# The Future of New Mexico's Deep Water Permitting

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*Guy is the Water Resources Administrator for Sandoval County. He is engaged in project management for the County's water related projects, including the deep brackish water wells in the Rio Puerco area, located west of Rio Rancho Estates. Guy was previously with contractor services providers in support of the City of Rio Rancho and the Eldorado Area Water and Sanitation District (near Santa Fe). Prior to his water career, he served in the Air Force (1966-70) and Navy (1973-95). Following retirement from the Pentagon in 1995, Guy worked for Dynamics Research Corp as a consultant/project manager to the Department of Defense and the Department of the Treasury for 3½ years, and 1½ years with Sikorsky Helicopter as VP of a joint venture with Lockheed Martin to support the H-60 maritime helicopter fleets worldwide. Guy has lived in Rio Rancho since 2000. He received a bachelor's degree in university studies from the University of New Mexico and master's degree in systems management from the University of Southern California.*

Thank you very much. I want to thank everybody here for the opportunity to speak today, and I want to thank Isleta Pueblo for their fine facility and the hosting of this event. I represent Sandoval County and work with the development department as the water resources administrator. Before I started with the county, the county commissioners had decided to expend some money on the research and potential of what became the deep water wells that are located in the Rio Puerco.

Figure 1. Overview of Site

I'm going to provide you an update on what we're doing at this point as well as during the past summer and early fall and then work backward to how we started. Figure 1 shows the well site as of about the middle of last month. All the good photos in John D'Antonio's presentation are our good looking wells, and all the ones that you didn't like, those were somebody else's.

Figure 1 shows well site 6, where that big tall rig that John D'Antonio showed was two years ago. Two years ago we drilled the two wells, a year ago we did our flow tests for 30-days, and this figure shows our current pilot test. The purpose of the pilot test is to reduce the risk of going forward with a project that isn't going to be economically feasible, or that is incapable of meeting the needs of potability based on the water with which we start. We want to confirm that this selected process works; we want to determine what the costs and expenses might be, and until we know exactly what does work with this water, we won't be able to predict the associated expenses.

The end of the pilot test will be the basis for the Preliminary Engineering Report. We will then decide on whether the project is a "go" or "no-go." If we decide to continue with the project, the next step will be to design a plant. Obviously we would like to minimize costs for everybody's benefit so we will try to identify the economic potential of by-products. This water is 12,000 TDS (total dissolved solids), so we met OSE's standard for being non-potable but we have some concerns. A bit of background: on the way to the water that we obtained, which is basically 3,700-3,770 feet down, we didn't run into any potable water, or any other type of water, until we got below 3,700 feet. You have probably heard discussions and seen photos of the faulting in the area. We are located on one of the high parts of that fault system, and we actually drilled across one of the faults while drilling the first well. It caused some confusion for a while, but we figured it out. There is some separation between these formations and, we believe, the Santa Fe Group aquifers. To confirm how much water exists will require more testing than has been done so far. This pilot testing part of the project is funded by a legislative appropriation of $600,000.

Figure 2 shows the process trailer. The tank you see in the foreground powers the generator, which is the square box in front of the trailer. CDM is doing this work for us with a prime contractor (Universal Asset Management) from Missouri. The pilot plant has been on site since August. We have made the basic connections and are working on what I like to call "optimizing." Basically we are improving the balance of all the various factors required to deal with the contaminants in the water. We should have our findings and recommendations around December.  We did some bench level testing earlier in the summer and evaluated four different ways to treat this water. We reported to the New Mexico Environment Department (NMED) on those options and recommended the one I will discuss in a minute. We received approval from NMED before we configured the pilot unit, which is basically a warm lime-softening process plus filtration and then Reverse Osmosis (RO) (Fig. 3).


Figure 2. Process Trailer

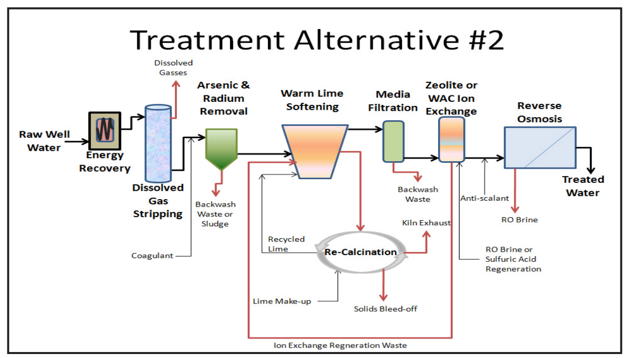


Figure 3. Treatment Alternative #2

It may be a little difficult to see from Figure 4, but you can open the valve on this pre-filter system until water comes out with no pump, it flows in artesian fashion. The first well is 160 psi on the surface when closed in; the second well does not flow as well as the first, but it has 200 psi (close in) pressure on top. We believe that both wells come from the same body of water and are connected underneath. When we flowed the first well, we had monitoring instruments on the second well and we detected a response and a drop in pressure at 3,200 feet (where those instruments were located). When we flow the well fast enough, we actually get a temperature rise in the water. At 3,200 feet, the water is 160˚F; when it reaches the surface at several hundreds of gallons per minute of flow it is about 150˚F. So from the very start we have a couple of plusses in our favor; one is we have an opportunity to recover energy from pressure and from temperature. Even if we don't really recover all of it, we can still use some in the process. That may help keep costs under control. It can also help in the process itself because some steps in the process work better with warmer or colder water. Membranes do not tolerate hot water so we must cool the water by the time it gets to the membranes to at least below 100˚F.


Figure 4. Pre-filter System (sand & anthracite)

Looking again at Figure 3, on the left we have energy recovery. Basically we want to see what we can recover. We have several investigations evaluating options for using that energy. The next step is to strip out the dissolved gases that are entrained in the water, for example, carbon dioxide. We recognize the issues associated with the carbon footprint and we do have naturally occurring carbon dioxide coming out of the well. We are looking at ways to collect the CO2 and possibly use it to feed algae as another potential renewable energy source.

The next step is to increase the pH up so we add some caustic solution and that's where we get the lime salt. We don't have the coagulant stage in the process right now, but eventually that stage will take out arsenic and radio-nuclides. We do have arsenic in abundance. We are at 70 times the drinking water standard on arsenic, and we recognize that after concentration, we will have a hazardous waste stream to deal with, and that's not the only one.

Next, lime softening is done in the big green "claricone" (Fig. 5), which you will see again in a minute. From there we go through media filtration using sand and anthracite (Fig. 4), and then through a zeolite bed that helps take out a little bit more of the hardness (Fig. 6), and lastly through the RO process (Figs. 7, 8). The large green claricone is where we drop out the hardness; we have about 1,800 ppm (CaCO3) with which to deal. The white pipes in the background of Figure 7 contain the RO membranes used during the first stage. The white pipes used during the last stages are a bit smaller and you can't see them very well in Figure 8.

Figure 5. General Overview Sep 09

Figure 6. Softening Tank (Ion Exchange)

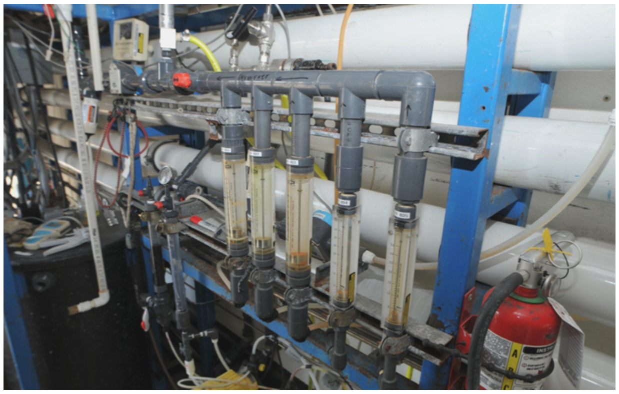

Figure 7. Rotometers, RO Membranes

Figure 8. Pilot Membranes

Today (mid-October), we are supposed to put in what we consider the final version of the second stage membranes and we will then have a better idea as to the kind of recovery we will get out of this process. The recovery rate as of yesterday is in the neighborhood of 83%, which is really kind of an eye-watering value; we don't know that we can afford that kind of number. We think that if we continue with our process, we may be able to get a higher recovery rate than 83%. The ultimate question is whether we can afford the costs of the energy and the chemistry. In the end – and I don't want to downplay it at all – we have a clear awareness that we have a disposal issue with the concentrate.

Phase 1 was the exploratory phase that included drilling and testing. We are now in Phase 2, pilot test and design. Phase 3 will be construction and Phase 4 will involve operations and maintenance.

We brought in a lot of folks for the exploratory phase, shortly after we drilled the wells and understood that we had some water. Among the people with whom we have been talking to from the start are representatives from Laguna Pueblo. I have been to the Pueblo and talked to the Laguna government twice myself, and we invite them to various meetings where we discuss what the possible uses are and which communities might be served with this water. I say "might" be served because we haven't made any (oral or written) agreements with anyone except for the original developer with which the county has an agreement (Master Plan has been approved by County Commissioners for Rio West Development). Beyond that, we had some meetings and said to the community developer, "Tell us what your dream would be, where would you really want to go." That way we could understand what size of a plant is appropriate. We have determined that 5 million gallon a day trains in the process is a good break-even point for cost curves. Thus we are looking at, nominally for money purposes, 25 million gallons per day at a point when you could have a demand for that much water, which could be 50 or 60 years away. We don't plan on being able to do this tomorrow, but we'd like to build and expand as demand dictates and whatever the technology allows.

We talked about the water itself: 12,000 TDS, 150˚F. We did the flow tests and we understand that with two wells there is a limit to what you can learn. Being a consultant, I have learned that the last line in almost every report is "further study is warranted," which translates to "pay me some more money and I'll give you some more information." That is definitely true here. Other oil wells that exist in the area were data sources and we think we learned some things from them as well. The flow test was done for 30 days in October 2008, the OSE is inspecting the reports, and we are going forward with the pilot test.

In evaluating how much water might be in that aquifer, we came to a value of about 2,500,000 acre-feet based on some of the charts you saw in the state engineer's presentation.

Phase 3 construction will be dictated by what we learn in the pilot test and what process has the potential to work. Phase 4 will be operations and maintenance. As for our budget, we put $6 million into drilling and aquifer testing, about $2 million per well, and those two wells were only about 6 7/8" diameter at the bottom and built to OSE standards. In the state engineer's presentation, you saw photos of the folks measuring the pipe and doing the cement work – that was the first well. We invited OSE staff to come back (as required) and look at the process and materials so that we will build to their standards. We have cemented to 3,000 feet, which is 500 feet below the point where OSE's jurisdiction (at the time) ran out. The second well was cemented to 3,200 feet with the upper casing and it is cemented again below that lower casing until you get to the area where the penetrations are to get the water inside the well casing.

We expect to be taking more visitors to the site soon. Monday we'll host some of the division directors from the county and after that we will probably have some opportunities to take folks from the press to the site. We did a media day at the end of the pump tests a year ago and we will likely do the same thing with this pilot test shortly.

Thank you.