Missouri Department of Natural Resources
St. Francis River - WBID 2835
Water Chemistry and Bacterial Data, 2000-2006

																		Recreational Season	
Org	Site	Site Name	Yr	Mo	Dy	Time	H	Flow	C	DO	pH	SC	NH3N	SO4	Cl	FC	Ecoli	Log FC	Log Ecoli
USGS	2835/36.8	St. Francis River at Saco	2000	1	10	1500	5	388	7	13.9	7.8	190	0.0099			5	1		
USGS	2835/36.8	St. Francis River at Saco	2000	3	14	1515	6	392	12	11	8.7	181	0.0099			2	1		
USGS	2835/36.8	St. Francis River at Saco	2000	5	10	1520	9	150	23	6.5	7.9	246	0.0099	14	10	6	1	1.79	0.00
USGS	2835/36.8	St. Francis River at Saco	2000	7	25	1430	5	84	26	8	7.7	204	0.0099			13	11	2.56	2.40
USGS	2835/36.8	St. Francis River at Saco	2000	9	14	1045	4	36	24	6.2	7.4	246	0.0099			74	68	4.30	4.22
USGS	2835/36.8	St. Francis River at Saco	2000	11	14	1530	9	171	10	11.6	7.7	369	0.0199	21	25	11	1		
USGS	2835/36.8	St. Francis River at Saco	2001	1	18	835	5	697	2	13.6	7.9	178	0.0199			25	18		
USGS	2835/36.8	St. Francis River at Saco	2001	3	12	1410	5	394	10	12.1	7.7	207	0.0199			3	2		
USGS	2835/36.8	St. Francis River at Saco	2001	5	9	1140	9	177	21	7.9	7.7	230	0.0199	13	7	11	7	2.40	1.95
USGS	2835/36.8	St. Francis River at Saco	2001	7	16	1540	9	56	28	8.7	7.7	230	0.0199			3	4	1.10	1.39
USGS	2835/36.8	St. Francis River at Saco	2001	9	5	1500	9	75	28	7.9	7.2	198	0.0199			8	4	2.08	1.39
USGS	2835/36.8	St. Francis River at Saco	2001	11	13	1610	9	96	11.8	13	7	252	0.0199		27	3	2		
USGS	2835/36.8	St. Francis River at Saco	2002	1	23	850	9	234	3.8	13.9	7.9	250	0.0199			2	1		
USGS	2835/36.8	St. Francis River at Saco	2002	3	6	1315	5	781	5.8	15.3	8.2	180	0.0199			1	0.499		
USGS	2835/36.8	St. Francis River at Saco	2002	5	15	1700	5	2750	17.4	8.7	7.5	1242	0.0199		2.1	900	180	6.80	5.19
USGS	2835/36.8	St. Francis River at Saco	2002	7	15	1510	9	227	27.6	8.1	7.9	262	0.0199			8	6	2.08	1.79
USGS	2835/36.8	St. Francis River at Saco	2002	9	4	1430	9	195	28.5	7.1	7.5	196	0.0199			11	5	2.40	1.61
USGS	2835/36.8	St. Francis River at Saco	2002	11	19	855	9	296	8.7	10.5	8.1	269	0.0199	17	9	9	1		
USGS	2835/36.8	St. Francis River at Saco	2003	1	7	920	7	967	3.7	14.6	7.5	174	0.0199			110	0.499		
USGS	2835/36.8	St. Francis River at Saco	2003	3	10	1730	5	626	7.5	12.7	8.2	175	0.0199			4	0.499		
USGS	2835/36.8	St. Francis River at Saco	2003	5	20	920	8	831	19.4	7.8	7.4	169	0.0199	11	4	175	100	5.16	4.61
USGS	2835/36.8	St. Francis River at Saco	2003	7	8	915	9	227	28.6	5.5	7.2	263	0.0199			13	7	2.56	1.95
USGS	2835/36.8	St. Francis River at Saco	2003	9	4	1620	5	590	24.6	7.3	7.2	186	0.04			420	290	6.04	5.67
USGS	2835/36.8	St. Francis River at Saco	2003	11	19	1440	8	12700	13.4	9.8	7	94	0.0199	8	3	1800	1700		
USGS	2835/36.8	St. Francis River at Saco	2004	1	20	1500	7	1250	2.8	13.1	7.7	144	0.0199			230	120		
USGS	2835/36.8	St. Francis River at Saco	2004	3	16	1530	6	642	9.2	11.3	8	191	0.0199			17	4		
USGS	2835/36.8	St. Francis River at Saco	2004	5	4	1150	5	1850	14.2	9.2	7	126	0.0199	10	3	360	420	5.89	6.04
USGS	2835/36.8	St. Francis River at Saco	2004	7	7	1410	9	152	27	7.1	7.8	251	0.0199			15	10	2.71	2.30
USGS	2835/36.8	St. Francis River at Saco	2004	9	7	1545	4	125	25.3	7.7	7.2	177	0.0199			27	15	3.30	2.71
USGS	2835/36.8	St. Francis River at Saco	2004	11	23	840		767	12.3	9.2	7.2	191	0.0199	13	6.3	40	32		
USGS	2835/36.8	St. Francis River at Saco	2005	1	25	915		614	2.4	13.5	7.8	190	0.0199			18	13		
USGS	2835/36.8	St. Francis River at Saco	2005	3	15	930		293	7.6	11.4	8.2	227	0.0199			4	1		

Org	Site	Site Name	Yr	Mo	Dy	Time	H	Flow	C	DO	pH	SC	NH3N	SO4	Cl	FC	Ecoli	Log FC	Log Ecoli
USGS	2835/36.8	St. Francis River at Saco	2005	5	17	1145		266	20.7	8.4	7.7	230	0.0199	13	6	30	12	3.40	2.48
USGS	2835/36.8	St. Francis River at Saco	2005	7	19	930		129	27.2	7.6	7.5	284	0.0199			500	360	6.21	5.89
USGS	2835/36.8	St. Francis River at Saco	2005	9	6	1150		81	25	6.4	6.8	274	0.0199			12	7	2.48	1.95
USGS	2835/36.8	St. Francis River at Saco	2005	11	2	950	8	118	12	9.2	7.5	277	0.0199	13	7.7	24	21		
USGS	2835/36.8	St. Francis River at Saco	2006	1	3	1300	9	219	7.2	14	8.4	280	0.0199			6	2		
USGS	2835/36.8	St. Francis River at Saco	2006	3	6	1220	9	305	9.1	12.7	8	219	0.0199			1	1		
USGS	2835/36.8	St. Francis River at Saco	2006	5	8	1315	5	448	17.8	9.5	7.8	173	0.0199	11	3.9	21	0.499	3.04	-0.70
USGS	2835/36.8	St. Francis River at Saco	2006	7	10	1340	5	92	24.8	5.1	7.3	248	0.015			130	74	4.87	4.30
USGS	2835/36.8	St. Francis River at Saco	2006	9	12	905	4	19	23.4	4.9	7.3	276	0.00499			16	27	2.77	3.30
MoDNR	2835/65.68	St Francis River at Hwy H	2001	8	8	1540	9		28	5.9	7.8	306	0.02499						
MoDNR	2835/65.68	St Francis River at Hwy H	2001	8	9	1505	9	6.7	29	5.4	7.7	317	0.05						
MoDNR	2835/65.68	St Francis River at Hwy H	2001	8	9	655	9		27	4.3	7.7	337	0.09						
MoDNR	2835/65.68	St Francis River at Hwy H	2001	8	10	650	9	7.35	27	3.8	7.6	327	0.1						
MoDNR	2835/65.68	St Francis River at Hwy H	2004	7	22	650		4.93	27.5	7.6	7.8	663	0.01499						
MoDNR	2835/65.68	St Francis River at Hwy H	2004	7	22	1230			30	9.9	8	670	0.01499						
MoDNR	2835/69.46	St. Francis River 1.75mi Below Wolf Creek	2001	8	8	1520	9		28	6	7.8	398	0.1						
MoDNR	2835/69.46	St. Francis River 1.75mi Below Wolf Creek	2001	8	9	640	9		26	4	7.6	418	0.15						
MoDNR	2835/69.46	St. Francis River 1.75mi Below Wolf Creek	2001	8	9	1450	9	6.7	29	6.6	7.8	429	0.17						
MoDNR	2835/69.46	St. Francis River 1.75mi Below Wolf Creek	2001	8	10	640	9	7.35	26	4.2	7.6	444	0.17						
MoDNR	2835/69.46	St. Francis River 1.75mi Below Wolf Creek	2004	7	22	620		4.27	26	6.9	7.9	964	0.01499						
MoDNR	2835/69.46	St. Francis River 1.75mi Below Wolf Creek	2004	7	22	1250			28	9.5	8	977	0.01499						
MoDNR	2835/71.8	St. Francis River at private property	2006	7	18	1315		3.5	29.3	8.4	8.1	1280	0.06						
MoDNR	2835/71.8	St. Francis River at private property	2006	7	19	1240			28.5	8.9	8.2	1370	0.05						
MoDNR	2835/71.8	St. Francis River at private property	2006	7	19	640			26.2	6.1	8.1	1360	0.06						
MoDNR	2835/71.8	St. Francis River at private property	2006	7	20	630			27.3	6.2	8.1	1480	0.07						
MoDNR	2835/73.8	St. Francis River 1.5 mi.below Farmington W. WWTP	2001	8	8	1505	9		28	5.8	7.9	573	0.11						
MoDNR	2835/73.8	St. Francis River 1.5 mi. below Farmington W. WWTP	2001	8	9	1440	9	3.7	29	6.6	8.1	603	0.07						
MoDNR	2835/73.8	St. Francis River 1.5 mi. below Farmington W. WWTP	2001	8	9	630	9		26	3.3	7.7	553	0.12						
MoDNR	2835/73.8	St. Francis River 1.5 mi. below Farmington W. WWTP	2001	8	10	630	9	4.35	25	2.9	7.7	598	0.08						
MoDNR	2835/73.8	St. Francis River 1.5 mi. below Farmington W. WWTP	2004	7	22	555		0.76	26	4.2	8	1590	0.01499						
MoDNR	2835/73.8	St. Francis River 1.5 mi. below Farmington W. WWTP	2004	7	22	1310			28	8.4	8	1590	0.01499						
MoDNR	2835/73.8	St. Francis River 1.5 mi. below Farmington W. WWTP	2006	7	18	1335		2.9	29.2	11.6	8.3	1580	0.03						
MoDNR	2835/73.8	St. Francis River 1.5 mi. below Farmington W. WWTP	2006	7	19	615			24.6	4.3	7.9	1680	0.03						
MoDNR	2835/73.8	St. Francis River 1.5 mi. below Farmington W. WWTP	2006	7	19	1255			29.1	10.3	8.2	1680	0.04						
MoDNR	2835/73.8	St. Francis River 1.5 mi. below Farmington W. WWTP	2006	7	20	605			26.1	3.8	7.9	1800	0.1						
MoDNR	2835/75.1	St. Francis River below Farmington Manor	2002	1	24						7.4		0.02499						

Org	Site	Site Name	Yr	Mo	Dy	Time	H	Flow	C	DO	pH	SC	NH3N	SO4	Cl	FC	Ecoli	Log FC	Log Ecoli
MoDNR	2835/75.3	St. Francis River 0.25 mi. above effl. Trib.	2001	8	8	1455	9		28	6.6	7.8	169	0.02499						
MoDNR	2835/75.3	St. Francis River 0.25 mi. above effl. Trib.	2001	8	9	620	9		26	4.7	7.7	172	0.02499						
MoDNR	2835/75.3	St. Francis River 0.25 mi. above effl. Trib.	2001	8	9	1430	9	2.7	30	6.8	8	174	0.02499						
MoDNR	2835/75.3	St. Francis River 0.25 mi. above effl. Trib.	2001	8	10	620	9	2.7	26	5.4	7.7	177	0.02499						
MoDNR	2835/75.3	St. Francis River 0.25 mi. above effl. Trib.	2004	7	22	1300		0.01	28	3.7	7.6	670	0.05						
MoDNR	2835/75.3	St. Francis River 0.25 mi. above effl. Trib.	2004	7	22	630			25.5	2	7.6	660	0.07						
MoDNR	2835/75.3	St. Francis River 0.25 mi. above effl. Trib.	2006	7	18	1425			28.6	7.8	7.7	644	0.12						
MoDNR	2835/75.3	St. Francis River 0.25 mi. above effl. Trib.	2006	7	19	1345			28.7	10.7	8	547	0.01499						
MoDNR	2835/75.3	St. Francis River 0.25 mi. above effl. Trib.	2006	7	19	600			24.2	5	7.6	583	0.08						
MoDNR	2835/75.3	St. Francis River 0.25 mi. above effl. Trib.	2006	7	20	550			26.2	5.4	7.8	533	0.01499						

Geomean	33.85	17.77
Log Mean	3.52	2.88
Log Std. Deviation	1.66	1.88
Sample Size	21	21

The water quality standard for *E. coli* in Class A Whole Body Contact recreational waters for protection of human health is 126 col/100 mL. The water quality standard for fecal coliform bacteria is 200 col/100 mL in Class A Whole Body Contact recreational waters. These standards are for the geometric mean of all bacterial counts taken during the recreational season, April 1 through October 31. For *E. coli* or fecal coliform bacteria, a water is judged to be unimpaired if the 60 percent Upper Confidence Limit on the mean is less than the appropriate water quality standard. The formula for the 60 percent Upper Confidence Limit is:

60 percent Upper Confindence Limit = (sample mean) + ((0.253)(standard deviation)/(square root of sample size))

The *E. coli* and fecal coliform data is normalized by natural log transformation and the UCL calcuations are as follows:

E. coli 60 percent Upper Confidence Limit = (2.88) + ((0.253)(1.88)/(4.58)) = 2.98 Anitlog of 2.98 = 19.71

Fecal Coliform 60 percent Upper Confidence Limit = (3.52) + ((0.253)(1.66)/(4.58)) = 3.61 Anitlog of 3.61 = 37.1

Since 19.71 is less than the Class A *E. coli* standard of 126 and since 37.10 is less than the Class A fecal coliform standard of 200, this water is judged to be **unimpaired** by bacteria.

The water quality standard for protection of aquatic life for dissolved oxygen is 5mg/L. For dissolved oxygen, the Listing Methodology Document allows a water to be judged as impaired if measurements on 10 percent of the days fail to meet the water quality standard.

Site	Frequeny < 5mg/L	Percent
2835/36.8	1 of 41	2.4
2835/65.68	2 of 4	50.0
2835/69.46	2 of 4	50.0
2835/71.8	0 of 3	0.0
2835/73.8	5 of 7	71.4
2835/75.3	2 of 7	28.6

One of 41 days exceeded the standard at Site 2835/36.8, or 2.4 percent. Since the binomial probability is more than the minimum allowable type one error rate of 0.1, this site is judged to be **unimpaired** by low dissolved oxygen.

Sixteen of 25 days at various sites upstream of Site 2835/65.68 exceeded the standard, or 64.0 percent. The binomial probability is 0. Since this probability is less than the minimum allowable type one error rate of 0.1, this segment is judged to be **impaired** by low dissolved oxygen.

It is believed that the Farmington West Wastewater Treatment Plant contributes to the higher percentage of low dissolved oxygen measurements at Site 2835/73.8. A Total Maximum Daily Load for high Biochemical Oxygen Demand (which contributes to low dissolved oxygen) and ammonia was approved by EPA in 2006. EPA has approved the removal of St. Francis River from the 303(d) List. However, because of low dissolved oxygen levels above the treatment plant and several miles below the treatment plant, it is believed that there are additional causes contributing to low dissolved oxygen in the St. Francis River

Missouri Department of Natural Resources' Water Protection Program, 573-751-1300, www.dnr.mo.gov
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