

Select visuals for update on Aquifer Storage & Recovery (ASR) Proposed Permit Modifications

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Equus Beds GMD No. 2 special Board meeting
Dec. 20, 2017



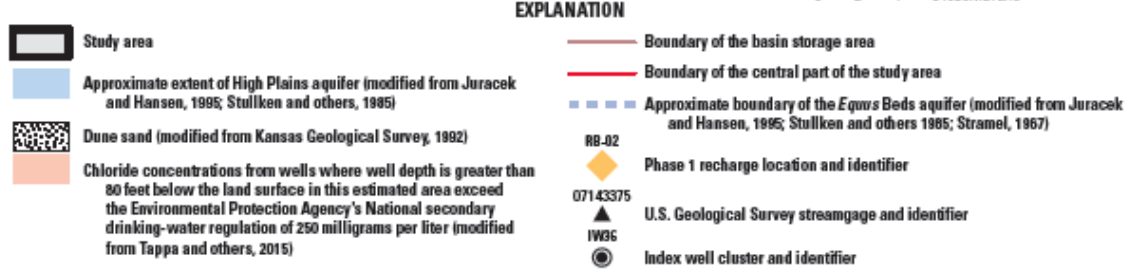
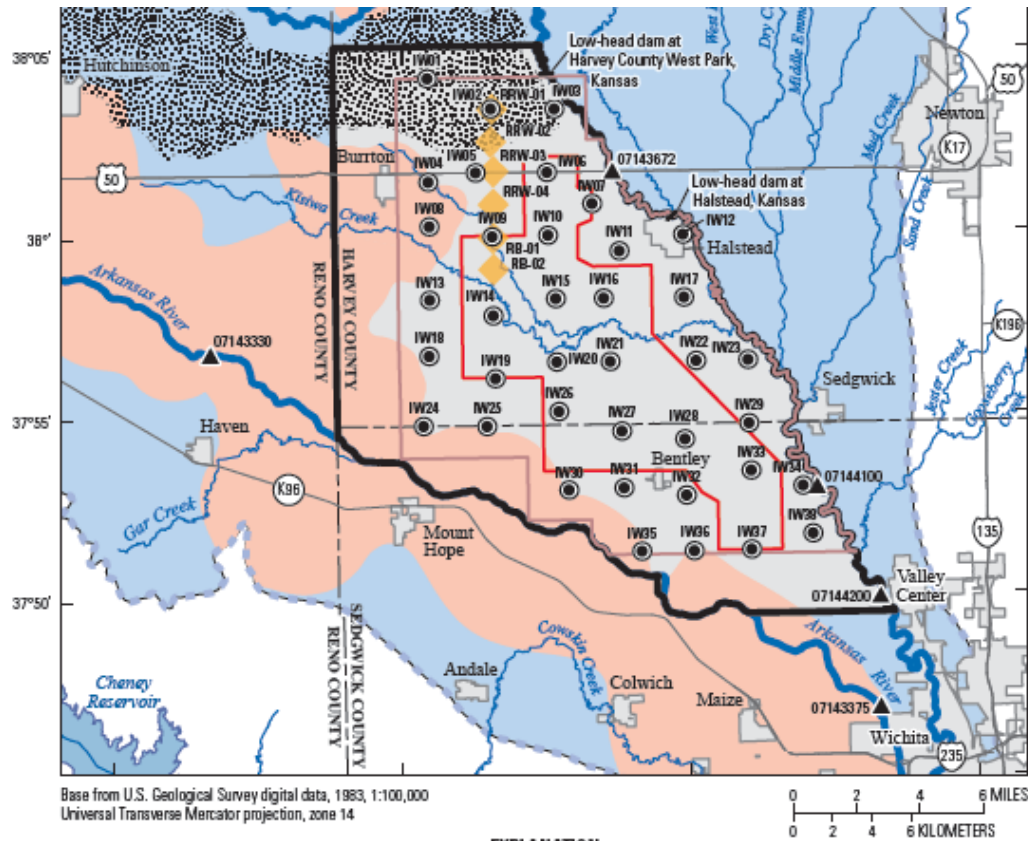


Figure 1. Location of study area near Wichita, south-central Kansas (modified from Hansen and others, 2014; and Tappa and others, 2015).

Table 2. Average groundwater-level changes, storage-volume changes, and total aquifer storage volume in the *Equus* Beds aquifer for various study areas near Wichita, south-central Kansas, predevelopment to January 2015.

[Predevelopment is defined as before substantial pumpage began in the area. 1993 is defined as historic low water levels. --, not applicable; <, less than]

Area (figs. 1, 4, and 6)	End of time period	Average water-level change (feet)						Total aquifer storage volume (acre-feet)	Storage-volume changes				Storage-volume change since 1993 as a proportion of storage-volume change from predevelop- ment to 1993 (percent)	Percent of total aquifer storage volume
		Since predevelopment			Since 1993				Since 1993					
		Meas- ured	Measured and inter- polated	Raster ¹	Meas- ured	Measured and inter- polated	Raster ²		Since predevel- opment (acre-feet)	Subtrac- tion ³ (acre- feet)	Raster ⁴ (acre- feet)	Difference between subtraction and raster as a proportion of subtraction (percent)		
<i>Shallow part of the Equus Beds aquifer</i>														
Study area														
	Predevelopment	--	--	--	--	--	--	³ 3,192,000	--	--	--	--	--	100
	1993	-20.99	-19.45	-10.77	--	--	--	--	-195,000	--	--	--	--	94
	January 2012	-11.42	-10.58	-6.89	5.43	5.12	3.88	--	-125,000	70,000	70,100	<1	36	96
	July 2012	-11.93	-11.99	-9.66	3.11	4.43	1.11	--	-175,000	20,000	20,100	<1	10	95
	January 2013	-12.29	-10.50	-8.50	3.04	4.79	2.26	--	-154,000	41,000	41,000	0	21	95
	January 2014	-12.63	-9.38	-6.41	7.80	7.77	4.37	--	-116,000	79,000	78,900	<1	40	96
	January 2015	-10.85	-9.23	-7.43	6.03	6.93	3.30	--	-135,000	60,000	59,800	<1	31	96
Basin storage area														
	Predevelopment	--	--	--	--	--	--	² 2,400,000	--	--	--	--	--	100
	1993	-25.87	-19.66	-14.08	--	--	--	--	-188,000	--	--	--	--	92
	January 2012	-14.01	-10.90	-8.44	6.20	8.37	5.58	--	-112,000	76,000	75,200	<2	40	95
	July 2012	-14.68	-12.52	-11.64	3.50	5.00	2.39	--	-155,000	33,000	32,200	<3	18	94
	January 2013	-15.84	-11.51	-10.04	3.74	5.69	4.01	--	-134,000	54,000	54,000	0	29	94
	January 2014	-15.32	-10.30	-8.18	8.62	8.58	5.89	--	-108,000	80,000	79,400	<1	43	96
	January 2015	-13.18	-11.31	-8.92	7.13	7.85	5.10	--	-119,000	69,000	67,900	<2	37	95
Central part of the study area														
	Predevelopment	--	--	--	--	--	--	¹ 1,025,000	--	--	--	--	--	100
	1993	-31.01	-24.18	-23.04	--	--	--	--	-121,000	--	--	--	--	88
	January 2012	-15.51	-12.56	-11.20	10.74	6.64	11.84	--	-59,000	62,000	62,000	0	51	94
	July 2012	-17.07	-13.41	-14.13	9.00	10.30	8.91	--	-74,000	47,000	46,700	<1	39	93
	January 2013	-17.52	-13.07	-13.19	7.95	10.18	9.85	--	-69,000	52,000	51,600	<1	43	93
	January 2014	-16.35	-12.76	-12.10	12.18	12.09	10.94	--	-63,000	58,000	57,300	<2	48	94
	January 2015	-14.67	-12.92	-12.36	10.65	11.73	10.54	--	-65,000	56,000	55,200	<2	46	94

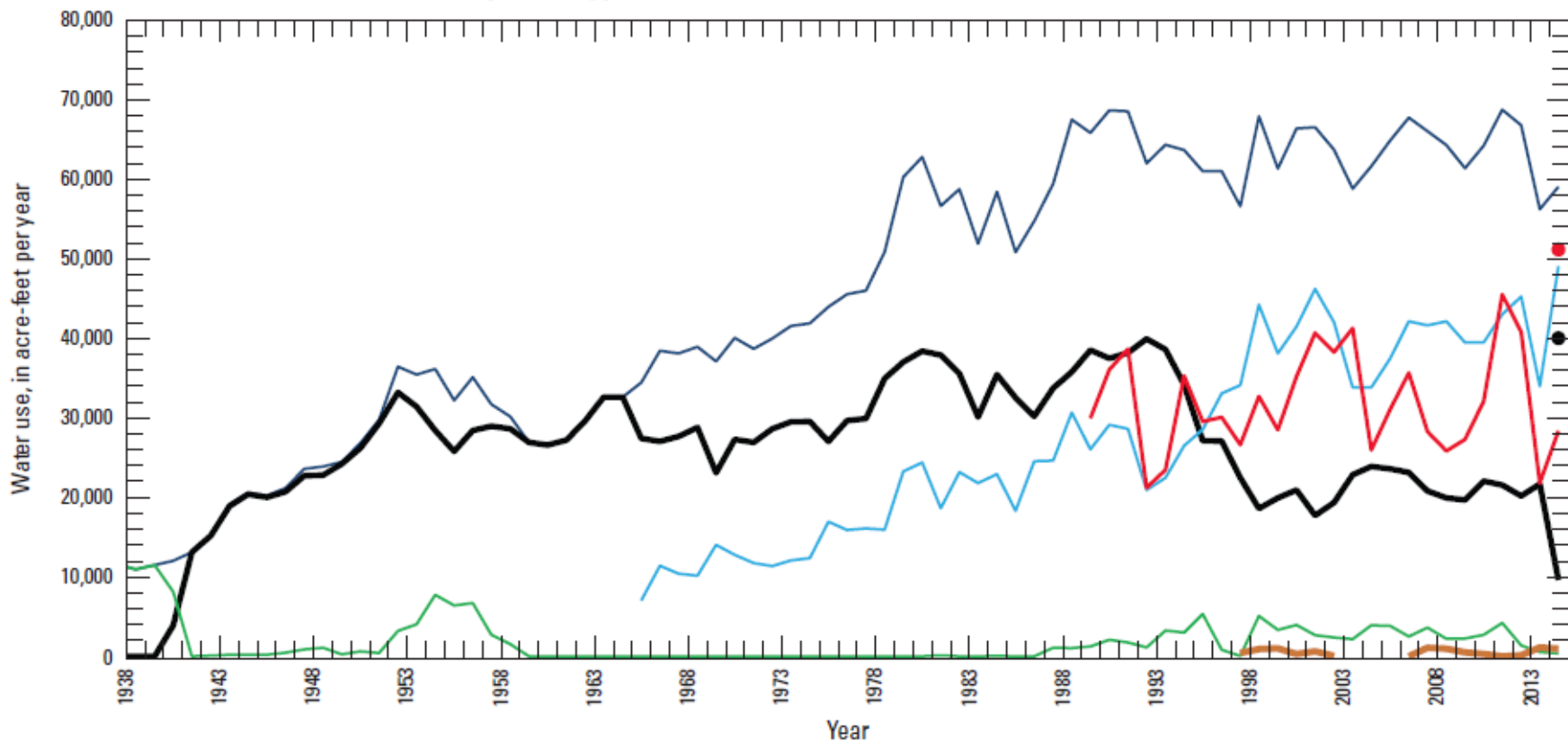
Groundwater-Level and Storage-Volume Changes in the *Equus* Beds Aquifer 15

Storage in Basin Storage Area: 2.4 million acre-feet

Storage in Central study Area: 1.0 million acre-feet.

1993 depletion: 0.12 million Acre-feet.

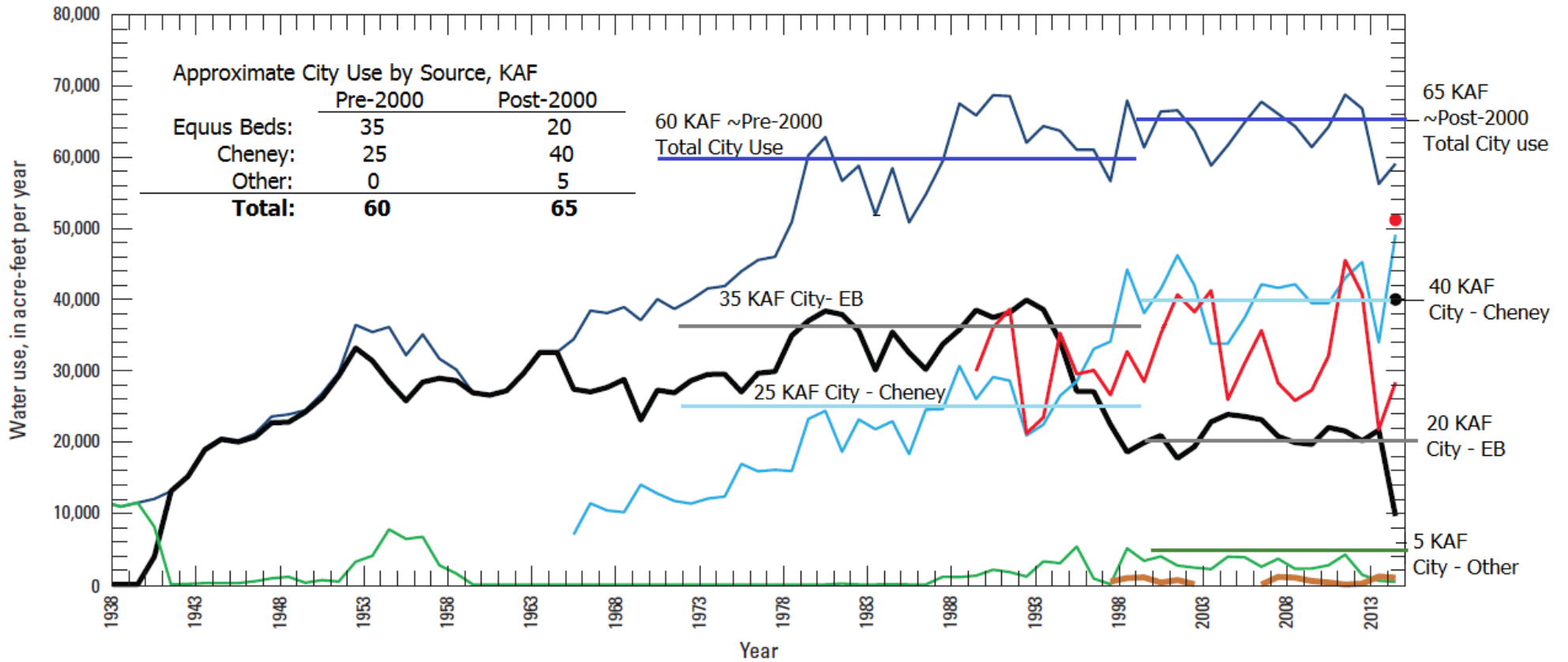
B. Water use for city of Wichita public supply and for agricultural irrigation



EXPLANATION

- Total city water use for public supply
- City surface-water use from Cheney Reservoir for public supply
- City artificial groundwater recharge
- Permitted groundwater use for agricultural irrigation in study area in 2014
- City groundwater use for public supply from study area
- City groundwater use for public supply from outside study area
- Estimated groundwater use for agricultural irrigation from study area
- Permitted groundwater use for city public supply with limitations in study area in 2014

Water use for city of Wichita public supply and for agricultural irrigation



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USGS, 2015
Modified by KDA-DWR
December 19, 2017

Table 1. Storage-volume changes in the *Equus Beds* aquifer near Wichita, Kansas, since predevelopment (pre 1940) and since 1993 to January 2016 for the study area, the basin storage area, and the central Wichita well field area.

[--, not applicable]

End of time period	Storage-volume changes	
	Since predevelopment (acre-feet)	Since 1993 (acre-feet)
Study area		
1993	¹ -195,000	--
January 2012	¹ -125,000	² 70,000
July 2012	¹ -175,000	² 20,000
January 2013	¹ -154,000	² 41,000
January 2014	¹ -116,000	² 79,000
January 2015	¹ -135,000	¹ 60,000
January 2016	-74,000	121,000
Basin storage area		
1993	¹ -188,000	--
January 2012	¹ -112,000	² 76,000
July 2012	¹ -155,000	² 33,000
January 2013	¹ -134,000	² 54,000
January 2014	¹ -108,000	² 80,000
January 2015	¹ -119,000	¹ 69,000
January 2016	-68,000	120,000
Central Wichita well field area		
1993	¹ -121,000	--
January 2012	¹ -59,000	² 62,000
July 2012	¹ -74,000	² 47,000
January 2013	¹ -69,000	² 52,000
January 2014	¹ -63,000	² 58,000
January 2015	¹ -65,000	¹ 56,000
January 2016	-41,000	80,000

¹Storage-volume change previously reported in Whisman and others (2015).

²Storage-volume change previously reported in Hansen and others (2014).

The Wichita well field has recovered 80,000 acre-feet of the 120,000 depletion in 1993.

Table 3 – MODSIM-DSS simulation results for the 1% drought resulting in an optimized raw water resource utilization strategy and the sustained viability of Cheney Reservoir

MODSIM-DSS Variable	Drought Year 1	Drought Year 2	Drought Year 3	Drought Year 4	Drought Year 5	Drought Year 6	Drought Year 7	Drought Year 8
Baseline City Demand (AF)	81,690	81,690	81,690	81,690	81,690	81,690	81,690	81,690
Simulated Hydrologic Year of Drought	1933	1934	1935	1936	1937	1938	1939	1940
Revised Demand from Drought Response Plan (AF)	81,262	72,492	71,116	71,890	70,812	70,811	71,116	70,664
Cheney % of Conservation Pool 12 Month Average	110%	92%	62%	59%	62%	53%	53%	63%
Demand Assigned to EBWF & ASR	34,202	45,651	59,907	46,732	56,579	41,980	39,308	39,491
Demand Assigned to Cheney Reservoir	47,060	26,841	11,209	25,158	14,233	28,831	31,808	31,173

Wichita future base demand = 81,690 AF/year

In drought, reduced to approx. 71,000 AF/year

Wichita plans to use its 40,000 AF native rights to full extent in long term drought.

Demands > 40,000 AF to be provided from ASR credits.

Are AMC's passive recharge credits?

From the CE's 2005 order:

- Finding #10. *“That on October 18, 2004, a pre-hearing order was issued by the Chief Engineer, setting forth the following issues to be addressed in the public hearing:
b. Will the City be considered to be recharging water into the Equus Beds by the concept of "passive recharge?" --i.e., **water which the City could have legally pumped, but did not pump.**”*
- Finding #42. *“The final amended M.O.U. between the City and GMD #2 did not contain an agreement or recommendation concerning the City's request for passive recharge credits (**credits for not pumping City wells in the basin storage area**) and deferred the matter to the Chief Engineer.”*
- To obtain AMC's under the draft proposal:
 - the water must be diverted and treated at their ASR facility within the approved rates and quantities authorized under File no 46,627
 - there must be inadequate space to store in the basin storage area
 - meet other conditions under development (e.g. cap on total credits, etc.)

Process ahead

- **The City** will work through its process, including continuing its work with DWR and GMD 2 staff, to **finalize its request** to include specifics for accounting and modeling, revised terms and conditions for the new applications currently on file as well as other ASR permits, with supporting technical work (for more detail, see #4 below).
- When the City's request and support work is complete, DWR will start its formal consideration by **sending the package to GMD 2 for review**. We will also post the documents on our web site for the general public.
- Notwithstanding DWR's public notice for the new applications, we want to make sure everyone is informed of the City's proposal and the public hearing. Per our discussion, this will include **publishing notice** of the hearing in area newspapers, posting details of the proposal on our web site, and a direct mailing to all those within 1,000 feet of the proposed points of diversion (existing municipal wells).

Process ahead (con't)

- We plan to hold a **hearing** approximately 45 days after providing the package to GMD 2. We anticipate there will be an informational meeting earlier on the same day.
- Due to the nature of the project, we will allow the GMD **two board meetings plus 10 days** following the public meeting **to complete its review and recommendations.** (corrected via email of 9/22/2017)
- Following receipt of GMD 2 recommendations, **DWR plans to process the pending new applications** within approximately 45 days.
- **Findings and Orders for existing ASR permits will be processed** in conjunction with the new application approvals, and will address proposed revisions to the 1993 aquifer levels and other revisions to the permit conditions.

What we expect from the City

What we expect from the City – The City’s proposal should include **details for accounting and modeling of AMCs** including how they will be distributed and tracked, how this accounting and modeling will interact with accounting and modeling of the recharge credits currently authorized, and a proposal for notice/reporting on source of pumping (i.e. water rights from Equus Beds aquifer, “normal” ASR credits, AMCs).

In addition, the City’s proposal should include **proposed permit conditions**. We are happy to work with you on developing these permit conditions

Potential terms and conditions

- Require all AMCs to be water diverted and treated at their ASR facility within the approved rates and quantities authorized under File no 46,627.
- Define under what conditions the City can pump this water directly to the City for credit (i.e. some definition of what cannot reasonably be stored, likely this will include limitations related to rates of intake and available storage capacity within the aquifer.
- A cap on AMC credits or total recharge credits.
- Provisions to minimize plume migration (e.g. the City will not pull credits from the Burrton area or they will be the last of the credits taken.
- Sequencing related to the use of credits.

Other potential conditions

- Ensuring other area native rights are protected from impairment by requiring the City to use pumping rotation and timing if conflicts occur.

Can the City fulfill their drought need under currently approved plan?

- Some have suggested the City should fulfill their drought purposes under their existing terms and conditions. They could do this.
- To build credits for drought, they would have to switch back to previous, lawful operations:
 - Reduce use of Cheney and
 - Increase use of their native ASR rights to lower the aquifer and make storage space available for generate of the needed credits.

Questions