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Year (calendar) 2010

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Comments/Keywords

GMD2

Accounting and Annual report 2009 Review

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EQUUS BEDS GROUNDWATER MANAGEMENT DISTRICT NO. 2

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September 23, 2010

David Barfield, Chief Engineer
Division of Water Resources
Kansas Department of Agriculture
109 S.W. 9th Street, Second Floor
Topeka, Kansas 66612-1283

Re: Aquifer Storage and Recovery Project 2009 Accounting (& Annual) Report

Dear Mr. Barfield:

The City of Wichita Aquifer Storage and Recovery (ASR) Project 2009 Accounting Report was reviewed by the Equus Beds Groundwater Management District Board of Directors at the September 15, 2010, meeting. The 2009 Accounting Report also included the elements required in the Annual Report specified in K.A.R. 5-22-10(a), effectively combining the reports into one report. A copy of the District's Fact and Information Review Sheet is enclosed for your information.

Upon review of the report, the District Board of Directors determined that the report satisfies the requirement set forth in the initial (and as later modified) order for the ASR project and satisfies the conditions of the Aquifer Storage and Recovery System: Data Reporting Requirements Regulation K.A.R. 5-22-10(a), subject to providing the information concerning the key groundwater quality parameters as required by K.A.R. 5-22-10(a)(4)(B), once the data is made available by the United States Geological Survey (USGS). Additionally, the City's consultant advised that the quarterly water-level change maps not included in the report would be provided once the maps are completed by USGS.

The Board of Directors recommends that subsequent ASR Project Accounting (& Annual) Reports include:

1) Water quality information presented in an improved manner, utilizing elements such as tables and graphs.
2) Index groundwater levels are presented graphically (hydrographs) and geographically (water-level change maps).

Please contact the District should you have any questions regarding the review or recommendations.

Sincerely,
EQUUS BEDS GROUNDWATER
MANAGEMENT DISTRICT NO. 2

Tim Boese
Manager

TDB/db

Enclosure

pc: Debra Ary, City of Wichita
Paul McCormick, Burns and McDonnell
Jeff Lanterman, Division of Water Resources, Stafford

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Equus Beds Groundwater Management District
Board of Directors
Fact and Information Review Sheet

City of Wichita, 2009 Aquifer Storage and Recovery Project
2009 Accounting & Annual Report
Summary
By
Daniel Clement and Tim Boese, GMD2
September 14, 2010

Background:

Construction of phase I of the ASR project was substantially completed on September 13, 2006 and phase II is currently under construction. During 2009 the City operated three diversion wells, a surface water treatment and intake plant, four recharge wells, and Recharge Basin No. 2. Per DWR Chief Engineer's orders, recharge credit accounting must use an adequate groundwater model that addresses the many natural and artificial sources of groundwater gains and losses within the storage area. The ASR Phase I project operated for a third full year in 2009.

Source Water & Aquifer Storage:

Type - Recharge water was taken directly from the Little Arkansas River using surface water and groundwater from the three diversion wells located along the river bank.

Quantity Available - Based on stream gauges stream flow exceeded the minimum limits for diversion and recharge for a total of 280 days in 2009

Quantity Diverted – Diversions totaled 556.03 acre-feet with metered recharge at 521.78 acre feet as shown in the tables below. Well maintenance consumed 3.74 acre-feet, while system operations consumed 34.25 acre-feet. Surface water that passes through plant during startup is not recharged due to high turbidity. This water was diverted to a drainage ditch and was not metered. Water used for flushing surface water pipeline and for system deactivation is also diverted to a drainage ditch.

Techniques Used – During 2009, water was recharged via four recharge recovery wells (RRW) and recharge basin 2 (RB2).

From Table 2.1
2009 Metered Diversion and Recharge Volumes

Diversions:	Gallons	Acre-Feet
Surface Intake	22,745,792	69.81
DW1	60,258,960	184.94
DW2	36,911,313	113.28
DW3	61,256,432	188.00
		Total: 566.03

Recharged (metered):	Gallons	Acre-Feet
RB2	52,498,208	161.12
RRW1	16,182,600	49.67
RRW2	28,374,240	87.08
RRW3	27,865,840	85.52
RW1	45,091,616	138.39
		Total: 521.78

Well Maintenance Pumping:	Gallons	Acre-Feet
RRW1	175,668	0.54
RRW2	360,811	1.11
RRW3	332,874	1.02
RW1	348,132	1.07
		Total: 3.74

Physical and Chemical properties of Source Water – Water captured from bank storage wells was not treated, but recharge quality remained good. All surface water diverted from the Little Arkansas River was treated and all water recharged met MCL established for drinking water. Additional filtration is implemented at RB2 to remove biological constituents from surface water. Data was included in the report inside Appendix C.

Recharge Credits Withdrawn - There has been no recovery of stored water to date.

Hydrologic Conditions:

Quarterly index water levels - Water level measurements for the ASR index wells were obtained via GMD2 and were supplied in the report in Appendix C. However, only the water-level change map for the 1st quarter of 2009 was available.

Key groundwater quality parameters – The USGS collects samples from the Index Wells on an annual basis. The data was not available at the time of the report thus this information was not included. This data will be provided as it becomes available.

Monthly and annual precipitation data – The monthly annual precipitation data was provided by GMD2. The McPherson County weather station served as representative data for the area. The monthly data was included as Appendix G in the report.

Withdrawals from Non-domestic wells - DWR provides the city with a spreadsheet showing the pumping from all non-domestic wells for use in the annual accounting model. According to the 2009 data furnished by DWR, 167,657.93 acre-feet was pumped from the Basin Storage Area. This data was included as Appendix H in the report.

Annual stream flow, including baseflow and above baseflow stages – The annual stream flow data for the Little Arkansas River was obtained from the USGS and is included as Appendix I.

Summary of conjunctive use amounts - Conjunctive use amounts are totaled when the City uses more than its base water rights of 53,000 acre-feet from Cheney during wet years. This did not happen in 2009, so the conjunctive use amount is 0.0 acre-feet.

Water supply and demand forecast for next three years – The City's current water supplies are anticipated to meet the projected demands, and no ASR credits are anticipated to be used in the next three years.

Year	Gallons
2011	21,715,000,000
2012	21,900,000,000
2013	22,630,000,000

Other Supporting Documentation:

Groundwater Modeling – DWR requires a groundwater-based accounting system to track movement of recharge credits as a condition for approval of permits required to capture, store and recover water for beneficial use by the City. Several models are currently being utilized to track the groundwater movement of the ASR project recharge credits. Models included dynamic and acceptable calibrated parameters to produce more accurate results. Models account for precipitation, stream flow, groundwater pumping, natural vs artificial recharge, individual cell inflow and outflow, evaporation and transpiration, and target accurate stream infiltration rates.

For the accounting model, a total of 38 hydrostratigraphic units were established and numbered to represent the 38 ASR index cell areas. Several index cells were extended eastward in the model to include the river. The map below was taken from the report (Figure 4.2). Hydrologic data for each index cell was included in Appendix A and B. Calculated model data indicates that the barrier to the Burrton Salt Water Plume is beginning to form.

Figure 4.2 - A map of the Hydrostratigraphic Units used in the ASR area.

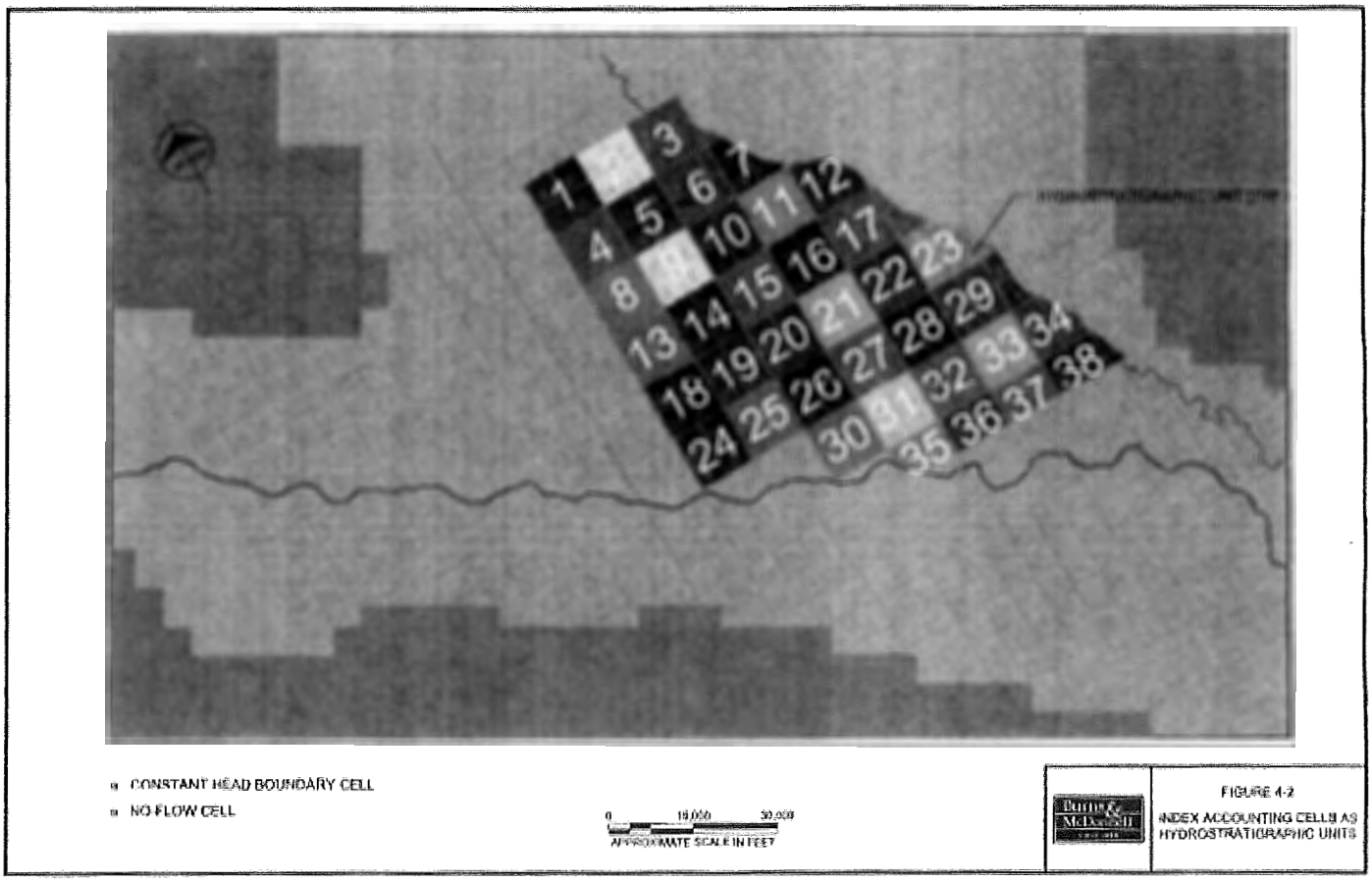

Table 4.3
2009 Recharge Credit Summary
(Acre-Feet)

Index Cell	Previous Recharge Credit (2006-2008)	2009 Metered Recharge	2009 Metered Recovery	Net Recharge Credit Underflow Entering Index Cell	Net Recharge Credit Underflow Leaving Index Cell	Net Recharge Credit Loss to River	Current Recharge Credit
1	----			----	----	----	----
2	197.0	49.7	1.5	82.8	124.3	----	203.7
3	19.3			187.7	35.5	0.0	171.5
4	----			----	----	----	----
5	324.3	85.5	6.0	48.8	186.1	----	266.6
6	63.3			172.5	183.7	----	52.2
7	22.1			91.7	16.6	73.2	97.2
8	----			----	----	----	----
9	227.0	138.4	2.9	56.3	150.1	----	268.6
10	63.8			102.9	106.0	----	60.7
11	26.0			60.0	45.7	9.0	31.3
12	5.2			15.5	3.1	11.4	6.2
13	----			----	----	----	----
14	296.9	161.1	0.0	-23.8	102.8	----	331.4
15	43.8			57.9	49.0	----	52.7
16	21.6			38.6	28.7	----	31.4
17	5.7			19.7	9.8	5.7	9.9
18	----			----	----	----	----
19	24.8			-2.8	-19.1	----	41.0
20	18.4			17.7	8.0	----	28.1
21	12.0			22.2	13.8	----	20.3
22	4.1			11.8	7.7	----	8.1
23	1.1			4.4	1.6	1.9	2.0
24	----			----	----	----	----
25	8.5			6.2	5.9	----	8.9
26	1.2			10.3	8.8	----	2.7
27	5.8			8.4	4.7	----	9.4
28	2.4			4.9	2.5	----	4.8
29	0.7			2.3	0.9	0.3	1.7
30	0.5			4.2	2.7	----	2.0
31	1.8			3.0	1.9	----	2.8
32	0.8			1.7	0.9	----	1.7
33	0.3			0.9	0.4	----	0.8
34	0.0			0.3	0.0	0.2	0.1
35	0.5			0.6	0.2	0.1	0.8
36	0.2			0.4	0.2	----	0.4
37	0.1			0.2	0.1	----	0.2
38	0.0			0.1	0.0	0.0	0.0
Total	1399.06	434.7	10.3	1007.2	1082.6	101.8	1719.4

* * * * *

Total water recharged to the basin 2006 through 2009 is 2529.10 acre-feet. Total recharge credit established through 2009 is 1719.4 acre-feet, which is approximately 68% of the total water recharged.

Staff Comments:

- For 2009, the Accounting and Annual Reports have been combined, as many reporting requirements are common to both reports.
- The 2009 Accounting & Annual Report meets the requirements set forth in the initial and (and as later modified) order for the ASR project and the Aquifer Storage and Recovery System: Data Reporting Requirements Regulation K.A.R. 5-22-10(a), pending a list of the key groundwater quality parameters as required by K.A.R. 5-22-10(a)(4)(B).
- Water quality information should be presented in an improved manner such as tables and graphs.
- Index water-levels should be presented graphically (hydrographs) and geographically (water-level change maps)