

Part B: New Mexico Produced Water Research Consortium



Rebecca Roose, New Mexico Environment Department

Rebecca Roose joined the New Mexico Environment Department (NMED) in May 2019 as the director of the Water Protection Division. Roose leads surface and groundwater quality, drinking water protection, and water infrastructure finance programs for the state. Prior to joining NMED in 2019, Roose worked for the U.S. Environmental Protection Agency. At EPA headquarters, she devoted 11 years to supporting EPA, states, and tribes with the implementation of federal water protection programs. During her last two years at EPA, she served as senior advisor for tribal capacity development in the American Indian Environmental Office. Roose earned her law degree and a certificate in Natural Resources Law from The University of New Mexico, as well as her bachelor's degree in Geography from Valparaiso University.

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I am going to overlay a regulatory policy perspective on the really great technical presentations we're hearing. It is very handy to have an overview of the technical research being done in the state and see the amount of expertise we have.

Jumping right in, I want to highlight where the New Mexico Environment Department (NMED) fits into this whole great discussion about the research that's being done. This will cue off some of the points Stephanie made earlier. From the Produced Water Act, NMED clearly has jurisdiction over the treatment and use of produced water for purposes outside of the oil and gas sector. That's first and foremost where we come into this conversation, but I want to add an important caveat to that. Even though jurisdiction over infield recycling of produced water for fracking is not under NMED's jurisdiction—it's not under our regulatory purview—we are 100 percent on board with the policy objective and value of, first and foremost, recycling and reusing as much of this produced water in the oil field as possible. We work closely with our colleagues at the Oil Conservation Division to that end and support those provisions of the Produced Water Act that help to incentivize and drive more infield recycling.

When we're coming into the conversation and you hear me talk about produced water, more than likely you're going to hear me talk about the path from where we are right now to potentially getting to authorized uses of treated produced water outside the oil and gas sector. The Water Quality Control Commission is responsible for adopting regulations. NMED will be the department that essentially drafts those regulations and presents them to the commission, and that is why NMED is so

invested in research through the Produced Water Research Consortium.

When the Water Quality Control Commission adopts any regulations under the Water Quality Act, they're required to consider the following:

- Character and degree of injury to/or interference with health, welfare, environment, and property
- Public interest, including the social and economic value of the sources of water contaminants
- Technical practicability and economic reasonableness of reducing or eliminating water contaminants from the sources involved, and previous experience with equipment and methods available to control the water contaminants involved
- Successive uses, including domestic, commercial, industrial, pastoral, agricultural, wildlife, and recreational uses
- Feasibility of a user or a subsequent user treating the water before a subsequent use
- Property rights and accustomed uses
- Federal water quality requirements

It's essential to note that there is a tremendous amount of rigor, rightly so, to ensure that the water quality regulations we put in place in the state protect water quality, safeguard wildlife uses, serve the public interest, and consider a number of other factors. These are some of the overarching guiding principles that NMED must consider when developing draft regulations that will be presented to the commission.

One of the things the department discussed right away when the Produced Water Act was passed and went into effect was that we, as a regulatory agency, do not believe

that we have the science in front of us to develop science-based rules to propose to the commission for permitting the off-field, outside oil and gas, uses of treated produced water.

We set out a phased rulemaking approach. Phase one may involve some near-term rules that will fill some of the current gaps while we wait for the science to come in. These rules would clearly demonstrate that untreated produced water use outside of the oil and gas industry is prohibited. We are also considering if there is a way for us, through rulemaking, to increase the amount of information made available to NMED to further inform our phase-two regulations. That piece of that phase-one rule—whether we ultimately end up with rules or find another way to go about this—is so important because, as a regulatory agency, we can’t regulate something that we don’t know is out there. We can’t protect our water resources from potential contamination if we don’t know what is in the water being used, treated, and reused. That’s an important piece, and it certainly complements many of the consortium’s efforts.

Phase two would get into the rules for, as the Produced Water Act puts it, the “discharge, handling, transport, storage, and recycling or treatment of produced water or byproduct thereof outside the oilfield.” That’s ultimately what we come back to as our charge. We are committed to establishing rules based on sound science, and we aren’t there yet. The timeline for phase two is to be determined, which brings us to the consortium.

The Produced Water Act was passed and went into effect. We reviewed our current knowledge and identified areas where we lack understanding, both within the state and nationally. We then partnered with New Mexico State University through a Memorandum of Understanding, which we signed in September 2019. The consortium really started to kick off last fall with Mike Hightower coming on board as the program director, and he cast a wide net to recruit experts from different sectors. It was very important to NMED, in partnering with the university, to set up this consortium, which draws on expertise from a range of views, perspectives, and sectors. We’ve got amazing experts from academia. Mike can correct me, but around 11 to 13 different universities or institutions of higher education joined. We have experts from environmental organizations, government agencies

(state and federal), and industry, including midstream companies and water treatment companies. Tons of expertise came together. Since January, the consortium has been working to advance the process of filling these critical science and technology gaps. NMED is glad to be involved as a core partner. I chair the government advisory board, which comprises 11 or 12 representatives from state and federal agencies, and we support the technical research conducted within the consortium. We’re very invested in that.

While we’re focusing heavily on our partnership with the consortium and ensuring that the research progresses in a manner that will allow us, as a regulatory agency, to rely on the data and findings that emerge, we’re also undertaking a few other initiatives, which are available on our website: <https://www.env.nm.gov/new-mexico-produced-water/>. We have focused on public participation, and, as Stephanie mentioned earlier, held a number of meetings last year. We released several resources in 2020. We’ve got a set of frequently asked questions on the website that is not just NMED-specific. It’s broken down into three sets of questions: one related to our role, another related to the Office of State Engineer, and a third related to the Oil Conservation Division. That’s a handy resource, which was informed by the questions that arose during our public outreach in fall 2019. On the Public Participation page (<https://www.env.nm.gov/new-mexico-produced-water/public-participation-2/>), we provide a detailed summary of the feedback we received during those meetings. After this technical panel today, if you’d like to get your finger on the pulse of what our fellow New Mexicans think and feel, what questions and concerns they have, what interests they have in produced water, the “Summary of Initial Public Input on Produced Water” document, released September 2, 2020, is a great resource.

We will continue to keep our eyes and ears open, engage in conversations like this, and collaborate with our partners, other state agencies, and the outstanding researchers who are actively focused on these issues. We are really looking at the results of these efforts to inform our future science-based regulations for treatment and reuse outside the oil and gas sector, all while staying keenly focused on our mission to protect our precious natural resources and human health along the way.



Mike Hightower, New Mexico Produced Water Research Consortium

Mike Hightower is a research professor at The University of New Mexico in the Center for Water and the Environment, and program director of the New Mexico Produced Water Research Consortium, a joint effort by the New Mexico Environment Department and New Mexico State University. Mike is a technical consultant to Sandia National Laboratories, specializing in water treatment, desalination, and energy and infrastructure resiliency research, where he worked for 38 years. Mike holds bachelor's and master's degrees in civil and environmental engineering from NMSU and has experience in aerospace, weapons, energy, and natural resources research, analysis, and engineering. His focus over the past two decades has been on developing innovative distributed energy and water technologies to enhance critical infrastructure and natural resource security, resiliency, and sustainability.

I'm going to take a few minutes to talk about the New Mexico Produced Water Research Consortium. I'm the program director, and Pei Xu from New Mexico State University is the research director. The consortium has approximately 60 participants and around 160 technical experts from a diverse range of sectors, including government, industry, academia, NGOs, producers, and midstream companies. We've made a lot of effort to go out and bring in a broad spectrum of support and input for our research program. The consortium spent the first six to nine months examining the analysis of some of the issues: What are the methods for measuring water quality and quantity? What are some of the general technologies people are interested in? We haven't conducted any research yet, but we are planning to move forward.

I would like to discuss the reasons for the need for research, the directions we will pursue, and the opportunities for the State of New Mexico, as well as why we believe some of these directions are appropriate.

Figure 1 sets the stage for why we're seeing other states moving toward this opportunity to use these nontraditional water resources for beneficial reuse, whether for industrial applications or other types of applications. If you look at the United States, we're essentially tapped out on fresh surface water availability. We haven't built any new large reservoirs in 30 years; all of our major groundwater aquifers have been impacted by overpumping and mismanagement, particularly in the western United States, where we are located, and where significant oil and gas production occurs. These kinds of issues are driving the

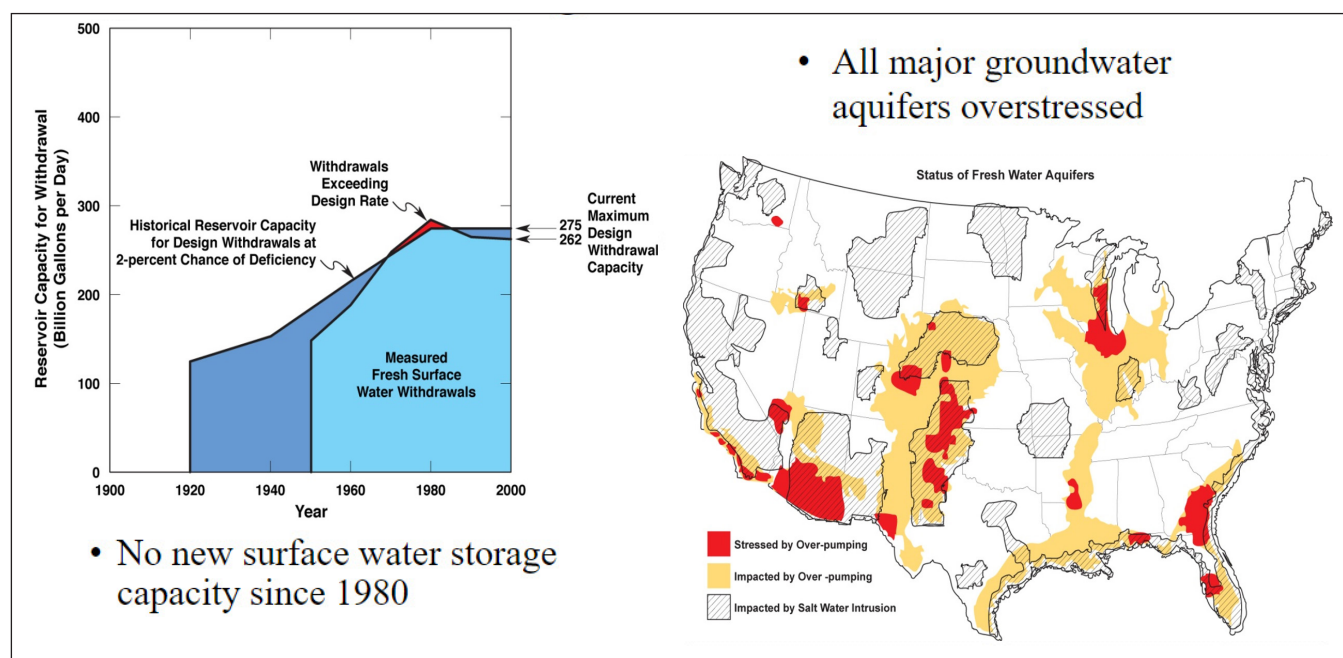


Figure 1. Water stress driving use of non-traditional waters.

Environmental Protection Agency, the Department of Energy, and other federal agencies, such as the Department of the Interior, to explore major initiatives related to the reuse of nontraditional water resources.

Figure 2 shows a bigger driver. If you look at climate change issues and climate history, we're in a very severe arid cycle. Most of these arid cycles last 300 years in the midlatitudes. We're about 150 years into the current arid cycle, which began around 1850 to 1860. Not only do we not have a lot in our savings account from available fresh surface water or groundwater to address these issues in more aridity over the next century or so, but we will also have to look at other resources. We've seen in the past that these large stresses, combined with low water availability, led to the abandonment of numerous historical sites, including Petra in the Middle East, Anasazi and Chaco Canyon, and Angkor Wat. We don't want to be the next abandoned, so we need to explore these alternative resources.

The Environmental Protection Agency, along with other federal agencies, is working on the National Water Reuse Action Plan (WRAP), which was initiated in late February 2020. This plan examines water stress across the United States and is based on the 2014 GAO report. It shows that most states are presenting either local or regional water stress and issues. Finding the next potential water supply is the driving force behind exploring these nontraditional water resources. That's why you see a lot

of water organizations talking about "one water"—the fact that wastewater is going to become, with treatment, a new water supply.

The EPA program's focus includes produced water. Bob mentioned that New Mexico has been looking at produced water closely since the early 2000s. NM WRRI was involved in a 2003 study on a statewide produced water reuse program, and there has been significant work in New Mexico on this topic since then. Due to the work New Mexico has undertaken in the past, our consortium and the State of New Mexico have been asked to collaborate with the Groundwater Protection Council to lead activities associated with this national EPA program on produced water. That's quite an honor and one we take seriously. We currently have a Memorandum of Agreement with the Groundwater Protection Council to work in some of the areas Martha mentioned, specifically regarding public access to the water quality database information.

I'll talk about the heart of why we are looking at treatment. Bruce mentioned that produced water has a high salt content, which is not amenable to many desalination technologies. However, there are areas within produced water where we can see that certain types of treatment will benefit the State of New Mexico. Several pretreatment applications, where produced water is treated specifically for use within the oil and gas sector, as Rebecca mentioned, have advantages for New Mexico's water supplies, including the fact that pretreatment could

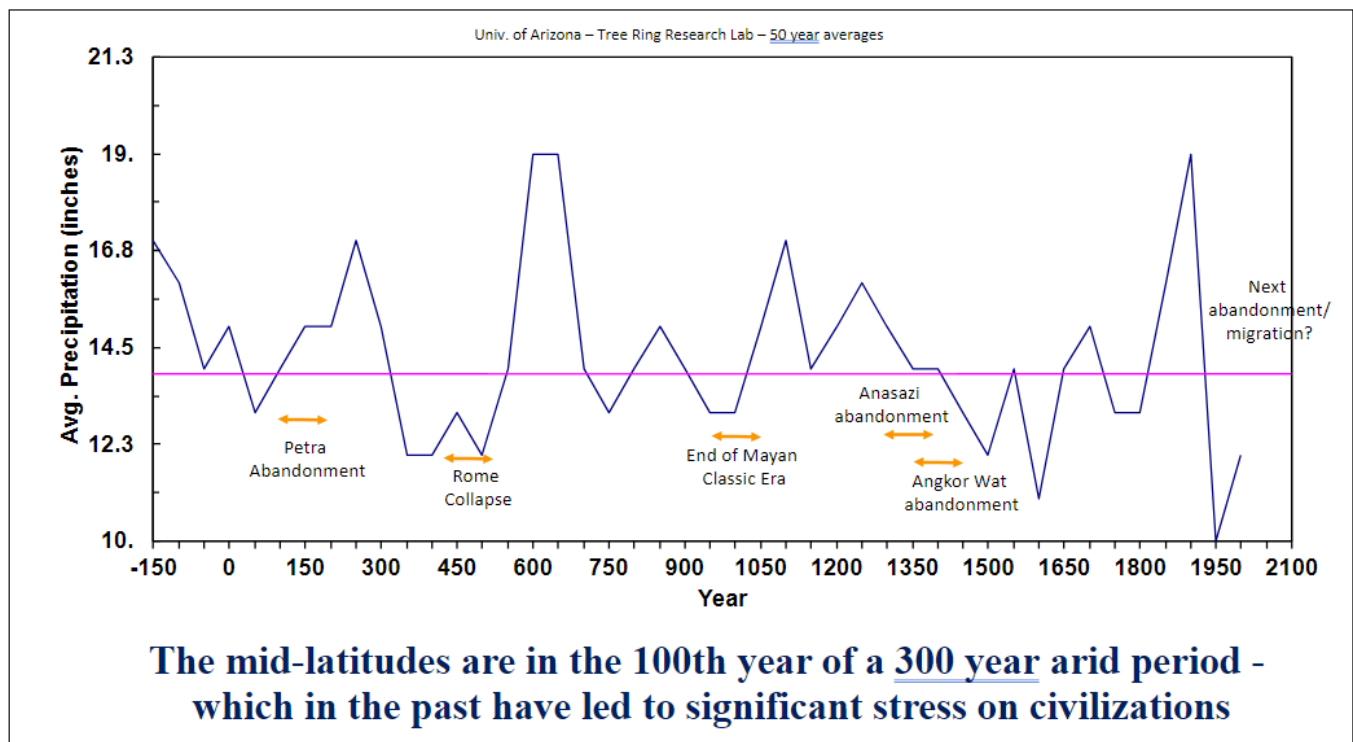


Figure 2. Southwest climate history based on tree-ring data.

eliminate the need to use freshwater for fracking. There is a movement in a number of states to look at these pretreatment standards as a way to eliminate or reduce freshwater use in industry. In many cases, people are looking at partial treatment because, as Bruce mentioned, the large number of salts associated with full treatment of produced water. Reclaiming some of the water, while not removing all the solids, would allow you to reuse some of the water and still reduce disposal volumes. It addresses some of the earthquake issues that Alex talked about. Even some of these different types of treatments that are not full desalination can still offer several benefits, including mineral recovery, creating additional usable resources, reducing the risk of earthquakes, and seeing reuse in oil and gas applications. Many of the treatment technologies people traditionally use could be applied to parts of produced water treatment, providing us with an opportunity to use additional water resources and address some of the climate change issues we're seeing.

Figure 3 shows some of the trends we're seeing within the oil and gas industry. It shows three qualities of water. In New Mexico, we have three types of produced water. Some very clean produced water comes from coalbed methane in the Raton Basin. It is in the 3,000 TDS range and sometimes a little bit better than that. There is a lot of conventional produced water from conventional oil and gas in the 35,000 TDS range, which is around seawater salinities. For those qualities of water, reverse osmosis and other types of technologies work quite well. There are some fouling issues caused by suspended solids, oils, and greases, but for some of these waters, these types of technologies are available. As mentioned before, as we enter more unconventional waters, we're looking at 200,000 to 250,000 TDS in some cases, which will require thermal technologies, which in the past have been very expensive. The point is that, even as we examine some of the high costs associated with these treatment technologies, we've seen a significant increase in disposal costs for the oil and gas industry. When I was working on this in the early 2000s, we were looking at 8 to 10 cents a barrel, which works out to be about two dollars per thousand gallons. In those days, treatment of brackish water was 4 to 5 dollars per thousand gallons. It was not economical 20 years ago to treat water. Fast forward to 2020, where we're looking at current disposal costs ranging from around 50 cents a barrel to 3 dollars a barrel. So, we're looking at

an order of 20 to 80 dollars per thousand gallons. Even thermal technologies have an opportunity to be cost-effective in this area.

We're seeing a change in the target we're trying to meet. It was very difficult, even 10 or 15 years ago, to meet some of the disposal targets. However, with the large volumes of disposal and the reduction in disposal space due to saltwater disposal wells, the costs are increasing. The higher pressures in deeper wells are causing an increasing number of problems with earthquakes. The more water we can reuse on the surface and the less we dispose of it, the better off we will be from both an economic and environmental standpoint. Different applications are going to be the trend—different levels of treatment applied in different ways for different types of water. I don't think that there is a silver bullet out there, but I think that some imagination in how we put these treatment drawings together, which produced waters we select to treat, and how we treat them, has some benefits for the state.

Figure 4 comes from Bruce Thomson. He mentioned the fact that the State gets a third of its revenue from oil and gas, but I'm really interested in what Professor Janie Chermak in the Economics Department at UNM has come up with in looking at the social and economic benefits of using produced water for various purposes in the state. I've pointed out, at the very bottom, the broad range of what she has come up with, but all of them are positive. There is nothing in her evaluation that says that this could be negative. It would be if we can't treat the water to a standard that is protective of public health and safety. Even the lower range of estimates for the volumes of treated produced water we might be able to use is on the order of one or two Albuquerque's a year. That is a significant amount of produced water, and it presents an opportunity for substantial socioeconomic benefits to the state. We're trying to identify, in the next couple of years as we move forward, what types of treatments make the most sense for which locations, which produced water types and qualities, and how can we maximize our ability to utilize that water for our best uses and improve the socioeconomic opportunities for the State of New Mexico, whether for industrial economic development or other applications. That is a summary of where I see the consortium moving and the interest we have in treatment over the next couple of years. Thank you.

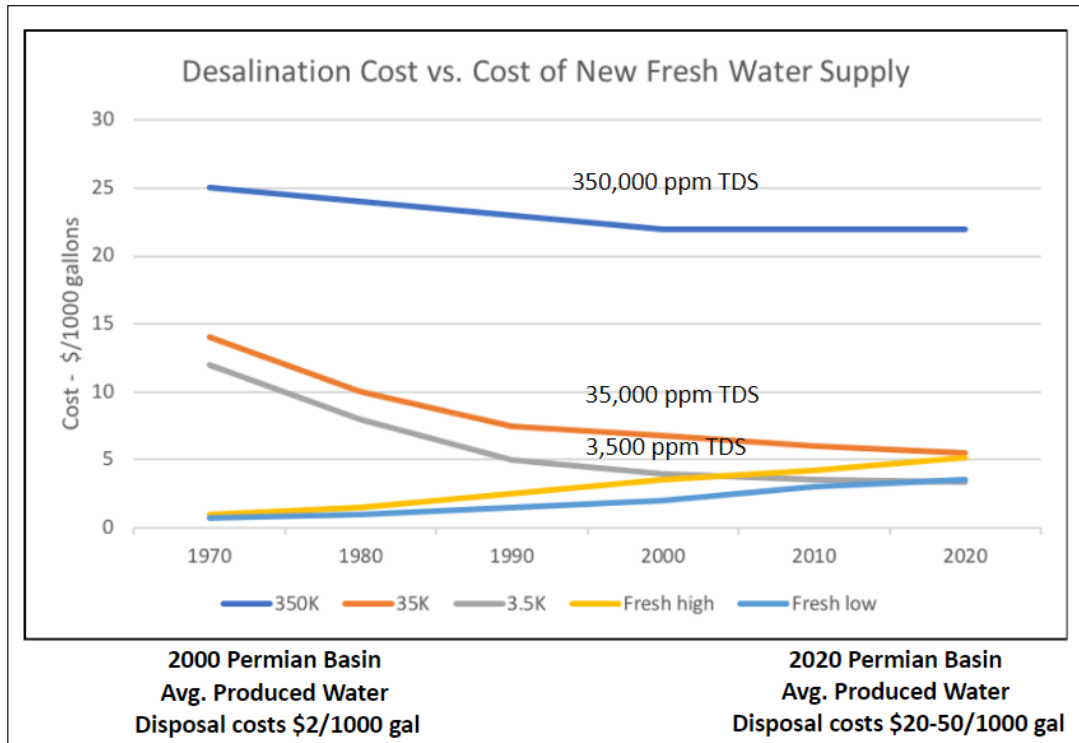


Figure 3. Changing desalination and produced water disposal costs.

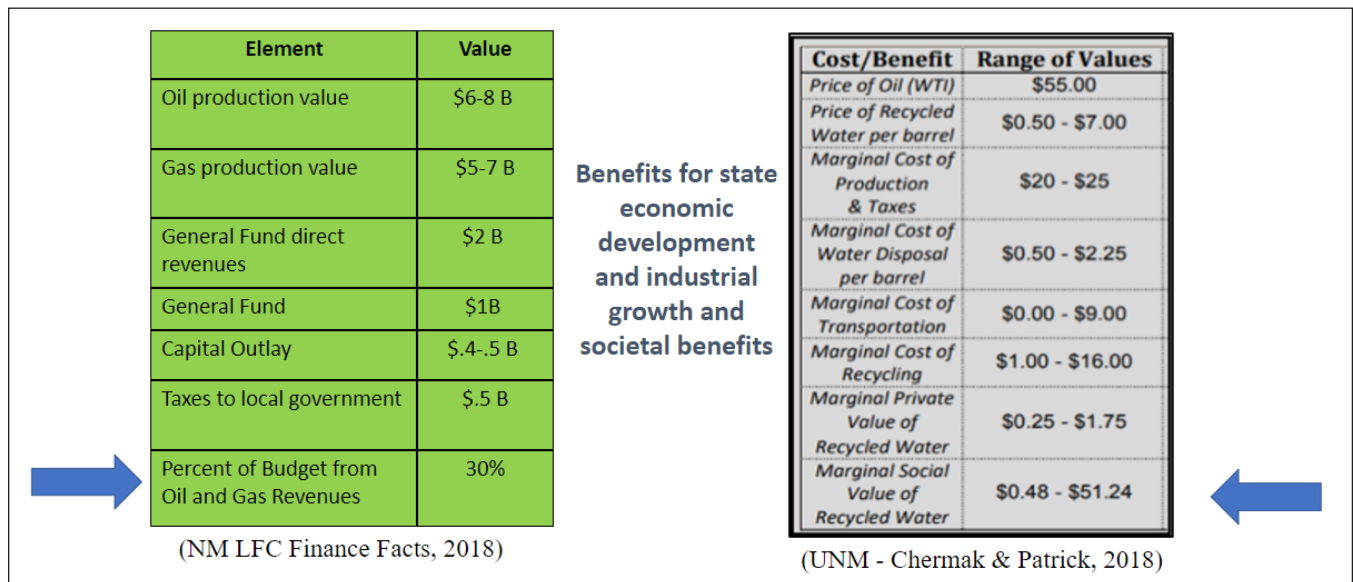


Figure 4. Socioeconomic benefits of produced water reuse.