

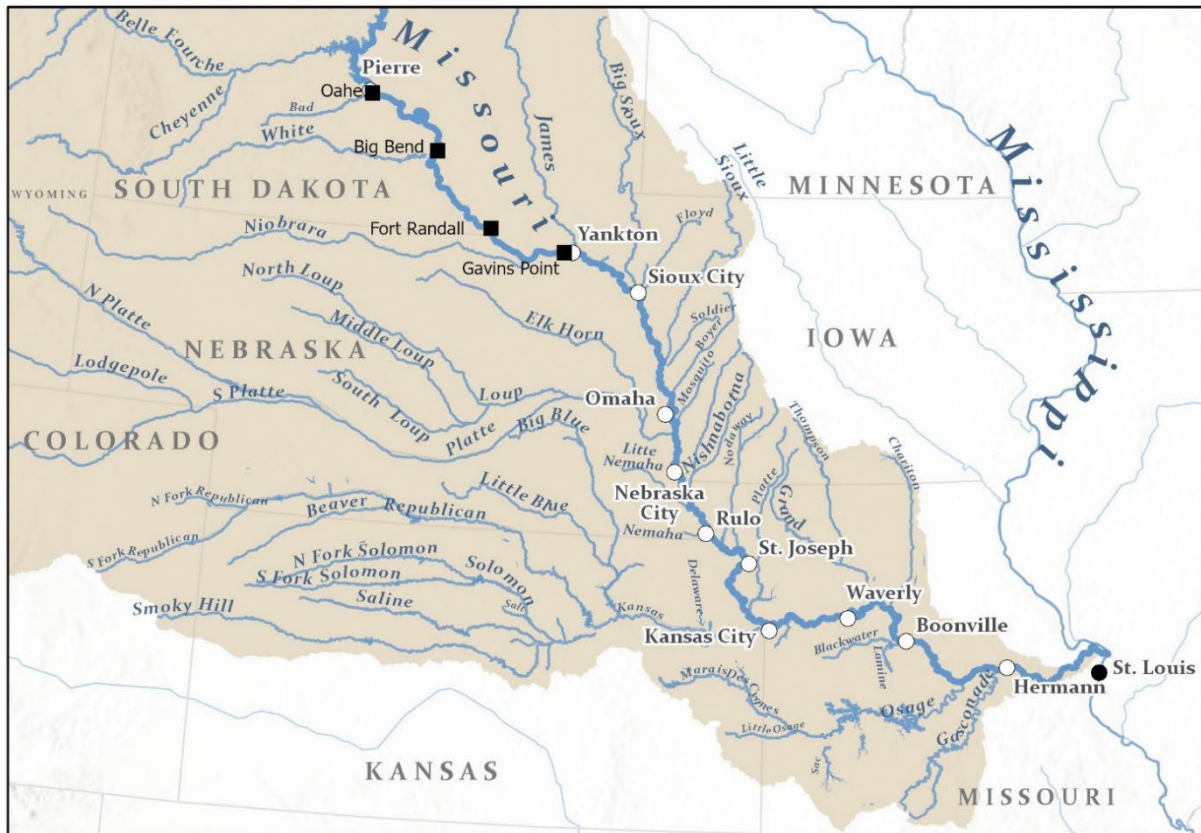


US Army Corps
of Engineers ®

Missouri River Flow Frequency Study

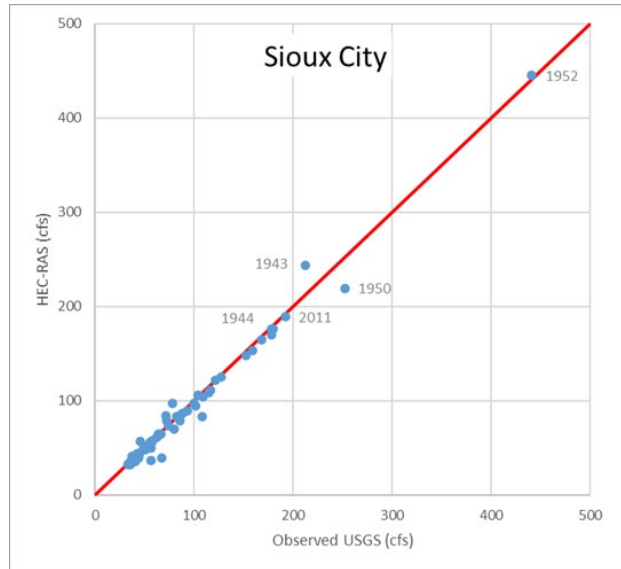
Yankton, South Dakota to Hermann, Missouri

***Appendix H: HEC-RAS Observed, Unregulated,
and Regulated Plots and Top 5***

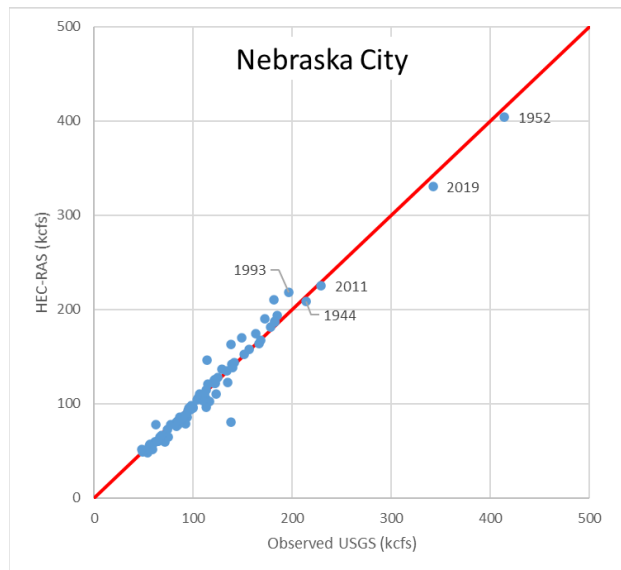


U.S. Army Corps of Engineers
Northwestern Division
Omaha District, Kansas City District, and
Missouri River Basin Water Management

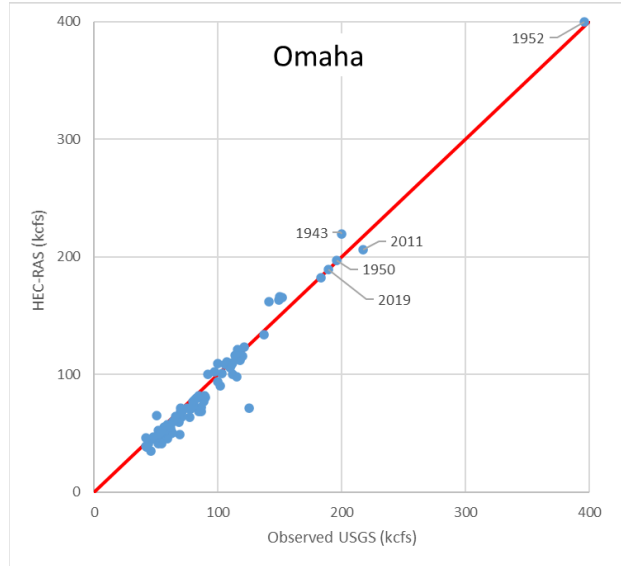
June 2023



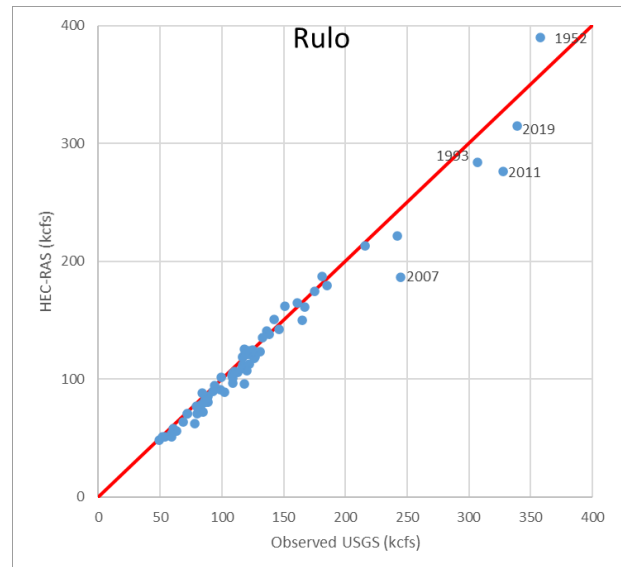
Rank	Water Year	USGS Observed	HEC-RAS Modeled	Difference	
				cfs	%
1	1952	441,000	445,032	4,032	1%
2	1950	252,000	219,405	-32,595	-13%
3	1943	212,000	243,841	31,841	15%
4	2011	192,000	188,931	-3,069	-2%
5	1944	180,000	175,665	-4,336	-2%



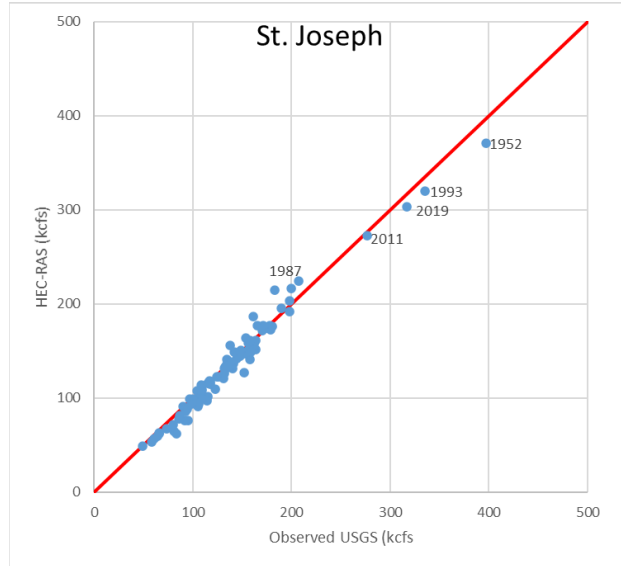
Rank	Water Year	USGS Observed	HEC-RAS Modeled	Difference	
				cfs	%
1	1952	414,000	404,162	-9,838	-2%
2	2019	342,000	330,017	-11,983	-4%
3	2011	229,000	225,262	-3,739	-2%
4	1944	214,000	208,898	-5,102	-2%
5	1993	196,000	218,442	22,442	11%



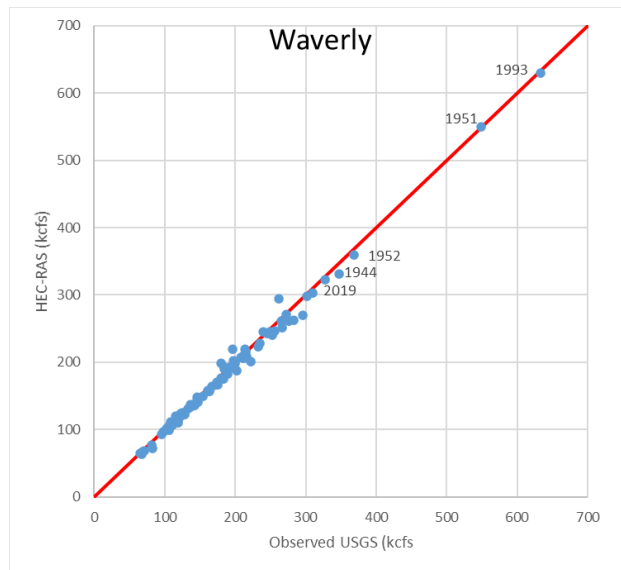
Rank	Water Year	USGS Observed	HEC-RAS Modeled	Difference	
				cfs	%
1	1952	396,000	399,622	3,622	1%
2	2011	217,000	206,133	-10,867	-5%
3	1943	200,000	219,186	19,186	10%
4	1950	196,000	196,707	707	0%
5	2019	189,000	188,937	-63	0%



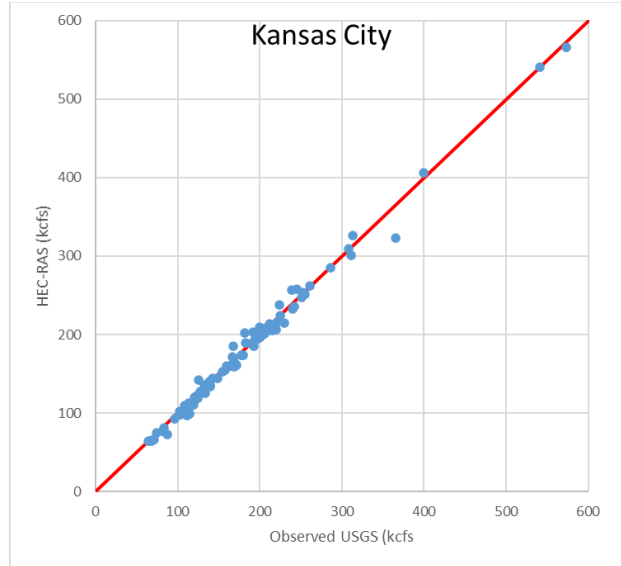
Rank	Water Year	USGS Observed	HEC-RAS Modeled	Difference	
				cfs	%
1	1952	358,000	389,870	31,870	9%
2	2019	339,000	315,140	-23,860	-7%
3	2011	328,000	276,250	-51,750	-16%
4	1993	307,000	283,880	-23,120	-8%
5	2007	245,000	186,250	-58,750	-24%



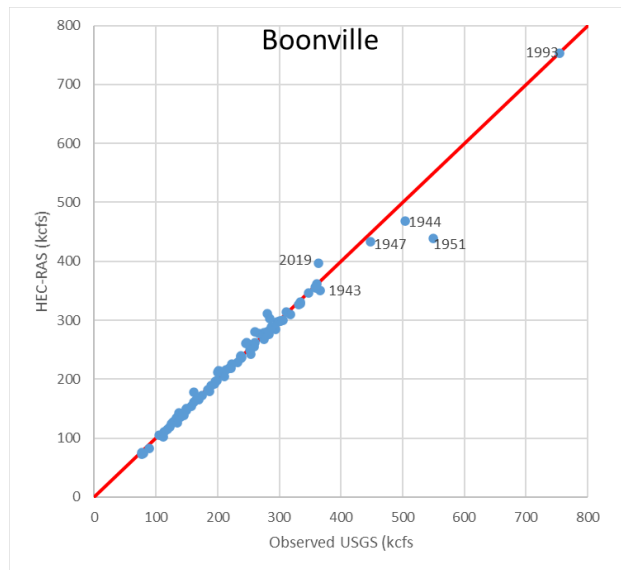
Rank	Water Year	USGS Observed	HEC-RAS Modeled	Difference	
				cfs	%
1	1952	397,000	370,370	-26,630	-7%
2	1993	335,000	319,790	-15,210	-5%
3	2019	317,000	303,120	-13,880	-4%
4	2011	277,000	272,890	-4,110	-1%
5	1987	207,000	224,140	17,140	8%



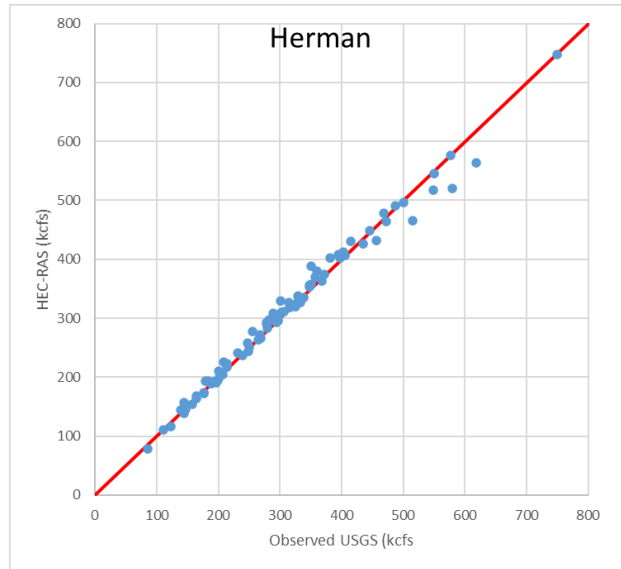
Rank	Water Year	USGS Observed	HEC-RAS Modeled	Difference	
				cfs	%
1	1993	633,000	629,870	-3,130	0%
2	1951	549,000	549,540	540	0%
3	1952	369,000	359,150	-9,850	-3%
4	1944	347,000	331,850	-15,150	-4%
5	2019	328,000	323,110	-4,890	-1%



Rank	Water Year	USGS Observed	HEC-RAS Modeled	Difference	
				cfs	%
1	1951	573,000	566,580	-6,420	-1%
2	1993	541,000	541,320	320	0%
3	1952	400,000	406,310	6,310	2%
4	1943	366,000	322,800	-43,200	-12%
5	1974	313,000	326,570	13,570	4%

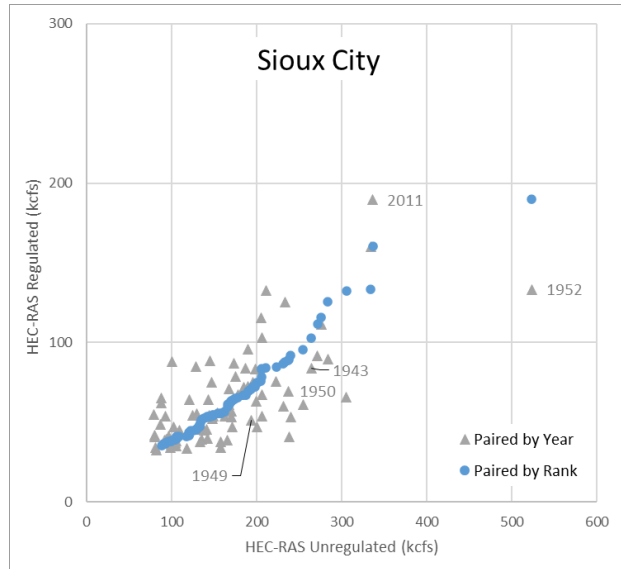


Rank	Water Year	USGS Observed	HEC-RAS Modeled	Difference	
				cfs	%
1	1993	755,000	752,540	-2,460	0%
2	1951	550,000	439,130	-110,870	-20%
3	1944	504,000	467,670	-36,330	-7%
4	1947	448,000	433,240	-14,760	-3%
5	1943	366,000	350,750	-15,250	-4%

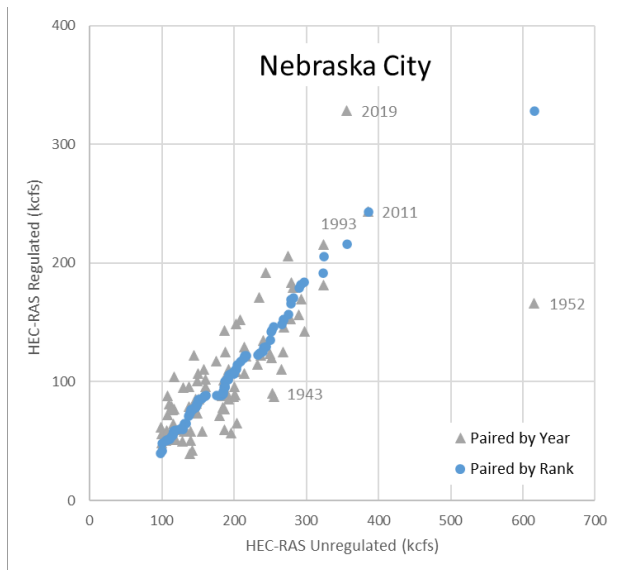


Rank	Water Year	USGS Observed	HEC-RAS Modeled	Difference	
				cfs	%
1	1993	750,000	747,300	-2,700	0%
2	1951	618,000	563,470	-54,530	-9%
3	1995	579,000	520,450	-58,550	-10%
4	1944	577,000	576,480	-520	0%
5	1943	550,000	545,890	-4,110	-1%

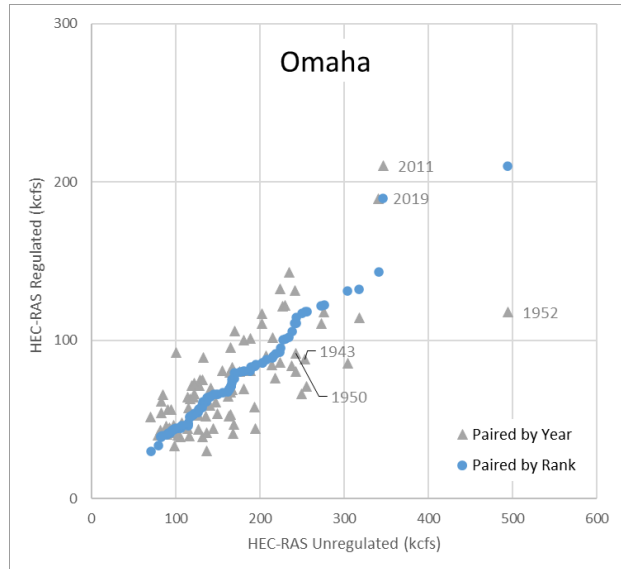
*The two HEC-RAS models overlap from Nebraska City to St. Joseph, values for Rulo are from KC district model.



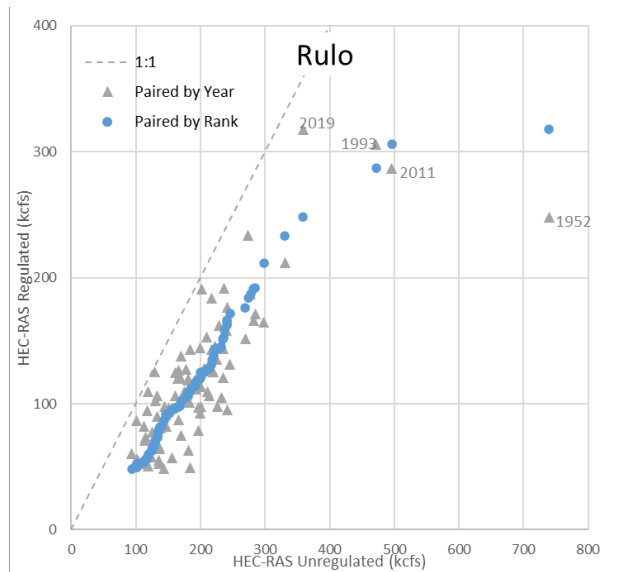
Water Year	HEC-RAS		
	Observed	Unregulated	Regulated
1952	445,032	523,198	133,328
1943	243,841	264,315	83,875
1950	219,405	237,137	69,574
2011	188,931	336,434	189,801
1949	176,418	193,396	51,206



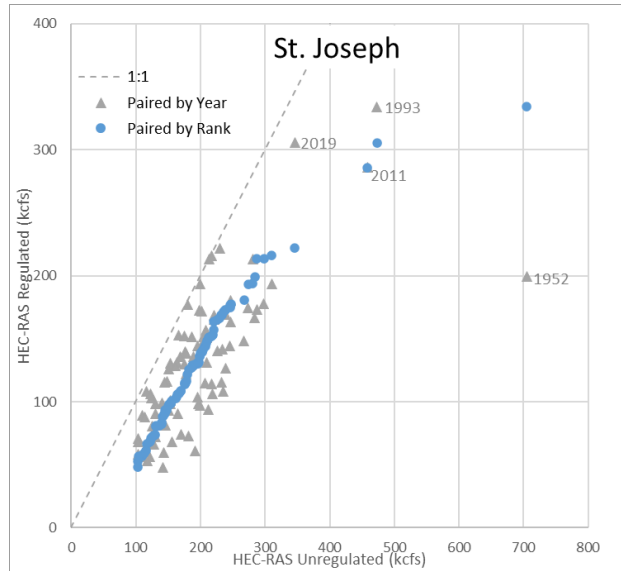
Water Year	HEC-RAS		
	Observed	Unregulated	Regulated
1952	404,162	615,935	165,896
2019	330,017	356,151	328,169
2011	225,262	385,691	243,186
1993	218,442	324,011	215,899
1943	209,878	252,540	90,062



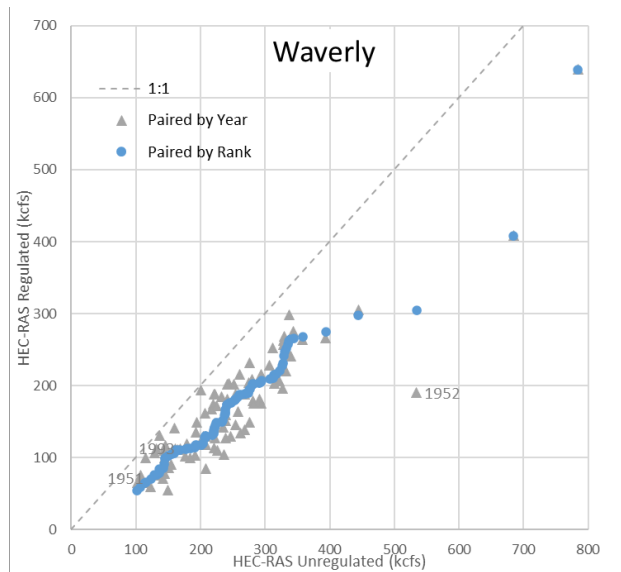
Water Year	HEC-RAS		
	Observed	Unregulated	Regulated
1952	399,622	494,101	117,893
1943	219,186	253,266	87,977
2011	206,133	346,178	210,144
1950	196,707	242,400	91,645
2019	188,937	340,597	189,600



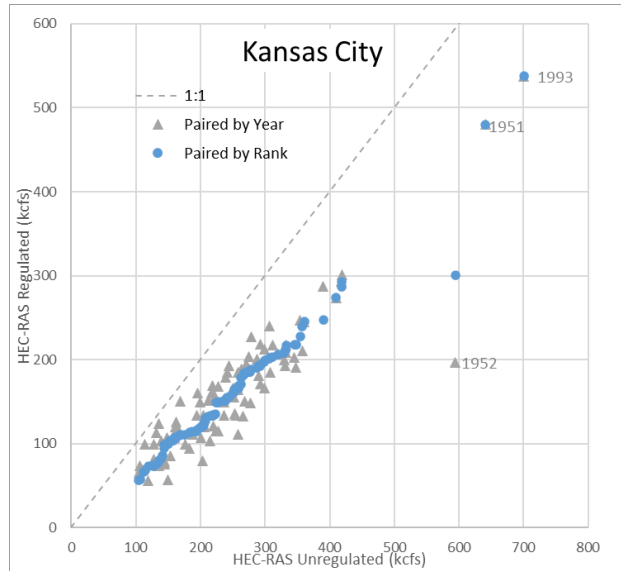
Water Year	HEC-RAS		
	Observed	Unregulated	Regulated
1952	389,867	739,590	248,088
2019	315,136	358,877	317,766
2011	276,250	496,194	286,650
1993	283,883	471,982	305,815
2007	186,248	202,058	191,035



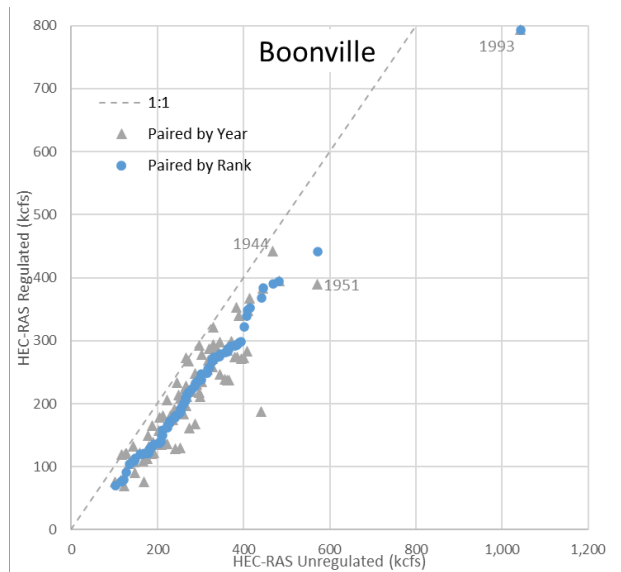
Water Year	HEC-RAS		
	Observed	Unregulated	Regulated
1952	370,370	704,859	199,337
1993	303,124	345,754	305,438
2019	272,886	458,298	285,723
2011	319,794	473,361	334,012
1987	215,042	217,614	215,855



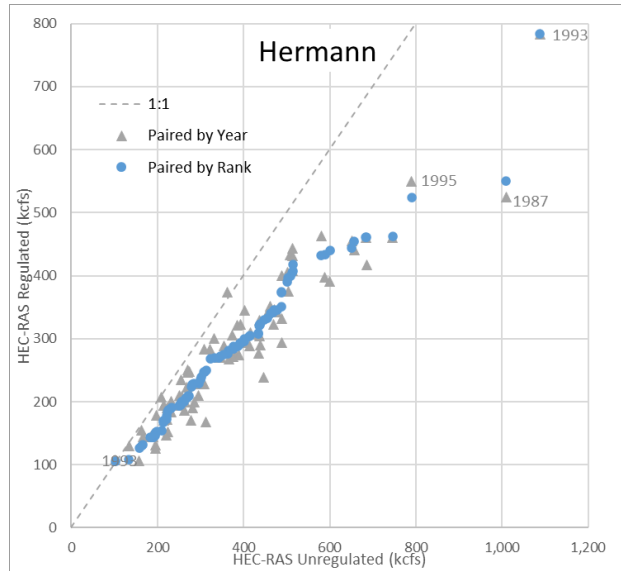
Water Year	HEC-RAS		
	Observed	Unregulated	Regulated
1993	629,865	784,216	638,965
1951	549,544	684,738	408,364
1952	359,154	534,669	190,092
1944	331,854	330,132	268,289
2019	323,114	444,380	305,285



Water Year	HEC-RAS		
	Observed	Unregulated	Regulated
1951	566,581	640,737	479,890
1993	541,316	700,171	537,390
1952	406,305	594,563	197,010
1943	322,804	347,733	190,581
1974	326,568	418,978	300,594



Water Year	HEC-RAS		
	Observed	Unregulated	Regulated
1993	752,543	1,042,555	793,274
1951	439,131	572,136	389,941
1944	467,670	467,832	441,775
1947	433,235	445,175	383,403
1943	350,752	362,661	237,993



Water Year	HEC-RAS		
	Observed	Unregulated	Regulated
1993	747,297	1,088,325	783,414
1951	563,473	686,169	417,415
1944	576,481	580,171	462,856
1947	490,714	502,148	405,153
1943	545,888	588,903	397,469

*The two HEC-RAS models overlap from Nebraska City to St. Joseph, values for Rulo are from KC district model.