not predetermine any outcomes. I can also tell you – and this may be a reminder to those of you who have been with Reclamation through past processes, or those of you who have not – this approach is not new, in terms of the way Reclamation does business on the Colorado River or how we've approached the design of previous processes.

So, how do we move forward? By taking the concepts that have guided past efforts that have been recently re-emphasized by the public stakeholders and partners and adapting them to reflect the current perspectives and realities in the Basin. If we continue to adhere to the foundational, guiding principles of inclusivity, transparency, thoroughness and science-based that have brought us this far, I believe we will be set up as best as we can for a successful outcome with respect to post-2026 operations. In the short-term, we have challenges we simply must address. I hope and expect that our short-term focus will also utilize these same core principles. It's our commitment and my personal commitment in this new role to be transparent, inclusive and to use the best available science. That's why I was excited to compete for this position and honored to be selected.

And in closing, thank you all for your work to address the challenges the Basin is facing by doing so in a spirit guided by working together. These times call for more, rather than less, cooperation. Thanks everyone.

BOWLES: Thank you, Carly, really appreciate you taking the time to come speak to us today.



Tanya Trujillo, Assistant Secretary of Water & Science, Department of the Interior.

Jennifer Bowles, Executive Director, Water

Education Foundation: Last, but certainly not least, it's my great pleasure to introduce Tanya Trujillo. I don't really have to introduce her but I'm introducing her.

Tanya Trujillo, Interior's assistant secretary for water and science, where she oversees water and science policy for the department and has responsibility for both the Bureau of Reclamation and the U.S. Geological Survey. So as everyone knows, Tanya has been an avid participant in our Symposiums over the past years. So we're super happy to have her speak today. Tanya, take it away.

Tanya Trujillo, Assistant Secretary of Water & Science, Department of the Interior:

Thank you very much Jennifer. I am coming to you all live from the Palace of the Governors in Santa Fe. I am thrilled to be here, but very sad that we're not here all together. I want to just start off by saying how honored I am to be part of this program and to be part of the team at the Department of the Interior. The role that I have as assistant secretary for water and science allows me the opportunity to work closely and hand in hand with the excellent technical team at the Bureau of Reclamation and the U.S. Geological

Survey (USGS). And it's been great so far this term. I'm looking forward to many more months and years with them as we go forward.

But I wanted to just pick up on a theme that my friend Pete Silva started with respect to the fact that I am standing here at the Palace of the Governors where 99 years ago our forefathers signed the Compact for the Colorado River Basin. And we will be celebrating here next year on the 100th anniversary of that Compact, but it was too late for the forefathers who were here. Right now, during our current tenure, we are making history because we have a thorough and virtually 100 percent team of female leaders now in the Basin. Starting with just the acknowledgement of Carly Jerla, she will be an incredible leader for us as we go forward in the Basin. And then I want to say a special hello to our friends and colleagues in Mexico, the commissioners for both CILA and IBWC. We are looking forward to working closely with you. And at the Bureau of Reclamation, Camille Touton will be a great leader for us there, and she is working her way through the confirmation process, but hopefully we'll have that concluded soon. Myself as assistant secretary for water and science and

CLOSING REMARKS

then our leader at Interior, Secretary Deb Haaland. It really sets the stage for a great opportunity to make history and also just develop additional partnerships.

I think this program is a great forum for us. There's no shortage of challenges, and it was great to hear the presentations and hear all of the different perspectives that exist in the Basin. Each state has tremendous challenges. Each state is experiencing shortage. Each state has undertaken conservation efforts, and as we know, and as we're predicting, we're going to be having to continue that and to do even more. The upside of all of that is we have the skills. We have the technology. We have the tools available to us that allow us to do more. And most importantly, we have the human capacity. We have the human spirit that it's going to take.

But we have the obligation, to ourselves, to each other, to roll up our sleeves and continue that necessary work. There's a proven track record in the Basin as many of you know – many of you have been part of that proven track record – and it's incumbent upon all of us to be able to continue that. I am happy to be the first from the Reclamation team to just recommit – not the first, but an additional member of the Reclamation team to recommit to an inclusive and expansive process as we do move forward. I think we will, of course, include the essential partners from the tribes, the essential partners from the states, and many, many other sources of technical input that we will be receiving.

So I understand that happy hour is up next. I am definitely in line for that here. So I appreciate just the opportunity to be part of this family. Water Education Foundation, thank you again for pulling everything together. And to everyone who is on the call, great to see you and I look forward to this ceremony again next year.

BOWLES: Thank you so much, Tanya. And we're looking forward to seeing Tanya and hopefully Secretary Haaland at next year's event. We are going to open up some happy hour chat rooms in just a moment. But first, please join me in thanking the moderators and panelists who shared their insights. If you want to turn on your cameras and give a round of Zoom applause to everybody. Yay. Thank you so much everybody.

You know, the Foundation is honored to host this event and we're so glad all of you could be here with us in virtual Santa Fe. We look forward to seeing you all again in 2022. That is September 21st to 23rd. But in the meantime, don't forget to stay in touch and watch out for those Colorado River Water Leader apps coming soon.



We have the obligation, to ourselves, to each other, to roll up our sleeves and continue that necessary work.” – Tanya Trujillo

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Adam Arellano

Adam Arellano is the Vice President of Power Marketing for Western Area Power Administration's Colorado River Storage Project Management Center (CRSP-MC) in Montrose, Colorado. Adam began his federal career at WAPA in 2004 while attending the University of Colorado School of Law. After graduating, Adam worked in WAPA's Office of General Counsel, where he successfully handled a wide variety of cases and issues. In 2009, Adam was selected to solely represent the CRSP-MC through many issues, including the negotiation of the 2025 Salt Lake City Integrated Project Marketing Plan and the Glen Canyon Dam Long-Term Experimental and Management Plan. In 2020, Adam became a recovering lawyer and joined the CRSP-MC.

Jennifer Bowles

Jennifer Bowles was named Executive Director of the Water Education Foundation in March 2014. A veteran journalist, Jenn worked as a reporter and editor at The Associated Press in the Los Angeles bureau for 10 years. She later became the environmental reporter at The Press-Enterprise, garnering awards for her coverage of water issues in California and the Colorado River Basin during a nine-year stint. She joined Best & Krieger LLP in 2009, where she worked as a writer and communications strategist with some of the state's leading water law attorneys. Jenn has a bachelor's degree in journalism and history from the University of Southern California and completed a year-long Scripps Fellowship in Environmental Journalism at the University of Colorado, Boulder.

Anne Castle

Anne Castle is a Senior Fellow at the Getches-Wilkinson Center for Natural Resources, Energy, and the Environment at the University of Colorado, focusing on Western water issues. She has recently authored reports on urgent Colorado River policy issues and recommended infrastructure projects to improve overall sustainability in the Colorado River Basin. From 2009 to 2014, Anne was assistant secretary for water and science at the Department of the Interior, where she oversaw water and science policy for the department and had responsibility for the Bureau of Reclamation and the U.S. Geological Survey. While at Interior, she spearheaded the department's WaterSMART program, which provides federal leadership on the path toward sustainable water supplies. Anne also provided hands-on leadership of Colorado River issues and was the chair of the Glen Canyon Dam Adaptive Management Work Group and a champion of Minute 319 between the United States and Mexico. The fact that the Colorado River descended further and further into drought during her tenure is generally believed not to be her fault. Anne is a recovering lawyer, having practiced water law for 28 years with the Rocky Mountain law firm of Holland & Hart.

Ted Cooke

Ted Cooke was appointed General Manager of the Central Arizona Project (CAP) in March 2016 and is responsible for carrying out the board of directors' policy directives and overseeing all operational aspects of CAP. The Central Arizona Project is Arizona's largest water provider, transporting and delivering approximately one-half of Arizona's Colorado River apportionment to the interior of the state each year. Previously, he was interim general manager and deputy general manager, finance and administration. Ted joined CAP in 1999. His four-decade career in utilities, technology, finance and operations has also included management and executive positions at Xerox Corporation, Luz International Limited and OESI Power Corporation. Ted serves on the Governor's Water Augmentation, Innovation and Conservation Council and the advisory boards of the Arizona State University Kyl Center for Water Policy and the University of Arizona Water Resources Research Center. Ted is executive chair of the Water Utility Climate Alliance. He earned a bachelor's degree in physics from Loyola Marymount University, a master's degree in operations management and management science from UCLA and a doctorate in management from California Coast University.

Maria-Elena Giner

Maria-Elena Giner was appointed by President Biden Aug. 20, 2021, as the United States Commissioner of the International Boundary and Water Commission. Dr. Giner, the second woman and first Latina to hold the post, previously served as general manager of the Border Environment Cooperation Commission (BECC), an institution that developed environmental infrastructure along the U.S.-Mexico border in association with the North American Development Bank. During her tenure at the BECC, she focused on policies that addressed U.S.-Mexico cooperation on water, energy and climate change. She has published extensively on water policy and transboundary bilateral cooperation. She earned a bachelor's degree in civil engineering from Loyola Marymount University in Los Angeles, a master's degree in business administration from the University of Texas at El Paso, and a doctorate in public policy from the University of Texas at Austin. She is also a registered professional engineer, first-generation college graduate, and daughter of an immigrant.

Nick Gray

Nick Gray is Programs Director for the Water Education Foundation, where he manages workshops, conferences and tours of key water regions and topics across California and the Southwest. Before joining the Foundation in the summer of 2018, Nick spent 15 years involved in formal and informal science education as a science teacher in the classroom and as the education director of a science museum.

He has also been involved with regional science communication organizations, including Capital Science Communicators. Nick has a bachelor's degree in biology from the University of Dayton in Ohio.

Bill Hasencamp

Bill Hasencamp is the Manager of Colorado River Resources for the Metropolitan Water District of Southern California, where he develops and manages water supply programs to augment Metropolitan's Colorado River supplies. He has been with Metropolitan for 20 years, negotiating transfer agreements with irrigations districts, exchange agreements, and funding new water supply projects that have doubled Metropolitan's Colorado River water supplies. In 2007, Hasencamp negotiated and worked with other states to develop the Intentionally Created Surplus Program, which allows Metropolitan to store up to 1.5 million acre-feet of conserved water in Lake Mead at no cost. Bill is one of California's representatives to the Colorado River Basin Salinity Control Forum. Bill has a bachelor's degree in civil engineering from California State University, Long Beach, and a master's degree in business from Pepperdine University.

Manuel Heart

Manuel Heart is chairman of the Ute Mountain Ute Tribe in southwest Colorado and chair of the Ten Tribes Partnership, a coalition of Upper and Lower Basin Tribes that have come together to raise their voices in the management of the Colorado River as water challenges persist. Mr. Heart was raised on the Ute Mountain Reservation in Towaoc, Colo. He was first elected into Tribal Council in 1995, and since then he has served as chairman, vice-chairman, treasurer and secretary/custodian. He is a strong advocate for education, housing, water and economic development. Mr. Heart is also recognized by many Native American organizations for his leadership and service on a national and state level as former Area Vice President of the National Congress of American Indians for the Southwest region, Colorado Commission of Indian Affairs, Utah Tribal Leaders, New Mexico Indian Affairs, Colorado Energy Resource Tribes, Albuquerque Area Indian Health Board and Native American Finance Officers Association. He is happily married with six children and 16 grandchildren.

Carly Jerla

Carly Jerla is the Senior Water Resources Program Manager at the Bureau of Reclamation. Her career has been devoted to improving the technical foundation for Reclamation's operational decisions across the Colorado River Basin, as well as enhancing partners' and stakeholders' ability to engage in Basin decision-making. Jerla joined Reclamation in 2005 as a graduate student at the University of Colorado's Center for Advanced Decision Support for Water and Environmental Systems (CADSWES) in Boulder, Colo. Currently, she leads a modeling and research team based at CADSWES, which has responsibility for research and development of modeling

applications and decision support for water operations and planning in the Colorado River Basin. She obtained a bachelor's degree in civil and environmental engineering, and engineering and public policy from Carnegie Mellon University, and a master's degree in civil engineering from the University of Colorado.

Season Martin

Season Martin is a founding partner of Martin & McCoy, a water and natural resources consulting firm based in Tucson, Ariz. She holds a bachelor's degree in geology and environmental studies from Whitman College, and a master's degree in environmental science and management with a specialization in economics and policy of the environment from the University of California, Santa Barbara, where she was a member of the first cohort of Sustainable Water Markets fellows. Prior to co-founding Martin & McCoy LLC, she served as the water projects and sustainable finance director for The Nature Conservancy's Colorado River Program, was a restoration coordinator at the Tamarisk Coalition, focusing on building collaborative partnerships to implement riparian restoration throughout the West, and worked for the Grand Canyon Trust in the forests of southern Utah. She resides in Tucson, Ariz., where she cultivates her cactus garden and enjoys gatherings to celebrate the desert.

Peter Nelson

Peter Nelson, who currently serves as Chair of the Colorado River Board of California, has been a member of the Coachella Valley Water District Board of Directors since 2000. Six of those years were as president, and four as vice president of the board. He served on the Salton Sea Authority from 2000 to 2014, and currently serves on the California Farm Water Coalition. He also served on the California Desert Grape Administrative Committee, a federal marketing order, from 2008-2012, and for six years with the Coachella Valley Resource Conservation District. In addition, Peter served on the Lower Colorado River Multi-Species Habitat Conservation Farm Advisory Group. He is a graduate of California State University, Fresno with a degree in agricultural business. Peter participates in groups ranging from the Association of California Water Agencies to the Colorado River Water Users Association. He has represented the district to a wide variety of state, federal, locally elected and water industry officials.

Jennifer Pitt

Jennifer Pitt is the Colorado River Program Director for the National Audubon Society. She joined Audubon in December 2015 to advise the organization's strategies to protect and restore rivers throughout the Colorado River Basin. At Audubon, Jennifer continues her work on United States-Mexico collaboration to restore the long-desiccated Colorado River Delta. Previously she worked as the Colorado River Project director at the Environmental Defense Fund (EDF). Before joining EDF in 1999, Jennifer worked on river restoration for the National Park Service and as a legislative aide to Congressman Mike Kopetski. She also has worked as a ranger at Mesa Verde

and Sequoia national parks. Jennifer has a master's degree in environmental science from Yale University.

Jim Prairie

Jim Prairie is a Hydrologic Engineer who has worked for the Bureau of Reclamation since 2000. He is stationed at the University of Colorado's Center for Advanced Decision Support for Water and Environmental Systems (CADSWES). He has extensive experience directing and coordinating research, development and modeling projects. He leads applied research in mid-term operations and long-term water resource planning, climate variability and decision support under uncertainty. Jim directs river basin modeling technical teams and oversees the consumptive use, natural flow and natural salinity development programs for the upper Colorado River Basin. He received his doctorate in civil engineering at the University of Colorado, Boulder and a bachelor's degree in environmental resource engineering from the State University of New York College of Environmental Science and Forestry.

Adriana Reséndez

Adriana Reséndez is the Commissioner of the Mexican Section of the International Boundary and Water Commission, and the first woman to head the commission. She was appointed Sept. 15, 2021, by Mexican Foreign Secretary Marcelo Ebrard. She has 23 years of experience in the IBWC in the Operations and Engineering areas, as chief engineer of operations and deputy director for engineering for the Colorado River. Over the course of her career in the IBWC, she has participated in various negotiations and in the inter-institutional and binational coordination needed for carrying out key projects in the border region. She has an undergraduate degree in civil engineering from the Autonomous University of Chihuahua, where she also studied toward a master's degree in water management in arid zones with a specialization in water use and quality.

Gene Shawcroft

Gene Shawcroft leads the new six-member Colorado River Authority of Utah as chair and represents Utah on all Colorado River issues as Utah's Commissioner on the Upper Colorado River Commission. He is also the General Manager for Central Utah Water Conservancy District, the state's largest water conservancy district. After graduating from Brigham Young University with bachelor's and master's degrees in civil engineering, he joined the State of Utah at the Division of Water Resources. Shawcroft came to the Central Utah Water Conservancy District in 1991 and served as a project engineer, assistant general manager, deputy general manager, and was appointed general manager in January of 2015.

Pete Silva

Pete S. Silva is President of Silva-Silva International, an engineering consulting company specializing in water policy and regulatory affairs. He has more than 40 years of experience in the water and wastewater fields and is an expert on

U.S.-Mexico border affairs in these areas. Pete served two years as the assistant administrator for water at the U.S. Environmental Protection Agency and six years as the vice chair of the State Water Resources Control Board in California. In addition, Pete was appointed during the Clinton administration to the board of directors of the Border Environment Cooperation Commission (BECC). He has held positions at the U.S. International Boundary & Water Commission, the city of San Diego and Metropolitan Water District of Southern California. In addition to his consulting work, he is also involved in advocating for the involvement of Latinos in water policy matters at the state and national levels. Pete is a founding partner of Water Education for Latino Leaders (WELL) and assists California Rural Legal Assistance to expand its role in working with underserved communities. Pete received a bachelor's degree in civil engineering from California State Polytechnic University, Pomona. He is a registered professional engineer (California) and a board-certified environmental engineer. Pete is a member of the Water Education Foundation Board of Directors.

Camille Calimlim Touton

Camille Calimlim Touton is Deputy Commissioner of the U.S. Bureau of Reclamation. Prior to her appointment in 2021, she served as professional staff for the U.S. House Committee on Transportation and Infrastructure. She was the staff lead on the resiliency provisions enacted as part of the Water Resources Development Act of 2020. Her congressional experience also includes serving as professional staff for Interior's authorization committees –the Senate Energy and Natural Resources Committee and the House Natural Resources Committee. She also served as Interior's Deputy Assistant Secretary for Water and Science under the Obama administration. She holds bachelor's degrees in engineering (civil) and communication studies, and a master's degree in public policy.

Tanya Trujillo

Tanya Trujillo serves as the Assistant Secretary for Water and Science at the U.S. Department of Interior. She most recently worked as a project director with the Colorado River Sustainability Campaign where she coordinated efforts among state, federal, tribal and local agencies to promote efficient water management in Western states. Before that, she served as the executive director of the Colorado River Board of California. She has served as senior counsel to the U.S. Senate Energy and Natural Resources Committee and as counselor to the Assistant Secretary for Water and Science at Interior. She received a bachelor's degree from Stanford University and graduated from the University of Iowa College of Law.