NEVADA LEGISLATURE
JOINT INTERIM STANDING COMMITTEE ON NATURAL RESOURCES

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MINUTES

January 28, 2026

The first meeting of the Joint Interim Standing Committee on Natural Resources for the 2025–2026 Interim was held on Wednesday, January 28, 2026, at 9 a.m. in Room 4100, Legislative Building, 401 South Carson Street, Carson City, Nevada. The meeting was videoconferenced to Room 165, Nevada Legislative Office Building, 7230 Amigo Street, Las Vegas, Nevada.

The agenda, minutes, meeting materials, and video recording of the meeting are available on the Committee's meeting page. The video recording may also be found at https://www.leg.state.nv.us/Video/. Copies of the video record can be obtained through the Publications Office of the Legislative Counsel Bureau (LCB) (publications@lcb.state.nv.us or 775/684-6835).

COMMITTEE MEMBERS PRESENT IN CARSON CITY:

Assemblymember Natha C. Anderson, Chair
Senator John Ellison
Assemblymember Rich DeLong
Assemblymember Bert K. Gurr

COMMITTEE MEMBERS PRESENT IN LAS VEGAS:

Senator Michelee Cruz-Crawford, Vice Chair
Senator Julie Pazina
Assemblymember Venicia Considine
Assemblymember Jovan A. Jackson

OTHER LEGISLATORS PRESENT:

Assemblymember Selena La Rue Hatch, Assembly District 25

LEGISLATIVE COUNSEL BUREAU STAFF PRESENT:

Becky Peratt, Senior Policy Analyst, Research Division
Destini Cooper, Senior Policy Analyst, Research Division
Jen Jacobsen, Research Policy Assistant, Research Division
Serina Hale, Research Policy Assistant, Research Division
Jeff Chronister, Deputy Legislative Counsel, Legal Division
Daniel Miller, Principal Program Analyst, Fiscal Analysis Division

Items taken out of sequence during the meeting have been placed in agenda order.
[Indicates a summary of comments or clarification.]

AGENDA ITEM I—CALL TO ORDER

Chair Anderson:

Good morning, I feel like I am doing an announcement at a football game—almost. Welcome to the first meeting of the Joint Interim Standing Committee on Natural Resources (JISC NR) for the 2025–2026 Interim. Secretary, will you please call the roll?

[Roll call was taken.]

Before we begin, just a few housekeeping announcements. Please remember to silence your phone and your laptops because my laptop went off earlier. The agenda for today is posted. Please note the agenda items may be taken out of order, combined, or postponed. Members of the public, if you would like to receive email notifications when meeting materials are posted on the Committee's website, web page excuse me, you can sign up for that on the Nevada legislative website. Finally, you might see some of us using laptops to follow the presentations, please do not take that as a sign of disrespect. Committee members, our staff has provided binders for the meeting materials for the first meeting. We will not do so for the next meeting, unless requested to do so. If you make the decision to do so, please make sure to ask for that with at least two days' notice.

AGENDA ITEM II—PUBLIC COMMENT

Chair Anderson:

Public comment is actually the first thing we have got on our agenda today, so let us start with that. During interim meetings, we have two opportunities for public comment, once at the beginning and once at the end. Members of the public can also provide testimony in person, over the phone, by email, or by snail mail, instructions are provided on the agenda. If you are testifying in person, please remember to sign in at the table by the door. Please remember to clearly state and spell your name before you begin and limit your comment to two minutes. Staff will time each speaker during public comment to ensure everyone has a fair opportunity to speak and although this is might not be needed for today, ditto is always a wonderful comment to make if your comments have already been stated. If you wish to provide public comment over the phone, the number is 888-475-4499, the meeting ID for today is 881 1761 9045, then press the # key and then press the # key again if you are asked for participation ID.

Let us start here in Carson City, if anyone would like to give public comment, come on up to the table and while doing so, if you would like to provide public comment in Las Vegas, you can go on up to the table at this time as well. Is there anybody here in Carson who would like to provide public comment? Seeing no one making that mad dash, let us move on over to Las Vegas. You may begin when you are ready.

Jackie Spicer, Coordinator, Nevada Environmental Justice Coalition:

Good morning, Chair Anderson and members of the Committee. Today, we are speaking in support of Assembly Bill 109, which we will be receiving a presentation on today. With Assembly Bill 109, we have the opportunity to protect one of the state's most precious resources and a lifeline to all life, our water. As the driest state in the nation, we have a duty to protect our water and not allow unchecked use to drain our groundwater. Water is

becoming more and more scarce, and we must manage it wisely and fairly; AB 109 balances economic growth with sustainability. We understand how crucial geothermal and mineral resources are to the transition to a sustainable future, but not at the cost of draining our water table and definitely not at the cost of our farmers, ranchers, and families who rely on groundwater to survive. Nevada has long been a national leader in innovative water management and conservation, and AB 109 continues that legacy. It supports key economic growth in a responsible manner without compromising the water security of our communities. In a state where every drop matters, we cannot afford to drop this bill. Thank you for your time and dedication to the people of our state.

Chair Anderson:

Thank you so much. Are there any further comments in Las Vegas? Seeing none. Let us go to the phones. AVH [Audio Visual Hearings Unit], do we have anyone who wishes to make public comment?

AVH, Information Technology Services, Administrative Division, LCB:

Chair, the public line is open and working. There are no callers at this time.

Chair Anderson:

Thank you. Also, before we continue on with the agenda, I would like to very quickly do a thank you as well to our staff, whether they are here in Carson, in Las Vegas, or I guess the voices in the sky. You have done so much to help us prepare not only for this meeting but also doing some research and other information, and it is greatly appreciated. It is not just during the 120-day session that you are here to help us, and I know I can only speak for myself, but it is incredibly important for us. Thank you so much for all of your professionalism and help during this time.

AGENDA ITEM III—COMMITTEE MEMBER AND STAFF INTRODUCTIONS

Chair Anderson:

With that, we are going to move on actually to Item Number III, Committee member and staff introductions. Let us start with our members in Las Vegas and then come back here to Carson City. When introducing yourself, if you could please remind us of the District you represent and a little bit about yourself. Vice Chair Cruz-Crawford, would you like to begin?

Vice Chair Cruz-Crawford:

Thank you so much, Chair Anderson. I represent north Las Vegas. I am very excited to continue to learn more about the needs of Nevada so I can help support in the natural resource realm. I did chair my first Natural Resource Committee last session, and I am excited to be of support. Thank you.

Chair Anderson:

Great. Senator Pazina, would you like to go next?

Senator Pazina:

Thank you so much, Madam Chair. I represent Senate District 12 in the southern part of the Valley, West Henderson, Green Valley Ranch, Silverado Ranch, and Seven Hills, and I am thrilled to be here back on the Interim Committee on Natural Resources. I had the opportunity to chair this Committee in the last interim, and I served as Chair in the 2023 Session in the Senate; though in the 2025 Session, I chaired Commerce and Labor. I am excited to be back and working on bills related to water was something I spent a whole lot of time doing, so, I look forward to a lot more discussions here in the interim. Thank you.

Chair Anderson:

Thank you. Assemblymember Considine?

Assemblymember Considine:

Thank you, Chair. Good morning, I have the honor of representing Assembly District 18, which is in southeast Las Vegas and a little bit of north Henderson. I have served on the Natural Resources Committee for three terms, and I am happy to be here during the Interim Committee. Thanks.

Chair Anderson:

Thank you and ending up in Las Vegas, I believe is Assemblymember Jackson.

Assemblymember Jackson:

Thank you, Chair. I represent Assembly District 6 as representing the historic west side and older parts of north Las Vegas. I am happy to be here back in Committee. I did not chair a committee, I sat on this Committee during the regular session, and I look forward to this interim.

Chair Anderson:

Thank you so much. We will now move up here in Carson and as opposed to mentioning each of you individually, I will just let Assemblymember DeLong start it and then move on over.

Assemblymember DeLong:

Thank you, Chair. I represent District 26 in southwest Washoe County. I am a geologist—it has been my professional career, served on the Minerals Commission for 16 years, including as Chair. The Minerals Commission oversees the Division of Minerals, which regulates geothermal development in the state. I have been on Natural Resources for two terms, and have enjoyed it, and look forward to this interim.

Assemblymember Gurr:

Thank you, Chair. I represent District 33, which as most of you in the room know of is about the eastern third of the State of Nevada—five plus counties, well not plus, just five counties over 50,255 square miles. I think it is 1.49 persons per square mile in my District. I have sat on Natural Resources two sessions. My profession is—I am a real estate broker. I have been that way for almost 50 years, and I grew up in Elko. I know the back country pretty well, and I am enthused to be on the Interim Committee. Thank you.

Senator Ellison:

Thank you, Madam Chair. I had the pleasure of this last session to work with two of my colleagues down in Las Vegas on two different committees, and they did a great job—a wonderful job on Nat. Ram. [Natural Resources] and Commerce and Labor. They—I cannot say anything—they were perfect. They did good—they let you ask questions, and it was perfect. My District is a little tiny one, it goes from the Idaho border, the Utah border, to the California border. If you look at basically half the state, that is my District, and you will see from Bert [Assemblymember Gurr] that you better buy a new truck every two years because you are going to need it. But anyway, I am an electrical contractor by trade, and I am in the commercial and residential properties, so I enjoyed that. I just sold one business, thank God, and if anybody wants to buy some more let me know. I did serve 12 years in Nat. Ram. as a state Assemblyman, and then I got to serve last session, so I enjoyed it. Last session, I had four committees, and I stayed here late at night just trying to read bills, so, it was quite interesting last session. It is good to be on Nat. Ram., it is very important to the state, and mostly in Bert's and mine's districts, and Washoe—so it is important and whatever happens here is going to affect the State of Nevada. Thank you for having me.

Chair Anderson:

Thank you, and I will end with myself—Assembly District 30, which is primarily Sparks; although I have a little bit of the Reno area as well. My real life, as I call it, or my other life, I am a high school civics and English teacher. My students are actually starting the legislative branch tomorrow, actually today when I am not there, they are looking up some textbook stuff. I think that is one of the reasons why I love having a civics and English teacher actually be on a Natural Resources Committee. I have no science background, and yet that is the beauty of a citizen's legislature—it is laws being discussed by people that are in the industry, such as some individuals, and some people that are not in the industry, but are greatly aware and influenced by the importance of those items. It is my honor to be the Chair, and I have served on Natural Resources since my freshman year, so that was three sessions ago, and I have had the opportunity to be on the Interim Committee now twice. I am looking forward to not only productive discussions but also a continuation of what we have had over the last three sessions, including the interims where it is not about the party. It is also not about the region you come from; it is about looking at the resources we have as a state, protecting them, planning for the future, and also celebrating them.

I would also like to take this moment to introduce our nonpartisan Committee staff from the Legislative Counsel Bureau who will support us during the interim, our Committee policy analysts, and literally my right-hand person, Becky Peratt and Jered McDonald, and then our Committee counselors, Jeff Chronister, Erin Sturdivant, and Daniel Delap. Our Fiscal Analysis Analyst is Daniel Miller, and our Committee secretary is Jen Jacobsen. Our

members in Las Vegas will also be assisted by policy analysts, Destini Cooper and Alberto Quintero. As I stated at the beginning, there is no way we could do this without so many LCB staff, but that also includes all of our staff—our AVH, legislative police, our maintenance crews, just everyone, and also our retail therapist known as the gift shop, thank you so much. Thank you for keeping everything running smoothly and safely.

AGENDA ITEM IV—PRESENTATION OF THE COMMITTEE BRIEF

Chair Anderson:

Now let us move on to section number IV, where our Committee Policy Analyst, Becky Peratt, will present the Committee Brief. If you would please proceed whenever you are ready.

Ms. Peratt:

Thank you, Chair Anderson. The Committee Brief (Agenda Item IV) provides information pertinent to the Committee's work. This includes information on the Committee's statutory authority and jurisdiction, changes to the Committee with the passage of Senate Bill 226 last session, statistics on natural resources related legislation from the 2025 Session and Committee staff contacts. You can also find links to Legislative and Executive Branch audit reports on natural resources related state agencies, and Research Division publications. To conclude, staff from the Research Division and other divisions are here to provide confidential nonpartisan assistance to the Committee and it is members, and to provide any assistance in any way possible on any topic. My role is to provide policy and research assistance to help you make informed decisions on policies reviewed by this Committee. As a reminder, as nonpartisan staff, I can neither advocate for nor oppose any recommendations that come before the Committee. Please do not hesitate to reach out if I can be of any assistance. Thank you, Chair.

Chair Anderson:

Thank you, and I really appreciate the information that you presented in the Brief, especially on page two, as I stated in my introduction, the statistics are incredibly interesting about how many bills we discussed—how many bills we actually passed. Of the bills that came out of the Assembly, all 27 of our bills had bipartisan support, which shows that we take the time to really discuss things whether it is in the interim or outside the interim, and 23 of those 27 in the Assembly were with unanimous support. Similarly, on the Senate side—to back up what Senator Ellison was saying about how important it is to be able to work with each other—the Senate passed 34 of the bills, and 33 had bipartisan support, with 27 unanimous support. Again, I hope we can continue that trend of being able to discuss with each other rationally and come forward with decisions that are best for the entire state.

All right, any other questions or comments? Seeing none and feeling like I am back in my classroom. Let us move on to number five with cloud seeding across the state, the policy trends and programs.

AGENDA ITEM V—CLOUD SEEDING ACROSS THE STATES: POLICY TRENDS AND PROGRAM GOVERNANCE

Chair Anderson:

We will actually have first a presentation (Agenda Item V) from the National Conference of State Legislators (NCSL) on cloud seeding policy trends in other states. I believe they will be joining us via Zoom—AVH, are we ready to go?

AVH:

Chair, this is Kim in Broadcast. Are you waiting for Mr. Klein?

Chair Anderson:

Thank you, Kim. I am, so thank you so much. Mr. Klein, please go ahead whenever you are ready.

Tom Klein, Policy Associate, Environment, Energy, and Transportation, National Conference of State Legislatures (NCSL)

Thank you, Chair. Is everyone able to hear me all right? Perfect. I cover cloud seeding and geoengineering air quality issues here at NCSL. I am going to share my screen, and I believe you are able to see that. Thank you for having me.

This presentation is going to talk about state policy trends and considerations behind some of those trends. I can speak minimally to the science behind cloud seeding and some of the concerns associated with it. Here is a map of the policy landscape and state legislatures. The purple states are states with enacted legislation on geoengineering and cloud seeding. The orange states are states that have introduced legislation in the past and have not yet prefilled or introduced legislation in this current session. The yellow states are states with pending activity, so introduced legislation on the topic, and the gray states have not touched this topic yet. I will note this presentation was submitted on January 14, and since January 14, I did a quick check this morning, 6 additional states have introduced legislation on this topic—those states are Georgia, Kansas, Mississippi, Rhode Island, West Virginia, and Virginia. Eight states have enacted legislation, those states are Colorado, Florida, New Mexico, Utah, Idaho, Nevada, Washington, and Wyoming, of those eight states, seven states have passed legislation in support of cloud seeding typically in the form of an appropriation, and one state, which is Florida, has passed a prohibition of cloud seeding and geoengineering activity in the state. Seventeen states, well that is what it says in the presentation, but currently 23 states have currently pending legislation, and all of that pending legislation includes restrictions/prohibitions of geoengineering, and 11 states have introduced legislation in previous sessions without passing—2 of those 11 states. As I mentioned earlier, Rhode Island and Virginia have introduced legislation again in this session. Now, I believe I have lost the feed, but I hope you guys are still able to see me here. There we go. Did I freeze there for a second?

Chair Anderson:

You were fine. We did not even realize it until you said something.

Mr. Klein:

Thank you, I just want to make sure I was not speaking to myself here. Here is another map, these are the states that have enacted legislation. As I mentioned before, Florida is the state that has unsupportive legislation surrounding cloud seeding and geoengineering out of the states that have passed. You notice that the states that have passed are typically western states with a bipartisan legislature compositions. Here are some reasons why the states that have passed legislation on this have supported cloud seeding. It is typically related to water scarcity and drought risk, and that is why we are seeing it in western states, so particularly states where precipitation variability directly affects water supply. I know in Colorado snowpack is very important because when the snow melts, we get the water in the rivers, so snowpack and watershed management is important to consider when it is significantly contributes to downstream water availability. There is a perception of cloud seeding being an affordable option or low-impact. I guess some just basics on cloud seeding. It is a special kind of plane that can be flown through already existing clouds that releases the particles, specifically silver iodide, which increases precipitation in clouds. I am sure there will be a scientist that will be able to better explain this than I did, but it is seen as a low-impact or incremental intervention—nothing super extraordinary. It also is used for regional or sector specific needs, so regionally, we are seeing it being enacted in states with drought. States that support cloud seeding most commonly do so through the appropriations process, authorizations, or program continuation. It is rarely a standalone regulatory framework and these measures typically direct funding or authority to existing agencies, water boards, research institutions such as universities, which I believe is action that was taken in Nevada in 2025 with an appropriation to the Desert Research Institute (DRI).

These are the states with pending legislation, as I mentioned earlier, this map should also include Georgia, Kansas, Mississippi, Rhode Island, West Virginia, and Virginia; and those states would also fit the trend that we are seeing with the introduced legislation. The introduced legislation we are seeing in states in 2026, is legislation that is unsupportive of cloud seeding—looking to prohibit cloud seeding and geoengineering weather modification. Sometimes cloud seeding is bunched with other weather modifications in state legislatures. Here are some reasons that states are opposing cloud seeding or geoengineering and some of their introduced legislation. Lawmakers are seeing high constituent concern about the topic, specifically when it comes to intentional atmospheric activity. There are concerns surrounding the chemicals that are involved in cloud seeding activity. There is public skepticism toward the government and private sector involvement with weather modification. Some policy overlap will, as I mentioned earlier, broadly include cloud seeding within weather modification or climate intervention debates so it can lead to a wider prohibition that includes cloud seeding. Some believe that there is uncertainty about long-term environmental impacts associated with cloud seeding and that—a different angle to consider that some states have included in their legislation—is a desire to avoid legal or liability exposure, especially where impacts are difficult to attribute or measure, when you are dealing with waterways that go over state lines or different districts. All of these cloud seeding bills that we are seeing introduced, in the previous map here, all goes around prohibition. I have not seen legislation cutting funds for research, it is mostly about outright prohibitions and are often paired with criminal penalties, civil fines, or enforcement authority rather than regulatory or permitting frameworks, in this introduced legislation we are seeing, as well as with the Florida bill that was passed in 2023.

Here are some examples of legislation that, I separated them by supportive and unsupportive. The three bills on top here are examples of legislation that are supportive towards cloud seeding. Two of them are with Idaho. In 2020, that was one of the earlier bills passed in support of cloud seeding, it authorized the Department of Water Resources to develop, coordinate, and provide for weather modification projects, so essentially officially legalizing it; and in 2021, they added to the existing law which authorized state funds to be used for cloud seeding in areas with low or insufficient water supplies. The other bill I included in the examples of legislation supporting cloud seeding is a New Mexico bill that appropriated money to the University of New Mexico for cloud seeding programming and research.

Now here are some of the unsupportive bills below; these are not enacted bills; these are all pending that were introduced this year. Missouri Bill 2388 creates the Clear Skies Act which would prohibit geoengineering, cloud seeding, and other atmospheric interventions and would authorize the DNR [Department of Natural Resources] to investigate violations, so it includes criminal penalties. The Ohio and Tennessee bills are pretty similar. In Ohio, it prohibits a person from engaging in solar radiation modification, cloud seeding, or sunlight reflection methods, and they named this one the Atmosphere Protection Act. In Tennessee, HB 899, currently pending, it would make it a violation of the State Consumer Protection Act of 1977 for a weather-related company to conduct weather modification activities. Feel free to contact me if you would like more information. I have a full list of all the bills that have been introduced and enacted.

Here is my contact information if you would like some more information on this topic or others. If there is time, I am not sure how the agenda is slated, I am happy to try and answer any questions, but if not, that is perfectly fine.

Chair Anderson:

Thank you so much Mr. Klein for both the visuals, but then also just very quickly giving us some examples of both the positive and the negative legislation that has been, or I am sorry, the supportive as well as the more prohibiting legislation that has been presented in other states. If you are able to answer some questions, that would be great. I believe I have got a few from the Committee. Is that okay with you?

Mr. Klein:

Yes, yes please.

Chair Anderson:

Wonderful, we will start off with Assemblymember DeLong.

Assemblymember DeLong:

Thank you, Chair, and thank you very much for the presentation. The term cloud seeding is a long-used term, I think pretty well understood what it means. To me, the term geoengineering is a new concept, a new term, and I do not think well-defined. Are you aware of any actually scientific analysis about what is included in the term geoengineering, excluding cloud seeding? And if there is, could you make that available to the Committee?

Mr. Klein:

Thank you for the question, Assemblyman I believe geoengineering encompasses other forms of weather modification such as solar radiation. I would like to provide you with that full list, and I am happy to send that to you in an email, as well as a clearer definition of geoengineering, which I unfortunately do not have on the top of my head. Thank you for the question. I will make sure to provide that definition for you.

Chair Anderson:

If you could provide—if you could send that to our Committee analyst and in that way everybody in the Committee could have that; that would be great. Do you have any further questions? Senator Ellison?

Senator Ellison:

Thank you, Madam Chair. Can you tell me how many counties right now in the State of Nevada are doing cloud seeding?

Mr. Klein:

Thank you for your question, Senator. Regarding the number of counties in Nevada engaging in cloud seeding, I do not have that information. I have been tracking the state policy trends of cloud seeding in different legislatures. I do know that Nevada in 2025 passed Nevada Senate Bill 6 which was an appropriation to the Desert Research Institute making an appropriation to the research institute, which is the system of higher education, to support the Nevada state clouding seeing programming. I can also try and look into that for you and find information as to which counties in Nevada are operating in a cloud seeding capacity and provide that for you.

Senator Ellison:

Yeah, because I think it would be important for the state to know that the cloud seeding they are doing now, and what impact it is having. If you could get that, I appreciate it. Thank you.

Mr. Klein:

Thank you, Senator. I will make sure to do that for you.

Chair Anderson:

Thank you. There is a possibility of the next presentation going into that information, Senator. If you are okay, you might be off the hook. We do not know yet, but I just looked at the individuals presenting next, and I believe they will be presenting that information. Any further questions, seeing none. Thank you so much again for being able to participate with our meeting today. Greatly appreciate your presentation, and you will more than likely get a few more follow up questions.

Mr. Klein:

Thank you, Chair. Feel free to email me. I am happy to speak more on this question and others.

Chair Anderson:

Thank you.

AGENDA ITEM VI—PRESENTATION ON THE SCIENCE OF CLOUD SEEDING

Chair Anderson:

All right; next we will actually have the presentation (Agenda Item VI) from the Desert Research Institution on the science of cloud seeding. Joining us is Frank McDonough, a research scientist in atmospheric science at DRI. Welcome and please go ahead whenever you are ready. I do not believe your microphone is on yet. There you go.

Frank McDonough, Research Scientist, Atmospheric Science, DRI:

Good morning. I manage the cloud seeding program for the State of Nevada. I have a PowerPoint presentation that I would like to give and be glad to answer any kinds of questions, including some of the ones that were introduced in the previous talk. As you know, representing the state, Nevada is the driest state in the U.S. [United States] and mountain snowfall during winter storms provide the critical water resources that the state relies on. Periodic drought and competing water needs are often greater than the amount of water that many basins can deliver. There is a chronic shortage, in many parts of the state, of water. Cloud seeding is a safe, proven method to increase the efficiency of clouds to produce additional snowfall. This is an important topic that has come up in the recent last few years is cloud seeding can also offset the detrimental effects of upwind air pollution. Upwind air pollution is actually putting particles into clouds; it is actually reducing cloud seeding. These bills that were just talked about in the past that make no mention of industry's role in inadvertent cloud seeding.

What is cloud seeding? Well, it is a technology to improve a cloud's ability to produce meaningful precipitation. It is done by introducing an ice-forming dust into subfreezing liquid water cloud layers which are colder than 23 degree Fahrenheit. The dust forms embryonic ice crystals, which will then grow quickly when the subfreezing liquid water drops are present. This is some physics that is a little bit complicated, and I am not going to get into the details, but that is basically the way it works. We are looking for clouds with subfreezing liquid water. We introduce embryonic ice into that, and we can grab onto those water drops and grow those baby ice crystals into snowflakes, and then that snow will end up falling to the ground as increased precipitation and subsequent runoff and provide water resources for the state.

How does cloud seeding work? Well, you can see if we go around this slide—here we go. See number one, a microscopic amount of silver iodide is released—and I would like to, I mean, I do not know if you can see this, but this is enough cloud seeding material to make an acre-foot of water, which is a foot of water over a football field. We are talking about this much, and it is a safe piece of dust. It is made of a rock called silver iodide, and I will talk about that in a little bit. The silver iodide particles rise into the clouds and then the particles

enhance the cloud's ability to convert the subfreezing liquid water drops into ice crystals, and then as I said, these ice crystals will quickly grow big enough and fall out as snowflakes over the mountains, and then that will increase the snowpack, and we get more runoff.

How is cloud seeding done? Well, in the State of Nevada program, the cloud seeding is entirely done from the ground. There is no aircraft used in this program whatsoever—everything is from the ground. Here is an image of a cloud seeding generator out in the Ruby Mountains, and I am not going to go through all the details of it, but basically, you can see it sits on the ground. It is parked in a climatologically-favored location to capture air as it moves towards the mountains, we introduce the dust particles into the clouds and they grow the snow, and then the snow falls out over the high peaks, and that adds to the snow pack.

When is cloud seeding done? Cloud seeding is only done when winter storms are moving across the project areas, and there are widespread low clouds, so we are looking at clouds below mountain top. If there is any kind of high blue sky, nobody is cloud seeding in that, they are cloud seeding when there is a huge overcast cloud-deck with very low cloud bases. As previously mentioned, cloud seeding cannot create clouds, it can just change what is in the clouds in terms of ice or water. What is the cloud seeding dust made of? It is a naturally occurring, inorganic molecule. Like I said, you can see it—we are the silver state, and this is silver iodide. It is a safe naturally occurring rock. The reason it is used is because the molecular structure of silver iodide is very similar to ice, so it creates a surface for the water vapor and droplet molecules to line up on to create the initial crystalline freezing event that then can create snowflakes. This material remains a solid before, during, and after cloud seeding, and when it does come out of the sky, it does not disassociate, it remains an uncharged molecule, and it does not become bioavailable. So most when, you know, and I hear a lot of people over the years talking about their concerns with cloud seeding; this is not anything new and most of the material people present to me is studies based on silver ions and a silver iodide is a piece of silver that has become disassociated from another molecule, and it carries a positive charge and that positive charge allows it to be reactive to both biology and to plant life. The cloud seeding material does not disassociate. It is not bioavailable—it is insoluble so that no silver ions are created, and it does not add free silver to the environment. So, all the concerns from/about silver are not related to the cloud seeding molecules used.

Does cloud seeding work? It does work. It can increase snowfall by up to 15 percent, and several good studies have shown average stream flows of up to 8 percent increase. So, it is putting down quite a bit of water, and it works very well. It is been studied for decades, and it does work. Here is a listing of a few of the reports which I am not going to go over at the moment.

The next question is, are there safeguards built into cloud seeding? Obviously, if there is 50 feet of snow, nobody wants more. We have a whole list of criteria that we operate under that protect the snow pack from getting excessive, and we keep our eye on the weather conditions, flood watches, and so we have suspension criterion that are built in there. They include flood watches, we keep an eye on the snow pack, and if the snow pack exceeds an unacceptable number—we stop. If we have avalanche warnings that are going to impact roadways or communities—we shut down the program. And then as I said, there are numerous environmental impact studies that show no negative impacts from cloud seeding and these are going back 60-70 years. A big question we always get is, does cloud seeding

steal precipitation from other mountain areas? The answer is no, and you know—this is a complicated slide here, and I do not think I will take the time to go through it—but the main take home point is the amount of moisture that is removed from the air mass as it moves over a mountain range with cloud seeding is less than 1 percent, a fraction of a percent, of the total moisture is removed from the storm system. It has zero impact downwind of the area in terms of snow pack or the precipitation for the next mountain range over.

What is not cloud seeding? So obviously, there is a lot of confusion out there about what cloud seeding is and is not, and the EPA [Environmental Protection Agency] under President Trump has just issued a link through the EPA of what cloud seeding, or what contrails are. Here is a big shot of contrails. People send me this picture all the time and tell me—this is me doing this. This is actually water vapor being created by the exhaust of jet aircraft, and so these jet aircraft fly, they have a hydrogen-based fuel, the hydrogen-based fuel reacts with the atmospheric oxygen to create H_2O [Water]. The H_2O comes out the back of the aircraft and it adds moisture to the upper atmosphere and that extra moisture is enough to push the clap—push the layer beyond its saturated moisture level and create these long-lived contrails. That is basically is not cloud seeding, it is just aircraft exhaust pollution basically.

Then what is geoengineering? Geoengineering is a research topic that is designed to study possible methods to offset the negative effects from CO_2 [Carbon Dioxide] emissions. There is no active geoengineering going on—it is all research in computer models, and it is an idea, and unfortunately, there has been a sort of, kind of an overlap where people think these contrails are geoengineering, and they are actually not. Actually, there was an interesting study done right after 9/11 where there was no aircraft flying except a couple of aircraft. They were able to actually measure the change in temperature of the Earth's surface with and without the condensation trails from the jets and actually turns out these contrails are a warming of the Earth. These things are actually making the Earth even hotter than what is already being done. These obviously are not geoengineering, and they are certainly not going to cool the Earth in any way. Anyway, that is just a little aside.

Let us move on to the Nevada State Cloud Seeding Program. The Nevada State Cloud Seeding Program has been going on for decades now. The state has invested in the program for many years and there is currently $2.5 million in infrastructure that is owned by the state. It has already been built, it is operational, it has been installed in climatologically favored locations, and this infrastructure includes cloud seeding generators, weather stations, icing detectors, web cameras, communication systems, and then the equipment to do the field work in the winter as well. These weather stations and web cameras are available to the Weather Service [National Weather Service] and any other weather forecasting groups to use—so it is also benefiting weather forecasting. We also enjoy strong support across the state. We have the support of the Southern Nevada Water Authority, Truckee Meadows Water Authority, Humboldt River Basin Water Authority, the Walker River Irrigation District, the Nye County Water District, and then from some of the other groups—the Save Red Rocks group has endorsed us, Lee Canyon Ski Area, the Nevada gold mines, and Nevada farmers have all participated in our programs.

Here is where the projects are located. We have operated nearly continuously under state funding from 1976 through 2009, and then after the big recession in 2009, the funding was cut due to lack of funds. These arrows, to the Senator's question, these arrows show where cloud seeding is currently conducted. We have a project in the Santa Rosa Mountains in

Humboldt County. We have a project in the Ruby Mountains, which is Elko County. We have a project in the Spring Mountains, which is along the border of Nye and Clark County. Then we have a project in the Tahoe-Truckee watershed, which partially is operated in California, and then also in Washoe County. That is where we are doing the cloud seeding at the moment. There are many other locations across the state that could benefit from this cloud seeding, primarily the Diamond Mountains—have a serious water issue and we have studied whether or not we could seed the Diamond Valley, the peaks above Diamond Valley, and it looks like we could. Hopefully, we can maybe expand and help to offset some of the issues with that. Recently we had a project funded by the state in 2017–2018, and then in 2023–2024, and 2024–2025 projects were funded by the state, and then we are active again this winter as well.

A fully operational program can produce 40,000 plus acre/feet, some years quite a bit more, of additional snow/water equivalent—that is liquid water in the snowpack on the ground. Just for reference, a Reno household uses one-third of an acre-foot of water per year, so 40,000 acre-feet is enough water for 120,000 houses, and it cost $10 an acre-foot to produce, and you are paying probably almost, you know, 50 to 75 times that at your tap. It is a really cheap way to get additional water, and it is pretty much the only way to get additional water without massive piping of water resources. Some of the other programs in other western states, that the gentleman showed on the slide, Utah is spending $9.2 million this year on cloud seeding, and then on top of that, they have additional funding from the Lower Colorado Basin, which is six southern California water providers, Southern Nevada Water Authority, and the Central Arizona Project. The goal of some of those projects is to get water into the great Salt Lake and then also to get run off in the Colorado River. The State of Wyoming recently has spent $800,000 per year, and then on top of that, some additional funding from the Lower Basin. Idaho is spending $4 million per year, and Colorado is putting in $700,000 per year from the state, and then there is other funding from the Lower Basin of the Colorado River, as well.

Here is some of the results from the 2023–2024 season, we were able to produce 56,000 acre-feet, like I said, that was enough water for 150,000 Nevada homes for a year, and the cost was $10.66 per acre-foot. Last year was a little drier, so we did not quite produce quite as much water, but we still produced over 40,000 acre-feet on last winter and that ended up costing $14.75 per acre-foot. So far, this year, it has been kind of a strange winter so far, we are definitely below average in the Sierra. We are about 66 percent of normal, out in eastern Nevada we are more upwards of 85 percent or so, and down in the Spring Mountains, we are actually up well over 100 percent of normal. So anyway, we have had 17 seeded storm periods so far this winter.

Just to summarize, the cloud seeding has been used for decades in the western U.S. to enhance water supplies. It is conducted under real-time supervision and only within our defined weather parameters and our suspension criteria. With that, I would be glad to take any questions.

Chair Anderson:

Great. Thank you so much. We do have a few questions. Before doing so though, I am going to ask; in the introduction, you said that there had been no discussion about businesses that might inadvertently do cloud seeding. Did I misunderstand that?

Mr. McDonough:

No, so basically, we have a growing body of evidence that suggests that air pollution of various sorts creates small aerosol particles. These aerosol particles get into the atmosphere, they go up into the clouds, and we are seeing—downwind of large urban areas—a decrease in the amount of precipitation. So if we look at some of the air crossing the California big cities and then moving into the Sierra, we are seeing a decrease in precipitation and a longer time to create precipitation because of this aerosol pollution from human activities—that includes industry, cars, you know, there is all kinds of pollution, farms, fields that are laying fallow over the winter—all those kind of things are adding dust into the atmosphere and that dust changes how effectively clouds produce precipitation. I just wanted to point out that some of these bills that are being passed across the eastern U.S., that have no water issues whatsoever, they just do not want to see contrails in the sky. Tennessee passed a bill about a year ago to try to ban the contrails, and as far as I know those jet trails are still zooming right over Tennessee, and it has not done anything to stop the contrails and so they are mismatching geoengineering with contrails and that is kind of a mixed-up thing. But none of these bills address the results of what we call inadvertent cloud seeding, which is when human activities are changing the ability of clouds to produce precipitation.

Chair Anderson:

Thank you so much for that clarification, and just to reiterate that is not based upon one industry, it is based more upon the habits that we all have as humans. Okay, thank you so much, and I know that there are some other questions, but I might have more after that. Senator Ellison.

Senator Ellison:

Thank you, Madam Chair. I like the presentation a lot. It brings a lot of information, but I did have some questions. Most of all of our seeding that we have, like in the Ruby Mountains is stuff like this—these are all ground seeders. I was kind of surprised that Diamond Valley had not been seeding, period. That is a major issue down there because they are buying up the farms or the ranches and closing them off because the water issues and so we are losing thousands and thousands of acres of alfalfa and whatever. It seemed like, to me, that should have been a priority long time ago. But most of the stuff we are talking about right now where you are talking about nationwide is—are you talking aerial, or are you talking ground seeders?

Mr. McDonough:

Through the Chair to the Senator, basically, most of those bills are not specific, they just are banning any purposeful change to the environment, to the atmosphere. So basically, they are banning the release of dust or aerosols to purposefully impact weather or climate. That is what those bills are saying, but the constituents' concerns are the contrails. They believe that the jet trails are active geoengineering operations, and they are not. I mean, so basically that is the kind of some confusion. Then cloud seeding for precipitation enhancement, like I said, that is only going to be done when you have low clouds or when you go out to the Ruby Mountains, you cannot even see the mountains when we are cloud seeding—it is low overcast you cannot even see the blue sky—there is no blue sky when cloud seeding is being done. Most of these bills are mostly just banning something

that they are already not doing because, you know, if you are east of the Mississippi River, you do not have water issues—your water issues are flooding—it is not lack of water, so it is mostly just a bill that is getting rid of something that does not exist there anyway. They do not have any experience with drought, and they have never seen a four-year drought where no water makes it to Rye Patch. It is easy to ban something when it is not an issue for your state, but in this state, the driest in the U.S., we should be working to try to mitigate and improve our water resources. Like I said, this is a safe, very cheap overall for the amount of water it produces, and effective way to add water resources to the Humboldt River. As far as the Diamond Mountains, I inherited a study over the Diamonds which showed that the ridge was too skinny to affect, you know, the air goes up and over very quickly because as you know, that is a narrow mountain range. So, the previous research study, which was done about 20 years ago, showed that the aerosol—the cloud seeding material would go up and over very quickly, but I did a new one just over the last two winters and it showed that we could actually impact them from the northwest side and actually have a much longer residence time over the peak, so I think we could expand the program into the area of the Diamond Mountains. We would like to, the problem is when we got the funding in 2023, we had to refurbish all the existing programs, and we had existing equipment out in the Rubies, and in this Tahoe area, and down in the Spring Mountains, so we just spent our time kind of getting the program back on its legs over the last two years. I think we will try to expand into the Diamonds and hopefully next winter, we can actually have a program that includes the Diamonds, so that is on our list of places to go, and that is the next place. Actually, that is our highest priority.

Senator Ellison:

The other question I had was Clark County. You know, we have an issue down there as far as the water table dropping quite a bit in the reservoir. What is the mountain area up there that is right outside of Las Vegas? Is it Charleston or what is that called?

Mr. McDonough:

Through the Chair to the Senator, those mountains are the Spring Mountains. We do have an active program there. Those mountains are very porous, so basically the water/snow that goes on there percolates into the ground and there is—understanding groundwater recharge is highly complex; like how long it takes to get snow to percolate into a crack, in the rock, on the top of mountain. Mount Charleston is the high peak in the Spring Mountains—and to get that water droplets that melt through that crack to come out in a groundwater reservoir is, we do not know if—some of those springs are one year, some of them take 100 years, some of them that water melted 1,000 years later, and it shows up in the spring. We sort of need to really understand the percolation and some of the extra snow we are putting down in the Spring Mountains now may show up in the spring in 50 years; we do not know. The Nye County Water District has a serious water issue as well, as you know, the state engineer was down there, and they actually require two wells to be taken off-line if you want to develop a property that you already own. We are trying to do a project targeting the west side of the Spring Mountains, especially, to see what the recharge in the Pahrump aquifer looks like, and so we are on the fourth year of that study right now, and so hopefully we get some insight on how well the project can recharge groundwater, but it is a highly complex question. But more water is always better.

Chair Anderson:

Thank you. Next up, we will go to Clark County, Assemblymember Considine.

Assemblymember Considine:

Thank you, Chair. I think my question has somewhat been answered. My question was that in your program results, you are showing snow/water equivalent precipitation, and my question was, when you are saying that 40,674 acre-feet of water, that is not measurable as far as seepage through a snow pack all the way into the aquifer that recharges, that is just what is sort of landing in the snow. So, the generation that you are saying acre-feet of water is not water that is potentially content, currently or foreseeable future, completely going to be usable. That is just where it lands, and it still needs to go through the seepage and percolation. So, we do not have that final number yet. Did I understand what you are saying correctly?

Mr. McDonough:

Yes, through the Chairperson to the Assemblymember. That is correct. That is correct. You, yeah, it is basically snow on the ground, and like I said the recharge challenge is a big one and even the runoff is, it is exceedingly complicated that snow falls on dry ground versus a wet ground that the runoff is different. But like I said, there has been a really good study done during a 50-year project by Southern California Edison over their hydro project in the Central Sierra, and they were regularly seeing 8 percent more water coming down the river during the cloud seeding operation. That was a really robust study with decades of research behind it; so that is probably the best study. We have some interesting results from the Humboldt River—we have the north fork of the Humboldt comes down from an unseeded area along the Idaho border of the Jarbidge Mountains and then the south fork of the Humboldt comes out of the Rubies. We can actually compare the flow of the south fork to the north fork during the seeded and unseeded years, and we see it regularly—see almost 10 percent more water in the south fork during the seeded years. We feel pretty confident that the runoff—although it is certainly not all the snow that is being put on the ground—a decent amount of that does come down as additional water. But like I said, it is a highly complex process—the getting the snow to be usable water resources.

Chair Anderson:

Did you have a follow up? Oh, great. Thank you so much. Next step, we will go up with Assemblymember Gurr.

Assemblymember Gurr:

Thank you Chair. I think you have danced around the answer to my question pretty closely. But when you are looking at the difference between a normal storm and when it is cloud seeded, you can tell the difference between the snow just by snow depths. You can tell that storm was only going to put down 10 inches of snow, and you seeded it, and it put down 20. Is that—how do you get to that point?

Mr. McDonough:

So basically, through the Chair to the Assemblyman, basically you look at what is in those clouds. So the clouds—we have weather models that can tell us what is in the clouds, it uses observational information including satellite, radar, and observational networks, and then we can put all that into a weather model, then we can run all the physics we understand to calculate how much liquid water is in those clouds, and then we can also calculate how well the cloud seeding material would go from our ground based equipment into those clouds. Then based on how much water there is and the temperature, we have done studies that show how quickly that—basically these clouds with water have very tiny—these drops are very, very tiny, they do not fall out, they just float with the cloud. Whereas if you can get all these drops onto one snowflake, they come down. That is really what the goal is to take all these tiny drops and get them onto a single snowflake and then have that snowflake bring that water to the ground. And like I previously said that those drop numbers seem to be increasing based on upstream pollution.

But anyway, long story short is we can calculate, based on the amount of liquid water in the cloud, how long our aerosols are in the clouds, how much growth we are going to get onto our snowflakes. So, it is more on the order of about, you know, a 10-inch snowstorm would be an 11-inch snowstorm if the clouds with liquid water present. We have meteorologists looking at all our project areas for 24-7, pretty much, and if they see the evidence—the cloud liquid water layer in the temperature range where cloud seeding could be done are there—they are going to turn on these generators and then base. So somewhere like the Spring Mountains, it is amazing how much water comes through those mountains in the clouds versus, you know, somewhere up in the Jarbidge, it is much colder, and the amount of water is much less, but the storms last for three times as long. It is kind of like I said, we are watching the weather, we have studied the clouds extensively, and we know how effectively the ice will pull the water out, and so we can calculate how much water we think we are creating based on the cloud seeding and the atmospheric conditions that are present; but we do not have a great way to measure it. When we do validation, we try to do, we use these SNOTEL [snow telemetry] measuring sites which are in the mountains and then we try to do what we call target control for a snow site that is being seeded versus not being seeded and try to do a statistical analysis of that. Usually that turns out pretty positive, like up in the Santa Rosa Mountains, we did one which I feel is a pretty robust one. We are seeing upwards of 30 percent more snow over the, you know, three or four years that we have run that project. That is a great mountain range to do the work, Santa Rosa, because it is, you know, it is a great research place for us to study cloud seeding. The results show on the order of over, you know, on, and now obviously some storms are not seed able if there is no water in those clouds, if it is all ice and snow, then we are not, you know, we cannot do anything with those, we just let them go, but if that water layer is there, we are going to seed it, and we can add the 10 percent. So that 40,000 acre-feet is coming from a post analysis of all the times we seeded compared to all the weather conditions that were present when we did the seeding.

Assemblymember Gurr:

So, it is a very complicated process. Okay, but I appreciate the answer. Thank you.

Chair Anderson:

Thank you, Assemblymember DeLong.

Assemblymember DeLong:

Thank you, Chair. Thank you very much for the presentation. I think you provided a lot of clarity on the issue on what cloud seeding really is and what geoengineering, at this point, really is not because there is a lot of discussion about geoengineering and the contrails—are all these companies spraying all these chemicals—and which is, from my perspective, not true. Really good presentation on the cloud seeding. I actually have a couple of questions. One is why would you use aerial versus ground-based cloud seeding?

Mr. McDonough:

I will just answer if that is okay. Basically, ground-based—first of all you do not have to fly in clouds. These water-drop clouds, subfreezing water drops are actually icing clouds as well. So, aircraft going in here are going to ice up and, you know, we are flying during winter storms at low altitudes with heavy turbulence and strong winds and stuff. It is a little bit, you know, I am not saying it is not doable, but most of the time you do it from the ground because it is cheaper—number one. Number two is that you can cloud seed continuously for however long you want, without having to send the aircraft back to refuel and go up in the clouds. The reason aircraft would be beneficial is if a warmer storm comes in. We cannot really effectively cloud seed until the temperatures at 10,000 feet are colder than 23 degrees Fahrenheit, and so some storms are significantly warmer than that where that 23 degrees Fahrenheit layer is up at 13,000 feet. And so, our ground-based equipment cannot reach that high of an altitude. Like I said, we are just not doing aircraft. So, you know, I think aircraft would be really interesting as actually to do validation, to go fly and intercept the cloud seeding materials and to help beef up—but it is done. I mean, there is projects in other places that do use aircraft. I think some California projects do but yeah, we do not do anything with the aircraft.

Assemblymember DeLong:

And then one follow-up question, if I may. How is the silver iodide, actually aerosol—aerosolized—to get up into the atmosphere?

Mr. McDonough:

It is dissolved in acetone solution, and then we burn the acetone solution, and the precipitate is a solid piece of silver iodide that is about 100 nanometers in size. That is the perfect size to create an ice nucleus, so that is been engineered, and like I said, this has been going on for 70 years now and DRI is a, like the State of Nevada actually is, is a pioneer of this technology; and Desert Research Institute, actually still is one of the world-renowned cloud seeding locations. This is something that the state is one of the global leaders in as well.

Assemblymember DeLong:

Thank you very much. I think this is a great program. Thanks a lot.

Chair Anderson:

Thank you so much. One last question for me, I appreciate everything with the water. Appreciate all the science behind it. Incredibly important. I want to make sure that is very clear, but natural resources are not just about water, it is also about other areas in our state. Has there been any sort of discussion and/or studies around the migratory patterns and whether or not this is also impacting the animal habitats, because that has been one—there has been an item that is brought up to me by critics.

Mr. McDonough:

Okay, so basically, like I said this technology was accidentally discovered in the late 1940s, and they instantly realized that the silver iodide was the perfect molecule to use. That was probably in the late 1940s and by the 1950s there were operations, you know, being in the West, you see a way to make water and everybody jumps on it so as early as 1950s. There has been studies on silver iodide in the environment for, since the 1950s, there is like dozens of studies and every one of them comes to the same conclusion that the silver iodide is not soluble in water. It is like a piece of sand. If you drop a piece of sand into a glass of water, and you can stir it for, you know, a month and you are never going to get that piece of sand to dissolve in that water. So, when plants take up the water, they are not taking up the particles, and so the particles tend to just stay in the dirt. Then there has been—there was a really good study done in the late 1990s. The Mokelumne River, which is just south of Highway 88, there is this area called Blue Lakes, and Blue Lakes is the headwaters of a project that the PG&E [Pacific Gas & Electric] has been seeding since the 1960s—so, 50-60 years of continuous cloud seeding. They went up there and they pulled out sediments from the bottom of the lake. They pulled out sediments from around the lake and from soils around the area, and then they compared the measurements of silver to the measurements of silver over some lakes in Yosemite, which has never been seeded. There is no difference in the background silver, so there is no evidence that silver is accumulating in the environment even after 60 years, and there is no reason it should be accumulating. The other results all say that the lack of solubility of the cloud seeding materials actually leads to no biological impact from the cloud seeding as, like I said, the amount going up over the whole winter is probably a few pounds total of this.

Chair Anderson:

I am going to cut you off, because I think you might have misunderstood what the question was really asking for. Thank you though for going into the agriculture area. This has more to do with the migratory patterns of animals. Is there a change that has been studied as to whether or not animal migration has changed because of the water coming down at different time frames. That has been an item that has been brought up as a concern to me, and then I think from other legislators, this has also been sent to us. Has there been any study about the impact on cloud seeding when it comes to animal migratory patterns?

Mr. McDonough:

Animal migratory patterns? Okay, I do not know if that has been, but I think that in terms of—these are existing watersheds that, you know, one winter there is a bunch of water comes down from the Rubies, the next winter hardly any comes down. The cloud seeding—all the cloud seeding is really going to do is give you 10 percent more runoff year to year. But over, you know, if it is like a horrible winter that there is still going to be limited

water and if it is a big winter, we are going to stop seeding once the snow pack exceeds it. It is not going to really have any impact on the changes—it might help keep ground or a pond in a certain basin active for a few extra weeks. So, if the birds are coming through and they need a resting spot and without the cloud seeding, that resting spot might already be dry where they could come in and maybe take a rest in a wetland area that is not totally dry yet. That is kind of the impact. I think in terms of, you know, ranching and things like that, I think there is more greenery in the grazing areas for everybody that is participating in grazing and then trees as well probably benefit somewhat from the extra water.

Chair Anderson:

Great. Thank you so much, and I recognize the fact that it was about the water first, but that has been something brought up. So, thank you so much for your presentation. I am sure we will be having more discussions in the future. Thank you.

AGENDA ITEM VII—PRESENTATION ON THE SCIENCE OF GEOTHERMAL RESOURCES AND SYSTEMS

Chair Anderson:

Before we move on to our next presentation, I do want to make a really quick announcement. I think it is very important for us to have as many discussions as we can, ask the questions—so I have, I am planning at this time possibly to break for lunch at 12:30 p.m., if we need it. If we are able to, we will not be breaking for lunch, but at 12:30 p.m. we will possibly be breaking for a 30-minute lunch break. That way everybody knows to plan for it and everybody just kind of has an idea. Now we will move on to the presentation (Agenda Item VII) on the science of geothermal, number seven on our agenda. Our first presentation is from the Nevada Bureau of Mines and Geology, and we have Dr. Cary Lindsey joining us to discuss the science of geothermal. Please begin whenever you are ready, and thank you for being here. Go Pack! Just saying, not that we are playing UNLV Friday but—Go Pack!

Cary Lindsey, Ph.D., Research Scientist, Great Basin Center for Geothermal Energy, Bureau of Mines and Geology, University of Nevada, Reno:

Okay, thank you. Let me get my slides pulled up. Good morning. Today—thank you for inviting me down, today—I am going to share with you kind of a high level of the geothermal science. I will go through it pretty quick because I want you guys to ask as many questions as you would like. First off, who are we? We are a small but mighty group, we have three full-time faculty that are dedicated to geothermal research—about to be four when we graduate our next Ph.D. student in the summer, who is going to stay with us because what we do is really fun, fascinating work. We were created in the early 2000s. You can actually see a change in the geothermal output in Nevada that is consistent with our work, so we do have some impact on what is going on in the state. We are part of the Nevada Bureau of Mines and Geology. We actually are your State Geologic Survey. We are a department of the Mackay Schools at the College of Science of UNR—but we are also a state agency, and we are a world-renowned research center in geothermal space.

First off, what is geothermal energy? I think that we all have a pretty good idea, the deeper we go, the hotter the earth gets, so technically that is geothermal energy. All you need is

some heat source, some way for a fluid to get to it that can bring that heat source back to the surface so that we can utilize that for various reasons, including generating electricity. These are really basic schematics that I am going to show today and of course, nature does not really work that way, so that we can all understand where we are at.

Why Nevada and why is Nevada so important for geothermal? There are a few things, Nevada is completely encompassed by the Great Basin region, which is part of the Basin and Range, which is an extensional area. For those of you who are not geologists, Nevada is being stretched all the time. Nevada is actually the fastest growing state in the United States, and we get about a football field a year. I do not know who is paying taxes on that or whose property goes up for that, but somebody's getting an extra football field a year. If we are cloud seeding that, then you know, I guess that is more people that we are getting water for. Because of this, the heat is actually a little closer to the surface in Nevada than it is in other parts of the country. We also have the Walker Lane which is on the western border of the Basin and Range in the Great Basin. We are all familiar with the San Andreas, right? That accommodates all this movement that is happening on the western coast. Well, it actually does not accommodate all of that, some of that motion is accommodated in the Walker Lane, which was an extensional area of faulting. The Ridgefield earthquake a few years ago, that is along that Walker Lane area—that is a high heat flow area. All this to say Nevada is really structurally complex. We need heat that is close to the surface, and we need really complex geology, and we have that here. Most of the geothermal systems are predominantly amagmatic. A lot of people when they think about geothermal, they think about volcanoes. That is not the case here. We just have heat that is close to the surface.

This is just the schematic of what is happening. As Nevada gets stretched, these blocks, these grabens, they drop down; so that is the basins, right. Then we have these horsts that are uplifted, and that is the ranges that you see. If you drive across Nevada, you see it: a range, a basin, a range, a basin, a range, a basin—this, along these range fronts, we are closer to that heat, and so that heat can find a way to get closer to the surface to make it economically available for production.

Why geothermal? I do not get into the why geothermal a lot. I am a scientist, and I do this strictly for the science, but I like this plot that I put together. You know, geothermal, it is renewable, it is base load, it is always on, it is low emissions—it is a good answer if you got it, and we got it.

Types of geothermal, a lot of what you are going to hear in Nevada is about generating electricity. We have 20 some-odd power plants here in Nevada that generate electricity. But geothermal is experiencing a revival and that is not just about generating electricity anymore. It is about direct use applications for geothermal, so heating buildings, melting sidewalks, industrial demand—so thermal energy. In the United States, we combust natural gas to create heat for heating processes that we need when we already have heat that we could use directly in Nevada and in other places. Ground source heat pumps, which in my opinion should be the standard for new construction. In my mind, that is more of an energy efficiency tool than a geothermal tool because you do not need anomalous heat to do a ground source heat pump. You can do that anywhere in the country, and so for new builds, that makes a lot of sense. The conventional geothermal which is what we have in Nevada. We are generating electricity from those conventional hydrothermal systems—Hybrid, Co-located Systems, which we also have in Nevada. So, you might have a geothermal power

plant that also has solar next to it or a geothermal power plant that might have storage next to it. The big topic right now is next generation geothermal. There has been a lot of knowledge and technology transfer from the oil and gas industry over the last five years, and that is really advanced what we call Next Generation Geothermal. I will share a little bit of each of those.

So direct use, our favorite one in Nevada, is directly recreating in these hot springs. So that is a use that we should not forget, it is an important one, we should all set aside some time to have fun—it is not all about work. We can also use that geothermal heat directly; we can do greenhouses. In Oregon, they do tilapia farming so lots of different uses. I think that the limit here is our creativity. Geothermal Heat Pumps, as I mentioned, big fan of those. Took me a long time to start calling these geothermal because again, you do not need anything anomalous—it is just a heat pump.

Then conventional geothermal, again this schematic is really basic, but this is a typical Great Basing system. You have got some heated and economic depth, you have got some fluid—I will go back and forth between calling it a brine, a fluid, or a water—I will get into the specifics of that in a minute, but for now, fluid—you got some fluid that at some point in time managed to recharge one of these systems. It may not be recent times, but it has happened. Then you want some permeability for this fluid to make it is way back up to the surface. Again, Nevada is a very seismically active state and so that is also good for geothermal, because it keeps us shaking a little bit and keeps these permeable pathways from getting all clogged up.

Here is an Enhanced Geothermal System. I will flip back—regular—and enhanced. So what is missing here? We do not have that permeability. We do not have that fluid, but we do have heat at some economic depth. So, the objective of an enhanced geothermal system is to tap into that and to create basically a geothermal reservoir, so you are drilling at some depth, you are fracturing hot dry rock, and then you are introducing a brine to that so that you can mine the heat. The objective is you bring that fluid back to the surface, and you have essentially created a geothermal power plant, you condense, you inject that fluid back into the surface, and that is your working fluid that you cycle through. If you have heard about work by companies like Fervo in Nevada and Utah—this is what Fervo is doing.

Another one that is I would say probably a little bit further back on the advancement level—it is probably not as much money has been spent on it as EGS, just yet. But I do think a really interesting one is Advanced Geothermal Systems. So, these are completely closed-loop. Your fluid actually never goes out into the rock; it never goes out into the reservoir. The fluid essentially goes through this piping system, and it mines heat out of the subsurface, and then it comes back up to the surface. Again, you have got your geothermal power plant at the top. So, this is still, I think, in the testing phase, but we will see if they get the thermodynamics to work. I mean, who does not like that when your fluid never comes in contact with, with the rock source?

The question is why choose and maybe in Nevada, we do not have to choose. It is possible that we can use all of these resources. Not every location is great for conventional and not every location is going to be great for EGS [Enhanced Geothermal System]. But I think there are locations that we could deploy any and all of these across the State of Nevada. And that is a lot of the work that we do is assessing the locations as to where this stuff might be available. I guess, I should say, as your state geologic survey, I think one of our

responsibilities is and should be reporting back to you guys on what the potential is for this natural resource that we have in Nevada. Just like the U.S. Geologic Survey does nationally.

And then this is something—so, that is just kind of a general idea of what geothermal is, and what it looks like. And this is a slide that I put together because the conversations today are about water. As all Nevadans, I care a lot about water, and I do not come from a state that cares a lot about water. I am from Mississippi; I am from one of those out east where we have plenty of water. We do not worry about it. So water really stresses me out here. But as I mentioned, there is a little bit of difference in the fluids that we are talking about, and so I put this slide together because I really want us to think about what we are talking about when we are talking about a geothermal brine or a geothermal fluid. This is not groundwater. It may be recharged in the same sense that typical potable groundwater is, as it comes from rain, it comes from snow melt, it percolates back down into the surface. This has another step that happens to it, it gets super-heated and that heat makes this water much more reactive to the rock that it is in. So, if you have got seawater on one side, which I think we all understand is not drinking water, and we understand why it is not drinking water, and we understand the complications of making that drinking water, take that, and heat it up, and throw it in some rocks—and now you have got a geothermal brine. And that is why I hesitate to call this water. It is a geothermal brine. Is it mostly water? Yes, it is mostly water as we are also mostly water. But that does not make this water. In order for us to treat this water or use this water ever to the point that this would be potable water would cost us more water and energy than we would get from treating this fluid. So, while I do think we need to keep these—geothermal fluids and groundwater, they do interact with each other, the subsurface of Nevada is not a closed box. These waters mix with each other all the time, but they are drastically different in their source and in their composition. Geothermal brine has lots of dissolved minerals in it—it is very salty; it is very briny. It is one of the reasons why we do not really want to mess with it, and we keep everything closed-loop. If I am not mistaken, all the power plants in Nevada are now closed-loop, binary-type systems, except for one, okay. I just wanted to share this with you guys, just so that we kind of understand what we are talking about when we are talking about these fluids and the differences in them.

Hot springs and geothermal, this is another big topic. Can we have hot springs, and can we have geothermal beside them? Yes, absolutely, we can. Yes, absolutely, we do. We have that in south Reno. We have a power plant and right across the street, we have a hot springs resort. So, these two things can exist in one location. That is not easy to model. It is not easy to guarantee. I would say we probably cannot guarantee it, but there are a lot of really smart geologists, scientists, and engineers who work on the subsurface and before companies go in and drill in these locations, they want to make sure that that is not going to happen either because it is not good for their bottom line.

And then this is the exciting thing about Nevada—most of the systems that we are going to be developing from now on in Nevada are hidden geothermal systems. These are systems that have no surface expression. They do not have an active hot spring at the surface, or they are not actively depositing geothermal minerals at the surface. There are no fumaroles, there is no steaming vents; why is that? Well, these systems, for whatever reason evolve this way, there may be some strata on the top that just makes it impermeable for that fluid or a hot spring to exist at the surface, it moves off laterally. The cool thing about developing these systems is if these systems are developed, we are not worried about messing up anybody's hot spring, because it does not exist to begin with. That is a really cool thing. We

think in our reporting that up to 70 percent of the systems in Nevada are going to be these conventional, hidden geothermal systems. I think that is good news for everybody. I showed a slide early in the beginning that shows geothermal. It is a slide of all the different geothermal potential here. This just shows all the different types of geothermal use, and I will show you my last slide because everybody always gets a kick out of it. I did not like this slide; I thought the slide was very austere and does not really represent what geothermal looks like in the wild. So here I fixed it, we still have trees, we still have the mountains, we still have the birds. We can have all this, and we just have to be responsible about how we do it. Thank you.

Chair Anderson:

Thank you so much, and are you able for a few questions?

Dr. Lindsey:

Absolutely.

Chair Anderson:

Thank you. Any questions here in Carson? I am not surprised. I am going to start at the other end this time, Assemblymember DeLong?

Assemblymember DeLong:

Thank you, Chair. Thank you very much for the presentation. Just one quick simple question. I think on the closed-loop enhanced geothermal systems has most of that research been with a water working fluid, or they have been looking at Isopentane or other more volatile working fluids.

Dr. Lindsey:

So, one of the companies that is doing research in this area has actually reached out to us and they are trying, of course, they looked at the Isopentane and Isobutane, which are standard secondary working fluids in geothermal systems. Many of them are trying to find a more water-based solution, but you know, thermodynamics.

Assemblymember DeLong:

Yes, thank you.

Chair Anderson:

You can go down to Las Vegas, Assemblymember Jackson.

Assemblymember Jackson:

Thank you, Chair. I am just trying to get a basic idea of how big of the drilling is. Like, how far down is the drilling to perform this geothermal energy?

Dr. Lindsey:

Sure. So that is variable across the state. But most systems, most conventional systems in Nevada exist between one and three kilometers. So that is pretty shallow for Nevada. There is a lot of exploration that is drilling deeper than that to get to deeper, hotter systems.

Chair Anderson:

Did you have a follow-up, Assemblymember?

Assemblymember Jackson:

No, thank you. Thank you.

Chair Anderson:

Thank you. Senator Ellison.

Senator Ellison:

Thank you, Madam Chair. We have had a lot of geothermal in our areas for a long, long time, and I remember when they first put in the geothermal in all the schools, the jail, the City Hall, county—we heated them buildings for years with geothermal. So, when they did Beowawe, they finally kept saying God, you are missing the boat out there, and now they got the power plant out there, and I do not know if that is on full-line yet or not. Is that, I know they were expanding, is it on-line now? Is the geothermal at Beowawe?

Dr. Lindsey:

Yes, they are producing.

Senator Ellison:

Okay. Thank you.

Dr. Lindsey:

We are doing some work right across the ridge there. We have got a $15 million DOE [Department of Energy] grant that we are currently working on, and we are out in that area.

Senator Ellison:

I think geothermal in Nevada is going to be number one because there is so much in—it does not go down, it does not go up, it is there continuously. So, it is a good thing to do when we can heat our schools and air conditioning our schools just on something that is natural.

Dr. Lindsey:

That is there already.

Senator Ellison:

Thank you.

Chair Anderson:

Thank you, Senator. I do have a quick question. You had mentioned that there were some people or some companies doing exploration. Is there still a need to do some permitting or application in the county for those explorations? And if so, how long does that usually take from your experience? Understanding that you are taking this from the education point of view, so you might not have that information.

Dr. Lindsey:

My experience is limited but we actually—because our projects go all the way to temperature gradient drilling—then we do have some experience with exploratory drilling permits. We are dual-permit state if we are on BLM [Bureau of Land Management] land. So, we get permits through the Bureau of Land Management, different regional offices, and then we also get a permit from the Nevada Division of Minerals—I will say Nevada Division of Minerals is very quick to turn those around. We can usually get permits for drilling temperature gradient wells within 30 days from NDOM [Nevada Division of Minerals] it can take months to years from BLM. We had one that we submitted three years ago that was lost. We never heard back from it. So, it can be a tedious process, and we are an educational institution, we are an institution of higher education. We are not actually going to produce anything. We are not producing any fluids. We are only drilling temperature gradient wells.

Chair Anderson:

Thank you, and I really do appreciate your presentation. I am sure that we will be in contact in the future on some other things. The discussion about BLM taking a little bit more time to get back to any sort of item has been of concern for more than a few years. Thank you again for your presentation.

Dr. Lindsey:

Thank you. It has been a pleasure.

Chair Anderson:

Thank you. All right. Oh, and I am sorry, Las Vegas. I forgot to double check. Were there any other questions? Seeing nobody rushing to the microphone, I am going to think, no. All right. Let us move on to number eight, a production and permitting update.

AGENDA ITEM VIII—PRODUCTION AND PERMITTING UPDATE—NEVADA'S MINING, GEOTHERMAL, AND DISSOLVED MINERAL RESOURCE EXPLORATION PROGRAM

Chair Anderson:

Now that is Mining, Geothermal, and the Dissolved Mineral Resource Exploration Program (Agenda Item VIII). I believe we have got our Administrator Robert Ghiglieri on production and permitting. If you wanted to also bring up some of those difficulties that were brought up right at the end, that would be wonderful, but also understand that was not a question asked of you earlier, before the presentation items were asked of you. Whenever you are ready.

Robert Ghiglieri, Administrator, Division of Minerals (NDOM):

There we go. Okay. Thank you for having us today. I really appreciate the opportunity to talk about mining and geothermal. With the initial request of the presentation, it was mining and geothermal and developmental resources which I understand there is a time on this, so I am going to try to move through some of them a little quicker than others on that. I will address quite a bit of the questions that were just raised to Dr. Cary Lindsey. So, we could go through those as they come up. Okay. In my presentation, I am going to highlight mining over the last production statistics that we have, which is year 2024. Then I will cover geothermal, dissolved mineral resource exploration, and then the mining law nexus between all of those.

Since 1978 you can see this graph shows the mineral production value by commodity. Obviously, the largest one is gold, and we are still seeing that increase with 2024 actually being the second highest year ever for value of minerals produced in the State of Nevada. That is obviously due to significant increase in gold and silver price as well as a little bit of copper in there too. But what you do see as well, it is hard to see, but you can see that there has been an increase in geothermal energy production as well. With that though, you will see a big difference in the next graph, you see the volume of value of minerals produced, but actual gold production in the State of Nevada has been on a steady decline since the late 1990s. This is mainly due to a lot of different things. A lot of the 1990s was near-surface, oxide-ore open pit, a lot easier to get to, a lot more volume being done at a higher grade. We are seeing a transition to a more of an underground sulfide-type ore which is a lot more expensive to mine out as well as process. But what you do see is a very steep change in the price of gold, and this was submitted what, two weeks ago, three weeks ago for this presentation? And the gold price has already gone over $5,000, actually went up $200/share, close to it. It is mind boggling what is happening with that. But you can see there has been a drastic decrease in actual volume of minerals produced year over year, and we actually estimate that it will go down slightly more again in year 2025. But just for comparison, in 2024 the average gold price was $2,383 per ounce, in 2025 it was $3,250, roughly and we are exceeding that to increase even more.

We are the silver state; we have produced a lot of silver over the years. In the mid-nineties, again, the largest amount of silver production was done in the State of Nevada by a few different operations. Then you can see the price of silver compared to it as well. Again, the price of silver is now over $110 compared to when this was put together just a few weeks ago. So really unique time that we are in for commodity prices, but you do really see the

difference in change of silver production through the years in the State of Nevada—how it slowly declined.

Copper, on the other hand, has kind of bounced on and off. You can see that big drop in 2000, that is when a mine went into care and maintenance. Now that mine in Ely, Nevada, under KGHM is operational, and they have been continuously under operation. Since then, copper production in Nevada is a big aspect and big future for mining in Nevada and for everything we use with electronics is very important in that aspect. Lithium production, I do not have the graph of commodity of lithium prices, it is very hard to get an accurate graph of that. We did see a spike a few years ago on it that went, I think, over $80,000 a ton. It is back down to I think $12 or $13,000 a ton somewhere in that range again. We have been producing lithium for a long time in the State of Nevada. This is just going back to when we have very accurate records in our Division of Minerals. With that, it is a requirement by every operation to provide production statistics to the Division of Minerals on an annual basis. That is due in April, and we are actually going through a rule-making process and in a few weeks, we will be having a commission meeting and trying to bump that time frame up to the February time frame to match the same time reporting for Net Proceeds of Mineral Tax that allow us to get the data out there faster and have better reporting statistics on it. But lithium again is something that is been produced, and we have seen a ton in the headlines on it.

With that said, Nevada is unique where it has not one but two taxes that are unique to the minerals industry, the Net Proceeds of Minerals Tax, which is in the *Constitution* up to a 5 percent net tax. You can see over the years, and this information comes from the Department of Taxation, what that is. Obviously in 1999, when gold was like $300 an ounce, roughly, do not quote me on that exact number, somewhere in that range, the net versus gross is a lot different. You see a big bump in 2011–2012, that was when gold went all of a sudden up to $16 to $1,800 an ounce, it was a big change. Right now, we are going to see that again. So, in 2024 net proceeds, roughly $190 million, half of that went to the State General Education Fund, and half of it to the counties where those minerals were produced. Then the new Gold and Silver Excise Tax, which was put in the 2021 Session, in 2024, it was roughly $84 million—when I put this presentation together, that data was not out, since then it has come out—I think it came out around $86 million. We anticipate these to increase this next year and potentially significantly increase this next year. Again, the Gold and Silver Excise Tax is 100 percent dedicated to the State General Education Fund. The Net Proceeds Tax is half to the county is produced, half to the State General Education Fund as well—so, a big contributor there for that. With that though, you see a 20-year history of the gross versus net. Again, we anticipate kind of that same as that 2011–2012 time frame peak this next coming year. But one of the big things you can see is 81 percent of all the minerals that come from it are from, in order, mostly Lander, Eureka, and Humboldt County—81 percent of those mineral commodities from the net proceeds is coming from those. In the future, there are a few other operations that may or may not come online that may diversify a little bit of that, but that is what we are currently seeing for the State of Nevada. So that is what I am covering for mining right now. I am happy to take questions at the end on it, if you guys have any more questions on it.

I am now going to jump into geothermal. So here is production of geothermal in the state since 1985 when we first had production. You can see that the price has, you know, changed over the years. We actually took a slight decrease in price, but we are seeing an increase in actual megawatt hours sold in the State of Nevada. Here is the permitting

oversight for geothermal, so going back to the county level. So generally, we have got to remember, Nevada is 85-87 percent federal land, I forget that exact number, 60 something percent of that is BLM. A lot of permitting is through the Bureau of Land Management and Division of Minerals; we are a dual-permitting state. We ensure that we are being permitted both of us at the same time. So, on the federal side, there is quite a bit of permitting oversight of Geothermal Steam Act, FLPMA [Federal Land Policy and Management Act], NEPA [National Environmental Policy Act], Energy Policy Act, Safe Drinking Water Act, or EPA Class V Wells. That is going to be under Department of Conservation Natural Resources Division, Environmental Protection, their Underground Injection Control Program. They have had primacy for a very long time for all wells, they are the ones that implement that for the State of Nevada. Multiple Mineral Development Act is something that can be used, National Historic Preservation, Clean Water Act, and Danger Species Act are all part of the permitting. Then there is also for the federal side, the BLM regulatory policies and these are the rule making processes that the BLM will go through and those have determining factors in the process for the State of Nevada, Division of Minerals. NRS/NAC 534A is the well drilling and production statistics, that is where all the permitting for this is. The Division of Environmental Protection, NRS/NAC 445A and 445B, 445A is the UIC [Underground Injection Control] program under water pollution controls, and 445B is any production goes to air permit processes as well. The Division Water Resources, which will speak later, has NRS/NAC 533 and 534 under water, if producing energy, Public Utilities Commission. Then you start getting down to the more local level stuff on some of them—State Fire Marshal, county permits, Business and Industry, and Department of Transportation—all may or may not have some sort of permitting aspect for a geothermal operation within the State of Nevada.

So next, I am going to dive into how do you get the mineral rights for geothermal on a federal land. So there is a leasing process. This leasing process also has a royalty and a funding mechanism to it. So, 43 CFR 3200, what happens is a company or proponent will nominate a lease. At that point in time that lease will be nominated, the BLM will have to go through an either EA [Environmental Assessment] or DNA [Determination of NEPA Accuracy] decision for each one of those parcels that is nominated and those all include a 15 to 30-day public comment period. Then those are posted of Notice of a Competitive Lease sale. Those are posted right now. The BLM is working on the lease sale for October 2026. They are going through this process now and working, compiling the information. And then it goes out to a public sale so anybody could bid on these. You have to register to bid, but it is all public sale, open auction on it. The annual lease payments on the bid process starts at $2 per acre for the first year, and then after that goes up to $3 for ten years, and after ten years up to $5 an acre. And then if you get to production on your leases, there is a royalty payment, so 1.75 percent of the gross proceeds for the first ten years and 3.5 percent for ten years after that. So, this is how it is managed for how you could acquire the geothermal rights. It is underneath the Geothermal Steam Act, and it is a leasable mineral, not a locatable mineral and the map on the right, it is hard to see at that scale, but those are the active geothermal leases in the State of Nevada on federal lands.

What does this result in? This results in revenues and the royalties, and how it works, so, the October 21, 2025, geothermal lease sale had the highest revenue I have created from a geothermal sale in the United States. It was 113 parcels with up to 377,000 acres, 86 of those parcels received bids with covering 280,000 acres. The high bid was by far and away the biggest one that we have ever seen on record, $410 per acre for a total bid of

one parcel of just over 5,000 acres of just over $2 million. The previous bids last year in 2024 set the record, and it was like $205 an acre. The previous high bid before that was in, I think the eighties or somewhere around there. So, it is exponentially growing on some of these bids. A lot of these parcels of the 86 sold closer to that $2 range, but there are some of them in the $400, there are some of them in between there. But in total $9.4 million was paid for geothermal leases on this—or in this sale. The key that we see of this in that aspect, that is really important for the state is there is actually a revenue split for all these sales on federal lands, 50 percent of it goes to the state, 25 percent goes to the county where the geothermal lease is, and then 25 percent to the U.S. Treasury so the BLM could actually manage the program. There is over a million acres under lease in the State of Nevada right now. It seems like a big number, but when you look at the actual disturbance of these geothermal sites, it is a fraction of a percentage. So, the annual lease payments in FY 24 to the State of Nevada was $2.25 million according to the annual lease payments was $2.2 million according to the Department of Interior. Looking into this using the openbudget.nv.gov, which is a great resource if you are looking at anything budget in the state, a total of $7.6 million was received under the Federal Mineral Leasing Act Revenue to the Department of Education. Again, this is another revenue source to the Nevada Department of Education.

How are regulations managed in the State of Nevada? So, geothermal resource is defined under NRS 534A:

> "Geothermal resource" means the natural heat of the earth and the energy associated with that natural heat, pressure, and all dissolved or entrained minerals that may be obtained from the medium to use to transfer that heat, but excluding hydrocarbons and helium.

Then we dive into the water, and what we are here to talk about today. Applicability procedures for appropriation—a consumptive use of water brought to the surface outside of the geothermal well is subject to appropriations of Chapters 534 and 533 except for water that is removed from an aquifer or geothermal reservoir to develop and attain geothermal resource, if the water is returned or reinjected into the same aquifer or reservoir, the reasonable loss of water during the drilling, testing, and temporary failure of a system as long as it is not excessive amount.

This is what this is based off of is—if you are pumping a geothermal brine from a geothermal resource and then reinjecting it back into that same resource, it is a non-consumptive and does not need an appropriation. There is one project in Nevada that is still using a water right appropriation, and that is the Wubuska plant, which is actually the first geothermal plant in the 1980s, and they are drilling injection wells because they are going through the process of changing that and getting it to an injection. That is just outside of Yerington—on the way to Yerington from Carson City. So that one is the only one left that is actually using a consumptive use for that. Any consumptive use of fluids to develop or operate the plant needs to be acquired through an appropriation or buy the water rights for that.

What the Division of Minerals permits. Okay, so we really focus on the location, the subsurface of these wells, where the drilling permits. So, we are really focused on subsurface. What type of well is it? There are four main types of geothermal wells: thermal gradient; observation; production; and injection. Production and injection are the

two larger ones. So, the diameters of these wells could drastically vary, and the depth of them too as well, and I will talk about that in a moment. We want to focus on the depth, the temperatures, who has the mineral rights—making sure that they have the mineral rights, or the lease, or an agreement with the lease—and the geologic formations. The Division of Minerals does not permit in a silo, under NRS we are required to notify the other state agencies, so we notify Department of Wildlife, Department of Conservation and Natural Resources, the State Engineer, and the Division of Environmental Protection. Every permit we receive with a complete application is sent to them for their review and their applicable laws. Then every time we permit something and give a permit, we also send it back to them that these were permitted moving forward.

What we are really focused on the premise is casings, the cement and annular space and filling that annular space. Blowout prevention, ensuring that if you are drilling at significant depths that there is not going to be a blowout and a failure of the well. Bonding, so any time there is a drilling, there is a bonding associated with it. The cuttings and logs—Nevada has a unique law where we require all cuttings and logs to be skeletonized and actually sent to the Bureau for collection so there is future research and data associated to the public of these. There is a confidentiality period of five years on geothermal, but the Bureau of Mines and Geology has the fun issue of trying to find places for all these cuttings into the future, that is another topic. And then we receive monthly production injection reports, so we track what is produced, the volumes that are flown in, all aspects of it. For the casing designs, some of the things under NRS 534A.260, surface casings must provide for control of formation of fluids and protection of freshwater. Just like Cary was saying, that these are looking at deep geothermal brines, not the freshwater surface or access to the freshwater surface of these. So, when we are looking at it, we are making sure that these casing and all drilling well designs are isolating the freshwater aquifers. They must be cemented, and the cementing must be circulated up to the annulus of the surface. That cement when they go down, they set the casing and then they fill the outer annulus space with cement to the surface. So it is not only a metal casing. Then a cement on the outside of that. And with multiple casings—so this is a very generic thing that I drew in PowerPoint, so do not hold me to the exact accuracy of it—but you have a conductor casing, which is generally the very big surface, that is the initial to set the well for the drill rig that could be anywhere from 30 to 100 plus feet, generally relatively shallow. Then you have surface casing, surface casing is going to go much deeper than that. If needed, they will do an intermediate casing and then potentially even a production casing. The production casing sometimes can be slotted from a certain distance, it could be slotted the whole way, but it is going to be much after the initial casing. The cementing must be at least 10 percent of the depth, so with that, the question earlier was what are the depths that we are looking at? When we look at geothermal production in the State of Nevada, the average depth of traditional geothermal or conventional geothermal is 4,000 feet. So, we are looking at 4,000 feet is the average depth, some of them are a little shallower, some of them a little deeper. But we are seeing a change, over the past five years we have seen that average increase to nearly 5,500 feet or one mile deep. That is for conventional geothermal. So, these are not near surface. These are deep geothermal wells, EGS or next generation are much, much deeper. We have actually seen the shallowest, we have seen for proposals on those is 8,000 feet with more of them being closer to 10 to 12,000 feet. And then you start seeing those advanced geothermal that we talked about the closed-loop and the, I am going to forget the name of the other; some of those are 4 to 5 kilometers. The reason why those are still in "test" is the drilling technologies need to be advanced to be able to drill up that depth, that heat, that temperature, economically. We know we could drill that deep. But if you are spending

$500 million to drill a well you are going to take a long time to get a net return on that. So, they have got to be able to figure out how can you do this and advance that technology to drill that depth right there. We are seeing a lot of the technology coming from the oil and gas industry to this and that is where the drilling technology is being advanced from. So again, they must be cemented 10 percent of the total death and the other strings, if you have multiple casings must overlap by at least 100 feet and be cemented during that overlap.

With that, I did not talk about the water. Water, in that all water for injection of these, and the tracking of the water, and the chemistry of the water is under the Division Environmental Protections UIC program. So, they are the ones that are doing that. We partner with them, we work with them all the time, we call/talk to them on a weekly basis, probably. So, this is something that we work through on that. They are the ones that are handling all the injection because the Division of Environmental Protection has had primacy from the EPA for, I do not know, close to 30 years somewhere in there, which is really fortunate that we have that within the state. I actually found out recently the State of Pennsylvania with all their oil production actually does not have primacy. So, all primacy for drilling of oil and gas wells in Pennsylvania actually goes to the EPA, so it actually even adds another layer to it. That is where we are focused on the water. But for us, ours is the subsurface focus ensuring that the freshwater fluid is not going to be interacting with it and that we are ensuring that drilling is engineered, designed to meet the standards of the state.

With that, we could see an increase in geothermal. So here are the permits going all the way back to 1985. There was a huge boom in the mid-2000s, there was a lot of permits issued, as you could see in 2009, quite a few wells drilled, but there are a lot of thermal gradient wells. Thermal gradient wells are much shallower; those wells are not to intersect the geothermal resource. They are basically testing the temperature of the earth, right, plug and abandon fairly quickly afterwards, and back then they did a lot more gridding, so they go to a basin, and lay out grids, and drill wells. Now, we are using a lot more remote sensing, a lot more geophysics surveys and other opportunities to help find these blind systems that Cary was referencing. They are actually being much more efficient in their drilling. But as you can see in 2025, we had the fourth highest year for permits ever, and the third highest year for actually wells drilled.

Where can you find this? This is all found on the Division of Minerals website. All geothermal permits, all dissolved mineral resource permits—are all on our website. As soon as they are there, we get them up as fast as we can on our website. Another great resource we like to highlight is our open data site. The Division of Minerals has a very unique open data site to where other states and federal agencies have tried mimicking the quality of it. They have been unable to do it. You can go in there and look at the history of all oil, gas, and geothermal wells. You can start looking at production statistics. You can look at the individual plants, their volume of what they produce on an annual basis. It is all available free online to the public and the open data site is even downloadable for free as well.

The next big thing is enhanced geothermal. There has been a lot of headlines on this, the Division of Minerals is very closely following it. Cary kind of mentioned the science behind it. But there is a *USGS* (*U.S. Geological Survey*) article last May, "Enhanced Geothermal Systems in the Great Basin Could Supply 10% of the U.S. Electricity Demand." That is a huge number if you think about it. Right now, we supply less than 1 percent, right? This

magnitude scale difference. We are very closely monitoring this and the technologies, and the Division of Minerals in August held a workshop on changes to NAC 534A to look into and to be able to better regulate these. We are working on them right now. We are working with LCB on getting the first draft from them out and answering a whole bunch of questions, and we are focusing really on a lot of aspects of monitoring before the stimulation projects happen, how stimulations will occur, the process for permitting stimulations, as well as, induced seismicity and having a monitoring plan for induced seismicity with these to ensure that there is a plan to ensure there is not constant induced seismicity from them. So that is where we are with enhanced geothermal, the processes are long and lengthy and a lot of fun. I will just leave it at that. Okay.

Now I am going to dive into enhanced or sorry, dissolved mineral resources. So dissolved mineral resources, this was a new bill. Here is our permitting of it in the history of our program, you can see 2024 was by far and away, the biggest permitting year we ever had. This is mainly boreholes. Now wells are a little bit different, but 2025 had the greatest number of wells drilled in a single year. So, it was created in the 2017 Session, codified code in 2018. Since 2018, 62 wells have been permitted. Out of those 62, 31 wells have been drilled, 10 wells have already been plugged and abandoned, 10 wells have been pumped with 7 of them currently reporting. Each one of these dissolved mineral resource exploration projects through NRS is allowed up to five acre-feet of flowing their wells per project, not per well; we monitor this as a quarterly reporting to us. A total for all of these wells, since 2018, only 4.75 [acre]-feet total have been flown out of all projects. So there has been minimal water impact. I think that is maybe up to 15 households average use of water in the state. So minimal water has been flown, but this is something to look at and dissolved mineral resources. And the reason why we are closely watching and tracking this is the idea and concept under direct lithium extraction.

The idea is traditional lithium production—what I showed you the statistics for earlier—is a brine evaporation where they pump out all the brine, put on the playa, evaporate it out, get a high enough concentration of salts, and then process for the lithium. That is about a two-year process to do. DLE [Direct Lithium Extraction], which was proven by SLB in Nevada under a pilot scale, produced lithium from DLE at scale. It produces the lithium 500 times faster than conventional methods while only using 10 percent of the land and up to recovery of 96 percent of the lithium. Brine evaporation, you are recovering only 45 to maybe 55 percent of the lithium. So, you are actually leaving a lot of it in the salts that are left there, and salt is not a locatable mineral, it is not a leasable mineral, it is a saleable mineral. It then goes into different mineral right for those aspects as well. Like I said, the SLB solution, and this is—right, they are not the only ones looking at this technology, this is the one that just was proven in Nevada—has recovery in just hours instead of years. It absorbs the lithium ions while rejecting most undesired ions, and uses significantly less water than spent brine. This is what is being developed.

And then I wanted to talk about, because this is something that everybody loves to talk about, lithium and worldwide production.

Chair Anderson:

I think it is all connected and really appreciate it, but you are getting pretty, you are a little bit over that 20-minute limit, and I know that there are questions, but please.

Mr. Ghiglieri:

I will go quick, I promise. As you can see here in Nevada, we did not produce much, roughly 240,000 metric tons of lithium produced in the world. Here are the reserves, the U.S. has 19 million [tons] according to the USGS. This is before [inaudible] operations in Nevada had updated it. We did an analysis with the Bureau of Mines and Geology who put out a great report on lithium here in the U.S. Thacker Pass itself has over 14 million tons in their reserves now. They are significantly changing the output for lithium in the world, or in the world but as well as in the U.S. But you look at what it is for brine, right now the reserve for brine is less than 1 million tons, right? So, until DLE technology proves itself and proves itself in economic form, that is what we are seeing as we are tracking it, monitoring it, but we do see an anticipated amount of most of lithium production in Nevada is actually coming from clay. Okay.

Mineral rights. I am going to dive into this very quickly. Three main things to focus on. Leasable minerals: oil, gas, geothermal, sodium, and a couple other ones. Saleable minerals, common variety: sand, gravel, aggregate, stuff for building—stuff like that. And then the big one, locatable, metallics and non-metallic: gold, silver, copper, lithium, fluorspar, barite, many others. There are a lot of differences between them, and they have different laws regulating them.

However, with that, geothermal is leasable, lithium is locatable, and then you could also have the access of private minerals associated with that. Each of them has to be considered as a real property. That is what they are considered. Water rights does not give access to dissolved minerals because the minerals are either owned by the federal government, they are either privately held, or they have been withdrawn. They are not always available. Water can be used as a medium to transport the dissolved mineral resource or the geothermal resource—the heat of the earth—but if the water of the geothermal brine is not returned the same formation, then they would need a water right. So, water does not equal mineral rights on this, and they are completely separate even though they are one and the same. But then there comes another aspect, geothermal leasing does allow for byproducts to be co-produced from a geothermal lease. Underneath the Geothermal Leasing Act, you could produce byproducts—exclusive of oil, gas, hydrocarbon gas, and helium—of less than 75 percent of the value of the geothermal steam. You could coproduce these, we have not seen this yet. This is something we are watching. There are technologies being developed for that. If you are able to utilize DLE in a manner to be able to use a geothermal resource and DLE, and be able to produce some lithium from it as a benefit, you can do that, but the areas you need to focus on—the mineral rights would have to be evaluated and potentially regulated under different laws. You may have to permit the same facility under two different rules and regulations. There is also the locatable versus the leasable and the load claims and plaster claims, which is a whole lawsuit that we are seeing now. Again, technology advancement, you are not going to be able to run the volume that geothermal does through DLE technology in that time. That is something that needs to be looked at, and there are opportunities for that.

Chair Anderson:

Thank you, sir.

Mr. Ghiglieri:

Go from there, and that is it.

Chair Anderson:

Yes, thank you, because I do want to make sure that we also honor the people that are presenting after you and that they have time and then also there is time for questions. Speaking of which, Assemblymember DeLong, because I knew that you would have one. No? Okay, Senator Ellison.

Senator Ellison:

I got a very small one. How long does it take to get the permits on the geothermal through the federal government?

Mr. Ghiglieri:

It varies drastically. We have seen significant time, like Cary said, over a year, and we have seen stuff turned around a lot faster. Recently, some geothermal projects have utilized the emergency 14-day EA [Environmental Assessment] process on this. But all those projects we have seen were actually projects that were in the queue under previous EAs for some of them, over years, before they got that permit put through. So, it does vary. I cannot say an exact number, that is not something I 100 percent track, but it is more than the 90 days that is underneath our regulations.

Senator Ellison:

Thank you.

Chair Anderson:

I do have a question as well, very quickly. You had mentioned that there is a possibility anticipated that we will have a significant increase in the excise taxes even though it appears we are not producing as much. Could you really quickly go into that? Just a little bit more.

Mr. Ghiglieri:

Yeah. The Gold and Silver is a gross up to, I forget, 1.7 percent—so that is a gross revenue. We anticipate the revenue to go up because the price of gold has almost doubled in that time frame. It is a slight decrease in price, but the gross revenue will be much higher and then that will then result in a higher net versus gross proceeds for the net proceeds of tax. We do anticipate it to go up, I do not know what that number is going to be, but I do think it is going to be higher than we have seen before.

Chair Anderson:

Good news for Economic Forum then in May and even better news for the budget—for education in particular. My last question has to do with the permitting. Does your office work with the counties? There has been some discussion about counties, especially smaller

counties which appear to be where the bulk of mining is, one person having to go through that permit process. Is your office helping them, or are those counties on their own?

Mr. Ghiglieri:

Those counties—we would be happy to help assist as we can, but those counties have yet to reach out to us and ask for assistance.

Chair Anderson:

I will make sure representatives from NACO is aware of that then; the Nevada Association of County Officers. All right, seeing no other questions. Thank you so much for the very in-depth presentation. I am sure we will be in discussion again.

Let us move on now to our next agenda item, the water rights related to dissolved minerals and geothermal.

AGENDA ITEM IX—WATER RIGHTS RELATED TO DISSOLVED MINERALS AND GEOTHERMAL DEVELOPMENT

Chair Anderson:

If we could, please welcome our Acting State Engineer Mr. Thorson, thank you by the way, and Deputy Administrator Bolotin, please begin whenever you are ready.

Chris Thorson, P.E., Acting State Engineer, Division of Water Resources (DWR), State Department of Conservation and Natural Resources (DCNR):

Thanks, Chair Anderson and members of the Committee. I will kind of give a quick intro while James is trying to get this thing fired up. With me today I have James Bolotin, Deputy Administrator for the Division. We are really happy to be here to provide more information (Agenda Item IX) on how water rights are handled when dealing with the dissolved mineral and geothermal resource development within the state. As you heard from Rob, our two agencies work together on permitting geothermal and dissolved mineral projects pursuant to NRS 534A and 534B and then 533 and 534. In fact, we have worked with the Division of Minerals and NDEP [Division of Environmental Protection] to establish a permitting guide and frequently asked questions document to help operators navigate this permitting process from a state aspect. This is located on our website and the Division of Minerals' website for everyone to access and use. Before we get into the details of how each industry is handled, James is going to cover some general background of Nevada water law to kind of set that stage.

James Bolotin, Deputy Administrator, DWR, DCNR:

Thank you, Chris. As a refresher for the Committee, Nevada water law has a few core tenants that it shares with most other western states. Underlying these core principles is the public's ownership of water pursuant to NRS 533.025. All water within the boundaries of the state belongs to the public, whether surface water, or groundwater, and people with water rights do not own the actual water rather they are permitted to use the public's water.

The first major tenant is the prior appropriation doctrine, first in time, first in right to the use of water. In other words, those with the oldest or most senior water rights have priority over those with newer or junior water rights. The prior appropriation doctrine dictates that a senior water right holder is supposed to receive the entire duty of the right to use the public's water before a more junior water right receives any water. In times of shortage, the most junior water rights are the first to go without water and that is the process that is known as curtailment. Second is beneficial use under NRS 533.035. Beneficial use shall be the basis, the measure, and the limit to the right to use the public's water. Beneficial use has been described as singularly the most important public policy underlying the water laws of Nevada and many in the western states. In other words, the right to use water depends on a party actually needing and using the water for a beneficial purpose such as irrigation, municipal, mining, commercial, wildlife, et cetera. Lastly, is the use it or lose it principle, which is tied to beneficial use doctrine and the scarcity of water in Nevada. Failure to show good faith and reasonable diligence to the use of water will result in cancellation of permits. Similarly, failure to use water that was previously certificated or failure to resume use of that water will result in forfeiture. Water rights can also be lost through abandonment where there is evidence of intent to abandon a water right. For purposes of our discussion today, the key statutory chapters governing DWR and water rights are NRS Chapters 533 and 534. NRS Chapter 533 governs the legal right to use water and specifically controls the permitting process for both surface water and groundwater including both new appropriations and applications to change existing appropriations. NRS Chapter 534 provides specific laws governing accessing groundwater and the State Engineer’s authorities to regulate the resource.

Next, I want to touch on a subject that is especially relevant today, particularly when we discuss geothermal, and that is consumptive versus non-consumptive uses of water. Consumptive use refers to water use where the water is withdrawn from a source and consumed or depleted and not returned back to that same source. Thus, reducing the availability of water for other users. Consumptive uses are what most people think of in terms of water use. For example, irrigation, ore processing, dewatering in mining, municipal water supply, and water for livestock. Non-consumptive water use refers to water that is used, but returned to it is original source without depletion of the resource. So theoretically it remains available to other users. Non-consumptive uses include geothermal, geothermal reinjection, hydropower generation, closed-loop cooling, and rapid infiltration basins (RIBS). Under Nevada law, as stated earlier, water rights are generally regulated under NRS 533 and 534. All uses including non-consumptive uses generally require a permit, because they involve a beneficial use of the public's water even if the uses do not reduce the overall availability. The only exception to this is in geothermal under NRS 534A.040 where only the portion of the water that is actually consumed requires a water right. No permit is needed for the water that is not consumed. However, all water is still accounted for through various mechanisms. Some water right holders report the amount of water used to DWR while in some areas division staff read meters annually. This data is included in the water use inventory reports maintained and published by the Division of Water Resources. I will now pass it back to Chris on some specifics regarding geothermal resources and dissolved minerals, and how they fit into Nevada water law and the permitting process.

Mr. Thorson:

Thanks, James. So, how do water rights work with the geothermal resource development? As defined in statute, a geothermal resource in Nevada is defined as the natural heat of the

earth, and its associated energy. This can include geothermal water being used as an avenue to harness this energy. When evaluating a geothermal project, we consider two different types of water—that is non-consumptive and consumptive uses of that water. James kind of explained those two different categories of use of water within the state. Under NRS 534A, a water right is not required for non-consumptive use of water when it is returned to the same aquifer or reservoir. However, if the water is not returned to the same aquifer, then a water right would be required by the Division.

Next slide, most geothermal projects require some form of water right for consumptive purposes, Rob kind of went into this a little bit, but whether it is for cooling water, potable water supply, or even to account for the losses within that system. For NRS 534A.070, NDOM is required to forward applications to our office to ensure compliance with NRS 533 and 534. Our staff review these to determine if there will be a consumptive use related to the pending application in front of NDOM and our staff responds accordingly. Additionally, the Division can impose permit terms on geothermal projects as needed, as supported under NRS 534A. As previously mentioned, we have worked with NDOM to develop a permitting guide and frequently asked questions document to help answer a lot of these common questions on how to get through the permitting process within the state.

Go back one, I am sorry. All right, so switching gears. Now, how are projects that mine for dissolved minerals handled? These projects involve pumping water that contains a dissolved mineral to the surface for mineral extraction and processing. This is covered under NRS 534B. Under this statute, any water that is pumped for this purpose requires a water right from the Division. These applications are processed like any other water right application and are governed by NRS 533 and 534. Once the project is permitted, the project must report usage to the division and comply with all permit terms issued by the permit from our office. So, how does the dissolved mineral project get permitted? NDOM issues exploration permits, which Rob went over, through that each exploration project may extract up to five acre-feet of water per project to determine whether the resource is available after the exploration is complete. The project must apply for a water right through the Division of Water Resources, and this could potentially include both a non-consumptive and a consumptive use component. These applications are reviewed under the same criteria as all water right applications per NRS 533.370. If approved, the project may proceed and the Division will oversee water use of that project, and then they are normally required to report all water use to our office. The permitting guide that I previously mentioned also includes these types of projects.

What are the key takeaways of all of this? First, all state agencies have developed a clear guide to help the public navigate the permitting process for both dissolved mineral and geothermal development in the state. Second, there is ongoing collaboration between the state agencies and the federal government. When there is a proposed project, we notify each other to ensure that each agency is aware of the pending application that is coming forward. Finally, there is an existing framework within statute that clearly defines when a water right is required for these types of industries, providing transparency and consistency in the permitting process. And with that, we will open it up for questions. I will let Rob take some of my time.

Chair Anderson:

Poor Rob. Sorry, Rob to have done that to you. Are there any questions? Wow. I think we are all stunned. Yeah, is right. Thank you so much for the presentation. There is somebody in Vegas that has a question, and I am sorry, I do not know who it was. So, who would ever like to jump on in? Please do so.

Senator Cruz-Crawford:

Thank you, Chair Anderson. Sorry, my throat is a little scratchy. I do have a question, not really about the presentation but about the state engineer. Do we have a process on what we are going to follow in order to get a new state engineer? Is there an employment process that was announced?

Chair Anderson:

Thank you, Vice Chair. I think right now since we are really prepared for this information instead of putting the Acting State Engineer on the spot because he is looking at me like deer in headlights. I think we all are right now with that. Maybe instead what we can do is, in the next meeting, possibly go through what role the legislative process has with the State Water Engineer and any sort of information that we might have with it. Because if I understand correctly, I might ask our analyst to double check this. I do not believe the legislative process has anything to do with the selection of the Water Engineer. If I remember correctly, if you could, or would our legal counsel like to do so, but we will have information in our February meeting based upon this question.

Mr. Thorson:

I can add that, the State Engineer position is appointed by the Director of the Department, and he is actively searching for the next State Engineer.

Chair Anderson:

Vice Chair, does that satisfy the question?

Vice Chair Cruz-Crawford:

Not 100 percent, but I will follow up in the proper route. Thank you.

Chair Anderson:

Thank you. Any further questions? Thank you so much for jumping into a position that is definitely not easy, and has, I am sure, more than a few headaches. Thank you, so much for the presentation. Thank you.

All right, let us move on now to our next presentation.

AGENDA ITEM X—PRESENTATION ON ASSEMBLY BILL 109 (2025)

Chair Anderson:

The next agenda item will be a presentation on 2025's Assembly Bill 109, excuse me. We have a few presenters joining us today: Assemblymember La Rue Hatch; Steven Wadsworth, Chairman of the Pyramid Lake Paiute Tribe; Kyle Roerink, Executive Director of the Great Basin Water Network; and Dr. Steven Emerman—I am sorry if I mispronounced that—with Malach Consulting, who will be discussing Assembly Bill 109 from the 2025 session. I believe Dr. Emerman will be doing his presentation from Zoom. So, there are a few of you up here and so every time you need to answer a question or speak if you could please remember to state your name. We appreciate you joining us today, and you may begin whenever you are ready. (Agenda Item X A-1).

Assemblymember Selena La Rue Hatch, Assembly District 25:

Okay. Well, good morning. Thank you so much, Chair Anderson and Committee. I am the proud sponsor of AB 109, and I will allow my co-presenters to introduce themselves briefly.

Steven Wadsworth, Chairman, Pyramid Lake Paiute Tribe:

Good morning. Thank you for having me.

Kyle Roerink, Executive Director, Great Basin Water Network:

Good morning. Thank you for having us, and I will pass it to Dr. Emerman.

Steven Emerman, Ph.D., Owner, Malach Consulting:

Thank you. I am the owner of Malach Consulting, a mining consulting firm in Spanish Fork, Utah.

Assemblymember La Rue Hatch:

And thank you so much, Chair Anderson for giving us the time to discuss AB 109 this morning. I would like to draw the Committee's attention to our coalition letter (Agenda Item X A-2) that we submitted. I just wanted to draw your attention to that because it really is the genesis of this bill. I was approached by a variety of groups, from rural counties and water users, to public interest advocates, to tribal members, all pointing out this loophole, it seemed, in a bill from 2017, and wanting to just correct what we think may have been an oversight or maybe a mistake that has left open some loopholes in our water law. And so really the goal of this bill is not to create dramatic changes, it is not to hurt any industry, it really is to protect what I think is the gold standard of water law in the West and make sure that we are applying it fairly, which is why we are calling this the Water Rights Fairness Act. Now, when we talk about this gap, we just heard from our State Engineer—and I love that he went before us because he pointed some things out that I think are really important—and my favorite sentence that he said is that all of the water of Nevada belongs to the public, and I think that is such an incredible thing, and I am so proud to be in a state where that is true. And he also pointed out that every single water user that puts the waters of this state to beneficial use has to be permitted. That includes non-consumptive uses, that includes farmers or ranchers that are using water non-

consumptively. It includes hydropower which is using it non-consumptive. Yet, for some reason, geothermal seems to be the only exception to this rule. And when I saw that, that was confusing to me, and I really wanted to look at how do we make sure that all of us, every single one of us, is on the same page when we are accessing the waters of the state; and we are all going through the same process. I think importantly, we also want to clarify so there is nothing confusing, there is nothing nebulous. Everyone fills out the same one-page permit, pays the same, almost $300, to have their permit accessed and reviewed by the State Water Engineer, and everyone is publicly noticed and goes through the process. So that is it. That is what AB 109 is. It is not meant to harm anything. It is not meant to be a dramatic change. It is meant to make sure we are all on the same page, and I will pass it to my co-presenter to give us more details.

Mr. Roerink:

Thank you so much Assemblymember, and thank you to the Committee again. You know, we have heard a couple of things today in our presentations and this is, we are talking about the future of Nevada, and it is exciting that we have this opportunity to discuss the future of the waters of the state. We are talking with AB 109, bills that are dealing with waters that do run deep. We are largely dealing with groundwater, we are dealing and we are largely talking about non-consumptive uses. So, this bill is dealing with entities that want to stick really big straws in the ground, pump that water out, and then they want to reinject that water, and you would call that non-consumptive. And that is largely I think when we talk about new geothermal projects, DLE projects, direct lithium extraction, that is what we are really talking about is sticking these straws in the ground, extracting whatever you want, whether that be heat or minerals, and then reinjecting. That is in many cases, in the nation's dries state, better than some operations where you would pump water and then maybe have it sit in pools where then it evaporates, at least from a consumptive perspective versus non-consumptive. So, you know, but we also have to think that pumping, pumping, and then reinjecting is not just a silver bullet all around. Pumping is kind of the issue that we want to get at here and pumping can lead to certain types of instabilities underground that can have impacts for us above ground. And what we are really talking about and trying to prevent is springs going dry. We are trying to prevent conflict among existing water rights users. We are trying to prevent harm to the public interest. And I mentioned those criteria about conflict and harms to the public interest because they are a part of the core tenants of Nevada water law in NRS 533.370, Section 2. And those are the areas where the state engineer really has to live by.

And so again, AB 109 really is about limiting conflict, limiting harm to the public interest, and also about providing due process because another core tenant of our water law is ensuring that the public can engage and understand matters of what is happening with the waters of the state. We believe that the waters of the state are also those deep waters that have been discussed here today. We have heard state regulators admit to connectivity with those waters, whether you know, however you want to define geothermal brines. We have heard regulators today say that there is connectivity with our water sources in those brines. So, that means you could have impacts there. We have also heard the state admit today that there are no guarantees about what could happen to fresh water sources if you have pumping for deep brines. And we also have heard the state admit today that there are no permits required within the Division of Water Resources for a non-consumptive use. AB 109, as drafted, is not perfect, we want to help, you know, we can help make that better. And I

think this is a starting point and from there, I want to pass it to Chairman Wadsworth just so he can offer some of his perspectives. Thank you.

Chairman Wadsworth:

Oh, thank you, Kyle. There has been a lot said today including the last presentation too. I think one thing that is definitely been missed from that presentation unless I misheard him was, you know, there is also that government to government consultation with tribes that was not mentioned. Again, I am sorry if it was, but I did not hear that and as a primary water holder on the Truckee River—the Pyramid Lake Paiute Tribe has claims one and two, they did a nice educational piece on what that means, that means that no matter what happens, the Tribe is getting their water before anybody else, but that does not mean, you know, we hold that over anybody's heads for the time being because we as a tribe watch all the water for our entire region. And of course, this is going to be statewide. But there is that accountability piece that comes with all the people within the State of Nevada and that includes all the tribes—and we got 28 tribes—that have to watch all of their resources no matter where they are coming from, even if they are right on their borders because there has to be that consultation, government to government. So, without a permit, you are just kind of left until you start seeing stuff right along your borders, and then you got your tribal members asking, "Hey, what is going on over there?" We do not know, there is no permit, it is really that simple. I mean as other legislatures yourself, you know, that have to answer to the people, you guys would have the same thing—something is going on in your neighborhood, we do not know what it is, there is just, there is no permit for that. It is non-consumptive ground use. And you know, that non-consumptive ground use, you know, it is still disruption, anything that disrupts the environment is going to have repercussions sooner or later. Thank you.

Mr. Roerink:

Just to play off that again, we just want to underscore what we are asking for is for non-consumptive uses. All non-consumptive uses, just like a hydropower project, that claims to be 100 percent non-consumptive has to go through the Division of Water Resource's permitting process. That is simply it, and I think it is important to really again get a grip on this non-consumptive idea, especially for things beyond exploration. You know, a lot of what we heard about earlier when we heard 534A mentioned multiple times, that is just for exploration. Regulators have to approve that permit in ten days, and it also does not mandate a public noticing process. So again, I think getting back to non-consumptive, we have Dr. Emerman here with us just to help give another perspective on what that could really mean. Thank you, Dr. Emerman.

Dr. Emerman:

Okay. Thank you, Kyle. Thank you for having me at this hearing. I would first like to explain the difference between the consumptive use and the non-consumptive use of water. The consumptive use of water is the part of water withdrawn from surface water or groundwater that is evaporated, transpired, incorporated into products or crops, consumed by humans or livestock, or otherwise not returned to it is source, so that it is not available for immediate use. On the other hand, the non-consumptive use of water is the volume of water withdrawn from surface water or groundwater, but which remains in or is immediately returned to the local water environment. It is streams, lakes, or aquifers from which, from

where it was extracted. There are many examples of non-consumptive water rights that went through proper review by the Nevada State Engineer. Some examples are the Truckee River permit, the Lamoille permit, and the Mount Rose permit. The Truckee River Operating Agreement introduced an alternative means to exercise a water right which is to forgo diversion at the place of use downstream and to store the consumptive use portion of the water right upstream, excuse me, consumptive use portion of the water right upstream in the reservoirs.

The real issue that we want to address is pumping in problematic groundwater systems. In those cases, pumping can be the problem, and reinjection is not necessarily the solution. Except for very shallow water table aquifers, aquifers are geologic units in which the contained water is pressurized. Once pumping commences the water pressure decreases, the aquifer undergoes compaction and the land subsides, which often includes fissures and cracks in infrastructure such as roads and canals. When so much groundwater has been pumped that the water pressure drops below its historical level, the aquifer compaction and the land subsidence become irreversible. This means that the aquifer can no longer hold as much water as it did before pumping. Then why is reinjection of water not necessarily the solution? Water cannot necessarily be reinjected at the same rate at which it is pumped. In some cases, attempts to reinject water at the same rate at which it is pumped has caused fracturing and permanent damage to the aquifer. Even so, water cannot be reinjected at the exact same spot from which it is being extracted, which means that there could be a substantial delay for the reinjected water to drain back to its place of origin. For example, if a spring is fed by an aquifer that is pumped and also reinjected, the spring could go dry due to the delay and the reinjected water flowing back to it is place of origin. In summary, reinjection does not guarantee or fully prevent impacts or changes that could harm water users, businesses, wildlife, plant life, and other factors. This leads to harm of private property and the public interest. Currently, the uncertainty about permitting standards leaves communities in the dark. This means that the State Engineer, existing water users, and other interests might not even know about proposed pumping that could impact their rights. By ensuring compliance with existing law, there is transparency, due process, and a public forum. Thank you.

Mr. Roerink:

Madam, excuse me, Madam Chair, I think that is all we have, you know, right now we just believe that setting that process up would be really important as it relates to getting non-consumptive uses permitted by DWR.

Assemblymember La Rue Hatch:

Yeah, I just want to close it by saying we are not trying to attack the geothermal industry. I am someone that is constantly talking about how we need to switch to renewable energy, that we need to reduce emissions. I am not someone that is going to come and try to kill an industry that is helping us do that. I believe that it has to be part of the equation. I also believe though if a renewable resource like hydropower has to get permitted for non-consumptive use, then another one in a similar vein, like geothermal, should go through the same process. I think it is fair, I think it is reasonable, and I think most importantly, it allows for the public process, it allows for the notification, and it ensures that no industry and no water rights user will be surprised by the waters of the state being put to beneficial use without notice. With that, we stand ready for questions.

Chair Anderson:

Thank you so much. We do have a few. We are actually going to start here in Carson with Assemblymember DeLong.

Assemblymember DeLong:

Thank you, Chair. Thank you for the presentation. Just a comment on the individual on Zoom. His discussion about aquifer characteristics during pumping sounds like he is assuming an isotropic system, which is not usually what you get with geothermal aquifers, those are usually fracture controlled aquifers in Nevada. So, that compaction issue does not seem to be germane to what we are talking about. But my question has to do with, I am trying to understand what the issue is with regards to a potential effect. I think you guys are talking about the fact a spring might go dry, is that what you are talking about?

Mr. Roerink:

Madam Chair, springs going dry is certainly a part of conflicts that could certainly occur from non-consumptive pumping.

Assemblymember DeLong:

Are there other conflicts you are thinking of besides a spring going dry, because I have not heard anything.

Mr. Roerink:

What do you mean you have not heard anything?

Assemblymember DeLong:

Other than springs going dry?

Mr. Roerink:

Oh, well I think, you know, largely why we came here was because…

Chair Anderson:

Since there are three of you at the table if you could say your name every time. Sorry about that.

Mr. Roerink:

Largely why we assembled this was due to springs and conflicts with springs. And we know that there have been conflicts out in the field amongst parties over the years on entities that have been claiming non-consumptive use. We are not here to hit at any one given party. But we do know that there have been people who have spent tens of thousands of dollars trying to ameliorate situations with companies that are drilling, pumping, returning—seeing conflict with springs.

Assemblymember DeLong:

Are you talking geothermal projects?

Mr. Roerink:

In that case, yes.

Assemblymember DeLong:

And are we expecting the State Engineer just to regulate a spring?

Assemblymember La Rue Hatch:

I just want to jump in here. I think it is less about us trying to regulate a single issue or a single spring and more about us trying to make sure that our statutes align with the base tenets of water law. We do not ask, when we ask others to get permits, we do not say, oh, do you have to get this because this one specific spring. We have a base understanding that if anyone is putting the waters of the state to beneficial use, which I think we have all agreed from the presentations today that geothermal is a beneficial use, that they should go through the same process. I think that is at least my focus, and my intention is it is less about a specific instance and more about the fact that we have discovered this loophole in the law, and we want to make sure it is applied fairly and evenly to all industries and all water users.

Assemblymember DeLong:

To that I would say that...

Chair Anderson:

Follow up, Assemblymember DeLong.

Assemblymember DeLong:

Yes, I have a follow up.

Chair Anderson:

Thank you.

Assemblymember DeLong:

I would say that the Legislature made a decision with regards to the application of water law to various industries. The geothermal industry is different than most other water users because of the characteristics of where they obtain the water to get the heat. I think that the Legislature made an informed decision about that. Thank you.

Chair Anderson:

I believe that was not really a question—more of a statement unless there was a question in there.

Assemblymember La Rue Hatch:

Could I just respond briefly?

Chair Anderson:

You may do so.

Assemblymember La Rue Hatch:

I would just like to ask my colleague, does that mean he has now endorsed every bill we have passed as a Legislature and agrees with it, or does he think we should maybe look at it sometimes when time is passed and reevaluate?

Assemblymember DeLong:

As it relates to the specific situation we are talking about, I think the Legislature made an appropriate decision that is very specific to what we are talking about.

Chair Anderson:

I think that this conversation can continue off outside the interim session, or outside this interim meeting. Thank you so much for both of you. Next up, Assemblymember…

Dr. Emerman:

Excuse me, excuse me, Madam Chair. Could I respond to the Assemblymember since he discussed my presentation, please?

Chair Anderson:

Yes please, and if you could please again, state your name.

Dr. Emerman:

I am the owner of Malach Consulting in Spanish Fork, Utah.

Chair Anderson:

You may also answer the question, sir.

Dr. Emerman:

Okay, thank you, okay. I believe the point made by the Assemblymember was that if the aquifer was isotropic. I am not sure whether he meant, I think he meant anisotropic or if the aquifer is anisotropic, it is not isotropic, which is typical for geothermal aquifers, then you will not have compaction. My first point is that there is someone who needs to make that judgment. Someone like the State Engineer has to say yes, this aquifer, this is anisotropic; we will not have compaction. That is the first point. The second point is this is not correct. An anisotropic aquifer means that you have different hydraulic conductivity, vertical and horizontal, that is not connected with compaction. What happens in compaction is that as you pump out water, the water pressure decreases, that elevated water pressure

was holding that aquifer skeleton out, as you decrease that pressure, that aquifer skeleton will contract, and that is completely unrelated to the isotropic or anisotropic nature of the aquifer. Thank you.

Chair Anderson:

Thank you. All right, next up, we will go to Assemblymember Jackson.

Assemblymember Jackson:

Thank you, Chair, and I missed this portion. How does requiring geothermal permits help tribes and other industries?

Chairman Wadsworth:

It really ties into all of our reservations and really, I can only speak to Pyramid Lake, of course, I do not represent any of the other 27 tribes. But really, it depends on their resources of what you are looking at, you know at Pyramid Lake, we have geothermal that outlines our borders of our reservation, and we have worked with them to set up monitoring wells because it could have a direct impact on our resources, i.e., the lake. And then even if you are taking a very large 10,000 feet ceiling look at everything, there is a big correlation between what happens in the different basins. You know, we have of course the Truckee Meadows, we have the Carson, and they are all intertwined together. If you are not aware of that, you know, Pyramid Lake, we watch all of these basins because what happens in the Carson directly affects what happens in the Truckee. And that is because if the Carson River is not flowing enough and feeding Lahontan Reservoir, that means more water is diverted to the Truckee, which of course means less water to Pyramid Lake. That is why for Pyramid Lake we need to be made aware of these things. Of course, Pyramid Lake is a little bit more on the pulse than some of these other tribes, but it all just ties together with proper notification. Thank you.

Chair Anderson:

Thank you. Follow-up Assemblymember Jackson?

Assemblymember Jackson:

No. Thank you.

Chair Anderson:

Thank you. Senator Pazina.

Senator Pazina:

Thank you so much, Madam Chair. I guess two questions, and I apologize if I missed this. One, how many permits do you think this would end up, I guess total in a year, if this were to move forward? And two, how do other states in the region handle this? Thank you very much for the presentation.

Mr. Roerink:

Madam Chair to Senator Pazina. I do not want to answer how many permits it would affect, but I think the state does total about 1,000 permits a year, and I think this would—you know, in terms of processing applications about 1,000—and I think this would be a relatively small number if we are to add to that.

Assemblymember La Rue Hatch:

To clarify, that was 1,000 total permits for everything, not for this. I believe an earlier presentation said we had 20 geothermal plants or maybe she was saying all power plant? 27 total right now in production. And so I would imagine it is going to be a very small number of new plants that are opening up per year in the future.

Senator Pazina:

Thank you so much. Follow up, Madam Chair.

Chair Anderson:

Yes.

Senator Pazina:

Thank you, and then I guess my other question was in regards to other states in the region. How do they handle this permitting process for geothermal?

Mr. Roerink:

I think Senator Pazina, you know what we are seeing happen in Utah, I can speak to applications that have been filed by Fervo in Beaver County, for example, and I have actually had discussions with a number of folks in Beaver County about that. We can also see it with certain types of dissolved minerals where there, for example. And on the Green River, there was an application for 19 CFS nearly 14,000 acre-feet, non-consumptive, and that went through the State Engineer's process. And so those are two examples where I have personally seen in Utah.

Assemblymember La Rue Hatch:

What we are seeing is if it is truly non-consumptive, just like with our current non-consumptive permits, there should not be a long delay. It should not be a conflict. It should be a one page, and a $300, and it is processed, because it is not in conflict with other rights. So, we are not trying to delay, we are not trying to create years of backlog. It should be a relatively straightforward process if it is a truly non-consumptive use. And I do not want to speak out of turn, and hopefully staff can maybe supplement this later. But I do believe that Nevada is somewhat unique in having this exception, and I know that it has been relatively recent as well.

Chair Anderson:

Thank you, any further questions? All right, and then, sir did you also want to answer this question since it sounds like you are from Utah?

Dr. Emerman:

Oh, I do not have anything. I do not have anything to add to what Kyle said.

Chair Anderson:

Thank you. I think that both this presentation and some of the other presentations have truly shown that this is a unicorn industry and sometimes it fits in with some areas and it does not in others. And so, from the experiences that have brought this bill forward, have there been specific events that really asked for this bill to be brought forward last session or was this more based upon, as was mentioned in the presentation, more of an anecdotal, what is going on with this area? If you can go into that?

Mr. Roerink:

We have heard from water users, senior rights water users, out on the ground who have experienced conflict with entities and these things get complicated. Again, we are not here to point fingers or anything like that, we are just hearing from people out on the ground and that is not the only one that we have heard, and this is about limiting conflict in the future. If we are following the process outlined in NRS 533, we are going to ensure that conflicts are limited in the future, and that, as you know, Nevada's water law is the best in the West and that is why we feel so strongly about it. Thank you.

Chair Anderson:

Thank you so much for the presentation and for the information; it is a lot for us to have to think about. I know that we also have a few more presentations on the same item today. Thank you so much for making the drive. Seeing no other questions, I should have checked that first.

All right, let us go on to the next one, our final presentation. So as soon as I said that we would have lunch, we are able to maybe get through it beforehand for our final presentation today.

AGENDA ITEM XI—INDUSTRY PERSPECTIVE ON GEOTHERMAL USE IN NEVADA

Chair Anderson:

We have a representative from the geothermal industry joining us: Erica Fresse, I believe I said that right, Director of Business Development; Ryan Libbey, Chief Geologist with Ormat; Raymond Scoble, Hydrologist with SLB; and Vanessa Robertson, Director of Policy and Education with Geothermal Rising. Again, since there are more than one or two of you presenting with us today, every time you answer a question or speak if you would please say and spell your name. Thank you for presenting. I believe, do we have somebody coming

from on Zoom, or is everybody here in person? Everybody is here in person, I think, so whenever you are ready. Thank you for joining us.

Vanessa Robertson, Director of Policy and Education, Geothermal Rising:

Perfect, thank you. Let me get this going really quick. Good morning, almost good afternoon, I think we can get you to lunch on time. Good afternoon, Chair, Vice Chair, members of the Committee, members of the public and the industry that are in the room and also in down south in Las Vegas. I am the Director of Policy and Education at Geothermal Rising; the nation's largest and longest running Geothermal Association. (Agenda Item XI A). Thank you for the opportunity to speak with you today. I am here to share our concerns with Assembly Bill 109 and to share why. While we fully support protecting Nevada's water resources, we believe the bill, as drafted, would unintentionally hinder Nevada's leadership in geothermal energy. As a nonprofit founded in 1972, our mission is simple, to ensure that geothermal benefits communities, landowners, and the clean energy transition responsibly. We educate, convene, and support the entire geothermal ecosystem. We do not advocate for individual companies or projects. We represent the sector as a whole, across Nevada and all of North America. We have over 100 organizational members and partners who represent diverse groups and voices from developers, operators, manufacturers, universities, national labs, NGOs [non-government organizations], and tribal entities. Many of these companies are represented here in the room today or online. We work across North America to advance geothermal as a clean, reliable, 24/7 energy resource, and to support responsible science-based policy at all levels of government.

I think it is important to re-emphasize, because I think we have heard quite a bit already that geothermal is already one of the most heavily regulated clean energy sectors in the West. To develop a project, companies must complete exploration permits, drilling permits, environmental analysis under the NEPA, resource surveys, injection control permits, and comprehensive utilization plans reviewed by state and federal agencies. These steps already take multiple years to complete, include public comments and are specifically designed to protect water, land, wildlife, cultural resources, and public safety. Nevada already has strong modern safeguards in place—hmm, there we go.

Across the country, geothermal is gaining unprecedented momentum, and Nevada is at the center of it. From a policy perspective, we are already seeing federal, bipartisan support for permitting reform, which is a unicorn in the energy world, we know, to reduce uncertainty and shorten timelines while maintaining environmental safeguards. Federal agencies are increasingly prioritizing geothermal as firm, clean power, essential to grid reliability, industrial growth, and long-term energy security. Just last month, the Department of Energy and the Geothermal Technologies Office announced the Geothermal Accelerator program with 14 states in partnership with the state energy offices, and Nevada is one of them and is seen as a leader in the geothermal space. Geothermal's long-standing geothermal framework already aligns with these federal priorities and has supported responsible development for decades.

Leasing momentum—we have already heard a little bit about Nevada. Nevada consistently leads the nation in federal geothermal leasing because of its high-quality resources, strong developer interest, and a robust system that supports the leasing nomination process. We are seeing this momentum in other states as well. Recent BLM lease sales in Utah, Idaho,

and California show rising acreage, increased participation, and higher total receipts returned to counties and the state. In 2025 alone, we saw these states bringing over $23 million. Lease activity is an early signal; companies invest before drilling begins and that investment depends on predictable permitting.

Technology momentum—modern geothermal looks very different from projects 20-30 years ago. Traditional hydrothermal continues to advance with better reservoir management, improved drilling techniques, and enhance reinjection practices that sustain productivity. This is a symbiotic relationship; it is to the benefit of operators to maintain this resource appropriately. Next generation technologies are expanding geothermal into new geologic settings and many of these advances draw from oil and gas expertise, improving precision, and lowering risk.

Investment—hundreds of millions of dollars in private capital have flowed into the geothermal development and technology companies in the past few years. Investors are choosing geothermal for firm, long duration power and domestic energy security, but they invest only where permitting is clear and predictable. Adding unnecessary or duplicative permits increases financial risk and can shift development to other states. Nevada does not need to slow geothermal down to manage it responsibly. The state can protect its land, support communities, and grow it is leadership by building on the strong permanent foundation already in place, not by adding new barriers that threaten momentum.

Unintended consequences are the heart of our concern here. Additional delays and permits would mean reduced state and county revenue from electricity generation and lease sales, slowing job growth in rural communities, a less diverse and less resilient energy portfolio for Nevada, and an increase in administrative backlog as agencies already managing robust geothermal processes must incorporate a second review track without the staff and resources to do so. All of this could have a chilling effect on investment particularly in the early-stage exploration where predictability is critical. And importantly, these added reviews and permits do not solve a new or identified problem within geothermal. Nevada already has the tools and decades of experience to protect water resources while permitting geothermal responsibly. We strongly support Nevada's commitment to safeguarding its water, but we do not believe AB 109, in it is current form, advances that goal. Instead, it risks undermining one of Nevada's greatest clean energy strengths. Thank you.

Chair Anderson:

Thank you. Is anybody else presenting? Great, okay. Whoever is next.

Ryan Libbey, Chief Geologist, Ormat Technologies, Incorporated:

Thank you. Good—almost afternoon—everybody. (Agenda Item XI B). So, following up from Cary's talk, I will provide some additional context for the geology and development strategies of geothermal resources, hopefully providing some more context for the framework around the discussions of AB 109. To start, here is some context on Ormat, we are among the two top largest developers of geothermal in the world, and we have been in the game for 60 years with 1.1 gigawatts of installed capacity across the globe. That is in 7 different countries, and we operate 30 different geothermal fields. Some of those geothermal fields have multiple power plants on them, and so that makes us the largest portfolio of any geothermal developer on the planet. There are a lot of different perspectives

from different geologic contexts, and we generate 34 percent, currently, of all the geothermal power that is in the United States. That is across six different states, but Nevada, our home base, is where we have 505—currently—megawatts of installed geothermal capacity. And, just for context, you know, 1 megawatt is about 1,000 U.S. households in terms of electrical consumption.

So, Ormat is a vertically integrated company, so we have all the in-house capabilities to do everything from the exploration, drilling reservoir, engineering, plant design, operation, and of course, the business development. I bring this up not as, I know this is not a sales pitch, but it is just to give context that we do have a unique perspective in that sense of thinking very holistically about how we apply development strategies to our resources because we see things from their infancy.

So, here is a schematic of how our power plants work. Geothermal fluid at temperatures of 250 to 400 degrees Fahrenheit, typically flows up production wells to our heat exchangers. The heat flashes the secondary working fluid with a lower flashpoint temperature than water, and that working fluid is then utilized to spin a turbine and generate electricity before it is returned or recondensed through our air-cooled condensers. These are two closed cycles. The geothermal fluid does not come into contact—direct contact with the working fluid and essentially 100 percent of the geothermal fluid is injected back into the subsurface. You know, sometimes we will take a chemical sample here, chemical sample there, but essentially 100 percent of it is reinjected at the vast majority of our plants.

On the right of the slide is a simplified schematic of a geothermal system common to the Basin and Range in Nevada. These systems naturally advect fluids along permeable fault zones creating the what we call "up-flow" and "outflow" geometries that are depicted in the graph. And in a geothermal development, we are most commonly setting cemented casing to 1,000 to 3,000 feet and targeting wells into these outflow zones. It is important to consider that in a typical undeveloped basin and range system, fluid is naturally advecting at rates of anywhere from less than 100 gallons per minute to at the very high end, maybe upwards of 1,000 gallons per minute in the extreme upper end. That is just the natural advection that is happening as part of these convective cycles, water is rising, it is getting heated, and it is rising along permeable fault zones. So those numbers, again are 100 is kind of the average end to 1,000 maximum. A geothermal development that uses production wells and injection wells is moving fluids at volumes that are two to three orders of magnitude more than that in a typical development, sometimes even more. What this looks like is on the order of 10,000 gallons per minute for a typical 15 megawatt, oh sorry 30-megawatt project with a 300 F resource temperature. So that is a lot of fluid. This point emphasizes that reinjecting the volumes that we extract back into the subsurface is imperative to provide the pressure, support, and sustainable development of our operations. We basically, we could not do it without it.

Wabuska was an example that is brought up earlier, we can talk about it more, but it basically, it is a very small operation of a megawatt or so and drives on the point that without it, without reinjection, this does not work.

The 100 percent reinjection of Ormat plants contrasts with older plant designs and that use evaporative cooling towers. And in the last few decades—this is just one of the approaches that has changed to geothermal development—we have also come a long way in the understanding of the geological and reservoir engineering aspects of these resources, and

as a result, we are collecting more robust monitoring data sets—and we can talk about what those are if anybody has any specific questions—but we are able to be more intentional about where we produce and where we inject. And we are able to utilize numerical models to calibrate our understanding of the resource and make forecasts and predictions of how the resource will respond to production.

So geothermal systems come in all sorts of shapes and sizes and a key part of our job, especially my job as a geologist, is to try to understand the geometry and temperature distribution of the subsurface within and around these systems. These are some temperature cross-sections through some of the geothermal systems in the Basin, and Range, and elsewhere around the world all at the same scale. It is probably hard to read. Hopefully, I was hoping that screens would be a bit bigger, but we, what we see especially in the Great Basin, is that the temperatures at or near the water table around these resources are commonly hot, perhaps not surprisingly sometimes at the boiling point, and without the presence of overlying potable aquifers.

That is not to say that there are no other types of subsurface waters adjacent to our systems. Again, another complicated and busy diagram here, but the point being that depending on the system, there could be cool groundwaters in the range, there could be high-salinity confined aquifers in the basins, and sometimes small, perched aquifers above the regional water table. So as a part of the creation of a geologic, what we call a conceptual model of a geothermal resource, part of this involves the understanding of these hydrological "end members" and the potential thermal hydraulics, or pressure, or chemical connection that they could potentially have at the margins of our resource. We case deep with our wells and avoid these surrounding hydrological units as—if we did not—their lower temperature and sometimes their adverse chemistry would be detrimental to our operations and hurt our bottom line. We also characterize—as part of this conceptual model development for each resource—we characterize the occurrence of surface manifestations, springs, steam vents, et cetera, in the context of the overall hydrological model of a project, and understanding the relationship of these features to the overall hydrology informs strategies surrounding the mitigation of any potential effects on these features.

All of this geologic understanding of the geothermal resource we develop is integrated into numerical models which are a powerful tool, once again, just for making those forecasts, those predictions to how the reservoir will respond over time with production. So, that is the lightning tour of our approach to the understanding of geothermal systems, and now I will pass it off to Erica for talk about the permitting process.

Erica Fresse, Director of Business Development, Ormat Technologies, Incorporated:

Yeah, so I think I get to say good afternoon now. I think if you can go to the next slide, I oversee the environmental permitting at Ormat, so I get to deal with the federal component, the state component, and the county component that has been asked about a couple of times. I will just reiterate a couple of things. Rob mentioned it earlier, we are known for having big-lease sales and having lots of land under lease. Here are some great examples of how much actual disturbance is used for various facilities, McGinness is a good example. With our McGinness facility, we have over 16,000 acres of leases associated with that facility. We have produced 146 megawatts and there is only 112 acres of disturbance. Obviously, every facility, every field is slightly different, but I will say we get a lot of bang

for our buck for a small disturbance. So, do not let lease size scare you, it sounds big, but disturbance footprint is actually quite small.

You can go to the next one. So again, I deal with the permits. I focused here on federal and state permitting, but I can touch on the county permitting as well. So—the component that we are quite regulated in all of the things that we do in Nevada—I do not—there are very few projects that do not have a federal component from a geothermal development perspective. We have a lot of projects that also have a private component just with our railroad lands and et cetera, but most projects are utilizing some portion of a BLM geothermal lease. We go through a NEPA process, they regulate our geothermal leases, our unit agreements, our management of the geothermal reservoir, we work with them on our drilling permits, our construction of our facilities, whether that is power plants, pipelines, well pads, or the transmission component. Then when we get down to the state level, there are several agencies that we work with. First and foremost, you heard from Rob with NDOM, that is really well-driven, so they are ensuring that we have good well integrity that we are not casing inappropriately where we could be impacting the groundwater aquifer. We also do work with NDWR, so we do have water rights for several facilities. Most of that is associated with operations or our firewater. There is a couple of legacy examples where we are doing reservoir augmentation. But I do want to call out that we do have water rights for those consumptive uses.

You can go to the next slide. Then I think the one that I was hoping would also be at the table today here is NDEP [Nevada Division of Environmental Protection]. We have air permits for operational facilities, certainly for construction and surface disturbance, but I think the big one here is the Bureau of Water Pollution Control that runs the underground injection control program. I highlighted it in bold because they are tasked with preventing degradation to underground sources of drinking water within the state, and if that is the concern of AB 109, there is already an agency tasked with doing that, and we are required to have permits associated with all of our operational facilities because we do inject all of our resource back into the reservoir. They regulate that injection process to ensure that we are not inadvertently impacting waters of the state. They also oversee the chemical uses that are associated with our facilities as well.

What I did not include in this presentation, and obviously of interest, is all of the county permitting that are associated with our facilities. Like a lot of things in Nevada, every county is different, every county chooses to do it differently. Some currently have renewable energy special use permits, some are working on them, some use a regular special use permit process. Washoe County is very different from all of the other states; there is about five separate permits that we get just associated with drilling and operation of our facilities in Washoe County. Some of the more rural counties are slightly less cumbersome, but while we may not need a county permit to do our exploratory drilling, I do not know of an instance where we would not need a special use permit or a conditional use permit from the county to build a power plant and do the injection process that everybody is talking about today. I will also add that I think you can see that there is a fairly robust permitting process. We touch a lot of agencies, a lot of counties, there is a federal component, and by and large, all of those permit processes have a public component, whether that is a public comment period, public meetings, or public notifications. With that, I will say thank you for letting us talk to you today. And while Ramon did not have a presentation, I will let him introduce himself in case you have questions related to the DLE component of this.

Ramon Scoble, Hydrologist, SLB:

SLB is an acronym or a company name for Schlumberger Limited. We are a partner with Ormat, we are a 100-year-old energy innovation company. We have been working in geothermal for 30 years, and I am happy to answer any questions.

Chair Anderson:

Thank you so much. Thank you for the presentation and also for the variety of information given. Before we go into the Committee questions, I do have one question. It is based upon a statement that was made in the prior presentation. In particular, do you reach out to any of the tribal communities because unfortunately, I have seen some of the permits where they simply say, "Did you talk to somebody as opposed to, have you had conversations? In your experience with the permitting, has there been outreach in particular with the tribal communities in Nevada?

Ms. Fresse:

Yes. I will say yes. So, Chairman Wadsworth did make a comment about tribal or government-to-government consultation. That is a government process. So, as proponents, we are not part of that process, but in the federal component, when you are going through NEPA working with BLM, there is a government-to-government consultation process that is done for all of those projects, whether that is resource confirmation or full plant development, so that is it is own component. I will not speak for the entire industry, although I know many geothermal companies and Ormat, we do try and talk to the tribal communities. We are trying to be better with our engagement and be more involved when they are willing to let us. I will not say that we do it perfectly, but we are certainly trying.

Mr. Scoble:

With respect to SLB's involvement in a DLE process demonstration plant in Esmerelda County, over the last five years, we engaged with the three Western Shoshone Tribes, going and visiting each tribe on their reservation prior to initiating the project. So that was outside the process that Erica spoke of, which is the government-to-government. We acknowledged that there was a responsibility as a corporate entity for a personal relationship.

Chair Anderson:

Thank you, and I am just going to make a really quick statement about that because I appreciate the comments with it. I know that last session, if I remember correctly, during the interim, both Assemblymember DeLong and I sat on the Public Lands Commission [Committee on Public Lands] and there was a very clear statement that, at times, with some of the—not necessarily in this industry maybe in others—that at times the consultation was "We are doing this, do you have any problems," as opposed to let us sit down and talk about how this could impact your roads, how this could impact your water. Thank you for that information that there are some companies that see it as a responsibility but is not universally seen that way. Am I hearing that correctly? I am not expecting you to say that for everybody. All right, please.

Ms. Robertson:

I just like to note, you know—this—although this industry—yes, has been around for—we have been generating electricity for 100 years—robust in Nevada—we know that there is still work to be done. And Geothermal Rising as you know, somewhat of the neutral voice, we want to be a resource to councils, to committee members, to other nonprofits, to work together, to hear concerns communicate that. One thing that Geothermal Rising has done is we have, we have created an Indigenous Geothermal Symposium that precedes our annual geothermal conference, which is the largest geothermal conference in the world. It is that venue to bring stakeholders to the table, to share these conversations, and to really educate both the companies, and you know, just the community of how this works. That we all know that we can do better, and we want to do better. Thank you.

Chair Anderson:

Thank you for that. I also want to put it out there that it is not just this company, there are numerous industries that have had problems with this outreach. So, thank you very much for that information. Are there any questions? Seeing none, you guys are off the hook. Unless you want some questions, we can make some things up. Thank you very much for your presentation today.

All right, this concludes our, basically we arrived, we have arrived at the last item on the agenda. We made it before the 12:30 deadline for lunch.

AGENDA ITEM XII—PUBLIC COMMENT

Chair Anderson:

It is our second period of public comment again to call in. Please dial (888) 475-4499, and when prompted, please enter meeting ID: 881 1761 9045 and then press the pound key. When prompted to a participant ID, please press pound again. Please remember to clearly state and spell your name before you begin. We will start again in Carson City. If anyone would like to give public comment, please come to the table at this time. You are on.

Olivia Tanager, Executive Director, Sierra Club, Toiyabe Chapter:

Thank you, Madam Chair. I am the Executive Director of the Sierra Club, Toiyabe Chapter, the largest grassroots environmental organization in the State of Nevada. I just want to be really clear about what we are talking about when we talk about AB 109. My organization was in strong support of that bill last session. We are talking about one filing per geothermal project to ensure no other water rights come into conflict. This is hardly the red tape the industry is making it seem and is plainly and simply about water fairness. We do want to increase renewable energy in the state that is obviously the purview of my organization and something we have been longtime advocates of, so certainly we do not want to hinder renewable energy coming online, but we do want to make sure that everybody is following the same rules and the waters of the state are protected. If hydropower, as we heard today, has to get a permit it makes sense to me that geothermal should also have to get a permit.

Briefly to the tribal consultation piece, just so folks are aware, there is current litigation from the Fallon Paiute Shoshone Tribe against Ormat. I will not speak for the tribe on that

matter, but it seems clear to me that there is ample room for growth with tribal engagement and consultation with these industries that are coming to our state. In the instance of the Dixie Meadows Geothermal project, which is the basis for the lawsuit, five independent hydrologists said Dixie Meadows Hot Springs would dry up, which again is part of the lawsuit. And just so folks know, and I know I have talked to, I think, most of you about this topic, but data centers certainly are a topic of conversation that is happening in Nevada right now. The load growth that is projected recent forecasts from NV Energy about the load growth associated with data centers is exponential, and I can provide graphs and NV Energy has publicly available graphs to that effect too. But because of the load growth and how much energy we are going to have to generate in the state to meet the load growth associated with data centers, it is my strong perspective that we need to button-up all of these loopholes and make sure that we are able to get renewables online quickly, so we are not having to power all of these data centers solely with gas. Buttoning-up or closing-up these loopholes to make sure that no water rights come into conflict going forward would certainly be in the best interest of the state and of the people who live here. Thank you.

Chair Anderson:

Any further public comment here in Carson City? Seeing no one rushing to the table. I believe the last number I heard was there were five people, never mind, they must all be playing monopoly. But if there is anybody in Vegas that would like to, in Clark County, who would like to make public comment. Seeing none, AVH is there anyone that would like to make public comment by phone?

AVH:

If you would like to provide public comment, please press *9 now to take your place in the queue. Caller, you are unmuted and maybe begin.

Bevan Lister, President, Nevada Farm Bureau:

Thank you, Madam Chair and members of the Committee. You will be most likely associated with Doug Busselman, our executive. I believe he is there in the meeting today. I just wanted to introduce myself, Doug is our executive and lobbyist. I am just the elected President, but so you know a little bit about me, I grow alfalfa hay on 1,000 acres in three locations across 300 miles in eastern central Nevada. Agriculture has not been on your agenda today, but we assume it will be in the future. I just wanted to introduce myself, and I am sure you have, like I said, met with Doug, to offer ourselves as a resource as you go forward in your Committee work. Thank you.

Chair Anderson:

Thank you, and it is so nice to meet you by phone. Next caller?

AVH:

There are no other callers to give public comment at this time.

Chair Anderson:

Thank you AVH. So, that concludes our meeting for today. Members, I look forward to working with all of you over the next few months. The caller actually opened it up really well, if you have ideas that you would like us to present possibly or have presentations about, please feel free to email Vice Chair Cruz-Crawford, myself, as well as Miss Peratt so that way we can make sure that we can get the presentations going. Our next meeting is Wednesday, February 25, and I also want to give a little heads-up again, based upon something that was stated in public comment, we will be doing a joint meeting with Growth and Infrastructure in our March meeting, and it will deal with the data centers because data centers have both a connection to growth and infrastructure and also a connection to water, and so because of that, the interim Chair of Growth and Infrastructure and I had a discussion and made a decision to combine those meetings, and this way we could have a more robust conversation as data centers continue to be a part of our news. Thank you so much, and I hope everyone has a wonderful Wednesday. This concludes our meeting. Thank you.

[Subsequent to the meeting, written public comment was submitted by:

- Matt Houde, Quaise Energy, Inc. (Agenda Item XII A);
- Samantha Hermany, Zanskar (Agenda Item XII B);
- Vanessa Robertson, Geothermal Rising (Agenda Item XII C);
- Rusty Muscarella, TLS Geothermics (Agenda Item XII D); and
- Jaina Moan, The Nature Conservancy (Agenda Item XII E).

AGENDA ITEM XIII—ADJOURNMENT

There being no further business to come before the Committee, the meeting was adjourned at 12:21 p.m.

Respectfully submitted,

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Jen Jacobsen
Research Policy Assistant

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Becky Peratt
Senior Policy Analyst

APPROVED BY:

_____

Assemblymember Natha C. Anderson, Chair

Date: _____

MEETING MATERIALS

AGENDA ITEM	PRESENTER/ENTITY	DESCRIPTION
Agenda Item IV	Becky Peratt, Senior Policy Analyst, Research Division, Legislative Counsel Bureau	Committee Brief
Agenda Item V	Tom Klein, National Conference of State Legislatures	Microsoft PowerPoint Presentation
Agenda Item VI	Frank McDonough, Research Scientist Atmospheric Science, Desert Research Institute	Microsoft PowerPoint Presentation
Agenda Item VII	Cary Lindsey, Ph.D., Research Scientist, Great Basin Center for Geothermal Energy, Nevada Bureau of Mines and Geology, University of Nevada, Reno	Microsoft PowerPoint Presentation
Agenda Item VIII	Rob Ghiglieri, Administrator, Nevada Division of Minerals	Microsoft PowerPoint Presentation
Agenda Item IX	Nevada Division of Water Resources, Nevada Department of Conservation and Natural Resources	Microsoft PowerPoint Presentation
Agenda Item X A-1	Great Basin Water Network	Microsoft PowerPoint Presentation
Agenda Item X A-2	Great Basin Water Network	Letter
Agenda Item XI A	Geothermal Rising	Microsoft PowerPoint Presentation
Agenda Item XI B	Ormat Technologies	Microsoft PowerPoint Presentation
Agenda Item XII A	Matt Houde, Quaise Energy, Inc.	Written Public Comment
Agenda Item XII B	Samantha Hermany, Zanskar	Written Public Comment

AGENDA ITEM	PRESENTER/ENTITY	DESCRIPTION
Agenda Item XII C	Vanessa Robertson, Geothermal Rising	Written Public Comment
Agenda Item XII D	Rusty Muscarella, TLS Geothermics	Written Public Comment
Agenda Item XII E	Jaina Moan, The Nature Conservancy	Written Public Comment

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