MINUTES OF THE BOARD OF CHURCHILL COUNTY COMMISSIONERS

155 N. Taylor St., Fallon, NV 89406
February 12, 2018

Call to Order:

The regular meeting of the Board of County Commissioners was called to order at 5:30 PM on February 12, 2018.

PRESENT:	Churchill County Chairman H. Peter Olsen, Jr.
	Churchill County Commissioner Carl Erquiaga
	Churchill County Commissioner Harry Scharmann
	Lyon County Chairman Bob Hastings
	Lyon County Commissioner Don Alt
	Lyon County Commissioner Ken Gray
	Lyon County Commissioner Greg Hunewill
	Lyon County Commissioner Joe Mortensen
	Churchill County Manager Eleanor Lockwood
	Deputy Clerk of the Board Pamela D. Moore
	Chris Mahannah, Mahannah & Associates
	Supervisory Hydrologist Kip Allander, USGS
	State Engineer Jason King
	Deputy Administrator Kelvin Hickenbottom
	Lyon County Utilities Director Mike Workman
ABSENT:	Clerk/Treasurer Kelly G. Helton

Pledge of Allegiance:

The Pledge of Allegiance was recited by the board and public.

Public Comment:

Chairman Olsen asked if there was any public comment but there was none.

Verification of the Posting of the Agenda:

It was verified by Pamela D. Moore, Deputy Clerk of the Board, that the Agenda for this meeting was posted on the 6th day of February, 2018 between the hours of 1:00 and 5:00 PM at all of the locations listed on the Agenda, in accordance with NRS 241.

Consideration and possible action re: Review and adoption of Agenda as submitted or revised:

Commissioner Carl Erquiaga made a motion to approve the Agenda as submitted. Commissioner Harry Scharmann seconded the motion, which carried by unanimous vote.

Appointments:

Consideration and possible action re: Presentations and discussion on the Carson River upstream and downstream water issues and concerns to include:

1. Introduction, downstream perspective, 'Capture' basic concepts, concerns upstream of Lahontan, additional demands from growth, over appropriated basins upstream, *Chris Mahannah, Mahannah and Associates*

2. Groundwater Hydrology & Capture 101 and summary of USGS existing and ongoing studies upstream of Lahontan and potential impacts; DRI/USGS Humboldt River Capture model, *Kip Alexander, USGS*

3. Summary of applicable Legislative changes pertinent to a downstream perspective; summary of Humboldt River capture modeling & anticipated conjunctive use management, *Jason King, State Engineer, DWR*

4. Lyon County perspective; issues and challenges meeting demand and not impacting existing surface rights; Churchill Valley growth challenges, *Mike Workman, Lyon County*

5. Q&A round-table discussion

Chairman Olsen said he wanted to open the meeting tonight with appreciation to staff here at Churchill County, including County Manager Lockwood, Julie Guerrero, Pam Moore, and all of the others who helped facilitate this meeting, as well as Chris Mahannah who helped gather up all of the experts. I also want to thank the Lyon County Commissioners for taking the time out of their busy schedules to come here today and meet with us on this very important matter. I think everybody recognizes that growth has come to northern Nevada again and we are all concerned about that and we would like to make sure that the most precious asset that we have - water - is handled in an efficient and fair way. All of us have probably spent enough money and time in the courts and with lawyers. I would really like to see us do this in a manner where we sit down and go through and really understand the problems and try to work through those problems together as leaders in our communities, rather than leaving it to the courts to decide. With that as an opening, I think I will toss it over to Chris.

Chris Mahannah said I will give an opening presentation overview. I want to thank Commissioner Olsen for coming up with this idea. I think it's great to get everyone together to talk about water and thank you to the Lyon County Commissioners for attending. I am a water resource consultant civil engineer. I have practiced in water resources/water rights for 37 years and have made a practice in rural water resources. I have represented a number of entities in the lower watershed, Churchill County, TCID, and the U.S. Fish and Wildlife Service on the Truckee and Carson, as well as Pershing County on the lower Humboldt. Commissioner Olsen

asked me to organize a panel and I'm fortunate that we got some really high-level speakers. I will give a quick overview. Kip Allander, who is with the USGS, is a Supervisory Hydrologist and he will be giving a talk following mine on groundwater hydrology, groundwater 101, summaries of studies that the USGS has done on the Carson River watershed, and then talk a little bit about their efforts in the Humboldt River capture and the groundwater model that they're working on. With Kip is Dave Berger, the Chief of the USGS in Carson City. Dave and I met back in the mid-80s when I did an internship with the USGS. Jason King and his staff, Kelvin Hickenbottom, will be giving a presentation. We are honored to have Jason and his staff here to answer any questions and add their insight on the topic, although they may deviate and talk about legislative changes in the last session and, again, the State Engineer's efforts on the Humboldt River in their capture model and how they may address conjunctive use going forward. We also have Mike Workman, who I'm sure you all know, who is the Lyon County Utilities Director. Mike and I have worked on opposite sides and together on various water cases over the years. So, we are pleased to have these folks. I will do the introduction, Kip will go, and then we will have a brief break for dinner, and then follow up with Jason and Mike.

Mr. Mahannah said I would like to set the tone of the downstream perspective. Churchill County is, obviously, on the lower end of the Truckee and Carson Rivers. They are totally reliant on the surface water flows of the Truckee and Carson. The natural groundwater recharge to the Lahontan Valley is pretty much negligible. The objectives tonight are just to create an open forum to discuss upstream and downstream water issues and to gain a better understanding of the science and positions of the respective parties, water rights, administration, and, hopefully, avoid or minimize conflicts going forward. This is a slide I've used many times. I attended a water law conference in Boulder Colorado, probably 25 years ago, when Sandy McDougal was an attorney and attorneys tend to like to simplify things. He put this slide out and it sets the tone for some of what we will be talking about: "Wells take water…all groundwater originates as surface water…it's just a matter of timing." I stole this next slide from Jason. He gave a talk at the water summit the week before last and some of you were in attendance at that. Things that keep Jason up at night include: 1) severely over-appropriated basins; 2) domestic wells; 3) conjunctive management; and 4) mitigation of impacts to avoid conflicts. Jason has assured me that before he retires he is going to solve all of these issues so that he can sleep well in his retirement. The following slide was a quick summary of the basins upstream of Lahontan Reservoir starting at the upper end in the Carson Valley, including the estimated perennial yield by the USGS, the rights that the State Engineer has committed, which are underground rights, and then the percent that it is over-appropriated. You can see that every basin, from Carson, Eagle, Dayton, all the way down to Churchill Valley is over-appropriated on paper. In other words, the State Engineer has issued more water rights than is estimated to be recharged in each of those basins. The standout culprit here is Churchill Valley, which is immediately upstream of Lahontan Reservoir, which is almost 600% over-appropriated. The total for the entire watershed is a little over 200%. Granted, the devil is in the details. A lot of these committed rights aren't in use at the present time but could be. This also doesn't account for secondary recharge from septic tanks and that sort of thing. It just gives you a perspective of one of Jason's concerns. This is not unique to the Carson River watershed. It has happened in many hydrographic basins in the state and they will probably explain why that has come to be.

Looking at the spatial distribution throughout the watershed of all active underground water

rights, this next slide is a map of the individual basins within the Carson watershed and the blue dots are permitted underground water rights, the points of diversion. This is just a database from the State Engineer that I did about a week ago. If you overlaid domestic wells on top of that, the next map shows what it looks like and you can see that there is a large concentration of domestic wells in Churchill Valley adjacent to Lahontan Reservoir. There is also a large concentration along the entire river corridor.

Mr. Mahannah displayed a pamphlet bulletin that the USGS published several years ago and some of the figures that I will present come from this document. I have extra copies here that I would like to get rid of if anybody would like to take a copy home. It's a very easily understandable document on what groundwater capture is. We will jump into that here in a second and I am sure Kip will correct me if I make any mistakes here. I am just going to touch on this briefly because I am sure Kip will go into this. He displayed a hydrograph of surface flows of a river where you have cubic feet per second. This could be any stream versus time. You can see these little jumps here. He showed what would be the total flow and then the black line that would be what is referred to as base flow. There is groundwater contribution that contributes to the stream flow, so this would be flows later in the summer and the fall. Whereas, these jumps would be either from storm events/surface water runoff, snow melt, reservoir releases, etc. This is a demonstration of the connection between groundwater and surface water and we will talk about that a little later related to how the State Engineer has historically dealt with groundwater and surface water in various rulings. The next slide was a hydrograph of some water levels and the Carson River stage of a couple wells here in the Lahontan Valley. I presented this slide last week to the Churchill County Commissioners. If there are still folks that are in doubt of the connection between groundwater and surface water, this slide should, hopefully, convince them otherwise. It's a plot of water level versus time for the Carson River stage, just west of town, and then 2 wells that are roughly 200-250 feet from the river. You can see this is the flood last year and you can see almost very close tracking of water levels in the wells adjacent to the river and the stage of the river. I am sure Kip will go into this in a lot more detail but the next slide relates to the idea of capture in the capture model that USGS is working on with the Humboldt and they also have one for the Carson River, as well. This is a plot of the fraction of the pumping rate versus time. When you first turn on a well, 100% of that water is coming from storage or from the pore spaces in between the aquifer material. As you pump the well, in time, the amount that comes from storage decreases and then the amount that comes from this term "capture" increases. The shape of these curves is dependent on aquifer parameters and then the distance from the well to the river. The capture could be increased inflow from surface water or decreased outflow to surface water or reduction in evapotranspiration. Let's look at these in a more pictorial fashion, which might be a little easier to understand. This is a cross-section of an aquifer and a stream. In this case, you have a pumped well, a cone of depression that is drawing water from the stream to the well. That would be one source of capture. Another would be a gaining stretch of the river where you have a water table that is higher than the stage of the river, the well is pumping, and you are intercepting groundwater that would have contributed to that base flow that I talked about earlier. The third source of capture is when you pump and you lower the water table and you reduce the amount of evapotranspiration. Those are the sources of capture, which I am sure Kip will go into in a little bit more detail.

Mr. Mahannah displayed a few quotes from USGS scientists that he wanted to highlight. "The idea of safe yield…in which the size of a development if it is less than or equal to the recharge is considered to be 'safe' is fallacious." "Often streams are depleted long before the pumping reaches the magnitude of recharge." "Despite being discredited repeatedly in the literature, safe yield continues to be used as the basis of…water-management policies, leading to continued ground-water depletion, stream dewatering, and loss of wetland and riparian ecosystems." "…if pumping equals recharge, eventually streams, marshes, and springs dry up." "Equilibrium is reached only by an increase in recharge (induced recharge), a decrease in natural discharge, or a combination of the two." Putting all of those together, this is the slide I borrowed from the USGS: "Because of the connection between ground-water and surface-water systems, the amount of pumping allowed without adverse consequences has little to do with annual recharge." If you go back to that original table where I showed you the perennial yield of each basin and then what prior State Engineers have allocated, even if those were brought back into balance, it would still not address impacts of groundwater pumping on surface water. That is the subject of the litigation on the Humboldt River right now. Jason may or may not be able to address some of that because it is in litigation. The Pershing County Conservation District has filed suit. One of their points is that all of the basins upstream of Rye Patch Reservoir are over-appropriated and they need to be brought back in balance. Even if that was done, it would not solve the capture issue, unfortunately. I am going to put up a couple of rulings. In fairness to Jason, none of these were Jason's rulings. This is a ruling less than 20 years ago on the Truckee River of applications that Churchill County protested, the Pyramid Lake Tribe protested, and, at the time, this was their position:

- "…subsurface flow under the Truckee River is not part of water decreed pursuant to the Orr Ditch Decree, but is part of those waters counted as perennial yield of the groundwater system.
- Many stream systems have some hydrologic connection to groundwater, based on the very fact that it starts by water falling on the surface of the land, in Nevada, the underground water and surface water have been managed under different statutory schemes for more than half a century. To change the policy set forth in that statutory scheme at this late date would upset the entire history of Nevada water law and would not be prudent."

This is the tone of many of the State Engineer's prior rulings. They have administered groundwater and surface water relatively separately. It hasn't always been the case. It is dependent on the State Engineer and their positions but because of operating this way for 50-60 years, groundwater didn't really start becoming developed until the 60s and 70s but we have dug ourselves a pretty big hole. As Jason says, that is one of the things that keeps him up at night and trying to figure out how to rectify that. In other Western states, they have attempted to address that. Some of them are a little further ahead than we are. It is a huge issue that Jason and his staff are trying to wrap their arms around. Rewinding the clock for 20 years prior to that, this is a different State Engineer with a different philosophy. This involved change applications in Dayton Valley where they: "…denied on the grounds that additional withdrawal of groundwater in close proximity to the Carson River, and in the concentrated well area north of the Carson River, would conflict with existing rights and be detrimental to the public interest." That was in 1980. His next slide is a picture that I'm sure many have seen and I am going to wrap up with a

couple quick stories. Unfortunately, this picture depicts how water has been discussed. I have personally looked down the wrong end of the 30.06 measuring water. My dad, in the 70s when he was working on the Alpine Decree in Carson Valley, was chest deep in water measuring and the rancher came out and asked him what he was doing and he attempted to explain that he was measuring water to divide up water pursuant to the Alpine Decree, which hadn't been entered into yet. This old-timer, who was pointing a 12 gauge shotgun at them, told him this was how they divided water up out here. Water can be a contentious issue. I think most of the Lyon County Commissioners have come online since about 10 to 12 years ago when Churchill County and the Tribe were protesting groundwater applications up in the Dayton/Lyon County area. It was a rather contentious time. Rusty Jardine is here and he remembers that on some of these very issues. Mike Workman and I worked together through that and it's a challenging issue. We've also worked cooperatively with Lyon County. There was the TRI General Improvement District who acquired a large number of Carson Division surface water rights below Lahontan Reservoir and they attempted to move those water rights out of the Newlands Project and split that joint right between the Truckee and Carson by diverting water through an induction well on the Truckee and another induction well adjacent to Lahontan Reservoir. We mounted a protest to those applications and they were joined by Lyon County, Pyramid Lake Paiute Shoshone Tribe, and multiple other entities and, fortunately, the applicant realized that that was not a prudent thing to do and withdrew the applications. Those water rights were purchased back by the U.S. and Fish and Wildlife Service. With that, I will close and turn it over to Kip to give us a little more on the science and to update us on their studies on the Carson.

Kip Allander, Supervisory Hydrologist, Nevada Water Science Center, had a PowerPoint presentation and thanked Chris. He also thanked the boards for this invitation to come speak to both Commissioner bodies. He also thanked the public, who were residents from Churchill and Lyon Counties. It is my pleasure to give these presentations. For the next 40-45 minutes or so, I have three presentations I'm going to give as Chris introduced. The first one is going to expand on some of the concepts that Chris introduced to put everybody at the same base level of understanding about groundwater hydrology and some of the principles of capture. Some of these slides will go from really simple concepts to fairly difficult concepts. We like to do this because it really just helps to set the stage and give everybody a base level understanding to work from. I like to call this one Groundwater Hydrology and Principles of Capture. The concepts that I will cover will start from really basic:

- What is groundwater?
- Groundwater and surface water, how are these connected or related?
- Where does water come from when a well is pumped?
- What is capture and how does it work?
- What are groundwater models and why are they useful for estimating capture?

I will conclude this section by talking about a complex tool that we typically use called groundwater flow models. I will talk about why we use them and how they are useful for helping us to estimate capture and a little bit about how we work with those models. What is groundwater? I think most people have this understanding - it is the liquid water in the ground

beneath the subsurface. It really is that water that occupies the spaces between the sand grains, between the gravel, and sometimes it's really tight formations like silt. This is the typical type of systems we have in the Great Basin within the alluvial basins. We call these basin fill aquifer systems. The water exists within those pore spaces between the grains. We also have different types of aquifer systems and we also have fractured rock systems, which are just fractures in joints and rocks and the water will occupy that space in those rocks. We have some systems in Nevada that are in limestone. We call those carbonate rock systems. It is a calcium carbonate type rock that slowly dissolves in time from more acidic water and it creates the caverns in the limestone, which allows water to move through that type of rock. The ability for the water to move through the material and through these rocks is governed by the aquifer properties. These are what is really important to the hydrologists. You will hear about various properties today or at other times and, generally, there are two classes of property. The first is permeability, which is how readily the water can move through any given material. You will hear it called hydraulic conductivity, transmissivity, or sometimes diffusivity, which is a more complex term. Then the next term that we are always after is storage, which is basically how much water can be stored within a unit volume of the groundwater system. More specifically, it is how much we can take out because we can't always take it all out, so it is really that amount that can be extracted. The way groundwater works is it doesn't just sit there in the ground doing nothing. It is almost always moving almost everywhere. In some places, groundwater moves fast and in some places it moves very slowly and often very slowly, but it is almost always moving. It moves from areas where the water enters the system, down gradient through the system, to someplace where it discharges. So, in this example, we have a cartoon that shows a conceptual aquifer system where we have recharge occurring either from precipitation on land surface, maybe it's a stream up there, or maybe a mountain stream coming down over the alluvial fan and recharging the groundwater system. Those water molecules enter the system and displace the water in front of it and push it down gradient and it just moves through the system until it reaches someplace where that water exits the groundwater system. Typically, this is, as Chris explained, streams or through transpiration through vegetation or sometimes it is evaporation from soil. It is recharge, groundwater movement, and discharge. You will also hear the term aquifers versus groundwater and the distinguishment between aquifers and groundwater is aquifers are that part of the groundwater system that can be developed and supply water to wells, so it is the more productive areas of a groundwater system. Chris showed this book right here and it is available on the internet at this link listed or you can search for this title. It is a really good resource. It really helps to understand how groundwater works and how it interacts with streams. It is really a necessary understanding for being able to effectively manage our water resources. This has become a lot more popular. People are becoming a lot more aware of this and it is starting to really have a grip and to help to shape water management policies in the west. That is what is going on here in Nevada.

Mr. Allander said groundwater and surface water are a single resource. You can think of this in a real simplified term - if you have a stream that flows year-round, we call that a perennial stream, it flows year-round and it is almost always connected with the groundwater system because that water has been there for so long it has filled up all of the pore spaces beneath it and the system has had a long time to respond to that water. It comes into balance and it raises the water tables adjacent to the streams so that they are at a level with the streams. You start to develop more of this dynamic relationship between the groundwater systems and the streams.

Typically, what is happening is the water table right adjacent to the stream is at or equal to the same level as the stream. Sometimes the aquifer systems are a little higher than the streams, in which case the flow is moving downwards toward the stream and discharges into the stream. We call that a gaining stream. Sometimes the water table adjacent to the stream is lower than the stream itself, in which case, the flow in the stream is leaving the stream into the groundwater system. We call that a losing stream. A lot of times we have stream reaches that go through these changes throughout the year depending on what the hydrograph is doing or what the stream flows are doing. In a typical stream, during the spring snow melt, it will be rising, the streams will rise well above the water table, and you will lose a lot of flow during those conditions and it will recharge the adjacent system. Some people have heard of this as bank storage. Then later on, as the groundwater recession occurs, that groundwater starts to come back and supply the stream. That groundwater is considered as base flow, as Chris had indicated earlier. It supplies the stream as it is receding. This dynamic change occurs throughout the season on many stretches of a river.

In Nevada, we like to talk about what we call river connected groundwater systems, which are these groundwater basins that are connected by rivers. In particular, we have the Humboldt River, Carson River, Truckee River, Walker River, and then a couple down south. In these systems, it is really important to understand that relationship of the river to the groundwater system, understanding that the groundwater movement between those groundwater basins can occur much more readily because they can kind of basically short-circuit through the river and the river is the supplier or the source or where the groundwater ends up going. In Nevada, they make about 25% of our groundwater systems and on these systems we have a lot of surface water users and a lot of groundwater users so, during times of limited supply, we end up with the potential for conflict because of the shared nature of the resource. Where does the water come from when you pump a well? Chris explained this and I will explain it in a little bit more detail with a different cartoon. In a natural system, it is in balance where recharge is equal to discharge. The amount coming in flows through the system and is equal to the amount going out. Again, the discharge is either through transpiration through vegetation or discharge to a stream or spring. It maintains a balance through time until some sort of pertubation takes place, like inserting a well and starting to pump water. When you put a well in and you first start pumping, that water initially comes from the ground just around that well and it lowers the water table right there, so it is considered to be coming 100% from storage. All of the water being pumped is coming from storage. As time goes on, that gradient from the well from that drawdown starts to propagate outwards and it starts to link up with some surface water body nearby or starts to lower the water table beneath the vegetation that is using it and it starts to do what we call capture - capturing that ET or capturing the streamflow. As that continues on through time, eventually, it doesn't go down any further because it captures all the flow from the ET and from the rivers, so that is what the supply of that water is to that well at that time. This curve over here (as demonstrated) is called a capture chart and it explains this in a different way but it shows the same thing. This is percent of pumpage from 0 to 100 and this is time going forward. As I explained, when you first start pumping, 100% comes from storage but, as time goes on, less comes from storage and more starts coming from the capture - streamflow capture and ET capture until, at some point in time, storage is no longer changing.

Now, let's talk a little bit more about capture because it seems a little bit confusing because we

have different terms for it and I want to clear that up. You will see it written as streamflow depletion or as stream capture but it really is the same thing. It is the reduction in the streamflow of that water supply and it really is equivalent to a stream diversion. The big difference is that the diversion starts small and then grows steadily with time until it reaches some amount below the pumping. You also will hear ET capture and ET salvage, which are the same things, as well, and it is defined as that water that has been intercepted from plant use and or evaporation. Also, as Chris explained, the stream capture can occur whether streams are gaining or losing. This is often a misconception in understanding capture. A lot of people think capture only happens when you induce flow away from the stream but that is not true. Capture is the reduction in the streamflow so, if you're intercepting flow that is discharging to the stream and you are pumping and intercepting and reducing the flow in the stream - that is capture. Of course, it is the same thing if you cause the flow away from the stream to increase to serve a well. Another important concept about capture is it doesn't stop when pumping stops because it takes a long time for that signal to build up for streamflow depletion or stream capture and, because of that, it also takes a long time after the pumping stops for that to decrease and to come back down to that pumping not taking water from that water body. The capture is not the same everywhere. That is the real challenge to understanding the impact of groundwater development and groundwater pumping on streamflow depletion. It is really how much is occurring at any given location, so this next slide illustrates how capture can vary throughout a groundwater system or throughout a basin, depending on your location and depending on the properties of the system. This is a basin down in Arizona called the San Pedro River, Well A, and it shows a much greater streamflow depletion over the same amount of time as Well B, which is much further away. In this case, the properties are nearly similar in the system and it is the distance that is really driving that difference in capture. Being able to understand how that capture occurs throughout the basin is, obviously, a very critical component for being able to estimate the impact of pumping on streamflow depletion. If you take wells like this or if you use a model and you estimate this capture everywhere throughout the system, you can contour it in a colorful map like this, which is what we call a capture map, and it basically highlights or portrays that level of capture that occurs throughout the system at some point in time. In this case, we are looking at capture after 50 years in the San Pedro River Basin. You see that, along the river, the red indicates a higher capture, 100% capture, from the stream. You can see that, generally, it is highest along the stream. There is a pocket in here where it is not as high and that is because the properties are different in that area that don't allow that exchange to happen so readily, so it has a lower fraction. Mapping it throughout the system is the goal of capture maps and the point is to be able to understand - if you pump, how much is that going to deplete some surface water source? Generally, we develop these capture maps from the groundwater flow models because they are pretty complicated and require a distribution of properties. So, what are groundwater models? These are mathematical representations of these complex systems. He showed an example from the lower Walker River Basin that I developed in 2014 for Walker Lake and the surrounding alluvial basin. The idea for these models is that they solve this very complex equation, which I am not going to go into but the point of this is that it represents this three-dimensional changing characteristics or properties of the system. That is very complex and that is why we have to use numerical tools to solve these types of equations. What the models allow us to do is to simulate the hydrologic systems based on the principles of hydrology, based on the properties of the system, based on observations that we have had over a long period of time, and based on the boundary conditions or what is happening at the surface

where the wells are, where the rivers are, and things like that. It also makes predictions about the system. These models are often needed to estimate capture because of the complexities of the systems. They are irregular geometries. If they are all rectangular basins with straight-line rivers, we could use real simple equations to do it but, because they are never like that, we need to use these models. The models allow us to represent these irregular geometries of the aquifer systems and the streams, they allow us to spatially vary the properties in the system, and allow us to use complex pumping schedules because not every well pumps 365 days a year. Some wells only pump a few days a year, so it allows us to evaluate for different pumping schedules. He asked if there were any questions at this point before he moved on to the next presentation but there were none.

Mr. Allander said now we are going to talk about an example of a capture study, although I know that Jason and Kelvin are going to talk about this too from the State Engineer's perspective, but this is the work that we are doing with the State Engineer's office, as well as with the Desert Research Institute. I have to recognize my collaborator, Greg Pohll. This is a very large project and we have entire teams working on these together but it is a complete collaboration and we developed this presentation together. This presentation will be given to NWRA at the end of the month, so this is a preview of that. A lot of scientists are involved with this and I want to make a quick acknowledgment of those folks. The Humboldt River Basin is just north of us and it is biggest basin in the state consisting of 1,700 square miles. I think that one of the greatest characteristics about the Humboldt River Basin is it is entirely within the State of Nevada, giving Jason the ability to manage the resources here without having to go through federal courts and things like that, so it is within their jurisdiction completely. I am going to talk about some of the problems in the Humboldt River Basin and why we need to understand capture, talk about the approach we are taking, talk about the models a little bit, talk a little bit about the analysis being done, and then wrap up by talking about what to expect from this project and when.

Like many basins in Nevada, the surface water is fully appropriated in the Humboldt River Basin. The most senior rights in the Humboldt River Basin are from the early to mid-1920s, whereas groundwater started being developed much later on. The water rights associated with groundwater are junior to the surface water. Almost all groundwater is junior to surface water. Over time, the groundwater has been developed in the Humboldt River Basin with the advent of turbine pumps and technologies. Farmers discovered that we can farm in places we couldn't farm in the past by pumping from various depths and being able to produce a lot of water to produce agriculture. Over time, this pumping increased in the Humboldt River Basin in the early 1960s and it really ramped up in the 70s. For agriculture, it more or less peaked out in the early 80s and has held more or less consistent at that level ever since. In the early 1990s, they started figuring out a different way to mine for the gold in the Humboldt River Basin and started doing the large open pit mining and that required removing a large amount of water in order to get access to those mineral resources. That is what these yellow bars show right here is the mine dewatering, so they are just dewatering to be able to get to the mineral resources here. What has happened though is, over time, the total groundwater withdrawals within the Humboldt River Basin are now in excess or near the mean annual flow of the Humboldt River at Palisade. As you can see, if this goes on for a long period of time, there is going to be potential that some of this pumping might be impacting some of the river flows. I think Jason will talk a little bit about

that since that is what some of the users in the basin think. We know that groundwater pumping captures flow from the Humboldt River by some amount. We know that the wells that are right next to the river are probably capturing all of their water from the river. We know that wells in the upper end of the Reese River Valley will probably never capture any water, so there is this whole range of effects of pumping, depending on where you're located and the properties of the system. That is what we really need to find out and that is what we are trying to figure out. In order to do that, we do need to know the properties of the system. That is what the models are for. We are using them to figure out what the permeability and storage of the aquifer systems are at all locations within the basin or all locations where we have observations. We will then estimate the rest. We need to know these things to be able to estimate what the impact of the pumping is on the streamflows. The study components for the Humboldt River Basin study involves a large study to estimate evapotranspiration discharge from groundwater because it is an important component from our flow models and it has never been done for the entire basin at one time using modern methods. It involves creating a consistent data set for us to use to help adjust and calibrate these models to determine these properties. We have set it up where we have three different models to estimate the characters of the groundwater system in the basin. We call it the Upper Basin Model, the Middle Basin Model, and the Lower Basin Model. I will use one slide to talk about each of these and I will talk about why we have to do this because of the differences in each of those domains and different things we need to do with those models. Ultimately, we can use them all for the same purpose - to determine capture. The ET study is for the entire basin and it's really because ET of groundwater is a major, major component of the water budget system. We need to be able to simulate that with the models in order to do a reasonable job estimating the properties. This next image shows where most of the groundwater discharge is taking place throughout the basin. It is no surprise – it is along the river corridor in most areas where groundwater is shallow and up some of the tributary basins and also up in Paradise Valley. The goal of the study by Justin Huntington of the Desert Research Institute (DRI) is to estimate the areas where the discharge is taking place, the rates that it is taking place, and, once you have those two, you can calculate the total volume of groundwater that is discharging through these areas. They are using modern methods using remote sensing techniques, Landsat satellites, DEMs, weather station data on the ground, going out in the field verifying these boundaries are, in fact, groundwater discharge areas.

Now stepping through the models from upstream to downstream, the Upper Basin Model is being led by DRI. The unique hydrologic characteristics that we are representing on this part of the system involve lots of headwater streams. Each of these streams has a decree associated with it and decree flows associated with it. There are farmers using those waters, so they all needed to be represented. It also has some very large semi-regional springs that are discharging on the order of 10,000 acre-feet per year to the Humboldt River, so that is a complex simulation for those models. There is also a fair amount of groundwater use, upwards of 24,000 acre-feet per year, and this particular model simulates the typical things, groundwater levels, water budgets changing groundwater conditions, as well as changes in the streamflows along each of these tributaries. One of the important aspects is it provides information to the model downstream to the Middle Model at the Carlin gauge. It is just a change in streamflow at that location that is being propagated down. Of course, this model is being used to estimate the stream and river capture.

Moving downstream, the Middle Basin Model receives its flow at the Carlin gauge and then it flows through the system and then discharges at the Imlay gauge, which is just above Rye Patch Reservoir. There are unique characteristics in the middle Humboldt River Basin. We have many diversions from the Humboldt River used to irrigate pastureland along the river. The large-scale mine dewatering operations are all represented in this particular model and it has major groundwater use, upwards of 275,000 acre-feet. This model simulates actual streamflow in the diversions from the stream, which is a little more complex. It also does typical things like groundwater levels, water budgets, and changing groundwater conditions. The big difference with this model is we are simulating mine dewatering and that water gets routed somewhere. What basin is it being removed from or does it get put into the streams after it has been treated if the water can't be used anywhere else, so that impacts the water resources in this part of the world pretty substantially.

With the Lower Basin Model, it begins at the upper end of Rye Patch Reservoir. A unique characteristic to this is that it has large irrigated acreage, the Lovelock farming community. Rye Patch Reservoir is in here. It has very little groundwater use, only about 4,000 acre-feet per year. It involves mostly domestic wells and a couple very big pumping wells that are only used for a few days. This model requires more fieldwork and more field testing because the system isn't changing a lot because there is not a lot of groundwater use down there, so we had to go down there and do field testing to learn properties. This model also simulates groundwater levels, water budgets, changes in streamflow, and it will be used to estimate stream and river capture.

The process called model calibration is to adjust the properties of the system so that you can simulate the observations. This shows what those types of observations are that we use. We use water level data, we use streamflow and the rivers discharge from springs, we use old recharge estimates, and we use this new ET data set that is being developed. We just basically set these up as targets, set the model to simulate them, figure out why we are not matching them, and we go in and adjust all of the properties of the system until we do, and we go through that process iteratively over and over and over until we have a satisfactory fit and we can satisfactorily reproduce our observations. Once we fill that the model is reasonably calibrated and those are the properties of the system, that is the model we use to do the capture. The next slide depicted the analysis, which I described earlier and this is what is being done for the Humboldt River Basin. It is basically developing a capture map for the entire Humboldt River Basin.

With the Middle Basin Model, we are also evaluating the impact of the mine dewatering on the Humboldt River flow. This is for mine dewatering through the end of 2015. The real question here, although we know that some of the mine dewatering activity has produced flow for the river, but someday that might stop and then they will no longer be adding water to the river and we will have these depleted groundwater reservoirs, so is that going to create the reverse situation where we will start seeing depletion from some of these mining activities? We are evaluating this question for the nine largest mine dewatering operations in the Humboldt River Basin. These were depicted on the slide and that is one of the major exercises for that model.

The deliverables for the project are capture maps as shown here today but they will be using digital capture maps in the application so you can just query a location depth and pumping

duration and it will tell you what the amount of depletion is for that location. This will be published in four reports – 2 USGS reports and 2 DRI reports. One journal article has already being published and then data releases for data associated to support these models. They are being released as we finish them and there are a lot of those. This project started two years ago this month and has another two years to go before we have all the work finalized, reports out, and capture maps for the State Engineer to use. That is the Humboldt presentation. Are there any questions before I move on? Someone who did not identify himself said I am just curious about the Carson River system. The USGS comes around every year and they have to test by sounding my well every year. How many of those wells that you showed earlier do you monitor? What percentage of domestic wells do you monitor to see how they go up or go down? Mr. Allander said that is a good question and I am going to show you a map that has our monitoring network on it for the Carson River Basin but, off the top of my head, I would say it is probably 200 wells or more in the entire basin. He was then asked what percentage that would be. Mr. Mahannah said, off the top of my head, it would probably be a pretty small percentage because, of the two maps I showed, one was the underground water rights that the State Engineer issued and then the others were domestic wells. Just the domestic well count itself, I am guessing is probably several thousand, although Jason could probably nail it down better, so maybe 6,000 to 10,000 wells in the Carson Watershed upstream of Lahontan. Just in this basin alone, there are an estimated 5,000 domestic wells and then you add on top of that the permitted wells, which is probably 1,000 or more. It is a relatively small percentage. Mr. Allander said I would say, based on that, maybe 1-5%. I doubt if we monitor 5% though. The state also has a monitoring network that I am not showing, in addition to Chris' monitoring network.

Mr. Allander said we will move on to the Carson River, so we are getting closer to home. This presentation is focusing on the select water science that USGS is conducting in the Carson River Basin. I really wanted to go through it all and then I realized you guys would be here all night, so I cut it back because it is going too long as it is, right? I think most people are familiar with the Carson River Basin. It extends from the East and West Forks of the Carson River down through the valleys and then eventually discharges down here into the Lahontan Basin, which is its final destination. I need to point out a couple other major features. I think everyone knows about Lahontan Reservoir and this connection to the Truckee River system through the Truckee Canal. That is, obviously, a very important hydrologic connection between the two systems and plays a big role in some of what I will be talking about. I will talk about a particular project that is using a bunch of hydrologic models, like I spoke about for the Humboldt River Basin, but this is for the Carson River Basin. I will then talk about our monitoring network real briefly to kind of show how much we are keeping an eye on things, how much we are keeping track of, as well as our stream gauge network. I will close it out by talking about last year's runoff because it was so amazing and it's worth reliving that since we are not quite getting that this year. The water for the seasons is a big project and it extends over both the entire Carson and Truckee River systems. The main purpose of this project is just to try to understand what kind of potential changes might occur to the water resources in these basins as a result of future climate variability. One of the ideas is we have our management systems in place right now but what is going to happen to our system under those current frameworks? We want to have an idea, as time goes on, to be able know what to expect in the future. The other task is to say, well, that might be what happens in the future but what might happen if we try to change some of the approaches to the way water is being managed in these basins? That is the big picture. The

collaboration is between the Desert Research Institute (DRI), UNR, and the USGS. DRI and UNR have the Truckee River Basin and they have a bunch of existing models that they are leveraging for this work to evaluate the Truckee River system. We have our Carson River models that simulate the Alpine Decree and those are what I am going to focus on here. Of course, these two systems are again tied together through the Truckee Canal and through the Truckee River Operating Agreement (TROA). The DRI and UNR focus is on simulating under the TROA management and the Carson is under the Alpine Decree. This is the team that has been doing all of this work. There are a lot of folks that are involved, just on the Carson side.

Mr. Allander said I am going to walk this from upstream to downstream. His slide depicted the East Fork and the West Fort Carson River. We call this the headwater flow models. They feed into this model of the Carson Valley system and then that, in turn, feeds into the Middle Carson River Basin model system, which brings it all away down to below Lahontan Reservoir to the stream gauge below Lahontan and that is where it terminates. We do not extend out into the Lahontan Valley with any models. The headwater flow models are watershed models that simulate the streamflow of the system but it takes into account the watershed characteristics, things like altitude, slope aspects, soils, vegetation, impervious cover, and parameterizes all of that, and simulates the flow at a downstream gauge. In this case, there are two models – the East Fork Carson Model, which simulates the streamflow at this gauge near Gardnerville, and then the West Fort Carson River at Woodfords. You adjust the parameters until you get streamflows very close and then you have a calibrated model that you can use for testing various scenarios. In this case, the model is being used to simulate various climate scenarios and we will talk a little bit about those. It then takes those climate scenarios, re-simulates the flows, and then runs those downstream to see what kind of impact you will have on the management of the water and the water supply downstream. Also, their downstream models are being used to test the different management strategies to deal with that changing water supply characteristic.

The Carson Valley Hydrologic Model is a rather complex model. It takes into account the operations of the system, the priorities of the system, and it really honors the Alpine Decree. He displayed a slide with a figure that shows some of that complexity. The flows enter at the West Fork at Woodfords and then the East Fork near Gardnerville. It simulates the diversions, pumping, supplemental pumping, the return flows, the ditches, the canals, the river itself, and then it flows out at the Carson at the Carson gauge near Carson City. That is where it transfers its flow to another model downstream called the Middle Carson Hydrologic Model. This again takes the streamflow from the upstream model of the Carson at the Carson gauge, it translates it through four or five valleys, depending how you want to count them, it goes through Eagle Valley, Dayton Valley, Stagecoach, Churchill Valley, and then terminates at the Carson River below Lahontan. This is an integrated model so it simulates the groundwater systems and surface water systems and also simulates diversions. That is the background.

Now, I am going to give you a little bit of the very preliminary results about the Carson River and what we are seeing from this work. This is by Mike Dettinger of the USGS. It is titled, *What Will the Carson River Be Like in the Future?* These are some very complex graphs but I will try to step you through them. These represent future climate scenarios. Basically, there are two different scenarios and they are called RCP 4.5 and RCP 8.5. These are pretty much standard scenarios that climatologists like to use for simulating future climate change. The 4.5 is

based on greenhouse emissions peaking in the year 2040 and then starting to decline. The RCP 8.5 is for greenhouse emissions rising all the way through the end of the century in year 2100. This shows the temperature through time, starting from the early 60s and 80s, where we are currently, and this indicates that, for the emissions peaking in 2040 scenario, the temperatures rising about 5° more than they are right now, whereas the 8.5 scenario shows it 10° greater than it is right now. These are the scenarios we are putting into the watershed models to simulate the conditions. Over here is precipitation and you will see that precipitation does not have the same characteristic as temperature; it doesn't have an obvious trend. That is really what the climate scientists believe for our area - is that we are not going to be much wetter and we are not going to be much drier, but the one thing you will notice, all of these background curves right here where all of this noise is, this is the year-to-year variability in climate and then moving forward is when you start to see that the variability starts to increase. We have much more severe winters, many more wetter periods, yet, our average is about the same. In order to have the same average, we have to have longer and more frequent and more severe droughts. That also shows up down here in these climate projections. If you take the temperature and the precipitation from these projections and put them into the watershed model, it simulates and then it goes downstream for the Carson Valley Model. The next slide shows what happens to the growing seasons in the Carson Valley and what we see is that for the RCP 4.5 scenario, it is suggested that the length of the growing seasons are going to grow by as much as 40 days, whereas the RCP 8.5 scenario is as much as 60 days longer. These are pretty big changes in the local climate as far as growing seasons go.

What kind of impact will that have on the streamflows in the system? The next example is from the West Fork Carson River simulating those scenarios and then bundling it up and trying to get a snapshot picture of what happens. Let me try to step you through this chart. Down on this axis, this is the increase in temperature and this is the annual runoff, which is called center of mass. Think of it as peak spring runoff flow. It goes from January through July. This is 0° and this is where we are right now (depicted on screen) so, on average, the peak flows are around mid-May, so we call that the center of mass flow. As temperatures go up, you have less snowpack, you have warming conditions in the mountains, so you end up with lower snowpack, lower snow water equivalent, you end up with warmer storms, runoff coming off more in the winter, and then running off earlier in the spring, so you see this transition of that center of mass of the flow in the river systems start to creep earlier into the season through time. It is projected that at around 4° Celsius that it is going to be about eight weeks earlier and that is about 7° Fahrenheit. If the temperature is increased by that much, we could see the peak runoff occur eight weeks earlier. That has a large impact on our resources. The other big result of this is that, with earlier runoff, it means there is less flow later in the year because a lot of that water has worked its way down through the system. It has more time to flow during the summer and so we will have lower base flows at the end of the year and it will be harder for agriculture at the end of the year. That is what this chart shows is that there is the potential for a decrease in deliveries in the Carson Valley. These are priority blocks on this chart, so they represent priorities of delivery. For instance, these are water rights from 1850-1859, 1860-1869. In the Carson Valley, the vast majority of the water distribution serves these two priority blocks. The black bar represents no change in temperature and then each of the following bars 1° warmer and what happens to the deliveries in the valley. What we see is about a 1,000 or so acre-feet per year, per degree, warming for each of these priority blocks. This adds up pretty fast when

you think about the total irrigation of the system. This, again, is largely because of the timing of irrigation season right now versus the timing of runoff when it will come in the future.

To summarize, for the Carson River, in the future, we expect warming, expect the snowpack to start decreasing and to runoff earlier, expect the growing seasons in the valleys to increase, there will be increase in evaporative demands, the actual precipitation in the watershed is not expected to change that much but the characteristic of that precipitation is expected to change a lot. There will a greater number of drier days and drier years, as well as bigger years and bigger storms, like 2017. We expect the overall streamflow will not be that different but it is going to be earlier in the season and, because of that, it will be smaller later in the season.

Mr. Allander said that was the models and now I would like to talk a little bit about the groundwater monitoring real quickly. We have long-term monitoring in all of these valleys. It has very important information and it allows us to monitor the trends in the water level in the groundwater system. It gives us the data we need to develop the models, it allows us to investigate the aquifer conditions and the properties, and then it also allows us to see what the impacts of various management actions are. The slide depicts our network, which, again, is at least 200-250 wells throughout the Carson River Basin. It extends all the way from Carson Valley down into Lahontan Valley. It involves quarterly and annual measurements mostly. We do have some select areas, like in the Mark Twain Estates, where we have a more concentrated network at a higher frequency because of a potential water issue. We have a small part of our network that is dedicated to being able to focus on specific issues. We also do some water quality monitoring in areas that have septic systems and some without sewer systems to look at nitrates. We also monitor the Basalt Aquifer here in Fallon for arsenic and chloride. The data is available online to everyone and it is usually online shortly after we return from the field. The stream gauge network includes a bunch of gauges in the Carson River system, working our way downstream, three in the East Fork Carson, one in the West Fork Carson on the main stem, and then we have six tributaries that are monitored. We are also the ones that monitor Lahontan Reservoir. Particular to Lyon County, the Carson River at Deer Run Road is in Carson City but, technically, it is like the inflow into Lyon County. That is the gauge that we use to represent the inflow into Lyon County. We then have the Carson River at Fort Churchill, which is the inflow into Lahontan Reservoir. We will talk a little bit about 2017 at those gauges. The next slide depicted a picture by our office in Carson City on Morgan Mill Road around Deer Run Road. This is what it looked like almost exactly a year ago. It was February 11th last year when this picture was taken. It was a great year on the Carson River system. This shows the data for the Carson River at Deer Run Road. Although it is hard to see, this flow started almost near zero at Deer Run Road. It was just a tiny trickle at the beginning of the water year, which is October 1 and then, of course, we had a great November. A lot of water from November really set up the system and then we had the big rain events in January and February. Of course, we also had monster snow in the mountains, which resulted in a nice runoff throughout the rest of the summer. This chart shows the median flow based on 32 years of record. After we got going in the early fall last year, we pretty much stayed above the median year the entire year. You can see what we did throughout the summer this year where the flows were over 100 CFS all year at the Deer Run gauge. The slide showed the flood level in 1997. We didn't quite get to that same level. We were less than half of the flood level of 1997 but it was still flooding. He displayed a streamflow hydrograph, which is a great way to look at the streamflow volumes over a year. It

basically just accumulates the flow over a year from October through the end of September. What you see here is this green band. This is the between the 25th and 75th percentile. This is the middle 50% of flows that occur within this green band. The black line right here actually represents 2017. What is really cool is 1983 was the previous highest year and you'll see right here that the black line came out on top. 2017 was actually our biggest year on record for this gauge. Again, it was only based on 32 years of records, so this is not a long-term gauge. The total flow last year was almost 950,000 acre-feet by the Deer Run gauge. The average is 310,000 acre-feet, so it was three times the average.

Mr. Allander said now what about the Carson River near the Fort Churchill gauge? It is the same type of plot. The big difference for the Fort Churchill gauge is that it involves 105 years of record. We have been measuring this before Lahontan Reservoir was built. This was the highest year ever for 105 years of record. The total flow into Lahontan last year was around 920,000 acre-feet. The average is only 269,000 acre-feet. With regard to Lahontan Reservoir itself, I don't know if everybody remembers what it looked like at the beginning of 2017, but you can tell right here that it was at zero. It was actually pretty much completely empty and it completely filled that year. Of course, the fill level is only about 300,000 acre-feet, so it didn't just fill – it filled and spilled and it spilled hard. There was an outflow of almost 700,000 acre-feet from the reservoir last year total. That includes irrigation water too. That was the second biggest outflow for the record at this site. The biggest was 1983 and the reason 1983 was greater than 2017 is because the reservoir started near full in 1983, not at empty.

Mr. Allander said we have a very active Twitter account. He displayed photos of folks in the field and said I would like to recognize that they are always out there and you might see them out there measuring the flows in the river. They work really hard in really bad conditions to bring everybody the data they need. Our data is accessible at this site: https://waterdata.usgs.gov. We have a nice webpage at: https://nevada.usgs.gov and then our Twitter @USGS_Nevada is very active. It is enjoyable to look at. That is all I have but are there any questions?

Tim Tucker, of 4325 Collin Parkway in Reno, Nevada, said I am interested in the size of the Basalt Aquifer in the Fallon basin. Mr. Allander said it is not very big but Chris might help me out with the actual dimensions. I think is like 10 miles long by 6 miles wide and it's shaped like a mushroom, so it is biggest near the surface and then it cones down into a sharp cone. It really isn't very big down below. I don't know what depth that all starts happening at but I do know that it is not an extensive aquifer throughout the valley.

Don Alt asked if he had looked into the Pinon Juniper encroachment. Mr. Allander said he had not. We are aware that this phenomenon is occurring; the Piñon Juniper seems to be moving downwards in many locations and so it likely has some effect on intercepting a certain amount of water but we haven't quantified what that is. Actually, I don't think I know of any estimates but do you, Jason or Chris? They indicated that they did not. Mr. Allander said that is a question of active research though I am sure.

Chairman Olsen asked if there were any questions from the public but there were none. He said we are scheduled to take a break now. I believe that, if you sent in your RSVP for this evening,

there is a meal being provided. The plan, for those that are in the audience, is that we will take about a 30 minute break, which would put us back here at 7:20 PM. If you would like to go on break, we will reconvene at 7:20 PM. The meeting was reconvened at such time.

Jason King, State Engineer, thanked the Churchill County Commissioners and the Lyon County Commissioners for inviting us to be here with this panel. On my left is Kelvin Hickenbottom, Deputy State Engineer, who will be the one who is going to give this presentation tonight. If you will indulge me, I would just like to provide a few 30,000 foot observations on our presentation and our endeavor. Clearly, we are here to talk about conjunctive management of surface water and groundwater, specifically on the Humboldt River. This truly is our maiden voyage into this new way of processing applications and looking at these two water sources. As Chris pointed out on the one slide, this is one of the four things that really keep us up at night at Water Resources. If I had to pick the number one issue, it is conjunctive management. It is this one issue. As he mentioned, for over 100 years of our office being an office that regulates water in the state, there have been thousands of decisions on groundwater and surface water rights made and, consequently, there have been dozens of court affirmations of those decisions that we've made over the decades on surface water and groundwater that has guided our water policy to where we are today. So, as we are now changing how we are viewing that, as I said, this is the issue that scares me the most because of the history that we have. It goes without saying that we don't believe we can continue to put our head in the sand and not look at that, so that is what we are endeavoring to take on. As you will hear from Kelvin, we are talking about conjunctive management on the Humboldt. We are trying to work with the stakeholders, both surface water and groundwater users, and we are trying to sell it, if you will, that it is in the best interest of both parties to work together on this conjunctive management. Some people say what do the surface water users have to lose? They are senior in time. We are a prior appropriation state. The decreed users on the Humboldt have priorities from the 1860s to right around 1900. All of the groundwater use is junior in time. I understand that argument but I am also trying to point out to the surface water users that I have seen decisions come out of courts in other western states that have prior appropriation systems where, basically, the court had ruled that junior water users are entitled to the conditions at the time they were issued, but I am paraphrasing. I want to make them aware that you never know what the court is going to say, especially in a state where, again, we have 100+ years of looking at these water issues a certain way. So, we are hoping that we can get the surface water users and the groundwater users to work with one another. The State of Idaho just recently went through a very similar exercise to what we are trying to accomplish on the Humboldt. In hearing about their process, the first 10 to 12 years was really just marked by litigation. The Deputy State Engineer for Idaho said it took that many years of litigation for everybody to feel enough pain and hurt to finally bring them to the table to try to work together. So, as we go out to workshops on the Humboldt, that is the message we will try to deliver and say, "Listen, I understand it is real easy to lawyer up and fight these things but I am hoping we can point to the success that Idaho had and get all of the stakeholders to work together". I think that is all I wanted to say in terms of my opening remarks and then Kelvin will provide the presentation on what we are doing on the Humboldt.

Kelvin Hickenbottom said, hopefully, we can go through this pretty quickly because a lot of the slides are duplicative of what Kip and Chris have had. The first thing we were to address tonight was what legislation from the 2017 Legislative Session would potentially have an impact on

downstream users. It really just turned out to be a Legislative Declaration that said we will manage all waters, regardless of the source, conjunctively. So really, there wasn't a lot of substance to protect downstream users. Again, Nevada's water law is that surface water is governed primarily by NRS 533 and groundwater laws are under NRS 534. They are separate sections and, historically, they are managed separately. As Jason just said, there have been thousands of rulings out there that have shaped our water law, along with lots of court cases that guide us in the direction we have taken on a day-to-day basis. Water law and science don't necessarily mix. We are going into using more science. One of our other Legislative Declarations is that we use the most current and best science available to us. That is why we have gone out to contract with DRI and the USGS to develop models for us on the Humboldt. I think Chris brought up the 2001 decision that it is just too much work to basically separate groundwater and surface water management. Again, a lot of this is redundant. The problem is most of the surface water in the state was already appropriated prior to the creation of the water law in 1905. As was stated, groundwater is junior because most of the groundwater wasn't developed until the 50s and 60s, except for Las Vegas and Pahrump, so you have junior appropriators conflicting with senior right holders.

What we are looking at is that the groundwater pumpers are intercepting flows of groundwater to the river system that would constitute base flows and additional flows down the river or they would be pulling and creating a cone of depression, changing the gradient from the river to the groundwater basin. The premise of Nevada's water law has been Prior Appropriation Doctrine for some time where you use it or lose it. We also need to protect the senior water right holders from junior appropriators.

To provide a brief history of the Humboldt region, the Humboldt River is a fully decreed system. Senior priorities range from 1860s to about 1920. There are 285,000 acres of irrigation, almost 700,000 total acre-feet within the decrees and historical flows are only probably about half of what the total appropriations are, so they really relied on return flows, flood irrigation, and stuff like that. Then we come to our groundwater appropriations and it is 716,000 acre-feet throughout the 34 groundwater basins that encompass the Humboldt region. Of that, you can see that, in 2016, groundwater pumping is 323,000 acre-feet, which is a little less than half the total appropriations on the system. You can see the disparity between the upper Humboldt, which is above Palisade, is 43,000 acre-feet of pumpage versus downstream at Palisade, which was 280,000 acre-feet. The real difference is the headwaters are up above Palisade and their drainage areas are narrower so they don't really have the need to pump as much groundwater in the upper reaches as they do where it kind of fans out and has larger valleys and stuff in which to irrigate. Again, all decree rights are senior to the groundwater pumpers. Groundwater, again, is depleting the flows of the river, so we have a problem. We have already gone through the fact that we have contracted with the USGS and DRI to complete three models - one on the upper, one on the middle, and one on the lower Humboldt. Again, we are going to use the best available science and it will be completed in late 2019. It will better define the connectivity between the surface and groundwater resources. As Jason said, we have been working with a Humboldt River Working Group (HRWG), which is kind of a loose group; it's not official or anything, but it does include surface and groundwater users and irrigators, municipalities, and members from the mining association. We run all of our draft regulations through this group to get their input. We finally have a draft that was sent to the Legislative Counsel Bureau (LCB)

for their first review. Of course, we do not know how long it will take them to get to that. The Humboldt River, as the crow flies, is about 300 miles long but, as a river flows, it is over 1,000 miles, so you can just see the different number of uses potentially over a 1,000 mile stretch of river and the impacts of additional groundwater pumpers. You can also see the difference between the downstream basins in that they are a little more expansive than the upstream ones, so you can see why the pumpage on the upper reaches is quite a bit less than the lower.

The next side was a timeline of how things have occurred. People thought that we started deciding to go and get these models made to help us manage because the Pershing County Water Conservation District filed a Writ to force us into managing the system but that is not true. We started about a year earlier getting proposals from both DRI and USGS to create these models, so it was not driven by litigation. It was driven by us knowing that we have a problem. We probably saw that litigation was going to come but we really tried our best and we issued orders to meter all underground rights that pumped over 5 acre-feet, we fully designated all 34 of the groundwater basins in order to, again, issue orders in those ones that were not fully designated to have meters installed. In early 2016, we signed the contracts with DRI and the USGS to start working on the models. In 2017, we decided that we needed to have all of the surface water users install and maintain measuring devices and head gates on their ditches because, again, if you can't measure it, you can't manage it. That is the approach we took with the groundwater users. So far, in terms of groundwater, compliance with meters and self-reporting is roughly about 90%, so that is a pretty good number of people that see the seriousness of this. Two weeks ago, we sent the proposed regulations to the LCB for their review and comment.

The next few slides relate to Pershing County's Writ Petition. Pershing County, in the Lovelock area, irrigates 40,000 acres of ground, they have about 140,000 acre-feet in decreed rights and some additional statutory storage rights that they can use. They argue that the groundwater pumping upstream has depleted the flows in the river and they were not getting their full entitlement. For most years, other than one or two, they have gotten their full entitlement to what they are a priority for. Our Water Master on the lower end keeps track of all of those figures. In fact, he tries to go out of his way to make sure that they get their deliveries first, upfront, and then starts working back upstream to deliver the priorities above Imlay. Basically, the Writ Petition that the Pershing County Water Conservation District filed wanted us to curtail pumpage in all of our appropriated basins by priority and back to the perennial yield. They basically wanted us to eliminate the cone of depression that is caused by the pumping from groundwater and just change the gradient of the river's flow to the groundwater basin. I think Kip showed a graph the said it doesn't happen overnight, so that would not have helped them immediately anyways. Lastly, they wanted us to treat mining rights as permanent rights. Most of the mining rights are issued as temporary in nature because, when they were issued, the pumpage in those groundwater basins was not anywhere near what the allocations already appropriated were, so we could, by statute, issue them temporary in nature permits. No one really expected that the temporary in nature would go on to 40 years or whatever. That is really an issue. The State Engineer manages with regulations under NRS 533.030 and 534.020. All water rights are subject to existing rights, so our job is to protect those senior rights. Also, we are in the driest state and need to maximize the beneficial use of all sources of our water because we are so limited. These alternatives to curtailment would allow for continued

uninterrupted pumpage of groundwater rights within the basin because it would be catastrophic if, all of a sudden, we curtailed all the groundwater pumpers in all of the communities that depend on the water. All of these farmers and ranchers would basically just dry up and go away. What we are trying to do is provide some kind of mitigation to those senior water right holders that are being impaired by groundwater pumpage. We have been working with the current working group that comprises of all different manners of use to come up and work through this whole process to figure out an equitable way to mitigate the loss of surface water to senior water right holders.

Again, we are getting the studies done by USGS and DRI to tell us what the conflicts are. When applications come in now for groundwater pumpage close to the river or anywhere within the basin, we already run a little Glover's model to see what the impacts over a short period of time would be and, if they have a certain impact above a threshold, we will deny the applications. Otherwise, we will permit the use. That is for existing rights where they are filing a change application or something where they are moving it further away or closer to a river. We still look at the impacts on each of those applications. The models are being calibrated to historic conditions on flows on the river and the goal is to quantify the amount of capture per groundwater permit and not just the whole system-wide total. Hopefully, at the end of the model runs, we will know exactly how much impact each individual right holder has on the Humboldt River. He had slides that showed the capture maps that Kip had also shown. We went to capture maps so that we can illustrate to people where the highest capture amounts are going to be and make it simple for them to understand. Their reports are all going to be peer-reviewed and professional publications, so they will be looked at by the scientific community. Groundwater flow models are being developed to understand the capture of the Humboldt River. One major task, which they are working on now, is assembling data from pumpage, from stream flows, from water levels, the hydrogeology of the system, and they are trying to develop methods to make the capture maps are easily explainable to the general public and the people that are impacted. They will estimate recharge distribution throughout the system, which then leads to the development and calibration of the models not just to estimate regular groundwater pumpers but also the capture by mine dewatering. That's a big component to this, as well.

The proposed regulations are to allow for the replacement of dangerous injurious depletions of the surface water. The replacement is going to have to be through direct diversion rights because there is no storage on the Humboldt in order to have somebody acquire right and let it down through a reservoir. The object is to get priorities back to where they should be and deliver the water. Groundwater is not going to be used for replacement either, but I'm sure there will be some exceptions. If it's so far away from the river that it doesn't show that there is a detrimental impact, that may be allowed. We haven't fully decided on that. If there is no replacement water to be had, you can't acquire it, the senior right will allow it to flow down the river to satisfy your depletions. We will basically mitigate through financial compensation. We have been in talks with UNR to develop a program of what the value of these waters are so that we not just arbitrarily saying some $800 per acre foot or whatever. There will be an economist study on the value of water on the Humboldt system, although I don't know all the specifics, but I'm sure it would be by crop type or things of that nature.

Problems and issues are that the regulations don't really fix the basic problem that the

groundwater pumpers are intercepting the river flows and causing depletions. We have heard it many times that the lower users want water; they don't want money because of all sorts of reasons. One is related to crop insurance and stuff like that. If they are just getting money and they are not being able to put water on their fields for a certain amount of time, it affects what kind of crop insurance they can get. There is no way that we will return all of the flows to pre-pumpage levels. It just will not happen, at least without stopping all the pumping for as long a period as they have been pumping, at least in order to recover what has been depleted from the groundwater system and the river system. These are priority issues between groundwater users and groundwater users versus surface and groundwater users. We do not know what our assessments are going to be until we have the economist come up with a model that we can use to evaluate the cost of water and, in some instances, we figure those assessments against those groundwater pumpers may be so high that they can't really afford to continue using that water. Again, domestic well owners are always a problem. There are a lot of them out there and they are all entitled to 2 acre-feet and they have the same impacts on the groundwater and surface water as the big producers have. We can discuss whether they should be in or out of the regulations. Forfeiture is an issue. In this past session, they made it even more difficult to get unused water off the books because now we have to send a one year warning letter to every water right holder that has four or more years of nonuse and then follow it with a 30 day notice if they haven't filed for an extension of time or presumption of use. It just makes the problem that much worse.

Advantages that we see are that the groundwater right holders are not going to be impaired by these regulations. Monetarily they probably will be impaired a little bit but they will still be able to continue. These are the same water right holders that the Writ wants us to curtail or cut back. Again, senior right holders will be compensated by some formula that we haven't developed yet. The conflict is going to be to determine how much to compensate them, which will be based on a 10 year average of what their pumping has been and what impacts those flows have caused the surface water users. It is a better management practice for the whole basin. Everybody continues to operate. If they can't, they are mitigated and, hopefully, it works. We shall see.

Chairman Olsen asked if there were any questions. Doug Frenton, President of the Nevada Wells Cooperative, said doesn't present day law right now put a distinct difference between surface and groundwater rights? Mr. Hickenbottom said it does. As I said, under NRS 533 and 534, it basically separates out surface and groundwater but, in reality, surface water becomes groundwater and groundwater become surface water, so they are connected, whether the law says they may or may not be. Again, we have a Legislative Declaration that says we need to look at the connectivity and the conjunctive use of both groundwater and surface water as a whole. Jason King added that, in Oklahoma as an example, they actually have language in their law that says surface water and ground shall never meet. They make that clear distinction. We don't have that kind of clear distinction, as we mentioned. It has been guided by how we have interpreted perennial yield of a groundwater basin and that connectivity. On a few occasions, we have acknowledged it. On most occasions, we have not. I would say there is not a bright line that says they are different water sources. That is the way our office has gone and we see that that is not the way we need to go. That is why we are doing what we are doing. Mr. Frenton said I understand that all this that you're presenting is as if surface and groundwater rights are completely connected in the eyes of the law. Do you anticipate some sort of impact from that

law when you go forward trying to manage the water? Mr. King said I can't tell you how many questions I have about what we are going to be facing. That is why I said this is the scariest thing, in my opinion, that we are taking on because of the ramifications that it has to existing water users. Clearly, our office has culpability in the fact that we have issued thousands of acre-feet in groundwater rights. At some point in time, we issued the permit. We signed it and we checked the box that said it did not conflict with an existing right because that is what it says in statutes. At one point in time, we checked that box and now we are saying, "Well, we probably shouldn't have checked that box." I don't know what to do because you can't un-ring that bell. All we can try to do is to do right by the hydrology and by the science and it is going to be a bumpy road. We have felt that, if we don't take it on, again, the issue is not going away. If this helps out water users and future State Engineers, it's worth taking on.

Chairman Olsen asked if there were any further questions. Mike Casey said if you change the place of use on decreed water, do you lose your priority date? Mr. King said you do not, even on groundwater rights you don't change the priority. So, if you file a change application tomorrow on February 13, 2018, if you're changing a right that was issued in 1941, it maintains that priority.

Chris Mahannah said I know a lot of your effort recently has been on the Humboldt with the capture model. How do you anticipate the policies and science that is being developed there might be implemented on other surface water, groundwater, connected systems on the Truckee, Carson, Walker, etc.? Mr. King said before we decided to go down this road, we knew that once we opened up this Pandora's box we didn't know what was going to be on the other end. I will tell you that the Humboldt River seemed that we could distinguish the Humboldt River from the Carson, Truckee, or Walker Rivers somewhat in that it actually travels through 34 groundwater basins and there is extensive groundwater pumping in those basins. To us, it fit the bill as a system that really begged to be dealt with as conjunctive management. That is not to say we don't have those issues elsewhere. I just believe they are on a smaller scale but I could be wrong. The long-winded answer to your question is we want to see what we can get done on the Humboldt and I know we are going to be litigating. I expect that we will and we will see what kind of decisions come out of this process and then we will have to go from there. One of my favorite sayings is that we are building the plane and flying it at the same time, so we will have to see how it goes, which is not the statement I like to say but that is where we are at.

Chris Mahannah said if I could just conclude with a statement. I think it's refreshing to see the approach the State Engineer's office is taking with this and finally acknowledging the science and trying to marry that with a hundred plus years of prior decisions. It wasn't that long ago when the philosophy was, if a well was within a quarter-mile of the river and you solid cased it to 100 feet, the regulations that the State Engineer had was that it had no impact to surface water. Fortunately, we have moved a long ways away from that.

Assemblywoman Robin Titus said I have one question for Jason. You mentioned that you had submitted some regulations to the LCB. Are you looking at just regulations or are you actually looking at a BDR coming out of that and would it just affect literally the Humboldt Basin? Mr. King said they are regulations and they are specific to the Humboldt drainage only. You will probably remember the last session when we had some BDR language that went further than

just the Legislative Declaration but, for a variety of reasons, it didn't pass. We felt like we cracked the door and at least got that Declaration that we should conjunctively manage all resources, which is good. I wouldn't be surprised to see a BDR or two that deal with conjunctive management. I have heard informally that that is where we should be looking at conjunctive management being is in statutes, not these regulations. We just submitted the regulations, we will hold the workshops, and, again, see if we can get them codified. Assemblywoman Titus said I had a feeling it would be coming across my desk eventually. My next question related to the Humboldt Basin is are there no tribal lands in that Humboldt Basin? Mr. Hickenbottom said there are some tribal lands but they were acquired lands, so there are no reservations on the Humboldt River that I'm aware of. Assemblywoman Titus said McDermott is not part of this? Mr. Hickenbottom said McDermott is up on the Quinn River. Basically, we are doing the main stem of the Humboldt River and it doesn't include the Reese River down into Battle Mountain. It is the main stem and the main tributaries within the Humboldt River Decree. Assemblywoman Titus said not to hang up the time too long but I am just curious because one of the big issues last session dealt with lithium and brine and some of the things used with the mining, so are there any lithium mine applications within the Humboldt? Mr. King said I don't know for sure but I would say that I think, if there are, they are placer claims as compared to the dissolved mineral issue that we have down in Clayton Valley. If there are, I think they are placer claims.

Chairman Olsen provided another opportunity for questions. He said I had a question that came during the break and it was where do we get these presentations to be able to look at them later. I am going to ask each one of our presenters, if they haven't already done it, to make sure that Pam Moore, with our staff, get all of them. Pam Moore said she has all of them and she was asked to post them to the website at www.churchillcounty.org. Chairman Hastings asked that those get sent to the Lyon County Manager, as well, for distribution within Lyon County, which was affirmed. Chairman Olsen said we are now to our last presenter for the Lyon County perspective.

Mike Workman, Utilities Director for the Lyon County Utilities Department, said Chris' presentation listed him as a P.E. but he is not; he is an operations guy. If he was a P.E., Jeff Page would have to give him a whole bunch of back pay. I have been the Utilities Director since 2004 and I came in right at the peak of the building boom there in Dayton and I had my hands full. Like Chris talked about earlier, there were quite a few issues and quite a few protests filed by Churchill and the tribe on water rights there in the Dayton area. As a result of that, in and about the same time, we put together a working group started by the Carson Water Subconservancy District that included all of the municipal providers along the Carson River. We had folks from Alpine, Douglas County, Carson City, Indian Hills GID, Lyon County Utilities, which serves from Mound House through Dayton up to 10 Mile Hill just before you get into Stagecoach, the Stagecoach General Improvement District, which provides water to the Stagecoach area, Silver Springs Mutual Water Company, Vidler Water, and, of course, Churchill County. Chris was an integral part of those meetings. Vidler Water had originally purchased a number of decreed Carson rights and were in the process of working on a interlocal pipeline with Carson City and Lyon County. I will get into that a little bit more. I do not have a presentation and I feel a little bit humbled with all of the experience behind me here and all of the studies. My presentation is just basic operations of what we were faced with in the early

days and where we are today. Again, I think it's a lot about collaboration and discussion between water users because we all are stewards of that water resource, not just from a use perspective but also how to protect our water resource. In my case in Lyon County, we provide wastewater services too, so I will touch on that a little bit.

Jason talked about what keeps him awake and I'm sure Chris is kept awake by a lot of the issues, as I am sure a lot of the folks here in Churchill County are also by the upstream issues. Just about everything that has been talked about today keeps me up at night. I will finish up my presentation at the very end by putting a perspective on it from the upstream user that may be impacted by the protests from an operational perspective. As the Utilities Director, we have to provide water to all of the connections and I take that seriously. I know forever is a big word but we need to serve those folks forever. I am just going to go through some real quick statistics so you get an idea of what Dayton is all about. Again, our service area is from Mound House into Dayton at the 10 Mile Hill, which is by Chavez Road. Right now, we have about 6,800 water customers and 5,900 sewer customers. Back in 1990, we had 900 water customers. Our average daily demand is 2.7 million gallons a day, with peak demands getting as high as 5 million gallons a day. That usually happens in July. We have our system completely looped. When I got there in 2004, we had five separate water systems, which seems crazy. We had water quality issues, pressure problems, and a variety of issues, plus a lot of the systems back in the 80s and even into the 90s were built out of junk. It wasn't uncommon to find electrical conduit over in the Mound House area that was used for water pipe. So, we looped the systems, we got rid of most all of the old pipe, I think all of the electrical pipe is gone now, at least I hope it is. We continue to have a capital improvement program that does replace and up-fit some of those older systems. Everything is looped and it works much better. Our pressure situation is much more stabilized, fire flows are far improved, and we have 11.9 million gallons of storage sitting up on the hills there that are all interconnected in some form or fashion. Right now, we have about 15 groundwater wells of varying size; some of them are the older wells. You drive by them and you don't even know it is a well. They produce 75 to 95 gallons per minute and then our biggest well in our system is our induction well where we pull our surface water rights and that runs at about 2,000 gallons a minute. With the system demands that we have right now, it stays at about the 1,500 gallons a minute range. With a lot of the older wells, back in the days when the system was put together, it was a privately owned system. A fellow by the name of Chester Barton was one of the original owners of the public system. With those wells, it is not uncommon to find a groundwater well 200 feet away from the river. We have slowly eliminated some of those. Well number one, which was one of the first wells, was constructed right by the Pizza Factory right there in Dayton. That well doesn't work anymore and we are in the process of relocating the water rights and we are trying to get rid of those wells that were the lower producers. Actually, some of them were pretty strong producers but we trying to get those groundwater wells at least 2,000 feet away from the Carson River.

Through discussions with Churchill County and with the State Engineer's office and just looking at the future, not necessarily looking at the capture models but talking about that concept, trying to, again, collaboratively come up with an operation scheme that helps satisfy some of the concerns of the downstream users, that was one component – quit putting your wells right next to the river. The induction well where we pull our surface rights from is about 400 to 500 feet off the river. It is 128 foot deep and it has a 100 foot sanitary seal. We have 20-

25 feet of a pumping area there. That is a true induction well. That thing is a workhorse with the sole purpose of harvesting the surface rights. We have a 16 inch interconnection with Carson City. When Vidler Water came into the picture about 10 or 11 years ago now, the idea was to pull the surface rights from the Carson City area. They've got a number of induction wells and they had planned to put in additional induction wells and build an interconnection between the two service areas. Carson City has a 3 million gallon tank right there in Mound House just as you get into the Carson City service area. It was a 3 million gallon tank and it was built on predicted demands but they were having a hard time turning that water over. That water was going bad in that tank, so they brought that water level down and then they were having corrosion issues inside the tank. On our side, we had a storage tank in our capital improvement program right across the street, a thousand feet from that 3 million gallon tank. We were going to build a 2 million gallon tank and back then the he City Manager got us all together with Vidler Water and, much like what we did with Churchill County, we sat down and collaborated to make this work. It all came together. We share that tank through that 16 inch pipeline. We send roughly 64 million gallons their way and they send roughly 64 million gallons back our way. It's funny how that balances. We bill each other twice a year, which seems redundant but we each send a bill. We want to have exact record-keeping and to know exactly what's going through that pipeline and when. I can't remember the exact numbers but it saved them millions of dollars. It saved us millions of dollars from having to build redundant infrastructure. We didn't have to build that storage tank; we use theirs. Our operators can take control of that storage tank and the pumping network with a two minute phone call. One of our guys gets on the phone to Carson City, tells him we have a problem, we need to grab water from you guys, and, as soon as he hangs up the phone, they get on and adjust it and it is off and running. In the 10 years that it's been operational, we have not had one single operational problem. We haven't had to get cross with each other. We meet once a year, usually over lunch, and it works fine. We do get together if there are operational issues. Their crew will come over and help our crew and vice versa but it's rare that that happens. So, the interconnection and the partnership of the interlocal agreement with Carson City and Lyon County includes the partnership with Vidler as a water rights holder. I want to say they spent roughly $7 million in infrastructure between the two service districts and everything is working fine so far. Again, we can pump water either direction.

We operate a Conjunctive Use Program. Early on, in the 2005-06 timeframe, they started throwing around these words "conjunctive use". We wondered what that was all about and why we couldn't just turn the wells on and go. As you dig into it a little bit, you figure out it's not quite that simple. We developed the Conjunctive Use Program, keeping in mind that we are going to be conservative on anything as we move forward, we are not going to be pumping that thing year-round. In fact, the most we have ever ran that well is 128 days and that was on a favorable year. We wanted to see what kind of production we could get out of that thing when there was enough water in the river to support operating it. It is very expensive to operate. It's a 450 HP electric motor. It eats a ton of chlorine, so when you turn that thing on, it costs a lot of money. At any rate, we figured out that we have roughly, in rounded up numbers, about 2,200 acre-feet of Carson River rights. The most we have pumped is 340 acre-feet of those rights and that was in that 128 period. Our system is designed to pump at under the 40-40-20 rule where we pump 40% in April, 40% in May, and 20% in June. Again, that all varies on what type of water year we've had and when the water comes down. Conjunctive use is something that we

now hold near and dear to our heart. We know that that is the wave of the future and it is built into our facility's plans, our water models, and just about everything we do.

With regard to water rights, which I will go over quickly, depending on which documents you read, although the water right specialists or water right surveyors that we have probably have different numbers because these are more from an operating perspective and it comes off of the ledger sheet we keep in our office, we have about 11,662 acre-feet of groundwater for municipal use. Everything I'm talking about here is for municipal use. We have 2,207 decreed Carson rights, about 1,725 right now are parked in our operating induction well and that induction well is in Segment 7B of the Carson River. We are the last user in 7B so, if the water is not in the river, we don't pump it. The Minor Ranch is immediately upstream so, if they have water, whatever water is left in the river is what we have. Again, we have about 13,800 acre-feet and there is some miscellaneous water in there with some smaller permits that I didn't include in my subtotals. We don't use supplemental groundwater for will-serves and that was one big issue that we crossed with Churchill County and the users way back when where they said when you get your Conjunctive Use Program going, you are going to run that induction well heavy when you can, you're going to rest your groundwater wells, when we shut the induction well off, then we supply the rest of the system with groundwater. The decision was made, and it has been an argument on both sides for a number of years between the developers and the county whether you should use your supplemental, when we got going on conjunctive use, we just took supplemental off the table. We wanted to make sure that we didn't over-pump the basin and, again, we wanted to be good stewards and we wanted to make sure that we were able to have a drought reserve but, again, working with Churchill County, the tribe, and others, the approach we took was that supplemental came off the table. So, what that means is we have all of that water parked there, we had development growing like crazy, at least back in the day, and it is starting to pick up again. For all of the development that we have in Dayton, we have roughly 6,600 acre-feet allocated to residential development. We have had a variety of allocation tables over the years. Back in the early days, each parcel required 1.12 acre-feet and that was lowered over time to .7 and now we call it the modified Truckee Meadows Rule. TMWA has a formula they use. We use that same formula times 1.4 and what that means, if you have an 8,000 square-foot lot, that is .6 of an acre-feet, 12,000 square-foot lot, .72 acre-feet, and that new allocation, the new Truckee Meadows Rule was in the 2007-2008 timeframe, so again, we have 6,600 acre-feet allocated for all the residents for the 6,800 customers in Dayton. Out of that, what the consumptive use piece, what we actually use is 2,698 acre-feet, so that leaves us a balance of 3,895 acre-feet that is left to the system. That is what we have been working on with the Division of Water Resources to secure that for what we call our drought reserve so that when we don't pump the river or can't pump the river with the surface rights, we can dip into that to help meet our system demands. That is a pretty healthy reserve and there have been some development interests that have suggested that we lower our allocation rating but we are not in the mood to do that just because we are in the fairly infant seat piece of our Conjunctive Use Program. We need to make sure that what we do today can be used from here on, so we are going to be very conservative in considering lowering that number. I don't think we should.

One of the big concerns when we first formed our user group is that Dayton didn't have a history of doing things right, as they used electrical conduit for water pipe. While that is true, we think we are little more sophisticated than we used to be. In fact, I know we are and I will

get into some of the measures that we implemented to help others, including the Division of Water Resources, our downstream partners, our customers, and our neighboring communities. In 2007, our average use per resident was a little over 1/2 acre foot; it was .52 acre-feet per connection. In 2016, that number is .30 per connection. So, we have driven our use by connection down. Some of that has to do with the economy and some of that has to do with water conservation where people are more aware. I hate say it and I didn't think I'd ever have to say it as a water purveyor, but a lot of it has to do with charging over $3 per thousand gallons of water, which is an incentive. It was not intended and it was not our goal. When we set our rates, it is based on what our operating costs are over a year. We include depreciation. We have a pretty healthy model for what we need to charge and that is what the number is. That is what it costs us to produce and that is what we charge to our customers. We did implement a five-year rate increase program. We had a rate analysis done and we decided we had better do 2% or 2.5% rate increases on an annual basis more connected with the CPI than waiting for five years and hitting our customers with a 14% or 15% rate increase or sometimes multiple increases because that can sting. By implementing those gradual rate increases, our use gradually went down and, like I said, we are now at .3 acre-feet,

With regard to stewardship components, what we do to make sure that we meet our commitments, not only to the state, downstream users, and ourselves, is to do monthly water audits. I just happened to bring one tonight. He displayed the water audits for a year, which was double-sided on 11 x 14 paper and it has every single parcel in Dayton's water use by month, every month for a year. In a water system, one of the things that just gets you and can just drive your cost up is unaccounted for water. In 2006, when we really got going on this, we wanted to show that we were responsible stewards. We had an 11.3% unaccounted for water loss. 10% is an industry standard and anything over 10% you better do something, anything below that you're okay. Today, it is 4.5% to 5%. We have been able to go out and get rid of those leaky fixtures, make sure that our production meters and everything are working properly, but most importantly, watch it every single month, every single year, and we track it religiously. We also track our top users. I remember one lady that had a lot on the golf course. She actually bought two lots and put a great big house in the middle of it, I don't know how much she spent on landscaping, but she was using twice the water allocation. We worked with her and we let her know but she didn't pay any attention, so we got a provision put into our ordinance that, if you use over your allocation, you pay double. The first month, she called me up madder than a wet hen. I went out and talked with her and found out that she had some really significant leaks in her irrigation system, plus she was watering about 1/3 of an acre of the golf course property just to keep it green. So, we got her water use down. She got mad and sold the house. We are in the process of a water meter replacement program, which is called fixed base metering. There are no moving parts in the meter and the meters report to the office, so no more meter readers. We do radio reads right now but under fixed base, the reads will come in at night and they collect data. We get a lot of customers and I'm sure that the customers down here call up and say there's no way I used that kind of water because I was on vacation for two weeks. We bring up the account, we download the data from the meter, and we can show them their water use trend by the hour, by the minute even, if that is what they need. You can find a leak real quick, whether it's a steady leak or whether they have a leak in their irrigation system. I hate to say it but you can even tell when somebody gets up to go to the bathroom at night. You can tell what a toilet flush is. We don't want to intrude on people's privacy but the information that they get and the

improvements they make directly impacts the water bill. We see it all the time where people can drop their water bill by 1/3 with just a little bit of effort. Again, we are moving to the fix based metering system. I think we will finish that up in about three years. It is a big project. We also worked with the USGS last year to put in another river gauge just below our induction well. Vidler Water and the Carson Water Subconservancy District helped to fund the maintenance of that station during the proving up period. We are funding that one right now and that gauge was designed not for high flows on the river, so it doesn't do the ranchers any good, but it was designed for low to moderate flow so we could better dial in our Conjunctive Use Program with the induction well. I talked about water rates. Right now, it is $3.12 per thousand gallons over your 5,000 gallon base amount. With your water bill, you get 5,000 gallons and every thousand after that is $3.12. Starting in July, that goes up to $3.20. With that, we saw a lot of landscape go away or some xeriscaping put in.

We have a groundwater monitoring program, with at least 26 monitoring wells that we read every single month. We log that data and share it with the USGS, Carson Water Subconservancy District, and anybody that wants it. We are not hiding anything. Our groundwater is stable in the Dayton Valley and if it helps somebody with their studies we are more than happy to share that. We have gone as far as doing demonstrations of xeriscape landscaping at our office. Just by doing that, we reduced our water use at our office by 40%. Again, we are making more of an effort to move those permitted groundwater wells further away from the river. We may need to have one a little closer than 2,000 feet, due mainly to topography, but that is yet to be determined. We are not in the game of throwing the groundwater wells in right next to the river. That just adds insult to injury, I think.

One of the things that I'm most proud of, not that I did anything because I wouldn't know which valve to turn, is that, again, we provide municipal sewer to the community and we treated 1,014 acre-feet of wastewater. Out of that 1,014 acre-feet, 1,000 acre-feet was reused through ribs for golf course irrigation, which reduces their groundwater pumping significantly. We have 97% reuse of our wastewater that is treated. One neat little program that I use more as a tool than anything is a small program that is called a Domestic Well Credit Program that the Division of Water Resources worked with us on. Actually, it was their idea a number of years ago where we have a lot of old domestic wells within our service area and when those wells fail, the owner can come to Lyon County and request that they abandon their well and connect to our system. While no water rights change hands, we have a credit. We only have six of them and four of them use water and we report it every year to the Division of Water Resources. What I use it for with that and a couple of other meters we have on some wells is just to see what those domestic wells are using. The domestic wells are allocated 2.2 acre-feet per well. We are finding out that they are actually using less than our average customer; they are in the .29 or .3 acre foot per year range. That made us think that, if that is the case, what about some of the other well owners out there? If you drive around our area, there are some people who have a lot of landscaping and they may, in fact, be using their 2 acre-feet. The vast majority of them do not have a lot of landscaping and very little, if any, livestock. So, we went out there a few years ago, although I probably won't do it again, but I went out there and kicked the hornet's nest and asked people if I could throw a meter on their well to see what they use. It is the weirdest thing - people were scared to death even though they were saying that we had to do something or we were going to run out of water. I told them we could put a meter on their well and nobody had to know about

it because it was an old meter and it wouldn't be reported but I just wanted to know what they were using and said they may want to know what they were using. I was able to get about a half a dozen of these meters out there. Most of them are employees because people just don't want to meter their wells. I respect that. We have yet to find a domestic well that uses anywhere close to 2 acre-feet. I don't know what that says about the overall picture but it is an indicator. I would love to get more meters out there. We still offer that when we take a meter out of service and we know it's a decent meter, like during our retrofits, if any well owner wants the meter, we will give it to them and we will help them and put the little tail pieces on and show them how to plumb it in. We will even come and read it for them. A lot of well owners have us dip their wells just so we can track the groundwater level. I wish we had more data but we don't. Right now, it is pretty neat.

We have quite a few water rights that get returned to the system, both ground and surface water. When ground and surface water rights go from ag to municipal, they get about a 50% reduction when they're changed. The unused portion of the municipal surface water allocation stays in the river. Supplemental groundwater, again, is not used; it stays in the basin. That's about 5,300 acre-feet. One big one that I think we finally got taken off the table, at least on my end I hope it's off the table, is what was called the El Dorado surface water rights. Many years ago, Ralph Herman, when he was developing the Herman Ranch through John Lawrence, through Dayton Valley Investors, had a plan to put an aquifer storage and recovery program together and use about 1,400 acre-feet of surface water. I think, through all of the discussions and negotiations over the years, that is off the table. I had a meeting with the developer who owns the property now and he said that is just not likely to happen. In fact, it's not going to happen in our service area. We just can't capture that aquifer storage for us in the next 45 years. That is not going to be a very palatable and cost-effective solution.

We created a conservation and drought ordinance that is in place. It includes monitoring and consultation with customers that exceed their allocation amount. We have drought triggers that are automatic. If the board declares a certain level of drought, automatically the water consumption must be reduced. We have yet to have to use that. We have kept everything well within our production goals. We are improving our wastewater treatment processes and are hopeful that, within the next few years, we can move into a Class A effluent and increase our rapid infiltration capacities. On a water quality perspective, we converted 500 septic tanks in the Mark Twain area. There was a septic tank every 75 feet, which far exceeds the septic tank density rules that we have nowadays but we were starting to see some declines in water quality in the aquifer. It took seven years but we got a grant loan package of about $12-$13M to retrofit every single one of the septic tanks to municipal sewer, which included the service line right up to the house and actually turning some of the plumbing around in the houses. That was at no cost to the homeowner and the homeowner pays the exact same sewer bill that the rest of the rate payers pay. The point there is getting 500 septic tanks within a mile radius off those leach fields. We do water and sewer facility master plans once every 7 to 10 years where we take a comprehensive look at conjunctive use, all of our water rights, all of our water facilities, zoning changes that need to happen, and all of those types of things. When we looked at it this last go-round, which was last year, we reduced the number of total units at build out by 4,500 units. The facilities plan that was presented in 2006 had us out at 16,500 units. Again, we reduced that by 4,500 units. We anticipate about 200 new units per year. In some years it will be less than

that and in some years it will be more than that, but that's just an average that we used.

Playing off of what Jason said, what really does keep me up at night and has been keeping me up at night a lot are some of the impacts to the old days of the protests. A water well is $1.4-$1.5M to do a decent municipal well, which doesn't include a lot of piping. If you add in some piping, it is another $1M. We have money in reserve to do that. We can handle most of that. We need to have a water well about once every 15 or 20 years, assuming we don't have to come up with replacement capacity for old wells. The scary part for me is the treatment plant and all of the sewer infrastructure because we've got a treatment plant right now that was designed at 1.2 million gallons and we are pushing about .88 million gallons. It is time to do a design and build on that plant to expand that plant. Depending on the technology that we use, we are looking at a minimum of $4M-$4.5M and a maximum of $10M and then the associated infrastructure, such as the lift stations, the force mains, and all of that type of thing. Within a 3 to 5 year period, we are going to spend $28M. Once we start down that road, it is hard to pull back. You have to do the engineering, you have to do the permitting, and you have to build the infrastructure to have the capacity needed in that sewer system to treat your current flows and your future flows. So, you start down this road to build your collection system and then your treatment plant and sometimes concurrently. With that $28M, I do not know whether there will be some debt on that but I would imagine some sort of SRF funding or possibly USDA, although I am not real sure. It may possibly be developer built but you have a lot of money in wastewater, so you go down that road and let's say you're in about 25% construction and Chris decides to file a couple of protests on water rights that we need to supply those homes that we just spent $28M to build, that will kill our utility; that will wipe us out. It is imperative that Chris, Churchill County, and other users such as Carson, Indian Hills, whoever is part of our group, understands - not the intimate details of our facilities plan but the basic concepts of it. How are we going to meet the demands? How much water are we going to pump? How are we going to be good stewards? I think we are getting back to those days where we are going to have to fire up that group again and sit down like we are tonight, as this is an awesome forum to do that, to discuss what we have done in the last 10 years and what we are looking at for the next 30 years to show the downstream folks and the upstream folks and the Division of Water Resources and others what we are doing. I think working collaboratively is the key. We are not ever going to agree on everything but we can develop a confidence in our partners. We are partners. This whole evening we have talked about the interaction between the ground and surface rights, so collaboration is key, as well as planning and a willingness to do what it takes. In our case, to show that we are good stewards is critical. That is all that I have and I went longer than I wanted to.

Chairman Olsen thanked him and opened the floor for questions. Steve Walker, who lives in Minden, Nevada, said the question I had is related to a chart that Chris put up showing the figure for hydrographic basins along the river and the amount of water rights in each one of those. I think that we should probably also look at water pumped and which one of those basins are actually exceeding the perennial yield. Do we have that information? Jason King said we do have that information. As Chris pointed out, the devil truly is in the details. When you look at those numbers, especially the Carson Valley, I think there is around 93,000 in committed. When we did an analysis probably a dozen years ago, half of that amount was in supplemental groundwater. Again, that is where things start getting dicey. In my earlier years, supplemental

groundwater rights should eventually go away and it shouldn't count against what could eventually be pumped in the long term. We have those numbers, although I don't have those numbers at my fingertips, but that is part of the discussion - all of those nuances to those individual rights. Mr. Workman said one of the things that we use are the rulings that come out of the Division of Water Resources. Ruling 5823 and Ruling 6184 go into, at least in the Dayton Valley, the groundwater consumptive use estimate. If you look at the current consumptive use profiles, at least on the municipal side, this is even considerably conservative, so we are pumping far, far less then what the estimates even in the rulings indicated. That is true at least for the Dayton Valley.

Jason King said I don't want to draw this out any longer than we need to but because we talked so much about conjunctive management, you talked about looking at what committed is versus the perennial yield and, as you saw around the turn of the 21st century, we basically said that the perennial yield of the basin belongs to the groundwater basin, so that is what you can approve up to. That has generally been our policy. Again, the pendulum is swinging, so as we start going down this road talking about perennial yield, we are viewing it in a different way in these river dominated systems. Mr. Walker said I understand. I have another statement. On the Humboldt River, the lower Humboldt has 4,000 acre-feet of groundwater pumped. That is a function of water quality more than anything. Is that correct because the TDS is so high Lovelock doesn't use that water, so that is really where that number comes from? Mr. King said that is exactly right. Again, it is the lower region farmers that have filed a Writ against us and they hit what I call the imperfect storm. They had a drought and the people at the very end of the system, unlike other farmers in the Walker or the Carson, have the ability to pump groundwater to supplement those low flows. Unfortunately, they don't for that very reason you just said, Steve. The water quality is just really poor. Mr. Mahannah asked if he could add something to address Steve's comment. I think that throughout most of Nevada, the amount of permitted water rights and the amount of pumped water will show there is significantly less pumped than what is permitted, with the exception of perhaps Pahrump and a few other outliers. I think the important part is that there are two things here. Those are still valid rights, so they could go up to that level and then the second point is, as I pointed out in my slide, that capture has nothing to do with perennial yield. You can have permitted rights that are half of what the perennial yield is but still have capture and impacts to surface rights.

Mr. Tucker told Mr. Workman that he had a really great report as far as the statistics that you have. I just want to go over those numbers again, real quick. I think I heard you say there is like 6,500 houses in the Dayton Valley. Mr. Workman said there are 6,800 and there is about 6,000 acre-feet of water that has been dedicated for those houses. Mr. Tucker said the houses are using about 2,000 acre-feet? Mr. Workman said they are using about 2,698 acre-feet. Mr. Tucker said out of the 2,600, how much is processed at the sewer plant on an annual basis? Mr. Workman said that I don't know the exact answer to that. I can do it on a yearly average - about 1,100 acre-feet is treated at the wastewater treatment plant. Mr. Tucker said from the 2,600 acre-feet that is being pumped about 1,150 gets to the sewer plant. So, you are seeing the use at about .3 acre-feet on an annual basis per house? Mr. Workman said that is roughly what it is. Mr. Tucker said it seems like about half of that is going through the house and about half of that is for outdoor because you have 1,150 acre-feet that is going to the sewer plant and that is about .45? Mr. Workman said that is correct. Mr. Tucker said I just wanted to go over those numbers and

make sure I understood this correctly. I think your information is great. My hat is off to you. Mr. Workman said I appreciate that. Summertime use, as you would expect, goes up. At our house, in the winter time, we use about 3,000 and gallons a month and, in the in the summer months, I have a 8,000 square-foot lot with some lawn and I try like crazy to grow pumpkins but I just can't. My wife tells me I don't have enough sun but we use about 20,000 gallons a month for drip irrigation and a lawn. Mr. Tucker asked if there was any effluent going back and being used at any of the residences? Mr. Workman said there is not. We got into a long-term agreement with the golf course with the rapid infiltration basins. We are also trying to reduce the noxious weed infestation down in our Rolling A open space where we are using effluent to grow some native grasses. Mr. Tucker said I noticed you also mentioned you raised the price of water and the use with .52 acre-feet per year per house. It seems, because of the more expensive water, it dropped maybe down to .3? Is that possible? Mr. Workman said the cost of the water definitely is a factor. We have had customers call up and say they have to take out their lawn. It is a trend, let's face it. You can't expect everybody to remove their sod. We are not large enough to have a sod buyback program or anything like that but, over time, as the rates creep up, as conservation efforts are advertised, since we benefit from the Truckee Meadows and the Reno area with all of the ads that they put on, people hear that. A lot of people work in Carson but live in Dayton but they get the flyers on water conservation and it crosses county lines. I think a lot of people are just more conscious of it, as well. The cost is a major driver though. Mr. Tucker said that is important to know.

Chairman Olsen asked if there were any further questions but there were none. As we wind down here, I want to thank all of our speakers for being here tonight. I think the question is where do we go from here? This was a great meeting. As has been mentioned by several of our speakers, it is a good start for some of us and a refresher for some of us about where some of the challenges might come from as we anticipate growth coming at us. Collaboration was something that was mentioned a lot. We now see too that the science is being more and more refined. We know better about what our different rivers are doing and what they can do. I had a great meeting with Kip Allander last year and we looked at the upper reaches of the Carson and the work that you had done there was very detailed and had very powerful tools there about seeing just what the impacts are with any sort of future additional uses on the river and what that does to the streamflows. You are working on getting that same sort of data and the modeling is close, as you said it should be done in 2019 for the next stretch of the river from the Carson gauge down. We are getting closer to having the kind of data that would help us better know what those impacts can be on the river as we continue to grow and what it would do to the downstream users. We know that there will probably be more legislation coming at us in the Legislature. I think it is our duty to monitor that and have an opinion. I appreciate forums like this where we can be educated so that we can have a decent opinion about it or be able to formulate an opinion based on education. Lastly, I think about all those basins. Some of the very first things that were shown were about, as we come down the different reaches of the river, they are all over-appropriated and that point was made just a few minutes ago that a lot of the basins in the state are over-appropriated. That is a question that I think that Jason and his folks are grappling with now with the worst-case scenarios that we have in the state. They are trying to come up with a better way of handling those things and get to some place where everybody can live. We are all going to have to live together and it is just a matter of how we are going to do it. We have the same resource and we are using it. Somehow we have to come

up with that collaborative way to come up with an answer about what the future looks for ourselves and our constituents and our children. With that, I want to thank everybody and I want to give Chairman Hastings a chance to speak.

Chairman Hastings said I would just like to thank, first of all, our presenters tonight. They had great information. Thank you for taking time out of your day for this. I want to thank your staff here in Churchill County for all that they have done and the staff in Lyon County that helped out. I agree with you that so much of what we are doing now we need to start looking at a little bit more regionally, as opposed to stopping at the border. We need to work together on that. I'm glad to see that we are coming together to do that. On behalf of Lyon County, I want to thank you Chairman Olsen and your staff for everything you guys did to pull this meeting together. Chairman Olsen thanked him.

Public Comment:

Chairman Olsen asked if there was any public comment but there was none.

Adjournment:

The meeting was adjourned at 8:53 PM.

Approved: _____
H. Peter Olsen, Jr., Churchill County Chairman

Approved: _____
Carl Erquiaga, Churchill County Commissioner

Approved: _____
Harry Scharmann, Churchill County Commissioner

Approved: _____
Bob Hastings, Lyon County Chairman

Approved: _____
Don Alt, Lyon County Commissioner

Approved: _____
Ken Gray, Lyon County Commissioner

Approved: _____
Greg Hunewell, Lyon County Commissioner

Approved: _____
Joe Mortensen, Lyon County Commissioner

ATTEST:
Kelly G. Helton, Clerk/Treasurer

ATTEST:
Nikki Bryan, Lyon County Clerk/Treasurer

_____
Pamela D. Moore, Deputy Clerk of the Board

_____
Clerk of the Board