---o0o---

TRANSCRIPT OF ZOOM PROCEEDING

Friday, April 22, 2022

9:00 A.M.

OROVILLE DAM CITIZENS ADVISORY COMMISSION MEETING

FLOOD SAFETY STAKEHOLDER TECHNICAL WORKSHOP

HOSTED BY THE CALIFORNIA NATURAL RESOURCES AGENCY

---o0o---

Reported Stenographically by: Anne Bryant, CA CSR No. 13516

PRESENTERS:

Gary Lippner, DWR

Dr. Michael Anderson, DWR

Joe Forbis, U.S. Army Corps of Engineers

Rick Poeppelman, U.S. Army Corps of Engineers

John Yarbrough, State Water Project

Wade Wylie, DWR

Eric Simmons, Federal Emergency Management Agency

Dr. Rune Storesund, UC Berkeley Center for Catastrophic Risk Management

Cindy Matthews, National Weather Service

Elizabeth Bryson, DWR

Casey Meredith, California Office of Emergency Services

Mike Mierzwa, DWR

ALSO PRESENT:

Nick Saffold, Kearns & West

James Pearce, California Natural Resources

Matt Mentink

Ron Stork

Patrick Porgans

Robert Bateman

David Sarkisian

Ariya Balakrishnan

AGENDA

ITEM 1: Introductions
ITEM 2: Extreme Precipitation
ITEM 3: Designing for and Managing Large Floods
ITEM 4: Role of Oroville Dam in Flood Management
ITEM 5: Inspection and Channels
ITEM 6: Flood Plain Mapping
ITEM 7: Proposed Risk Planning Study
ITEM 8: Forecasting and Noticing Flood Events
ITEM 9: Flood Operations Center
ITEM 10: Emergency Action Plan
ITEM 11: Opportunities for Engagement and Mitigation
ITEM 12: Public Comments
ITEM 13: Closing/Next Steps

P R O C E E D I N G S

Friday, April 22, 2022, 9:00 A.M.

(Court Reporter's access to Zoom hearing begins.)

MR. LIPPNER: Good morning, all. Welcome to the Flood Safety Stakeholder Technical Workshop. My name is Gary Lippner, and I am DWR's Deputy Director of Flood Management and Dam Safety. I am joined here today by representatives from the various federal and state agencies that work together before, during, and after flood events to reduce flood risks in the region.

Our facilitator today is Nick Saffold, who also facilitates the reoccurring Oroville Citizens Advisory Commission meetings. The purpose of the workshop today is to allow you to both hear from the flood risk management experts and ask them questions related to downstream flood safety.

Next slide, please.

You are looking at an artist's rendition of a watershed, much like the Feather River Watershed, where you can see headwaters; a large, multipurpose reservoir; rivers downstream of the reservoir; and various landings' activities. And today's focus is on the downstream flood safety elements of this watershed.

Today our speakers will generally be sharing

information about their agency's role in flood safety. They will focus on three key areas. First, there are activities we do before a flood event that focus on understanding extreme events and how to build, maintain, and operate systems to safely handle these events.

Second, there are activities we do during a flood event, such as forecasting and emergency response coordination.

Finally, there are activities we do after a flood event to recover from damages and prepare for the next flood event through activities such as mapping and investment planning. All of these activities are done with a specific watershed and its associated land use in mind.

Next slide.

So this is the part -- downstream side of the watershed we are talking about and some of the communities. And, of course, above this slide would be Oroville.

I want to mention there are a few topics that we do not have presentations for today. These include dam safety inundation mapping, evacuation planning, and forecast-informed reservoir operations. We do have experts from DWR's Division of Safety of Dams on hand to answer any questions about dam inundation mapping you

might have at the end of today's presentations. Local law enforcement has the responsibility for evacuation planning, and many of the activities that you will learn today -- about today will help law enforcement in this effort. Unfortunately, they are not able to participate today.

And, though we'll talk about forecasting, we will not focus on a specific forecasting-related topic that has been shared at previous Oroville Citizens Advisory Commission meetings, forecast-informed reservoir operations, or FIRO. Updates on how forecasts are used to inform reservoir operations will continue to be discussed at the Oroville Citizens Advisory Commission meetings that reoccur. For today, discussions on forecasts will be in the context of how they are used to inform downstream flood emergency response and flood mitigation planning activities.

Please note that a recap of our dialogue today will be shared at our next Oroville Citizens Advisory Commission meeting that is scheduled for this summer. Thank you again, and I'll turn it over to our facilitator, Nick Saffold.

MR. SAFFOLD: Thank you, Gary. Hello, everyone, and thank you for joining. Yes, I'm Nick Saffold with Kearns & West. I'll be helping support

today's workshop. In just a minute, we're going to start our presentations, many of which have been pre-recorded to help ensure we stay on time. However, some of today's presentations will be live.

So, after each presentation, we're going to have five minutes for stakeholder questions and comments. There will also be 30 minutes of time for further comments and questions following all of today's presentations. And I just want to note: If there isn't sufficient time to ask all of the questions wanted from stakeholders, we can take down email contact information, and we'll follow up with you offline to ensure everyone's questions are captured and answered.

We are, of course, doing our best to accommodate everyone today. We realize there's a lot to cover, and we're trying to do our best to both try and address previous questions or themes that come up at Oroville commission meetings. We'll also kind of creating opportunities for space and questions from the public here today.

So, if you would like to ask a question or make a comment following one of the presentations or during the public comment period, you can do so in a few ways. If you are using the Zoom platform, you can raise your hand to indicate you'd like to speak. To do so, you'll

just click the hand icon which should be located at the bottom of your screen, or you may click the Q and A button to type a question. And, if you're participating by phone today instead of Zoom, you will need to press "pound two" to raise your hand to speak following the presentations.

The last thing I'll mention is this is a three-hour meeting, pretty long, so we're going to have a five-minute health break around the two-hour mark.

So I think that's it for me. James, I'll turn it back to you to start our presentations. And, first up, we'll hear from Dr. Michael Anderson, State Climatologist.

DR. ANDERSON: Hello. Welcome to our presentation on atmospheric rivers, major flooding, and the 100-year flood. I'm Michael Anderson, your State climatologist with the California Department of Water Resources. This topic will look at atmospheric rivers and their relationship to California water. We'll look at components of major floods, from atmospheric rivers to snow and runoff; and, finally, we'll take a quick look at the concept of a 100-year flood statistical estimate.

So let's start with atmospheric rivers. They were first identified in 1998 with a new satellite

technology that could see water vapor in the atmosphere. Discovered that these features are hundreds of miles wide, thousands of miles long, and how 90 percent of the water vapor moves through the atmosphere in only 10 percent of the area. These features, then, are really important when they interact with thunderstorms, that causes heavier rains and snow in California, which are key to our water supply, and flooding.

So how do we characterize an atmospheric river? We start by how much water vapor is moving in an atmospheric river. To do that, we use a variable called the integrated vapor transport. It integrates the amount of water vapor in the vertical and multiplies it by the winds moving that water vapor along. And that gives us a sense of where the most water vapor is moving because that relates to where precipitation is going to be the heaviest.

Duration is the second characteristic. How long the atmospheric river is overhead is really key in how much runoff is generated.

And, finally, the third element, freezing elevation, where the rain turns to snow. In a cold storm, that elevation might be 2- to 4,000 feet, meaning most of the watershed is getting snow. If that freezing elevation is near 10,000 feet, then most of the

watershed is contributing runoff during that storm, and the flood peak will be higher.

So, working with my counterparts at the Scripps Institution of Oceanography and the Center for Western Weather and Water Extremes, there was a study done that looked at flood damages in the western U.S. and discovered that 84 percent of all flood damages in the western U.S. were associated with atmospheric river storms. But, if we zoom in to Northern California, we find more than 95 percent of flood damages are associated with these storms. This is why atmospheric rivers are a key element to understanding floods in California.

Another thing that the group did was to develop an atmospheric river scale very similar to the way that hurricanes have a scale. And the idea here was to take that innovated vapor transport, or how strong the atmospheric was, how long it was, and create a scale that goes from 1 to 2 -- which are mostly beneficial, providing much-needed moisture to California -- to then 3, 4, and 5, which were transitioned to where there's more hazard because there's too much coming at one time. And you can see that the longer the duration, the stronger or the more moisture being transported moves you into those higher numbers.

You also see that we have names associated with different thresholds of how much water vapor is moving through the atmosphere and going from not an AR, weak to moderate, to strong, to extreme, and to exceptional.

So how do we translate, then, from an atmospheric river into a flood flow? Well, first and most important are the prior conditions of the watershed, including snow.

A really good example of this is the atmospheric river that we had this past October which, at the Golden Gate, was a Category 5 atmospheric river. But it's falling on the watershed that has been dry from a previous year record dry year and a very long, dry summer. So, while there was quite -- or, rather, short-term increase in those flows, it wasn't the same type of response as might have happened had the watershed already been wet. And we were in winter, where there is already snow in the watershed that could melt and contribute to that flood flow.

So one of the other things we look at is how large the atmospheric river is, or are there multiple atmospheric rivers, which we call atmospheric river families. It might be one event that moves through, that's really big, or it could be a repeated series of storms impacting the region without much of a break.

And, for that, you can think of the February '86 flood, which had multiple storms over nine days leading to that flooding.

So we really look at the timing: When the AR happens in the year, the pace of the ARs, how quickly they're coming, and the scale of those atmospheric rivers to really understand, then, the timing; when did the streams come up, the pace of that increase, does it increase rapidly, or is it building slowly, and then the scale. In this case, where does it peak? Does it peak above a flood stage, or does it not quite get there?

And then the more we understand with both observations and forecasts, that improves our ability to manage flood response by better understanding the drivers of that flood in the atmospheric river and to provide enough lead time to take those actions that can mitigate the consequences.

So now we are going to pivot the talk a little bit here to talk about sizing the flood with statistics. This is a concept used when we're trying to evaluate how good is your flood management system. And so the concept that everybody hears about, because it's part of the National Flood Insurance Program, is that 100-year flood.

Well, a 100-year flood is really a flood that

is estimated to have a 1-percent or a 1-in-100 chance of being equaled or exceeded in any given year. 1-in-100 in any given year leads you to that notion of a 100-year flood. It's sized based on the statistics of the largest flows for a given year with as many years as you have data. So, the more years you have data, the more peak flows you have, the bigger your sampling is to try and estimate the size of that flood.

So we take that 100-year flow. There are that 1-percent chance of a flood peak or volume being equaled or exceeded in any given year, meaning that that percentage chance of exceeding always stays the same, and we use that as a threshold. That threshold, based on our historical and what we've seen in the history, guides engineering design, and there are actually federal guidelines that outline the methodologies to do this that is called the Bulletin 17C -- Bulletin 17. We're currently on Bulletin 17C or a third revision of those guidelines.

So let's talk about using those in terms of how we evaluate a flood system. Well, we can start with a systematic evaluation, where we use the statistical methods to get different-sized floods that help us establish a threshold, or how good -- what is the level of protection of my system. And we use this to meet

regulatory or statutory requirements. Can you -- Say, for the past 100-year flood.

Now, there's another way of doing it, where we take a scenario. It's either a real storm, say, the storm or record, or on constructed events that you create with plausible atmospheric conditions. Or maybe you want to look at a potential future flood and evaluate how the system works in response and how a flood response community would handle that event during, maybe, an exercise. You may have heard of an ARkStorm, a concept launched by the United States Geological Survey. And they're a group of folks who do sustain that after a decade to create such a scenario both for current conditions and potentially future conditions.

All right. So, as we get to the end of the talk here, we want three key points for you to take home. First off, atmospheric rivers, or ARs, are key to our floods and our water supply. The timing of them, the pace, how quickly they come, and the scale of how big they are determine that -- that benefit versus hazard.

Observations and forecasts, really key to making sure we maximize the benefit and minimize the hazard of any given AR event. And those flood evaluations that help us understand how our system is

doing, you can mainly use that systematic evaluation with those statistics, a.k.a. the 100-year flood, as well as a specific scenario meant to really dig in to some of the details and try to identify where we can improve.

Thank you for your time and attention. I'll be happy to answer questions when we get to that part of the workshop.

MR. SAFFOLD: Great. Well, thank you so much, Dr. Anderson. And are there any questions from the public at this time?

Great. It looks like we have one question from Mr. Matt Mentink.

MR. PEARCE: Matt, you should be able to unmute yourself. And just a reminder: Once you've raised your hand, you don't need to lower it and raise it again multiple times. But, Matt, you should be able to unmute yourself.

MR. MENTINK: Thanks, Nick. I just want to make sure I get a couple of questions in here.

It seems like a part of the message there, or a big part of the message, was to establish a 100-year flood as a standard of acceptability there. And I'm reading from the liability assessment of the FIRO for Yuba Feather River System, I think it's Section 8, Page

2, and it says the corner stored -- the cornerstone of these objectives is to achieve a high level of flood protection and reliable equivalent to protection against a 1- and 500-year event.

I was of the understanding that Oroville and Bullards Bar was going into this FIRO in a joint effort. In reading the viability statement, shouldn't we be looking at a 1-in-100-year flood?

Second is the '86 flood was said to have been a 1-in-70-year flood; and, yet, we had three of those in a 70-year period. So don't we really also have to question our forecast probabilities on top of planning for the 500-year flood?

DR. ANDERSON: All right. Thank you, Matt. A lot of good questions there, and we'll wade through them here.

First off, when we talk about 100-year versus a 500-year flood, that's part of that systematic evaluation where you pick different-sized floods and check on that performance. In the document that you referred to there with the forecast-informed reservoir operations, it's really looking at how far can we push the capabilities of the benefit of FIRO to get as much out of the flood protection as possible. And, to do that, you really have to push beyond a single target and

really look at a range of value. So that's where those two ideas kind of line up.

Now let's get back to that notion that you had there that if you have three 100-years in a 70-year period, how is that a 100-year event? Well, remember, a 100-year event is a 1-percent chance in any given year. So the fact that that 1-percent chance was realized three times in 70 years will eventually, when you revisit and redo the statistics, correct itself in those flood estimates. And that's why you will see a revisiting of the flood statistics through a project like the Central Valley Hydrology Study, which was an update to the comprehensive study.

Those are done periodically because that's how, when you get a new large flood, you can add it into the statistical mix and see how, then, the sizing works out. It's a statistical measure. It's not based on physics.

So the one important point there to keep in mind -- and it's an analysis tool that's not looking at the forecasting, which is trying to figure out what is actually going to take place. Hopefully, that kind of clears up a few of the ideas there. There's a lot there. I'll be happy to follow up with you on any of those, if you'd like.

MR. SAFFOLD: Yeah. James, let's open it back

up to Matt and make sure that answered his question or if he has a follow-up.

MR. MENTINK: Yeah, I think I've got several questions. I just don't know how much time I want to take on this. It would be what -- what is Oroville targeting their performance level at for a 100-year or 500-year and how that's going to affect the selection of the Comprehensive Needs Assessment alternative plans.

And, two, I understand what you say about statistical 100-year floods, but factual is something that I can grasp and understand. And, when we get three of those 70-year floods in a 70-year period, you have to question the statistical --

DR. ANDERSON: Well, yeah. What I question is the naming methodology. Really rather unfortunate because a 100-year flood gives you the sense that it only happens once in 100 years. So really unfortunate naming convention there that does cause this exact confusion. I'd love to find a new way to describe that methodology because it is frustrating to all parties involved.

MR. MENTINK: Yeah. You're probably familiar with the Great Flood of 1861 in the -- What's his name? Derringer, from USGS study.

DR. ANDERSON: Yeah.

MR. MENTINK: That that was not a one-off event, that that happens about every 200 years?

DR. ANDERSON: Yeah.

MR. MENTINK: And what would you call that flood? Would you call that a 1-in-1,000 flood when it happened every 200 years?

DR. ANDERSON: I am not quite sure where that flood sits in the statistical distribution. That's actually a topic that gets visited to try and figure out the sizing because we try and piece together that flood from the historical accounts that we have. I know there's some work going on where they found a high-water mark in the American River from that flood from a newspaper photograph and are trying to recreate what might have been to better understand kind of what was happening then.

There are huge challenges when we try and work with historic floods, particularly a flood of record like that. And that's what I would call the 1862 flood is that it's our flood that stands as our one in history that we point to and say that's the one that really was disruptive, and you can go through the history and look at all of the things that it did. But, yeah, like I said, there's a lot of work that goes on to try and figure out how big it was, how it might look if it

happened today, because a lot of the river channels are very different now than they were back then. The American River doesn't join the Sacramento in the same place as it did back then.

MR. MENTINK: Right.

DR. ANDERSON: So a lot of really interesting components to that. Yes, I do get the good fortune of talking with Dr. Dettinger, Dr. Daniel Schlenk down at UCLA to work with him to better understand these elements.

MR. MENTINK: One last comment for Nick. Are we taking the notes of the comments and questions that need later follow-up and put them on, like, a meeting recommendation log like we do at the CAC meeting so that comments from these stakeholders today can be followed up on?

MR. SAFFOLD: Yeah, Matt. That's a great question. We're going to make sure that all of the comments are captured. There's also going to be an official transcript that's going to be posted online so that everyone can see what was said here today. But there will also be a meeting summary, to your point.

MR. MENTINK: Great. I appreciate that. And the thing about hooking up later through email conversations to do one-offs with each other I think was

an excellent suggestion. Thank you.

MR. SAFFOLD: Yeah. Not a problem. Great questions, Matt.

Why don't we turn to Ron Stork with Friends of the River.

MR. PEARCE: Ron, you should be able to unmute yourself.

MR. STORK: There you go. Thank you. Good to see you, Michael.

DR. ANDERSON: Hey, Ron. Good to hear you.

MR. STORK: The -- The reservoir design flood for Oroville was not based on statistical probabilities. It was a -- as you call it, a scenario-based event, in those days called the Standard Project Flood. Actually, it's still called the Standard Project Flood.

DR. ANDERSON: Yeah.

MR. STORK: The interim operations at Oroville, according to John Leahigh -- Both Matt and I were on the DWR ad hoc for Oroville, where we had extensive conversations with the department.

But, anyhow, John -- DWR's John Leahigh said that the interim operations for Oroville was based on, still, the Standard Project Flood as determined back in the '60s, and they accomplished that by having a lower carryover cutoff conservation pool during the flood

control season.

The question that I have for you -- and this is in your world -- is, at least according to correspondence that we've seen with FERC and the department, there appears to be a new estimate for the PMF in the Feather River watershed that, somehow or another, is working its way through the process that may affect, of course, the spillway design flood. But is there -- is the department or FERC or anyone attempting to revise the Standard Project Flood estimate since things have happened in the last 50 years, 60 years, 70 years?

DR. ANDERSON: All right. Well, we work in the Standard Project Flood and the Frequency Based Flood and have those aspects. We work with our good partners at the Corps, and I'm staring at Joe Forbis' little square right now. Hopefully he's -- Yeah, there he is.

MR. STORK: I'm assuming -- I'm assuming, Michael, that the Standard Project Flood still will be a scenario-based --

DR. ANDERSON: It is a -- It is a scenario, again, sized relative to those historical events that shaped the region. And they're based on the information that they have from those floods. And so you have those elements, and you have then the Bulletin 17 framework.

And how those are -- are --

MR. STORK: This is statistical framework now --

DR. ANDERSON: Right, it is a statistical -- Right. You're right there. And, again, I -- I don't fully understand all of the regulatory world, so I will happily defer to Joe to correct me on these points. But different policy guidelines or rules will dictate which facet or way you look at the flood from the particular thing that you mentioned, the PMP and the PMF. Those are used to design and make sure that the structure of the facility itself can safely pass that flood.

As for the others, like I say, I'm going to happily defer to Joe and others at the Corps; that -- that's really more their world that they live in. I just try and help them with how big things are.

MR. STORK: Thanks, Michael. We will no doubt follow up on that question.

DR. ANDERSON: I'm just happy to talk with you, Ron.

MR. SAFFOLD: Joe, I can give you a minute, if you want to jump in here real quickly, but we also have another -- another question as well.

MR. FORBIS: Sure. So, at this point -- Great questions, by the way. At this point, there's not an

intent to update the Standard Project Flood, but there is the plan and the expectation that we will be using that event, plus the other types of events that some of you have already been referencing, whether it's, you know, frequency events like 100, 200 years, or, like, PMFs and -- and approaching it from a more -- like a robustness and sensitivity testing as we're going throughout the FIRO, as well as the water control manual update process.

So we wouldn't be basing any sort of update to operations solely on just one event. It would be a range of events to make sure that the shape of a hydrograph or the -- or in combination with the inflow of volume works in through Oroville's operations in one sense, but with a different shape it struggles more so. It's -- It's with a more risk and uncertainty and robustness and sensitivity approach. It's -- It's going to be more wide-ranging in the analysis than what it was, you know, decades ago.

MR. STORK: So you expect that the department will have a new reservoir design flood, which is a deterministic, scenario-based flood for when it changes from interim -- interim operations to future operations? And does that -- You know, do you expect that the resulting reservoir design flood will be larger or

smaller?

MR. FORBIS: That's a good -- I don't know the answer to the second one, if a specific design flood would be larger or smaller than the Standard Project Flood, but what I can say is that the events using the analysis will be based off the most current information we have available. So was it Ron or Mike or Matt -- I apologize.

There's mention of a new PMF information in the FERC process. They're going through some process with FERC that whatever is the most current information we have, we would want to use that in the analysis to ensure that whatever changes to the water control diagram or the emergency spillway release diagram are using the best and most recent -- the info that we have.

MR. STORK: Thank you. Obviously, that means more conversations ahead.

MR. FORBIS: Absolutely. Yes.

MR. SAFFOLD: Great questions, Ron. And thank you, Joe. Okay. We're going to keep it moving on to our next presentation.

Next up is Rick Poeppelman and Joe Forbis with the U.S. Army Corps of Engineers, and they're going to be presenting to us live.

Do we have Rick?

MR. POEPPELMAN: Yeah, this is Rick. I'm on --
MR. SAFFOLD: Okay. Yeah. Go for it, Rick.
MR. POEPPELMAN: Joe, do you want to lead it off?
MR. FORBIS: Yeah. Absolutely. Thanks, Rick. So Rick might be showing up as Joe Forbis; so, to many people's disappointment, there is two Joe Forbises here. And I'll start off with the talking, and then -- and then Rick will be jumping in and adding stuff in as we go along.
So, first, I wanted to start off and make sure that people were aware of, just real quickly, why the Corps of Engineers is involved with the operations at Oroville. And it's because of the 1944 Flood Control Act where, in the seventh section of that legislation, it talks about how, essentially, the Corps of Engineers --
Back then, they were using different terms, like "Secretary of War." But, essentially, the Corps of Engineers are going to be prescribing the rules as they -- and regulations as it pertains to flood control for reservoirs where flood control is an authorized purpose and federal funds, either partially or wholly, were used for the construction of said reservoir. And so that applies to many reservoirs within the Corps'

portfolio; and, within the Sacramento District, Oroville is one of those.

New Bullards Bar is another example. So that essentially takes the form of a water control plan or the water control manual that describes how the operations should be as it pertains only to flood control.

Next slide, please.

So a couple of examples of how that looks with our partnership and coordination and collaboration with the Department of Water Resources is we oversee flood operations and coordinate and collaborate with the Department of Water Resources on those operations at Oroville. We establish those rules for flood control, updating water control manuals, which I think many of you are aware that that process is underway for both Oroville and New Bullards Bar right now.

And then a fourth thing to highlight is the preparation of deviation packages, which would be temporary modifications to flood control operations, which can be done for many different reasons, maybe to respond to a drought, to respond as a -- as a modification to operations due to construction going on in the watershed. So we're involved in that process as well.

Next slide, please.

MR. POEPPELMAN: Hey, Joe. This is Rick. I just wanted to say, so that situation is not unique to Oroville. There's a number of other reservoirs, whether they're federal regulation by Folsom, where the Corps is also involved in a similar fashion. Then we have our own reservoirs that we own and operate, and they have a water control manual that governs the -- you know, the operation of those projects, too, so -- And at the State --

MR. FORBIS: Right.

MR. POEPPELMAN: -- and reclamation, for instance, are all on board and kind of cooperate in operation of the reservoirs in the system. Over.

MR. FORBIS: Correct. Great -- Great thing to add there, Rick. Yeah. Within the Sacramento District specifically, we have 45 reservoirs that are -- that have water control manuals that are in the states of California, Colorado, and Utah, and Oroville is one of those. So, of those 45, I believe 31 are Section 7 projects, like Oroville, New Bullards Bar, and Folsom are. Shasta is another example that you guys may be familiar with.

Okay. Thanks for that. The next slide, if you could advance it, I think there's another image that

shows up right next to it. Yeah. Great.

So we kind of were talking about a little bit earlier, during Mike's question-and-answer portion about, like, the sizing a reservoir or designing a reservoir as well as when developing, like, the flood operating rules -- the flood control operating rules. They're often connected to the size of a flood event or events that the project is intended to manage. So there's not a set -- at least on the Corps' side, there's not a set, single event that projects, like, have to do because they can vary geographically in watershed behaviorally on -- on what a project is intended to -- how it's intended to function and perform.

So, whether it's a 100-year event, 200-year event, Standard Project Flood, probable maximum flood, something else -- and there's a slew of different ways to characterize flood events. And it's really those types of events that are used to design the -- the reservoir as well as developing the flood control operating rules.

And those things are decided, like, at the beginning, initially through the design process, as, like, within, like, a Corps study process that leads to the project authorization that Congress then authorizes.

Nowadays, that's in the form WRDAs, W-R-D-As. So these oppositions for the long know, and then some -- some now changes would be in the form of changing the operations after construction, where appropriate.

And, in terms of operating a reservoir for flood control, there's multiple, like, components that -- or factors and parameters that are used when developing those rules. Those set of rules, I think I mentioned before, are called or labeled the "water control plan," which is a portion of the water control manual, and those components would lay out or talk about what the flood control space requirements are. And, you can see, on the right side of the slide, what the flood control -- There's a trapezoid there that indicates the space that's allocated for flood control. There's also downstream control points that you want to make sure that you are operating, too, that certain flows or stages aren't exceeded.

Then there's also aspects related to release requirements, where -- whether it's those flows or stages that you're not exceeding, but also random rates that you're not increasing releases too quickly or decreasing releases too quickly. And, definitely, water control plans for different reservoirs of -- have different details within them. But those three tend to

show up in every single one, whether it's Oroville or some other reservoir.

And so the water control plan, again, it's just looking at the flood control operations aspect. Obviously, for multipurpose reservoirs like Oroville, it has other authorized purposes that the -- that need to be met. But the water control manual and the water control plan included in that only specify the regulations as it pertains to flood control. So --

MR. SAFFOLD: Joe?

MR. FORBIS: Yes?

MR. SAFFOLD: Yeah, I just wanted to do a quick time check. We're --

MR. FORBIS: Sure. Sure. Yes. I was going to ask Rick to see if he had anything to add, and then I was going to skip ahead to the last couple of slides.

MR. POEPPELMAN: Yeah, I guess I would just comment on this. So kind of from this diagram you can see kind of where the flood control -- flood control pool sits in relationship to the top of the dam and the lower level outlet. So a majority of the flood -- flood-offs, you know, when we get to large -- large events that we can safely pass through the dam, we're counting on the main spillway, and the main spillway is near the top. Right? So -- So that pool -- And that's

how the pool -- the spillway is designed and how the water control manual, the flood-offs is built around that.

So kind of the -- A lot of similarities to our Folsom Dam, just if you're aware of that. But the main discharge for large flood events comes out of that -- comes out of the spillway -- the gated spillway, and that sits near -- that crest is near the top of the overall reservoir. It's an important -- important point. Over.

MR. FORBIS: Great. Thanks, Rick. Go ahead and go to the next slide, please.

MR. SAFFOLD: So, Joe, let's be concise, we're running pretty low on time now. Sorry.

MR. FORBIS: Okay. No, that's fine. Actually, go to two slides from now, where it shows a map, because we can talk about the same sorts of things on that.

So there's -- Downstream of Oroville, there are a few different spots that are of utmost -- not concern but attention for operating the reservoir. At different points there are different downstream capacities that should not be exceeded, if possible. And so, upstream of the confluence with the Yuba, downstream, that confluence; and then downstream of the confluence with the Bear, have different objective flows that, as you're

balancing the space in the reservoir and the flows in the downstream channels, you are trying to make sure you are passing the -- as much water as possible, with a flood -- during a flood event, without exceeding anything unnecessarily.

And the last slide here is a graphical representation of the water control diagram at Oroville, which has all of those details and space requirements and aspects to the operations that are needed as you go through the decision-making process for determining what flood releases to make.

So I think that's the best I can do, Nick.

Rick, I don't know if there's anything else that you wanted to add real quick since I took up too much time already. But I want to give you the last words there.

MR. POEPPELMAN: Yeah. Just to make sure you connect the dots between the discharge -- the flood control discharge from Oroville and the levee channel system below. Those levees are sized to handle the design discharge, so about 180,000 from Oroville. So the size of those levees, the height is based on that.

And, if you know, there's been a lot of work to strengthen those levees so that there's -- they don't fail before they hit their design -- design flows. So

that's the physical constraints on the capacity and how it's tied back to the Oroville Dam. They have to work together; and FIRO, for instance, is a way to try to maximize the current infrastructure. You can make improvements to the infrastructure, bigger, stronger levees, and it can even affect the discharge out of Oroville at a lower elevation, for instance, that -- that would also help -- help with the passing larger events. Over.

MR. SAFFOLD: Great. Well, thank you. We're going to go to a question that came up. And it looks like it was intended for the first presentation. So we're going to open it up for Patrick Porgans, and it looks like Matt Mentink has a question as well.

Matt, we're just going to hold that question. I'm assuming that's for the U.S. Army Corps; so we'll hold your question, and we'll take that first in the queue during the public comment period.

So, James, if we could open it up to Patrick.

MR. PORGANS: Can you hear me?

MR. SAFFOLD: Yes, we can hear you.

MR. PORGANS: Okay. First of all, I think it's important that the public understands what the Standard Project Flood is, as it's, you know, outlined in the manual. The Standard Project Flood is 440,000 cubic

feet a second coming in, with a 72-hour runoff of 1.5 million acre feet. And the maximum probable rain storm is -- hold on here -- it's 720,000 cfs coming in, and it has a 72-hour runoff of 2.51 million acre feet.

Now, we have never had the Standard Project Flood in Oroville. It just hasn't happened yet. So when you're talking about these downstream channel capacities, that's still weighing, according to the manual, is permitted to push out 250,000 cfs; and as much as 600,000 can be pushed out through that reservoir, according to the manual.

Now, you just mentioned what -- and you didn't go into detail on downstream capacity. The downstream capacities from Oroville are the Achilles heel here. The maximum amount of flow that's come into Oroville was back in 1997, on New Year's Day. It was 302,000 cfs. And reading that significant downstream -- And we exceeded that, you know, the required flow standards that they set here in the manual; 180,000 from the Feather River above the Yuba, and 300,000 below the confluence at the Yuba on the Feather. We were up at that 350,000. So the amount of water that was being pushed out of Oroville back in 1997 was 167,000 cfs without a Standard Project Flood.

So my point is, are we talking about ARkStorms?

And, you know, if we would have had that ARkStorm that we had in October 24th of 20- -- what was it -- 2021, and wet conditions appear in the watershed, we could have had a catastrophe. And I'm concerned about that, and I do not see where --

MR. SAFFOLD: Patrick, thank you.

MR. PORGANS: I'm almost done. It comes to what you guys are dealing with, that real -- that reality. Thank you.

MR. SAFFOLD: Great. Well, thank you for your question, Patrick.

Does anyone want to hop in and quickly make a comment on -- on Patrick -- to Patrick? Otherwise, we can kind of table that potentially and move that to the public comment period. We'll have a little bit more time.

MR. FORBIS: Nick, this is Joe. I think I -- Hopefully I can respond real quick and -- to Patrick. That's a good question.

A couple of things to keep in mind is that most dams, including Oroville, have the ability to release more water than what the downstream capacity is. And their design or the rules are such that that should be happening if there's a concern with -- or the dam safety concerns are exceeding the flood control concerns at the

time. So, if it's a question of Oroville overtopping or something, then that's when releases would be exceeding downstream capacities because you would want larger releases in that sense, more so than a large slug of water coming downstream due to some sort of dam failure. So, yes, the rules will say to go up to releases that high but only in the most extreme circumstances.

And then the other thing is that -- that we're in a better position now than before. It's not just the knowledge of the data and have decades of hydrologic data to look at. But the forecasting skill is so much better than the '60s and '70s that the ability to release water before those inflows actually start occurring at the reservoir is now in play that wouldn't necessarily have been in play 30, 40 years ago. So the ability to respond to something even that sizable is better; and the space being able to be created at Oroville, that skill is better as well. So I'm not saying that it could handle any event that ever comes, but the -- the methodologies and understanding are better today, so that hopefully put us in a better position than we were earlier in the, you know, 20th century.

MR. SAFFOLD: Thanks, Joe. Unfortunately, we're going to have to move on from this section so we

can get all of the presentations in.

Matt Mentink, Ron Stork, and Robert Bateman, I noted that you had your hands up, and we will get to you. We're just going to have to wait until we get to the public comment period where we're going to have a little bit more time. But we'll go into that order that I captured it in terms of hands raised. So thank you.

Okay. James, we're going to need to move to on to John Yarbrough, his presentation from Department of Water Resources.

MR. YARBROUGH: Hi. I'm John Yarbrough. I'm the Assistant Deputy Director for the State Water Project, and I'm going to talk about the role of the Oroville Dam in flood management.

Oroville Dam is able to provide a flood management benefit by being operated such that the reservoir elevation is kept lower during certain times of the year. And, in doing so, this creates some extra space so that if you have large winter flood events coming into the reservoir, that water can be stored behind the dam, and a much reduced amount of flow can be passed downstream. And, in doing so, this greatly reduces the downstream flow rates and therefore the stress on the downstream levee system.

The figure in the upper left shows a picture of

this as the reservoir elevation is reduced, creating this flood space or this flood reservation behind the dam. And the figure downstream shows how this has the effect of buffering this inflow, this very peaky inflow storm event coming into the lake. And, instead of passing the very peaky flow downstream, that peak just captured the water stored behind the dam, with that greatly reduced outflow hydrograph, so much lower cubic feet per second of water being passed downstream and, again, greatly reducing the amount of stress placed on the downstream system.

The size of the flood reservations or how much lower that water elevation is kept, that's determined by the operations of the Oroville facility as they're described in the Oroville Dam Flood Control Manual, prepared by the U.S. Army Corps of Engineers. And that reduction, the size of that flood reservation was designed and set by the Army Corps during the development of the facility, as the Army Corps looked at how much flood control benefit they needed from the reservoirs versus what would be provided from the downstream levee system.

And, in the case of Oroville, the -- that flood spacing, that flood reservation is designed such that a storm with a peak end flow of around 440,000 cfs can be

captured behind the dam, while only 150,000 is passed downstream of the dam. And so this sizing of the flood reservation, this became the basis for the amount of investment the Army Corps made in the Oroville Dam when it was being developed and then constructed. And, again, how these operations occur, the details that create this flood reservation is captured in the Army Corps Flood Control Manual.

This figure shows how this has happened in practice at the Oroville Dam. So, on the far left, see the storm event in 1955? So that had an inflow of 203,000 cfs and resulted in devastating flooding in the Yuba City area and resulted in the loss of 38 lives because of that flood event.

Moving right to the right, we can see, then, again, how the Oroville Dam is designed to operate, what the flood operations are. So taking an inflow of up to 440,000 cfs and storing that extra water in -- behind the dam so that the outflow can be limited down to 150,000 cfs. The operations of the dam are designed such that if there's a storm that produces an inflow larger than 440,000 cfs, this would mean that that empty space has been filled with water, and so additional water coming into the lake will have to be released in order to prevent the dam from being overtopped. And so

that would result in the outflow increasing over that 150,000 cfs because this would be a storm larger than what the flood benefit at Oroville was designed to accommodate.

Looking at the right, we can then see how Oroville Dam has performed over four years in the fairly recent history. So, starting in 1964, you can see the inflow, 250,000 cfs, all the way up to 302,000 -- 302,000 cfs in 1997, and see, then, the blue bars, how those inflows were attenuated down to around the 150,000 cfs amount.

The exact amount being released out of the dam will vary around 150,000, and that really depends on the real-time conditions occurring at each of those storm events and is determined with real close coordination between the DWR reservoir operators, other reservoir operators elsewhere, and then overseen by the Army Corps of Engineers. It's because the facility is designed -- the flood management is designed to -- up to this 440,000 cfs amount, with the outflow being limited to 150,000 cfs, and that's why that 150,000 cfs is what's used in a lot of the downstream planning studies. Because, again, that is the flood benefit that the Oroville facility is designed to provide.

Thank you, and I look forward to answering any

questions you might have.

MR. SAFFOLD: Great. We're running a little bit behind on schedule, so I want to make sure any questions, right now, are specifically around the presentation that John Yarbrough just gave.

So, Matt Mentink, I'll turn it to you. Do you have a question specifically for John?

MR. MENTINK: Yes, I do. Oroville's Dam's role in flood protection. You know, the FIRO operating strategy in which Oroville has joined Yuba River with considers the existing and future reservoir conveyance and structure projects, reflecting the absence of Marysville Dam, which was designed to provide 260,000 acre feet of flood storage. And the FIRO's target goal is to provide a functional equivalent of 260,000 acre feet of flood storage space to protect the downstream communities.

Now, the original plan had Oroville at 200- -- excuse me -- 750,000, Bullards at 170, and Marysville at 260, which was 22 percent of the total flood -- flood control storage space. Of that 260, Bullards just added that we're short, and we're trying to make up 260 through a FIRO-type operation. Bullards is in the process of a second spillway, which is going to meet 44 percent or 87,000 percent of that 260,000 equivalent.

So Oroville's share of that, 66 percent, is still 173,000 acre feet of storage that we need to come up with.

As we look back at the Comprehensive Needs Assessment plans, there was several of those plans that had a recommendation for a low level outlet at 435 feet, which I believe had 20,000 k capacity. In a rough estimate of taking that 20,000 k capacity to meet that 700 -- or that 173,000 would be four-and-a-half days at full capacity. So, when we choose that --

MR. SAFFOLD: Matt, we need to make sure we have time for everyone's questions. Matt, I don't mean to cut you off; but, if you could get to the end of your question so that John can respond, that would be great. Thank you.

MR. MENTINK: Okay. The plan that they're leading to in the Comprehensive Needs Assessment would take four-and-a-half days. Right now, our best forecasting is at three days. There's a lot of guesswork there on when to open up that capacity to meet Oroville's obligation on that other 173,000 of temporary storage.

Another plan that's in there is a gated spillway shoot; that's on five of the plans. But yet, coming out of the Comprehensive Needs Assessment in

their final report, it says that it may be that no further risk reduction is needed beyond the interim plans, and other measures will not be warranted for the near future or even for the foreseeable future, particularly if there are other --

MR. SAFFOLD: Matt --

MR. MENTINK: -- major safety operations needed elsewhere in the facility.

MR. SAFFOLD: Thanks, Matt. Joe --

MR. MENTINK: I think we've got a lot to talk about in the next meeting in June, when we talk about asset management for Oroville's previous role when it comes to flood reduction.

MR. SAFFOLD: I'm going to turn it to John now for a quick response, and then I note -- I'm noting all of the other hands that are raised, and we're just going to have to get through those at the public comment period.

MR. YARBROUGH: I can get off mute there. I guess just a real quick comment -- And there's a lot to unpack there. I think the quick comment would be that the -- what the -- really, the question is, is there additional flood benefit that Oroville should be providing. As Matt noted, Marysville. And so that's really something that DWR would look to the Army Corps

to say, "Hey, there's an additional flood benefit that we really need from your facility," and then that would set up those discussions about what kind of infrastructure is needed for that flood benefit.

Different than the CNA that was looking at -- for dam safety needs or other needs for projects. So those are two different potential reasons why you might add infrastructure. If we're looking at additional flood benefit, that's really -- you know, DWR would be looking for the Army Corps and looking through the water control manual process for identification of, hey, there's an extra flood we need to have provided and then discover -- or work on how to provide that.

MR. SAFFOLD: Great. Thanks, John. Okay. We're going to move to our next presentation from George Wylie with Department of Water Resources. And, again, I'm noting the folks that have their hands raised, and we'll get to you. Thank you.

If we can go to the next presentation, James.

MR. WYLIE: Hello. My name is Wade Wylie. I'm the manager for DWR's Flood Project Inspection and Assessment Section. Our team performs inspections of levees, channels, structures, public plants, and designated floodways throughout the Central Valley. We are also the primary resource for flood fight

specialists in the city, and they provide technical assistance to local maintaining agencies during the flood fight. We also provide high-water safety when necessary, after a high-water event has occurred.

Our staff inspect the state plan of flood control levees, which include those levees downstream of the Oroville Dam. Inspections are done four times a year. DWR inspectors do the spring and fall inspections, and the local maintaining agencies do the winter and summer inspections. The inspectors look for issues that might impact the integrity of the levee or impair the ability of the inspector to see issues along the levees and channels.

They look for and report on erosion sites, accidental levees, animal burrows, slough stability issues, trash and debris, and overgrowth of vegetation. The resulting reports are provided to the local maintaining agencies who are responsible for maintenance. Those same reports are provided to the Central Valley Flood Protection Board and the U.S. Army Corps of Engineers.

We also have an inspection team that is focused on the utilities that go through the levees. These inspectors do external inspections on pipes that penetrate the levees at least once every five years.

During their inspections, they look for breaks or ruptures, severe corrosion, missing or broken closure devices, and leaks that might cause erosion of the levee slopes. Their findings are also provided to the Central Valley Flood Protection Board, the local maintaining agencies, and the U.S. Army Corps of Engineers. Findings are also available to maintaining agencies at any time via our Flood Emergency Response Information Exchange Portal, also known as FERIX.

The Flood Project Inspection and Assessment Section also does an annual review of aerial imagery for the designated floodways. These 31 specifically delineated areas are reviewed for unauthorized encroachments. The inspectors use the aerial imagery to locate things like new buildings, earth and fill sites, debris and garbage piles, orchards, and other items that can have a detrimental impact on the capacity of the floodway. Items that are not permitted are documented and results are provided to the Central Valley Flood Protection Board for further analysis and possible enforcement action. This effort helps to reduce the impact to the capacity of the floodways that unauthorized development can have.

When there is a high-water event within the floodways, there can be impacts to the levees that must

be addressed. To ensure the local maintaining agencies that patrol the levees during high water are prepared for those occasions, DWR teaches flood fight training courses. Our inspectors regularly provide these hands-on courses to local maintaining agency, California Conservation Corps, and CalFire personnel; and that ensures that they have the basic skills needed to perform a flood fight.

When there is a flood fight, we have trained flood fight specialists that are ready at a moment's notice to head out to support the locals that are performing that action. Our specialists can help ensure the flood fight is performed appropriately and offer additional technical support if it's needed. They are also able to assess incidents for advanced flood fight measures.

After a high-water event, it can be important to collect locations and elevations of high-water marks throughout the affected reach of the river. This is especially important if the impacts were greater than what we expected for that event flow. Our inspectors will deploy to a river at the request of DWR modelers to place markers along the high-water line that will later be captured by our survey crews. The survey data will then be used to validate our hydraulic models. Our most

recent surveys were conducted along Cache Creek in 2019 and along the Kings and Feather River in 2017. All of these activities, including inspections, flood fight courses, and high-water staking help to ensure the levees and those that maintain them are ready for the next high-water event.

MR. SAFFOLD: Great. All right. Let's -- Let's have questions specifically for Mr. Wylie and his presentation.

Mr. Stork, I'm going to open it up to you. Hopefully you have a question for Mr. Wylie.

MR. STORK: No, I don't. I have questions for the earlier --

MR. SAFFOLD: Okay. I appreciate that. I'm going to hold your question, then, for the public comment period, and then you can ask your question of whatever expert you'd like.

Let's see -- How about Patrick? Patrick, do you have a question for Mr. Wylie?

MR. PORGANS: Yes. During the 1997 flood event, there was litigation, and the litigation indicated that the -- Mr. Wylie's department failed to properly inspect and ensure the downstream capacities for those channels were up to speed, and that's in the court record. So, you know, these things happen.

MR. SAFFOLD: Mr. Wylie, any response?

MR. WYLIE: Well, I was wondering what the question was there.

MR. PORGANS: The question was very simple. It has to do with, yes, you do hold these inspections. But when, you know, you fail or something fails when you haven't done an adequate inspection, which was in 1997, what happened there?

We had, you know, a levee break. And, when you have these levee breaks, you know, for lack of maintenance, whatever the reason, or too-excessive flows in the river, the DWR doesn't pay for those damages. Those damages are paid for by the public. So that's my question. It happened, but sometimes you don't do anything to ensure the protections, and it's in the court record.

MR. YARBROUGH: Hey, Nick. This is John Yarbrough. And for this one, I think we're really talking about, as we're looking forward, how all of these different pieces come together. And I think, going through, you know, past litigation, just we really don't have the right folks here on this workshop to delve into those topics. So I'm hoping we can really keep our discussion really focused on our current practices and how we're looking forward. Thank you.

MR. PORGANS: Excuse me. One last comment.

MR. SAFFOLD: Patrick, I apologize. We're going to unfortunately have to move on. But I'm going to -- I'm going to take down your information, if that's okay with you, and maybe we can connect with you offline. Or you can have some time during the public comment period, if we have time at the end. Okay. We're going to, unfortunately, have to move on to the next presentation. Thanks again, Mr. Wylie.

Next up is Eric Simmons with FEMA.

MR. SIMMONS: Hello. I'm Eric Simmons, an engineer with the Federal Emergency Management Agency, or FEMA. Today I'm going to highlight a couple of aspects in FEMA's flood map revision process, especially those related to outreach. FEMA creates and revises flood hazard maps to reduce future losses and damage. Flood maps are a foundation of all flood risk management strategies.

Each year, my office starts flood map projects in a few watersheds due to current resources, and the process has evolved to be more interactive under FEMA's risk map program. FEMA floodplain mapping begins with planning and a discovery process to get input from local and state officials. This includes discussions on how FEMA can help communities reduce future damage during

disasters. Watershed is reviewed to determine if there are needs and update -- updated flood map or other flood risk product. Current and historic flood-related data is reviewed to get a picture of local needs and the scope of any needed projects.

A critical component of floodplain mapping is topography. FEMA has provided the most funding nationally for the acquisition of updated topographic data. A technology called LiDAR, or Light Detection and Ranging, is typically used.

The center of this first slide shows a website for the FEMA's National Flood Hazard Layer, or NFHL. The NFHL is a geospatial database containing flood hazard information from digital flood maps. The flood hazard data supports the National Flood Insurance Program and floodplain management in general. One can use this information to better understand your level of flood risk. Contact information for FEMA's map insurance, toll-free call center is provided.

As we've seen on this slide, there are many milestones to update a FEMA flood map. The longest and most involved step is with data and product development. FEMA contracts with consultants to develop new hazard studies. Progress is coordinated regularly with impacted communities, for example, when draft hydrologic

analyses are available, when the hydraulic models are developed, after floodplain mapping is produced, and during a flood risk review week. This gives community officials a chance to provide early feedback on draft mapping. In addition, using the new information allows community officials to identify mitigation measures and communicate about changes in flood hazards.

Preliminary flood maps are formally distributed to community officials and posted publicly through FEMA's website. Several due-process steps follow, including publications in the government journal called the "Federal Register," FEMA letters, local newspaper notices, and a 90-day appeal period.

During this time, communities or the public can submit data to improve the preliminary flood map. After the resolution of any appeal, FEMA sends community officials a letter of final determination six months before the revised flood maps become effective for flood insurance purposes. Revised flood maps are designed to help communities effectively plan to mitigate flood risk. The numerous steps, meetings, and review opportunities allow FEMA and its partners to provide guidance to local officials to help them identify opportunities that work for their community.

The most used layer in FEMA's map products is

the high hazard zone, which is often called the 1-percent annual chance floodplain. FEMA flood maps affect floodplain development criteria and the requirement for flood insurance in that high hazard zone. For all projects, a strong emphasis is placed on community engagement and partnerships. A whole community approach is needed to reduce flood risk and build more sustainable communities. Again, the goal of FEMA floodplain mapping is to increase resilience and reduce future flood losses. Thank you.

MR. SAFFOLD: Okay. Any questions specifically for FEMA, Mr. Eric Simmons? Okay. I'm not seeing any questions in the queue for Mr. Eric Simmons at FEMA. We're going to move on, then, to our next presenter, Dr. Rune Storesund.

And, Dr. Storesund, the floor is yours. Again, reminder: You have 20 minutes and then hopefully five minutes for Q and A.

DR. STORESUND: All right. Thanks. Sorry. I did a personal wellness break, so I just got back to my computer. James, is this the corrected slide set? I know when I looked at the --

MR. PEARCE: This was the one that was given to me last night. Yes.

DR. STORESUND: All right. Cool. All right.

So good morning and greetings to everyone from Berkeley, California. I'm excited to have the opportunity to share with you some concepts and ideas related to safe and reliable flood management. The topic of flood management in the face of climate change turns out to be fairly complex. It requires more than one presentation to explore and understand all of the nuances. The presentation today is intended to provide a very high-level overview and a basic introduction to what I see as untapped resources to help ensure safe and reliable flood management of the future.

Next slide, please.

So a little about me. I have a unique perspective that's systems-based. It looks at the whole life cycle of a system, with consideration of both the physical aspects as well as the human and organizational factors.

My educational background consists of a dual-degree program, where one can choose from any humanities degree at UC Santa Cruz, and they are essentially guaranteed transfer to UC Berkeley, in your choice of engineering disciplines, assuming, of course, you show up and pass your classes at Santa Cruz. I received a BA in Anthropology from UC Santa Cruz and a BS in Engineering from UC Berkeley.

I worked for a little bit, went back to Berkeley, got my master's, worked a little bit more, and then went back and got my Doctorate of Engineering in Civil Systems at UC Berkeley. And today, I'm wearing the hat of Executive Director of UC Berkeley's Center for Catastrophic Risk Management, or CCRM.

Next slide, please.

I have a varied register of disaster research and forensic engineering, and my focus includes the human and organizational factors rather than just focus on the physical aspects. This broad disaster research has identified some cross-cutting phenomena related to the safety and reliability of critical infrastructure systems. While the industry sectors may differ, they all share one common feature: They're managed by people. My goal here today is to share some of these cross-cutting themes with you in hopes of leveraging them to enhance the safety and reliability of flood management throughout California.

Next slide, please.

There are a number of terms I hear people use, and they use them in various ways and contexts.

Extreme events. Well, what really makes these events "extreme"? What's the period of record being considered? What's the confidence interval? To

reliably estimate the 100-year flood, for example, we really need 1,000 years of data.

Risk. Risk is typically comprised of a consequence of failure and associated likelihood of failure. What actual consequences are we talking about, and how are the associated likelihoods of failure evaluated? Far too frequently, these are based on beliefs rather than any sort of reliable information.

"Residual risk" is another loaded term used frequently. What does "residual" mean? Is it a remainder, some small little thing not to be concerned about, or is it referring to all of the things you haven't looked at or thought too much about? If that's the case, is it really residual?

For much of my forensic work, when I look at the conditions that lead to an infrastructure's failure, rarely is the case it was overloaded. The far majority are situations where the systems were in fact underwhelmed. The problem is either we didn't look at something or just believed it wouldn't happen and didn't investigate it further.

Next.

Yeah. My favorite question to ask is, "What is safe?" Typical responses include, "Well, that depends," or, "Huh, that's a good question. I'm not really sure,"

or "I just dealt with a small aspect of the safety," or, "Well, I was told to design for the 100-year event." I find this quite curious because, if we don't know what constitutes "safe," how can we say anything meaningful about safety? I think we need to be more explicit about what "safe" means, and we know how to do this.

Next.

The first tool or strategy I'd like to highlight is that of high-reliability organizations. This concept has been around since the 1980s and is demonstrated in part by organizations who routinely practice proactive risk reduction. They leverage their workforce to be the eyes and the ears, always alert and mindful of potential disasters. A key attribute of HROs is that they have a very clear and explicit concept of what reliability or safety is. This clear and explicit concept empowers the workforce to flag warning signs well in advance of any major disaster.

Next.

Another attribute of high-reliability organizations is a positive and mature safety culture. There was an excellent report published by the National Academies after the Deepwater Horizon incident in the Gulf of Mexico that listed nine attributes. Some of these attributes are having an inquiring attitude,

having an environment of raising concerns, personal accountability, and continuous improvement throughout the organization.

Next slide.

Okay. So how can all of this be helpful? Well, there are really three risk management frameworks at play all at once. The first and foremost, foundational and -- is integrity management. This is one that explicitly defines what is acceptable or, actually, what's unacceptable because it's easier to do this. We know what we want to avoid.

Once you've built out the integrity of the system, you can now leverage your workforce through the "prevention through people" technique. This leverages your workforce, is a risk-reduction resource. Your people have the ability to foresee potential problems while they're still small and manageable. They can prevent small things from escalating to large, catastrophic disasters.

Finally, we all know and are aware of regulation. Regulation should really be a double-check. By its nature, regulation is always going to be largely reactive in nature. The combination of integrity management, prevention through people, and regulation is a powerful trifecta to help ensure safe and reliable

infrastructure.

Next slide.

This gives us the different types of events. For today, my focus will be on those events we've considered to be knowable and preventable. There are techniques to tackle the harder stuff, but I'm going to save that for another day. So, again, today the focus is going to be on the knowable and the preventable.

Next slide.

As I briefly mentioned before, the systems we're talking about are socio-technical systems. They're imagined, designed, constructed, managed, and operated by people. And I think this cartoon does a masterful job of communicating our typical approach to risk management today.

We recognize a potential hazard here, a boulder about to fall on the two individuals at the base of a cliff. Upon recognition of a hazard, there's analysis, debate, and evaluation as to the likelihood of the hazard becoming a real threat. And it's not until the boulder actually starts falling that the two individuals take action and get out of the way.

So, while this is a typical approach, it's not the only approach. For example, the individuals could have scooched a little bit to the left or to the right

so they weren't in direct alignment with the boulder coming down the hill. They could have secured the boulder to the top of the ledge. The point is there are a number of available options, but they didn't do any of them. And this highlights some research that was done back in the 1960s and '70s relative to subjective probabilities.

The graph in the lower left-hand corner -- and I'm not expecting you to be able to read that -- just basically highlights that cognitively, us humans have a hard time differentiating between very rare events and more routine occurrences.

Next slide.

Another strategy or tool we can use is to look at the total costs over the life cycle of the flood management system. I hear a lot of talk about the 100-year and the 200-year events. But, if you ask the question "How much more would you need to pay to get 500- or 1,000-year protection?" the answer, very frequently, is "Huh. That's a good question. I'm not sure." In my opinion, I think this is potentially a missed opportunity.

Next slide.

For example, if you look at the difference in the 24-hour precipitation amounts for the 100-year

event, which is just under seven inches, and the 1,000-year event, which is about eight-and-a-half inches, that's a difference of about one-and-a-half inches. It might be worse in cost calculations to see what future cost from flooding and inundation could be avoided by spending a bit more up front.

Next slide.

Risk is classically defined as PMF times CMF, where PMF is the probability of failure, and these are situations where the demands imposed on the system are greater than the system's capacity to resist them. And CMF are the associated consequences of failure. While this may seem like a very simple and straightforward definition, explicitly delineating what constitutes failure can be very challenging, as well as ensuring consistency in units across the considered consequences, differences between financial consequences, environmental consequences, and knowable and preventable loss of life.

I also note that this definition of risk relies on failure scenarios that can be specified or imagined. By default, this approach is limited to the known universe of failures and omits unknown failure roads. As a result, it should be understood and appreciated that it will only inform us to a subset of risk exposure

rather than the full exposure.

Next slide.

So not only is there vagueness and ambiguity in terms of what failure is, failure also changes with time. This is known as the bathtub curve. You have a higher failure rate in the early stages of a new system; these are referred to as burn-in failures. You then have an extended period of time with more or less constant failure rates. Then, as you approach the end of the service line for the structure, the failure rate starts to increase as a result of wear-out failures. In almost all risk analyses, only one probability of failure of value is given, and this is a problem because it completely neglects the increasing failure rates with wear-out failures and is blind to when the wear-out failures start occurring. This is not safe.

Next slide.

We should also discuss the difference between statistics and probability. As I present these terms here, statistics is focused on the past. These are events that have actually occurred. There's empirical data. Probability, on the other hand, is a forward-looking perspective that uses the past as a guide but also requires judgment to extrapolate occurrence into the future. This concept is especially

important and innovative of merging technologies because there is no existing information or statistics. These events have yet to happen.

Next.

If we look at modeling projections for sea level rise, we can fairly easily see that the estimates for the future are quite different from those in the past. Even the very low estimate for the sea level rise projections are different from the past observations, so we should be prepared that the past is not a perfect predictor of the future. Otherwise, we'll be surprised, which is a bit ironic because it was both knowable and preventable for us to be surprised.

Next slide.

As I've noted before, the current risk approaches rely on the imagination of experts to develop failure scenarios and then estimate their likelihood. That's the substantial basis by which safety is described. The problem -- and I'll represent to you this is a substantial problem -- is that an expert's imagination is limited. You just can't imagine all of the possible failure scenarios.

Does this mean we should not be doing these exercises? No, I'm not saying that at all. What I am saying is we need to do that and more. You need to

cross-check with multiple techniques. If you're evaluating using six different methods from six different perspectives and disciplines and you see convergence, you're probably close to the mark. If all six give you different answers, that should tell you more work is needed. If you rely solely on one technique, you'd never know you had a problem until it's too late. That is not safe.

Next.

Additional uncertainty is injected into the process of all of the life cycle stages just by the limitation of knowledge. Examples of these knowledge limitations include elements listed in this diagram, such as simplifications, incompleteness, ambiguity, and inconsistencies. All of these factors contribute to uncertainty in the safety and reliability of civil works. Many of these factors are omitted from current risk analyses.

Next.

So this is a busy slide, but what I'm trying to show here at the very high level is that we have different ways to deal with different degrees of uncertainty. We should have multiple tools in our toolbox to tackle these different uncertainties with different tools. As I'm sure you've heard before, if

all you have in your toolbox in the hammer -- is a hammer, then everything becomes a nail.

Now, it turns out we don't need to imagine new tools. We just need to pick up some tools that have been cast to the side and include them in our toolbox. High-reliability organizations and organizations with mature, positive safety cultures have capabilities across all four of these boxes.

I recently hosted a workshop at UC Berkeley on safety culture and high-hazard dams and showcased three different other operators across the United States as positive role models in this area. These concepts are not just ideas; they're in practice today.

Next.

Another challenge we face in the climate change context is the lack of crispness in the problem. Climate change is kind of a mess. It's ill-defined with lots of stakeholder disagreements or no clear answers. Very different, and on the opposite side of the spectrum, are exercises. Us engineers love exercises. They're bounded, structured, well-defined, and you can use the existing formulas to find the answer. However, we should be careful to avoid what we call E3 errors, or solving the wrong problem precisely. Sometimes messy problems have messy answers.

Next.

If I overlay the problem crispness onto the different degrees of uncertainty, you'll see that there's -- that where there's a lot of uncertainty, you're often in mess land. Where there's very little uncertainty, you're in exercise world. My point here is that there's a spectrum of situations. If you treat everything like an exercise, you're going to be surprised. This is knowable and preventable.

Next.

To illustrate this with a cartoon, what I typically hear people refer to as "residual risk" is a little bit of vulnerability in a larger universe of known calculated risk. A calculated risk is pretty solid.

Next.

However, there is an underlying layer of vulnerabilities that were believed to be possible but not very credible, so they were discounted and ignored.

Next.

And it turns out the ignored vulnerability set atop a whole set of what I call "unimagined risk," or scenarios not even considered because of a lack of imagination.

Next.

Governor Newsom was at Oroville on Tuesday and commented on a number of these concepts that we talked about this morning. I've included a QR code as well as the URL to his YouTube video of the press conference. What struck me in his talk was the statement, "The fact that this facility shut down last August, that never happened before, just never happened before. It was imagined, but we never thought it would be realized in our lifetime."

I think that stigma nicely illustrates the challenge in front of us. The challenge is not necessarily imagining more scenarios. The challenge is overcoming our belief about the credibility of something occurring. I might suggest, instead of focusing on what we hope will happen, there's an opportunity for us to prepare ourselves for a whole sweep of potential scenarios. This approach builds in resilience and sustainability, embraces integrity management, leverages our workforce to be mindful of potential surprises, and frees us from having to rely solely on the past to guide our future.

Next.

This slide is just a recap of the strategies and tools I briefly talked about this morning. I'm happy to provide more information or detail on any one

of these topics and, honestly, sometimes it's hard to get me to stop talking about them.

Next.

This is just another busy slide. But what I wanted to leave you with is a mapping of the high-reliability organization attributes and how they can be deployed to confront a wide variety of situations, i.e., more tools in the toolbox.

Next.

I'm also actively developing some online tools to widen the imagination within organizations and to leverage their workforce to help brainstorm what I call "scenarios of concern." These scenarios can be aggregated and used to shape future risk workshops, mock emergency drills, and workforce trainings. This resource will be available to all 16 critical infrastructure categories as defined by Homeland Security and will enable organizations to benchmark not just within their own internal organization but across their peer organizations and the same critical infrastructure category, as well as across all of the other critical infrastructure categories as well.

Next.

And, finally, we're working with a number of the groups in the workshop here today to broaden our

imagination by looking at possible elevated release scenarios from Oroville Dam and what potential inundation impacts we may see downstream, so we can better evaluate the need for potential enhanced evacuation protocols and benefit costs associated with increased flood conveyance.

Next.

And I'll end with this example, which is a very real example, and it was a surprise. During the Golden Gate Bridge 50th anniversary, the event organizers closed the bridge to vehicular traffic and anticipated a crowd of about 80,000 people to walk across the bridge. In actuality, we had about 800,000 people show up and cross the bridge, which actually physically stretched the bridge due to the weight of all of the pedestrians. So this leads me to my concluding thought for today: Expect surprises. Thank you.

MR. SAFFOLD: Thank you, Dr. Storesund. Any questions on that presentation? We've got five minutes for Q and A from any attendees.

Okay. It looks like Robert Bateman has a question. Go ahead, Robert.

MR. BATEMAN: My question is what work has been done in the area of high releases from Oroville. And a subsidiary question is, how do the releases measured,

and how the flow is measured. Because there seems to be some ambiguity about what's happened in the past.

DR. STORESUND: Robert, you're asking me questions I don't have answers to. I'll have to defer to one of the State Water Project folks from the department to answer that question.

MR. SAFFOLD: Yeah. John Yarbrough or someone from the DWR side, is that something you want to comment on?

MR. YARBROUGH: Sure. So the question was what -- what studies have -- So DWR has done the inundation studies that are done as part of the Cal OES process, that they become part of the emergency action plan. So that's what's --

MR. BATEMAN: Was that bent on to the question on what work's been done on higher releases in the study of high releases from the 180,000 to whatever. 150,000 is what I think the levees are -- are designed to protect.

MR. YARBROUGH: No. Those are based on the probable maximum flood, and so that goes into the emergency action plan.

And then additionally, at the last OCAP meeting, I think we discussed some of the other inundation study work that had been done, looking at

different releases. Also talked about the different -- oh, what types of events that would lead to a release, looking at some of the different pertinent structures, if those had failures and did releases. So that was what we were talking about at the last OCAP, that range in different -- looking at different facilities and then also looking at different levels of releases out of -- out of the facilities.

MR. BATEMAN: And there are studies showing the results of those?

MR. YARBROUGH: Right. Right. That's what, yeah, produces an inundation map.

MR. BATEMAN: The ones we saw around Oroville were not convincing. The one on -- on 235,000 cubic feet per second, when the inundation shown was less than it was in '97 or '98, whichever it was. And that brings in question about the measurement of the flows in '98 or the accuracy of the map showing 225,000 feet per second.

MR. SAFFOLD: Why don't we take it over to Gary Lippner at DWR.

MR. BATEMAN: Okay.

MR. MIERZWA: Hi. I want to introduce myself. I'm one of the speakers who will be later today, and my name is Mike Mierzwa. I'm a State Floodplain Manager.

It's a good question, Mr. Bateman, and I wanted

to cover that there are five things that we do from the downstream perspective in a real-time basis, as well as a planning basis, kind of leaning into Rune's presentation to monitor sort of both the expected and the unexpected.

The first, we do have the State plan of flood control facility inspections, some of which Mr. Wylie described. There are some other ones. I'm not going to get into the detail right now.

Something we will be talking with the next speaker, so I'm stealing a little bit of Cindy Matthews' thunder from the National Weather Service, is the 24-hour, seven days a week, 365-day river forecast operations. And then Wade talked a little bit about some of the downstream channel capacity assessments.

I will just highlight out there that those documentations are provided to the Central Valley Flood Protection Board, both through the five-year updates in regard to the protection plan I'm talking about, as well as annual reports, so that there are public records as to the capacity of the channels. And then there are a number of activities that we do for the flood management community to prepare for high water events, the most important of which, of course, are where we bring together a lot of the experts you have here today to go

through and provide the exercises that Rune was talking about.

And, in those exercises, there are a class of people called controllers, whose job is to literally go through and throw wild cards out there so that everyone who is running through the exercise prepare both for what they should expect to see and then occasionally something they wouldn't expect to see. And that kind of leads to sort of the last of the foundational activities we do, which is the flood emergency response planning. A little bit of that you'll see in a couple of presenters here, when Liz Bryson speaks to the nature of the flood operation center and how we coordinate in real-time.

Each of those topics can be described in more depth, but I just wanted to let you know that from a real-time basis, there are eyes on the ground at the federal, the state, and the local levels, and coordination between all of those entities before, during, and after flood events. Thank you.

MR. SAFFOLD: Okay. We're going to go to Dave Sarkisian, who has his hand raised also. Dave, if you can be brief.

MR. SARKISIAN: Sure. Thank you. To get to part of the question from Mr. Bateman about controlling

the releases, you know, in Oroville, we've got rating curves for the radial gates. And so our operators, they just need to know the water surface elevation of the lake and the gate opening, and they can set a target release.

Same thing at the diversion dam downstream. And then we have the ability at the Fish Barrier Dam to validate the release going down the river, as well as other points down the river. And so all of that ties together in real term, you know, operations to validate that we're releasing what we want to release.

The other point about our modeling in 2017, with that 100,000 cfs release, there were the high-water mark mapping that was described before conducted, and we've incorporated that into our model to help calibrate the model. And so we feel, you know, pretty confident that all of the results are accurate. You know, they're not going to be perfect in match, but Mother Nature can cause; and, of course, the river is a dynamic system, but all of that being said, we think that we've got a pretty solid model. Thank you.

MR. SAFFOLD: Thank you, David. We're going to have to leave it there and keep rolling in terms of presentations. I see a few hands raised, and we'll get to those later.

Now we're going to turn it over to Cindy Matthews with the National Weather Service.

MS. MATTHEWS: Good day. I am Cindy Matthews, the Senior Service Hydrologist for the National Weather Service Sacramento office, and today I'm going to talk to you about forecasting and notification from the two sister Weather Service offices that cover parts of Yuba County. There are ten Weather Service offices that cover all aspects of weather interfacing with the media, the public, and the emergency managers. You happen to be under the National Weather Service Sacramento office. Our sister office is the California Nevada River Forecast Center, where our hydrologic expertise for California rivers and reservoirs resides in California.

At the Weather Service office, we share weather information through a variety of means. Our partner emails gives a three to five-days outlook for impactful weather that will affect you. It's a great planning purposes tool.

Our watch warning and advisory program is how is the storms are arriving or the event is arriving that we share information with the public. "Watch." "Heads up." "Pay attention." "Be prepared." "Warning, it's here." "It's happening." "Take action immediately to save your life." That's where those emergency alert

system and wireless emergency alert messages come in, and advisories for the nuisance-type flooding. But, if you use your brain, you're not going to get hurt.

When we issue those products out to the public, those go out through some of our traditional long-line services, family of services, things of that sort. But, more and more these days, we see that social media has a better distribution network, so we're on Facebook and Twitter. And the Weather Service has its web page; weather.gov/sacramento. For life-threatening events, we will activate the Emergency Alert System and the Wireless Emergency Alert System on your cell phones. And, of course, those partner emails are invaluable for information coming in.

Our sister office, the California Nevada River Forecast Center, has a much larger geographic domain, but their expertise is a little narrower. They are the hydrologic expertise within the agencies. They deal with mainstem rivers, reservoir inflows, reservoir releases, snow pack, water supply.

The experts at the River Forecast Center are the ones who issue our deterministic river forecasts. More than likely, the graphic on the right-hand portion of this screen is what you have been looking for. And looking at the left-hand five days is what happened on

the river at that location. The right-hand five days, in green and pink, are what we are forecasting to happen and what we think will be happening in the longer term.

So those hydrologic experts sit down every morning; and they look at their observation networks, what happened, how much rain fell overnight, what did the river do. They look at the current conditions in the basin, along with the graphic there. How dry is the soil? How big is the snowpack? Is it melting off? What are the reservoir levels? What are the streamflow levels? Things of those sorts. All of those get ingested into hydrologic models as a starting point for what's going to happen today.

And, to the river forecast center, they look at the forecast. This is where they generate how much rain is going to fall within the next five days, in what time period will it fall. What are the temperatures going to be? What are the freezing levels going to be? If it's going to snow down to 4,000 feet, we are not going to see much in the way of inflows into Oroville Reservoir. But, if the snow level is at 12,000 feet, we will see a much larger inflow into the reservoir.

When that deterministic forecast is issued by the River Forecast Center, it gets sent out in a plethora of ways. Traditionally, the local Weather

Service office is how that gets out to the media, the emergency managers, and to the public. Weather.gov/sacramento is where you will find on the map if there is a flood warning for Feather River at Gridley a shape on the map for where the flooding will be occurring.

Because of our close working relationship with the Department of Water Resources, those deterministic forecasts are shared immediately on the California Data Exchange Center website, under the "River Forecast" tab. And on the right-hand side of the page is the California Nevada River Forecast Center page, cnrfc.noaah.gov. If there is one website you should bookmark and be using for river forecasts, it should be this website.

On that River Forecast Center web page, there is a plethora of information. The right-hand side of the map has a bunch of blue tabs. You should be exploring those blue tabs to find the sort of information that you're needing. Right up top, "Rivers and Reservoirs," that's where you get your deterministic forecast. That's also where you get your probabilistic forecast or your ensemble forecast for forecast points above the reservoirs. You could get your observed precipitation in a picture value there, or how about the forecast precipitation that went into the forecast for

today. Amazing amounts of information. Use that web page.

I do want to point out something new since the pandemic. At the bottom of their front web page, they are posting on a daily basis their daily briefing. It's their thought process and a couple of pictures and graphics of what went into the forecasting of those rivers and reservoirs as things progress.

In addition to our traditional distribution of our weather products, there is a lot that happens behind the scenes that's never seen by the media and the public. We communicate often frequently, and sometimes maybe a little much, without emergency managers, hourly, daily, weekly. We're on the phone with them; we give them videos; we text via private cell phones type stuff. The Weather Service has an experimental INWS, where those emergency managers can get text notifications when we issue warnings so they don't have to go looking for them. They will appear on their cell phones.

When Cal OES's state operation center is activated, the Weather Service has a representative in that EOC to help and share expertise. We can be deployed to County EOCs. We give state and local briefings. And, most importantly, the National Weather Service office is available 24 hours a day, seven days a

week. We're there for response. We are there for recovery for months afterward. We're there for mitigation for months afterward, and we are always eager to participate in exercise and preparedness to get us all ready for the next emergency.

And I am available for questions if you have any.

MR. SAFFOLD: Great. Any questions for -- specifically on that presentation for Cindy Matthews at Weather Service? Okay. It looks like Patrick Porgan.

Patrick, go ahead. You've got one minute to ask your question or make a comment. Thank you.

MR. PORGANS: Thank you. My comment is this: I have a statement here from the Office of Emergency Services during that 1997 flood, and it was Cindy Matthews from the -- her office, talking about it would be an anticipated 400,000 cfs coming into Oroville on the 1st of January, and to expect -- they expect to have releases of 240,000 cfs. But this information was not available to the public. And, when they were supposed to have a meeting down in Marysville about those conditions, right here in this document it says DWR never showed up. I'll provide anyone that wants a copy of this particular report at any time.

MR. SAFFOLD: Cindy, any -- any response?

MS. MATTHEWS: What you are sharing, sir, is an internal conversation that went on based on forecast precipitation and forecast reservoir conditions. In 1997, you know that the precipitation that came from that discussion stalled to the west of the Feather River Basin, and that rain did not appear over the basin, thus the runoff did not. So those conditions never showed up in the Feather River Basins because the weather did not show up and the rain did not.

MR. SAFFOLD: Okay. Any other questions for Cindy Matthews at the National Weather Service? Any other questions?

Okay. We're going to stop right here, and we're going to do -- we'll call it a three-minute health break, since we're running a little bit behind. So we'll meet you all back here in three minutes, so 10:56 by my clock. We'll see you soon.

(Interruption in proceedings.)

MR. SAFFOLD: Thank you.

MS. BRYSON: Good morning. My name is Liz Bryson, manager of the Flood Operations section with the Department of Water Resources Division of Flood Management. My presentation will cover the roles and responsibilities of the state-federal Flood Operations Center and briefly cover some of the work we do during a

high water or flood event.

The Department of Water Resources is the state agency for flood emergency response, and the Flood Operations Center's role is to coordinate DWR's response to flooding statewide. The Flood Operations Center is co-located with the National Weather Service to meet their shared goals of protecting life and property. Flooding can happen at any time of year, so DWR and the National Weather Service coordinate year round, not just when there are forecasted storms. Examples of the types of events that the Flood Operations Center responds to are high water and flooding, large or intense storms, flooding caused by earthquakes and tsunamis, and dam incidents. For dam incidents, the Flood Operations Center's focus is on the potential downstream flooding impacts.

The Flood Operations Center's primary function is to manage DWR's overall flood emergency response, which requires that we maintain year-round readiness. Key items that the Flood Operations Center provides are situational awareness to emergency managers, law enforcement, and government agencies; information to the media and public; technical and direct assistance to support local levee maintaining agencies in counties. Technical assistance is typically providing a flood

fight specialist who evaluate an area of concern and recommend mitigation measures.

And direct assistance is typically providing flood fight materials like sandbags and plastic sheeting for performing mitigation work under our emergency contracting authority. And the key function is coordinating local and county requests for technical and direct emergency assistance from the U.S. Army Corps of Engineers under Public Law 8499. DWR is the only State agency that can make this request. We have a memorandum of understanding in place with the Army Corps of Engineers describing the process and assistance that is provided.

Some important items that the Flood Operations Center does not do are declare emergencies or order evacuations. We don't have the authority to do this, so we leave that up to the locals. Also, the Flood Operations Center does not permanently repair levees. The assistance provided is intended to be a temporary measure to get through the immediate threat of flooding. There are other programs within DWR and the Division of Flood Management that can assist with permanent repairs.

As part of that situational awareness I mentioned, and in joint collaboration with the National Weather Service's California Nevada River Forecast

Center, DWR provides year-round daily forecasts of reservoir inflows, river flows, and water levels throughout California. We also issue river and tide forecasts for over 260 locations in California, parts of Nevada, and parts of Oregon, and the Flood Operations Center uses those forecasts issued by the California Nevada River Forecast Center to inform our partner agencies, the media, and the public of current conditions and potential impacts and also to make operational decisions.

Other users of this information include cooperating agencies like the Army Corps of Engineers, the U.S. Bureau of Reclamation, and Yuba Water Agency; local levee maintaining agencies along the Yuba and Feather Rivers; as well as State and county offices of emergency services, the media, and the public.

The Flood Operations Center also uses this official forecast information to make high water notification calls to our flood emergency response partners, which include local, city, county, state, and federal agencies. These high water notification calls are not evacuation orders but, rather, information that is used by these agencies to make operational decisions and, in some cases, take action.

As mentioned earlier, during a dam emergency,

the Flood Operations Center's focus is on the potential flooding impacts downstream with that dam. This responsibility applies to all dams across the state. The Flood Operations Center notifies and informs downstream emergency response agencies of current conditions and potential impacts, providing assistance and coordination as needed. Again, the Flood Operations Center does not order evacuations, but local agencies use this information to make decisions.

The Flood Operations Center also participates in regular meetings and exercises to improve communication and coordination year round so we are all better prepared to respond during an emergency. We follow the belief that in emergency response, it is better to make a friend before you need a friend.

That is all I have today. Here is the contact information for the Flood Operations Center, as well as links to the California Data Exchange Center and the California Nevada River Forecast Center. Thank you.

MR. SAFFOLD: Great. So we'll go to Q and A now. Any questions for Elizabeth Bryson or her presentation? We'll give it one more minute here. Any questions for Elizabeth Bryson? Okay. Let's keep rolling, then, so we have time during the public comment period for lots of questions and comments.

Next, we're going to go over to Casey Meredith, with the Office of Emergency Services.

MR. MEREDITH: Hello. My name is Casey Meredith. I'm with the California Governor's Office of Emergency Services Dam Safety Planning division, and I'm here today discuss EAPs, or emergency action plans.

The purpose of our program is to review and improve dam owners' EAPs in order to strengthen California's preparedness and planning for dam incidents. In 2017, legislation was passed in the Water Code and the Government Code regarding EAPs. Water Code Section 6160 and 6161 state that dam owners of State-regulated, jurisdictional dams must submit an EAP to Cal OES if a dam is classified as extremely high, high, or significant. Low-hazard dams do not have this requirement.

Each EAP must have an approved Department of Water Resources inundation map. It's now 2022, so all deadlines for EAPs have now passed and must have been submitted to Cal OES. Regarding Cal OES review timelines, we have 60 days to review an initial EAP that is submitted to us. If it's returned for revisions and then submitted back to us, we have 30 days to review that revision. Dam owners must update their EAP at a minimum of every ten years.

Government Code Section 8589.5 says that local public safety agencies must be consulted in the EAP development process. The EAP must adhere to FEMA 64, Federal Guidelines for Dam Safety. There are six elements of an EAP that must be included for approval.

One, our emergency notification flowcharts. Two, our responsibilities as the dam owner and responding agencies and a description of what they are responsible for. Three are activities the dam owner can conduct to prepare for emergencies. Four, each EAP is required to have an inundation map, and these maps are crucial in showing which jurisdictions would be effective in a dam emergency. Five, a description of the response process once a dam safety incident has begun. And, lastly, any additional information should be included in the appendices.

Examples of information for the appendices would include plans for updating and distributing the EAP, forms and log sheets, site-specific concerns, and the California State Warning Center Dam Incident Form. Lastly, every dam owner is required to conduct an EAP notification exercise with local public safety agencies annually.

The purpose of an EAP is to protect lives and reduce property damage. An EAP identifies potential

emergency conditions and hazards for a dam. The EAP should describe how each emergency level applies to that dam and contain information assisting the dam owner during an emergency.

Cal OES requires dam owners to reach out to every jurisdiction who will be affected by a dam incident. At a minimum, for the local level, this is every county and/or city law enforcement, fire department, and OES. At the state and federal level, we require input from National Weather Service, DWR's Division of Dam Safety, the Flood Operations Center, and the Cal OES Warning Center.

This outreach can be done through email, phone calls, group meetings, one-on-one consultations, whatever best fits the requirements for the dam. It is important for dam owners to start the outreach process early, as it is time consuming. It's also good to have the process started to share with the agency so there is something to develop together.

Notification flowcharts are one of the main required elements in an EAP. These charts identify who needs to be contacted in a dam safety emergency, who is doing the contacting, and the best order to conduct the notifications. Sometimes there will be up to four notification flowcharts per dam, based on the emergency

level.

Here is an example of a notification flowchart in our Cal OES example EAP for the fictional Santa Luisa Dam. This chart is in a tree format, and each cell has the individual who will be contacted and a 24-hour contact number. You will notice the dam owner does not have to contact each agency. After they have contacted the Santa Luisa County Sheriff's Department, that agency will make further contact to speed the process along. This is quite common but varies among jurisdictions. No two places are the same.

That concludes my presentation on EAPs. Please let me know if you have any questions.

MR. SAFFOLD: Great. Let's open it up for Q and A for Casey Meredith at OES.

It looks like Ron Stork has his hand raised. Ron, go ahead.

MR. STORK: Hopefully this is a quick question. Are the emergency action plans or the dam safety -- sorry -- the dam failure inundation maps or both -- either or both, are they available to the public? And, if there is some Water Code restriction or Government Code restriction on distribution or availability to the public that was passed in recent legislation, what was the governor's position on that bill that was -- may

have been signed by him?

MR. MEREDITH: Hi. Thank you for the question. I'll let somebody from DWR answer about the inundation maps. But, as far as the EAPs go, some of them are restricted. And it's kind of by the dam owner about what can be released to the public, and an outreach to the dam owner can answer that question. But each dam owner has a different justification for that.

MR. STORK: I think they're widely restricted.

MR. MEREDITH: Yeah.

MR. LIPPNER: Then, on the second question, Ariya has his hand up and will be able to speak on behalf of the department's dam safety purpose. Thank you, Ariya.

MR. BALAKRISHNAN: Thank you. So, in the Division of Safety of Dams, we have as occurred by California Water Code. We published the approved inundation maps on our website. Those are for sunny day inundation map in most of those dams, and sometimes they have floodplain used inundation maps.

Whatever we published, the information we received from the dam owner when they submitted the inundation map, and we publish those after we approve those maps. You can see those maps by going into California Division of Safety of Dams' website and

clicking into "Inundation Maps" tab. That will take you to the maps published on the website.

MR. STORK: Excellent. Thank you.

MR. YARBROUGH: Hey, Nick. This is John Yarbrough. Maybe I'll just add real quickly that our -- Ron, at our last OCAP meeting, we also had a brief discussion on the inundation maps, emergency action plans. And one of the things we talked about at that meeting was the reason why the emergency action plans, why those are not publicly available is they're really made to be an operational document they use in emergencies, so a big part of that is communication. So it has contact information for -- you know, for the sheriffs, for their deputies, for -- you know, all of that direct contact information type of stuff that you really don't want out in the public.

The second reason why the emergency action plans are not made public is if -- if someone was wanting to disrupt the response to an emergency, this would be the game plan for what all of the different agencies will be doing, so that's the second reason why those documents are not -- not made publicly available. But, again, the inundation maps, those are available.

MR. SAFFOLD: All right. Thanks, John.

Mike Mierzwa, let's go to you real quick.

MR. MIERZWA: Thanks. I just wanted to add one thing that was included by Casey's presentation, and Ariya talked about it briefly. But it's a point that Casey's predecessor, Jose Lara, and I often found people didn't understand is the maps that the State releases for dam inundation maps, which include Oroville, are for only State-regulated dams, so federal facilities are not necessarily provided out there. So I just wanted you to know, in this instance you're covered, but not always.

MR. SAFFOLD: Great. Thanks, Mike. Okay.

We're going to turn to Patrick Porgans. It looks like he has a question. Go ahead, Patrick.

MR. PORGANS: Thank you. Yes. I understand that the emergency action plans are not available to the public which, you know, unfortunately, a lot of the times, when there is an emergency taking place, such as the 2017 and the 1997 Flood, people were given only a matter of hours to evacuate.

Now, on that issue with regards to the inundation map that EWR put together was under a sunny day type of scenario. I think people need to look at the USGS inundation map, which is widely different and shows that, you know, with an ARkStorm and the dam intact, that there be 1.5 million people that will be evacuated, 725 billion dollars' worth the assets are in

harm's way, and over 200,000 people are going to have to be permanently located.

DWR is required under FERC to provide information as to what the level of dangers are associated with, whether it be an ARkStorm or that breach, and we don't have that data yet. So I'm going to hold off now because I don't want to take too much time. I do have one more point to make later.

MR. SAFFOLD: Thank you, Patrick. I appreciate that. DWR, any -- any response?

MR. MIERZWA: This is Mike Mierzwa again from the Department of Water Resources. Mike Anderson might be able to help me out here on the old ARkStorm.

I just wanted to point out that there is a new ARkStorm 2 effort that the department is working a partnership with the USGS and other partners to develop the data. But, in the older ARkStorm, one of the issues was the information that was provided was based on composites. This is the standard of practice. It's something that we have also done for our flood risk notification flyers.

We actually look at what we call "composite floodplains." So we stitch together multiple unlikely scenarios, going back to Rune's presentation, to get a maximum area of effect so we can have the greatest

awareness and greatest amount of participation and planning in event of the emergency. But it doesn't necessarily represent what Dr. Storesund would call one of the more likely scenarios. So it's really to exercise us in how we're thinking.

I believe that might be the case for the old ARkStorm, but I -- I could be off, so I'll let Mike correct me if he's here. Over.

DR. ANDERSON: I'm here. Hey, everybody. So the original ARkStorm, we did not have the resources to engage the National Weather Service to run through a forecasting and inundation modeling exercise. Instead, it took a frequency-based approximation; in other words, look at where the constructed storm sat in the frequency world, and then pulled the equivalent or interpolated return period flood maps that were available from the flood mapping program at the time.

So they were -- Our maps that were already available in part because there wasn't the resources to create something new. Working on a really interesting component with the ARkStorm 2.0, in looking at -- Right now, we're working on the scenario of construction, which is the storm scenario. The next step is to look at how that storm scenario manifests in terms of how often.

For that, they are planning to engage Oak Ridge National Laboratory, which has funding from -- The Airforce developed a national scale inundation map. And this will be the first hydraulic analysis that has been done with any ARkStorm scenario, so that will eventually fold in and will build slowly.

Again, there's no defined resourcing for the ARkStorm beyond a very small amount of money that the USGS has offered each year, somewhere in the neighborhood of only $60,000. So we're working with them, looking at opportunities where the State can help the process along. So we've helped with some of the funding from the construction of that storm scenario, both present and a climate change one, which then we'll be able to use in our flood exercises. We will work with Mr. Mierzwa's team there with the floodplain group so that they can learn the tools that Oak Ridge National Lab has at the national scale and see what can be leveraged and brought into the program here at the State scale. So a lot of work going on in that area, and I'm really looking forward to seeing how things can be improved upon past efforts.

MR. SAFFOLD: Great. Thank you, Dr. Anderson.

Okay. We're going to keep it rolling and go to the next presentation from Mike Mierzwa at DWR.

MR. MIERZWA: Hello. My name is Michael Mierzwa, and I am California's State Floodplain Manager. Today I will briefly introduce the general approach we use to make investments to buy down flood risk.

The image you see on this slide is a cover of the 2017 Central Valley Flood Protection Plan. This plan is an example of a large-scale flood risk assessment and investment strategy. I'll talk more about that later.

I will cover four topics today. First, I will share how we buy down risk. Second, I will provide an overview of the Central Valley Flood Protection Plan, a.k.a. "The Plan." Next, I will discuss how the State uses the Central Valley Flood Protection Plan to inform, not decide, future investments. And, finally, I will show one example of a flood risk assessment from the plan.

This U.S. Army Corps of Engineers graphic is a great example of how we can buy down flood risk. The most important takeaway is there is no single action that you can take to reduce risk; in other words, there is no silver bullet. Instead, managing risk involves three components. One, understanding the risk. Two, preparing and planning to manage the risk. And, three, having the capacity to respond when something big or

something unexpected and small happens, a.k.a. managing the residual risk. The basic idea is that it takes a portfolio of actions; and, with each investment in an action, you can only buy down a portion or increment of risk.

The first step is understanding risk, which is shown in red, and you've seen some of that today from the other speakers. This involves extensive mapping, data collection, computer modeling, and economic analysis. I'll talk more about that last part later. Once we have a basic understanding of risk, we then invest in a suite of actions, shown in blue. The Orville Citizen Advisory Commission has featured presentations on reservoir storage operations and using forecasts to inform these operations. I won't repeat that or go into detail on that issue here today.

As a State Floodplain Manager, I am responsible for some of the other actions you see in blue. First, the floodplain management and land use planning aspects. Second, insurance. And, three, on the far right, flood infrastructure development. Most operations and maintenance responsibilities are done at the local level due to the need to have boots on the ground; but there are some exceptions for large scale system features, where DWR has some responsibility here. Finally, the

last step shown in green is managing the residual risk.

Many of the presentations you've seen today focused on collecting and sharing information during emergencies, during after emergencies. My own team is used to help provide, interpret a forecast, and facilitate communications at the federal, state, and local levels. The reason we focus only on response and recovery today is, despite our best intentions, there will always be some level of risk, especially in light of population growth, development in floodplains, and climate change.

Given the same pressures of changing flood risk, the California legislature recognized the need for the State to develop a strategic plan to manage risk. Back in 2008, with the Central Valley flood Protection Act, also known as Senate Bill 5, the law requires that DWR prepare an update that states vision for managing flood risks in California's Central Valley once every five years. The plan covers a land area the size of Florida or England and protects one of the highest net agricultural production regions in the United States.

Over 1600 miles of levees protect over 1.3 million people who live in floodplains, and many more work or depend on these floodplains. The graphic to the right shows the rivers and bypasses of the northern

portion of the plan, including the project levees shown in red, better known as State-funded flood control levees. Discussions about the plan are held monthly at the public Central Valley Flood Protection Board meetings, and local agencies responsible for land use, levee construction, and levee maintenance have been critical to development of this plan.

While the value to the flood management community lies in the discussions made to develop the plan updates, the plan is really a blueprint for how much funding we need at the federal, the state, and the local levels to buy down flood risk. In 2017, the plan estimated that together, we need 17 to 21 billion dollars over the next 30 years. This investment includes funding from the state, federal, and local entities responsible for maintaining and building flood defense systems or flood risk reduction actions, as previously shown in the stair-step risk graphic.

The investment need is also divided into ongoing annual needs and one-time capital investment needs. These numbers help the legislature understand the short-term and long-term needs and abilities of the flood management community to buy down risk. These investment numbers were based on detailed risk assessments.

The graphic you are looking at is an example of one of these risk assessments of life safety analysis, using computer models and approaches developed by the U.S. Army Corps of Engineers and FEMA. My team accounted for extreme events, levee performance, and emergency response, both warning and evacuation, to estimate, on average, how many lives might be lost. My team then simulated the plan recommendations such as levee improvements and better land use planning, to show that by working together, we can reduce the future expected life loss.

The first part of the blue line represents the effectiveness of actions already taken to reduce risks between 2007 and 2017. The second part of the blue line shows that if we do not increase investments, that climate change and development in floodplains will slowly result in increased life safety risk. In contrast, the green line shows that if we continue to increase investments, we can slow the rate that residual risk increases. However, even with aggressive investments, climate change and population growth will still result in an increase in residual risk.

People ask me why can't we change the direction of this trend. The short answer is, we've been investing in the low-cost options. But, with each

five-year update of the plan, it is possible that new approaches of reducing risk might change the trend.

I would like to encourage you to join the monthly discussions related to this plan at the Central Valley Flood Protection Board's public meetings. Thank you.

MR. SAFFOLD: Great. Let's open it up for questions for Mike Mierzwa.

Okay. Patrick Porgan, go for it.

MR. PORGANS: Yes. I was involved in the formulation of that plan, and I had to withdraw my support because there was three primary mitigation measures that could have relieved of the downstream pressures on those levees.

As he indicated in his graph, showing that they were closed, above the Yuba would be at 180,000, with a release of 150,000 at Oroville and 300,000 just above the confluence of the Yuba. The 1997 Flood, the flood flows with the 167,000 coming out of Oroville at -- at the -- above the confluence of the Yuba was close to 200,000. That's almost 200,000 cfs above the 180. And, below the Yuba, it was about 365 to 370,000 cubic feet a second. It overwhelmed the entire Sacramento flood control system, which has the capacity of 600,000 cfs.

What I'm saying here is we needed to have the

bypass system to take some of those flows and pressures off the downstream. They took that out at the last minute. I said make more room at the Oroville reservoir for flood control space, especially in view of the climate changes that we're experiencing. That was the 2017 update. And then I also said to them that we need to remove certain materials that are obstructing flows in the river with other agencies that brought DWR's attention, which it has failed to do. Thank you.

MR. SAFFOLD: Thank you, Patrick.

Mike, do you want to jump in there?

MR. MIERZWA: Yeah, briefly. I want to add to -- I do understand what Patrick is referring to, and one of the things I wanted to point out there is the Central Valley Flood Protection Plan of 2017 set a 30-year horizon. And part of the justification on that is, is when we're going through and calculating what we want to do, we have limited capacity at the federal, the state, and particularly the local level financially and through experts to move into a lot of the large scale construction projects, including the bypasses that he was speaking, which -- which the plan does embrace.

And so we adopted both in the 2012 Flood Plan and carried forth that recommendation from the 2017 plan. They need to go through and develop the capacity

in the downstream reaches of that flood control system for the Sacramento River Basin first. And so if you go conceptually back to my graphic, you will see that we have been focusing on working right now, in the near term, in the Yolo Bypass.

And there has been a lot of success through the partnership that we've had with regional agencies, and I'll mention one name. The Sacramento Area Flood Control Agency has brought Solano, Yolo, and Sacramento Counties to the table to help us in that project. But there will be opportunities through each five-year cycle for us to reassess those channel capacities in a document that we call our State Plan of Flood Control Descriptive Document, and we have a second document called the Flood Systems Status Report Document that account for the performance of the -- the anticipated performance of the levees, as well as the channel capacities, using information coming from Wade's team, and then allow the department's planners to go through and look at what they actually think can be done from both a structural and a nonstructural perspective out there.

So I really do appreciate Patrick listing out the importance that bypasses have. That is the foundational concept of what plain management is,

literally getting the water away from people and also keeping people away from the water, and it does both of those at the same time. So it's something that I just wanted to reassure you, the State hasn't lost vision. Just because it's not in the immediate versions of the plan out there doesn't mean it's something that won't be carried forth in the future.

MR. SAFFOLD: Let's go over to Rune Storesund.

MR. STORESUND: Hey, Mike. Great overview. Is it possible to go back one slide, James?

MR. PEARCE: Yeah.

MR. STORESUND: Mike, I guess what caught my eye -- And I just wanted to get a little more information. The green line at the bottom, from 2017 to 2067, the number there is 22 and then 43. Is that -- That's your anticipated loss of life, 22 people in 2017 and 43 in 2067? Can you talk a little bit more about the assumptions that go into that? That seems to me like one of those knowable, preventable types of things. So, you know, what -- what sort of elements prevent you from getting those numbers down to closer to zero?

MR. MIERZWA: Thanks, Rune. And that's definitely the end goal. That's -- Our desire is to, if not get to zero, definitely get that trend in the green line going down as opposed to slightly up.

So I want to first talk about that 66 and 22. We are seeing that in 2017, we estimated that if we just stopped investments, that we would lose on average 66 lives per year. That number is really scary because it doesn't mean that you're losing just 66 lives per year.

We all know that the major floods have a recurrence period that's roughly about a decade within both the Sacramento and San Joaquin Basins. So that means, about once every ten years, we're having potential for a catastrophic failure with a number much larger than that's averaged down. That drop of 44 lives per year is basically the effectiveness of the coordination programs that Cindy and Liz were talking about through the Weather Service and the Flood Operations Center just to get evacuations and warnings out.

Now, the second half of your question is, is what can we go to change that number from 22 to something lower, not 43, within both the Sacramento and San Joaquin Basins. And those are some of the harder investments that we start getting into, which come, really, into a lot of the floodplain management principals and actions. It's not just about structural fixes and levees, because they aren't always a perfect situation.

Your own graphic showed that over time, just like people, levees get old and they need rehabilitation; and that costs time and money, which tends to be a very difficult political conversation. Whereas, if we go through and start elevating buildings, if we start flood-prepping buildings, if we don't build in some of the greatest risk areas, some of our deeper floodplains, we believe that we can actually change that trend to approach zero.

MR. SAFFOLD: Great. Okay. Why don't we move on to open public comment. And there have been some great questions and comments throughout the day, but I just want to create the last 25 or 30 minutes or so here for public comment and give everyone two minutes, if anyone wants to say something now. So let's just open it up. Any -- Anyone in the queue?

Okay. Back to Patrick. Let's do Patrick, and then we'll go to Mr. Stork.

MR. PORGANS: There's two things. I want to make it clear that I appreciate all of the efforts that have been undertaken thus far by the various agencies involved to reduce the risk of, you know, damages and loss of life.

Have been on that river since 1985, monitoring the operation of Oroville Reservoir during flood season.

EWR has the propensity to store more water in the reservoir during the flood season when it's allowable, and I have all of the documents to substantiate that from the U.S. Army Corps of Engineers.

The second thing I want to make clear is that although the Corps does establish the regulations, once they do that, monitoring and compliance responsibility rests with the Department of Water Resources, as the Department of Water Resources has an inherent conflict of interest. It's a water purveyor. And, at the same time, as it was pointed out earlier, it is involved in providing flood protection.

So, the until we get to the bottom line here -- and the bottom line is that when they cut off the natural bypasses there on the Feather River near the San Marino back bay, that water used to go across the basin, flood the entire base center basin, and even broke a levee on the west side of the Sacramento River. I have all of that data. So what we're talking about here is that until we can find out what the impacts are going to be from the ARkStorm in relationship to the inundation levels we are operating in a vacuum. So we need to get at that, and I mean -- and I'm saying soon. I trust USGS's data more than anyone else's. Thank you.

MR. SAFFOLD: Great. Thank you for your

question. I'm going to go to Mike Mierzwa.

MR. MIERZWA: Just wanted to respond on the second half of your question, which is the perception of the conflict of interest in decision-making on behalf of the State for the Department of Water Resources.

There is another entity that I consider to be very important, particularly within the Central Valley, which is the Central Valley Flood Protection Board. When it comes to the transparency of things related to our data collection as well as our flood risk reduction improvements, that infrastructure I talked about, in the Central Valley, we go through the monthly public meetings of the Central Valley Flood Protection Board, where their number is seven, I believe, governor-appointed board members to provide that oversight of transparency.

The second thing I wanted to point out with respect to the mapping of the floodplains as well as the emergency response coordination, we do have regulations from other federal entities, and those partners are here today. That's FEMA, the Federal Emergency Management Agency. So we're following in a compliance with federal guidelines, as well as laws, when we're going through, and those interactions -- And I'll come back to that in a sec.

And then, of course, the Weather Service. California is the only state where you actually have state employees who are actually issuing those federal forecasts at the large river forecast level, and that is because the State of California and the federal government have an MOU that dates back to the 1955 Flood on the Feather River. Both the federal government and the State recognize the need for collaboration and issuing one unified voice as to what those forecasts are. And the benefit to the people is is that there is a larger pool of resources issuing forecasts within this particular area.

Now, with respect to FEMA, I'm a big champion. FEMA's process is very slow, but Eric talked a little bit about this -- is that in going through and periodically updating the flood inundation maps, they do bring back the local floodplain managers. And there are over 530 communities in the state of California, and FEMA literally provides money from my team to go through and find those interactions. That's another thing that you're not seeing in the pre-event risk assessment planning world is that we wear both a state hat. But then, per our MOU and contract, my team is to really take instructions also from FEMA. Thank you.

MR. SAFFOLD: Okay. We're going to go to

Mr. Stork and then Mr. Bateman. Ron, do you want to go?

MR. STORK: Sure do. I'm not sure if I can keep it to two minutes, but I'll give it a try.

The conversation early on, I think, reflects the failures of the ad hoc group. There are three members of the ad hoc group on this call, at least. We didn't have sufficient time for mutual understanding. We didn't have the relevant conversations that were critical to have. And there were deferred decisions or deferred or, perhaps, unavailable information from the department that caused the ad hoc to -- to fail in some of its goals.

Also, I'd just like to comment that the flood manuals are generally unavailable, and they are helpful in understanding these things. And, also, that lack of access to FIRO development conversations by members of the old ad hoc or members of the interested public makes these conversations difficult, as we're having today, in -- in mutual understanding and relevant conversations.

I want to thank John Yarbrough for clarifying that the reservoir design flood and Standard Project Flood is meant to control or make a regulated release of 150,000 cfs. That's designing for 180,000 cfs at the confluence of the Yuba. But the reservoir design flood,

as it currently exists, does not use the emergency auxiliary spillway in the interim operations, but who knows what they'll be in the future. And the use of the reservoir design flood -- sorry -- the auxiliary spillway is pretty dangerous and causes a lot of disruption of flood operations.

And that -- that status up there is pretty significant with regard to the confidence of the facility in regulating the existing reservoir design flood, though not currently, because the interim operations don't envision the need to use that. So, hopefully, this conversation can move forward and have more time and set aside for deeper conversations. Thank you.

MR. SAFFOLD: Thank you, Ron. Appreciate your comments. I just want to open up space, if anyone from any of the panelists or DWR wants to respond to that.

Okay. Let's move on to Mr. Bateman. Mr. Bateman, go ahead.

MR. BATEMAN: Yes. I got into this in 1997, when our home was evacuated for the second time -- sorry, the first time, and then there was problems which don't get to be fixed in terms of the levees in Oroville. But, it seems to me, everything I've heard suggests -- and everything I've heard today that we are

going to have an emergency of some sort when the water control from Oroville Dam is -- is uncontrolled -- the water coming out of Oroville Dam is uncontrolled. And one of the reasons of that will be maintenance. And as Ron was mentioning, the CNA process had certain shortcomings and has not really gotten -- we do not have a lot of confidence in the results. And Rune Storesund gave a presentation mentioning quite a few of the problems, and certainly those need to be addressed if it can be. It's not just the weather changing. It's the fact that the dam is not being properly maintained over the years. That needs to be addressed.

Secondly, in terms of the opening up the levees and having flood releases, why is -- the Oroville Wildlife Area has not been opened up? There seems to be every reason why it should be, and it's a very inexpensive fix. And the DWR had a report several years ago which showed that it would be highly beneficial, and then nothing has happened. That's my comments.

MR. SAFFOLD: Thank you, Mr. Bateman.

Any response from DWR around the facilities? Go ahead, Mike.

MR. MIERZWA: Yeah. And I'm going to work backwards, and I'll do two of those.

First, SBFCA, the Sutter Butte Flood Control

Agency, has been working with the Department of Water Resources on a project that has been developed on that particular area with the Oroville Wildlife Area Stage Reduction Project, so it is something that has been included in the blueprint of the Central Valley Flood Protection Plan. These things, with experience, sadly take years to go through and conceptualize and move forward. So I appreciate the comment; and I would encourage you to keep bringing it up, put pressure on there.

MR. BATEMAN: Certainly.

MR. MIERZWA: Great. We'll keep the eye on the ball.

The second thing on the maintenance issues, that is a really big hot topic, too, that was covered in the Central Valley Flood Protection Plan series. I'm only going to speak to the levee maintenance issues.

When my team went through in 2017 and worked with local agencies on what funding they have available to go through and provide what maintenance to have and then work with what the current standards are. So what, basically, the state and federal government would expect to go through and do for maintenance, we found that basically, there was a multi-hundred-million-dollar deficiency. And, in the graphic that I provided on the

investment strategy, you will see, in 2017, we estimated that there was an annual need of 300 million dollars per year for both the Sacramento and San Joaquin Basins to provide maintenance.

And, getting back to Rune's question earlier of what are the things that we can do to reduce risk, we need to continue to go through and provide more funding to go through to do other maintenance. Now, with that, I'm happy to say that the administrations and the legislature recognized that. And, after the adoption of the 2017 Central Valley Flood Protection Plan, the State has been successful in increasing funds for maintenance activities. And some of that immediate benefit has already happened. Some of it will be forthcoming in the future through local assistance programs the State will be granting.

And I want to also acknowledge that particularly within your area -- I'm going to give a shout-out to Sutter County -- the communities have been going through and successfully passing increases to their assessments, which means the message of flood risk is well understood within your area of the state. People who have lived there for a long time and experience these floods do understand the importance of maintenance, and we have been seeing, particularly

within your area, that that local cost share definitely has been going up. And that, too, was reflected in our updates for the Central Valley flood Protection Plan.

We provide, every cycle, an estimate of what that funding cost share need is between federal, state, and local. And, when you look at our pie charts out there, you'll see that the state and local shares are getting bigger with each increment. And I'm hoping that over time we can rely on the federal government for more of the first costs, those capital improvements where a lot of the maintenance sits with us, who are closer to keeping everything going at the state and local level. Thank you.

MR. BATEMAN: Can I add a couple of questions?

MR. SAFFOLD: Yes, quickly. Thank you.

MR. BATEMAN: Quickly. The 150,000 cubic feet per second for testing your letters does seem to be a low number, and 180 would probably be better. And even that would probably be low, given the likely probabilities of releases in the future.

And the other thing is that the maintenance of the dam is what I was really -- the infrastructure I was referring to -- And I don't think anyone, even the DWR, thinks that that's been properly done in terms of, say, the spillway gates and -- and other aspects. Everything

seems to be done a bit late. And I suppose that will continue, unless something changes in the way the maintenance budgets are decided. And those, I think, might be controlled by the state water contractors to a large extent. Anyhow, that's a concern a lot of people locally have.

MR. YARBROUGH: Nick, I can offer some thoughts on that latter part there, and I guess I would start by pointing to our next meeting at the OCAP, where we're going to have -- this will be the second time we've done this -- is go through the different maintenance activities, our planned activities at the Oroville Dam facility for the upcoming year. I think that's -- Again, that's the second time we've been doing this.

I think that's an important venue for everyone to participate in and see what these activities are. Because, on the DWR side, we feel very strongly that the facility is absolutely maintained to very high standards. And yet, me just saying that probably doesn't do a lot of folks a lot of good, so that's why we allocate that time and we bring in the folks that can really talk in more detail about those activities so that, you know, folks in the public can understand why -- why I feel this way, that the facility is maintained to very high standards.

So, to summarize there, I would encourage everyone to join us for our next Oroville Citizens Advisory Committee meeting where we delve deeper into this topic.

MR. SAFFOLD: Thanks, John. And I can say that currently, July 29th is the scheduled date for that, and more information will be posted online closer to that meeting date in terms of agenda.

Okay. Let's go to Matt Mentink. Matt, go for it.

MR. MENTINK: Yeah. Thank you. I want to start by thanking DWR for this meeting today. I think it was an action-packed three hours. It felt like it could have gone longer with the amount of questions that were out there. I want to thank all of the subject matter experts for your time, for showing up -- without you, we'd really be in the dark on our safety down here in the downstream communities -- and to the stakeholders for taking their time.

One thing that I think is important is, is the amount of information that was thrown out there today was all captured in an audio recording. And, although you've already committed to putting the pre-recorded presentations on the website, I think it's important that this audio recording -- all of the questions from

Patrick and from Ron and Robert and everybody -- should be captured. And, earlier in the meeting, we committed to capturing all of those things into, like, a recommendation log so that it could be followed up. That, I think we should continue to do as well.

As far as attendance of this, I think we can greatly improve that by having an email address for those stakeholders downstream who want to attend the next meetings, that they can do so by signing up to be email notified to participate in these. Because I don't -- I can't see from my end what the attendance was down here.

And then on the procedural end of it, it might be beneficial to everybody involved, more efficient, is if we break into subgroups around three or four different topics where the stakeholders can choose which subtopics they want to jump in with those three subject matter experts and then spend a couple of hours doing that, where you just have a few people talking to a few people, with a lot more opportunity to make it a workshop, "workshop" meaning two-way communication. And we can, maybe, get as much of that two-minute communication on the, quote, "technical things" that this meeting was built to be. So those are all procedural things that I think we should take and use

the next time we have one of these meetings.

The one question that I do have, though, or comment that I do have, goes to the Army Corps of Engineer regarding the development of a new water control manual.

You know, it has to adhere to Code ER 11102-2-224, which reads that effective public information programs will be developed and maintained so as to inform and educate the public regarding Army Corps of Engineers water control manual activities. Public involvement in the development or significant revisions of water control plans, as well as certain deviations from the control plans, is required under this regulation. Documents should be prepared that explain the recommended water control plans or changes and deviations, technical informations, and it should describe a description of the plan's impact.

In this case, what they're doing is estimated annual damage reports for the different FIRO plans that are going on, which directly affect the public. And so my question is, you know, with all of this going on, the estimated damage with the alternative plans -- We're halfway through the process -- the three-year process, and the public hasn't been invited in yet. You know, we're selecting the matrix in which we measure it,

nominate, and formulate alternative plans. We conduct studies. We simulate performances. And --

MR. SAFFOLD: Matt, we're going to need to wrap it up, unfortunately. But --

MR. MENTINK: Yeah. If I can get a response from the Army on when the public will be going into the process under this recommendation.

MR. FORBIS: Yes. I'll be happy to answer that, Matt. Great question. Because one of the unique situations here in the Yuba Feather is that we have a water control manual update process underway that is concurrent and similar but still separate from the FIRO R&D project that's going on in the watersheds.

And so the FIRO-specific document, that's them looking into the more R&D aspect of it, like looking into improving forecasts and having a goal, but not necessarily like an authorized purpose tied to functional equivalent to the Marysville Dam. That is not part of the water control manual update process. Those are obviously considerable overlaps. So, for the FIRO effort, there -- with it being R&D in nature, it is not -- it doesn't have the same sort of public involvement that the water control manual update process does.

And you are correct to expect public

involvement as part of that official Corps of Engineers process. There's -- Later on, towards the end of the summer, we're expecting to have sort of a public information meeting to discuss exactly what you're talking about, and that's separate than the required NEPA process public involvement that is also going to be included in the water control manual update process. So there's going to be a couple of different initiatives or steps in the process that is going to absolutely require public engagement. We just haven't gotten to those steps yet.

MR. SAFFOLD: Thanks, Joe. Yeah. And that, I would just say in terms of your first part of your question or comment, we're always looking at ways to be more transparent and more engaging with the community, and we'll absolutely take this under consideration.

We are getting pretty close to noon here. I just want to give Ron Stork one last chance to make a comment, and then I think we're going to turn it over to Gary Lippner to close out the meeting.

Go ahead, Ron.

MR. STORK: Just to answer Robert's comments really quickly, the major issues that have troubled the basin since the construction of the levees and Oroville Dam, and for that matter, New Bullards, have been design

and construction problems, not maintenance problems. So, essentially, was the underlying system design reliable? And experience has proven that it was not, and they're at the major upgrades to the levee systems to begin to address that the lack of emergency spillway. A complete emergency spillway at Oroville has not yet been addressed and apparently deferred indefinitely by the department.

MR. SAFFOLD: Okay. Thank you for your comment. Does anyone else want to respond to that?

Go ahead, Mike.

MR. MIERZWA: I'm only going to, of course, speak towards the levees, the downstream flood system out there.

You know, Ron, you're correct. It definitely -- I want to hark back to what Rune was talking about out there is, you know, sometimes there has been what we might consider a little bit of a failure of imagination. But, in this case, it's understandable in that the levees that were really inherited, that we're basically managing out here, were originally mounted -- mounds of dirt that were pulled together when the original system was constructed. Over time, they have been incrementally improved.

But our thoughts as to the processes that

basically put the communities behind these levees and the other assets at risk has evolved and as our understanding has, as we've had, unfortunately, failures both here in California and elsewhere in the United States and the world. But your point is well taken out there. It's that it's not likely to be an overtopping failure but something else that has "I got you."

And the last thing I want to put out there is that really reinforces the importance, not only the planning inspections, but allowing to have some research and development, which is something Joe was talking about for the forecasting and what they're doing. And, you know, we probably could do a better job of advocating for, you know, just general levee safety. But, typically, the State has relied on the federal government to go through and kind of be that point of the spearhead as to what are the future issues that we might have out there. So I think we can add our voice to theirs and allow them to have the resources to go through and look at that.

But it's a great point, Ron. Over.

MR. SAFFOLD: Great. Mr. Gary Lippner is available to close us out. Gary, I'll turn it over to you, and I appreciate your final thoughts here.

MR. LIPPNER: Yeah, you bet. Thank you, Nick.

And thank you, everyone, for participating.

A few action items that, you know, I clearly heard and want to make sure we follow up on. There was just rich discussions from our subject matter experts, as well as great questions from the stakeholders. So I just want to make sure everyone knows, and we have a commitment that we will be reviewing the transcripts of this workshop and identify any follow-up actions, and we will continue to work with Nick Saffold on those actions to capture those responses and integrate into future Oroville Citizen Advisory Commission meetings. There's definitely some follow-up we need to do there.

And, most importantly, I just want to say thank you to all of the presenters, the panelists, and all of the stakeholder comments for participating in today's flood safety stakeholder technical workshop. I feel very good. It was packed tight. This was a very valuable three hours for me to hear all of the different aspects, to hear comments from the stakeholders, and to just advance our knowledge of our public safety system and how we work together. The one thing I certainly want to make a point on, too, is to encourage all of you to participate in Central Valley Flood Protection Board meetings and the associated Feather River Regional Management Plan meetings that help inform the flood

management decisions and efforts.

The public draft of the Central Valley Flood Protection Plan update 2022 was just released yesterday. So it's really an opportune time to tune in if you haven't, re-engage with the update '22 Central Valley Flood Protection Plan, and to be able to comment on the plan that is really the blueprint of flood management -- the State's blueprint of flood management in the Central Valley, moving forward. So I just certainly want to encourage all to participate in those board meetings and comment on our update '22 -- update 2022 that was just released yesterday, the public draft.

And, in closing, just as a reminder, a workshop summary will be presented at the next Oroville Citizens Advisory Commission meeting that is now scheduled for July 29th. Our hope is that the meeting will be able to be held in person. And, again, the transcript from this meeting will be posted to the Oroville Citizens Advisory Commission website, and we will follow up on action items with the transcript.

So, with that, thank you all again and -- for joining today and all of the participation. Thank you.

MR. SAFFOLD: Thank you, Gary. Thanks, everyone.

(Proceedings adjourned at 11:58 A.M.)

CERTIFICATE OF REPORTER

I, the undersigned Certified Shorthand Reporter, holding a valid and current license issued by the State of California, do hereby certify:

That said proceedings were taken down by me in shorthand at the time and place therein set forth and thereafter transcribed under my direction and supervision.

I further certify that I am neither counsel for nor related to any party to said action nor in any way interested in the outcome thereof.

The dismantling, unsealing, or unbinding of the original transcript will render the Reporter's certificate null and void.

IN WITNESS WHEREOF, I have subscribed my name on this date: May 9, 2022.

Anne Bryant
Certified Shorthand Reporter
No. 13516

B

C

S

T

Y