

Docuware Cover Sheet

DWR

Cabinet (circle one): DWR RRCA ARCA GMD

File Name State Programs (from index)

Sub File Name ASR (from index)

Sub-Sub File Name Wichita

Year (calendar) 2004

End Year _____

Privileged Yes - Circle if true

Comments/Keywords

Wichita ASR issued of concern for GMD2

After scanning:

File hard copy CE Desk / CE Cabinet / Laterals

Send to Archives

Send to Field Office

Recycle

File only:

File hard copy CE Desk / CE Cabinet / Laterals

ISSUES OF CONCERN
OF THE
EQUUS BEDS GROUNDWATER RECHARGE PROJECT
FOR THE
CITY OF WICHITA
WATER & SEWER DEPARTMENT

By

CARL E. NUZMAN, P.E., P.Hg.
Consulting Engineer/Hydrogeologist
3314 NW Huxman Road
Silver Lake, Kansas 66539-9243

Cell Phone 785 224 9929
Fax 785 582 4155
E-mail: cyjnzmn@swbell.net

For

EQUUS BEDS GROUNDWATER MANAGEMENT DISTRICT NO. 2
313 SPRUCE
HALSTEAD, KANSAS 67056-1925

Phone 316 835 2224

July 25, 2004

ISSUES OF CONCERN
BY THE
EQUUS BEDS BOARD OF DIRECTORS
GROUNDWATER MANAGEMENT DISTRICT NO. 2

Members of the Board of Directors of Groundwater Management District No. 2, both individually and collectively have expressed issues of concern regarding the City of Wichita's Aquifer Storage and Recovery project. The filing of Applications No's 45,567 through 45,576 with the Division of Water Resources of the Kansas Department of Agriculture, and the Bentley well applications have called into question, the policy, procedures and design criteria of the City of Wichita regarding the overall project. These applications have been referred to the Groundwater Management District No. 2 by the Division of Water Resources for review in accordance with established procedures.

The purpose of this paper is to identify those concerns and possible alternatives, and give potential solutions for these issues. If possible, the City of Wichita should adopt a formal policy and engineering guide lines for the development of the complete project that addresses the concerns of the GMD No. 2 and others.

1.0 SOURCE WATER FOR RECHARGE

1.1 Surface Water: Members of GMD No. 2 have expressed concern that the primary source of recharge water to the principle aquifer of the Equus Beds should be the direct diversion of excess flows of the Little Arkansas River, treated to meet water quality standards of the Kansas Department of Health and Environment. This should take precedence over the construction of wells along the Little Arkansas River.

1.1.1 The Consultants report addressed this issue in paragraph 7.8, pg 23, in suggesting the City should install a low head, high volume pump possibly in the vicinity of the Halstead test well. Recognizing that it is impracticable to treat a very high rate of flow, that an off channel reservoir or lagoon be established to receive the water direct from the diversion pumps and be processed at an appropriate rate of flow to the recharge system. Some losses due to infiltration and evaporation may be incurred and a portion of those losses could be recovered by small wells or well points completed in the shallow aquifer surrounding the reservoir or lagoon.

1.2 Shallow Aquifer: Where the direct diversion of surface water from the Little Ark river is not feasible, the shallow aquifer that is generally in direct communication with the Little Ark river channel should be considered as the source of water for the recharge project.

1.2.1 It is recognized that the geology is highly variable along the river and the yield of water to shallow wells is limited in areas to unacceptable low water yields. The GMD No. 2 Board of Directors would prefer the City of Wichita first establish a shallow test well in the vicinity of any proposed development area such as currently proposed in Section 8, T-23-S, R-2-W, and test the yield of the shallow aquifer to wells as would be placed along or near the bank of the Little Ark river. It is suggested that some minimum yield criteria be established for properly designed shallow wells before allowing completion of any source water wells for recharge in the principle Equus Beds aquifer.

1.3 Equus Beds Aquifer: It is perceived by members of the GMD No. 2 Board of Directors, that a source water well for recharge screened in only the principle Equus Beds aquifer constitutes an illegal transfer of ground water from one portion of the basin to another and constitutes an illegal appropriation of water in violation of GMD-2 Regulation 5-22-7, K.A.R. 5-3-10 and K.A.R. 5-3-11 of the Division of Water Resources where no direct connection exists between the aquifer screened for the diversion of water and the stream bed of the Little Ark river.

1.3.1 The basis for this opinion is that the sub-regional model did not include recharge from natural precipitation and the aquifers were not modeled to the eastern edge of the aquifer deposition. The eastern edge of the aquifer provides a negative boundary to the aquifer, doubling drawdown especially in the middle to lower portion of the Little Ark river south of Halstead where the boundary is relatively close to the river channel. Due to this fact and potential mutual interference between closely spaced wells, the drawdown in the aquifer must be limited in addition to complying with the Little Ark river minimum flow requirements. The suggested drawdown limit in any aquifer, shallow or deep, is 10 feet at a distance of 660 feet perpendicular to a line of wells on either side of the Little Ark river. Such drawdown will be monitored separately in each aquifer. Where the location of such monitoring wells is not acceptable, the location may be extended in distance and the drawdown reduced in allowable depth in accordance with a distance drawdown semi-log plot of the aquifer transmissivity appropriate for the location.

1.3.2 Where the shallow aquifer is incapable of meeting the minimum flow yield criteria as may be established and penetration of the principle Equus Beds aquifer is warranted, such well design will screen the shallow aquifer in a continuous manner connecting to the lower aquifer. The depth of penetration of the well screens in the lower aquifer should be no deeper than to provide an economic yield of water to the well at that location. Penetration of the full depth of the aquifer to bed rock is not acceptable except where warranted to obtain the minimum established water flow yield.

1.3.3 Calculations were made by the Board's Consultant in regard to mutual interference between wells. Based on the data gleaned from published reports, the transmissivity of the aquifer and influence of recharge were limited to where excessive drawdown and mutual interference would occur. For the pumping rate of 1200 gallons per minute applied for in 5 of the 7 applications, the projected drawdown was several times that reported by the Wichita Consultants which would require a minimum spacing

of 1320 feet between wells. Because of this and other uncertainties, an alternative is proposed.

1.4 Term Permit: Because of the uncertainties of the initial installation of the source water wells for recharge, it is suggested that the present applications for a permanent water rights be placed on hold by the Division of Water Resources to protect the filing date, and the City of Wichita file for term permits for each of the seven (7) wells located in Section 8, T-23-S, R-2-W, and proceed with the construction of these source water recharge wells in accordance with terms and conditions as may be agreed upon between the parties involved.

2. RECHARGE AND RECOVERY WELLS

2.1 Theory: The original theory of recharge and recovery wells was to store fresh water into brackish or saline aquifers for later recovery for subsequent use. This concept has been extended to temporarily store water during low water use to be withdrawn during peak water use periods. It is assumed this is the intent of the City of Wichita in the design and placement of the RRW wells. However this approach does not address the Burrton brine contamination issue. At the one (1) mile spacing, no hydraulic barrier exists and those wells within ½ mile of the contamination plume will in time allow brine to move around these wells and closer to the City well field.

2.2 Hydraulic Barrier: The Board's Consultant used an average value of formation permeability of 1000 gpd/ft² in estimating the cone of impression which is the mirror image of the cone of depression and found that the probable maximum distance between injection wells to form a hydraulic barrier was approximately ½ mile spacing. The optimum spacing between wells would be 1320 feet. It was pointed out that the line of injection wells proposed by the Board's Consultant did not adequately consider the southward movement of the salt brine plume west of the City Well 41. The line of injection wells needs to wrap around to the west and extend a minimum of 2 miles to the west of Well 41.

2.2.1 The predevelopment hydraulic gradient in the area was approximately 4 feet/mile from west to east. The hydraulic barrier needs to develop a reverse gradient of about 2 feet in ½ mile to the west to contain the brine contamination. Once the barrier is established, a large percentage of the water can be recovered by wells on the down gradient side of the barrier. These wells should be no closer than about ½ mile from the ridge of the barrier. The brine content of the Burrton plume will gradually dilute with recharge from precipitation and water usage within the plume to the extent possible will aid in the recovery. It is suggested that the City of Wichita consider this possibility in the future.

2.3 RRW Wells: The proposed RRW wells can certainly be used as future recovery wells and when excess water is available for recharge, operate as recharge and recovery wells to help meet peak flows in the future.

2.4 Recharge Pits: The City is encouraged to use any effective means to recharge the aquifer and pits are certainly acceptable. However there has not been a lot of dewatering in the deeper aquifers in that permeable sands and gravels are not essentially dry over a large area of the well field. It is suggested that the locations of the proposed recharge pits be converted to RRW wells to recover water from the hydraulic barrier to the west and serve as storage of excess recharge water to be recovered to meet peak demands.

3.0 Future Policy and Design Criteria

3.1 The lessons learned in this initial phase of the Recharge and Recovery Project should apply uniformly for the life of the entire project.

3.2 Decisions should be made and policy established as to the control of poor quality water migrating toward the City well field from the Big Ark river to the south.

3.3 Consideration should be given to the redesign of the Bentley wells to conform the well design criteria discussed in this document on Issues of Concern. These wells should be limited to withdrawals from the shallow aquifer only where sufficient thickness is available to provide an economical yield. If resurrecting wells with established water rights, then consideration to include screening the upper most aquifer should be considered.