In the Matter of Applications 53987, 53988,
53989, 53990, 53991 and 53992
filed to Appropriate Water in Cave Valley (Basin 180),
Dry Lake Valley (Basin 181), and Delamar Valley (Basin 182)
In White Pine and Lincoln Counties, Nevada

# REBUTTAL HYDROLOGIC REPORT


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## THE HISTORY OF KNOWLEDGE OF THE "DEEP CARBONATE AQUIFER"

Prior to 1990 there was very limited knowledge of the limit and extent of the "Deep Carbonate Aquifer" let alone the mechanics of how it interacted with the alluvium. We had the results of the testing done as part of the MX work but the limit and extent of the carbonates were a mystery. It was just lines on a map that covered Western Utah, Southern Idaho and a lot of Eastern Nevada. In the mid-1980's the Nevada Legislature along with others funded a study to be done by the University of Nevada (UNR), the Desert Research Institute (DRI), the U.S.Geological Survey (USGS), and the Bureau of Reclamation (BOR). Roland Westergard, as the Director of the Dept of Conservation and Natural Resources was on the steering committee. Hugh Ricci, retired State Engineer, thinks that the legislature expended millions of dollars on the study. After several years of study there were little results. I don't believe they actually did much drilling or pumping to stress the aquifer. Roland Westergard, Pete Morros and I all believed that the only way to better understand the system was to drill it, pump it and monitor it in order to get a real understanding of how the aquifer operates.

In the early 1990's several mining companies began mining gold in the carbonate rocks in the Carlin Trend west of Elko, Nevada. I don't believe anyone envisioned the carbonate rock province extending that far west until then. I, as State Engineer, granted the permits to de-water the Post-Betze mine with little knowledge of the geology. Only after extensive drilling and monitoring was it discovered that the pit is bounded on the southeast and southwest by large fault blocks. They pumped up to 70,000 acre feet per year for about ten years to lower the water table 1600 feet in order to extract the ore. I believe they still pump about 35,000 acre feet per year to maintain the water table below the pit bottom. There was a conceptual groundwater model in the beginning but only after several years and hundreds of monitoring wells was the model useful as a predictive tool to predict effects of pumping such a large volume of water.

After several years of study by several different scientists, the carbonate aquifer is still a bit of a mystery. As with the mining example, only large stresses will tell us how the aquifer really responds.

## SYSTEM IS NOT FULLY APPROPRIATED

Both Mayer and Myers concluded that the White River Flow System is fully appropriated. See attached Exhibit "A" taken from the DWR web site on December 11, 2007 that shows just the contrary. For 18 basins that make up the White River Flow System there is a total of 95,049 Acre Feet yet to be allocated. In addition, these numbers come from the Reconnaissance Series which were based on data from the 1960's. The science of estimating recharge has developed a great deal in the last 47 years. The PRISM precipitation map is a great tool, for the scientists today. The science of groundwater discharge has also advance a great deal with the work Nichols and others have done.

Mayer cites two rulings for his conclusion that the system is fully appropriated. Ruling No. 3225 was signed by the State Engineer in 1985, long before the Carbonate System was well understood. Ruling No. 5560 was signed by the State Engineer in 2006. The application was filed in 1997 and is junior in priority to these applications being heard today. Neither of the rulings declared the basin fully appropriated. Both of the applications were denied because of their close proximity to Crystal Spring and Ash Springs.

Mayer cites to four studies of the White River Flow System and states that they all use different basins to define the system. Some included Jakes Valley, others did not. Some included Long Valley, others did not. Some included Steptoe Valley, Lake Valley, Patterson Valley and Meadow Valley Wash. With so much uncertainty in what makes up the White River Flow System, Mayer and Myers cannot be so certain that the system is fully appropriated.

ROLE OF SPRINGS IN ALLOCATING GROUNDWATER

Many springs in Nevada are located in the mountains. In most cases these kinds of springs are called "perched" water because bedrock prevents the precipitation and snow melt from reaching the normal water table on the valley floor. Water percolates through cracks and crevices in the mountains until it hits the impenetrable bedrock and comes to the surface, usually in a canyon. Other springs appear near the edge of playas and dry lakes. These springs are forced to the surface by the fine grained material that makes up the lake bed. Valley floor springs are discharge points of water that is part of a larger flow system. Generally they come to the surface by artesian pressure through a weak spot in the alluvial material that makes up the valley floor. In allocating groundwater the State Engineer has to be cognizant of these springs and must protect the water rights on these springs. See State Engineer's Rulings 3225 and 5560.

USING MODELS TO PREDICT 2000 YEARS INTO THE FUTURE

All models have certain in-puts (ie. the term "garbage in garbage out"). All of the in-puts to a groundwater modeling exercise have a certain degree of error. In a given model, if the degree of error in estimating precipitation, recharge, and groundwater ET is plus or minus 5 to 10 percent, a modeler can quantify the limitations on the accuracy of a prediction. Modelers will then balance recharge and discharge and develop a water budget on an *average annual* basis with a reasonable degree of error. When a model includes certain stresses in the system, additional degrees of error are introduced. But when each of these potential errors are compounded over 2000 years, the results become meaningless.

In addition, we only have 100 years of weather data and stream flow data. In some cases maybe 150 years. Modelers have no idea what the weather was 2000 years ago any more than they know what the weather will be 2000 years from now. If your 100 years of precipitation record has a 5 percent error and you use that to make a 2000 year prediction you have compounded the error in your results by far greater than 100 percent.

TRANSITIONAL STORAGE

The traditional thought is when you develop a groundwater source you are not capturing the recharge but you are capturing the discharge. That discharge in a closed basin means that you are capturing the discharge that is otherwise lost to groundwater ET. In some basins the discharge is through subsurface flow to another basin. When a well is first drilled and begins to pump, the water is coming from "transitional storage". It is a physical fact of life. A cone of depression develops around the pumping center and the volume of water in this cone of depression is from storage. It may take years or even decades to reach equilibrium and begin to capture the discharge. This is an acceptable result.

Such is the case in Penoyer Valley (Basin 170). Penoyer Valley is a closed basin with no inflow or outflow. There is a large pumping area south of Highway 375. Ground water ET is largely from greasewood. There is in excess of 11,700 AF of irrigation rights in Penoyer Valley that have been pumping in excess of 20 years yet there still exists today thousands of acres of greasewood. All or most of the groundwater has come from "transitional storage". This is just one example of pumping from transitional storage in Nevada.

| HA | Perennial Yield (afy) | Active Water Rights (UG) (afy) |
|---|---|---|
| 175 | 6,000.00 | 4,749.36 |
| 174 | 12,000.00 | 49.78 |
| 180 | 2,000.00 | 46.58 |
| 207 | 37,000.00 | 31,818.51 |
| 181 | 2,500.00 | 56.56 |
| 182 | 3,000.00 | 7.24 |
| 171 | 6,000.00 | 38.12 |
| 172 | 6,000.00 | 559.21 |
| 208 | 21,000.00 | 29.89 |
| 209 | 25,000.00 | 9,587.23 |
| 206 | 0.00 | 1,000.00 |
| 210 | 18,000.00 | 16,304.00 |
| 219 | 37,000.00 | 14,762.49 |
| 216 | 400.00 | 3,845.00 |
| 217 | 200.00 | 2,200.00 |
| 218 | 2,200.00 | 3,067.51 |
| 220 | 16,500.00 | 5,713.25 |
| 215 | 1,300.00 | 7,216.73 |
| Total | 196,100.00 | 101,051.46 |
| Perennial Yield-Active UG Water Rights: | | 95,048.54 |

Exhibit A - Downloaded from NDWR Website on the 12/11/2007