SD–6 ADVISORY COMMITTEE REPORT
MARCH 28, 2019

This is a report on the SD-6 advisory committee meeting held on March 28, 2019 at the First State Bank of Hoxie meeting room.

The following topics were discussed:

Water use data
Water table information
Economic data
Violations, issues relating to violations, and metered data that relates to violations
New and preferable enhancement management options
Other items (meter alternative discussion)

In addition to information on the above subjects a copy of the SD-6 Order of Designation was provided to those in attendance.

Following are the minutes of that meeting:

MINUTES
SD-6 Advisory Committee Meeting
March 28th, 2019
2:00 PM @ First State Bank in Hoxie, KS

Those in attendance: Gary Moss, Stuart Beckman, Dennis Rogers, Roch Meier, Brett Oelke, Grant Gaede, Kelly Stewart, Steven Walters, Shannon Kenyon, Ray Luhman.

Those absent: Mitchell Baalman, Sharon Munk

1. Water Use Data
   Ray Luhman distributed copies of the spreadsheet showing individual water rights showing how much water was pumped in 2018 and how much each had left in their five-year allocation. He will be sending out letters next week informing water use correspondents of their remaining four-year balance.

2. Water Table Information
   Several sets of data were distributed and discussed. KGS's Interpolated Change in Feet, Cooperative Level Network 2018-2019 was reviewed by the committee. Index wells within the SD 6 LEMA were discussed as well as observation wells measured in the area.

3. Economic Data
   The Final Report 2013-2017 of "Monitoring the Impacts of Sheridan County 6 Local Enhanced Management Area" was distributed to committee members. It was noted that

not much had changed from previous years and that it was unknown if the study would continue.

4. Violations
   Copies of the violations of both the SD 6 and GMD 4 LEMA were distributed. The main topic of interest was meters. DWR is tightening the penalties for those who fail to read their meters throughout the irrigation season and will be fining users $500 beginning in 2019. Alternative meters were discussed with preference given to log books and AgSense.

5. New and Preferable Enhancement Management Options
   Not applicable at this time.

It was noted that the annual meetings will now be held in the spring, and that Mitchell Baalman and Brett Oelke had switched positions for the advisory committee.

A copy of the committee packet with attachments accompanies this report.

ANNUAL SD-6 ADVISORY COMMITTEE MEETING
2:00 CDT
Thursday March 28, 2019

First State Bank, Hoxie Basement

i. Water use data

ii. Water table information

iii. Economic data

iv. Violations, issues relating to violations, and metered data that relates to violations

v. New and preferable enhancement management options

vi. Other items (meter alternative discussion)

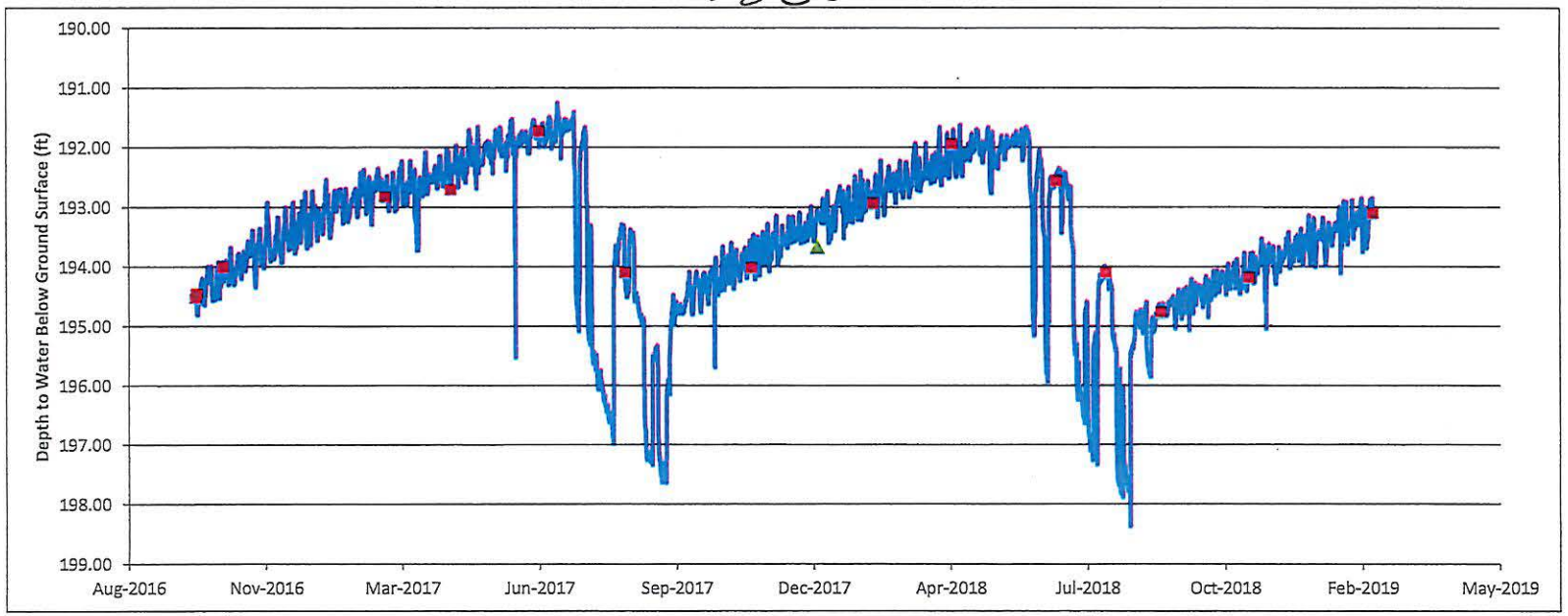
WR_NUM		WR	WR_NUM	WR	UMW	PDIV_ID	TWP	RNG	SE(	DV	APPR	NET	5 YR	5YR_2	LIMITING CLAUSE	END 2017	END 2018	2018 PUMP	5 YR BALANCE
4481	4481	00	16567	00	IRR	12958	8	29	1	3	198.0	198.0	655		COMB 4481,13826,16730,17851,20737,20785,22868D2,24344,29032 5156 AF	731.112	827	95.888	COMB
13826	13826	00			IRR	20490	7	28	20	1	300.0	300.0	502		COMB 4481,13826,16730,17851,20737,20785,22868D2,24344,29032 5156 AF	334.652	424	89.348	COMB
16730	16730	00			IRR	35961	8	29	12	2	160.0	160.0	404		COMB 4481,13826,16730,17851,20737,20785,22868D2,24344,29032 5156 AF	699.298	743	43.702	COMB
17851	17851	00			IRR	35833	7	29	25	3	300.0	300.0	644		COMB 4481,13826,16730,17851,20737,20785,22868D2,24344,29032 5156 AF	285.889	389	103.111	COMB
20737	20737	00			IRR	17534	7	29	24	1	284.0	284.0	806		COMB 4481,13826,16730,17851,20737,20785,22868D2,24344,29032 5156 AF	230.171	320	89.829	COMB
20785	20785	00			IRR	25860	7	28	21	2	245.0	245.0	644		COMB 4481,13826,16730,17851,20737,20785,22868D2,24344,29032 5156 AF	438.074	544	105.926	COMB
22868	22868	D2			IRR	22649	7	29	25	4	312.0	312.0	644		COMB 4481,13826,16730,17851,20737,20785,22868D2,24344,29032 5156 AF	617.907	739	121.093	COMB
24344	24344	00			IRR	32929	8	29	1	2	240.0	240.0	529		COMB 4481,13826,16730,17851,20737,20785,22868D2,24344,29032 5156 AF	177.031	261	83.969	COMB
29032	29032	00			IRR	34244	7	28	21	5	120.0	120.0	328	5156	COMB 4481,13826,16730,17851,20737,20785,22868D2,24344,29032 5156 AF	468.444	516	47.556	4375.578
4889	4889	00			IRR	3530	7	30	25	1	329.0	329.0	610		COMB 4889, 8725, 10907, 17346, 17349, 21207, 39275 4269 AF	847.2	923	75.8	COMB
8725	8725	00			IRR	3595	8	30	2	1	310.0	310.0	610		COMB 4889, 8725, 10907, 17346, 17349, 21207, 39275 4269 AF	102.967	185	82.033	COMB
10907	10907	00			IRR	10503	7	30	24	2	329.0	329.0	620		COMB 4889, 8725, 10907, 17346, 17349, 21207, 39275 4269 AF	383.821	508	124.179	COMB
17346	17346	00			IRR	46433	7	30	26	1	320.0	320.0	620		COMB 4889, 8725, 10907, 17346, 17349, 21207, 39275 4269 AF	577.129	690	112.871	COMB
17349	17349	00			IRR	31781	7	30	26	3	260.0	260.0	620		COMB 4889, 8725, 10907, 17346, 17349, 21207, 39275 4269 AF	749.184	862	112.816	COMB
21207	21207	00			IRR	18519	8	30	2	3	317.0	317.0	569		COMB 4889, 8725, 10907, 17346, 17349, 21207, 39275 4269 AF	642.944	712	69.056	COMB
39275	39275	00			IRR	52210	7	30	25	3	198.0	198.0	620	4269	COMB 4889, 8725, 10907, 17346, 17349, 21207, 39275 4269 AF	646.833	727	80.167	3612.078
5115	5115	00			IRR	16394	7	30	29	1	480.0	480.0	606			62.417	98	35.583	570.417
7188	7188	00			IRR	3724	7	30	24	1	395.0	395.0	617		COMB 7188, 16344, 16503, 20132, 39035 3248 AF	194.588	283	88.412	COMB
16344	16344	00			IRR	35872	8	29	6	4	324.0	324.0	617		COMB 7188, 16344, 16503, 20132, 39035 3248 AF	37464000	68985200	96.7350108	COMB
16503	16503	00			IRR	54974	7	30	23	1	320.0	320.0	617		COMB 7188, 16344, 16503, 20132, 39035 3248 AF	135.281	227	91.719	COMB
20132	20132	00			IRR	19153	7	29	30	2	298.0	298.0	780		COMB 7188, 16344, 16503, 20132, 39035 3248 AF	646.659	722	75.341	COMB
39035	39035	00			IRR	160	7	30	24	4	240.0	240.0	617	3248	COMB 7188, 16344, 16503, 20132, 39035 3248 AF	47125500	47125500	0	2860.209989
7242	7242	00	38654	00	IRR	49677	7	28	19	2	220.0	220.0	628			287.101	328	40.899	587.101
7262	7262	00			IRR	3504	7	29	18	1	320.0	320.0	1102		MAX 1102 W/28205	957.6	957.6	0	1102
28205	28205	00			IRR	1108	7	29	18	3	359.0	359.0	OL		MAX 1102 W/7262	759.3	759.3	0	OL
7606	7606	00			IRR	30042	8	30	13	1	320.0	320.0	592		0	760.634	871	110.366	481.634
7699	7699	00	9021	00	IRR	2377	7	30	25	2	310.0	310.0	600			83.697	170	86.303	513.697
7757	7757	00			IRR	19124	7	29	17	1	320.0	320.0	600			565.4	647	81.6	518.4
8088	8088	00			IRR	31930	8	29	17	1	320.0	320.0	600			717.266	774	56.734	543.266
8188	8188	00			IRR	30863	7	30	33	1	560.0	560.0	1004			160.399	309.105	148.706	855.294
8249	8249	00			IRR	74305	7	29	30	1	320.0	320.0	609			924.691	48	123.309	485.691
8496	8496	00			IRR	36799	7	30	29	3	480.0	480.0	1255			802.168	918	115.832	1139.168
8859	8859	00			IRR	53552	7	29	17	2	320.0	320.0	578			267.17	371	103.83	474.17
8886	8886	00			IRR	5989	7	29	4	1	200.0	200.0	595		COMB 8886, 22294 1195 AF	283.946	379	95.054	OL
22294	22294	00			IRR	36589	7	29	8	1	222.0	222.0	600	1195	COMB 8886, 22294 1195 AF	137.822	271	133.178	966.768
9333	9333	00			IRR	6990	7	28	21	1	236.0	236.0	617			592.997	703	110.003	506.997
9484	9484	00			IRR	26692	7	29	16	1	451.0	451.0	900			706.4	706.4	0	900
9750	9750	00			IRR	6097	7	29	16	2	700.0	700.0	1168			538.869	681	142.131	1025.869
9981	9981	00	17360	00	IRR	32874	7	29	4	2	309.0	309.0	789			921900000	964569000	130.946353	658.0536472
10497	10497	00			IRR	12627	7	29	27	1	310.0	310.0	600			301.09	411	109.91	490.09
10558	10558	00			IRR	8142	7	30	35	1	320.0	320.0	829			276.809	322	45.191	783.809
10612	10612	00			IRR	13111	7	29	32	1	320.0	320.0	600			262.641	333	70.359	529.641
10916	10916	00			IRR	25476	8	30	13	2	320.0	320.0	622			356.148	435	78.852	543.148
10918	10918	00			IRR	26789	8	30	11	1	296.0	296.0	600			955.71	26	70.29	529.71
11024	11024	00			IRR	18890	8	29	4	1	200.0	200.0	584			63438600	78229200	45.3906847	538.6093153
11225	11225	00			IRR	84315	7	29	22	1	431.0	346.0	485			428.793	476.23	47.437	437.563
11226	11226	00			IRR	1077	7	29	21	1	320.0	320.0	677			160.714	308	147.286	529.714
11234	11234	00			IRR	30601	8	31	27	1	247.0	247.0	600			794.69	934	139.31	460.69
13558	13558	00			IRR	30217	8	30	11	2	320.0	320.0	600			364.666	460	95.334	504.666
13559	13559	00			IRR	37880	8	30	3	1	320.0	320.0	622			132.678	213	80.322	541.678
14071	14071	00			IRR	50282	8	29	3	6	374.0	374.0	600			89853700	14383700	75.2798058	524.7201942
14072	14072	00			IRR	61523	8	29	4	4	248.0	248.0	551			41742500	67908700	80.3011192	470.6988808
14103	#N/A	00			IRR	76583	7	29	28	1	204.0	204.0	502			NO IRR USE		0	502
14245	14245	00			IRR	26685	8	29	14	1	309.0	309.0	1176		MAX 1176 W/27211	319.32	40960100	125.700951	948.8528296
27211	27211	00			IRR	18097	8	29	14	2	228.0	228.0	OL		MAX 1176 W/14245	248.065	33056600	101.446219	OL
14629	14629	00			IRR	16156	8	30	1	1	300.0	300.0	551			62383100	5619500	132.687639	418.3123606
15050	15050	00			IRR	40527	8	29	12	1	280.0	280.0	518			84.471	165	80.529	437.471
15082	15082	00			IRR	7640	7	28	32	1	320.0	320.0	597			491.346	608	116.654	480.346
15208	15208	00			IRR	9766	7	29	22	2	308.0	308.0	502			897.695	928	30.305	471.695

WR_NUM		WR_	WR_NUM	WR_	UMW	PDIV_ID	TWP	RNG	SEC	DV	APPR	NET	5 YR	5YR_2	LIMITING CLAUSE	END 2017	END 2018	2018 PUMP	5 YR BALANCE
15235	15235	00			IRR	34746	7	29	19	1	420.0	420.0	578			315.558	414	98.442	479.558
16095	16095	00			IRR	42224	7	29	25	1	320.0	320.0	583			379.733	490	110.267	472.733
16096	16096	00			IRR	4022	7	29	26	1	690.0	690.0	1162			565.328	697	131.672	1030.328
16288	16288	00			IRR	23770	8	30	16	1	459.0	459.0	1681		MAX 1681 W/26239	217.714	351.47	133.756	1410.05
26239	26239	00	32615	00	IRR	37367	8	30	16	3	318.0	318.0	OL		MAX 1681 W/16288	687.502	824.696	137.194	OL
16315	16315	00			IRR	80684	8	31	34	1	320.0	320.0	600			455.073	574	118.927	481.073
16602	16602	00			IRR	26450	8	29	7	1	288.0	288.0	1042			460.759	499	38.241	1003.759
16631	16631	00			IRR	71606	8	30	5	6	266.0	266.0	600			475.769	576	100.231	499.769
16725	16725	D1			IRR	39366	7	29	32	2	320.0	320.0	600			161.618	237	75.382	524.618
16725	16725	D2			IRR	41462	7	29	33	2	320.0	320.0	1740		MAX 1740 W/23340	70327600	10310700	122.703628	1544.736828
23340	23340	00			IRR	37968	8	29	5	2	296.0	296.0	OL		MAX 1740 W/16725 D2	60584200	84227800	72.5595441	OL
16865	16865	00			IRR	9876	7	29	29	1	358.0	358.0	1053			9070	10459	115.75	937.25
16903	16903	00			IRR	9282	8	30	4	1	320.0	320.0	622			767.469	803	35.531	586.469
16904	16904	00			IRR	40161	8	30	4	2	265.0	265.0	582			606.835	676	69.165	512.835
16920	16920	00			IRR	45187	7	29	25	2	315.0	315.0	622			525.968	612	86.032	535.968
17204	17204	00			IRR	37865	7	28	32	2	320.0	320.0	597			183.687	299	115.313	481.687
17348	17348	00			IRR	41079	7	30	26	2	260.0	260.0	600			296.161	401	104.839	495.161
17350	17350	00			IRR	2252	7	30	33	2	248.0	248.0	591			466.393	601	134.607	456.393
17650	17650	00			IRR	1370	8	31	36	1	300.0	300.0	751		COMB 17650 & 31024 1373 AF	316.568	389	72.432	OL
31024	31024	00			IRR	15540	8	31	36	2	320.0	320.0	622	1373	COMB 17650 & 31024 1373 AF	376.945	453	76.055	1224.513
17698	17698	00			IRR	13742	8	29	4	3	324.0	324.0	622			66414600	83624500	52.8152438	569.1847562
17740	17740	00			IRR	16412	8	29	18	1	320.0	320.0	600			920.452	951	30.548	569.452
17759	17759	00			IRR	46872	8	29	18	2	290.0	290.0	628			669.235	741	71.765	556.235
17795	17795	00			IRR	7478	7	29	27	2	274.0	274.0	600			12700	12179500	37.3385382	562.6614618
17811	17811	00			IRR	37899	8	30	9	3	320.0	320.0	600			537.646		0	600
17812	17812	00			IRR	35060	8	30	9	2	320.0	320.0	562			533.024		0	562
18371	18371	00			IRR	1779	8	31	23	1	297.0	297.0	617			323.768	400	76.232	540.768
18713	18713	00			IRR	54599	8	30	5	2	286.0	286.0	1167		MAX 1167W/ 20298	339.758	452	112.242	995.154
20298	20298	00			IRR	29277	8	30	5	4	282.0	282.0	OL		MAX 1167 W/ 18713	653.396	713	59.604	OL
18803	18803	00			IRR	13564	8	29	9	1	363.0	363.0	600			104.712	189	84.288	515.712
18864	18864	00			IRR	52832	7	30	28	1	338.0	338.0	1233			642.629	762	119.371	1113.629
18865	18865	00			IRR	71065	8	30	4	5	114.0	114.0	592			391.279	452	60.721	531.279
18961	18961	00			IRR	17693	8	30	14	1	270.0	270.0	600			972.212	16	43.788	556.212
19049	19049	00			IRR	54068	7	29	31	1	291.0	291.0	578			96.097	189	92.903	485.097
19074	19074	00			IRR	35096	8	29	15	1	247.0	247.0	565			280.302	375	0.00029062	564.9997094
19084	19084	00			IRR	18383	8	30	5	3	149.0	149.0	600		MAX 600 W/23903	612.604	696	83.396	498.851
23903	23903	00			IRR	31978	8	30	5	5	118.0	118.0	OL		MAX 600 W/19084	640.247	658	17.753	OL
19085	19085	00			IRR	28796	8	30	9	4	145.0	145.0	600		MAX 600 W/20653	178.243	237	58.757	510.017
20653	20653	00			IRR	15471	8	30	9	5	175.0	175.0	OL		MAX 600 W/19085	722.774	754	31.226	OL
19198	19198	00			IRR	34393	8	30	12	1	320.0	320.0	600			539.047	650	110.953	489.047
19222	19222	00			IRR	25652	8	30	11	3	315.0	315.0	600			420.324	506	85.676	514.324
19687	19687	00			IRR	18337	8	29	10	1	320.0	320.0	622			95400100	24341400	88.8175884	533.1824116
19716	19716	00			IRR	6715	7	29	32	3	202.0	202.0	600			69442000	96575500	83.2696539	516.7303461
19770	19770	00			IRR	49765	8	29	3	2	320.0	320.0	600			266.043	311	44.957	555.043
19914	19914	00			IRR	4011	8	29	11	1	225.0	225.0	457			684.583	759	74.417	382.583
19915	19915	00			IRR	11655	7	30	30	2	316.0	316.0	557			658.134	747	88.866	468.134
20003	20003	00			IRR	24456	8	29	9	2	342.0	342.0	600			481.907	587	105.093	494.907
20012	20012	00			IRR	20739	7	29	17	3	300.0	300.0	653		20012, 33972, 34510 1749 AF	0	148	148	OL
33972	33972	00			IRR	37325	7	29	6	1	256.0	256.0	558			85.493	138	52.507	OL
34510	34510	00			IRR	5333	7	29	6	2	256.0	256.0	538	1749		848.679	981	132.321	1416.172
20023	20023	00			IRR	21512	8	29	3	3	318.0	318.0	600			561.01	645	83.99	516.01
20031	20031	00			IRR	10125	7	28	30	1	286.0	286.0	597			173402000	219904000	142.709398	454.2906021
20032	20032	00			IRR	5215	7	28	32	3	312.0	312.0	606			444.016	563	118.984	487.016
20151	20151	00	42374	00	IRR	11296	7	29	18	4	301.0	301.0	655			643.4	643.4	0	655
20297	20297	00			IRR	29875	8	30	12	2	320.0	320.0	600			554.394	649	94.606	505.394
20400	20400	00			IRR	2360	7	28	29	1	289.0	289.0	600			681.773	756	74.227	525.773
20417	20417	00			IRR	44094	7	28	29	2	270.0	270.0	632			183.391	316	132.609	499.391

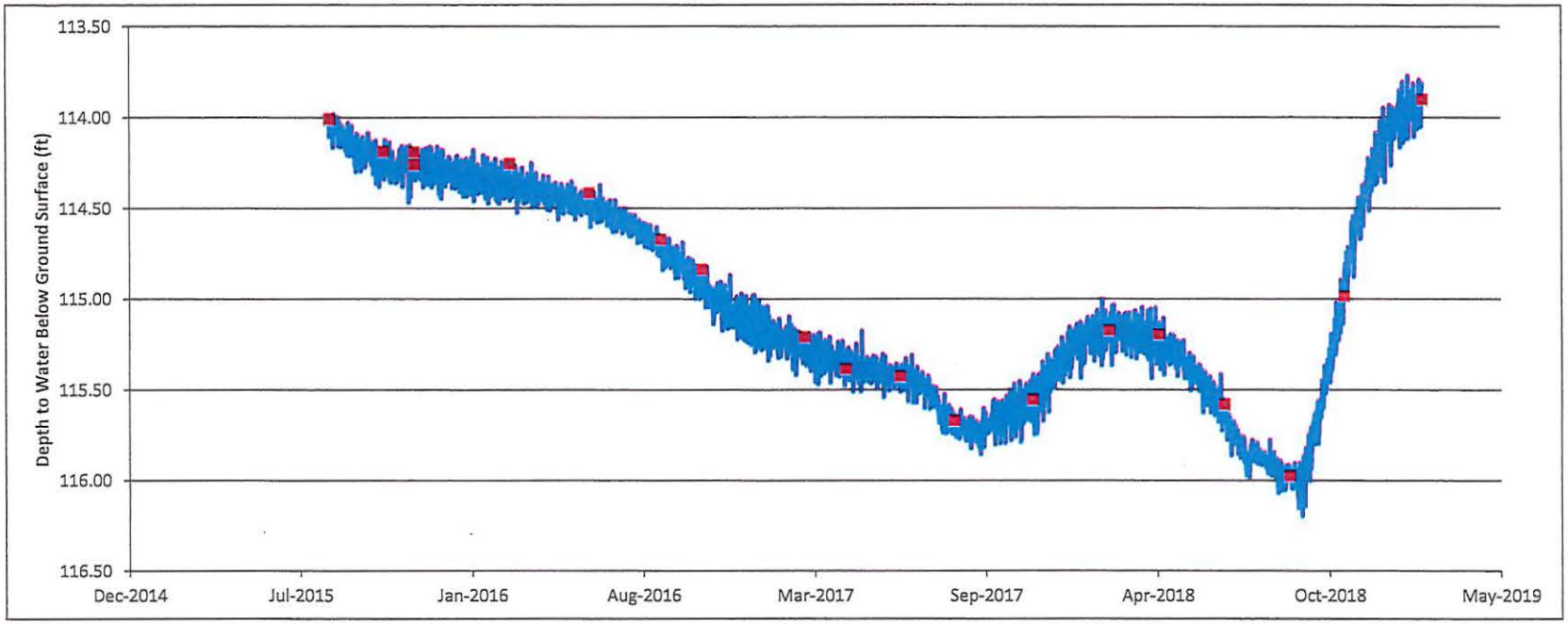
WR_NUM		WR_	WR_NUM	WR_	UMW	PDIV_ID	TWP	RNG	SEC	DV	APPR	NET	5 YR	5YR_2	LIMITING CLAUSE	END 2017	END 2018	2018 PUMP	5 YR BALANCE	
20464	20464	00			IRR	14543	7	30	26	4	360.0	360.0	600			337.085	422	84.915	515.085	
20480	20480	00			IRR	7111	8	30	16	2	480.0	480.0	1166			381.527	484.785	103.258	1062.742	
20612	20612	00			IRR	23036	8	30	4	4	314.0	314.0	606			463.646	531	67.354	538.646	
20973	20973	00			IRR	49340	7	29	27	3	298.0	298.0	600			425.649	539	113.351	486.649	
21019	21019	00			IRR	7911	8	30	7	2	175.0	175.0	600			96466800		0	600	
21019	21019	00			IRR	69953	8	30	7	3	264.0	264.0	600			64233600		0	600	
21057	21057	00			IRR	28341	7	30	30	1	320.0	320.0	628			358.249	469	110.751	517.249	
21189	21189	00	23695	00	IRR	39547	8	30	15	2	420.0	420.0	2021		MAX 2021 W/ 21189, 23695, 27915	683.493	771	87.507	1785.882	
21189	21189	00	23695	00	IRR	52338	8	30	15	1	408.0	408.0	OL		MAX 2021 W/ 21189, 23695, 27915	918.162	12	93.838	OL	
27915	27915	00			IRR	18953	8	30	15	3	240.0	240.0	OL		MAX 2021 W/ 21189, 23695, 27915	254.227	308	53.773	OL	
21191	21191	00			IRR	19936	7	29	21	2	320.0	320.0	600		0	473.027	473.027	0	600	
21279	21279	00			IRR	9104	8	30	14	2	344.0	344.0	600			437.48	505	67.52	532.48	
21316	21316	00			IRR	42532	8	30	2	2	320.0	320.0	622			136.194	228	91.806	530.194	
21627	21627	00			IRR	9689	8	30	6	2	320.0	320.0	584			75.641	166	90.359	493.641	
21628	21628	00			IRR	20584	8	30	6	3	320.0	320.0	578			576.082	644	67.918	510.082	
22083	22083	00	39567	00	IRR	4201	8	30	1	2	218.0	218.0	600			434.191	528	93.809	506.191	
22226	22226	00			IRR	16466	7	30	33	3	266.0	266.0	600			353.319	421	67.681	532.319	
22409	22409	00			IRR	38070	8	30	8	1	282.0	282.0	1200			418.451	514	95.549	1104.451	
22529	22529	00			IRR	10944	7	29	33	4	310.0	310.0	600			16813800	50785100	104.254092	495.7459084	
22669	22669	00			IRR	49418	7	28	33	1	296.0	296.0	802		22669 & 25905 1402 AF	797.695	917	119.305	OL	
25905	25905	00			IRR	43381	7	28	20	2	301.0	301.0	600	1402		382.452	491	108.548	1174.147	
22868	22868	D1			IRR	44564	7	28	30	2	293.0	293.0	704			48.119	112	63.881	640.119	
22868	22868	D2			IRR	22649	7	29	25	4	312.0	312.0	644			617.907	739	121.093	522.907	
22940	22940	00			IRR	26793	7	29	21	3	298.0	298.0	646			672.197	755	82.803	563.197	
22982	22982	00			IRR	29626	7	29	21	4	150.0	150.0	355			11.996	42	30.004	324.996	
23175	23175	00			IRR	8936	8	30	13	3	314.0	314.0	617			591.413	663	71.587	545.413	
23177	23177	00			IRR	23308	8	29	9	3	311.0	311.0	600			84797000	21817700	113.612357	486.3876434	
23311	23311	00			IRR	85835	8	31	25	3	115.0	115.0	550			16.617	14	17	533	
23719	23719	00			IRR	25422	8	31	27	2	290.0	290.0	592			672.921	785	112.079	479.921	
23823	23823	00	27891	00	IRR	17914	8	30	3	2	512.0	512.0	1153		MAX 1153 W/30477	952.235	125.53	173.295	979.705	
30477	30477	00			IRR	44911	8	30	3	3	124.0	124.0	OL		MAX 1153 W/23823	618.457	618.457	0	OL	
23949	23949	00			IRR	26036	7	30	27	1	518.0	518.0	1233			408.833	546	137.167	1095.833	
24124	24124	00			IRR	43477	7	30	28	2	294.0	294.0	606			323.771	391	67.229	538.771	
24142	24142	00			IRR	16620	7	29	22	3	160.0	160.0	592			415.857	523.863	108.006	483.994	
24353	24353	00			IRR	9280	7	29	34	1	210.0	210.0	1337		MAX 1337 W/24353	119.004	206	86.996	1157.286	
24353	24353	00			IRR	31460	7	29	34	2	246.0	246.0	OL		MAX 1337 W/24353	198.282	291	92.718	OL	
24354	24354	00			IRR	45882	7	29	34	3	233.0	233.0	1113		MAX 1113 W/24354	454.059	520	65.941	961.715	
24354	24354	00			IRR	48068	7	29	34	4	219.0	219.0	OL		MAX 1113 W/24354	313.656	399	85.344	OL	
24491	24491	00			IRR	25805	8	29	10	2	320.0	320.0	608			585.251	692	106.749	501.251	
24654	24654	00			IRR	21255	8	30	12	3	272.0	272.0	600			470.76	564	93.24	506.76	
24656	24656	00			IRR	47561	8	30	14	3	264.0	264.0	600			495.034	572	76.966	523.034	
25107	25107	00			IRR	15070	8	30	10	1	528.0	528.0	2376		MAX 2376 W/25107	0.676	120	119.324	2120.337	
25107	25107	00			IRR	22590	8	30	10	2	264.0	264.0	OL		MAX 2376 W/25107	483.661	620	136.339	OL	
25173	25173	00			IRR	26420	7	30	36	2	320.0	320.0	673			694.104	818	123.896	549.104	
25822	25822	00			IRR	69668	7	30	32	3	234.0	234.0	606			668.618	714	45.382	560.618	
26219	26219	00			IRR	2828	7	29	26	2	306.0	306.0	617			542.676		79	538	
26429	26429	00			IRR	29122	7	30	32	2	534.0	326.0	606			231.037	287	55.963	550.037	
26467	26467	00			IRR	32536	7	30	36	3	266.0	266.0	673			711.991	841	129.009	543.991	
26541	26541	00			IRR	50429	7	29	35	1	309.0	309.0	600			645.221	771	125.779	474.221	
27686	27686	00			IRR	51134	7	30	34	1	290.0	290.0	873			777.51	882	104.49	768.51	
27856	27856	00			IRR	9350	7	30	24	3	287.0	287.0	609			807.883	919	111.117	497.883	
27926	27926	00			IRR	42956	7	30	22	1	522.0	522.0	1200			488.526	584	95.474	1104.526	
28008	28008	00			IRR	40395	8	29	3	4	274.0	274.0	595			457.869	518	60.131	534.869	
28097	28097	00			IRR	7488	7	30	29	4	260.0	260.0	600			57.419		0	600	
28101	28101	00			IRR	20779	7	30	27	2	320.0	320.0	1200			132.989		0	1200	
29211	29211	00			IRR	25246	8	29	10	3	271.0	271.0	600			112.601	192	79.399	520.601	
30119	30119	00			IRR	6348	8	29	2	1	360.0	360.0	900			930.002	42	111.998	788.002	
30397	30397	00			IRR	27831	8	31	24	2	244.0	244.0	600			568.327		0	600	

WR_NUM		WR_	WR_NUM	WR_	UMW_	PDIV_ID	TWP	RNG	SE(	D\	APPR	NET	5 YR	5YR_2	LIMITING CLAUSE	END 2017	END 2018	2018 PUMP	5 YR BALANCE
30537	30537	00			IRR	51707	7	29	29	2	226.0	226.0	600			336.955	420	83.045	516.955
30629	30629	00			IRR	39093	8	30	1	3	218.0	218.0	1102			98.304	199	100.696	1001.304
30630	30630	00			IRR	81865	8	29	7	2	208.0	208.0	513			625.17	688	62.83	450.17
30752	30752	00			IRR	51584	7	29	8	2	416.0	416.0	993			161.822	316	154.178	838.822
31585	31585	00			IRR	48657	7	29	26	3	212.0	212.0	600			89853700	12477800	69.4308135	530.5691865
31634	31634	00			IRR	33231	7	29	31	2	496.0	496.0	1133			767.66	920	152.34	980.66
32038	32038	00			IRR	51209	8	31	35	2	207.0	207.0	600			669.014	727	57.986	542.014
32045	32045	00			IRR	13049	8	30	11	4	332.0	332.0	600			503.973	568	64.027	535.973
33467	33467	00			IRR	43222	8	30	13	4	182.0	182.0	617			27925100	47816700	61.0450789	555.9549211
33798	33798	00			IRR	18222	8	29	6	2	530.0	530.0	1004			94992800	45932900	156.329427	847.6705734
36040	36040	00			IRR	53297	7	29	5	1	222.0	222.0	566			294.897	431	136.103	429.897
37665	37665	00			IRR	12879	7	28	31	1	290.0	290.0	1055			12825200	12825200	0	1055
44489	44489	00			IRR	65616	8	29	4	5	172.0	172.0	693			30956000	66216700	108.211115	584.7888851
													1E+05						
14103		00			STK	76583	7	29	28	1	99.8	99.8	499	460		0	0	59686690	183.171726	276.8282743
16605		00			STK	61017	7	29	33	5	198.0	198.0	990	0		0	51530200	69915700	56.4230277	
16605		00			STK	15202	7	29	33	1	198.0	0.0	0	0		0	11716900	22966500	34.5237547	
16865		00			STK	9876	7	29	29	1	190.0	190.0	950	965		0	282588000	341540000	180.917045	784.0829551
21315		00			STK	72563	7	29	33	6	215.0	215.0	1075	0		0	80530300	50450000	214.57568	
21315		00			STK	793	7	29	33	3	215.0	0.0	0	0		0	65616400	65616400	0	
42102		00			STK	17786	8	31	36	3	25.0	25.0	125	0		0				
42102		00			STK	6056	8	31	36	5			0	0		0	43530500	49669000	18.8383648	
42102		00			STK	15888	8	31	36	4			0	0		0	77169500	81017000	11.8075439	
45385		00			REC	68306	8	30	18	3	7.5	7.5	33.75	33.75		0	4682960	5574420	2.73579028	31.01420972
													3E+05						
																194	187	16,234	109,083
																		15531.1896	107991.2274

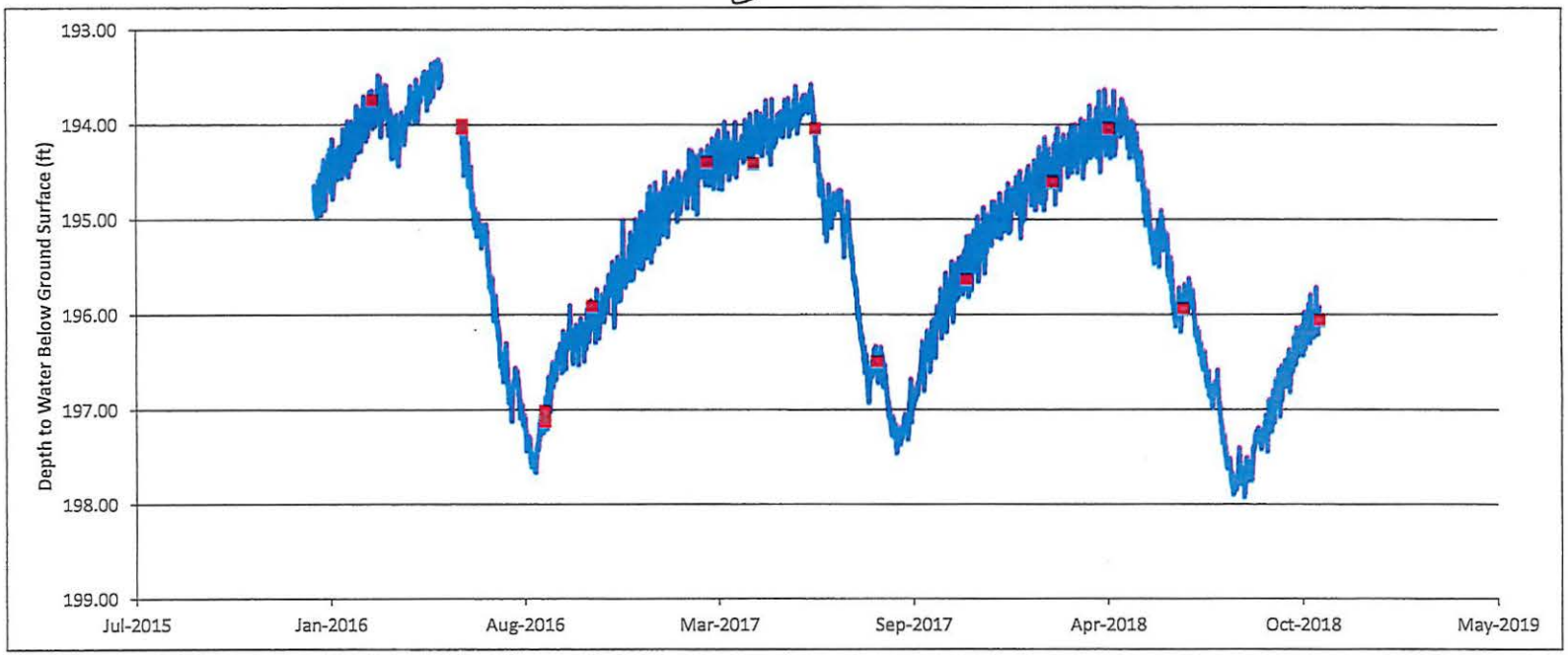
SEEG MILLER


Depth to Water Below Ground Surface (ft)
190.00
191.00
192.00
193.00
194.00
195.00
196.00
197.00
198.00
199.00
Aug-2016
Nov-2016
Mar-2017
Jun-2017
Sep-2017
Dec-2017
Apr-2018
Jul-2018
Oct-2018
Feb-2019
May-2019

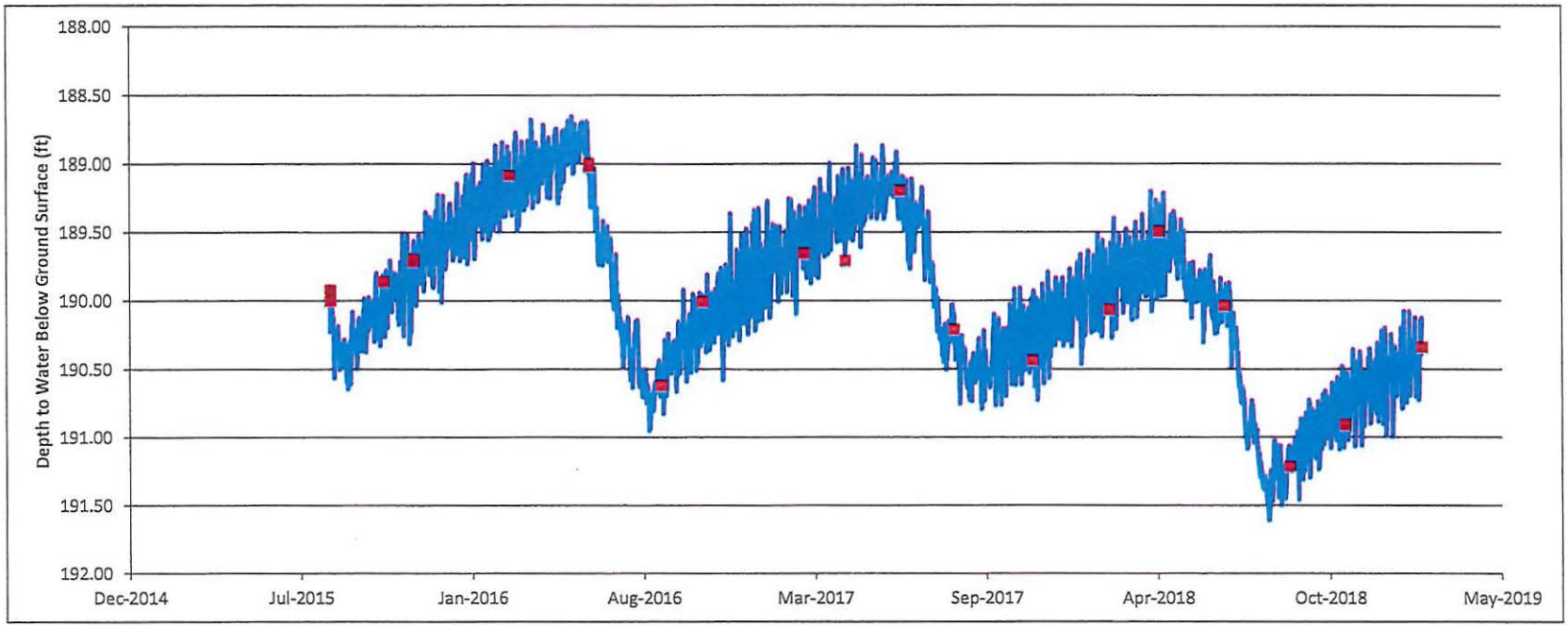
STEIGER


Depth to Water Below Ground Surface (ft)
113.50
114.00
114.50
115.00
115.50
116.00
116.50
Dec-2014
Jul-2015
Jan-2016
Aug-2016
Mar-2017
Sep-2017
Apr-2018
Oct-2018
May-2019

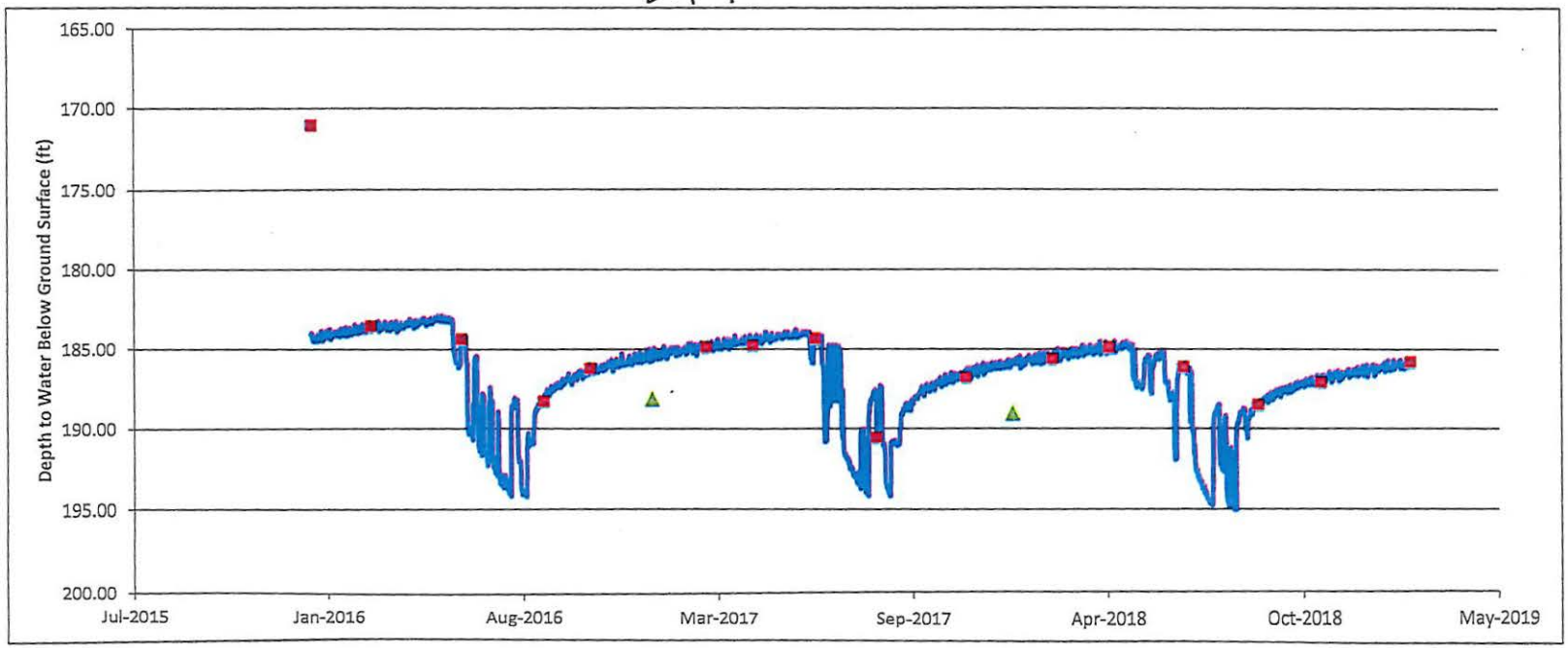
BECKMAN


193.00
194.00
195.00
196.00
197.00
198.00
199.00
Depth to Water Below Ground Surface (ft)
Jul-2015
Jan-2016
Aug-2016
Mar-2017
Sep-2017
Apr-2018
Oct-2018
May-2019

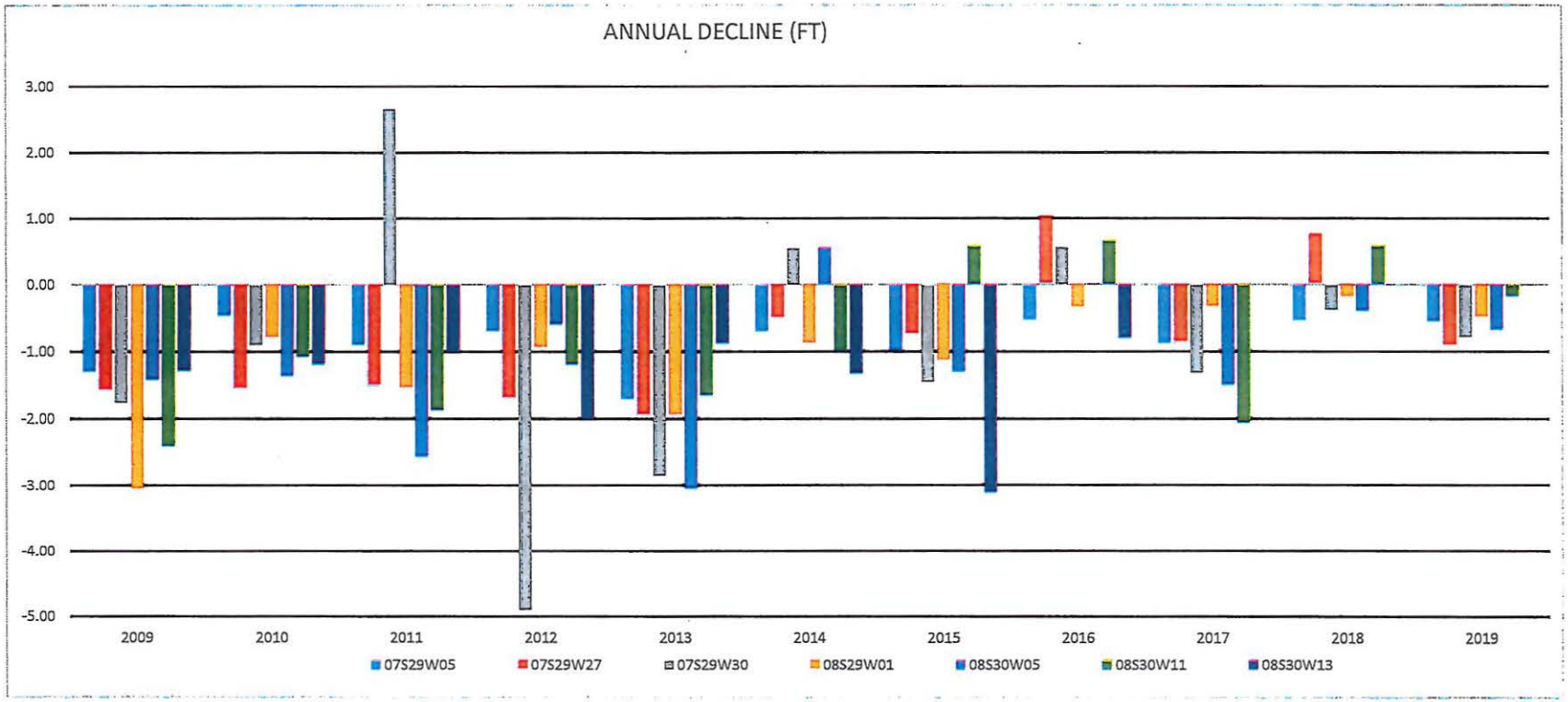
Moss

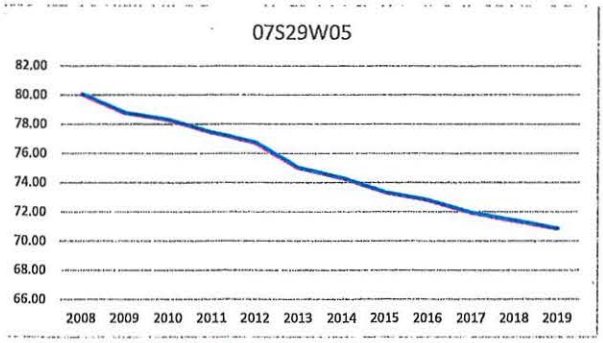

Depth to Water Below Ground Surface (ft)
188.00
188.50
189.00
189.50
190.00
190.50
191.00
191.50
192.00
Dec-2014
Jul-2015
Jan-2016
Aug-2016
Mar-2017
Sep-2017
Apr-2018
Oct-2018
May-2019

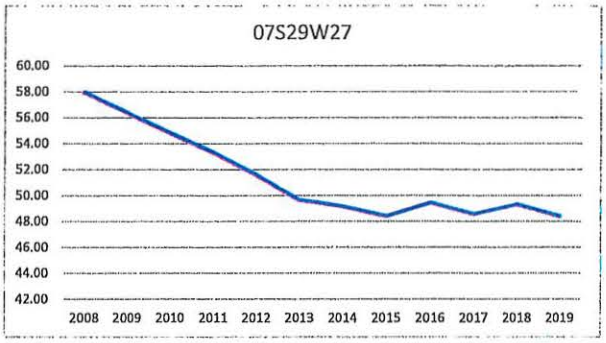
BAALMAN


165.00
170.00
175.00
180.00
185.00
190.00
195.00
200.00
Depth to Water Below Ground Surface (ft)
Jul-2015
Jan-2016
Aug-2016
Mar-2017
Sep-2017
Apr-2018
Oct-2018
May-2019

LEGAL 2	BR DEPTH	WL DEPTH	GEO UN	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
07S 29W 05BBB 01	203	190	TO	-122.94	-124.24	-124.7	-125.6	-126.3	-128	-128.7	-129.68	130.20	131.07	131.6	132.15
07S 29W 27CCC 01	265	267	TO	-207.05	-208.63	-210.19	-211.7	-213.4	-215.35	-215.85	-216.6	215.58	216.45	215.7	216.62
07S 29W 30ABA 01	255	255	TO	-183.75	-185.51	-186.41	-183.75	-188.65	-191.5	-190.95	-192.4	191.84	193.16	193.53	194.31
08S 29W 01BDD 01	248		TO	-172.24	-175.3	-176.1	-177.65	-178.6	-180.55	-181.44	-182.59	182.94	183.28	183.47	183.96
08S 30W 05CDD 01	272		TO	-190.95	-192.37	-193.74	-196.3	-196.9	-199.95	-199.4	-200.7	200.69	202.19	202.58	203.26
08S 30W 11CBC 01	277	286	TO	-213.1	-215.5	-216.58	-218.45	-219.65	-221.3	-222.29	-221.71	221.05	223.11	222.53	222.7
08S 30W 13DAA 01	257		TO	-172.9	-174.19	-175.39	-176.4	-178.4	-179.28	-180.61	-183.72	184.52			
LEGAL 2	BR DEPTH	WL DEPTH	GEO UN	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
07S 29W 05BBB 01	203	190	TO		-1.3	-0.46	-0.9	-0.7	-1.7	-0.7	-0.98	-0.52	-0.87	-0.53	-0.55
07S 29W 27CCC 01	265	267	TO		-1.58	-1.56	-1.51	-1.7	-1.95	-0.5	-0.75	1.02	-0.87	0.75	-0.92
07S 29W 30ABA 01	255	255	TO		-1.76	-0.9	2.66	-4.9	-2.85	0.55	-1.45	0.56	-1.32	-0.37	-0.78
08S 29W 01BDD 01	248		TO		-3.06	-0.8	-1.55	-0.95	-1.95	-0.89	-1.15	-0.35	-0.34	-0.19	-0.49
08S 30W 05CDD 01	272		TO		-1.42	-1.37	-2.56	-0.6	-3.05	0.55	-1.3	0.01	-1.5	-0.39	-0.68
08S 30W 11CBC 01	277	286	TO		-2.4	-1.08	-1.87	-1.2	-1.65	-0.99	0.58	0.66	-2.06	0.58	-0.17
08S 30W 13DAA 01	257		TO		-1.29	-1.2	-1.01	-2	-0.88	-1.33	-3.11	-0.8			




07S29W05
82.00
80.00
78.00
76.00
74.00
72.00
70.00
68.00
66.00
2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019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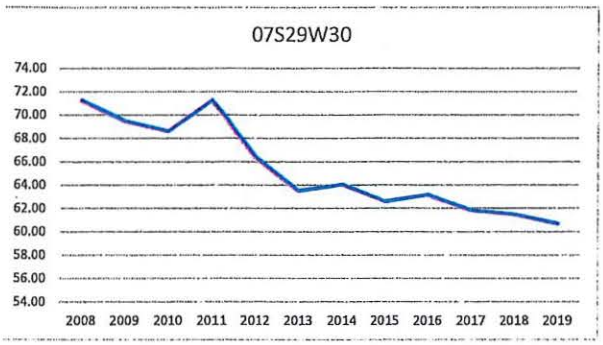
2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019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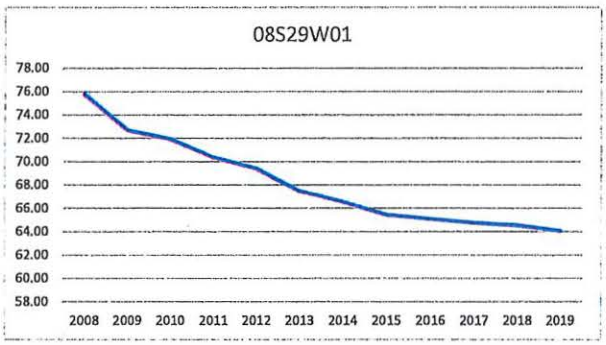
2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019


08S29W01
78.00
76.00
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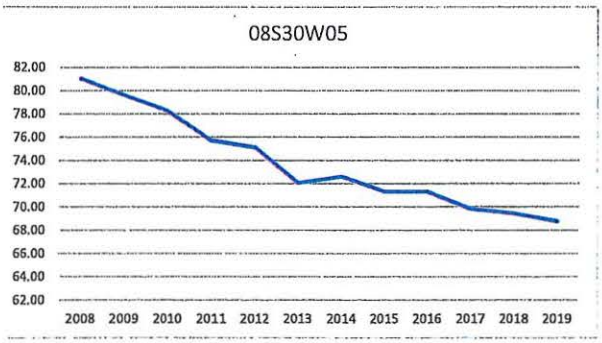
2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019


08S30W05
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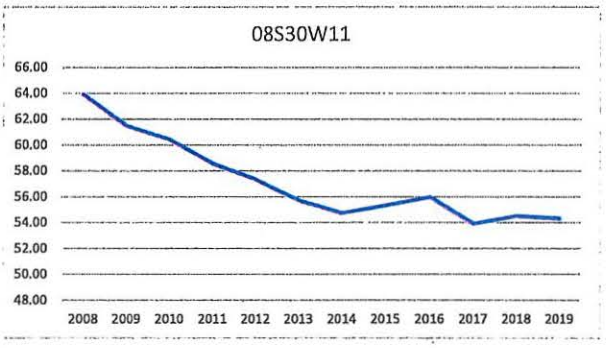
62.00
2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019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54.00
52.00
50.00
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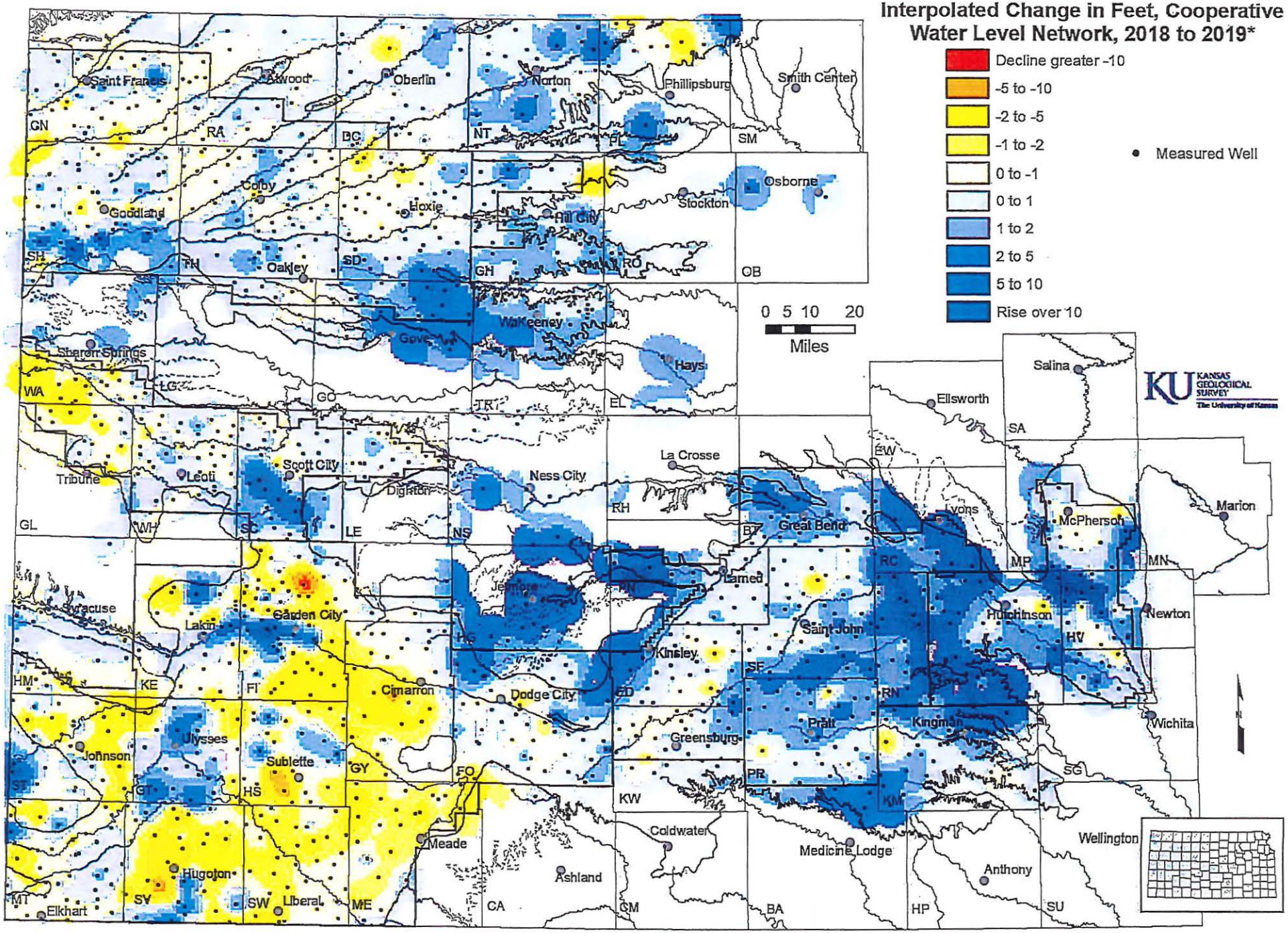
2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019


Interpolated Change in Feet, Cooperative Water Level Network, 2018 to 2019*
Decline greater -10
-5 to -10
-2 to -5
-1 to -2
0 to -1
0 to 1
1 to 2
2 to 5
5 to 10
Rise over 10
Measured Well
0 5 10 20
Miles
KU KANSAS GEOLOGICAL SURVEY The University of Kansas
Saint Francis
Atwood
Oberlin
Norton
Phillipsburg
Smith Center
Colby
Goodland
Oakley
Hoxie
Hill City
Stockton
Osborne
WaKeeney
Sharon Springs
Hays
Ellsworth
Salina
La Crosse
Tribune
Leoti
Scott City
Ness City
Great Bend
Lyons
McPherson
Marion
Syracuse
Lakin
Garden City
Jetmore
Larned
Hutchinson
Newton
Saint John
Kinsley
Cimarron
Dodge City
Pratt
Kingman
Wichita
Johnson
Ulysses
Sublette
Greensburg
Coldwater
Medicine Lodge
Anthony
Wellington
Meade
Hugoton
Ashland
Elkhart
Liberal
*Results are based only on the cooperative network (KGS and KDA-DWR) and do not include sub-regional networks from the KGS, KDA-DWR or local GMDs.

(1) Inspect, read and record the flow meter at least every two weeks the well is operating. The records of this inspection procedure shall be maintained by the well owner and provided to the district upon request. Should the flow meter reported readings be in question and the bi-weekly records not be available and provided upon request of the district, the well shall be assumed to have pumped its full annual authorized quantity for the year in question. Following each year's irrigation season, the person or persons responsible for this data may at their discretion transfer the recorded data to the district for inclusion in the appropriate water right file for future maintenance.

Option 1 is pretty straight forward. Pictures of the meter face are highly recommended along with calculating water use on a bi-weekly basis. Irrigators should be reminded that the important part of the meter face in the "odometer" and not the needle!

(2) Install and maintain an alternative method of determining the time that the well is operating. This information must be sufficient to be used to determine operating time in the event of a meter failure. Should the alternative method fail or be determined inaccurate the well shall be assumed to have pumped its full annual authorized quantity for the year in question. Well owners/operators are encouraged to give the details of the alternative method in advance to GMD 4 in order to insure that the data is sufficient.

Option 2 is the greyish area where we need clarification.

1) Engine/Pivot Hour Meter
    a. Only acceptable if fully functioning
    b. Meter must be placed away from equipment that may cause interference (vibration)
    c. Similar to water meter bi-weekly documentation (log book and photos)
2) Power Company Records (minimum of 3 years of records pumping year plus 2 previous years will be required to assess accuracy)
    a. Electricity
        i. Company records provided on bills or directly from company.
        ii. Electricity must be provided as operating hours and not kWh.
        iii. Calculations based on kwh will not be accepted as there are too many variables to consider when calculating water use.
    b. Natural Gas
        i. Provided directly on bills or directly from energy company
        ii. Calculate the number of therms to pump 1 AF
    c. Note these records may not be accurate enough to establish an accurate accounting of water pumped. GMD/DWR may assist in determining if accurate prior to using these methods.
    d. Some energy companies do not provide bills/records in a manner which allows for quantities to be calculated. Please review your bills prior to using this method
3) Ag Data service

   a. Readily available and easily discernible reports which indicates total hours pumped
   b. Companies/Irrigators are encouraged to provide reports upfront to determine if acceptable.
   c. Data must be from a sensor on the pivot. Simple prescriptions or irrigation schedules will not be accepted.
4) Secondary Water Meters
   a. Must be on the list approved by the Chief Engineer
   b. Must meet the installation requirements of the manufacturer and the Chief Engineer
5) I struggle to allow other easily removable sensors to be allowed aside from short term monitoring. Ideas we've heard have been the following:
   a. Temperature Sensors – attach to bottom of pipe
   b. Magnetic vibratory/electrical sensors
   c. Others?

All meters that do not work for longer than 2 weeks (☺) will be subject to fines as allowed by the appropriate rules and regulations. My understanding is that this is $500 per day.

All other water rights including municipal, stockwater, etc are subject to this requirement. My preference is to treat everyone the same in this regard.

(b) Recreation water rights will be limited to 90% of the December 31, 2010 annual authorized water right quantity. Each water right shall have the option of having this limited quantity as an annual limit or converted to a five-year water right at five (5) times the assigned allocation. The original water right will be retained.

4. Individual Allocation Amounts

The five-year allocations for every water right within the SD-6 LEMA that is covered by the above sections shall be converted to a five-year acre-feet total containing the assigned eligible allocations for each water right within the SD-6 LEMA. Each water right shall be restricted to its total acre-feet allocation.

5. Violations of Authorized Quantities

Exceeding any total allocation quantity (which shall include any transferred quantities) of less than four (4) acre-feet within any allocation period shall result in a $1,000.00 fine for every day the allocation is exceeded. This penalty shall apply to all rights in combined allocation accounts subject to the SD-6 LEMA.

Exceeding any total allocation quantity (which shall include any transferred quantities) by four (4) acre-feet or more within any allocation period shall result in an automatic two-year suspension of the water right. This penalty shall apply to all rights in a combined allocation account.

Exceeding the annual authorized quantity of the water right (not to include any transferred quantities) shall result in a $1,000.00 fine.

6. Metering

All water right owners shall be responsible for ensuring their meters are in compliance with state and local laws as outlined in the SD-6 LEMA Management Plan. In addition to all requirements set forth in state statute and regulation, all water right owners shall make meter inspections to record usage every two weeks while the well is in operation, or install and maintain an alternative method of collecting data every two weeks. This shall include all procedures outlined in statute, regulation, and the SD-6 LEMA Management Plan for repairing broken or otherwise inoperable or inaccurate meters.

7. Accounting

GMD4 shall maintain records of the annual diversion amounts for each water right within the SD-6 LEMA area, and the total five-year quantity balances. Annual status reports shall be mailed to each water right owner and provided to DWR.

7. Violations

a) The LEMA order of designation shall serve as notice of the creation of the LEMA and its terms and conditions to all water right owners within the GMD4 on its effective date.

b) Upon GMD4 learning of an alleged violation, GMD4 will provide DWR with the information GMD4 believes shows the alleged violation. DWR, at its discretion, may investigate and impose restrictions and fines as described below or as otherwise allowed by law.

c) DWR may address violations of the authorized quantities as follows:

(1) Exceeding any total allocation quantity by less than four acre-feet within the allocation period will result in a $1,000 fine for every day the allocation was exceeded.

(2) Exceeding any total allocation quantity by four acre-feet or more within the allocation period will result in an automatic two-year suspension of the water right and a $1,000 fine for every day the allocation was exceeded up to a maximum of $10,000.

d) In addition to other authorized enforcement procedures, if the GMD4 Board of Directors finds by a preponderance of evidence that meter tampering, removing the meter while pumping, or any other overt act designed to alter the metered quantity as described in K.A.R. 5-14-10 occurred, then the GMD4 Board of Directors will make a recommendation to the Chief Engineer that a written order be issued which states:

(1) The nature of the violation;

(2) The factual basis for the violation;

(3) That the water right is suspended for 5 years; and

(4) That the water right loses all remaining assigned quantities under the District Wide Local Enhanced Management Area.

8. Metering

a) All water right owners shall be responsible for ensuring their meters are in compliance with all applicable laws and regulations. In addition to maintaining compliance and annually reporting the quantity of water diverted from each point of diversion, all water right owners shall implement at least one of the following additional well/meter monitoring procedures:

(1) Inspect, read and record the flow meter at least every two weeks the well is operating. The records of this inspection procedure shall be maintained by the well owner and provided to the district upon request. Should the flow meter reported readings be in question and the bi-weekly records not be available and provided upon request of the district, the well shall be assumed to have pumped its full annual authorized quantity for the year in question. Following each year's irrigation season, the person or persons responsible for this data may, at their discretion, transfer the recorded data to the district for inclusion in the appropriate water right file for future maintenance.

(2) Install and maintain an alternative method of determining the time that the well is operating. This information must be sufficient to be used to determine operating time in the event of a meter failure. Should the alternative method fail or be determined inaccurate the well shall be assumed to have pumped its full annual authorized quantity for the year in question. Well owners/operators are encouraged to give the details of the alternative method in advance to GMD4 in order to ensure that the data is sufficient.

b) Any water right owner or authorized designee who finds a flow meter that is inoperable or inaccurate shall within 48 hours contact the district office concerning the matter and provide the following information:

(1) water right file number;

(2) legal description of the well;

(3) date the problem was discovered;

(4) flow meter model, make, registering units and serial number;

(5) the meter reading on the date discovered;

(6) description of the problem;

(7) what alternative method is going to be used to track the quantity of water diverted while the inoperable or inaccurate meter is being repaired/replaced; and (8) the projected date that the meter will be repaired or replaced.

(8) Any other information requested by the GMD4 staff or Board of Directors regarding the inoperable or inaccurate flow meter.

c) Whenever an inoperable or inaccurate meter is repaired or replaced, the owner or authorized designee shall submit form DWR 1-560 Water Flowmeter Repair/Replacement Report to the district within seven days.

d) This metering protocol shall be a specific annual review issue and if discovered to be ineffective, specific adjustments shall be recommended to the chief engineer by the advisory committee.

9. Accounting

DWR, in cooperation with GMD4, shall keep records of the annual diversion amounts for each Water Right within the LEMA area, and the total five-year quantity balances, and will make this information available to the Water Right Holder and the GMD4 on their request.

10. Advisory Committee

a) A District Wide LEMA Advisory Committee shall be appointed and maintained by the GMD4 Board of Directors consisting of fourteen (14) members as follows: one (1) GMD4 staff member; one (1) GMD4 Board Member; one (1) representative of DWR as designated by the Chief Engineer; and the remaining positions to be filled by irrigators with regional distribution identical to GMD4 board member distribution. At the first meeting of the Advisory Committee, one member of the committee shall be elected chair and they shall be directed to further organize the committee and ensure that annual meetings are held to consider:

(1) water use data;

(2) water table information;

(3) economic data as is available;

(4) violations issues – specifically metered data;

(5) any new and preferable enhanced management authorities become available;

(6) other items deemed pertinent to the advisory committee.

BEFORE THE DIVISION OF WATER RESOURCES
KANSAS DEPARTMENT OF AGRICULTURE

In the Matter of the Designation of the	)	
Sheridan 6 Local Enhanced Management Area	)	
In Sheridan and Thomas Counties, Kansas.	)	**001 – DWR-LEMA – 2017**
	)	
Pursuant to K.S.A. 82a-1041.	)	
	)	

ORDER OF DESIGNATION REGARDING THE SHERIDAN 6 LOCAL ENHANCED MANAGEMENT PLAN FOR 2018-2022

COMES NOW, David W. Barfield, Chief Engineer, Division of Water Resources, Kansas Department of Agriculture ("Chief Engineer"), who, having issued the Order of Decision Accepting the Sheridan 6 Local Enhanced Management Plan for 2018-2022 ("Order of Decision") on August 24, 2017, hereby issues this Order of Designation Regarding the Sheridan 6 Local Enhanced Management Plan for 2018-2022 ("Order of Designation") pursuant to K.S.A. 82a-1041.

I. PROCEDURAL BACKGROUND

1. On February 2, 2017, the Northwest Kansas Groundwater Management District No. 4 ("GMD4") submitted a formal request for the re-formulation of the original SD-6 Local Enhanced Management Area ("SD-6 LEMA"), including a proposed management plan for the period beginning on January 1, 2018 and ending on December 31, 2022 ("SD-6 LEMA Management Plan").

2. On March 6, 2017, the Chief Engineer reviewed the re-formulation proposal and found pursuant to K.S.A. 82a-1041(a) that the SD-6 LEMA Management Plan proposed clear geographic boundaries, pertained to an area wholly within a groundwater management district, proposed appropriate goals and corrective control provisions to meet the stated goals, gave due consideration to existing conservation measures, included a compliance monitoring and enforcement element, and is consistent with state law.

3. Pursuant to K.S.A. 82a-1041(b), timely notice of the initial public hearing was mailed to each water right holder located within the proposed SD-6 LEMA and published in two local newspapers of general circulation and the Kansas Register. The initial public hearing was conducted by the Chief Engineer at 10:13 a.m. on May 31, 2017 in Hoxie, Kansas. Based on all testimony and evidence entered into the record and applicable law, the Chief Engineer concluded that the SD-6 LEMA Management Plan satisfied the three initial requirements as set forth in K.S.A. 82a-1041(b)(1)-(3).

4. Pursuant to K.S.A. 82a-1041(b), timely notice of the second public hearing was mailed to each water right holder located within the proposed SD-6 LEMA and published in two local newspapers of general circulation and the Kansas Register. The second public hearing was conducted by the Chief Engineer in the afternoon of May 31, 2017 in Hoxie,

Kansas to consider whether the proposed SD-6 LEMA Management Plan was sufficient to address any of the existing conditions set forth in K.S.A. 82a-1036(a)-(d).

5. Based on all testimony and evidence entered into the record of the second public hearing, the Chief Engineer determined that the proposed SD-6 LEMA Management Plan is sufficient to address the decline in groundwater levels in the area in question, and issued the Order of Decision on August 24, 2017, with such order to be followed by an Order of Designation pursuant to K.S.A. 82a-1041(d) and (e).

II. APPLICABLE LAW

1. The formation of a local enhanced management area is governed pursuant to K.S.A. 82a-1041. When the Chief Engineer finds that a local enhanced management plan submitted by a groundwater management district is acceptable for consideration, then the Chief Engineer shall initiate proceedings to designate a local enhanced management area as soon as practicable.

2. Once the proceedings are initiated, the Chief Engineer shall hold an initial public hearing to resolve the following:

   a. Whether one or more of the circumstances specified in K.S.A. 82a-1036(a) through (d), and amendments thereto, exist;
   b. Whether the public interest of K.S.A. 82a-1020, and amendments thereto, requires that one or more corrective control provisions be adopted; and
   c. Whether the geographic boundaries are reasonable.

3. K.S.A. 82a-1041(b)(3) directs the Chief Engineer to conduct a subsequent hearing only if the initial public hearing is favorable on all three issues of fact and the expansion of geographic boundaries is not recommended.

4. K.S.A. 82a-1041(c) limits the subject of the second hearing to the local enhanced management plan that the Chief Engineer previously reviewed and in subsection (d) requires the Chief Engineer to issue an order of decision within 120 days:

   a. Accepting the local enhanced management plan as sufficient to address any of the conditions set forth in K.S.A. 82a-1036(a)-(d);
   b. Rejecting the local enhanced management plan as insufficient to address any of the conditions set forth in K.S.A. 82a-1036(a)-(d);
   c. Returning the local enhanced management plan to the groundwater management district, giving reasons for the return and providing the district with the opportunity to resubmit a revised plan for public hearing within 90 days of the return of the deficient plan; or
   d. Returning the local enhanced management plan to the groundwater management district and proposing modifications to the plan, based on testimony at the hearing or hearings, that will improve the administration of the plan, but will not impose reductions in groundwater withdrawals that exceed those contained in the plan. If

the groundwater management district approves of the modifications proposed by the chief engineer, the district shall notify the Chief Engineer within 90 days of receipt of return of the plan. Upon receipt of the groundwater management district's approval of the modifications, the chief engineer shall accept the modified local management plan. If the groundwater management district does not approve of the modifications proposed by the Chief Engineer, the local management plan shall not be accepted.

5. Pursuant to K.S.A. 82a-1041(e), if the Chief Engineer issues an order of decision, then an order of designation that designates the area in question as a local enhanced management area shall be issued within a reasonable time following the order of decision.

6. Pursuant to K.S.A. 82a-1041(f) and (g), the order of designation shall define the boundaries of the local enhanced management area and shall indicate the circumstances upon which the findings of the Chief Engineer are made. The order of designation may include the corrective control provisions set forth in the management plan and shall follow, insofar as may be reasonably done, the geographical boundaries recommended by the local enhanced management plan.

III. TESTIMONY

1. The record of the initial public hearing in this matter has been incorporated into the record for this second public hearing. (Transcript, p. 7-8.)

2. Since hydrologic conditions underlying the SD-6 LEMA remain similar to those established in the public hearings held in 2012, the Order of Decision, Order of Designation, and supporting testimony submitted by GMD4 dated November 28, 2012, from those proceedings was incorporated into the record for this second public hearing. (Transcript, p. 8.)

3. The Order of Decision, dated August 24, 2017, is incorporated into this order and made a part of the record.

4. Ray Luhman, Colby, Kan., Manager of GMD4 – Mr. Luhman led the oral testimony in support of the re-formulation of the SD-6 LEMA for the period 2018-2022 pursuant to GMD4's proposed plan. Mr. Luhman submitted written testimony similar to that submitted at the initial public hearing, with the addition of the SD-6 LEMA Management Plan 2018-2022 dated February 2, 2017, and the final committee report from the SD-6 LEMA Advisory Committee. Mr. Luhman's oral testimony was based, in part, on the previous testimony of GMD4 dated November 28, 2012, which was incorporated into the record. Further, Mr. Luhman testified that there continue to be declines in the depth to water at the seven observation wells within the SD-6 LEMA, although the rate of decline was reduced from an average of 1.5 feet per year from 2008-2013 to 0.68 feet per year from 2013-2017. Data from 2013, 2014, and 2015 show significantly less water was used within the boundaries of the SD-6 LEMA because of the SD-6 LEMA allocations and that this correlated with a slowing rate of decline in depth to water, and even a rise in

some places. Mr. Luhman also referenced Dr. Bill Golden's ongoing study that shows irrigators reduced water use within the SD-6 LEMA while maintaining a similar level of net profit compared to nearby irrigators outside the LEMA boundaries and their pre-LEMA net profits. He also noted the successful use of "umbrella accounts" to allow flexibility among water rights without detrimental effect.

The proposed SD-6 LEMA Management Plan allows irrigators 55 inches per acre in a five-year allocation (an average of 11 inches per year), livestock use would be limited to 12 gallons per head per day, and recreational uses would be held to 90% of the authorized quantity. The plan for 2018-2022 would also include a carry-over of up to five inches per acre into the new LEMA from unused allocations from the 2013-2017 period, which Mr. Luhman estimated to be about 8,400 acre-feet, if 2017 pumping was similar to 2016 amounts. Even with the carry-over provision, the pumping allowed for 2018-2022 would be significantly less than the pumping during the pre-LEMA period. The SD-6 LEMA Management Plan continues to include a mechanism to allow the transfer of water from one owner's account to another, the continuation of the Advisory Committee, and a requirement that any district established in this area with stricter corrective controls (such as a Water Conservation Area or another LEMA) would take precedent over the SD-6 LEMA requirements. Exhibits D and E (SD-6 LEMA Management Plan and GMD4 Written Testimony) were incorporated into the record. (Transcript pp. 11-28.)

5. Brent Rogers, Hoxie, Kan., President of the GMD4 Board – Mr. Rogers testified that he has heard a high amount of positive feedback from those who own property in the SD-6 LEMA. He was encouraged that a carry-over provision would be allowed because it further encourages water users to save anything left over in their existing allocations rather than use it unnecessarily for fear of losing the water. (Transcript pp. 27-28.)

6. Mitchell Baalman, Hoxie, Kan., GMD4 Board Member and GMD4 Board Member for SD-6 LEMA Advisory Committee - Mr. Baalman owns land inside and outside the SD-6 LEMA. He testified that the SD-6 LEMA has made the residents inside western Sheridan County become better water managers and that it is visible that the water users inside the SD-6 LEMA are using their water more efficiently. He also testified that the mentality of the farmer regarding water use was changing and that he was optimistic about the SD-6 LEMA and other LEMAs in the future. (Transcript pp. 28-30.)

IV. DISCUSSION AND CIRCUMSTANCES OF FINDINGS

1. There is extensive discussion in the original order establishing the SD-6 LEMA that is incorporated into the record and will not be repeated here, but remains applicable. When the SD-6 LEMA was established prior to the 2013 irrigating season it was the first attempt to put a LEMA into effect. The goals and corrective controls put into place were developed through a community effort that consisted of many meetings, and much time spent by individuals who were passionate about extending the life of the aquifer they rely on. This community based approach continued throughout the life of the first LEMA management plan with annual review and recommendations by an advisory committee. The SD-6 LEMA has provided data that justifies the intentional conservation of water and illustrates how communal actions may be undertaken in an inclusive manner to benefit individual irrigators.

2. As the record shows, the original SD-6 LEMA boundaries, and the need for the SD-6 LEMA itself, were based primarily on scientific data provided by the Kansas Geological Survey ("KGS") at GMD4's request. This data, in conjunction with that presented by the Division of Water Resources ("DWR") and GMD4, provided boundaries focused on areas facing withdrawal greater than recharge or facing excessive declines in the aquifer. (*See e.g.*, the Initial Order issued by Constance Owen and the Orders of Decision and Designation issued by the Chief Engineer in 2012 and 2013.) After five years of operation, ample evidence exists to prove that the corrective controls, primarily the allocation of 55 inches over five years, have had an overwhelmingly positive impact on the area included in the SD-6 LEMA.

3. Prior to the formation of the original SD-6 LEMA, it was shown that groundwater levels had declined by as much 70 feet in some areas since 1965. Since the implementation of the original SD-6 LEMA, evidence was presented at the hearings for the SD-6 LEMA Management Plan that show the rate of decline has slowed in many parts of the LEMA, and in some areas the depth to water has actually decreased, or in other words, groundwater levels have increased. (*See* Order of Decision.)

4. Dr. Bill Golden's work tracking the revenue of irrigators within the SD-6 LEMA has also shown that the original SD-6 LEMA was successful. Despite a significant cut in water use, area irrigators' willingness to embrace technology and new cropping practices has shown that profit margins can be maintained near the level they were at prior to water use allotments, and that any negative effects have been manageable up to this point.

5. It is also important to note that the irrigators within the SD-6 LEMA have been subject to corrective controls since the 2013 growing season and no legal challenges have been brought against the SD-6 LEMA. Further, no testimony was presented against the boundaries, the corrective controls, or the data they were based on during the present proceedings. This included the use of provisions for flexibility in moving allocations among different water rights within the LEMA as such uses did not produce any documented detrimental effects.

6. Several differences in the 2018-2022 Management Plan warrant comment. The overall water use goal increased 3,000 acre-feet, but this is due to the addition of new acres of production that were previously enrolled in conservation programs that did not allow them to receive an allocation in the original SD-6 LEMA. These new acres will be given the same 11 inch per year allocation as acres already in the SD-6 LEMA. The 2018-2022 Management Plan also rewards conservation by allowing a five-inch carryover for any unused allocation from the 2013-2017 period. As is noted in Mr. Luhman's testimony, total allowable pumping allowed for 2018-2022, even with this carryover, will be significantly less than the pre-LEMA period. The advisory committee will also continue to meet on an annual basis and GMD4 has installed seven additional monitoring wells that are now operated by KGS.

7. Based on the evidence, testimony, and all data submitted previously and as a part of the current hearing process, the great weight of the evidence makes it clear that the SD-6 LEMA is supported by those who irrigate within its boundaries and that such corrective controls and practices have not created an economic hardship, and have assisted in allowing irrigators to make major strides in extending the life of the aquifer.

V. FINDINGS OF FACT

1. The Order of Decision and all exhibits attached thereto, issued August 24, 2017 is hereby incorporated into this Order of Designation.

2. The proposed geographical boundaries of the SD-6 LEMA include the following sections in Sheridan and Thomas Counties, Kansas:

Sheridan County
T7S, R28W, Sections 19-21 and 28-33;
T7S, R29W, Sections 4-9 and 16-36;
T7S, R30W, Sections 19-36;
T8S, R29W, Sections 1-18;
T8S, R30W, Sections 1-18.

Thomas County
T8S, R31W, Sections 22-27 and 34-36.

3. The proposed SD-6 LEMA Management Plan proposes clear geographic boundaries and is located wholly within GMD4. Such boundaries are clear and reasonable; and, the boundaries are based on data shared by DWR, GMD4, and KGS concerning the hydrology of the area.

4. Evidence shows there remains a need for corrective control provisions and that those proposed in the SD-6 LEMA Management Plan have been effective. Groundwater levels in the areas described above were declining in 2012 and continue to decline, however, the implementation of the SD-6 LEMA has reduced the rate of decline. From 2008 through 2013, observation wells averaged 1.5 feet per year declines in the water table. From 2013

through 2017, the observation wells averaged 0.68 feet per year declines. Despite the improvement in the rate of decline, the evidence still conclusively shows that the water table continues to decline and corrective controls are required.

5. The proposed SD-6 LEMA Management Plan will limit water diversions within the SD-6 LEMA to 117,600 acre feet total for the period between January 1, 2018 and December 31, 2022 plus any carry-over amount from the existing SD-6 LEMA period. This five-year allocation, along with flexibility to move allocations, provide corrective control provisions which help meet the stated goal for reduced use of water while maintaining economic viability. This five-year allocation is an increase from the SD-6 LEMA Management Plan in effect from 2013-2017 because water rights were released from Environmental Quality Incentives Programs {"EQUIP") and Agricultural Water Enhancement Programs ("AWEP") and will be used again for irrigation within the SD-6 LEMA boundaries.

6. The proposed SD-6 LEMA Management Plan considers existing conservation measures by permitting a five-inch carry over allotment, if any such amount remains at the end of the existing SD-6 LEMA, to reward those users who have voluntarily used less water than their full allocation.

7. The supportive testimony for another five-year term indicates that the SD-6 LEMA is effective.

8. The overall effects of the original SD-6 LEMA provided a significant decrease in the rate of decline of the aquifer, leading to an extension in the life of the aquifer within the LEMA boundaries without causing significant decrease in profitability to irrigators. Such evidence supports the continuation of the SD-6 LEMA for another five-year period.

VI. CONCLUSIONS OF LAW

1. Notice of the initial public hearing and the second public hearing was proper and complied with the requirements of K.S.A 82a-1041(b).

2. As determined by the Initial Public Hearing Order, the initial requirements for the establishment of a LEMA were met during the initial public hearing.

3. The second public hearing took place according to the requirements of K.S.A. 82a-1041.

4. Corrective controls are required within the SD-6 LEMA in order to address excessive declines in the groundwater level and to address rates of withdrawal that exceed the rate of recharge pursuant to K.S.A. 82a-1036.

5. A corrective control provision that only reduces the rate of decline, but does not prevent decline, is in the public interest as contemplated by K.S.A. 82a-1020.

6. Pursuant to K.S.A. 82a-1041(d)(1), the proposed SD-6 LEMA Management Plan is sufficient to address declines in groundwater levels and a rate of withdrawal that exceeds the rate of recharge in the area in question.

7. The proposed SD-6 LEMA Management Plan is consistent with the Kansas Water Appropriation Act and other Kansas law.

8. The Order of Decision, dated August 24, 2017, was timely issued and properly approved the SD-6 LEMA Management Plan; and, therefore this Order of Designation is appropriate.

VII. ORDER OF DESIGNATION

COMES NOW, the Chief Engineer, pursuant to K.S.A. 82a-1041(e)-(h), who, based upon substantial competent evidence, as provided by testimony and comments offered at, or in relation to, public hearings held for the purpose of designating the Sheridan 6 Local Enhanced Management Area for 2018-2022, hereby finds that the proposed Sheridan 6 Local Enhanced Management Area 2018-2022 Administration, was properly approved in the Order of Decision, issued on or about August 24, 2017, and that the Sheridan 6 Local Enhanced Management Area shall consist of the following recommended boundaries:

Sheridan County
T7S, R28W, Sections 19-21 and 28-33;
T7S, R29W, Sections 4-9 and 16-36;
T7S, R30W, Sections 19-36;
T8S, R29W, Sections 1-18;
T8S, R30W, Sections 1-18.

Thomas County
T8S, R31W, Sections 22-27 and 34-36.

THEREFORE, the corrective controls and all other necessary elements of administration and management regarding the Sheridan 6 Local Enhanced Management Area contained in the Sheridan 6 Local Enhanced Management Area 2018-2022 Administration, shall be in place beginning on January 1, 2018 and until December 31, 2022 within the boundaries of the local enhanced management area described above, including the following corrective controls:

1. SD-6 LEMA Goals Corrective Controls

All water diversions within the SD-6 LEMA shall be collectively restricted between the period January 1, 2018 through December 31, 2022 to no more than 117,600 AF total with the following exception. Those individual or combined IRR wells that have a balance remaining in their respective accounts on December 31, 2017 may carry-over an amount not to exceed five (5) inches per program acre for irrigation use.

This LEMA shall exist only for the five-year period beginning January 1, 2018 and ending December 31, 2022.

The new total program diversion amount of 117,600 AF, plus carryover, shall represent five (5) times the sum of:

(a) Designated legally eligible acres (per section 1) x 11/12 inches for irrigation water rights plus carryover;

(b) Maximum permitted head of livestock on December 31, 2010 x 12 gallon per head per day for stock water rights; and

(c) Ninety percent (90%) of the December 31, 2010 authorized recreational water quantity for recreation rights.

GMD4 shall use the following procedures to determine the five-year allocation for each water right, and specify said values. All allocation values shall be expressed in terms of total acre-feet for the five-year LEMA period.

2. Allocations – Irrigation

(a) All irrigation water rights shall be limited to no more than 55 acre inches per irrigated acre for the period of 2007 – 2010 or any acreage adjustments due to appeal, covered by the water right over the five-year period beginning January 1, 2018 and ending December 31, 2022 except that a carry-over amount shall be added as determined below. Prior to December 31, 2017, GMD4 shall update the SD-6 LEMA Allocations spreadsheet ("Attachment 1") by adding those water rights that have exited the Environmental Quality Incentives Program ("EQUIP") and the Agricultural Water Enhancement Program ("AWEP"). GMD4 will provide a copy of this updated spreadsheet to DWR and make it available on the GMD4 website. GMD4 shall also inform any water right owners added of their designated eligible areas and proposed allocations.

(b) Carry-Over Amount. The carry-over amount will be determined based on water use records for the period January 1, 2013 through December 31, 2017 for irrigation use only. The carry-over amount cannot exceed five (5) inches per program acre and is the lesser of: 1) five (5) inches per program acre or; 2) a water user's unused acre inches per program acre. Within two (2) months of the completion of DWR's review of the 2017 water use data, GMD4 will review water use for 2013-2017 and develop a tabulation of carry-over amounts allowed pursuant to this order and the resulting total allowed allocation for 2018-2022 for the SD-6 LEMA. GMD4 shall provide a copy of this to DWR, make it available on the GMD4 website, and provide this information to all water right owners within the SD-6 LEMA.

(c) Wells pumping to a common system or systems shall be provided a single allocation for the total system acres. The total amount pumped by all wells involved must remain within the system allocation.

(d) For additional producer flexibility, water rights may at the discretion of the owners be combined into a single allocation account with flexibility of pumping the multiple wells within the account as directed by the owner, provided the total account allocation is not exceeded.

(e) Temporary transfers of allocations between water rights may be made anywhere within the boundaries of the SD-6 LEMA. Said transfers shall be in effect through December 31, 2022. An Application for Transfer form must be signed by all owners involved in the transfer. No transfer shall result in an allocation that exceeds the authorized amount for the water right receiving the transfer.

(f) No water right shall receive more than the currently authorized quantity for that right, times five (5).

(g) No water right within a K.A.R. 5-5-11, five-year allocation status shall receive an allocation that exceeds its current five-year allocation limit.

(h) No water right shall be allowed to pump more than its authorized annual quantity in any single year.

(i) In all cases the allocation shall be assigned to the point of diversion and shall apply to all water rights and acres involving that point of diversion. Moreover, in all cases the original water right shall be retained.

(j) On or before October 1, 2018 any irrigation water right owner will have the option of converting a five-year allocation amount to a Multi-Year Flex Account ("MYFA") provided, the MYFA quantity does not exceed the established five-year allocation quantity. No other conversions to MYFAs will be authorized.

(k) For water rights enrolled in EQIP and/or AWEP that will be exiting either program on or before September 30, 2022, the allocation quantity shall be set at 11 acre-inches per acre for only the remaining years of the 2018-2022 LEMA period.

(l) Any water right enrolled into, contracting with, or officially participating in a reduced water use program (AWEP, EQIP, Northwest Kansas Groundwater Conservation Foundation, WCA, etc.) during the period January 1, 2018 through December 31, 2022 shall not be allowed to transfer its LEMA allocation to any other water right or combine its LEMA allocation with any other water right.

3. Allocations – Non-Irrigation

(a) Livestock uses will be limited to 12 gallons per head per day based on the maximum head supportable by the feedlot permit in effect on December 31, 2010. Each water right shall have the option of having this limited quantity as an annual limit or converted to a five-year water right at five (5) times the assigned allocation. The original water right will be retained.

(b) Recreation water rights will be limited to 90% of the December 31, 2010 annual authorized water right quantity. Each water right shall have the option of having this limited quantity as an annual limit or converted to a five-year water right at five (5) times the assigned allocation. The original water right will be retained.

4. Individual Allocation Amounts

The five-year allocations for every water right within the SD-6 LEMA that is covered by the above sections shall be converted to a five-year acre-feet total containing the assigned eligible allocations for each water right within the SD-6 LEMA. Each water right shall be restricted to its total acre-feet allocation.

5. Violations of Authorized Quantities

Exceeding any total allocation quantity (which shall include any transferred quantities) of less than four (4) acre-feet within any allocation period shall result in a $1,000.00 fine for every day the allocation is exceeded. This penalty shall apply to all rights in combined allocation accounts subject to the SD-6 LEMA.

Exceeding any total allocation quantity (which shall include any transferred quantities) by four (4) acre-feet or more within any allocation period shall result in an automatic two-year suspension of the water right. This penalty shall apply to all rights in a combined allocation account.

Exceeding the annual authorized quantity of the water right (not to include any transferred quantities) shall result in a $1,000.00 fine.

6. Metering

All water right owners shall be responsible for ensuring their meters are in compliance with state and local laws as outlined in the SD-6 LEMA Management Plan. In addition to all requirements set forth in state statute and regulation, all water right owners shall make meter inspections to record usage every two weeks while the well is in operation, or install and maintain an alternative method of collecting data every two weeks. This shall include all procedures outlined in statute, regulation, and the SD-6 LEMA Management Plan for repairing broken or otherwise inoperable or inaccurate meters.

7. Accounting

GMD4 shall maintain records of the annual diversion amounts for each water right within the SD-6 LEMA area, and the total five-year quantity balances. Annual status reports shall be mailed to each water right owner and provided to DWR.

DWR shall provide, in a timely manner, to GMD4 copies of annual water use reports received in the office of the chief engineer. GMD4 and DWR shall cooperate on reconciliation and correction of any water use reports found to be in error.

8. Advisory Committee

A SD-6 LEMA Advisory Committee shall be appointed and maintained by the GMD4 Board. Such committee shall consist of an odd number of members between five (5) and nine (9) members as follows: one (1) GMD4 representative; one (1) representative of DWR as designated by the Chief Engineer; and the balance being SD-6 LEMA residents/owners/operators – one (1) of which must represent non-irrigation users. The committee shall meet annually to consider:

(1) water use data;
(2) water table information;
(3) economic data as is available;
(4) violations issues – specifically metered data;
(5) any new and preferable enhanced management authorities become available;
(6) other items deemed pertinent to the advisory committee.

The committee shall produce a report after every meeting which shall provide a status for considerations (1) through (6) and any recommended modifications to the current LEMA Order relative to these items. Said report shall be forwarded to the GMD4 Board and the Chief Engineer.

9. Formal Review

In addition to the annual review conducted by the SD-6 LEMA Advisory Committee, the SD-6 LEMA Advisory Committee shall also conduct a more formal LEMA Order review 1.5 years before the ending date of the SD-6 LEMA. Review items will focus on economic impacts to the LEMA area and the local public interest, including but not limited to water level data.

The committee shall also produce a report following this review to the Chief Engineer and the GMD4 Board which contains specific recommendations regarding future actions. All recommendations shall be supported by reports, data, testimonials, affidavits or other information of record.

10. Impairment Complaints

While this LEMA is in effect, any impairment complaint filed within the boundaries of the SD-6 LEMA shall be investigated by the Chief Engineer as required by the KWAA. However, the Chief Engineer shall take into account the existence of the SD-6 LEMA and the corrective controls in place when conducting such an investigation.

11. Coordination

The DWR and the GMD4 Board, as far as is practicable, shall coordinate and account for the umbrella accounts so authorized, authorize and account for water right transfers as such may be authorized, and account for annual pumpage amount by water rights located within the SD-6 LEMA.

12. Most Restrictive Conservation Program Applies

In the case of any allocations that may exist due to a special district other than the SD-6 LEMA, but also within the boundaries of the SD-6 LEMA, the requirements of the most restrictive special district shall apply.

IT IS SO ORDERED, THIS 7th DAY OF November, 2017.

David W. Barfield, P.E.
Chief Engineer, Division of Water Resources
Kansas Department of Agriculture

Attachments:

Attachment 1: "SD-6 LEMA Allocations" spreadsheet.

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RIGHT TO PETITION FOR ADMINISTRATIVE REVIEW

If you are aggrieved by this Order, then pursuant to K.S.A 82a-1901(c), you may petition for administrative review of the Order by the Secretary of Agriculture. A petition for review shall be in writing and state the basis for requesting administrative review. The request for review may be denied if the request fails to clearly establish factual or legal issues for review. See K.S.A. 77-527.

The petition must be filed within 30 days after service of this Order as provided in K.S.A. 77-531, and be filed with the Secretary of Agriculture, Attn: Legal Division, Kansas Department of Agriculture, 1320 Research Park Drive, Manhattan, Kansas 66502, or by FAX (785) 564-6777.

If no petition for administrative review is filed as set forth above, then this Order shall be effective and become a final agency action as defined in K.S.A. 77-607(b). Failure to timely request administrative review may preclude further judicial review under the Kansas Judicial Review Act.

Monitoring the Impacts of Sheridan County 6 Local Enhanced Management Area

Final Report for 2013 – 2017

11/15/2018

Dr. Bill Golden

Golden is an assistant professor in the Department of Agricultural Economics at Kansas State University. Liebsch is a graduate student in the Department of Agricultural Economics at Kansas State University. This research was funded in part by the Kansas Water Office under Contract # 15-0112, in part by the U.S.D.A. Ogallala Aquifer Program, and in part by the U.S.D.A. – N.I.F.A. Ogallala Water CAP Project.

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Monitoring the Impacts of Sheridan County 6 Local Enhanced Management Area

I. Introduction

Study Objectives

Current levels of groundwater consumption in northwest Kansas raise concerns relative to the long-term feasibility of irrigated agriculture in the area. In order to extend the economic life of the aquifer and maintain the economic base of the region, groundwater water use reductions may need to be considered. Past economic studies differ in the calculated economic impact associated with groundwater use reductions. One high priority subarea in northwest Kansas has recently mandated a reduction in groundwater use. Monitoring the Sheridan #6 Local Enhanced Management Area (LEMA) in real time will allow us to observe producer innovation aimed at maintaining revenues and disseminate these data to producers and stakeholders in other areas. The knowledge of how irrigated crop producers react to conservation policies will provide guidance on what is expected to happen in the future as groundwater supplies are diminished and/or conservation policies are implemented.

The purpose of this report is to provide the methods, assumptions, and estimates of the likely economic impacts associated with a groundwater use reduction in the Sheridan #6 LEMA. The reader should note that this is a 'Final Report' which provides information on the five years (2013 – 2017) of a five-year study. This research will compare water usage, cropping practices, and economic outcomes for the Sheridan #6 LEMA and surrounding irrigated acreage not located within the LEMA boundaries. This will be accomplished by:

1. Developing annual 'partial budgets' from data obtained from irrigated crop producers (current and historic) (Table 1). The partial budgets will generate measures of 'Cash Flow'.
    a. Each year, aggregated cash flow will be compared for land parcels within the LEMA boundaries and outside LEMA boundaries.
    b. After 5 years, historic cash flow and partial budgets will be compared and across boundaries (comparing LEMA and non-LEMA producers).
2. Developing measures of land-use changes for land parcels within the LEMA boundaries and outside LEMA boundaries from data obtained from irrigated producers and/or the Kansas Water Right Information System (WRIS).
    a. Each year, aggregated land-use will be compared for land parcels within the LEMA boundaries and outside LEMA boundaries.
    b. After 5 years, historic land-use will be compared both across time (comparing LEMA producers before and after) and across boundaries (comparing LEMA and non-LEMA producers).
3. Developing measures of water-use changes for land parcels within the LEMA boundaries and outside LEMA boundaries from data obtained from irrigated producers and/or WRIS.
    a. Each year, aggregated water-use will be compared for land parcels within the LEMA boundaries and outside LEMA boundaries.
    b. After 5 years, historic water-use will be compared both across time (comparing LEMA producers before and after) and across boundaries (comparing LEMA and non-LEMA producers).

Background on Sheridan County 6 LEMA

The Ogallala Aquifer is significantly over-appropriated. The aquifer has declined in some areas more than 60% since predevelopment. Past efforts to slow the decline and insure the future economic viability of the region have been largely unsuccessful. The 2012 Legislature passed SB 310 making LEMAs a part of Kansas water law. This law gives groundwater management districts (GMDs) the authority to initiate a voluntary public hearing process to consider a specific conservation plan to meet local goals. LEMAs are proactive, locally designed, and initiated water management strategies for a specific geographic area that are promoted through a GMD and then reviewed and approved by the Chief Engineer. Once approved by

the Chief Engineer the LEMA plan becomes law, effectively modifying prior appropriation regulations. The stated purpose of the LEMA legislation was to reduce groundwater consumption in order to conserve the state's water supply and extend the life of the Ogallala Aquifer.

On December 31, 2012, the chief engineer issued his Order of Decision accepting the LEMA proposed by GMD#4 producers for the Sheridan #6 high priority area. This voluntary LEMA imposed a fixed-quantity-per-right groundwater use restriction on local irrigators, which on average is approximately 20% less than historic use. Producers within the boundaries of the LEMA were assigned a 5-year allocation of 55 inches per acre. The LEMA blueprint may well be the future of groundwater management in Kansas. The LEMA process overcomes the problems associated with the 'top-down' Intensive Groundwater Use Control Area (IGUCA) process. To an extent, the new process also minimizes the common property externality associated with groundwater extraction.

Golden, Peterson, and O'Brien (2008) provided the initial economic analysis associated with the LEMA water use restriction. This static analysis yielded net economic losses associated with reduced groundwater use. Applying dynamic case study techniques, Golden and Leatherman (2017) suggested that, in the Wet Walnut Creek IGUCA, producers were able to mitigate the initial economic losses through innovation. This was accomplished by maintaining/expanding the production of higher valued crops and by adopting efficient irrigation technologies and practices. With these alternate research results in mind it is important that we monitor the economic outcomes associated with the water use restriction and disseminate the information to stakeholders. At present there are additional LEMAs planned for GMD 1, GMD 2, and GMD 4, however there is some hesitancy as local producers want to 'wait and see what happens in Sheridan #6 LEMA'.

When water-use is restricted, irrigated producers develop and implement strategies to mitigate potential revenue losses. Buller (1988) and Wu, Bernardo, and Mapp (1996) suggest that producers will change crop mix by shifting from high water-use crops, such as corn, into crops with lower consumptive use, possibly even converting to nonirrigated production. Burness and Brill (2001) and Williams et al. (1996) suggest that in such cases producers will adopt more efficient irrigation technology. Harris and Mapp (1986) and Klocke et al. (2004) suggest that computer-aided technologies and improved irrigation scheduling might provide a solution. Schlegel, Stone, and Dumler (2005) report significant water savings with the adoption of a limited irrigation management strategy. This research will provide insights into the management strategies adopted by irrigated producers in the Sheridan #6 LEMA.

II. Agronomic Model Overview

The agronomic portion of this research relies heavily on the quasi-experimental control group analysis method. This method defines an agronomic parameter of interest, a target area, a control area, and a treatment. Preferably, the only difference between the target area and the control area is that the target area received the treatment and the control area did not receive the treatment. For our case, the treatment is the implementation of the LEMA, as depicted in Figure 1, the target area is the Sheridan #6 high priority area, the control area is comprised of irrigated cropland within a three-mile boundary around the Sheridan #6 high priority area, and the agronomic parameters of interest are crop mix and groundwater use. If the agronomic parameters in the target and control areas are comparable before the treatment occurs, then any statistically significance difference in the agronomic parameters of interest after the treatment occurs represents the effect of the treatment. As an example, if the target area and control area had comparable irrigated acreage before the LEMA was implemented, and the target area had statistically fewer acres than the control area after the LEMA was implemented, then it is assumed that the LEMA caused a reduction in the number of irrigated acres in the target area.

A strong association between the target and control counties will simplify the statistical modeling by comparing parameters in a similar framework. By minimizing the effects of other factors such as

commodity prices, rainfall, and soil types, the effects of the LEMA should be easier to identify. The benefits of this approach are its intuitive appeal, transparency, and the fact that it is less dependent on assumptions regarding functional forms of structural models and reduced-form relationships. Since the target and control areas are similar, the use of a linear model to control for potentially convoluting factors should give a good approximation (ERS, 2004). The quasi-experimental control group analysis has been used extensively in impact analysis (ERS, 2004; Bohm and Lind, 1993; Reed and Rogers, 2003; Eklund, Jawa, and Rajala, 1999; Huff et al., 1985; Golden and Leatherman, 2017).

Broder, Taylor, and McNamara (1992) define a time-series linear regression discontinuity model that is suitable for this analysis. The model is estimated using binary variables (dummy variables) to test impacts associated with a treatment for significant intercept shifts or discontinuities. Golden and Leatherman (2017) applied a similar model to their analysis of the Wet Walnut IGUCA, and a more detailed description of the model can be found there.

In the following sections models for each agronomic variable of interest will be developed and the results reported and discussed. In most cases, data from the target and control areas will be graphed to provide a visual depiction of the data being discussed. Making direct comparisons of agronomic variable across the target and control area is problematic. While the data are statistically similar, the magnitude will not be identical. Indexed values will be used to make relative comparisons. When applied to a time series, indexed values are obtained by dividing each annual value by the starting value. When multiplied by 100, an indexed value represents the percent of staring values that occurs in each year.

The regression model used to analyze the indexed values can be defined as

$$\Delta AV = \quad AV_T - AV_C = \beta_0 + \beta_1 * D$$

where ΔAV is the difference in the indexed value of the agronomic variable of interest, T indexes the target area, C indexes the control area, and D is a binary variable that takes the value of zero for the years 2003 through 2012, and a value of one for the years 2013 thru 2017. β_0 is the estimated intercept and β_1 is the estimated intercept shift which defines the impact of the LEMA.

III. Agronomic Results

The following results are based on data obtained from the Kansas Water Right Information System (WRIS) for the years 2003 through 2017. The WRIS dataset provides time series data on each point of diversion (PDIV), typically a single water well, in the target area and control area. Producer generated annual water use reports provide the basis for the WRIS dataset. For each PDIV the dataset includes total annual acre-foot groundwater usage, total acres irrigated, and crop type. The crop type is listed as a code number- for example the crop code for a field that is 100% corn is '2' and the crop code for a field that that has both corn and grain sorghum (a mixed crop field) is '23'. When crop specific acres are discussed below, a 'Mixed Crop Allocation Table' was used to allocate acres to individual crops. As an example, if the crop code was '23' it was assumed that the reported irrigated acres was comprised of 50% corn and 50% grain sorghum. As a result, when crop specific acreage is discussed, all fields that were comprised of either a single crop or mixed crop were included in the calculation.[1] Unfortunately, for a mixed crop field, producer's only report total acre-foot groundwater usage, and no reasonable method has been developed to allocate the total acre-foot groundwater usage to individual crops. Therefore, when crop specific groundwater usage is discussed below, only fields that were comprised of a single crop were included in the calculation.[2]

[1] This method is consistent with methods used by the Kansas Department of Agriculture.

[2] The average groundwater use for alfalfa, grain sorghum, and wheat are not reported as there were insufficient numbers of single crop fields to generate valid results.

Total Irrigated Acres
Figure 2 illustrates the indexed values for total irrigated acreage within the target and control areas and Table 2 reports the regression results. The results suggest that prior to the LEMA the target area averaged a statistically insignificant 1.7% fewer irrigated acres than the control area and after the LEMA the target area averaged an additional statistically significant 10.9% fewer irrigated acres than the control area. This implies that the LEMA generated an average 10.9% reduction in irrigated acreage relative to the control area. However, referencing Figure 2, it should be noted that the control area significantly increased their irrigated acres after 2013.

Total Groundwater Use
Figure 3 illustrates the indexed values for total groundwater use within the target and control areas and Table 3 reports the regression results. The results suggest that prior to the LEMA the target area averaged a statistically insignificant 1.3% greater groundwater use than the control area and after the LEMA the target area averaged an additional statistically significant 23.1% less groundwater use than the control area. This implies that the LEMA generated an average 23.1% reduction in total groundwater use relative to the control area.

Average Groundwater Use per Acre
Figure 4 illustrates the indexed values for the average groundwater use per acre within the target and control areas and Table 4 reports the regression results. The results suggest that prior to the LEMA the target area averaged a statistically significant 2.6% greater average groundwater use per acre than the control area and after the LEMA the target area averaged an additional statistically significant 16.0% less average groundwater use per acre than the control area. This implies that the LEMA generated an average 16.0% reduction in average groundwater use per acre relative to the control area.

Total Irrigated Corn Acres
Figure 5 illustrates the indexed values for the total irrigated corn acres within the target and control areas and Table 5 reports the regression results. The results suggest that prior to the LEMA the target area averaged a statistically significant 9.2% less total irrigated corn acres than the control area and after the LEMA the target area averaged an additional statistically significant 23.3% less total irrigated corn acres than the control area. This implies that the LEMA generated an average 23.3% reduction in total irrigated corn acres relative to the control area. The percentage change amounts to an average of approximately 3,000 acres of decreased corn acreage within the target area.

Total Irrigated Alfalfa Acres
Figure 6 illustrates the indexed values for the total irrigated alfalfa acres within the target and control areas and Table 6 reports the regression results. The results suggest that prior to the LEMA the target area averaged a statistically significant 28.3% less total irrigated alfalfa acres than the control area and after the LEMA the target area averaged an additional statistically insignificant 13.5% less total irrigated alfalfa acres than the control area. This implies that the LEMA had no statistically significant impact on total irrigated alfalfa acres relative to the control area.

Total Irrigated Grain Sorghum Acres
Figure 7 illustrates the indexed values for the total irrigated grain sorghum acres within the target and control areas and Table 7 reports the regression results. The results suggest that prior to the LEMA the target area averaged a statistically insignificant 33.7% more total irrigated grain sorghum acres than the control area and after the LEMA the target area averaged an additional statistically significant 335.4% more total irrigated grain sorghum acres than the control area. This implies that the LEMA generated an average 335.4% increase in total irrigated grain sorghum acres relative to the control area. The percentage change amounts to an average of approximately 750 acres of increased grain sorghum acreage within the target area.

Total Irrigated Soybean Acres

Figure 8 illustrates the indexed values for the total irrigated soybean acres within the target and control areas and Table 8 reports the regression results. The results suggest that prior to the LEMA the target area averaged a statistically insignificant 1.0% more total irrigated soybean acres than the control area and after the LEMA the target area averaged an additional statistically insignificant 6.19% less total irrigated soybean acres than the control area. This implies that the LEMA had no statistically significant impact on total irrigated soybean acres relative to the control area.

Total Irrigated Wheat Acres

Figure 9 illustrates the indexed values for the total irrigated wheat acres within the target and control areas and Table 9 reports the regression results. The results suggest that prior to the LEMA the target area averaged a statistically insignificant 20.0% more total irrigated wheat acres than the control area and after the LEMA the target area averaged a statistically significant 60.3% more total irrigated wheat acres than the control area. This implies that the LEMA generated an average 60.3% increase in total irrigated wheat acres relative to the control area. The percentage change amounts to an average of approximately 500 acres of increased wheat acreage within the target area.

Total Irrigated Mixed Crop Acres

Figure 10 illustrates the indexed values for the total irrigated mixed crop acres within the target and control areas and Table 10 reports the regression results. The results suggest that prior to the LEMA the target area averaged a statistically significant 17.1% less total irrigated mixed crop acres than the control area and after the LEMA the target area averaged a statistically significant 30.8% less total irrigated mixed crop acres than the control area. This implies that the LEMA generated an average 30.8% decrease in total irrigated mixed crop acres relative to the control area. The percentage change amounts to an average of approximately 2,600 acres of decreased mixed crop acreage within the target area.

Average Groundwater Use per Irrigated Corn Acre

Figure 11 illustrates the indexed values for the average groundwater use per irrigated corn acre within the target and control areas and Table 11 reports the regression results. The results suggest that prior to the LEMA the target area averaged a statistically insignificant 0.9% less average groundwater use per acres than the control area and after the LEMA the target area averaged a statistically significant 17.8% less average groundwater use per acres than the control area. This implies that the LEMA generated a statistically significant 17.8% reduction in the average groundwater use per irrigated corn acre relative to the control area. Between 2003 and 2012 producers in the target area used an average of 1.24 acre-feet per acre on irrigated corn. During the first 5 years of the LEMA (2013 – 2017) producers in the target area used an average of 0.85 acre-feet per acre on irrigated corn, or a decrease of 31.2%.

Average Groundwater Use per Irrigated Soybean Acre

Figure 12 illustrates the indexed values for the average groundwater use per irrigated corn acre within the target and control areas and Table 12 reports the regression results. The results suggest that prior to the LEMA the target area averaged a statistically significant 9.9% more average groundwater use per acres than the control area and after the LEMA the target area averaged a statistically significant 19.4% less average groundwater use per acres than the control area. This implies that the LEMA generated a statistically significant 19.4% reduction in the average groundwater use per irrigated soybean acre relative to the control area. Between 2003 and 2012 producers in the target area used an average of 1.12 acre-feet per acre on irrigated corn. During the first 5 years of the LEMA (2013 – 2017) producers in the target area used an average of 0.78 acre-feet per acre on irrigated corn, or a decrease of 30.4%.

IV. Economic Results

As we move into the 21st century, goals for our water resources are gradually changing. Concerns over aquifer decline rates call into question the current allocation of water resources. With increasing frequency, producers and policy makers are asked to decide how to reduce groundwater consumption. Policy makers, producers, and other stakeholders are concerned about the likely negative economic impacts that the agricultural producers might incur as crop water use is reduced. Unfortunately, there is little economic literature and less empirical data that is capable of providing guidance on the likely impacts.

This section of the report reviews economic data collected from irrigated crop producers. These producers generally have irrigated cropland within the boundaries of the LEMA, as well as irrigated cropland outside the boundaries of the LEMA. Producer involvement was strictly voluntary; they reported data directly to GMD #4 who passed the data to the author for analysis. Due to the limited number of participants reporting economic data, the results cannot be considered statistically valid, never the less they are informative. Additionally, rainfall and soil type were not reported by the producers and these variables are important determinants of crop yield. In the following tables 'Cash Flow' was the economic metric reported. Cash Flow was defined as gross revenue (crop price x crop yield) less variable costs of production (fertilizer, seed, herbicide, hired labor etc.). While each producer reported their own crop price, for this analysis, the annual average crop price reported by all producers was used in the cash flow calculation. Land rent and fixed equipment costs were not included in the analysis.

Table 13 summarizes the producer reported data for the 2013 through 2017 crop year. Irrigated corn producers within the LEMA boundary reported using 23.1% less groundwater and yielding 1.2% less corn as compared to irrigated corn producers outside the LEMA boundary. These data are relatively consistent with irrigated crop production functions developed by Kansas State University Research and Extension which exhibit diminishing marginal returns, from the standpoint that using less groundwater typically generates less yield. However, if producers are efficiently using groundwater, outside the LEMA area we would expect a slightly larger yield loss. Somewhat surprisingly, irrigated corn producers within the LEMA boundary reported 4.3% more cash flow than their higher yielding counterparts outside the LEMA. Irrigated soybean producers within the LEMA boundary reported using 1.3% less groundwater and yielding14.9% less soybeans as compared to irrigated soybean producers outside the LEMA boundary. These data are relatively consistent with irrigated crop production functions developed by Kansas State University Research and Extension. Soybean producers within the LEMA boundary reported 12.4% less cash flow than their higher yielding counterparts outside the LEMA. There was only one field of irrigated grain sorghum reported from outside the LEMA boundary. The producers that grew irrigated grain sorghum inside the LEMA boundary applied an average of 4.1 inches per acre, 60.5% less groundwater than their counterpart, yielded 13.8% less grain, but 59.9% more cash flow.

V. Rainfall Data

As previously mentioned, rainfall is a major determinant of groundwater use and crop yield. Figure 13 illustrates the historic annual rainfall for Sheridan County for the years 2000 through 2017. The average for this period was 20.3 inches per year. Both 2013 and 2014 were dryer than normal years, while 2015, 2016, and 2017 were wetter than normal years.

VI. Hydrology Response

The stated purpose of the LEMA legislation was to reduce groundwater consumption in order to conserve the state's water supply and extend the life of the Ogallala Aquifer. While the purpose of this research was to document the observed economic and agronomic changes, it is certainly relevant to comment on the hydrology response to the LEMA. After analyzing the data, Jim Butler, Kansas Geological Survey senior

scientist and geohydrology section chief stated that the results indicate that the decline rate within the LEMA has gone from about two feet per year to about 5 inches per year.[3]

VII. Conclusions

The purpose of this report was to provide the methods, assumptions, and estimates of the agronomic and economic impacts associated with groundwater use reductions in the Sheridan #6 LEMA. The reader should note that this is the 'Final Report' and provides information from the five-year study

Relative to their neighbors outside the LEMA boundary, irrigated crop producers within the boundary of the LEMA: reduced total groundwater use by a statistically significant 23.1%, reduced average groundwater use per acre by a statistically significant 16.0%, reduced irrigated crop acreage by a statistically significant 10.9%, reduced irrigated corn acreage by a statistically significant 23.3%, increased irrigated grain sorghum acreage by a statistically significant 335.4%, and increased irrigated wheat acreage by a statistically significant 60.3%.

The economic results are consistent with Golden and Leatherman (2017) and suggests that, given the certainty of groundwater use reductions, producers are able to implement strategies to maintain returns and apply less groundwater. Additional research on the risk associated with reduced groundwater use is needed. The producer-supplied data suggests that producers within the LEMA boundary have been able to reduce groundwater use with minimal impact on cash flow. While we can observe the changes in crop mix and water use, we cannot discern, at this point, exact strategies producers are using to reduce variable expenses and/or adjust cultural practices.

On February 17, 2017, GMD 4, at the request of producers in the Sheridan #6 LEMA, submitted a request to the Division of Water Resources to extend the Sheridan #6 LEMA. On August 24, 2017, the Chief Engineer accepted the extension proposal for the period 2018-2022. This suggests that producers within the Sheridan #6 LEMA believe they can mitigate any negative economic consequences associated with reduced groundwater use and that the benefits of groundwater conservation outweigh the costs.

[3] Source: http://www.kgs.ku.edu/General/News/2017/stabilize.html

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IX. Tables

Table 1. Example of Partial Budgets

Name of Operator			**Due October 1, 2014**			
Phone #			Return to: Manager, GMD4			
Email:			(Electronic copy preferred)			
Crop Year 2013						
	Parcels *(land handled as a single parcel; can be 1/2 circle, can be multiple circles); add parcel columns as needed*					
Operator Designated Farm Identifier (name or number)	1	2	3	4	5	6
Is This Farm in the LEMA (yes or no)						
Total Groundwater Pumped per crop*						
Well Capacity (GPM/Acre)						
Total Irrigated Acres						
Crops						
INCOME PER ACRE						
A. Yield per acre						
B. Price per bushel**						
C. Miscellaneous Income *(if due to LEMA)*						
D. Returns/acre ((A x B) + C) *(auto filled)*						
E. COSTS PER ACRE						
1. Seed						
2. Herbicide						
3. Insecticide / Fungicide						
4. Fertilizer and Lime						
5. Crop Consulting						
6. Drying						
7. Miscellaneous						
8. Custom Hire						
9. Labor						
a. Planting						
b. Tilling						
c. Spraying						
d. Disking						
e. Harvesting						
f. Harvest Hauling						
g.						
10. Irrigation						
a. Labor (own time or hired)						
b. Fuel and Oil						
c. Repairs and Maintenance						
11. Land Charge / Rent***						
F. TOTAL COSTS						
G. RETURNS OVER COSTS (D - F) *(auto filled)*						

*** If growing wheat, total spring & fall water; if following wheat with another crop, separate out water per crop type**

** If not yet sold, give best estimate of price

***Any leases re-negotiated due to LEMA? If a % arrangement, give totals; write in crop shares

Table 2. Regression Results for the Difference in Total Irrigated Acreage

Variable	Description	Parameter Estimate
Intercept	Intercept	-0.017
D	Impact of LEMA	-0.109*
R^2	Degree of Fit	0.692

* Statistically significant at the 10% level

Table 3. Regression Results for the Difference in Total Groundwater Use

Variable	Description	Parameter Estimate
Intercept	Intercept	0.013
D	Impact of LEMA	-0.231*
R^2	Degree of Fit	0.848

* Statistically significant at the 10% level

Table 4. Regression Results for the Difference in Average Groundwater Use per Acre

Variable	Description	Parameter Estimate
Intercept	Intercept	0.026*
D	Impact of LEMA	-0.160*
R^2	Degree of Fit	0.768

* Statistically significant at the 10% level

Table 5. Regression Results for the Difference in Total Irrigated Corn Acres

Variable	Description	Parameter Estimate
Intercept	Intercept	-0.092*
D	Impact of LEMA	-0.233*
R^2	Degree of Fit	0.789

* Statistically significant at the 10% level

Table 6. Regression Results for the Difference in Total Irrigated Alfalfa Acres

Variable	Description	Parameter Estimate
Intercept	Intercept	-0.283*
D	Impact of LEMA	0.136
R^2	Degree of Fit	0.041

* Statistically significant at the 10% level

Table 7. Regression Results for the Difference in Total Irrigated Grain Sorghum Acres

Variable	Description	Parameter Estimate
Intercept	Intercept	0.338
D	Impact of LEMA	3.354*
R^2	Degree of Fit	0.679

* Statistically significant at the 10% level

Table 8. Regression Results for the Difference in Total Irrigated Soybean Acres

Variable	Description	Parameter Estimate
Intercept	Intercept	0.010
D	Impact of LEMA	-0.061
R^2	Degree of Fit	0.021

* Statistically significant at the 10% level

Table 9. Regression Results for the Difference in Total Irrigated Wheat Acres

Variable	Description	Parameter Estimate
Intercept	Intercept	0.200
D	Impact of LEMA	0.603*
R^2	Degree of Fit	0.294

* Statistically significant at the 10% level

Table 10. Regression Results for the Difference in Total Irrigated Mixed Crop Acres

Variable	Description	Parameter Estimate
Intercept	Intercept	-0.171*
D	Impact of LEMA	-0.308*
R^2	Degree of Fit	0.444

* Statistically significant at the 10% level

Table 11. Regression Results for the Difference in Total Average Groundwater Use per Irrigated Corn Acre

Variable	Description	Parameter Estimate
Intercept	Intercept	-0.009
D	Impact of LEMA	-0.178*
R^2	Degree of Fit	0.788

* Statistically significant at the 10% level

Table 12. Regression Results for the Difference in Total Average Groundwater Use per Irrigated Soybean Acre

Variable	Description	Parameter Estimate
Intercept	Intercept	0.099*
D	Impact of LEMA	-0.194*
R^2	Degree of Fit	0.500

* Statistically significant at the 10% level

Table 13. 2013-2017 Producer Reported Economic Data

Item	Observations	Water Use (in/ac)	Yield (bu/ac)	Cash Flow ($/ac)	Cash Flow ($/in)
Corn Weighted Average - Inside LEMA	20	10.3	218.0	$375	$36
Corn Weighted Average - Outside LEMA	11	13.4	220.6	$360	$27
Sorghum Weighted Average - Inside LEMA	4	4.3	152.6	$361	$83
Sorghum Weighted Average - Outside LEMA	1	11.0	177.0	$226	$21
Soybeans Weighted Average - Inside LEMA	5	9.5	59.6	$315	$33
Soybeans Weighted Average - Outside LEMA	4	9.7	70.0	$358	$37
Sunflowers Weighted Average - Inside LEMA	0	NA	NA	NA	NA
Sunflowers Weighted Average - Outside LEMA	1	6.0	2818	$788	$131
Wheat Weighted Average - Inside LEMA	5	5.7	76.3	$219	$38
Wheat Weighted Average - Outside LEMA	3	7.4	81.8	$178	$24

X. Figures

Figure 1. Target and Control Area

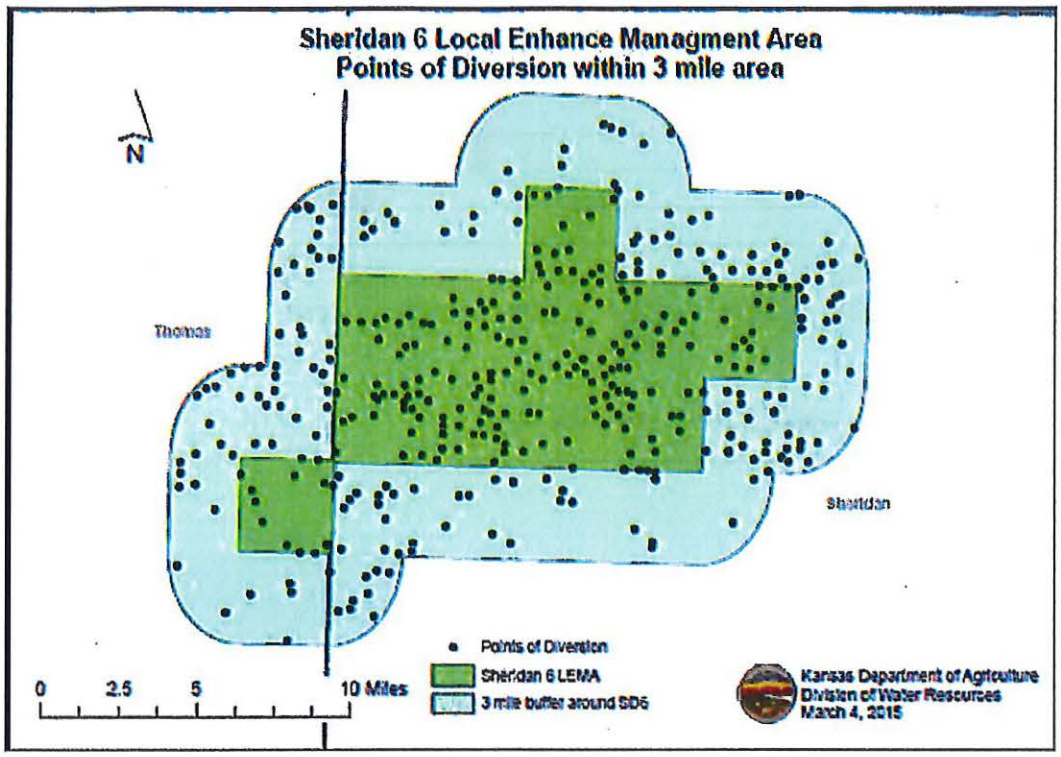


Figure 2. Total Irrigated Acres

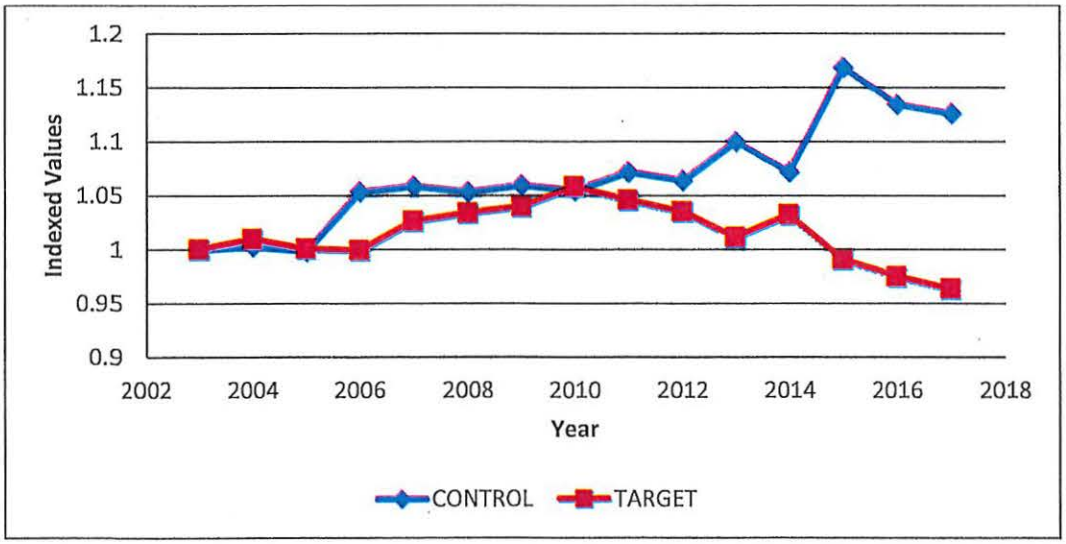


Figure 3. Total Groundwater Use

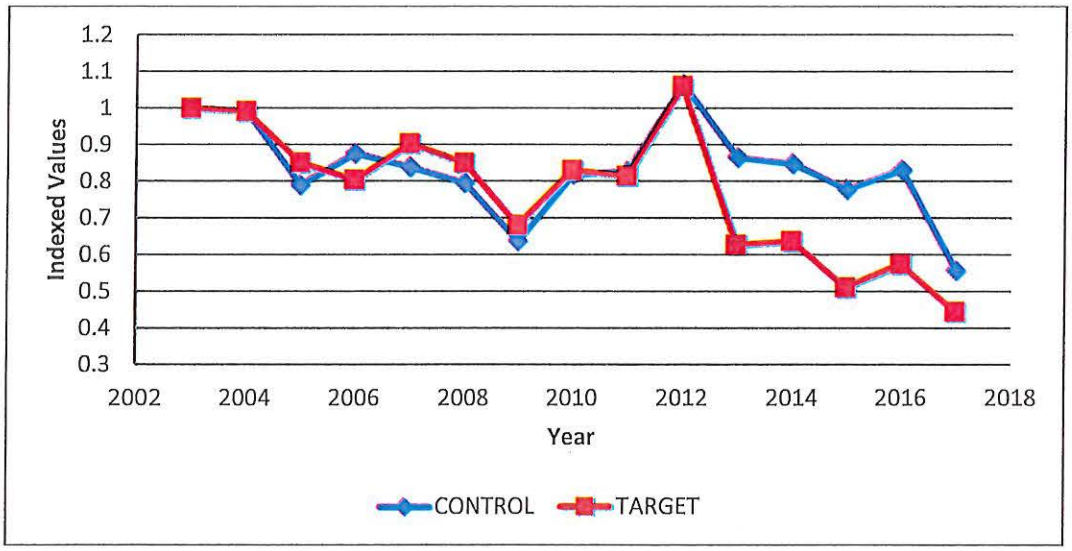


Figure 4. Average Groundwater Use per Acre

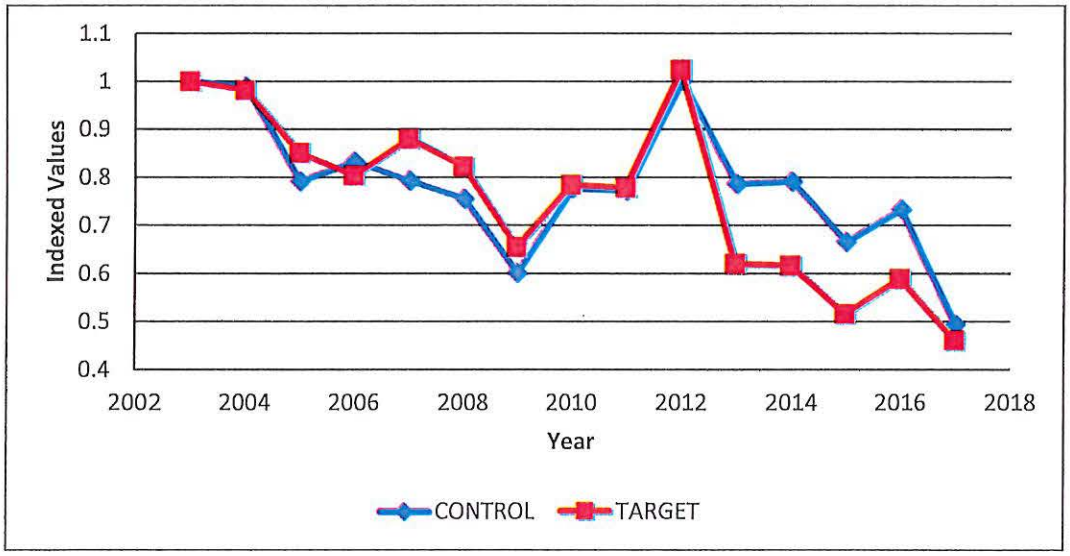


Figure 5. Total Irrigated Corn Acres

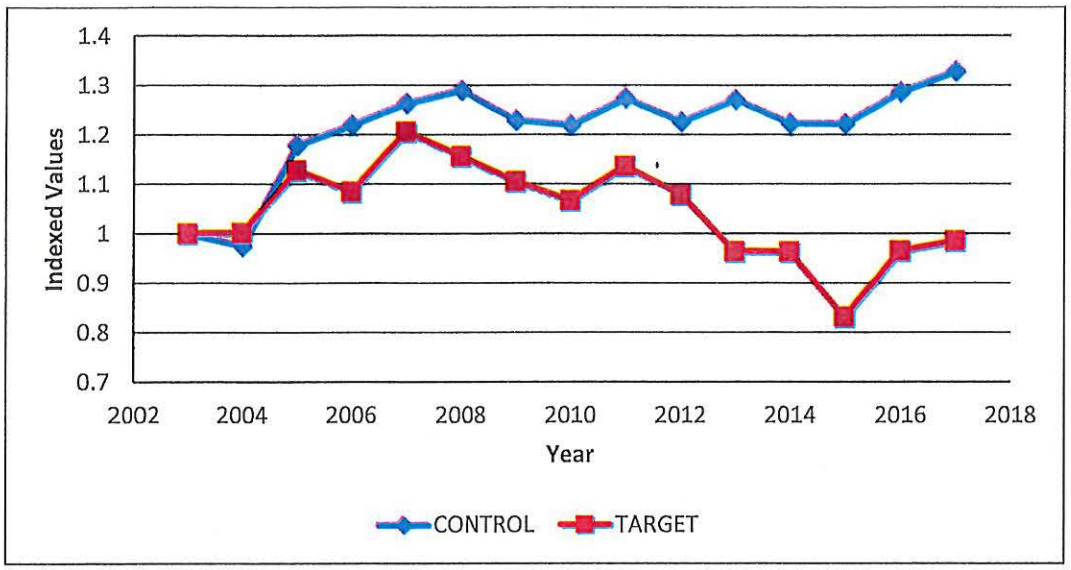


Figure 6. Total Irrigated Alfalfa Acres

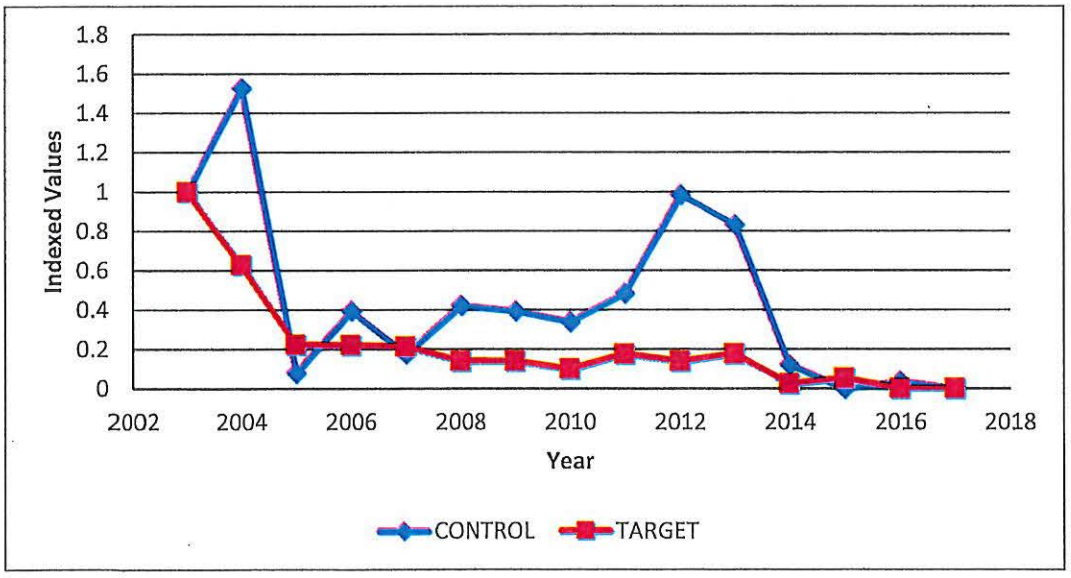


Figure 7. Total Irrigated Grain Sorghum Acres

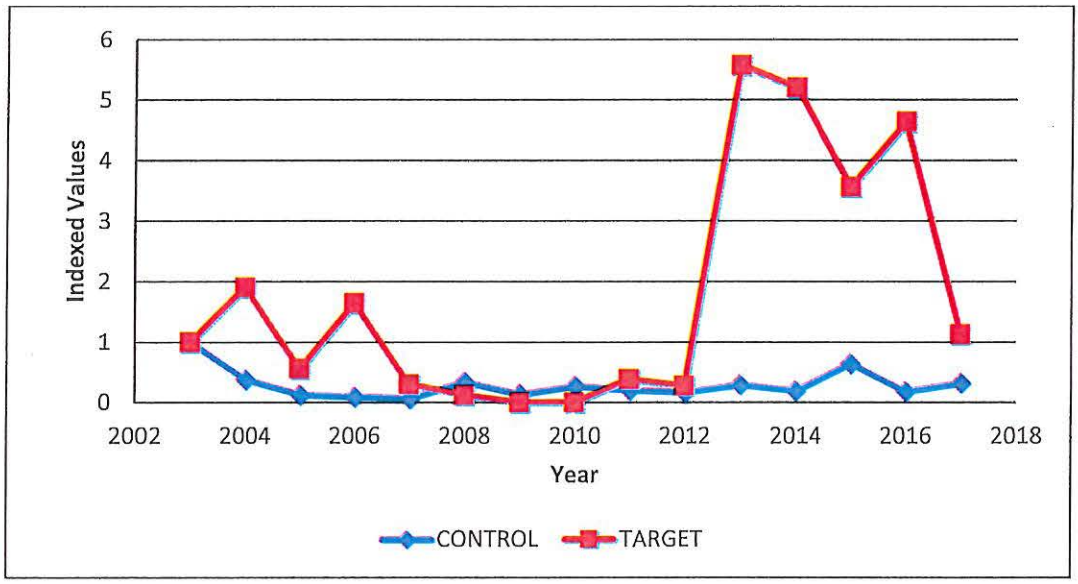


Figure 8. Total Irrigated Soybean Acres

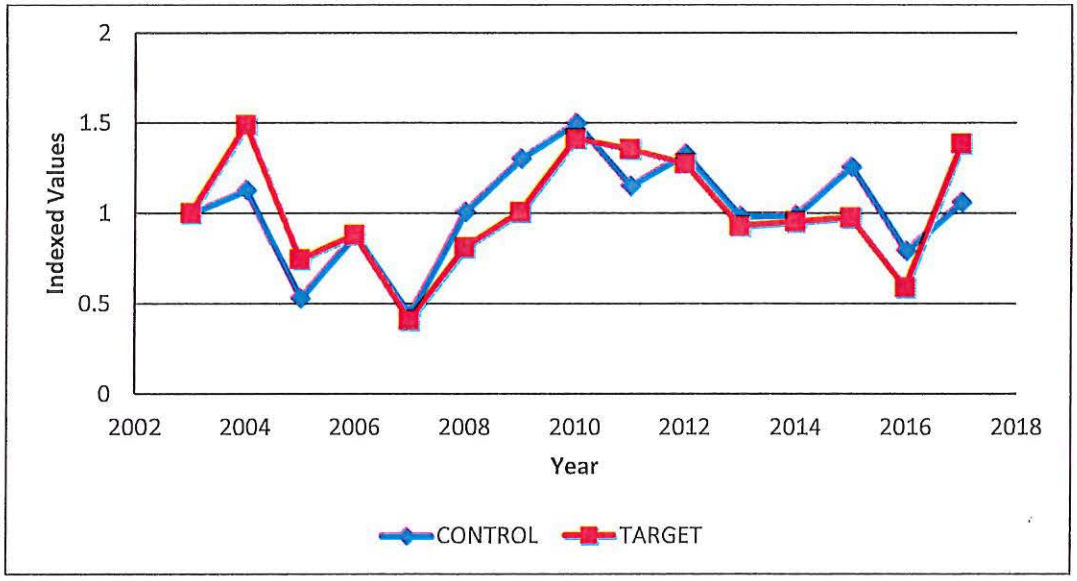


Figure 9. Total Irrigated Wheat Acres

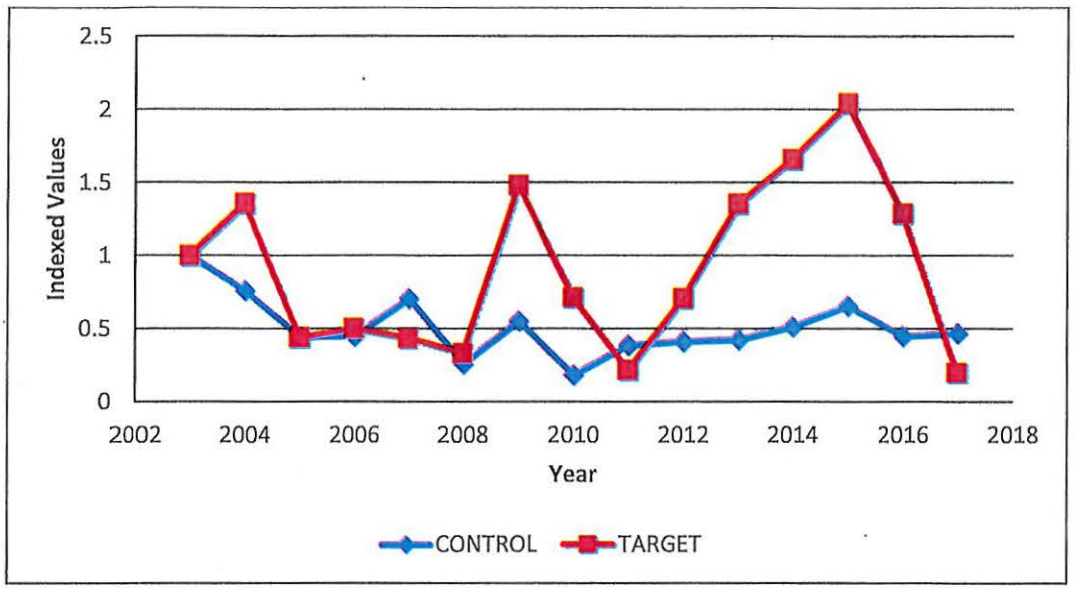


Figure 10. Total Irrigated Mixed Crop Acres

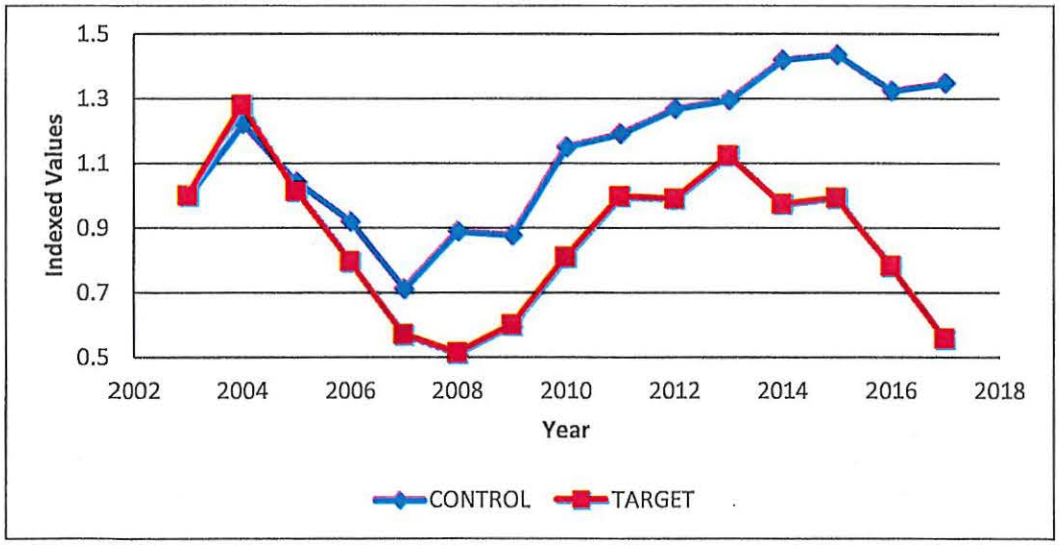


Figure 11. Average Groundwater Use per Irrigated Corn Acre

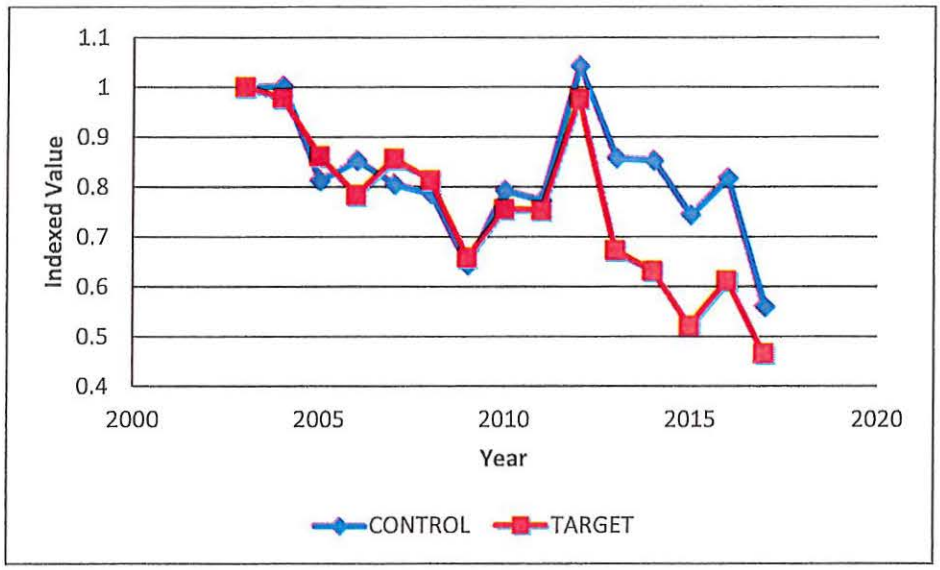


Figure 12. Average Groundwater Use per Irrigated Soybean Acre

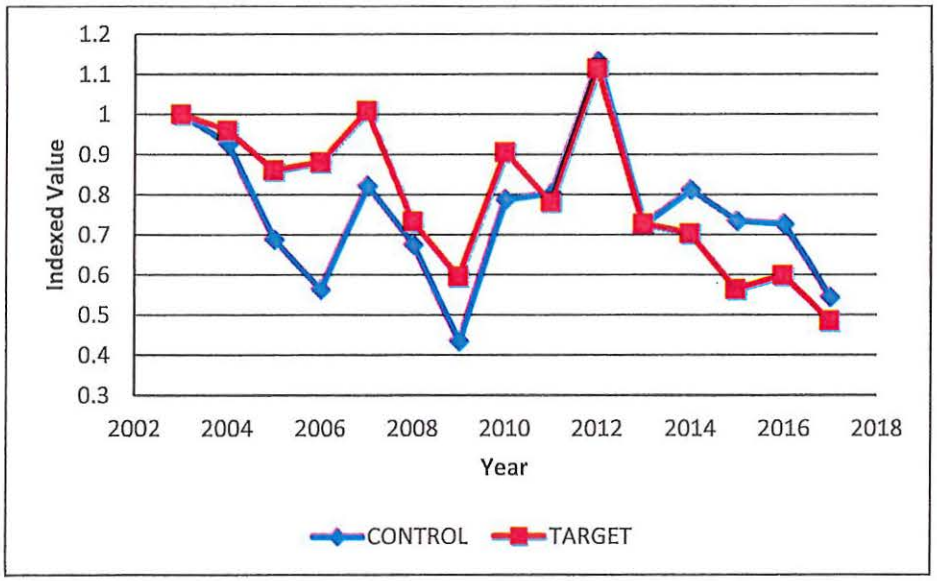
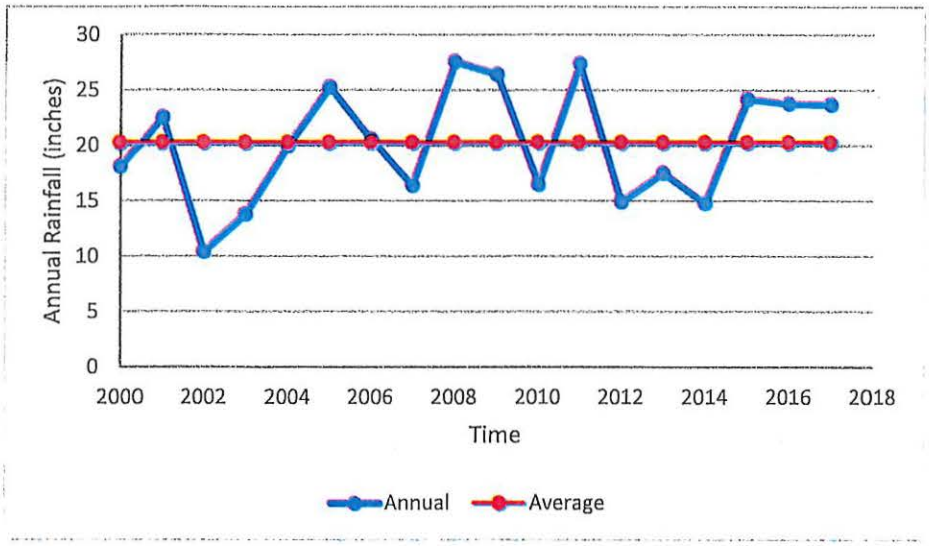


Figure 13. Historic Annual Rainfall for Sheridan County



Source: http://mesonet.k-state.edu