

Transcript Prepared by Clerk of the Legislature Transcribers Office
Legislature's Planning Committee October 25, 2023
Rough Draft

DeBOER: So--

IBACH: [INAUDIBLE].

DeBOER: Yeah. We are a small but mighty group today. Were-- did anybody have any questions they wanted Josie or others to follow up-- Dr. Schafer or others to follow up on on the child care discussion we had last week-- or, last month?

CLEMENTS: No. No.

DeBOER: OK. You all good on that? All right. I will say that, next month, our meeting will be earlier in the month because of Thanksgiving. And what we'll be doing is revisiting all the kind of old subjects that we wanted to with more information. And it sounds like some of the most interest is in housing. So we'll probably spend some time talking about that. Dr. Schafer has a presentation for us on the housing report that came out. And-- I almost called you Dr. Holdcroft. Senator Holdcroft has some information that he would like to share with us as well. So we'll probably spend the bulk of the time talking about housing but also doing a general review of where we are as we prepare to make our December deadline for our report, which goes out to the entire Legislature. So we'll be working on that in the month of December and get that out. And then hopefully we might have time next month as well to talk about what kind of legislation we'd like to prioritize out of the Planning Committee. So that's kind of the way forward that we're looking at. Anybody-- comments or concerns or questions about that? All right. Subcommittees. Rick wanted to take just a second to talk about what he learned about some housing stuff.

HOLDCROFT: Yeah. I was invited to the-- to a tour of-- with the Omaha Municipal Land Bank. So it's-- it's not a bank, but it is-- it was established by statute I think back in 2017. It's been a while. And then it was established under the Omaha City Council. And what their job is to kind of gat-- go around and acquire properties that have been in flo-- foreclosure or default. And, and so what they have is they have a bank of over 300 properties in, in Douglas County that they essentially own. And they've established a team that's trying to get developers interested in coming in. And most of them are, you know, quarter-acre lots that are suitable for single-family dwellings. But they have several that are adjacent to them just so they could, they could do something beyond that. But they don't have any money. We, we had turned-- we, we toured five properties yesterday. And, and

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they're all-- most of them-- well, all the ones we looked at, anyway, were overgrown with trees. And the estimate was it would cost about \$50,000 just to get it into a, into a state where a developer would be willing to come in and start, start doing that. And the developer doesn't want to put, you know \$50,000 up front to, to, to take that on. So we're looking for some kind of-- some funding or some, some win-win combination of people to, to try to get some of these properties into a state that they can start contributing to the city and the, and the state for property taxes and, and income sales tax. So that-- it was, it was very interesting. And I didn't know anything before I went there. And, and so [INAUDIBLE] they be willing to come and give us a little presentation here to the committee on, on the properties they own and, and their process. And I thought that would be good for November.

DeBOER: Yeah?

CLEMENTS: I have a question.

HOLDCROFT: Yes, sir.

CLEMENTS: Don't they have the authority to keep the property taxes if they improve the property to repay the cost of improvement?

HOLDCROFT: I think that was part of the statute, yes.

CLEMENTS: Right.

HOLDCROFT: Yeah. So.

CLEMENTS: Do you think maybe they could borrow the money to do the improvement, pledging the future real estate tax that they retain? As I, as I recall on that bill, the-- some of the developers were complaining that that gives the city an advantage over the developer who doesn't get to keep the property tax revenue, has to pay the property tax revenue. The hope was that their-- that provision was going to give them the ability to do the improvements. Somehow it's not really working, though, but.

HOLDCROFT: Good questions. And-- yeah. So we'll, we'll get the experts here next month and--

CLEMENTS: OK.

HOLDCROFT: --see what we can--

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CLEMENTS: All right. Thank you.

HOLDCROFT: --figure out. Thank you.

DeBOER: If you want to give me the people that you talked to that said they'd be willing to, just give me their contact information--

HOLDCROFT: Sure.

DeBOER: --so I call the right people and they know what we're talking about.

HOLDCROFT: I will do that.

DeBOER: That'd be great. Any more matters for the good of the order? None? All right. Today, we're going to be talking about water quality and drinking water. And so-- yeah. We will have presentations by Dr. Daniel Snow and Dr. Jesse Bell, so. Whichever order. It looks like maybe Dr. Snow is first.

DANIEL SNOW: Thank you. Can, can you hear me all right?

HOLDCROFT: Yes.

CLEMENTS: Yes.

DeBOER: Yep.

DANIEL SNOW: So I'm going to start just by giving you a little bit of my background. I grew up on a farm in southwest Iowa. I-- one of my jobs as a teenager was to clean out the, the farm well that we were drinking water out of. So I, I-- from that, I think I was inspired to go off and study groundwater. I got a undergraduate degree in geology at Missouri State in Springfield, a master's at Louisiana State University in geochemistry, and then came to Nebraska in '86 to do a PhD. Really interested in studying groundwater and learning as much as I possibly could. My PhD advisor was Roy Spaulding [PHONETIC]. He retired about eight years ago, eight, ten years ago. But I learned an awful lot under his leadership. And then I've been part of the Nebraska Water Sciences Laboratory since 1990, since it was created. I started out as a lab manager while I was finishing my PhD and then took over as director in 2004. So I'm going to talk just to kind of the high level about Nebraska drinking water. I just-- I only have just a few slides, but I kind of like to take my time and, and give you what I see as our, our past, our present situation, and the future

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of Nebraska drinking water. And feel free to interrupt me. I tend to kind of talk quickly. So if, if I'm going too fast, just let me know. So the-- this is kind of the-- what I think of when I think about the past of Nebraska's drinking water. Many of you are probably familiar with the High Plains aquifer system. It extends all the way from central Texas all the way up into South Dakota. And that's the center slide. And those blue areas in Nebraska show the thickness of that freshwater aquifer. Some people call it the Ogallala, but it's really the High Plains aquifer system. And we have a lot of groundwater in Nebraska that ends up feeding a lot of the surface water rivers that we have that traverse the Sandhills. We've always had a lot of groundwater in Nebraska, and I guess that's one of the reasons that we spend a lot of time and effort to study it and learn how to-- we can manage it better. The Sandhills are really the, the primary reason for having this thick-- thickness of groundwater. It's basically a sponge that we've had precipitation over the past several thousands of years that have accumulated a very thick layer of freshwater that we now have stewardship over. So the map on the right-hand side shows the, the present groundwater thickness throughout the High Plains aquifer system. And you might notice down in Texas and Oklahoma there's a lot of red areas. Those are areas where they pumped the groundwater dry. They, they've basically depleted the High Plains aquifer system in Tex-- many parts of Texas and Oklahoma into Kansas. And they're just basically running out of water. That's not the situation in, in Nebraska. For the most part, we have maintained the groundwater levels that we have, with the exception of the southwest corner of the state where we have seen some declines in groundwater levels. So those are areas where they're having to start rationing groundwater, particularly for irrigation. But the rest of the state's in pretty good shape with respect to quantity.

CLEMENTS: Dr. Snow.

DANIEL SNOW: Yes?

CLEMENTS: So when you say past, what year is that?

DANIEL SNOW: So this is what I would like to imagine the aquifer looked like 100 years ago.

CLEMENTS: OK.

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DANIEL SNOW: OK. Basically untouched. Yeah. And, and the reason for that-- you see the windmill. We weren't using a lot of groundwater a hundred years ago, so that's kind of the state that it was in.

DeBOER: Can you-- I'm trying to understand the, the color scheme between the first and the second. You said the, the darker is better in the first one--

DANIEL SNOW: Yes.

DeBOER: --in the past?

DANIEL SNOW: Yep.

DeBOER: And then in the, in the second one, is darker worse?

DANIEL SNOW: Right. The red areas are where there's huge declines in groundwater levels.

DeBOER: And the gray or blue or green is the same?

DANIEL SNOW: It's actually some places in the state where it's increased.

DeBOER: In the blue or green?

DANIEL SNOW: In the green, yeah.

DeBOER: And the gray is just-- it stayed the same.

DANIEL SNOW: It stayed the same, yeah.

DeBOER: Got it. Thank you.

DANIEL SNOW: Any other questions before I move on? All right. So this-- these two maps show how vulnerable that groundwater in the High Plains aquifer system is to surface contamination. The one on the left, published by Jason Gurdak and, and Sharon Kee [PHONETIC] at the University of Florida, shows how easy it is to contaminate that freshwater that we, that we draw from the, the High Plains aquifer system. The map on the right shows the median groundwater nitrate concentrations, published by the Nebraska Department of Environment and Energy in their annual water quality report. And what I wanted to point out from this map is that Nebraska, it has a lot of red areas that are highly vulnerable to contamination from nitrate. And I'm going to talk a little bit about why that is in the next couple of

slides, so. So this is, is two maps. The, the first is vulnerability or risk. And the, the upper right-hand corner shows actual concentrations in the groundwater in Nebraska. So we use a lot of groundwater. I, I came to Nebraska to study groundwater, and it has not disappointed me. There's, there's a lot of use of groundwater in Nebraska. Over half of that goes to irrigation. And it's, it's really hard to imagine how much groundwater we're pumping every year for crop production, but it's a lot. And then that pie chart shows that there's far fewer public supply wells and domestic wells. We have some monitoring wells, a few livestock wells and commercial. But by, by far and large, we use a lot of groundwater for crop production. And-- so that pie chart is basically just showing the number of wells. And then the map in the lower right-hand corner shows the density of those different types of wells. And the green, which is a little bit-- it's kind of hard to read here, but the, the green is the irrigation well density. So all those groundwater wells that we're sampling and monitoring and keeping track of, by far and above, they're irrigation wells. And, and you might notice that there's a lot of green on that map. That means that all the areas where we have green, we have a very high density of irrigation wells, some places more than six or eight per square mile. Pumping a lot of groundwater for crop production in the summertime. You can't really see the, the locations of the domestic wells or the other types of wells. It really is kind of overshadowed by the, the number of irrigation wells that we have. And then just for comparison, that's that same map that shows the, the distribution of groundwater nitrate in the state. You might notice that the areas that are red and yellow and orange, areas that have high nitrate concentrations, kind of coincide with the distribution of the irrigation wells. So why is that? Well, we did a study about five years ago looking at the, the high groundwater nitrate risk factors. And I've tried to distill it down into just four bullet points. Sandy soils. We have-- obviously, we have a lot of sandy soils in the, the Sandhills, but we have many sandy soils throughout the Platte River Valley and the Elkhorn River Valley, and those sandy se-- soils are, are highly vulnerable to nitrate leaching from the surface. I already pointed out that we have a high density of irrigation wells in these areas where there's a high potential for high nitrate concentrations in the groundwater. And then we have a very shallow water table. On many of these areas where nitrate is high, the, the depth of the water is probably less than 3 feet, 3 or-- 3 to 5 feet. So there's not much room for mar-- margin for error if you're applying fertilizer at the surface and you've got 4 or 5 feet to get to the water table in those cases.

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J. CAVANAUGH: Can I ask a question?

DANIEL SNOW: Yeah.

J. CAVANAUGH: So in terms of the, the soil composition, isn't that just how quickly it gets through? I mean, it-- does nitrate-- in-- the more clay-like soil or thicker soil isn't just going to slow its permeation but still going to hit it?

DANIEL SNOW: Yeah. I think what it really boils down to is water-holding capacity. So you're right. Clay's-- clay-rich soils are less likely to leach nitrate. But we have to apply more water in sandy soils because that-- those sandy soils don't have a very high water-holding capacity, if that makes sense.

J. CAVANAUGH: OK. Yeah.

DANIEL SNOW: It just doesn't hold as much water. So this is shortly after I moved to, to Nebraska. I've lived in the Lincoln area since 1986. So it wasn't until the late 1980s that we began to regulate well installation and monitor what was going on with Nebraska's groundwater. So in my lifetime, we've really made a lot of strides in understanding and protecting groundwater quality through this well registration program. Title 178 water well standards were enacted in 1988. And it wasn't until five years later that they included domestic and livestock wells. So we didn't really do anything with domestic wells until the, the mid-1990s. Drinking water for about 85% of Nebraskans, including Omaha, are from a public or supply well. So that, that's a lot of people that depend on groundwater for drinking water sources. And there's very roughly about 150,000 domestic wells in Nebraska. Well, we only have about 34,000, or 23%, are registered, currently registered. Now, remember, we didn't enact domestic well registration requirements. That only happens when a well is installed. So there's lots of wells that were constructed prior to that they were not required to register the wells. And this is-- some of these slides are the ones that I present to-- when I teach my class on water quality strategy, I talk a lot about the Safe Drinking Water Act. It protects public water supplies by regular monitoring and strict enforcement of maximum contaminant levels for a whole wide range of contaminants that can affect water quality. All Nebraska wells are subject to annual monitoring and reporting requirements that are enforced by Nebraska Department of Health and Human Services. And right now, we have about 5% of the 550 public systems that are required to, to treat their water supply. So very few public systems

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in comparison to some states actually have to treat their water supply. But that number is increasing over time.

DeBOER: Are those located in any one area of the state?

DANIEL SNOW: I'll show you a map. So if you're not familiar with the U.S. EPA's Safe Drinking Water Act requirements, it's available online. They regulate about 16 different inorganic contaminants, including nitrate and nitrite; about 55 organic contaminants, which includes pesticides; 4 radioactive contaminants; 5 microbiological; as well as 7 disinfection-- dis-- disinfectants and disinfection byproducts. So that's one of the problems with disinfecting public systems, as they can produce disinfection byproducts, which actually have human health effects. So you might think, well, why don't we just treat all of our wells? They can actually make the water quality worse. Maximum allowable concentrations of these contaminants are based on literature-supported health effects from long-term, chronic-- that is, long term-- exposure to low level concentrations of these contaminants. Fortunately, most public water supplies in the United States have a very low probability of exceeding maximum contaminant level. So I think most utilities now are doing a pretty good job keeping up with safe drinking water requirements. So you ask about nitrate and, and treatment requirements in Nebraska. Nitrate's not the only contaminant that we're treating for or monitoring for. But right now, we have about 20% of the public water systems are required to [INAUDIBLE] with saving-- safe drinking water re-- requirements through quarterly sampling and/or treatment for nitrate in well water. And this map shows the distribution for treatment. Administrative orders means that they have had some kind of problem with nitrate levels in their-- in one of their supply wells. Quarterly sampling are represented by the star. And then the other public systems, the location of those are black dots where they currently do not treat for nitrate contamination. All right. So let's flip the dial and talk about domestic well water quality. It is not subject to monitoring under the Safe Drinking Water Act anywhere in the United States. So it's not just Nebraska that has an issue with domestic well water quality. Domestic wells are voluntarily sampled and tested by well owners or water users. There are some counties like Lancaster, I think is an example, where they require existing well testing when the property is sold. But for the most part, well owners are up to, to doing their own testing and monitoring of the well water quality throughout the state.

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CLEMENTS: You see that Elmwood-Murdock High School on there? Elmwood has had reverse osmosis for 20 years. We just recently had an alert that we couldn't drink the water for five days or so [INAUDIBLE] maintaining the system and fixing it. So that's been the situation in my area for quite a while. I have another well development that-- I, I received a letter that there had high copper level. And there-- they were under an order from the state to correct that.

DANIEL SNOW: And those are public systems, right? So they're required to publicize when they're not meeting Safe Drinking Water Act requirements.

CLEMENTS: Right.

DANIEL SNOW: All right. So I mentioned this already: domestic wells are not regulated in the United States. But nationally, roughly 20% contain chemicals above health benchmarks laid out by the, the Safe Drinking Water Act or the U.S. EPA. This map shows the, the number of people, estimated number of people, using domestic supply wells per square kilometer. And it's kind of hard to see on this map, but in Nebraska, you, you might see the same density of people using domestic wells is where we-- what we have for irrigation wells. So those people are in particular probably more vulnerable to contamination to their domestic water supply. So how many domestic wells do we have in Nebraska? Well, the actual number and locations are unknown. This-- a national USGF study estimated that there's about 250,000 people in Nebraska using domestic wells as their primary drinking water supply. There's likely to be on the order of 120,000 to 150,000 wells, but we don't really know. Frequency of testing is also unknown. This map shows the locations of 33,754 registered domestic wells as of 2022. And we're guessing that maybe, you know, 20% of the 150,000 wells are tested at all. We don't really know. So I think, I think this is a, a great-- this is one of the main points I wanted to make, is that we got a lot of wells, people drinking water from domestic wells, and we don't know really what's, what's in that well water. So nitrate is not the only contaminant. Nationally, there's a strong relationship between nitrate and other contaminants. And I'm just going to list a few. If you want to l-- if you're interested in this report, it was put out by the U.S. Geological Survey, where they did a survey of all of the United States, including Nebraska. They found a strong relationship between nitrate and radon, strontium, arsenic, manganese, uranium-- which is what I did my PhD on-- boron, and fluoride. There's plenty of evidence that these are also contaminants that are issue-- an issue in domestic wells in Nebraska.

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J. CAVANAUGH: When you say there's a relationship, does that mean that one-- that nitrate is causing the others?

DANIEL SNOW: That's, that's kind of one explanation, yeah. So I could go into that.

J. CAVANAUGH: Do any of those things exist in, in nitrate-- or, in fertilizer?

DANIEL SNOW: Yeah. They do. The, the-- yeah. And the point of this is it's not just nitrate. If we have nitrate contamination, we probably have another contaminant that we're not testing for. So test your well [INAUDIBLE]. It's pretty much just nitrate that they test for, but it's probably other stuff in the water that we're, we're really not aware of. I think this is my last slide. Future of Nebraska Drinking Water. Well, one thing I've run into is that people don't realize that they have to sample and test their own domestic well. So this is one thing that I'd like to see happen, is that we get the word out that they're responsible for monitoring their domestic well water quality. And then if there's a problem with it, they need to come up with some way to get it treated so that it, it, it meets minimum requirements for drinking water. I think Nebraska has come a long way since I moved here to help public water systems, but we still have a little ways to go. I'd say, nationally, we're, we're right in the middle in terms of meeting Safe Drinking Water Act requirements through treatment. But we're, we're-- you know, we still have a ways to go. I think there's a lot of uncertainty about domestic well water testing and treatment, not just from my side of things where I'm studying the, the resource, but from a Nebraska citizen standpoint and what they're supposed to do and, and how they could respond to a potential contaminant in their well water. So I'd like to see increased scale-- scale and frequency of domestic well testing. That can take a number of different forms. One option that, that I've included in this slide is our Know Your Well Project. It was started with some Nebraska environmental trust funds about six years ago. It really-- it goes through the school systems to try to, to get students trained to properly sample and test well water. They, they send samples to the water sciences laboratory so we can be sure that the results are of defensible quality. And then we share those results with the well owners. And then the last bullet on there is I think we still have a ways to go on how we do crop production in the state. And, and we can probably improve, especially in those areas where we have very sandy soils a short distance to the water table, ways that we do crop production in the state. So I think

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there's, there's some room for improvement there. And I think that's all I had.

J. CAVANAUGH: Free to ask questions?

DeBOER: Yes. Please ask questions if you'd like. Senator Cavanaugh.

J. CAVANAUGH: Thanks for being here. Sorry I walked in a little late. I had a kid forget to take his iPad to school, so I had to go to school late. So I guess my first question is, on the-- well, I guess we'll [INAUDIBLE]. So there's 120,000 to 150,000 wells, but we only have 30,000--some are registered.

DANIEL SNOW: Yeah.

J. CAVANAUGH: Is there-- should we be trying to get the other 90,000 registered?

DANIEL SNOW: Right. That, that's a great question. I think you're going to get a lot of pushback, right, to requiring registration. Because, you know, people want to keep control of their own property, their own well. They want to, they want to make that choice. I think encouraging registration is a good direction to go, but not requiring it.

J. CAVANAUGH: What-- I mean, obviously, aside from just generally not wanting to do something you don't have to do, what comes with registration? Is-- are there some obligations or requirements if somebody wants to register--

DANIEL SNOW: I think there's an inspection. They might do an inspection. There's a-- like, a \$60 registration fee, inspection. That might be it, right? But they would probably have to get it sampled and tested.

J. CAVANAUGH: And you said something about it. It was, like, once every 30 years or something like that that was on there.

DANIEL SNOW: And that's-- the other thing is like, well, we think all those 30,000 are tested annually, like they would be required to under the Safe Drinking Water Act. It's probably only been tested once or twice. Sometimes they might do it more often than that, but it's unlikely that they have.

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J. CAVANAUGH: And if I test my well-- I go to well testing night or whatever-- and it tests unsafe, what do I do?

DANIEL SNOW: That's, that's another great thing about education, is that we can provide a well owner with resources to help make informed decisions about what's the best treatment system to, to use because there's a number of different options depending on what the well-- the water quality tests. And it's not just nitrate. And you have to decide, well, is it hard? Did they require softening? You really need to do softening if you're going to do reverse osmosis. Otherwise, the, the RO system is fouled within the first two or three years.

J. CAVANAUGH: And so say I'm going to install this reverse osmosis. I would do that on my own property?

DANIEL SNOW: Yeah. So you would need to pay for it, right, to, to do it on your own property, yeah.

J. CAVANAUGH: And I recall-- I mean, we appropriated a, a year or so ago for, for reverse osmosis in Creighton or Neligh or somewhere along those lines, and it was \$1 million.

DANIEL SNOW: Yup. It's expensive. Yup. And honestly, I don't think RO is the best solution for treating well water. It's, it's probably the cheapest, but it's not necessarily the best.

J. CAVANAUGH: That's the cheapest--

DeBOER: Because you could--

J. CAVANAUGH: --is it would be \$1 million?

DeBOER: Well-- because I'm remodeling my house and putting in an RO, you can get an individual one on your drinking water for--

DANIEL SNOW: Yeah.

DeBOER: It's not \$1 million, I will say that.

DANIEL SNOW: And I have an RO system too. But, you know, because I've looked at all the options, I think, well, it really depends, and if this is the best solution. If you do install filtration and reverse osmosis, you gotta make sure it's properly maintained. And you have to wonder how many people actually do that.

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J. CAVANAUGH: Gotcha. And so-- sorry. I, I just keep-- I'll-- I, I could go forever--

DeBOER: It's fine, John. We're in your, we're in your field now.

J. CAVANAUGH: So-- OK. And so just thinking about that-- like, you're talking about the improved land management. And I guess my thought process goes to that landowner's then bearing some cost, and it's associated with somebody else's conduct, right? Do we have any-- you're saying we need to engage in better land management practices. But under the water quality standards, are there any obligations to the point source? Or is it all a regulation of the, the municipal water?

DANIEL SNOW: Yeah. It's hard to prove if it's from a point source. I think that's-- if, if a domestic well is contaminated from a point source, it's very difficult to, to prove that it actually came from what you think is that point source. And I worked on some Superfund projects back in the '90s, so I understand. Even when you have source here, wells here, there's a lot that happens between the time that it's introduced into the soil or at the water table until the time it gets to a well. So it's, it's complicated. And because it's complicated, it's very difficult to prove who's financially liable for that contamination.

J. CAVANAUGH: But if you could prove, would they be liable, I guess is the question?

DANIEL SNOW: Well, you know, they, they've tried to do that with nitrate contamination. Iowa was a great example of where they tried to, to say, well, the people in this watershed are not managing the watershed properly. So we're going to sue the, the irrigation-- or, not irrigation, but the, the people upstream of the Des Moines, Iowa water system because it was contaminated with nitrate.

J. CAVANAUGH: Like feedlots and things like that?

DANIEL SNOW: The, the case was thrown out of court, right, because they couldn't prove who it was and who was financially responsible for that.

J. CAVANAUGH: OK.

DeBOER: They'd have to have a Super-- I used to do apportionment trials for the-- on the other side. And you'd have to show-- you'd

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have to get the Superfund site declared. And then you have to get-- so you'd have to have it declared under the--

DANIEL SNOW: That's the-- and, and this is nonpoint source--

DeBOER: [INAUDIBLE].

DANIEL SNOW: So point source is hard enough. But when you go to a whole watershed, even if it's your, your neighbor you know is the problem, it's, it's very difficult to prove that in the court.

J. CAVANAUGH: Right. Well, I guess we're in the kind of realm of public policy at the moment, I guess.

DANIEL SNOW: Yeah.

J. CAVANAUGH: And so the question we're talking about is, what are the land management practices where we're pot-- we're attempting to decrease the burden that one person puts on another person [INAUDIBLE], right?

DANIEL SNOW: Right, right. It-- the, the natural resources districts actually do a pretty good job of that. They-- you know, they've established groundwater management areas within their district boundaries. And, you know, they ca-- they look to the university as kind of the experts on how to do this. So those groundwater management areas, they enact regulations or policies about fertilizer, application, timing, rates, water use, and then they educate the producers in those management areas on what's the right way to do things. They don't go so far as to find anybody, to, to my knowledge, but they really work hard to make sure the producers know how to do things right, especially within those groundwater management areas.

CLEMENTS: I have an example of that at Elmwood. Just near town-- actually, close to the city's wells-- the farmers cannot apply fertilizer in the fall. They only can apply it in the spring, close to when the planting is so it doesn't have a chance to soak in as much. And farmers don't like-- when that came in, the farmers weren't very pleased about.

DANIEL SNOW: It was very controversial. And still is, actually, in some areas. So-- like, the Lower Loup NRD just enacted that regulation, this no fall fertilizer application. And it's amazing how many farmers didn't want to be regulated that way. But it, it's pretty wasteful if you think about it. They lose over half of the fertilizer

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that's applied in the fall anyway through volatilization. It, it seems like it would be a small step in the right direction to, to just do away with it altogether.

J. CAVANAUGH: And when you implement that type of program, do you see results from that?

DANIEL SNOW: It takes a long time to see the results.

J. CAVANAUGH: Are we talking ten years [INAUDIBLE]?

DANIEL SNOW: [INAUDIBLE] is one example where they say, well, our managements have been in place for one of the longest of any of the natural resources districts. They are seeing reduction. I don't know that if you can point to any one practice that's, that's leading to a reduction. In some places, they're seeing an increase, so.

J. CAVANAUGH: Oh.

DeBOER: This is--

IBACH: Go ahead.

DeBOER: No. Go ahead.

IBACH: No, I just have a follow-up question. And I appreciate that you explained the NRD's position on things because I think they do a great job managing different water locations because I think we're so diverse in Nebraska that I think there are different ways [INAUDIBLE]. Do you think there are other contributors? You mentioned agriculture, and it seems like we're focusing in on that. I get a little bit personal on that. But do you think there are other contributors to those nitrate levels as well other than agriculture?

DANIEL SNOW: To nitrate?

IBACH: Mm-hmm.

DANIEL SNOW: There might be a few isolated cases where it could be from a septic system or from a, a municipal wastewater system. I, I-- one of the projects I worked on as a graduate student was the wastewater treatment plant at Grand Island. And this is back in the '90s. They were applying biosolids to a field where it was about 6-foot to the water table. And they weren't really accounting for the amount of nitrogen in those biosolids. And we did a bunch of sampling

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and we showed conclusively that the-- these were contaminating the local groundwater. And this was municipal biosolids. So it--

IBACH: What was that?

DANIEL SNOW: In Grand Island.

IBACH: But when-- what time frame?

DANIEL SNOW: Early 1990s.

IBACH: So you feel like we've kind of addressed that in the meantime?

DANIEL SNOW: So I think there, there might be a few cases where that's happening, but now we're doing a better job of regulating, say, by biol-- biosolids application. The other factor that probably contributed to contamination was their lagoon wasn't properly lined. So leaking lagoons, both municipal and livestock, can contaminate local groundwater. There's no question about that.

DeBOER: But the vast majority is coming now from fertilizer application?

DANIEL SNOW: If you do the math--

DeBOER: But we're doing a better job than we used to.

DANIEL SNOW: Yeah. Yeah.

DeBOER: I-- I mean, I'll just-- full disclosure--

DANIEL SNOW: Yeah. I, I--

DeBOER: My-- our family business was Midwest Laboratories, so-- I may--

DANIEL SNOW: Right. I, I agree 100%. We're doing better.

DeBOER: --have some-- I have some knowledge of this. And Lexington-- I remember the Lexington area in the '90s was pretty bad, but it's doing a lot better now, right? So we, we do see progress. It takes a while.

DANIEL SNOW: It does. It, it, it's a slow system. There's a, a long time lag between what we do at the surface and that-- when we see a response in the, the local groundwater. So that's-- it's hard to communicate to people, right?

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DeBOER: Part of that is the agriculture is testing more so that they're applying specific fertilizer rather than a general-- generalized fertilizer.

DANIEL SNOW: Right.

DeBOER: And it-- those are the sorts of practices that will continue to help? Is that correct?

DANIEL SNOW: Well, I'd like to think so. I'd like to see-- think precision ag is going to help, you know, we're going to do-- apply the right amount at the right time in the right place. I-- unfortunately-- we're-- and I grew up on a farm, so I understand this-- we're still pushing yield, crop yield. And, and when crop yield is your most important metric, you're going to maximize all of your inputs to maximize your yield. OK? So as long as we have that metric in agriculture where yield is the most important thing, we're going to continue to overuse fertilizer, irrigation water to make sure we can maintain that high yield.

HOLDCROFT: Question.

DeBOER: Yes, Senator Holdcroft. Sorry.

HOLDCROFT: Thank you. Back to mechanics of testing. For small towns like Humphrey, Nebraska, 1,000 people got a beautiful water tower. So where do they test and where do they treat in that kind of a system? Do you know?

DANIEL SNOW: I don't know specifically for Humphrey, but I-- they, they have to send samples to a certified testing laboratory. Midwest is one of the, the certified laboratories in, in Nebraska. They can also send samples to the state health labs, which is also certified for drinking water monitoring.

HOLDCROFT: So I'm just curious about the tower in particular. I mean, obviously, they're pumping into the tower probably almost continuously, I would think, kind of make up for day use. Do you know anything about circulation within the tower? Do they-- I mean, my, my experience in the Navy, we make our own water, you know, under way. But, you know, it goes into a tank, gets treated for chlorine. But you, you have to use it. Otherwise, the chlorine will dissipate and you can have stuff growing in there in not too, too bit of time. So I'm just wondering, is there a, a, a process or, or procedure that

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ensures that the-- that what's in the water-- what's in the tower is getting used at a regular basis or--

DANIEL SNOW: That sounds like an engineering question.

HOLDCROFT: Uh-huh. Yeah.

DANIEL SNOW: I don't really know the answer.

HOLDCROFT: OK. All right. Thank you.

DeBOER: Thanks. Any other questions? Thank you so much for being here.

DANIEL SNOW: You're welcome.

DeBOER: It's been very helpful. Thanks. And we're going to go now with Dr. Bell.

JESSE BELL: All right. Well, thank you very much for having me here today. I really appreciate it. I'm Jesse Bell. I'm over at the University of Nebraska Medical Center, but I also have a position within the University of Nebraska at Lincoln. I've been at the University of Nebraska for about five years. And, and then during that time span, we've been working a lot on water quality and water quality-related issues in the context of human health. So I'll talk a little bit because I'm actually in the College of Public Health. Public health, just very broadly, is the science of protecting and improving the health of people in their communities. And so that's one of the primary goals of a lot of the work that we're trying to do, is understand what are some of the threats that are facing within Nebraska and how do we better protect those people that live in Nebraska as well. So like I said, we're going to be talking a little bit about some of the water quality-related issues here in Nebraska. And this is a nice follow-up to, to Dr. Snow's presentation. Just to kind of reemphasize that, I'll be primarily talking about nitrate, but obviously that's not the only issue that we face. Dr. Snow did a good job of illustrating a lot of other potential contaminants that we have within our water systems. But within nitrate, as Dr. Snow illustrated, nitrogen fertilizers, animal waste, and human waste are the primary drivers for nitrate contamination well-- and in water. The regulatory limit, as Dr. Snow said, was 10 milligrams per liter. And-- otherwise known as 10 parts per million. So sometimes I might use both. That-- and I'll talk about that in a second-- was set based off of potential health impacts. And the greatest areas of exposure are agricultural areas and individuals with private wells, which I think Dr. Snow did a

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really good job of illustrating, because they're not regulated. And they're also sparse measurements. So with-- what I'm going to do is summarize some of our knowledge right now about how nitrate can potentially be related back to human health outcomes. This is based off of literature across the, the world. A lot of this actually comes from the National Cancer Institute out of the National Institute of Health here in the United States. And so that's where I've received a lot of this information. We've also been doing some studies here in Nebraska as well, and I'll talk a little bit about those. So just to start off with, the regulatory limit for nitrate in drinking water is set based off of methemoglobinemia, otherwise known as blue baby syndrome. So that's where that 10 parts per million, or 10 milligrams per liter, comes from. It's not based off of other health outcomes, but there have been numerous studies that have been done looking at the relationship between nitrate in drinking water and found other potential health ailments associated with high nitrate in drinking water. Some of the strongest are minor ailments. I'll talk about some of those in just a bit. Like I said: blue baby syndrome, or methemoglobinemia; preterm birth issues; birth defects; pediatric cancers; and adult cancers. There have been studies have shown associations with all of those. So to start off, I'll talk a little bit about adult health issues. There have been some studies that have shown an increase in heart rate, nausea, headaches, and abdominal cramps with high nitrate exposure. There's also been different adult cancer studies: colorectal, thyroid, kidney, bladder, and non-Hodgkin lymphoma. And one of the things I'll point out here is you'll notice that there-- I have five studies for positive-- for colorectal and three studies, thyroid. That's the number of studies that have found relationships. So there are five studies; four of those found a, a positive association between colorectal cancer and nitrate concentration. There's also been some work that's been done showing a potential association of Alzheimer's, Parkinson's, and diabetes assoc-- and ad-- adverse health outcomes of diabetes associated with high nitrate concentration. I'll move into children's health, and this is a area that we've been more focused on. Obviously, like I said, methemoglobinemia, otherwise known as blue baby syndrome, especially for infants less than six months of age, has been pretty well-established with high nitrate in drinking water. There's also been studies of pediatric cancer, two with positive relationships-- which is actually three. And I'll talk about the third one in just a little bit. And then non-Hodgkin lymphoma: three studies, but only one has shown a positive relationship. And there is a non-Hodgkin lymphoma study that was done here in Nebraska, where they showed a three-fold

increase in risk when there was nitrate and atrazine present. And so that kind of goes back to-- what some of the stuff that Dr. Snow was talking about. That, you know, when we're talking about exposure, it's not individual exposure. There are multiple things that you're being exposed to on a single basis. Sometimes we're only monitoring for nitrate. So we don't know what some of these secondary exposures are. And that's one of the points I wanted to make real quick here as well. These are correlative studies, correlative studies. They're not causation and cause-and-effect studies. By that, I mean we're looking at areas of what are the concentrations of nitrate in groundwater. And do we see higher incidence of some of these health ailments in those regions as well? Cause and effect. The only way that we could really get at that is if we do clinical studies or studies within animal models or-- I joke: usually at this point, we don't do studies on people like that anymore, which-- thank goodness. And there have been studies looking at animal models and showing, with exposure to nitrate, that there's adverse health outcomes that can come about. Both cancers and birth defects have been shown with various different animal models when they've expose them to high nitrate concentrations. And then also maternal and fetal health issues. One of the earliest studies that was done that I could find looking at the relationship between nitrate and adverse maternal and fetal health issues was back in 1996. CDC, the Centers for Disease Control and Prevention, had a report talking about how there was a cluster of spontaneous abortions, otherwise known as miscarriages, in rural Indiana. They had reports that there was, in this rural area, multiple miscarriages were happening with various women in that neigh-- in that community or in that area. They went in and tried to understand what was potentially one of the underlying factor-- what are the underlying factors that could be contributing to it. And the only thing that they found as a commonality between all those households was that the private wells had nitrate concentrations somewhere between 19 to 26 milligrams per liter. So obviously, above that 10 milligrams per liter. There is also some more recent studies looking at potential adverse health outcomes of fetal growth restrictions and, and also spontaneous preterm birth. In California, there was a study that was done that showed more spontaneous preterm birth-- so before a full gestation period-- with nitrate in drinking water concentrations between 5 and 10 milligrams per liter. So less than that, that 10 [INAUDIBLE] the standard. There has also been work-- and I think this was out of The Netherlands-- showing fetal growth restrictions with exposure to high, high nitrate drink-- drinking water. There's a pathway-- and there's been some work looking at this-- for why that would potentially impact the fetus. And

so they've-- there's been studies that have been done looking at fetal hemoglobin and showing that they are particularly susceptible to oxidation, which is what methemoglobinemia, or baby syndrome, is and-- but that's-- methemoglobinemia is once the baby is born. And so-- but they've shown that there is a potential for the fetus itself to be susceptible to nitrate exposure. And there's also a pathway between that because there's been studies that have been done looking at the fetal cord blood-- or, the umbilical cord and the blood within the umbilical cord and showing that methemoglobinemia is actually present there. So that would be a pathway for mothers or individuals that are drinking water that is potentially contaminated with nitrate to potentially get to the fetus through that pathway, which would explain some of those potential negative or adverse health outcomes. There's also been studies done with looking at central nervous system malformations, otherwise known as birth defects of the brain and spinal cord. Five of the six studies that have been done have shown positive relationships with nitrate. Four of those studies have shown positive relationships below 10 milligrams per liter. Again, I just wanted to highlight that doesn't mean we know what all the other potential exposures are. We just-- they have nitrate as a potential exposure, but there could be other factors that are interplaying in there as well, as, as Dr. Snow discussed. So for me, you know, with the information that is provided based off scientific literature, one of the things that I'm most interested in is, how do we best communicate and engage with populations that are most at risk? And so for me, pregnant individuals and individuals of childbearing age and their fetus is obviously a category that we should be-- or at the-- I'm concerned about and how to best educate and inform them. Also, individuals with young infants less than six months of age-- that's especially because of that methemoglobinemia. Children in general, because of the associations with pediatric cancer, anybody with oxygen transport delivery issues, such as those with anemia, cardiovascular disease, lung disease, sepsis, et cetera. And then also anyone that is on a private well that potentially isn't monitoring-- or, doesn't have access to monitoring their, their-- what they're potentially being exposed to. I also want to illustrate that diet does seem to have some role in this as well. And so certain diets seem to exacerbate some of these conditions. And some, some diets seem to actually reduce potential exposure as well.

DeBOER: What are those diets?

JESSE BELL: Processed meats because they have a lot of nitrate in them. But we've actually changed the way that we process meat in the

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United States because of that threat of nitrate. Now they-- I forget which vitamins are put in there. Because it reduces risk of cancer and development of cancer. And so individuals that eat more leafy greens, high-- vegetables with vitamin C and, and other vitamins, vitamins seem to reduce the risk. Hence, a lot of vegetation, if you eat it-- it has nitrate in it. But when it gets into your stomach, because of all those other things that are present in leafy greens and et cetera, it doesn't convert into nitrosamine, which is a known carcinogen. Whereas if I just had a glass of nitrate here and I drank it bec-- with no other substance present and it gets into my stomach acid, it can convert into nitrosamine, which then can lead to-- which, nitrosamine is a, a known potential carcinogen. And so one of the reasons I'm concerned about this is just of issues that we see here in Nebraska. Some of you may have seen this before. Nebraska has one of the highest rates of pediatric cancer in the United States, especially when you look towards the central part. Obviously, there's higher rates up in-- it's a little hard to see, a little washed out there. But Nebraska, as far as the-- is the highest in the central part of the United States. That was from CDC. There was a study done in 2018 that also showed this. It came from University of Nebraska Medical Center that showed that we were in one of the top five as far as pediatric cancers. This study in particular showed that there was an equal distribution of pediatric cancer across the state and that certain counties, certain locations in the state have higher rates of some pediatric cancers than others, which got people interested in understanding what is potentially going on and why do we see that certain places have higher rates than others. There was also a pediatric oncologist that we've been working with before I got here who was also concerned about this and noticed that, in certain communities, he was seeing higher rates of pediatric cancer, more kids coming in from certain communities than others, and trying to figure out what was potentially going on. That's where this study began, was trying to look at potential exposures. Adults have a lot of different exposures over our lifetime, obviously. We-- you know, we have a lot of choices that we make and how-- you know, where we drink or we smoke or we do all these other things. Children don't have those long-term exposures. And so, a lot of times, if it's an environmental exposure, they also don't move as much. So when they have an exposure, it's easier to make that association or that relationship. And so that's why we started looking at things like water quality across the state and trying to see if we can find any associations because other-- you know, we're not the only place that's done this. Other places have looked at these types of associations. And based off this study

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looking at pediatric cancer from 1987 to 2016, we found that counties that had elevated levels of atrazine and nitrate reported more childhood cancers in those counties with lower levels of, of these chemicals. And that was especially true of CNS, central nervous system, tumors. And-- this wasn't a part of this study, but this was just some of the ways that we were trying to visualize the data. And I think it's kind of interesting. So Panel A, in-- everything that's in that red, pinkish color is above the national average for CNS, or brain and nervous system tumors. B is leukemia. C is lymphoma. And one of the first things that people noticed was with Panel A, especially for the central nervous system tumors or pediatric brain tumors, when you looked at where we have the most of row crop agriculture across the state, there is a, a potential association there. And they broke it up by watershed. I should mention that really quickly. Because they realized that-- when they were looking at this, they realized that geographic-- our, our geopolitical boundaries really don't define our environmental system very well, and so they wanted to try to look at it from a more natural system. And that's the reason that they, they put it in that, in that, in that way. So one of the things I always like to point out is that-- and this comes from Dr. Coulter, who's the pediatric oncologist that I work with. He said we're really good at treating pediatric cancer. A lot of kids live that are exposed to pe-- or, that have pediatric cancer. There's a number of different issues associated with that, though. Because if you get pediatric cancer, you're going to Omaha to get treated or you're potentially going out of state. So it's usually one of those two options for individuals. I'm from rural Nebraska, and getting to Omaha is about a three-hour drive from where I'm from originally. And so a lot of times when individuals that they have-- a child that has cancer, one of the parents has to move to Omaha to seek treatment. That becomes a financial burden on that household because somebody might have to quit their job. And one of the things that we know is, here in the United States, if somebody in your household has cancer, you're twice as likely to go bankrupt compared to a household that doesn't have somebody with cancer. Wisconsin did a study looking at what is the potential economic cost of, of poor water quality within the state based off of things like cancer and other negative adverse health outcomes. And these are pretty wide ranging, but they estimated somewhere between \$250,000 to \$1.5 billion of medical expenditures a year associated with water quality-related issues that might be contributing to health issues-- or, health issues that might be-- is in potential response to water quality. And then also a loss of \$1.3 to \$6.5 billion of productivity to the state. Just because-- when

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somebody has cancer, when somebody moves, that means, all of a sudden, that's a loss of revenue for that town. That's a loss of revenue for that, that community as well. So for me, I have four goals in trying to address water quality issues. One is identifying at-risk people and at-risk areas. So as Dr. Snow was talking about, some of those places that have higher exposure to nitrate, especially in drinking water, especially those with private wells. Making sure that we encourage testing of water so that individuals know what they're potentially being exposed to, and then finding low-cost to no-cost solutions for those individuals because, as Dr. Snow mentioned, it's up to the private well owner to, to address that issue and mitigate the issue that they have. And then also maintaining these systems can also be kind of costly over the long term as well. So we're doing a number of different things in that regard. We're, we're trying to improve education, outreach. We want better research within our community-- or, within our state as well to better understand some of these exposures and what does it mean for human health impacts, but then also trying to help with contributing to monitoring. We've actually started working with Shannon Bartelt-Hunt to help with her citizen science project. And so they have free testing strips that they send out to individuals so that they can do monitoring of their water quality. And so that's kind of where we're approaching it. There's a number of different things that we want to try to do to help with tackling this issue and just getting people more educated and informed so that that way, like I said, we get more testing and more testing and-- to hopefully reduce exposure for those that are most at risk. So like I said, I'm trying to get more research to better understand what's going on in Nebraska. And one of the big things that I really see in all this is building collaboration with the agricultural community to address these issues. You know, I know Dan and I have talked about this before and I've talked with other people about this: this is definitely a legacy issue within farm communities and farm families because, a lot of times, this is generational, right? You're passing it from your kids to your grandkids to your great grandkids if it works out appropriately. My family farm didn't go that way, but. But with that, if you have water quality issues, that obviously is something that can stick with, with that household or with that, with that family for, for generations to come. So that's why I think agriculture needs to be part of the solution and, and-- in collaboration with them as well. But then, yeah, education on public water testing and trying to figure out what are some mitigation options for those that are most at risk. And so that's pretty much it for me.

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IBACH: I have a question.

DeBOER: Yeah? Senator Ibach.

IBACH: So going back to your map on the locate the states, knowing that-- like, the northeast and the northwest-- other than Texas, and we know everything's bigger in Texas-- do you see a correlation between-- because they seem to always profess to be greener and healthier and do things, you know, more earth friendly? What would be the correlation between those northeast and those northwest states with Nebraska?

JESSE BELL: The-- you know, there's a number of different challenges there and differences between us and, and them. As far as why we are high and they are high, I don't know for certain. And I don't know if anybody's ever really looked at that. There's different potential exposures there because those areas, especially up around Pennsylvania and New York, throughout that region, were very in-- industrial for a long time. And so there may be legacy contamination issues in that area. I don't know. Dan, you might be able to speak better to that than me. There's also genetic differences as well that may be contributing to some of those. And I've talked with my colleague who does pediatric cancer, and he's mentioned that, that there's a lot of unknown variables on why those differences are. One of the things I should also say is, you know, Nebraska is obviously a hot spot for pediatric cancer. If we-- does not mean every single case of cancer is-- re-- result of water quality in the state. There's a variety of different factors at it. I just highlight this because we do have a high rate of pediatric cancer, and there are these potential associations with water quality, nitrate, and, and other potential exposures as well. If we can reduce those risks, maybe that can help us in some way.

IBACH: Thank you.

DeBOER: Other questions? Senator Cavanaugh.

J. CAVANAUGH: Thank you, Chair DeBoer. Thanks for being here, Dr. Bell. Well, I guess just to kind of piggyback on Senator Ibach's question, what's the difference between us and the Dakotas and Wyoming? I mean, they're so close to us and-- I mean, I always think of us as similar to South Dakota.

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JESSE BELL: Great question. And I don't know. This is one of the things that we want to try to look into a little bit more. We've actually been talking about trying to do a, a multi-state research project to understand why are we a little bit different. And-- so this is an area of, of understanding we need to develop. You know, do we have a higher percentage of people that are on municipal water systems? Do we have differences in water quality? Are there other potential exposures as well? Those things I just don't know at this time, and I think we need to understand that because they're-- maybe there's things that they're doing well that we could benefit from. Or maybe we can find that there are things that are just different about Nebraska, which then allows us to help with mitigating some of those issues as well.

J. CAVANAUGH: And-- so your point about testing and all that [INAUDIBLE] talk-- Dr. Snow talked about the number of wells that are unregistered and maybe untested. Do you guys have any information about whether people have a-- if there's higher incidences with folks who have unregistered wells versus people who have registered and tested wells? Is there any--

JESSE BELL: I don't think so.

DANIEL SNOW: No data, yeah.

JESSE BELL: No data at this time.

DANIEL SNOW: [INAUDIBLE] the, the, the wells that we're sampling could very well [INAUDIBLE] asking [INAUDIBLE] register [INAUDIBLE]. [INAUDIBLE] get more information like that, we could answer some of those questions.

J. CAVANAUGH: And the testing you're talking about, is that just for nitrates and atrazine or--

JESSE BELL: Yeah. You know, for me-- and that's part of it too. And, and-- Dr. Snow would probably be able to speak on this better. You know, nitrate would be obviously one of them that I would love to see more testing around. Atrazine is another one because of that adverse health outcomes that we've seen here in Nebraska with those associations. However, I know a lot of people don't test for atrazine because it is a more expensive test than just nitrate. Nitrate is a much cheaper test to do. And then that also goes back to that individual-- they have to pay for that. And one of the things that

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we've shown-- and, and I know Dr. Snow has also done some work around this as well-- the timing may matter. And so whether you test in the spring or in the fall, whether you test during a dry year or a wet year, all of those things could potentially-- so you might not be able to catch-- if you don't test consistently, you might not catch that maybe this year you're actually above and next year you're below. I don't know. Dan, is that a fair statement?

DANIEL SNOW: Well, that's the difference between public water systems, is they're required to test at least annually. [INAUDIBLE] used to that system. Private wells might be tested once. That's the other time that [INAUDIBLE] not especially high concentration, so.

J. CAVANAUGH: So in terms of, like, what we do here is what can we do-- what can we do to like help address some of these hurdles to actually getting that correct information and education?

JESSE BELL: Well, I'm not supposed to [INAUDIBLE].

[INAUDIBLE].

J. CAVANAUGH: There's no bad i-- no bad ideas in brainstorming.

JESSE BELL: Yeah. You know, I, I think-- one is, you know, just generally helping with the communication around some of these issues and, and figuring out better ways to communicate and educate people around water quality and, and understanding that there is adverse health outcomes that could potentially happen to encourage testing and helping with finding those no-cost to low-cost solutions. Because that's my worst-case scenario, is, say you have a woman in rural Nebraska who's on a private well. And she comes in and she says, OK, I found out that mine's at 20 parts per million. What do I do? And you're like, oh, too bad. Coming up with whatever potential solutions and how to help that individual, especially considering there might be a, an ad-- a, a cost associated with that, which I'm-- I know that there's been-- some legislation has passed around that.

DANIEL SNOW: And, and I'd like to think about well-thought-out solutions rather than just say get an RO [INAUDIBLE]. Because that's-- I mean, that's in the right direction, but I don't know that it's-- there's a lot of thought that was put into what trype-- type of treatment [INAUDIBLE] to subsidize and how that would be [INAUDIBLE]. [INAUDIBLE] little more thought into [INAUDIBLE].

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JESSE BELL: Yeah. Yeah. Because these systems aren't without cost as well-- over long-term maintenance, and then they also-- depending on the RO system that you have, it can be-- it can use a lot of water as well. So there's--

DANIEL SNOW: They're pretty wasteful.

JESSE BELL: Yeah.

J. CAVANAUGH: Gotcha. Well, and to your point, you want low-cost or no-cost solutions, but that's to the individual.

JESSE BELL: Right.

J. CAVANAUGH: But somebody has to find a way to bear that cost. Chair of Appropriations sitting over here. I'm sure he'd be more than happy to dole out a couple hundred million dollars.

HOLDCROFT: You got money.

DeBOER: Other questions? I had one. The-- it strikes me that, again, the difference between Nebraska and South Dakota. Clearly, water doesn't respect state lines. So is it really as clear-cut as that or are there areas in Nebraska that are just so high and then there might be some areas in South Dakota but they're offset by other things?

JESSE BELL: Yeah. Yeah. There's-- I mean, I can't say for certain on-- looking at county by county, I-- we could-- it's kind of hard to access some of those data, just to be honest, especially for other states that understand what they're experiencing. But I would imagine that most of these states are going to be very similar in some way to Nebraska, where we find higher rates of certain cancers in certain locations than others. And there's a variety of different factors that could potentially interplay with that: population, genetics of the individuals that live there, exposures--

Geology.

JESSE BELL: Geology. Yeah. So-- yeah. And that's one of the things that-- like I said, we want to try to do-- we're, we're hoping to do a study that can combine multiple states in this region so that we could work with these other states to understand what are the potential-- why are we different? Why is it that Nebraska keeps coming up with high rates of pediatric cancer compared to some of the surrounding states?

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DeBOER: Because it seems like then we could get-- I mean, yes, it'd still be correlative, but we could get more data on that would help, help us feel more confident that we had found a connection or a link.

JESSE BELL: Yeah. And that's one of the issues as well. You know, places like Nebraska-- although I'm a big fan of Nebraska when it comes to studies, it's hard because we don't have a huge population. Whereas you look at places like New York or California or some of these other places, they have a much bigger population to draw from and try and understand some of these relationships. That's why I would like to see us be able to exp-- or, I'm looking forward to us trying to expand that to multiple states to understand, you know, what are the potential exposures. What's going on? There's still a lot to be understood, but, but I also just want to emphasize there's enough to be a, a little bit concerned too.

DeBOER: Yeah. Senator Ibach.

IBACH: With this program, I know it talks about-- I know a lot of FFA kids do this too, and I think it's a great program. Is there any follow-up if, if your well tests--

DANIEL SNOW: Yes. Yeah. So the-- each well owner that participates gets a, a report from the [INAUDIBLE] with the, the test result [INAUDIBLE] publications on proper treatment. So we, we try to educate [INAUDIBLE].

IBACH: OK. Because we were talking about follow-up and how do, how do people that test positive, how do they know what to do?

DANIEL SNOW: Right.

IBACH: And I just-- I noticed in here there's really no follow-up procedures. But if they have them in place, I think that's great. Thank you.

DANIEL SNOW: We can always do more [INAUDIBLE].

DeBOER: Other questions? Appreciate so much you coming and, and giving your presentation to us.

IBACH: Thank you both.

DeBOER: Yeah.

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JESSE BELL: Appreciate it.

DeBOER: I think then we'll turn to discussing, if we don't have any more questions, as a committee what we might want to do with some of this information. I think it certainly is-- I learned some things today-- I don't know if you all did-- that were sort of surprising.

CLEMENTS: I did have one question.

DeBOER: Oh, you did? OK.

CLEMENTS: Thank you, Chair. Dr. Snow, if I wanted to [INAUDIBLE] if I know somebody that has a domestic well and they should have it tested, what's the-- what should they do next? How to, how to get a test kit? Where do you get one?

DANIEL SNOW: Well-- so I, I-- people would call me and ask to have their domestic well tested. And the first thing I ask them is, well, what do you expect is the problem? More often than not, it's-- can be nitrate or bacteria. Those two tests are offered very cheaply through the, the [INAUDIBLE] health laboratory. So that's where I direct them. And then if, if they-- or, either one of those contaminants come up, then there are disinfection systems or bacterial contamination [INAUDIBLE]. If nitrate is an issue, then [INAUDIBLE] hiring a plumber to install some kind of a water treatment system.

CLEMENTS: But how do they get the water to the testing lab? Where do they get the bottle to put the water--

DANIEL SNOW: [INAUDIBLE] we'll mail a test kit with the, with the proper containers.

IBACH: Are those available at the--

CLEMENTS: Free of charge?

IBACH: --NRD offices?

DANIEL SNOW: Do they charge? Yeah. It's about \$20. \$20 to \$21 [INAUDIBLE]. And, and [INAUDIBLE] NRDs-- some of the NRDs offer domestic well testing for nitrate. And then they have the test a well-- test your well night, where they're promoting domestic well water testing.

CLEMENTS: OK.

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DANIEL SNOW: The, the only concern I have about having owners do the testing themselves is the, the, the samples are properly collected. So that's one reason I like our program, [INAUDIBLE] well program is because we [INAUDIBLE] the students how to properly sample and evaluate well construction, potential contaminants at the surface. So it's not just about getting the sample to the laboratory. It's more about educating [INAUDIBLE]. Why are we even worried about domestic [INAUDIBLE]? And then what do you do with the results?

CLEMENTS: All right. Thank you.

J. CAVANAUGH: Got another question.

DeBOER: All right. More questions.

J. CAVANAUGH: Just get-- priming the pump. What are the other-- besides reverse osmosis, what are, what are the other treatment options we're talking about?

DANIEL SNOW: Ion exchange is another option. Distillation is, is, is another option. It really depends on how much water is used for drinking, for example. And the, the, the other contaminants-- you know, salt present in the, in the water source itself, how much it's going to cost to treat it with reverse osmosis versus distillation or ion exchange.

J. CAVANAUGH: But those would be-- any one of those would be an installed device that then would be ongoing, right?

DANIEL SNOW: Yeah.

J. CAVANAUGH: What's the-- do you have a, a concept of what the cost difference is for a residential--

DANIEL SNOW: Yeah. If, if you do a-- we have another paper out where we did that comparison between different treatment for, for nitrate in Nebraska. [INAUDIBLE] anywhere from \$500 to \$2,000 [INAUDIBLE] average household [INAUDIBLE] installing and maintaining that, say, over a five- to ten-year period.

J. CAVANAUGH: And that's how long it would last and then need to be replaced or--

DANIEL SNOW: Yeah. So you got to-- you got to replace the filters. You got to replace the membranes occasionally if they get fouled. You--

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one thing that we don't even think about is, like, we really should test it to make sure it's working properly. The fee for the, the water that's coming in is one thing, but you got to test the water that's coming out of the, the, the treatment system too to make sure it's properly treating that water supply. That's part of your maintenance.

J. CAVANAUGH: Yeah.

DeBOER: With respect to the high nitrate water risk factors, is it just in the drinking water or does washing your food and other-- you know, bathing, other daily activities, do those sorts of things affect it? So could you just pinpoint the drinking water to remediate or do you need to pinpoint the whole water system residentially?

JESSE BELL: That's a good question. You know, the drinking water is the, the highest priority, I would say. As far as other potential exposures, that's-- or, go ahead.

DANIEL SNOW: I can answer for one contaminant. I know radon-- which is one we don't think about very often-- but radon, the exposure is more through inhalation and taking a shower than it would be through drinking. So if radon is a problem in your domestic well, then, you know, we want to know that [INAUDIBLE]. [INAUDIBLE] exposure's going to be totally different.

DeBOER: OK. Now are we-- I think now we're done with questions. OK.

J. CAVANAUGH: For the time being.

DeBOER: What I was saying a minute ago is I think that I have learned some things here. It does seem to be that there is an information gap. Would you all agree with that, between what these people know and what Nebraskans--

J. CAVANAUGH: Oh, yeah.

DeBOER: --know? So possibly one of the things we could think about would be, how do we, as a state, work on a informational campaign to--

DANIEL SNOW: If I could add to that, I know our vice chancellor, Mike Boehm, is, is talking about putting together what we know about Nebraska groundwater. And, and I think this is a great idea. This is an awesome time to be doing that. [INAUDIBLE] to talk about ways that we [INAUDIBLE] projecting the future of what groundwater will look like in, say, 20 years from now.

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DeBOER: And what's the best way to get information out to the individual Nebraskans who would need to know that? You know, I know you have your Know Your Well Program and through the, the students. And obviously, you've-- you have all have put some thought into this, but are there other points of contact that we could sort of work through?

JESSE BELL: Yeah. I-- one of the areas I've been really interested in-- or, we're trying to develop some ideas around this is for health care, especially in rural areas. Because your health care-- you know, most people don't talk to their NRE. They don't talk to me. But they will talk to their doctor, nurse, PA, whatever it is. And one of the things that I would love to do is, one, getting them more educated around this, but also helping them communicate. So if somebody comes in-- they're childbearing age. And, and then that health care worker can provide information to say, maybe you should get your well tested. And if they get their well tested, then there might be an opportunity for them to either talk to the public health department or to the NRE to better educate about what are their options in addressing water quality issues, if they do have water quality issues.

DeBOER: How much would it cost for the state? Now, I'm not saying-- just asking the question. How much would it cost for the state to do a program where we said, look, we'll test for nitrates for anybody who wants to bring in their well water?

DANIEL SNOW: That's another idea, I think, presented by the vice chancellor [INAUDIBLE]. It would be fairly inexpensive to do that through a screening campaign.

DeBOER: I should know this, but is there an economies of scale to testing-- I, I can't imagine there is-- large numbers of, of samples to, to look for nitrates?

DANIEL SNOW: It is cheaper if you do large numbers, yeah.

DeBOER: So we could bring that \$20 down if we were to do a massive push to do a lot of testing all at once?

DANIEL SNOW: But remember, this is voluntary.

DeBOER: Sure. Sure. And we obviously need the-- we obviously need the campaign. But if one of the barriers-- and I don't know if it is-- if one of the barriers to testing is the cost, it would be interesting to

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see how we can affect that. Anybody else think that is a marginally interesting idea? Senator Clements.

J. CAVANAUGH: I like it. If you did all 150,000, it'd cost you \$3 million.

DeBOER: Yeah. I don't think all 150,000 are going to--

J. CAVANAUGH: I beat Clements to the math.

CLEMENTS: Pretty good job.

DANIEL SNOW: You, you may recall that I was the one who took care of our well when I was a teenager on the farm. And I talked to my mom [INAUDIBLE] our well tested through the, the high school, [INAUDIBLE] testing. And she came up with the \$20 to get our well tested, and it tested high for nitrate.

DeBOER: Interesting.

DANIEL SNOW: So if, if, if you get your kids to say this is a good idea, it's going to happen.

IBACH: And don't underestimate the power of FFA.

CLEMENTS: Yeah, knowledge-- or, awareness is probably more valuable than the--

DANIEL SNOW: Yes.

CLEMENTS: --money.

IBACH: Yeah.

DANIEL SNOW: And it's going to inspire future water scientists and engineers, right? To keep this-- to take care of this resource that we have in Nebraska.

DeBOER: Yeah. So maybe then the communication issue is more-- and if, if a point of entry would be through health care, that might be something to look at. It's-- how we would get more health care folks interested in-- maybe we could provide the little pamphlet for them and then they can pass it out to their people or something like that, that we would be able to get that information out there. This seems like it's-- one of the biggest things is the information gap rather

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than anything else. Now, there's the other side of making sure that we're using the good, you know--

IBACH: Practices.

DeBOER: --practices and, and all of that. But, but that's a more slow solution anyway. Even if we today changed everything, it would be still 20 years before we would see any kind of efficacy.

DANIEL SNOW: And, and that's the other part of the education piece, is to explain how long [INAUDIBLE] once you change things at the surface to actually see the change in, in the groundwater.

DeBOER: So we, regardless of what we do on the, the agricultural and, and wastewater treatment side of things, we would still need to have some kind of intermediary educational push? Yeah?

J. CAVANAUGH: Does anybody know if there's any federal funds available to supplement testing? [INAUDIBLE] safety testing programs.

DANIEL SNOW: Not to my knowledge, no.

[INAUDIBLE].

DANIEL SNOW: Yeah. We're not regulated, so not many federal programs.

J. CAVANAUGH: [INAUDIBLE] Anybody that would give us money to expand any [INAUDIBLE] offerings.

DANIEL SNOW: So-- I, I guess I take that back because the USDA has allocated money for water quality issues. So if you're on the education side, reducing use, you know, fertilizer maybe, more education-- demonstration projects are another great way to educate locals about practices that could be employed at no cost [INAUDIBLE] reduce the amount of nitrate [INAUDIBLE] water supply.

J. CAVANAUGH: Does any of this have any interaction with the--

DeBOER: --healthy soi-- soils?

J. CAVANAUGH: --soils, yeah.

DeBOER: Yes. I was going to ask the same thing. So the--

J. CAVANAUGH: Tim, Tim Gragert's bill from two years ago.

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DeBOER: The Healthy Soils Task Force. Are you all familiar with that?

DANIEL SNOW: Yeah.

DeBOER: And what is the relationship?

DANIEL SNOW: It, it could have. I won't say it will, but it could help. If you recall, one of the things that I think is the biggest problem is the water-holding capacity of [INAUDIBLE] soils. If you improve the, the health-- kind of a fuzzy word-- of that sandy soil, it's going to improve the water-holding capacity [INAUDIBLE]. [INAUDIBLE]--

DeBOER: With more--

DANIEL SNOW: [INAUDIBLE] benefits.

DeBOER: The, the improved health would be, what, more organic material within the--

DANIEL SNOW: Yeah.

DeBOER: Yeah. OK.

DANIEL SNOW: Yeah. Yes. [INAUDIBLE] microbes. But the main thing is keeping the water in the soil, all right, after you apply it through irrigation. Keep that water there, let the plant use it, and the nutrients. Then we're all happy. [INAUDIBLE].

DeBOER: Well, this was very interesting. Any more discussion? OK. I think-- let's take two seconds and just-- maybe more than two seconds. Let's take a minute and talk about anything you'd like to have followed up by Dr. Schafer or others for our November meeting. Which I think-- what date is it-- we have to do it?

Friday the 17th seems to be kind of the only day. I'll send out the Doodle poll after the meeting. But it's mostly just choosing what time works best for everyone and getting a head count of who could be there. So less of a choice on date and more of a choice on time.

DeBOER: Sorry. We, we ran into a confluence of many things to try and find a, a date that would work. But are there specific things that-- I know Senator Holdcroft would like to have the land bank come and talk to us. I think that's a great idea. Are there other things on child care, water follow-ups? You can also submit these-- not in this very

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instant-- but in, in the next week or two as you're thinking about them. Maybe week would be the-- since it's coming up rather quickly because of Thanksgiving. Yeah?

Can I ask a quick-- Senator Holdcroft, do you have any interest in hearing about could a land bank model work in rural areas? Or are you really just hearing from how Omaha has been--

HOLDCROFT: Well--

[INAUDIBLE] with us?

HOLDCROFT: Certainly. In fact, the-- in our discussion yesterday with Omaha, they were, they were saying that, I think, Norfolk and North Platte maybe, they're both looking at establishing one. So yeah.
[INAUDIBLE].

DeBOER: And Dr. Schafer, you were going to present on the-- can you give us a little information on what you're going to--

JOSIE SCHAFFER: So I shared-- after Shannon Harner from NIFA presented, there was a number she presented about the number of homes for sale. And I was like, that sounds really low to me based on the population stats. So I went back and confirmed she was correct. And so then I wanted to add some context around that. You know, how many people are moving? How important is housing to moving? How many homes are for sale by county? Is that high? Is that low? And in fact, it's a one-month supply. Now, August of 2023, there was a one-month supply of houses for sale. The Nat-- the National Realtors Association says there should be a six-month housing supply to have normal churn. And right-- the majority of that was in Omaha and Lincoln. And so, right, this idea that people can-- go to rural Nebraska; we have homes, is not playing out. They're certainly not for sale, which is why that it's interesting-- in that brief too, I also put the number of vacant homes. So I work with a lot of rural counties on community development issues, and they're like, there's all these vacant homes. Can't people move in? Very few of those vacant homes are for sale. So a land bank model could be interesting. Because something has to happen to turn those vacant homes into homes that can be for sale. So I just followed up on a couple of those themes that Shannon had presented just to bring a little more sort of-- I, I think urgency is what I saw in those numbers to the housing issues and across the state, right? That sort of normal churn of, I can move into a nicer home. I, you know-- I want to go back to school, so I need a more affordable home. There is

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just no ability to just jump into another house that suits my needs at this time. [INAUDIBLE] another kid, I need a bigger house. I, I-- frankly, I can't move with a one-month housing supply. So just wanted to follow up on those. So I put that together in a brief. We shared that about two months ago now. So you have it. If you wanted me to follow up on any-- or just sort of walk through some of those stats again or with some of Shannon's if housing remains an issue. We could also bring someone else to talk about a focus on housing solutions if you want to go that route.

IBACH: That'd be good.

DeBOER: Yeah.

J. CAVANAUGH: Mm-hmm.

HOLDCROFT: Yeah.

DeBOER: OK. So we'll probably try to spend a few minutes following up on water, a few minutes on child care. But then we'll probably spend the bulk of our time on housing, it sounds like, because that's where the committee seems to be focusing, which is, I think, a great focus. Happy to-- happy to do it.

JOSIE SCHAFFER: And a presentation on land banks.

DeBOER: Yep.

JOSIE SCHAFFER: OK.

DeBOER: Which, which is housing-related--

HOLDCROFT: All right.

DeBOER: --so. All right. Thank you all for coming today. And thank our presenters.