Groundwater Issues and Recommendations

ISSUE: Lack of continuous monitoring to evaluate effects of pumping on induced migration of high salinity groundwater into high-quality groundwater areas.

RECOMMENDATION: The recent Aquifers of Arkansas report (ANRC, USGS, and FTN Associates) established three main areas of elevated salinity in the Mississippi River Valley alluvial aquifer; one of the most important natural resources in the State. There exists a strong need to select wells in these areas for continuous monitoring to investigate if continued high-volume pumping for irrigation is resulting in migration of high-salinity groundwater into fresh-water areas, which could threaten future crop production.

ISSUE: Every large-scale groundwater model developed in Arkansas has highlighted the importance of accurate groundwater-use reporting in predicting aquifer conditions and for developing effective management approaches. These models also have indicated potential error in water-use reporting and resultant databases. Most recently, evidence of possible inaccurate reporting of use from the Mississippi River Valley alluvial aquifer was indicated by modeling efforts (Clark and others, 2013) that explored the effects of reported use on simulated heads. Reducing the reported use by as much as 50 percent resulted in substantial improvements of observed compared to simulated water levels in several localized areas, indicating the possibility of considerable over-reporting of water use. The poorest matches of observed versus simulated water levels were noted after the early- to mid-1980s.

RECOMMENDATION: Metering of wells provides a consistent method for reporting of water use from wells in the Mississippi River Valley alluvial aquifer should result in more accurate use values. Short of this requirement, however, additional studies could assist in evaluating the accuracy of water use reporting. One recommended study would entail calculating water use from annual crop production and required water demand, which have well-documented figures, and comparing these values to reported use over a specified time period (for example, from 1970-present time). Results would show if large deviations exist between calculated water demands from annual crop statistics compared to water-use reporting values, and identify time periods and areas of the State reflecting the largest discrepancies. Similar studies could be applied to other aquifers, where necessary.

ISSUE: As the Mississippi River Valley alluvial aquifer has become unable to meet agricultural water needs in some areas of eastern Arkansas, an increasing number of wells have been completed in the deeper Sparta aquifer to augment yields. Many wells are believed to be dual completions (producing from both the alluvial aquifer and the Sparta), and a there is concern that water-use from many wells that produce from the Sparta is reported as alluvial aquifer water use.

The Sparta aquifer is a confined aquifer with orders of magnitude less water available from storage than the alluvial aquifer. Drastic water-level declines in the Sparta aquifer could occur very quickly if subjected to extensive pumping for agricultural demands. The number of wells producing from the Sparta may be underreported as well as water use from the Sparta.

RECOMMENDATION: One recommended study to determine whether production from the Sparta may be incorrectly assigned would be to run basic water chemistry analyses on a number of wells and determine geochemically from which aquifer that water is derived. Such an approach would be able to quantify the relative contributions of Sparta and alluvial aquifer in mixed water from dually completed wells.

ISSUE: Critical declines have been noted in several areas of the Mississippi River Valley alluvial aquifer. Many of these areas are along major rivers, which are identified as major recharge sources to the aquifer. Evidence from recent studies, however, suggests that infiltration of precipitation through coarse channel proximal to the Arkansas River serves as a larger component of recharge compared to actual influx (leakage) of water from the river. If the greatest component is through infiltration of precipitation, then potential changes in climate resulting in reduced annual precipitation, even where maintaining reasonable or current river stage from water outside the State, will result in greater declines in groundwater levels due to in-State reduced rainfall infiltration.

RECOMMENDATION: A study is recommended to quantify the various components of recharge along the Arkansas River in the Mississippi embayment. While similar studies could be useful along other major rivers (for example, the White River), more data are available in the area of the Arkansas River, which would reduce the need for collection of additional, new data. Knowledge related to quantification of water contributed by the various sources of recharge (leakage from rivers, infiltration of precipitation through permeable surface sediments, leakage from underlying aquifers, and other minor pathways) will assist in future groundwater planning and management scenarios.

ISSUE: The recent Aquifers of Arkansas report (ANRC, USGS, and FTN Associates) compiled abundant available data to document historical and current water use, water levels, water-level decline trends, and water-quality conditions for 16 major and minor aquifers of the State. However, no method currently is available for use of the data to accurately quantify water availability and identify areas that have additional development capacity from the regional extent of all aquifers, which is driven by criteria including economics (depth of pumping requirements), available water storage, variable water quality, and other important indicators of freshwater availability.

RECOMMENDATIONS: The economy of Arkansas continues to grow, and with it an increasing demand on water resources in the State. Some aquifers in the State are known to have additional development potential; however, this knowledge is available only by searching and interpreting numerous reports and databases. No single tool is available for integrated evaluation of water availability and aquifer development potential. A beneficial tool for categorizing and compartmentalizing available groundwater sources throughout the State would be gained from the creation of a set of indices for ranking available groundwater sources and applying these rankings on a well-by-well basis for each of the State's aquifers. It is recommended that such a study be conducted to identify and weigh important ranking criteria, to devise a method for spatially applying these rankings to each aquifer, and to produce a map of the resulting rankings for each aquifer for use by ANRC in identifying optimum areas for future supplemental water supplies to meet ongoing water demands in the State.

ISSUE: A pressing need continues for exploring and expanding conjunctive use as a means to reduce groundwater level declines in the Mississippi River Valley alluvial and Sparta aquifers. Although some historical studies have discounted artificial recharge systems to replenish groundwater, mainly as a result of economic considerations, newer passive storage systems have demonstrated technical improvements and improved cost-benefit analysis. Such systems could reduce use of valuable land used for on-farm reservoir systems.

RECOMMENDATION: Conversations with farm owners and managers currently using surface-water diversion technology as a supplemental source of irrigation supply have expressed interest in studies to evaluate the efficacy of passive-storage techniques for replenishing groundwater storage following irrigation season. There is a need to conduct these studies for evaluating the feasibility of its use in Arkansas.

ISSUE: Confidently identifying and delineating areas where aquifers are beginning to show consistent water-level declines, including declines that would fall within the definition for critical groundwater areas, is difficult in areas with a scarcity of water-level measurements. Where monitored, most water-level measurements are taken annually, and no effective means are available for documenting seasonal as compared to long-term (drought years versus wet years) variation in water levels from natural causes. Additionally, many aquifers in the State are not regionally extensive, are only of local to sub-regional importance, and currently receive lesser monitoring attention.

RECOMMENDATIONS: There is a critical need to develop an integrated continuous groundwater-level monitoring network throughout the State, especially within the Mississippi embayment. Real-time monitoring not only assists agencies charged with water-resource planning and management responsibilities, but assists farm managers in evaluating water-level

changes during the irrigation season. Recent meetings with various farm owners and managers have revealed a willingness by the farming community to assist in funding efforts for such an effort.

ISSUE: Long-term viability of groundwater resources is a primary goal for water managers in the State, and a well-defined knowledge of sustainable yield is paramount to achieving that goal. Studies determining sustainable yield have played an important role in providing information for management and policy development for areas of the Mississippi River Valley alluvial and Sparta aquifers; however, our knowledge of sustainable yield of other smaller, though important, aquifers in the State is completely lacking.

RECOMMENDATIONS: Aquifers for which sustainable yield information is lacking should be prioritized, and data assimilation and modeling approaches should be applied to determine sustainable yield, as defined by relevant Arkansas regulation and policy, for other important aquifers in the State.

ISSUE: Water availability has been the limiting factor for economic development and growth in several areas of the State. One of these areas is the Ozarks, particularly the Boston Mountains and Springfield Plateaus, where communities have drilled numerous, deep, high-cost, high-risk (in terms of achieving desired yields and water quality) wells in the marginal zones of the Ozark aquifer. These deep Ozark wells often have relatively low yields and require considerable treatment to insure good water quality, but are nonetheless viable water sources. In recent years expansion of rural water districts has brought surface water from northern Arkansas lakes to these areas, resulting in less dependence or outright abandonment of the deep wells. Because of potential liability issues, an ill-considered response has been to move forward with plugging of these wells, which represent millions of dollars of investment.

RECOMMENDATIONS: Deep Ozark aquifer wells which are being abandoned represent a water source made available by very large capital investments, and although Federal support of expansion of surface-water delivery in the State has changed the economic equation, deep Ozark wells should be preserved as viable alternative water sources in the case of extended drought, terroristic sabotage of surface-water impoundments or delivery systems, or need for augmented supply for the time when growth in these areas results in water demand exceeding what surface water can supply. The community-supply, deep Ozark aquifer wells are some of the only water-level monitoring points available for broad areas of the Ozark aquifer, and provide an excellent opportunity to establish continuous monitoring of water levels and water quality at each of these wells. Such a project would provide an important reason for maintaining these boreholes, yielding critical groundwater level and quality information while preserving a near-immediately available alternative water source locally. The pragmatic nature of this recommendation is seen

in the very recent moves of two communities—Marshall and Lead Hill—to move back to their original groundwater sources.

ISSUE: ANRC and other water-management and water-monitoring agencies in the State have conducted a large number of studies and accrued voluminous information on the various aspects of groundwater budget—precipitation, evapotranspiration, recharge, storage, transit rates, pumping, leakage, stream discharge, etc.; however, no single publication or tool has been developed consolidating all of this information, identifying knowledge gaps, linking connected aquifers and spatially separated aquifer zones, and synthesizing a single, integrated, user-friendly construct that can quickly address questions and issues on large-scale water budget.

RECOMMENDATION: An integrated spatial database of water budget data for the State with an outcome and needs specific interface and companion publication should be developed. Such a product will also highlight data gaps and enable targeted collection of any additional needed data. Outputs from this tool would include budget quantities for various budget compartments and interfaces, such as recharge values for a given area of an aquifer, or leakage between two aquifers in a specific location.