DESALINATION OF BRACKISH GROUNDWATER IN ARIZONA[1]

Edwin H. McGavock and Chuck C. Cullom[2]

Recognizing that desalination of brackish groundwater will be an integral part of Arizona's future water supply, the Central Arizona Water Conservation District has embarked on a program to identify and prioritize Arizona basins where desalination is most feasible. Brackish groundwater is defined for this study as containing 1,000 to 10,000 milligrams per liter (mg/l) total dissolved solids (TDS). Based on this definition, more than 600,000,000 acre-feet of brackish groundwater is estimated to be stored in Arizona aquifers, generally at depths of less than 1,200 feet. While this volume seems large, it is still modest in comparison to the 1 billion acre-feet of brackish groundwater estimated to be stored in New Mexico's aquifers (New Mexico State Engineer Report, 2004).

Brackish groundwater is found throughout Arizona in a variety of hydrogeologic environments (Daniel 1981). Evaporite deposits are responsible for most salinity in northern Arizona aquifers, and agricultural irrigation is primarily responsible for brackish groundwater in southern Arizona. Evaporites are also a factor in southern Arizona basins, such as Safford, Picacho, and the West Salt River. Although dozens of brackish groundwater areas exist in Arizona, results of Phase I investigations indicate that only five or six have sufficient volume in storage to be of near-term interest for development of desalination projects. Locations for these areas are shown on **Figure 1**, along with estimates of recoverable brackish groundwater stored in the areas or sub-areas.

The area extending from the Picacho basin near Eloy and continuing along the Gila River into the Yuma area is of interest because desalination could replace current or future Central Arizona Project (CAP) uses, augment CAP deliveries to the Tucson area, and/or possibly mitigate waterlogging in the Buckeye and Yuma areas. The Safford basin has a good potential for desalination, if large fresh-water supplies are needed in the area. The Willcox basin also may have a large volume of brackish groundwater in storage that could be treated and used to augment supplies near Sierra Vista. Finally, extensive brackish groundwater resources exist in the Little Colorado River basin, both on and off of the Navajo and Hopi Reservations. In the western part of this brackish groundwater area, near Winslow, desalination could be used to augment supplies for Flagstaff, provide drinking water for several Native American communities, and/or provide water for industrial uses. Several electrical generating stations are located in or near the central and eastern parts of the Little Colorado brackish groundwater area, suggesting the potential for future co-location of power and desalination plants in this area. Advantages of the Little Colorado brackish area include the fact that brackish groundwater withdrawals would not be anticipated to adversely affect adjacent fresh water areas, and that

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[2]Edwin H. McGavock, Hydrologist, Errol L. Montgomery & Associates, Inc., 1550 E. Prince Rd., Tucson, AZ 85719, bigchino@kachina.net. Chuck C. Cullom, Geologist/Hydrologist, Central Arizona Project, P.O. Box 43020, Phoenix, AZ 85080, ccullom@cap-az.com.

sodium chloride-type groundwater that occurs in the area is reported to be most efficient for desalination.

While there are several key prospects in the state, major limitations to groundwater desalination remain, including energy costs associated with treatment and the difficulty with brine disposal, especially in Arizona. Current costs to produce fresh water from brackish water range from about $2 to $5 per 1,000 gallons. Studies in Texas indicate that water in the 1,000 to 3,000 mg/l TDS concentration range is optimal for energy efficient treatment, with energy costs rising rapidly when TDS is above 15,000 mg/l. This is important because electrical energy accounts for about 45 percent of fresh water production costs. Although greater efficiencies are being achieved in desalination technology over time, gains may be offset by rising energy costs.

A major impediment to desalination in Arizona is the state's classification of all aquifers as "Drinking Water Aquifers", including those where salinity substantially exceeds that of seawater, or where yield rates to wells are less than one gallon per minute. Because brine injection into deep, saline aquifers is often the best, or only, feasible method of brine disposal, the ability to utilize Arizona's abundant brackish groundwater resources may depend on a reappraisal of the aquifer classification system in the state.

REFERENCES CITED

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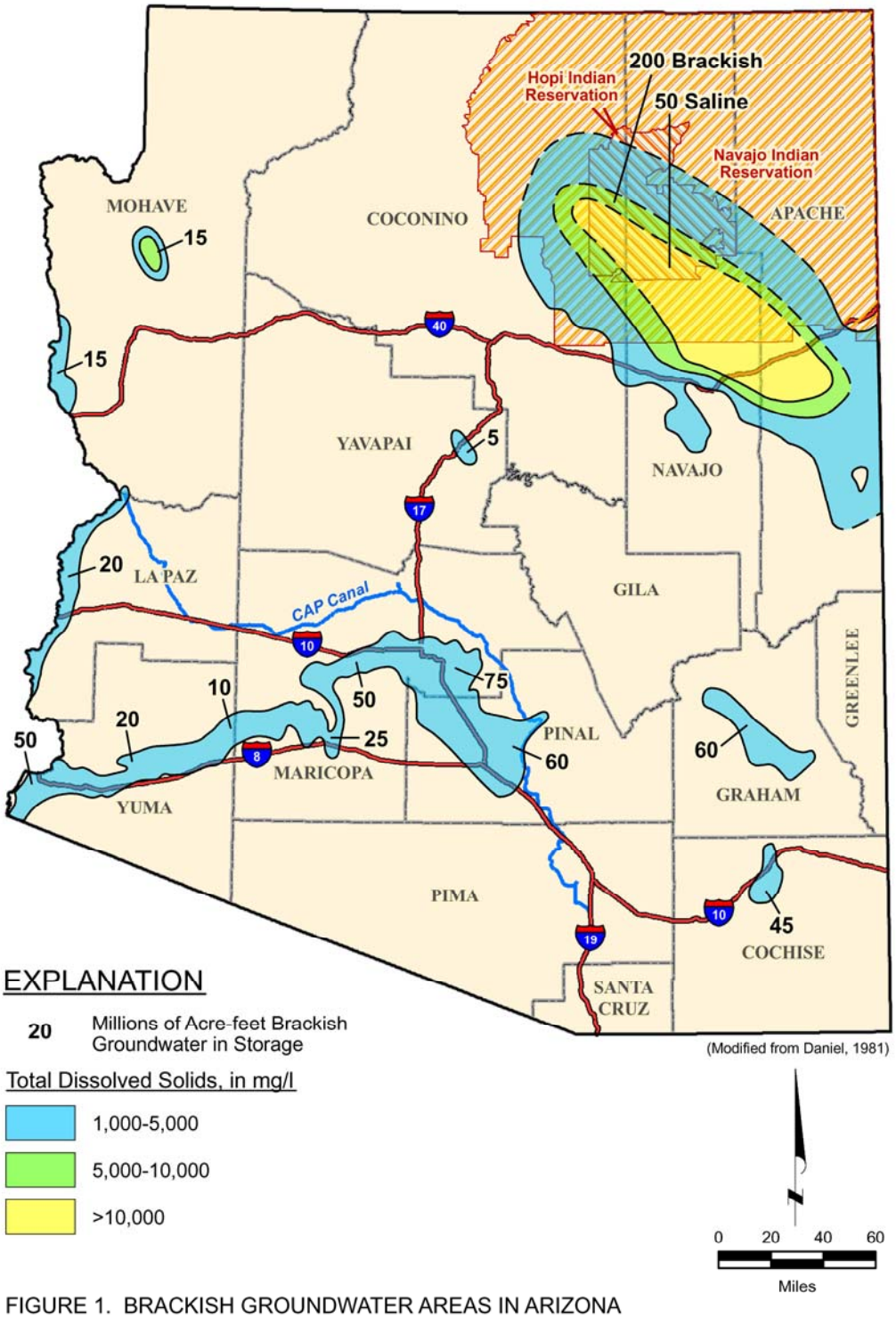

FIGURE 1. BRACKISH GROUNDWATER AREAS IN ARIZONA

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