APPENDICES

Setup, Calibration, and Validation for Illinois River Watershed Nutrient Model and Tenkiller Ferry Lake EFDC Water Quality Model

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APPENDIX A
HYDROLOGY RESULTS

A.1 CALIBRATION

A.1.1 Annual Flow Statistics Table

Reach	Name	Annual Flow (in)			Daily		Monthly		Daily Peaks % Diff	NSE	
		Sim	Obs	% Vol error	R	R^2	R	R^2		Daily	Monthly
150	Illinois River at Savoy, AR	14.59	13.77	5.97	0.81	0.65	0.91	0.83	-8.96	0.63	0.83
316	Osage Creek near Elm Springs, AR	18.64	17.07	9.18	0.77	0.59	0.88	0.77	0.72	0.48	0.74
516	Sager Creek near West Siloam Springs, OK	18.13	18.03	0.56	0.71	0.50	0.81	0.65	-12.84	0.40	0.65
523	Flint Creek near Kansas, OK	12.75	12.28	3.78	0.79	0.62	0.89	0.80	3.45	0.57	0.79
630	Illinois River South of Siloam Springs, AR	14.13	14.07	0.43	0.83	0.69	0.91	0.83	-8.44	0.67	0.82
640	Illinois River near Watts, OK	13.76	13.60	1.18	0.81	0.66	0.92	0.85	-3.48	0.63	0.84
706	Baron Fork at Dutch Mills, AR	14.81	15.10	-1.89	0.75	0.57	0.84	0.70	-8.46	0.49	0.69
746	Baron Fork at Eldon, OK	14.10	13.69	3.01	0.88	0.78	0.95	0.91	-6.91	0.78	0.91
870	Illinois River near Tahlequah, OK	13.57	13.74	-1.27	0.77	0.60	0.95	0.90	-11.77	0.58	0.88
912	Caney Creek near Barber, OK	14.20	13.18	7.70	0.79	0.62	0.90	0.81	4.44	0.57	0.80
Mean Values		14.87	14.45	2.87	0.79	0.63	0.90	0.80	-5.22	0.58	0.80

A.1.2 Annual Flow Volumes Tables

Illinois River at Savoy, AR (Reach 150)

Year	Precipitation	Simulated Flow	Observed Flow	Residual	Percent Error
2001	50.59	18.23	14.21	4.02	28.30%
2002	43.88	15.24	13.62	1.62	11.89%
2003	34.41	6.78	7.57	-0.80	-10.52%
2004	44.99	15.55	17.05	-1.50	-8.78%
2005	30.07	8.47	9.04	-0.57	-6.28%
2006	52.51	14.32	8.26	6.06	73.27%
2007	35.89	9.45	9.20	0.25	2.75%
2008	56.16	22.13	23.39	-1.26	-5.40%
2009	56.58	21.12	21.55	-0.43	-2.00%
Mean	45.01	14.59	13.77	0.82	5.97%

Osage Creek near Elm Springs, AR (Reach 316)

Year	Precipitation	Simulated Flow	Observed Flow	Residual	Percent Error
2001	44.94	18.09	16.13	1.96	12.18%
2002	40.15	18.33	16.67	1.66	9.94%
2003	37.79	13.21	10.53	2.68	25.46%
2004	49.49	24.22	18.29	5.93	32.44%
2005	32.79	16.21	13.94	2.27	16.28%
2006	41.50	12.64	9.75	2.89	29.61%
2007	35.19	14.28	13.94	0.33	2.40%
2008	54.97	26.97	31.33	-4.36	-13.90%
2009	53.74	23.79	23.05	0.73	3.18%
Mean	43.40	18.64	17.07	1.57	9.18%

Sager Creek near West Siloam Springs, OK (Reach 516)

Year	Precipitation	Simulated Flow	Observed Flow	Residual	Percent Error
2001	42.63	18.64	15.06	3.58	23.75%
2002	44.05	20.22	15.49	4.73	30.53%
2003	36.47	12.75	8.39	4.36	52.01%
2004	48.55	22.70	24.52	-1.82	-7.43%
2005	33.75	14.57	13.17	1.40	10.59%
2006	40.59	11.88	10.56	1.31	12.44%
2007	35.13	13.97	14.18	-0.21	-1.45%
2008	49.31	21.86	33.83	-11.97	-35.38%
2009	55.56	26.62	27.08	-0.47	-1.72%
Mean	42.89	18.13	18.03	0.10	0.57%

Flint Creek near Kansas, OK (Reach 523)

Year	Precipitation	Simulated Flow	Observed Flow	Residual	Percent Error
2001	40.86	10.32	11.89	-1.58	-13.25%
2002	39.07	11.67	9.62	2.05	21.36%
2003	35.89	7.27	5.84	1.43	24.42%
2004	50.36	17.91	17.53	0.38	2.17%
2005	32.49	9.73	10.80	-1.07	-9.91%
2006	39.24	6.72	4.33	2.39	55.11%
2007	37.75	9.93	8.25	1.68	20.42%
2008	56.04	22.96	25.66	-2.70	-10.53%
2009	52.23	18.21	16.62	1.59	9.55%
Mean	42.66	12.75	12.28	0.46	3.78%

Illinois River South of Siloam Springs, AR (Reach 630)

Year	Precipitation	Simulated Flow	Observed Flow	Residual	Percent Error
2001	47.60	15.46	14.23	1.22	8.60%
2002	41.70	14.85	14.24	0.61	4.30%
2003	35.70	8.70	7.32	1.37	18.73%
2004	45.87	16.65	15.13	1.52	10.06%
2005	30.25	10.26	10.42	-0.16	-1.50%
2006	46.26	11.23	6.92	4.31	62.36%
2007	34.04	9.83	10.42	-0.58	-5.57%
2008	53.43	20.79	26.09	-5.30	-20.31%
2009	54.27	19.36	21.83	-2.47	-11.32%
Mean	43.24	14.13	14.07	0.06	0.42%

Illinois River near Watts, OK (Reach 640)

Year	Precipitation	Simulated Flow	Observed Flow	Residual	Percent Error
2001	47.26	14.83	14.00	0.83	5.90%
2002	41.55	14.39	13.36	1.03	7.74%
2003	35.57	8.31	7.48	0.83	11.12%
2004	45.73	16.14	14.89	1.25	8.39%
2005	30.34	9.95	9.91	0.05	0.48%
2006	46.46	10.88	7.55	3.33	44.11%
2007	34.28	9.63	10.01	-0.38	-3.78%
2008	53.55	20.53	25.45	-4.92	-19.32%
2009	54.27	19.15	19.74	-0.59	-2.97%
Mean	43.22	13.76	13.60	0.16	1.16%

Barron Fork at Dutch Mills, AR (Reach 706)

Year	Precipitation	Simulated Flow	Observed Flow	Residual	Percent Error
2001	44.85	13.58	13.87	-0.29	-2.08%
2002	40.18	12.79	11.52	1.27	11.00%
2003	32.51	4.95	6.31	-1.36	-21.51%
2004	43.24	13.87	14.70	-0.83	-5.64%
2005	34.49	9.79	8.61	1.18	13.64%
2006	57.78	16.18	20.50	-4.33	-21.11%
2007	39.96	10.29	10.60	-0.31	-2.95%
2008	62.52	26.90	29.17	-2.27	-7.77%
2009	61.48	24.96	20.58	4.38	21.28%
Mean	46.33	14.81	15.10	-0.28	-1.88%

Barron Fork at Eldon, OK (Reach 746)

Year	Precipitation	Simulated Flow	Observed Flow	Residual	Percent Error
2001	47.09	13.23	14.96	-1.73	-11.57%
2002	42.13	12.72	11.42	1.29	11.31%
2003	37.18	7.27	6.31	0.95	15.09%
2004	49.09	16.57	17.59	-1.02	-5.80%
2005	33.20	9.04	9.94	-0.90	-9.06%
2006	49.52	10.24	7.44	2.79	37.55%
2007	40.05	10.56	11.08	-0.52	-4.65%
2008	61.85	26.19	24.44	1.75	7.16%
2009	55.94	21.11	20.03	1.08	5.40%
Mean	46.23	14.10	13.69	0.41	3.02%

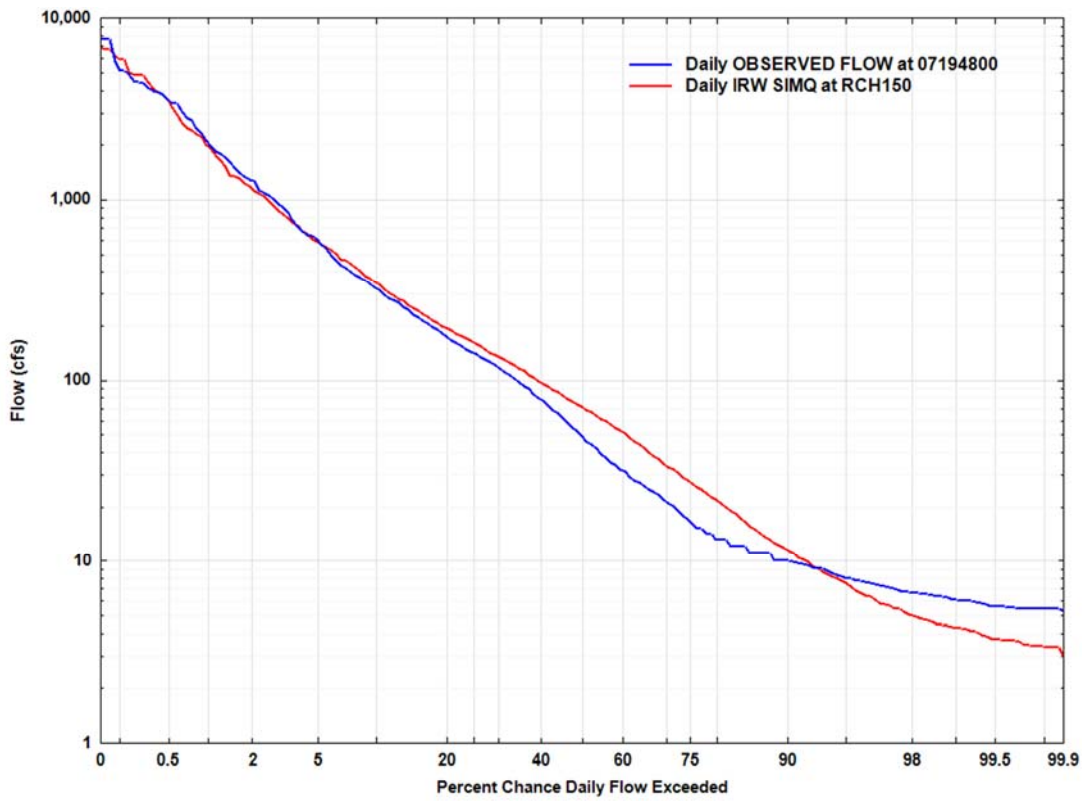
Illinois River near Tahlequah, OK (Reach 870)

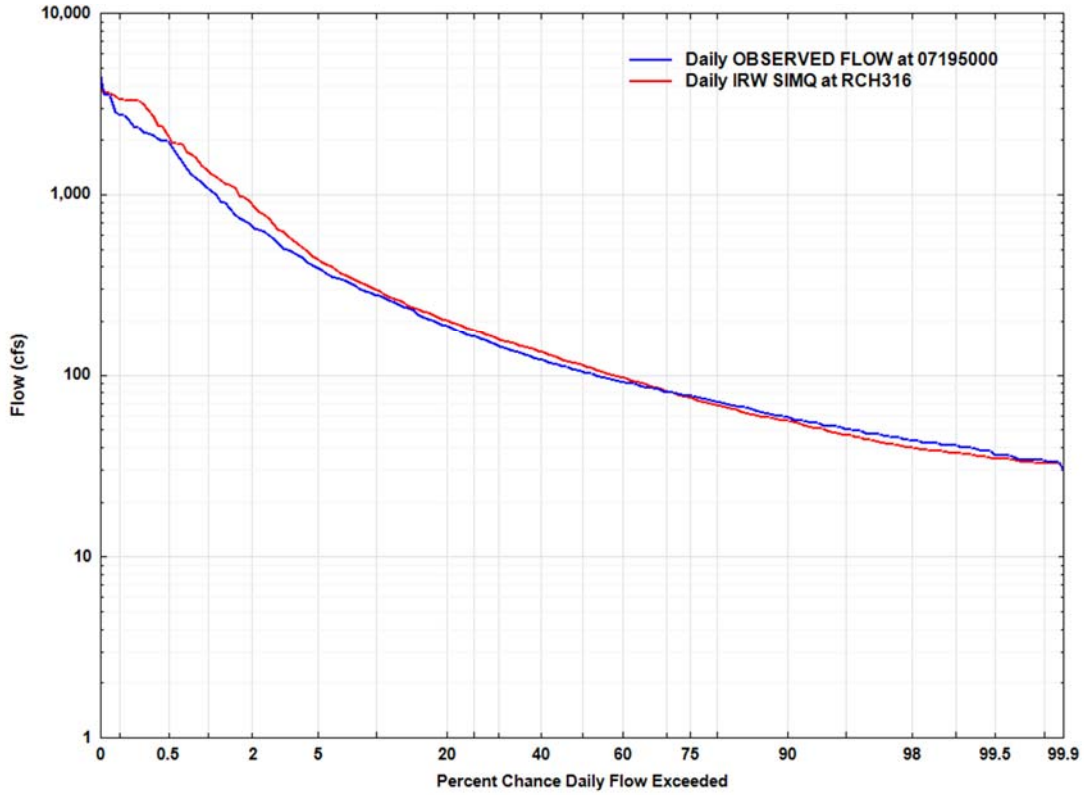
Year	Precipitation	Simulated Flow	Observed Flow	Residual	Percent Error
2001	46.01	13.42	14.77	-1.35	-9.17%
2002	41.06	13.01	12.16	0.84	6.94%
2003	36.20	7.91	6.83	1.07	15.72%
2004	48.19	16.86	16.59	0.27	1.63%
2005	31.14	9.69	10.20	-0.50	-4.93%
2006	45.11	9.44	6.12	3.32	54.15%
2007	36.57	10.01	10.52	-0.51	-4.85%
2008	56.93	22.93	26.36	-3.43	-13.02%
2009	53.81	18.84	20.11	-1.27	-6.33%
Mean	43.89	13.57	13.74	-0.17	-1.25%

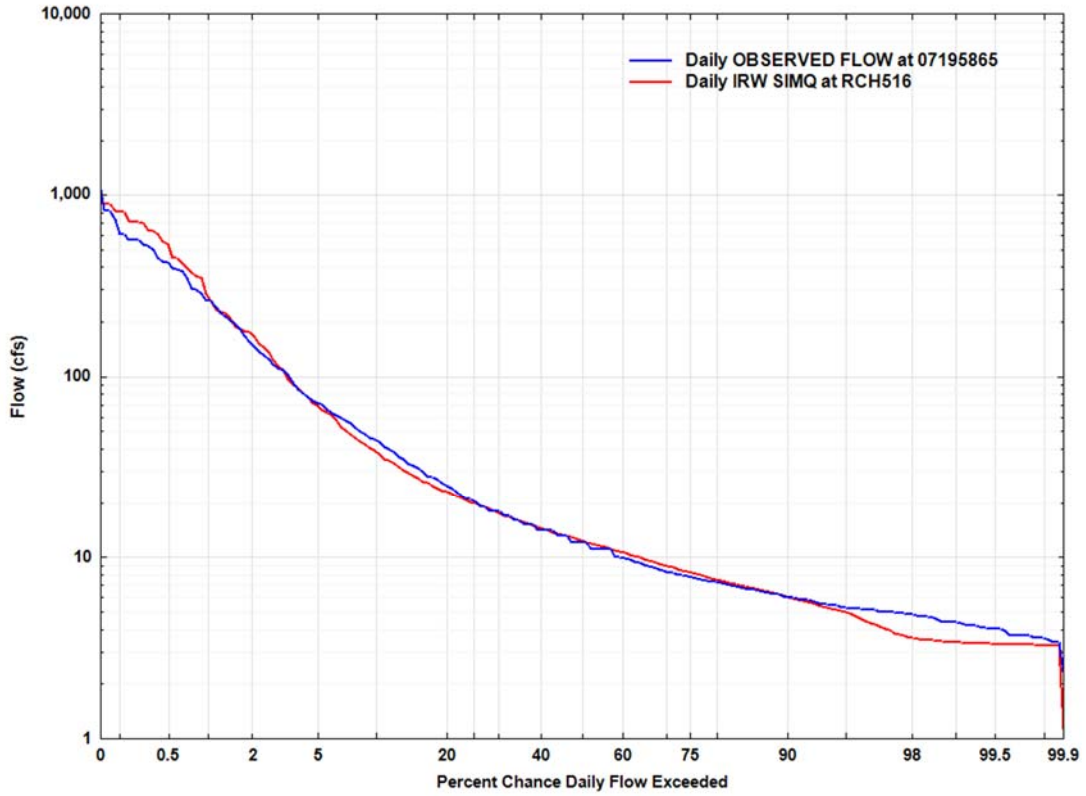
Caney Creek near Barber, OK (Reach 912)

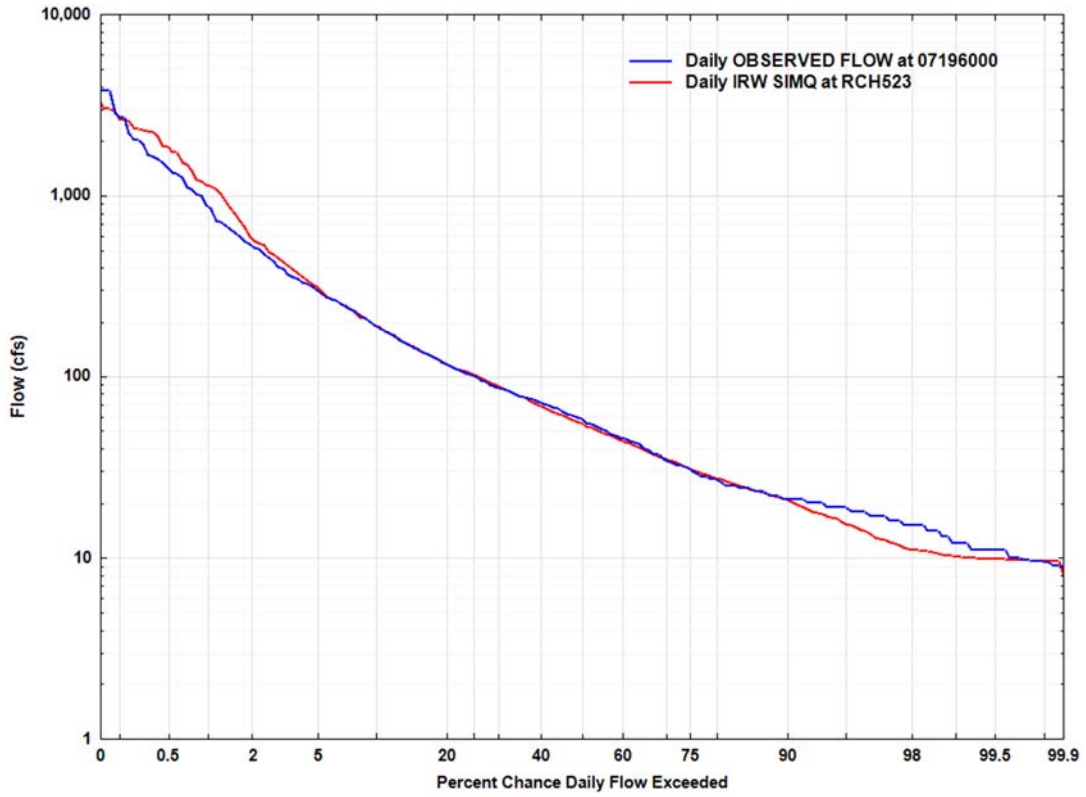
Year	Precipitation	Simulated Flow	Observed Flow	Residual	Percent Error
2001	49.42	13.44	16.35	-2.91	-17.81%
2002	44.50	12.88	11.34	1.53	13.51%
2003	40.63	8.64	5.58	3.06	54.82%
2004	53.73	18.87	19.08	-0.21	-1.09%
2005	33.54	8.89	10.46	-1.57	-15.04%
2006	46.74	7.64	6.57	1.07	16.33%
2007	42.19	11.45	10.28	1.18	11.45%
2008	61.13	25.42	19.54	5.89	30.12%
2009	56.93	20.56	19.45	1.11	5.68%
Mean	47.65	14.20	13.18	1.02	7.70%

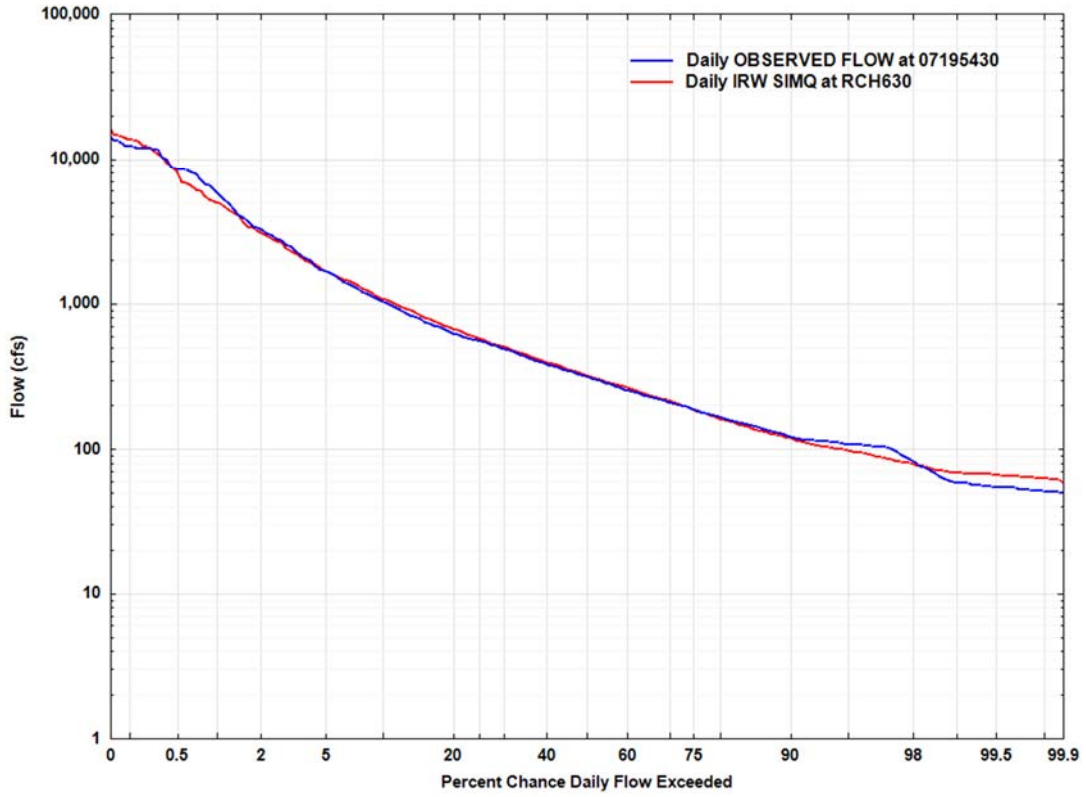
A.1.3 Flow-Duration Curves

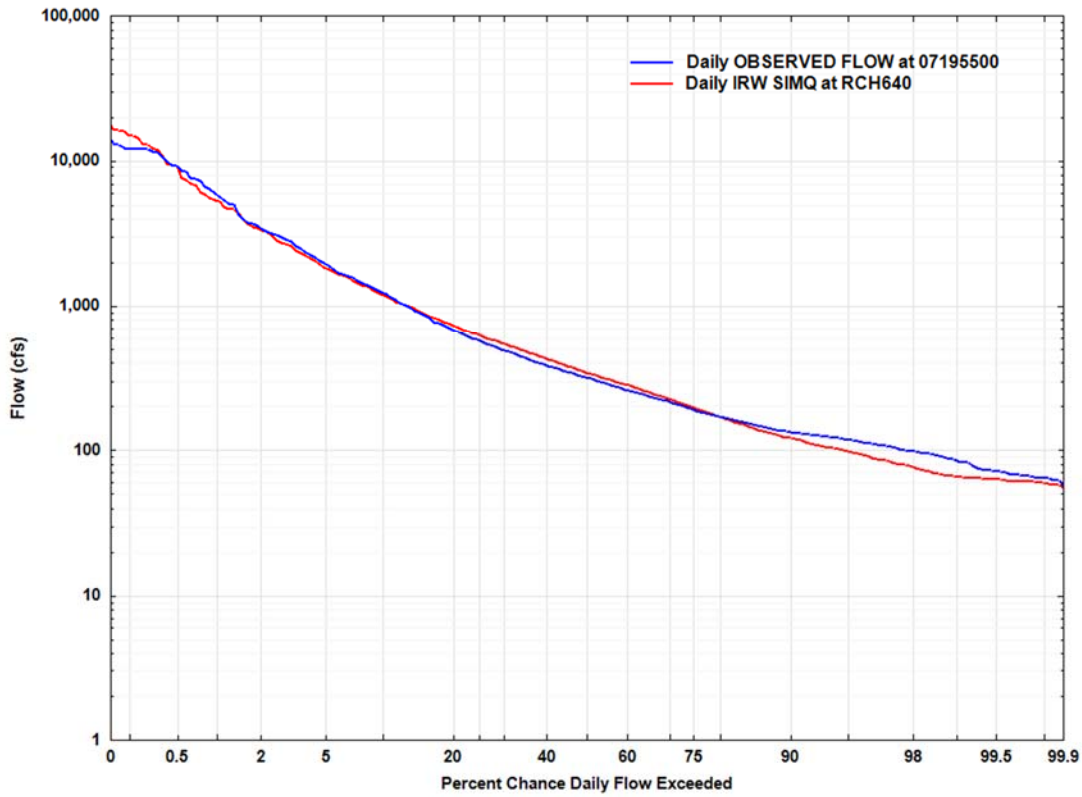


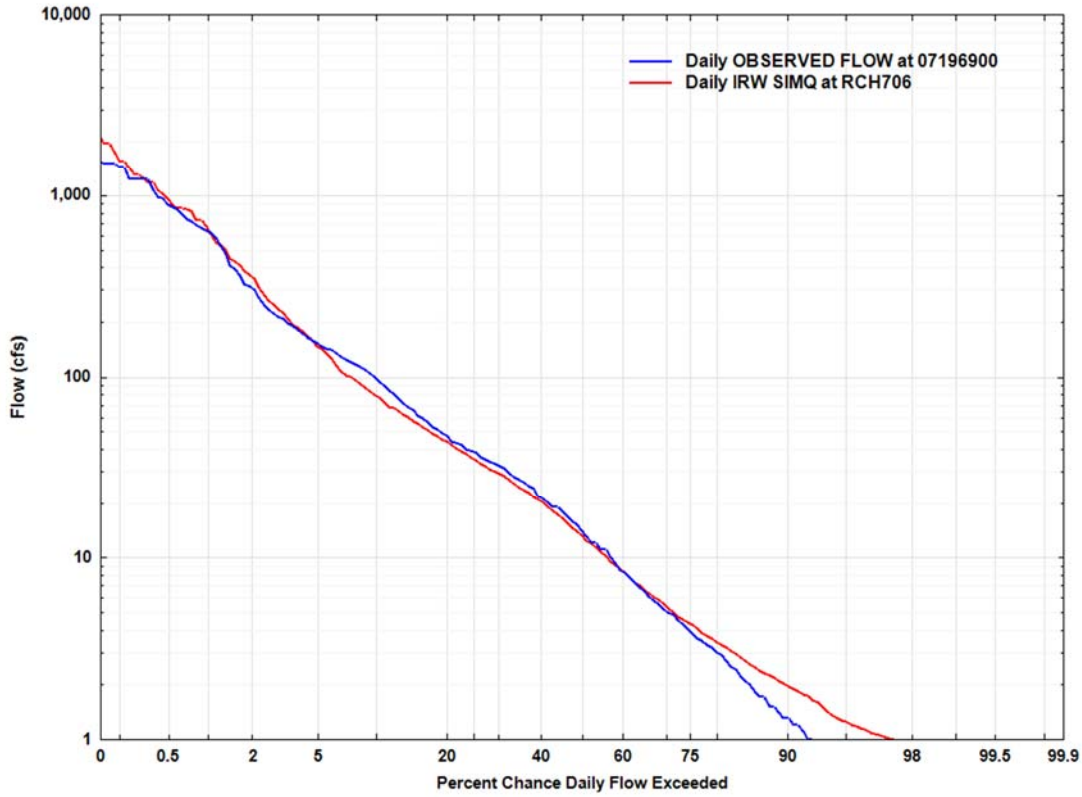

Daily OBSERVED FLOW at 07195000
Daily IRW SIMQ at RCH316
Flow (cfs)
10,000
1,000
100
10
1
0
0.5
2
5
20
40
60
75
90
98
99.5
99.9
Percent Chance Daily Flow Exceeded

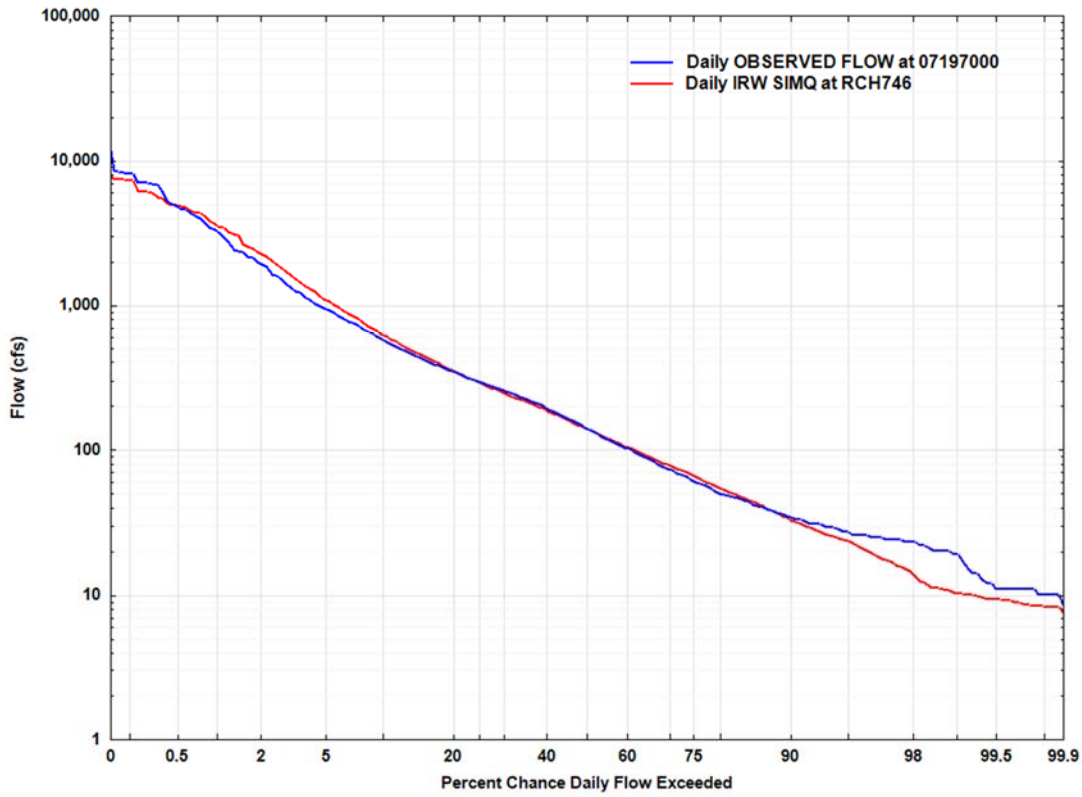

Daily OBSERVED FLOW at 07195865
Daily IRW SIMQ at RCH516
Flow (cfs)
10,000
1,000
100
10
1
0
0.5
2
5
20
40
60
75
90
98
99.5
99.9
Percent Chance Daily Flow Exceeded

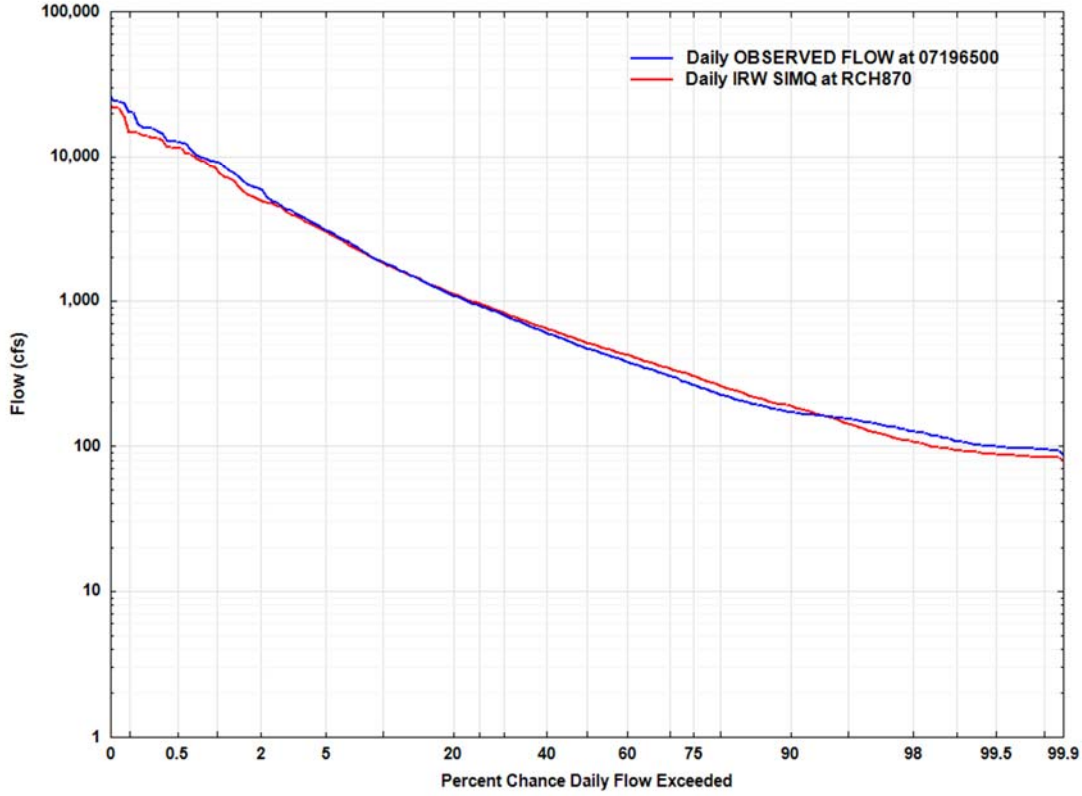

Daily OBSERVED FLOW at 07196000
Daily IRW SIMQ at RCH523
Flow (cfs)
10,000
1,000
100
10
1
0
0.5
2
5
20
40
60
75
90
98
99.5
99.9
Percent Chance Daily Flow Exceeded

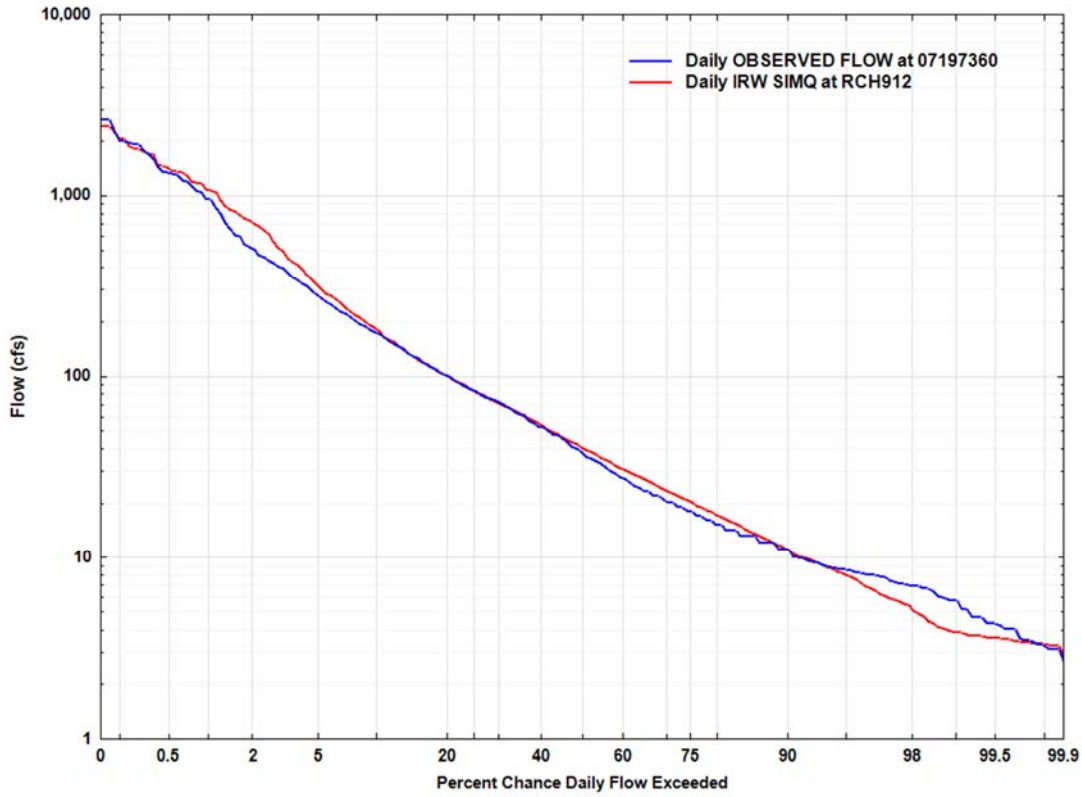

Daily OBSERVED FLOW at 07195430
Daily IRW SIMQ at RCH630
Flow (cfs)
100,000
10,000
1,000
100
10
1
0
0.5
2
5
20
40
60
75
90
98
99.5
99.9
Percent Chance Daily Flow Exceeded


Daily OBSERVED FLOW at 07195500
Daily IRW SIMQ at RCH640
Flow (cfs)
100,000
10,000
1,000
100
10
1
0
0.5
2
5
20
40
60
75
90
98
99.5
99.9
Percent Chance Daily Flow Exceeded


Daily OBSERVED FLOW at 07196900
Daily IRW SIMQ at RCH706
Flow (cfs)
10,000
1,000
100
10
1
0
0.5
2
5
20
40
60
75
90
98
99.5
99.9
Percent Chance Daily Flow Exceeded

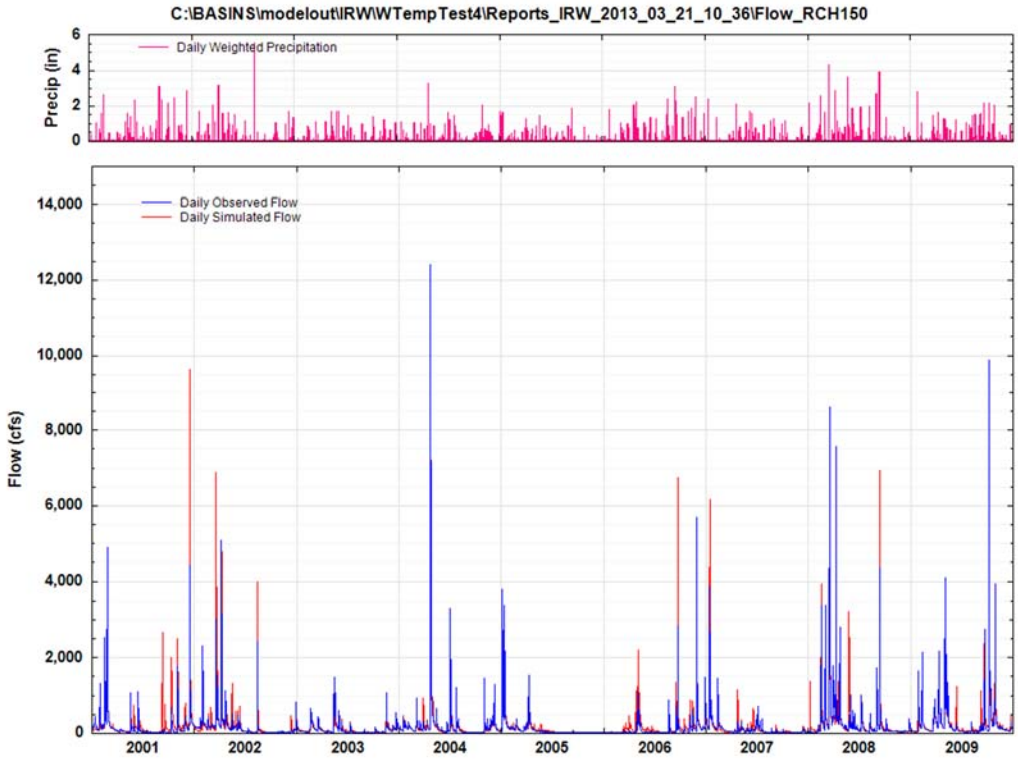

Daily OBSERVED FLOW at 07197000
Daily IRW SIMQ at RCH746
Flow (cfs)
100,000
10,000
1,000
100
10
1
0
0.5
2
5
20
40
60
75
90
98
99.5
99.9
Percent Chance Daily Flow Exceeded

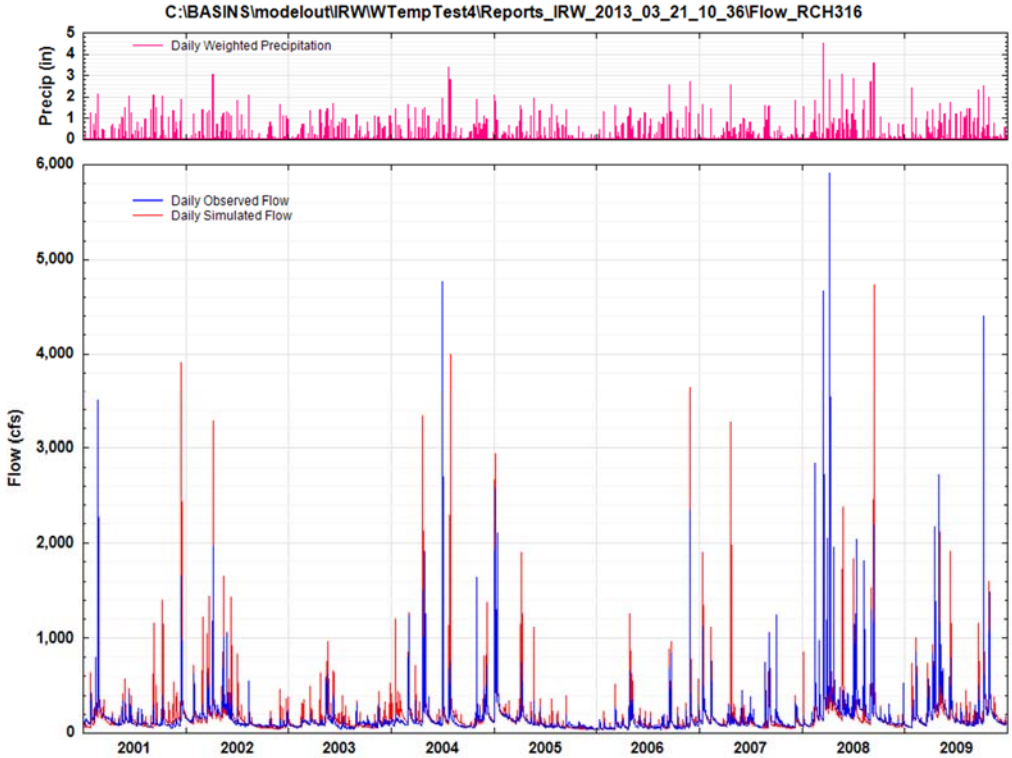

Daily OBSERVED FLOW at 07196500
Daily IRW SIMQ at RCH870
Flow (cfs)
100,000
10,000
1,000
100
10
1
0
0.5
2
5
20
40
60
75
90
98
99.5
99.9
Percent Chance Daily Flow Exceeded

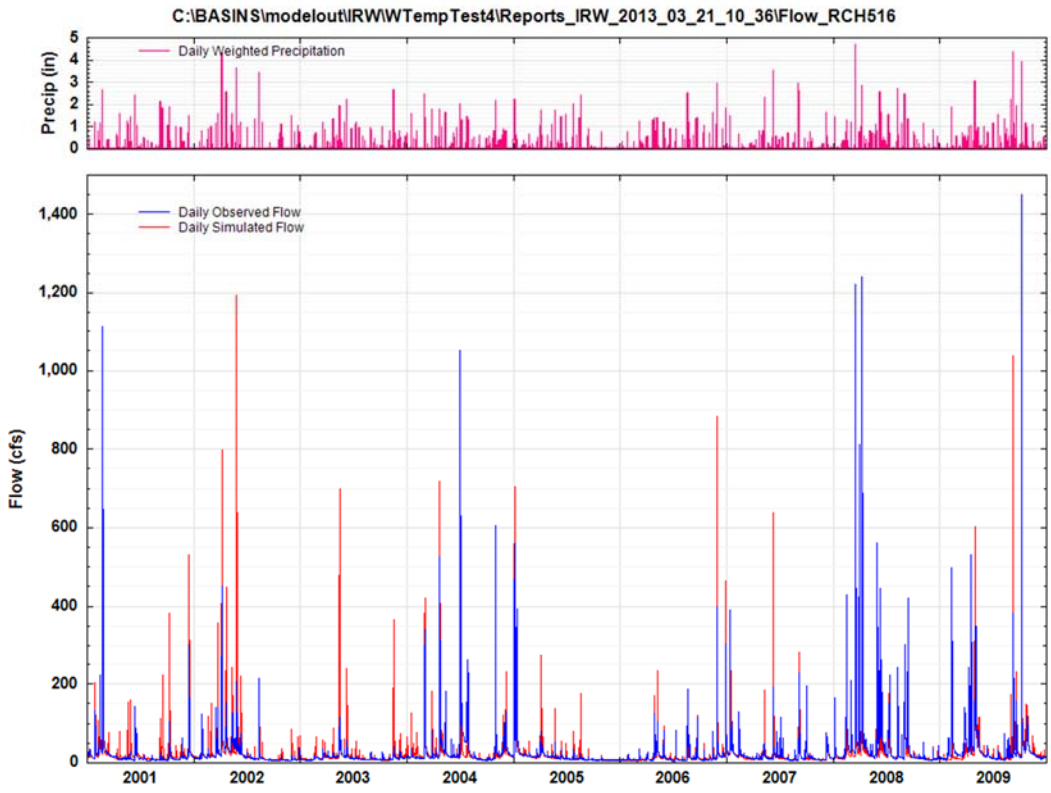

Daily OBSERVED FLOW at 07197360
Daily IRW SIMQ at RCH912
Flow (cfs)
10,000
1,000
100
10
1
0
0.5
2
5
20
40
60
75
90
98
99.5
99.9
Percent Chance Daily Flow Exceeded

A.1.4 Time Series

Arithmetic Plots



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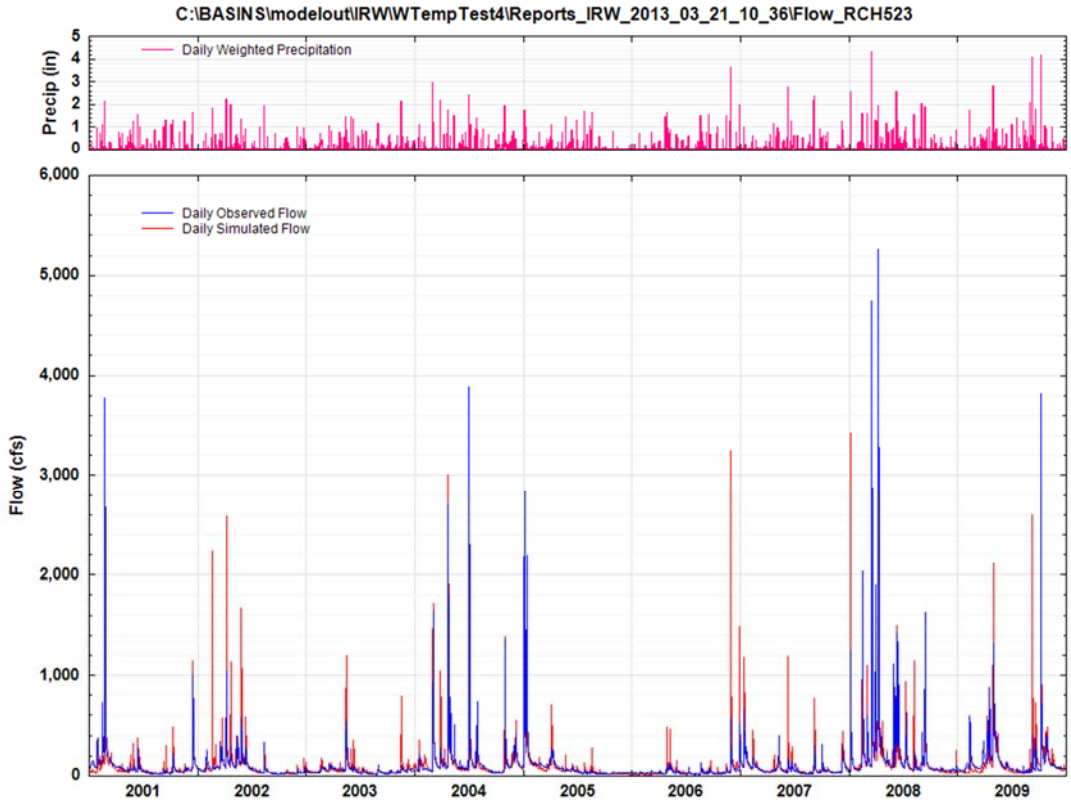
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
2001
2002
2003
2004
2005
2006
2007
2008
2009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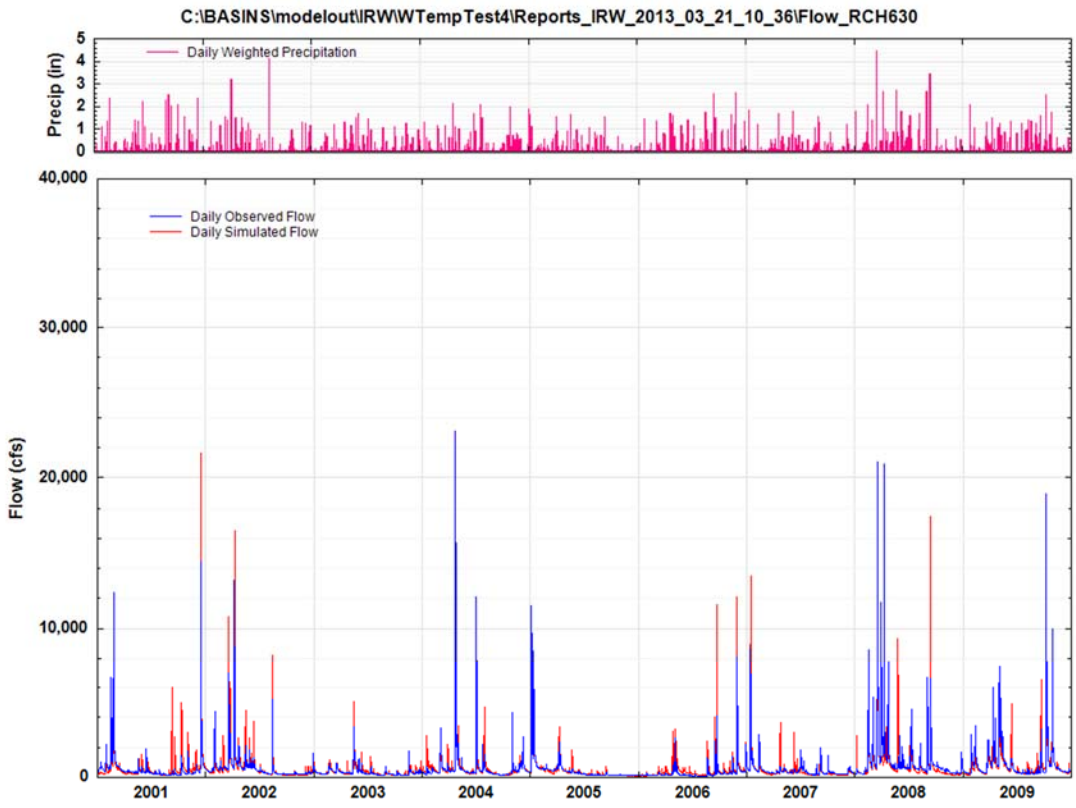
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
2001
2002
2003
2004
2005
2006
2007
2008
2009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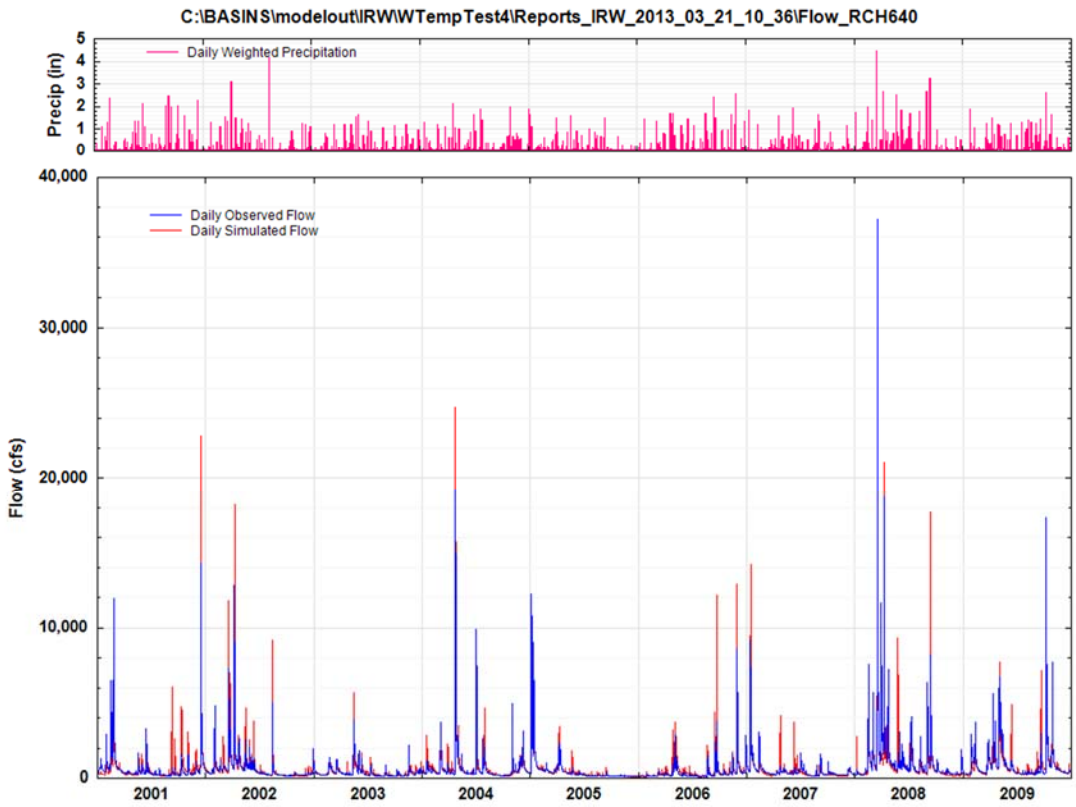
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
2001
2002
2003
2004
2005
2006
2007
2008
2009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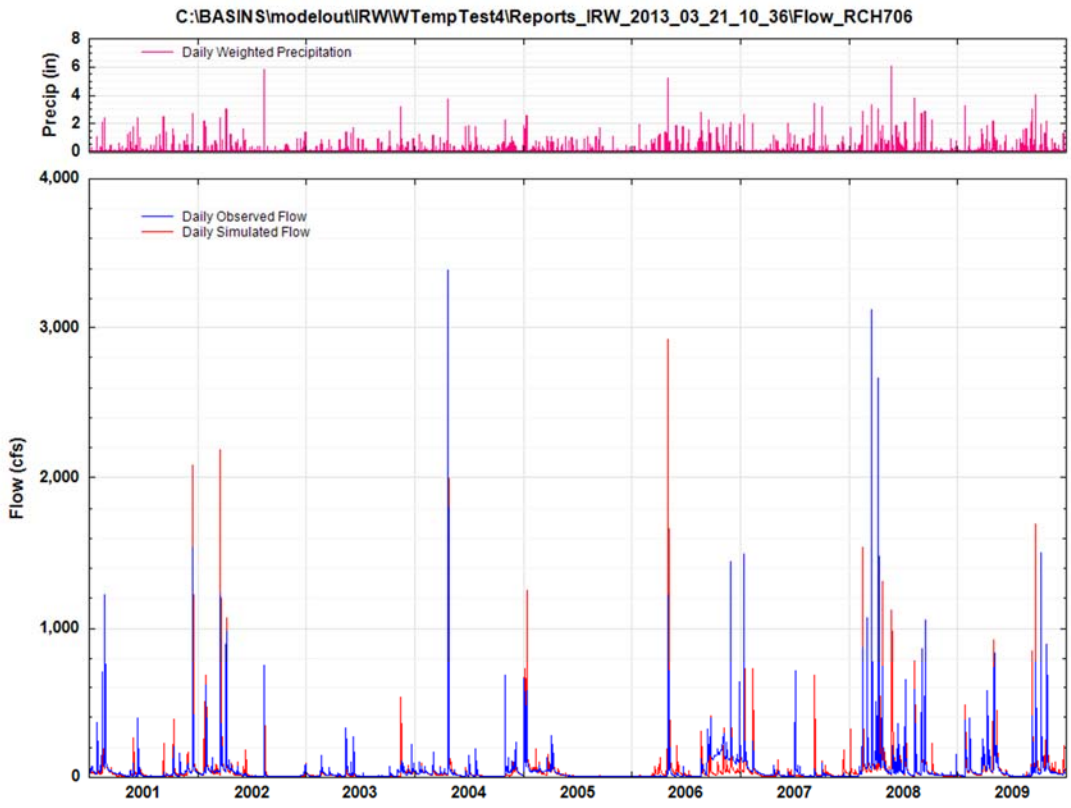
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
2001
2002
2003
2004
2005
2006
2007
2008
2009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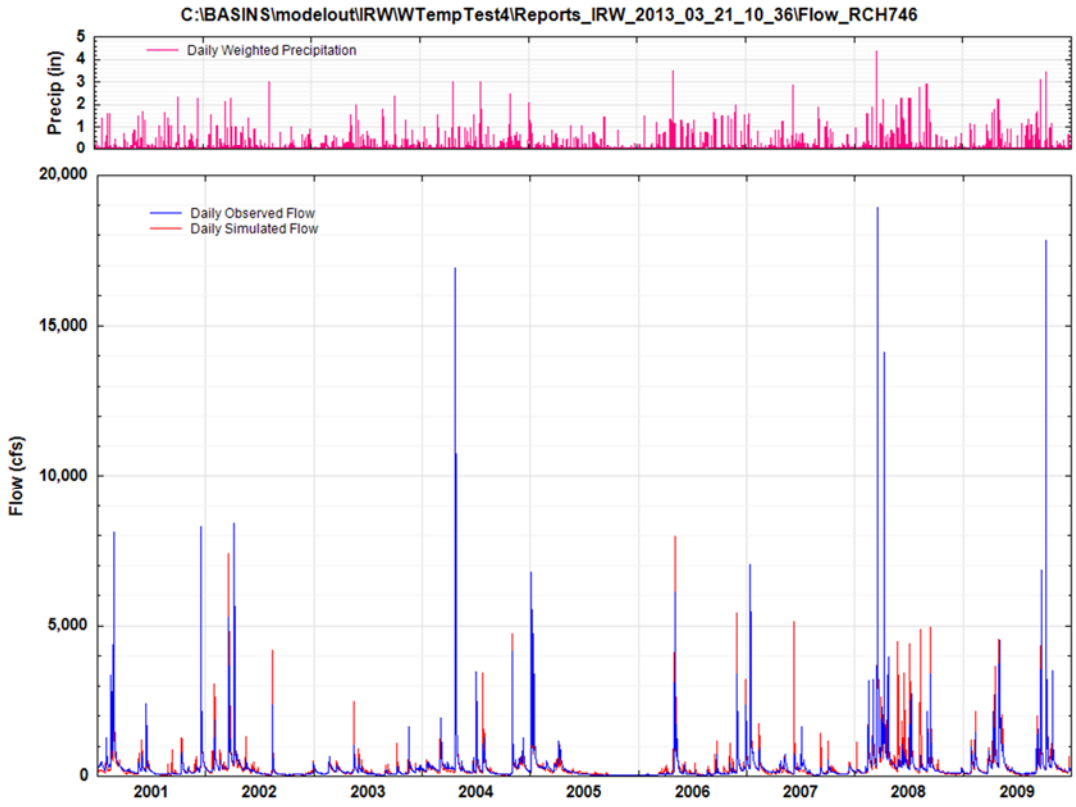
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
2001
2002
2003
2004
2005
2006
2007
2008
2009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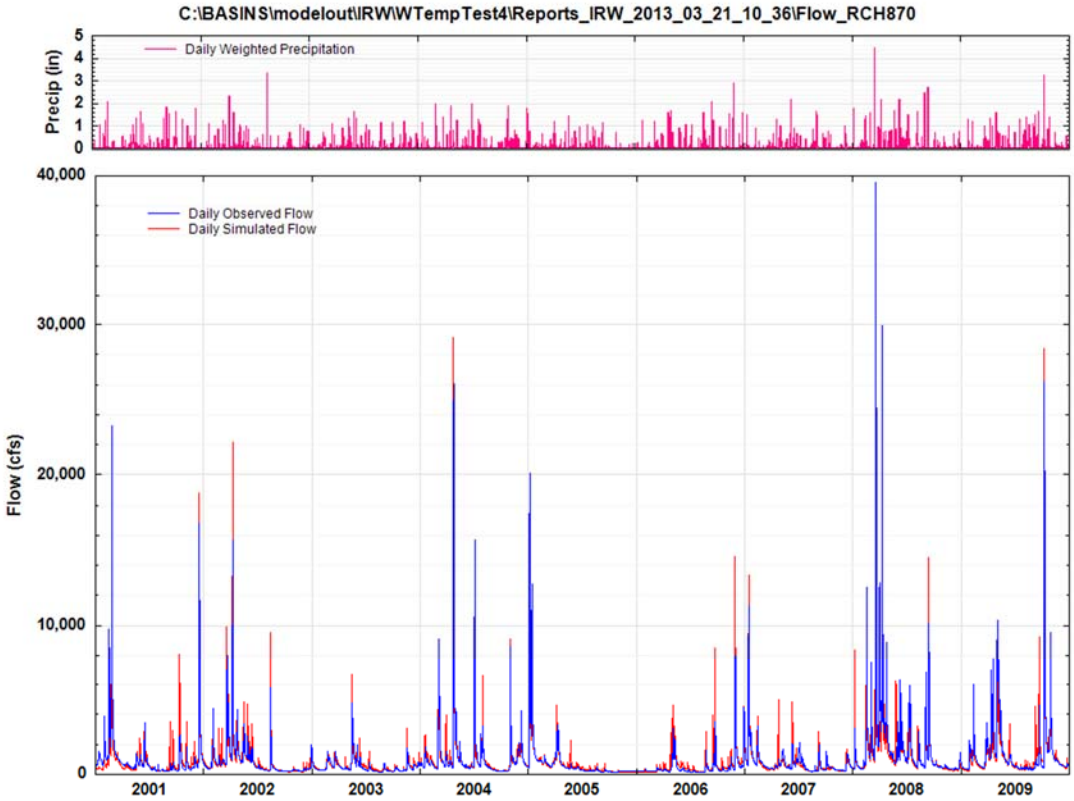
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
2001
2002
2003
2004
2005
2006
2007
2008
2009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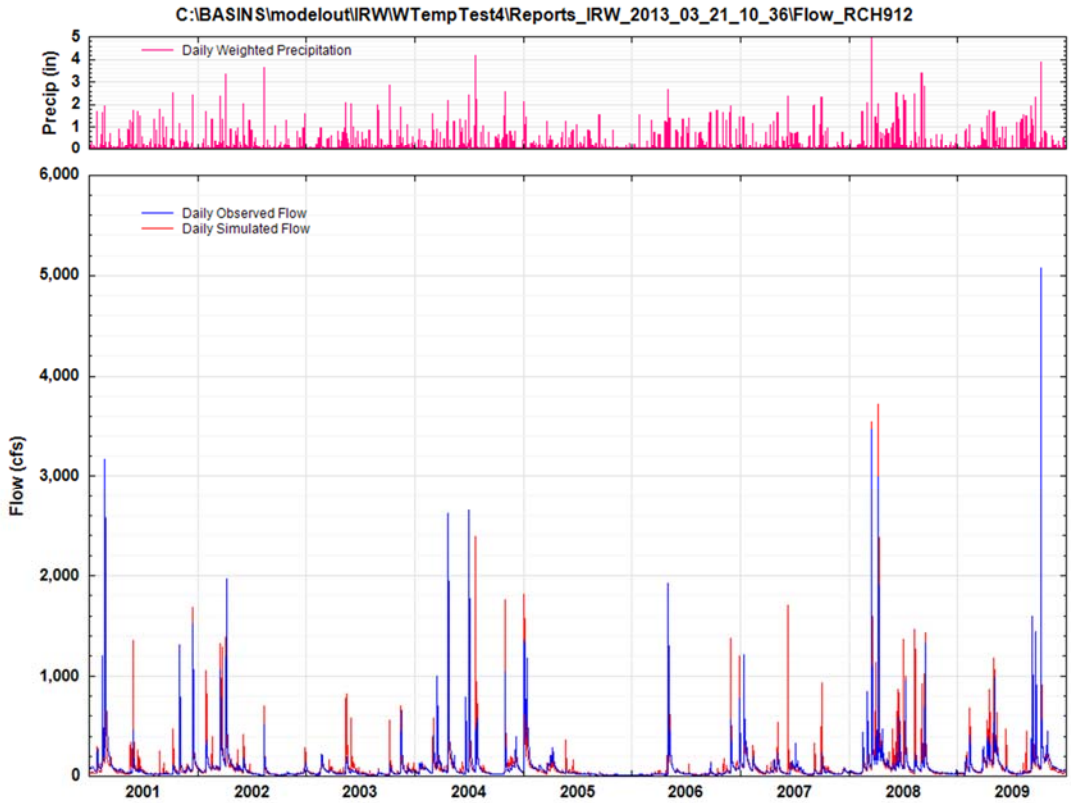
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
2001
2002
2003
2004
2005
2006
2007
2008
2009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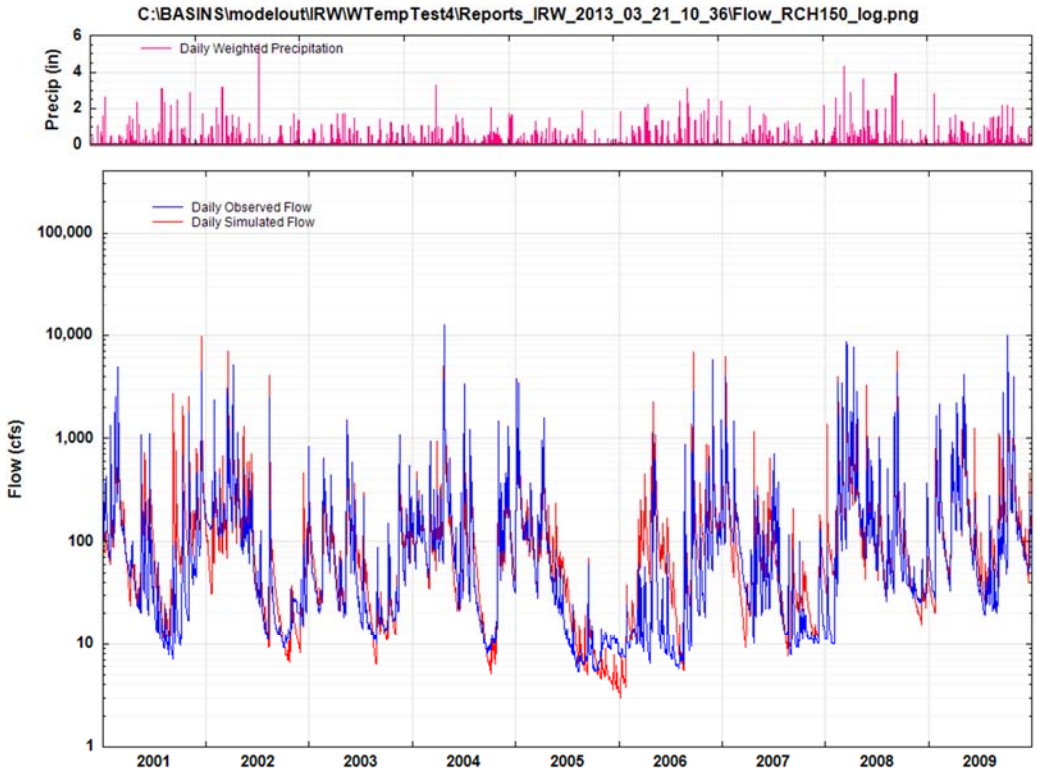
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
2001
2002
2003
2004
2005
2006
2007
2008
2009

Log Plots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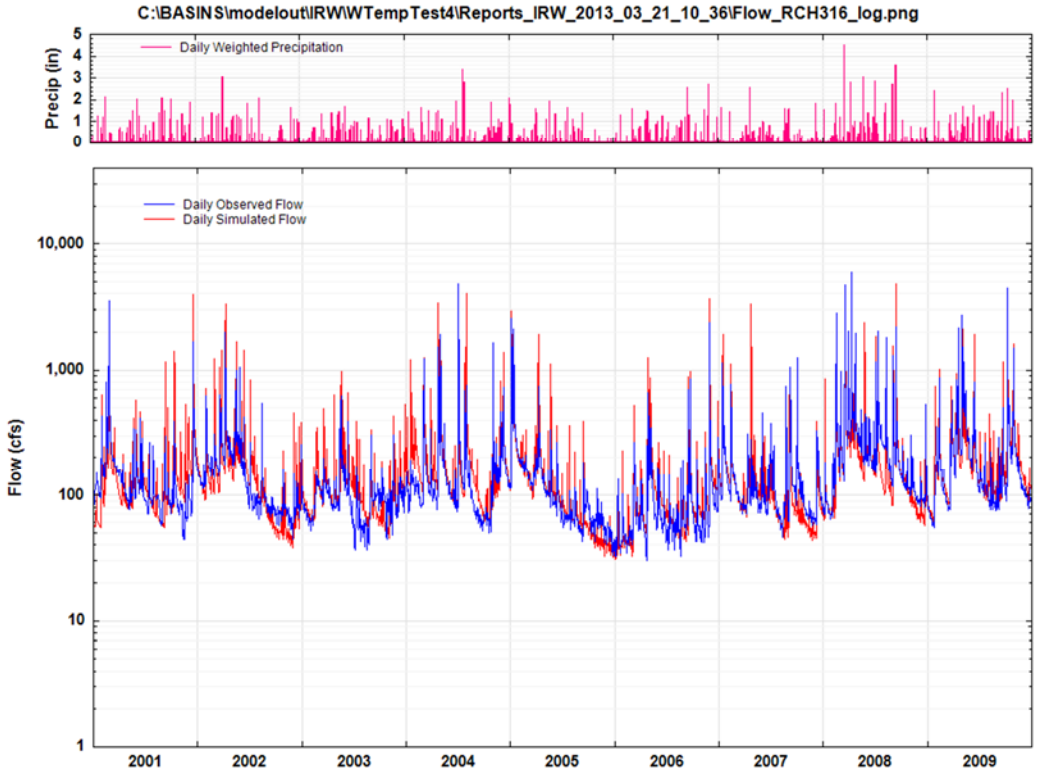
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
2001
2002
2003
2004
2005
2006
2007
2008
2009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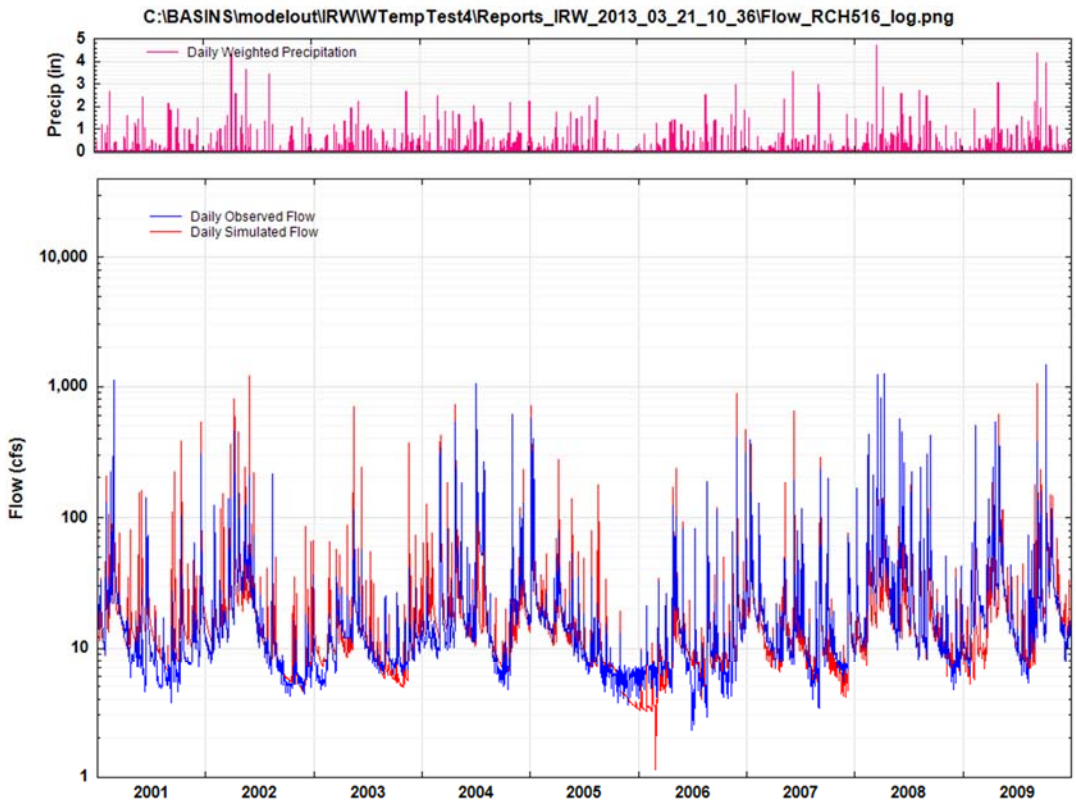
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
2001
2002
2003
2004
2005
2006
2007
2008
2009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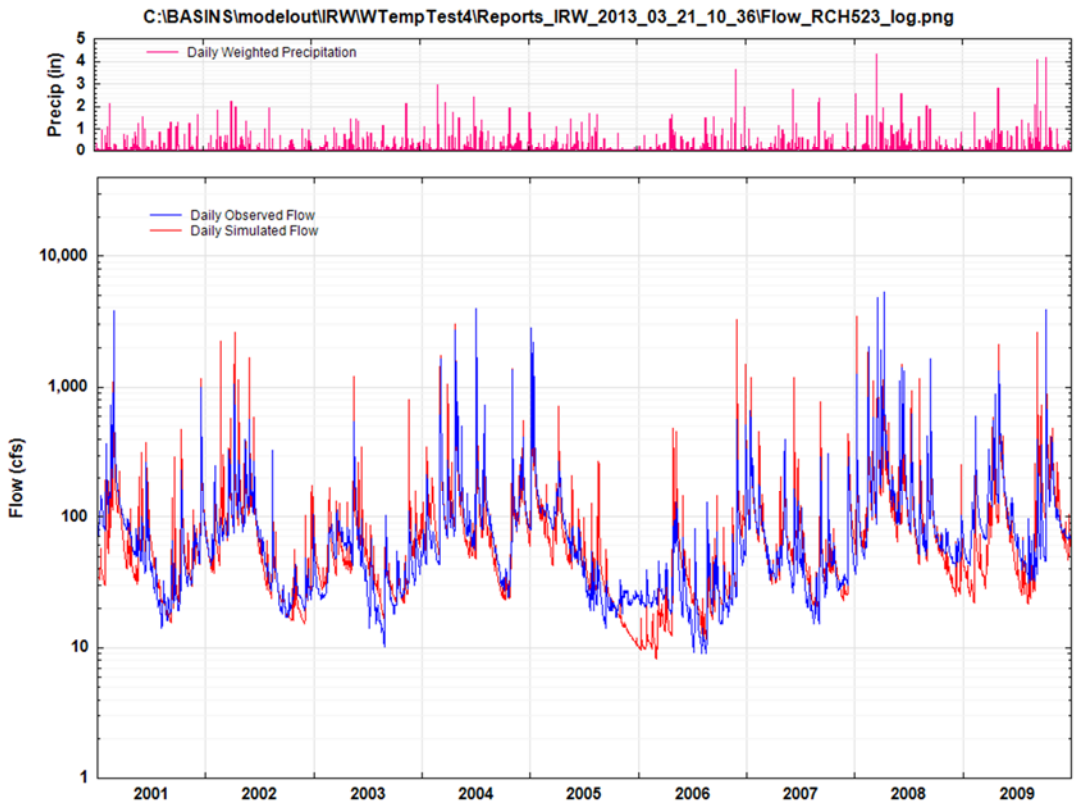
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
2001
2002
2003
2004
2005
2006
2007
2008
2009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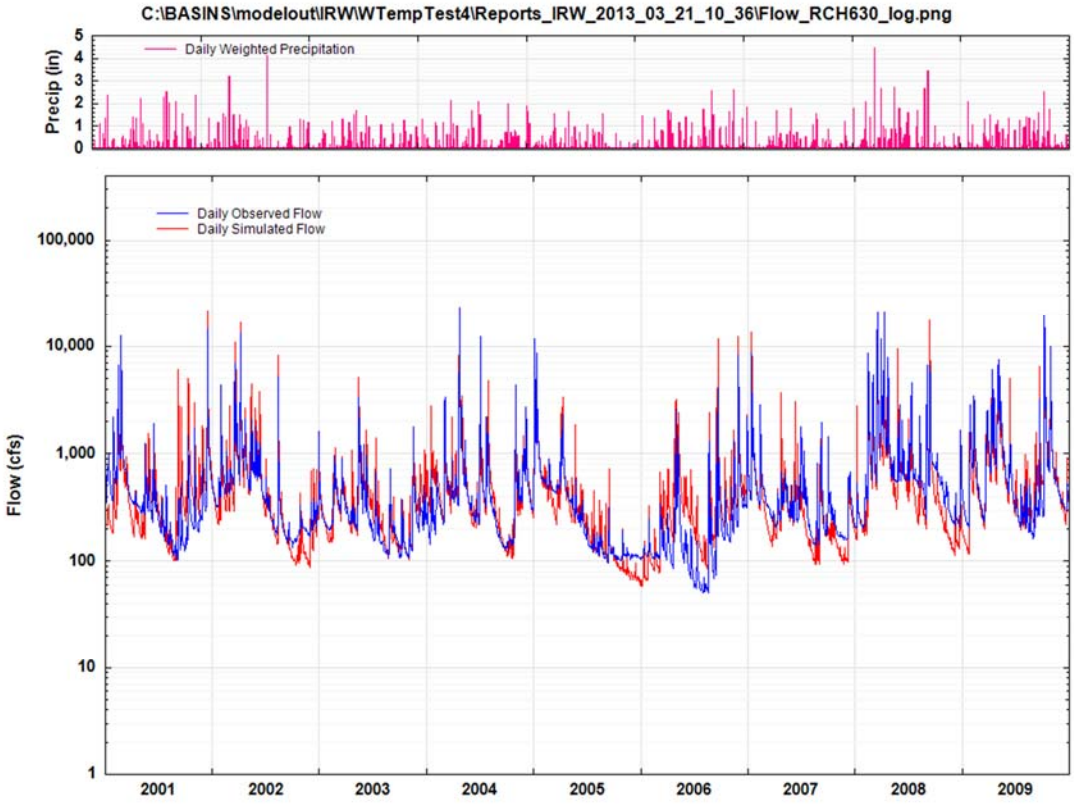
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
2001
2002
2003
2004
2005
2006
2007
2008
2009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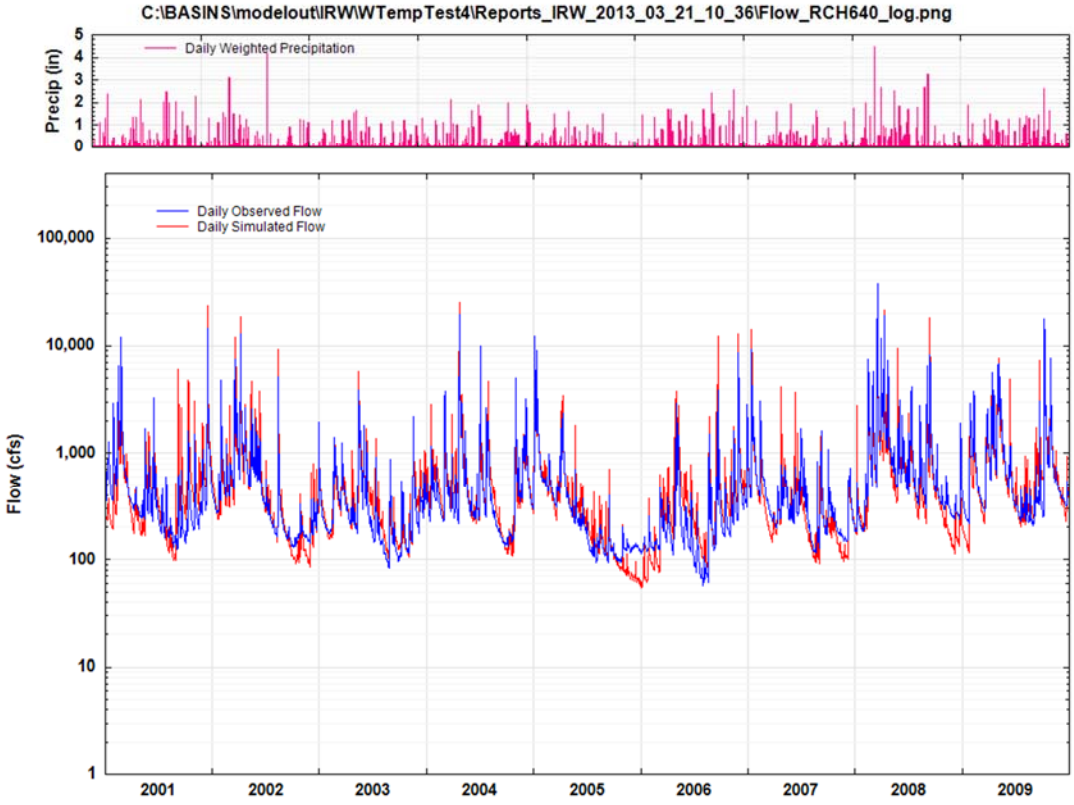
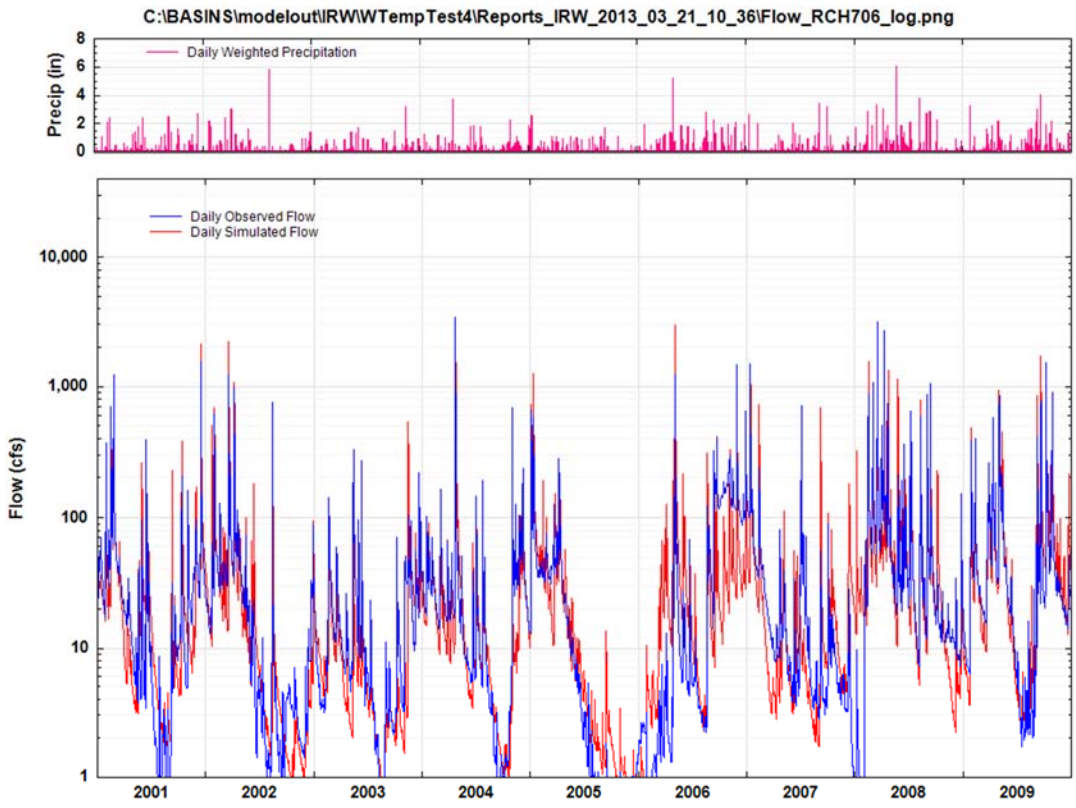
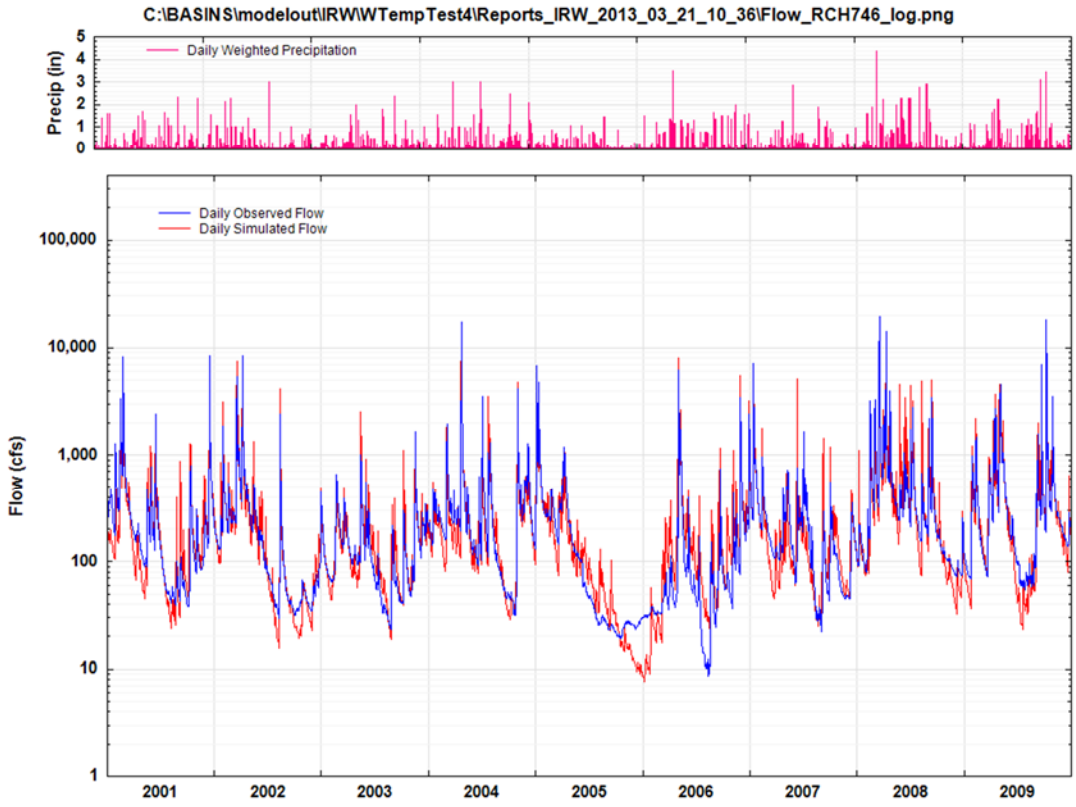
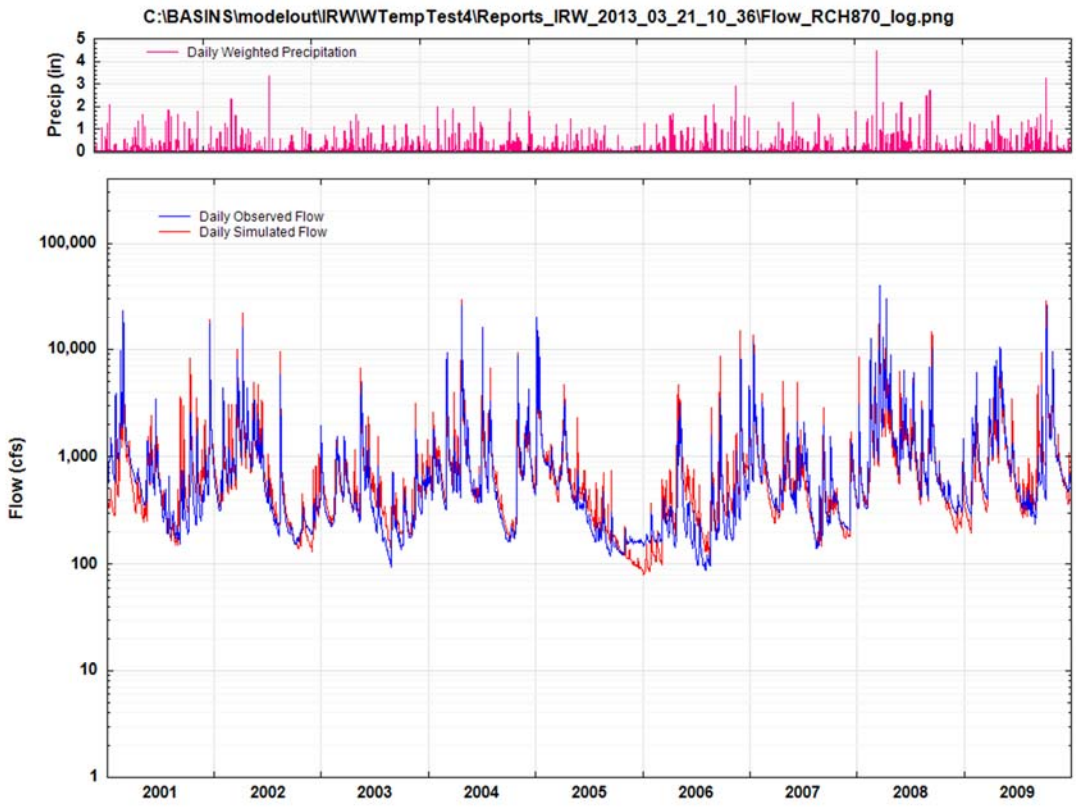
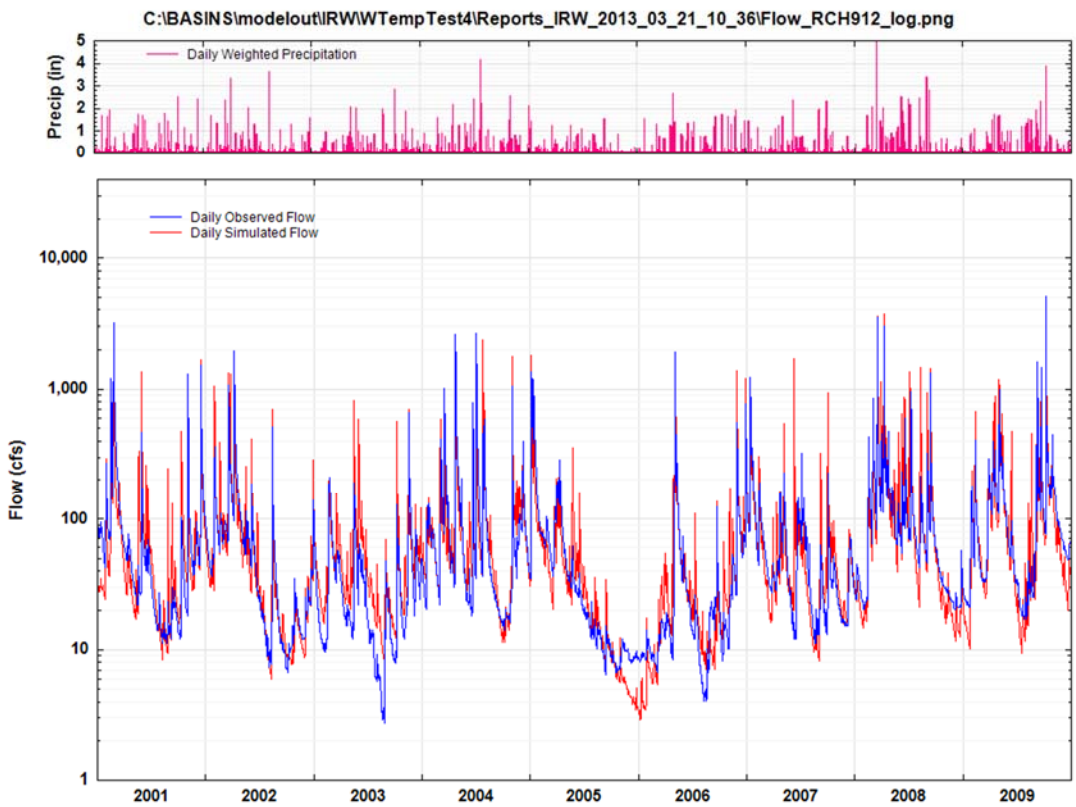
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
2001
2002
2003
2004
2005
2006
2007
2008
2009


C:\BASINS\modelout\IRW\WTempTest4\Reports_IRW_2013_03_21_10_36\Flow_RCH640_log.png
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
2001
2002
2003
2004
2005
2006
2007
2008
2009


C:\BASINS\modelout\IRW\WTempTest4\Reports_IRW_2013_03_21_10_36\Flow_RCH706_log.png
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
2001
2002
2003
2004
2005
2006
2007
2008
2009


C:\BASINS\modelout\IRW\WTempTest4\Reports_IRW_2013_03_21_10_36\Flow_RCH746_log.png
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
2001
2002
2003
2004
2005
2006
2007
2008
2009


C:\BASINS\modelout\IRW\WTempTest4\Reports_IRW_2013_03_21_10_36\Flow_RCH870_log.png
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
2001
2002
2003
2004
2005
2006
2007
2008
2009


C:\BASINS\modelout\IRW\WTempTest4\Reports_IRW_2013_03_21_10_36\Flow_RCH912_log.png
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
2001
2002
2003
2004
2005
2006
2007
2008
2009

A.2 VALIDATION

A.2.1 Annual Flow Statistics Table

Reach	Name	record starts	Annual Flow (in)			Daily		Monthly		Daily Peaks % Diff	NSE	
			Sim	Obs	% Vol error	R	R^2	R	R^2		Daily	Monthly
150	Illinois River at Savoy, AR	1996	13.64	14.40	-5.29	0.67	0.45	0.86	0.74	-22.63	0.29	0.73
316	Osage Creek near Elm Springs, AR	1996	17.85	15.86	12.55	0.71	0.50	0.89	0.79	-3.61	0.14	0.69
516	Sager Creek near West Siloam Springs, OK	1997	19.63	17.22	13.99	0.48	0.23	0.61	0.37	-34.63	0.00	0.31
523	Flint Creek near Kansas, OK	1993	16.75	15.34	9.18	0.67	0.44	0.84	0.71	-8.85	0.29	0.69
630	Illinois River South of Siloam Springs, AR	1996	13.43	14.95	-10.19	0.77	0.59	0.91	0.82	-16.46	0.57	0.81
640	Illinois River near Watts, OK	1992	16.79	16.30	2.97	0.78	0.62	0.90	0.81	18.45	0.46	0.80
706	Baron Fork at Dutch Mills, AR	1992	18.65	18.48	0.90	0.42	0.18	0.73	0.53	-0.71	-0.29	0.47
746	Baron Fork at Eldon, OK	1992	18.13	18.43	-1.65	0.85	0.73	0.93	0.87	-6.47	0.72	0.87
870	Illinois River near Tahlequah, OK	1992	16.40	16.20	1.24	0.75	0.57	0.91	0.84	-1.99	0.51	0.84
912	Caney Creek near Barber, OK	1998	20.52	14.71	39.52	0.83	0.69	0.93	0.87	59.18	0.32	0.74
Mean Values			17.18	16.19	6.10	0.69	0.50	0.85	0.73	-1.77	0.30	0.69

A.2.2 Annual Flow Volumes Tables

Illinois River at Savoy, AR (Reach 150)

Year	Precipitation	Simulated Flow	Observed Flow	Residual	Percent Error
1996	26.52	4.20	7.32	-3.12	-42.62%
1997	49.70	19.31	17.75	1.56	8.79%
1998	49.04	16.77	16.15	0.62	3.84%
1999	47.56	17.54	17.01	0.52	3.12%
2000	40.61	10.37	13.77	-3.40	-24.69%
Mean	42.69	13.64	14.40	-0.76	-5.29%

Osage Creek near Elm Springs, AR (Reach 316)

Year	Precipitation	Simulated Flow	Observed Flow	Residual	Percent Error
1996	30.67	9.78	10.28	-0.50	-4.86%
1997	44.83	20.67	17.73	2.94	16.58%
1998	43.88	21.87	17.43	4.44	25.47%
1999	51.85	23.34	19.74	3.59	18.24%
2000	35.25	13.58	14.11	-0.53	-3.76%
Mean	41.30	17.85	15.86	1.99	12.55%

Sager Creek near West Siloam Springs, OK (Reach 516)

Year	Precipitation	Simulated Flow	Observed Flow	Residual	Percent Error
1997	41.67	15.12	NaN	NaN	NaN
1998	40.50	20.94	13.32	7.62	57.21%
1999	55.44	27.26	17.93	9.33	52.04%
2000	38.60	15.21	20.42	-5.21	-25.51%
Mean	44.05	19.63	17.22	3.91	13.99%

Flint Creek near Kansas, OK (Reach 523)

Year	Precipitation	Simulated Flow	Observed Flow	Residual	Percent Error
1993	64.58	27.03	25.30	1.73	6.84%
1994	45.40	18.52	15.59	2.93	18.79%
1995	55.11	22.54	19.85	2.69	13.55%
1996	31.56	5.92	5.61	0.31	5.53%
1997	42.02	11.93	13.81	-1.88	-13.61%
1998	43.06	14.67	10.81	3.86	35.71%
1999	51.24	20.56	17.15	3.42	19.88%
2000	44.84	12.82	14.60	-1.79	-12.19%
Mean	47.23	16.75	15.34	1.41	9.18%

Illinois River South of Siloam Springs, AR (Reach 630)

Year	Precipitation	Simulated Flow	Observed Flow	Residual	Percent Error
1996	28.60	6.08	8.38	-2.31	-27.45%
1997	44.77	15.84	18.64	-2.80	-15.02%
1998	43.87	16.55	15.52	1.04	6.64%
1999	51.59	18.62	18.51	0.11	0.59%
2000	36.05	10.05	13.71	-3.66	-26.70%
Mean	40.98	13.43	14.95	-1.52	-10.19%

Illinois River near Watts, OK (Reach 640)

Year	Precipitation	Simulated Flow	Observed Flow	Residual	Percent Error
1992	54.62	18.49	16.44	2.05	12.47%
1993	62.45	29.47	25.08	4.39	17.50%
1994	47.83	17.56	14.54	3.02	20.77%
1995	42.34	16.85	16.88	-0.03	-0.18%
1996	40.99	13.18	15.00	-1.81	-12.13%
1997	41.60	11.70	12.34	-0.64	-5.19%
1998	44.10	16.11	15.37	0.74	4.81%
1999	41.58	15.52	17.08	-1.56	-9.13%
2000	43.73	12.21	14.01	-1.80	-12.85%
Mean	46.58	16.79	16.30	0.48	2.96%

Barron Fork at Dutch Mills, AR (Reach 706)

Year	Precipitation	Simulated Flow	Observed Flow	Residual	Percent Error
1992	60.86	22.34	15.89	6.45	40.59%
1993	72.68	35.74	34.37	1.37	3.99%
1994	54.47	19.82	12.23	7.59	62.06%
1995	42.38	11.43	17.92	-6.48	-36.22%
1996	53.06	21.08	21.33	-0.25	-1.17%
1997	43.00	10.35	11.87	-1.52	-12.81%
1998	62.05	26.98	20.18	6.80	33.70%
1999	36.69	11.89	15.14	-3.25	-21.47%
2000	40.00	8.23	17.44	-9.21	-52.81%
Mean	51.69	18.65	18.49	0.17	0.90%

Barron Fork at Eldon, OK (Reach 746)

Year	Precipitation	Simulated Flow	Observed Flow	Residual	Percent Error
1992	56.91	18.17	19.21	-1.05	-5.41%
1993	62.22	27.30	30.51	-3.21	-10.52%
1994	51.24	17.17	14.29	2.88	20.15%
1995	48.09	16.31	18.37	-2.06	-11.21%
1996	52.35	18.51	18.88	-0.36	-1.96%
1997	47.93	14.80	14.64	0.16	1.09%
1998	53.55	20.58	17.84	2.75	15.36%
1999	42.95	14.52	15.72	-1.21	-7.63%
2000	49.64	15.76	16.41	-0.65	-3.96%
Mean	51.65	18.12	18.43	-0.31	-1.66%

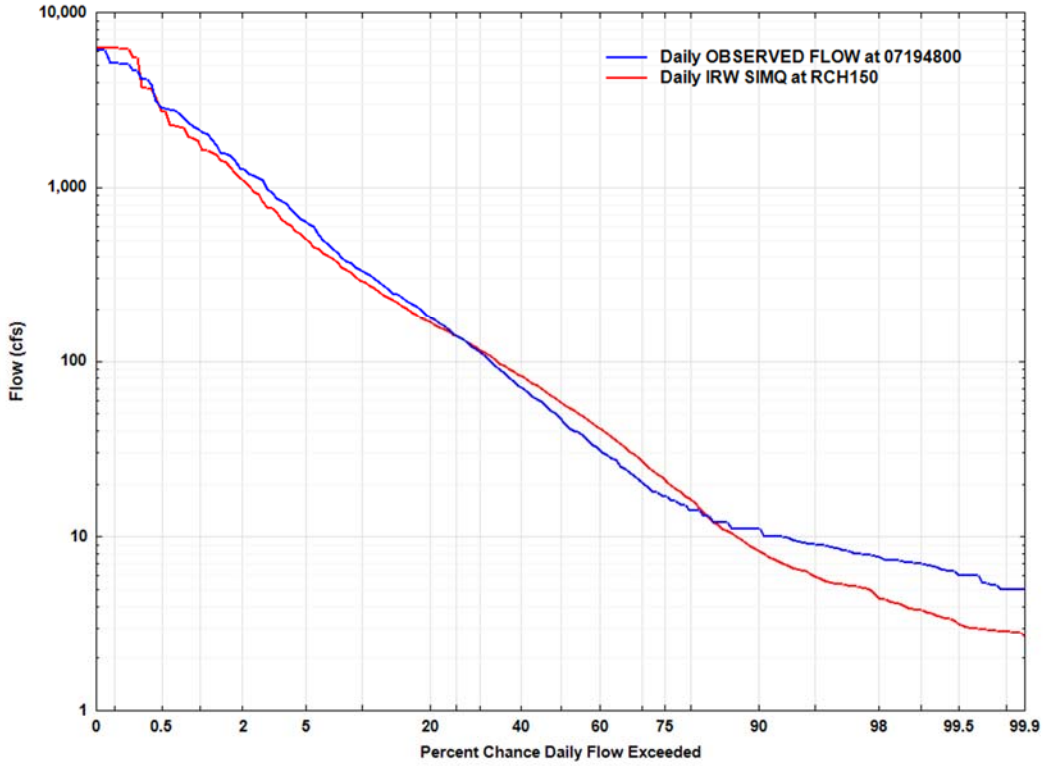
Illinois River near Tahlequah, OK (Reach 870)

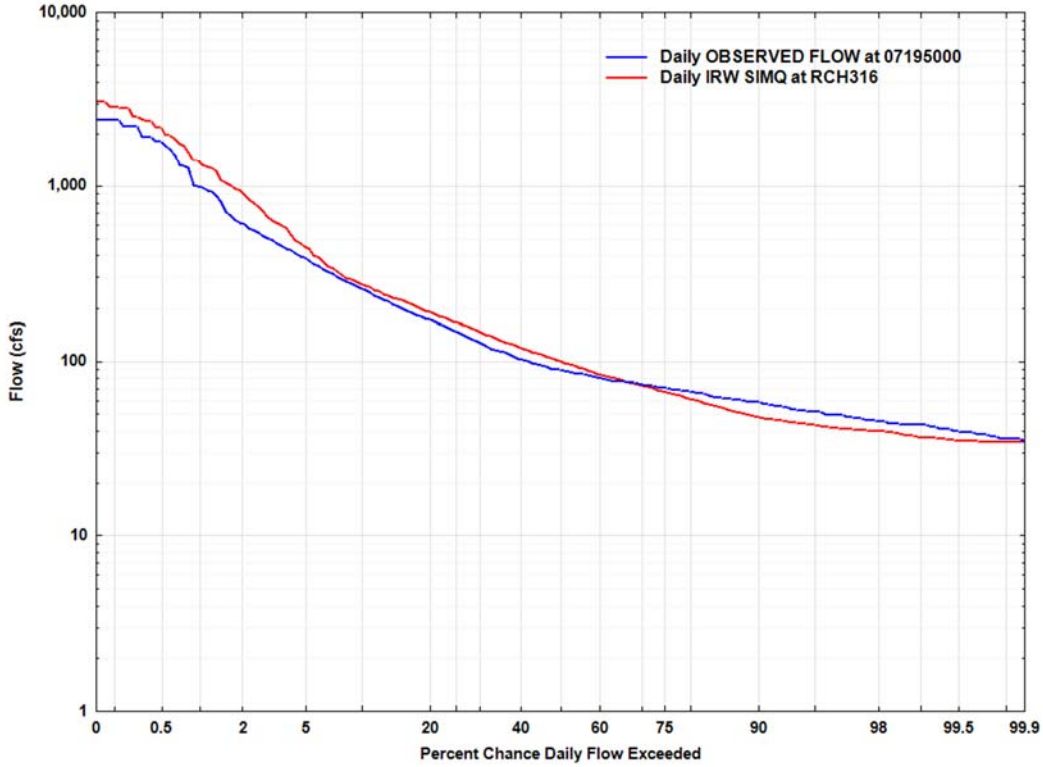
Year	Precipitation	Simulated Flow	Observed Flow	Residual	Percent Error
1992	53.95	17.35	17.30	0.05	0.29%
1993	60.35	27.36	25.03	2.32	9.31%
1994	48.92	17.58	15.32	2.26	14.75%
1995	43.39	16.54	16.05	0.49	3.05%
1996	40.54	11.74	13.44	-1.70	-12.65%
1997	42.74	11.77	11.82	-0.05	-0.42%
1998	44.73	15.71	14.92	0.78	5.29%
1999	43.62	16.01	16.34	-0.33	-2.02%
2000	45.98	13.50	15.53	-2.02	-13.07%
Mean	47.14	16.40	16.19	0.20	1.24%

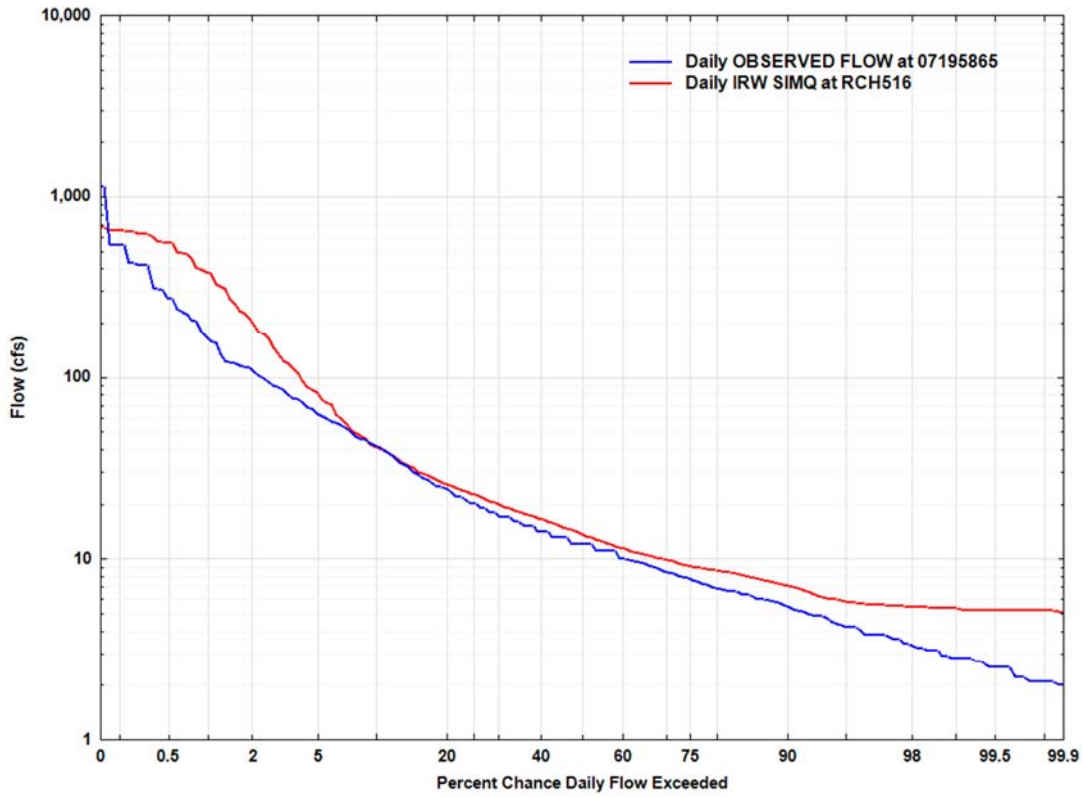
Caney Creek near Barber, OK (Reach 912)

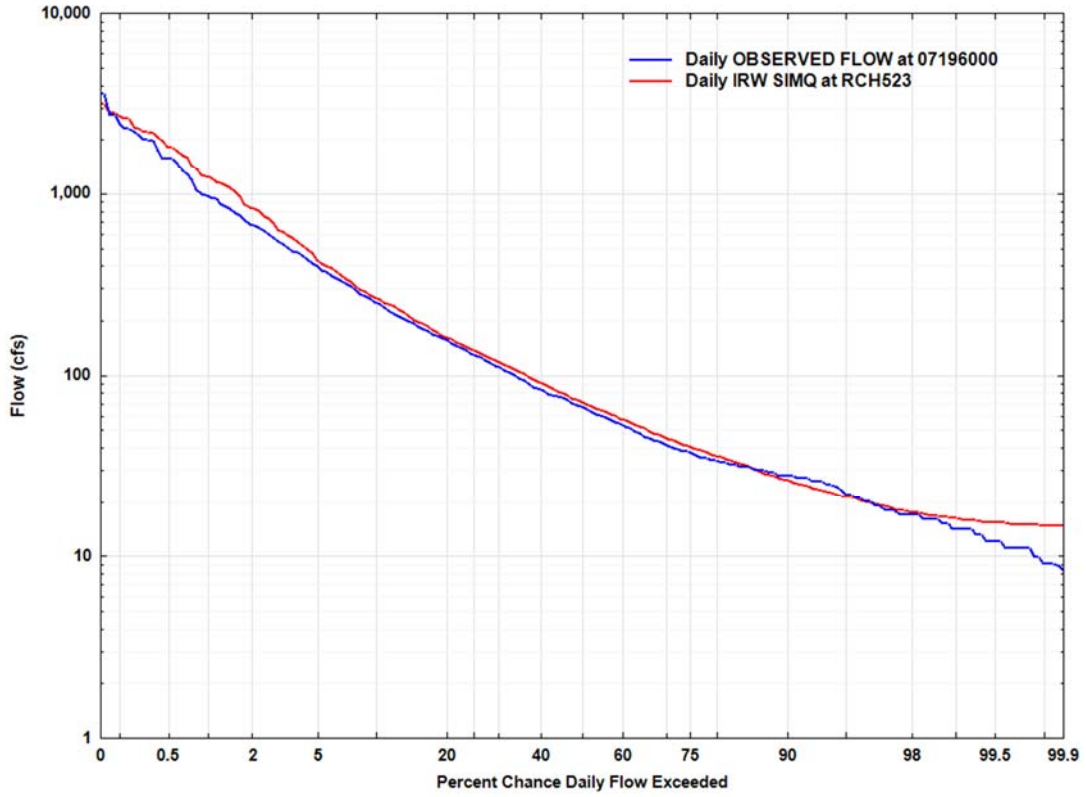
Year	Precipitation	Simulated Flow	Observed Flow	Residual	Percent Error
1998	59.54	24.69	16.92	7.78	45.92%
1999	54.85	20.84	14.35	6.48	45.23%
2000	47.47	16.04	12.86	3.18	24.73%
Mean	53.95	20.52	14.71	5.81	39.52%

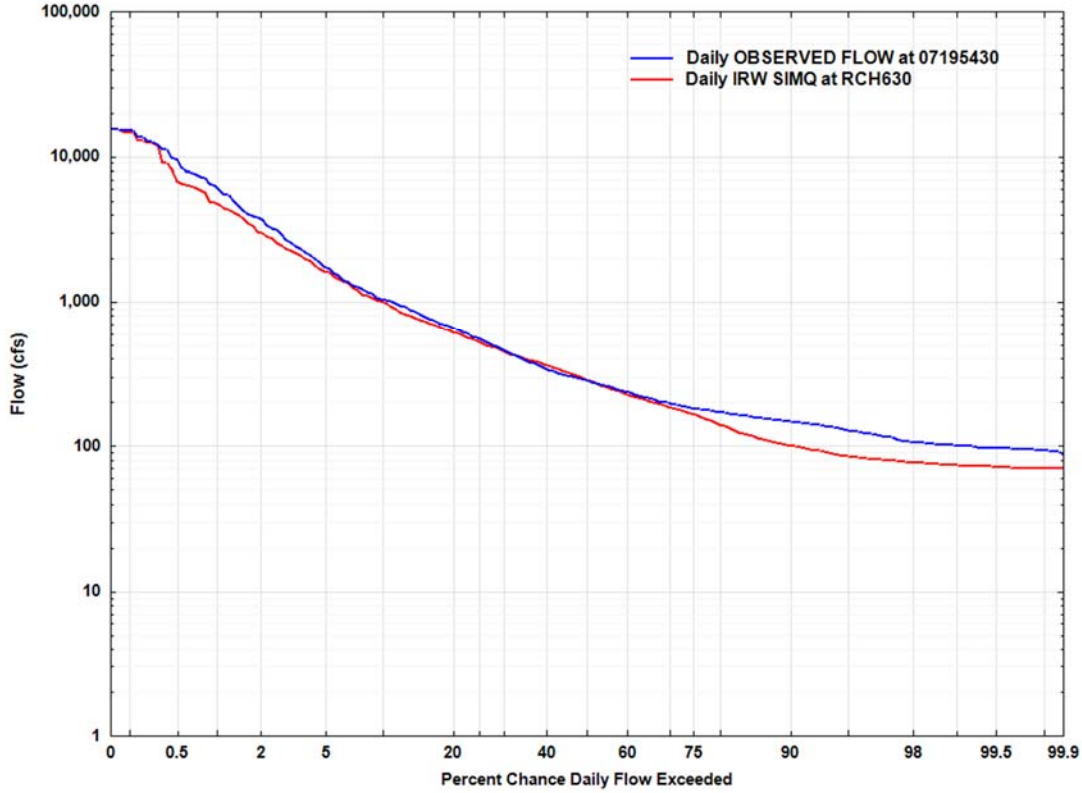
A.2.3 Flow-duration

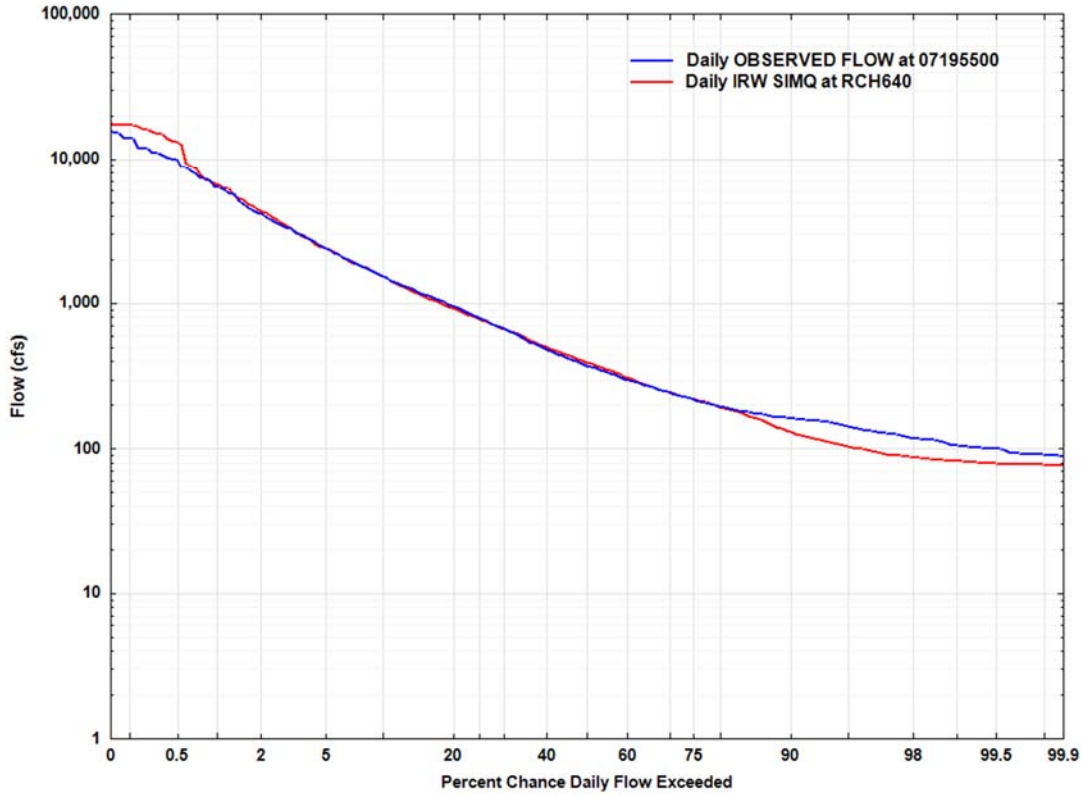


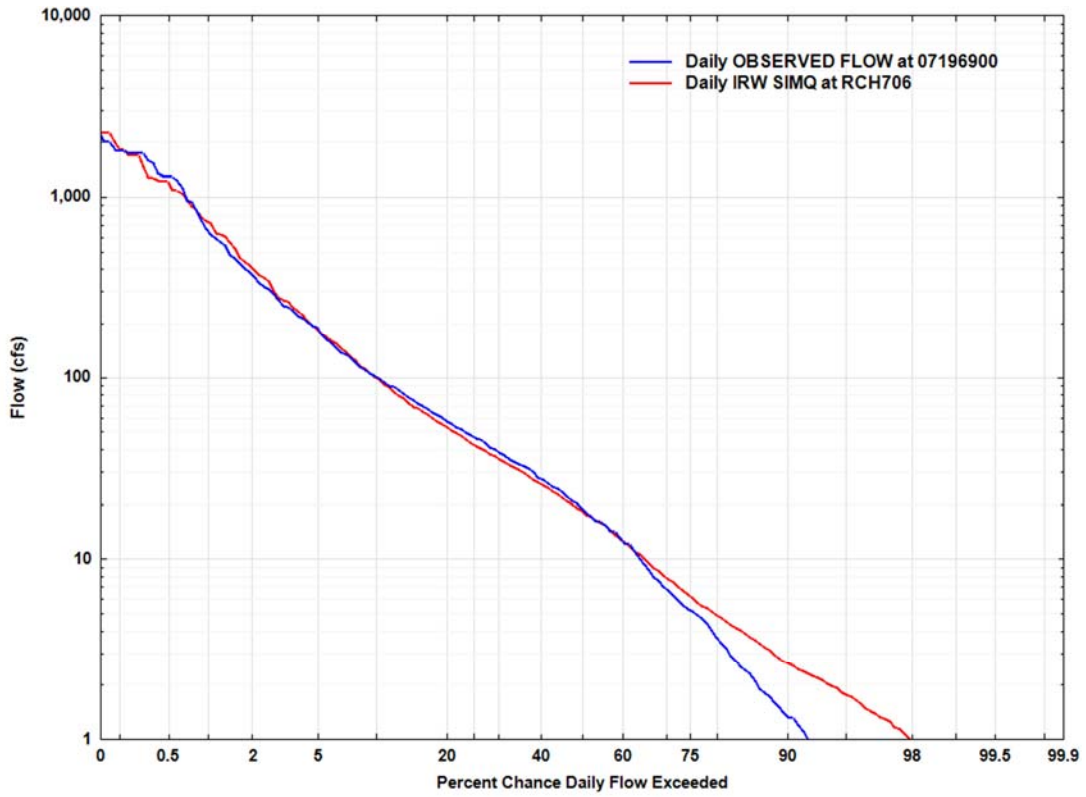


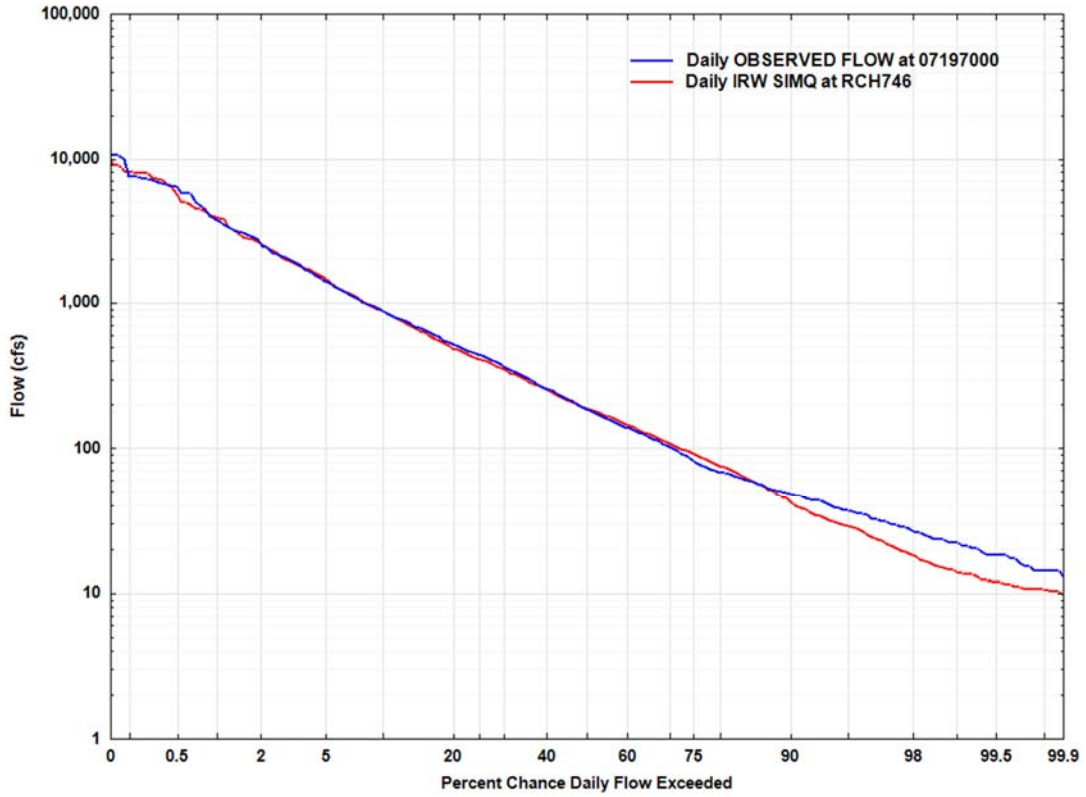

Daily OBSERVED FLOW at 07195865
Daily IRW SIMQ at RCH516
Flow (cfs)
10,000
1,000
100
10
1
0
0.5
2
5
20
40
60
75
90
98
99.5
99.9
Percent Chance Daily Flow Exceeded

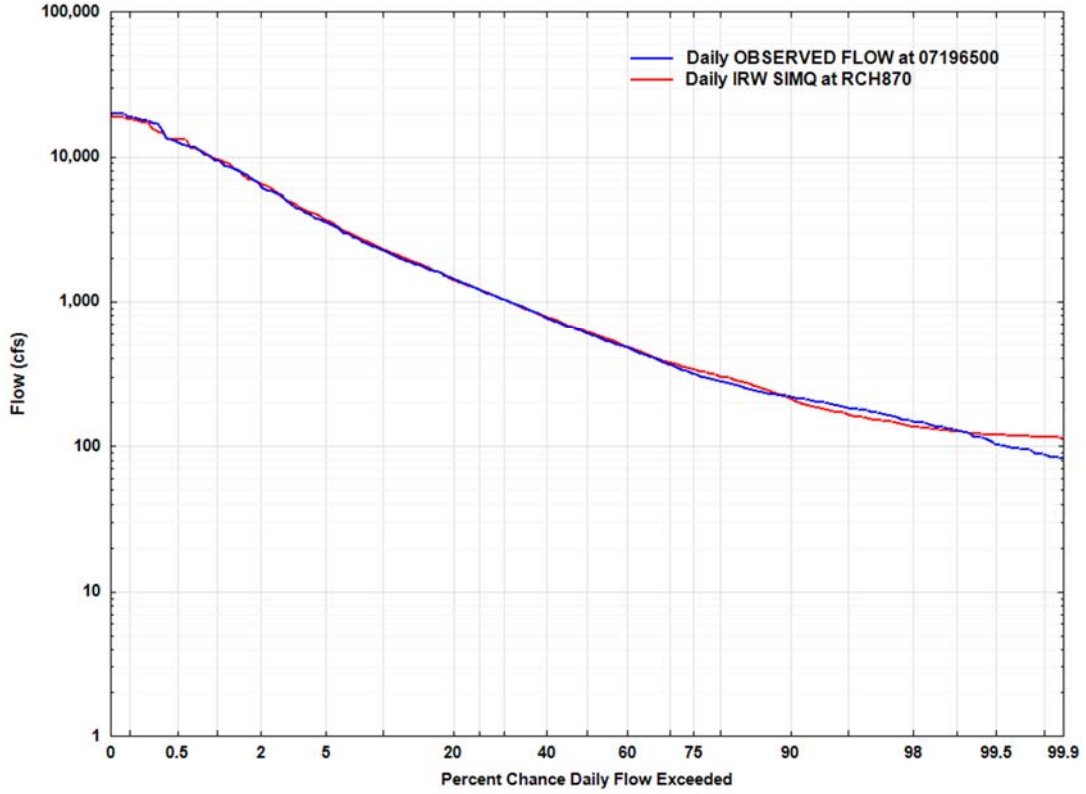

Daily OBSERVED FLOW at 07196000
Daily IRW SIMQ at RCH523
Flow (cfs)
10,000
1,000
100
10
1
0
0.5
2
5
20
40
60
75
90
98
99.5
99.9
Percent Chance Daily Flow Exceeded

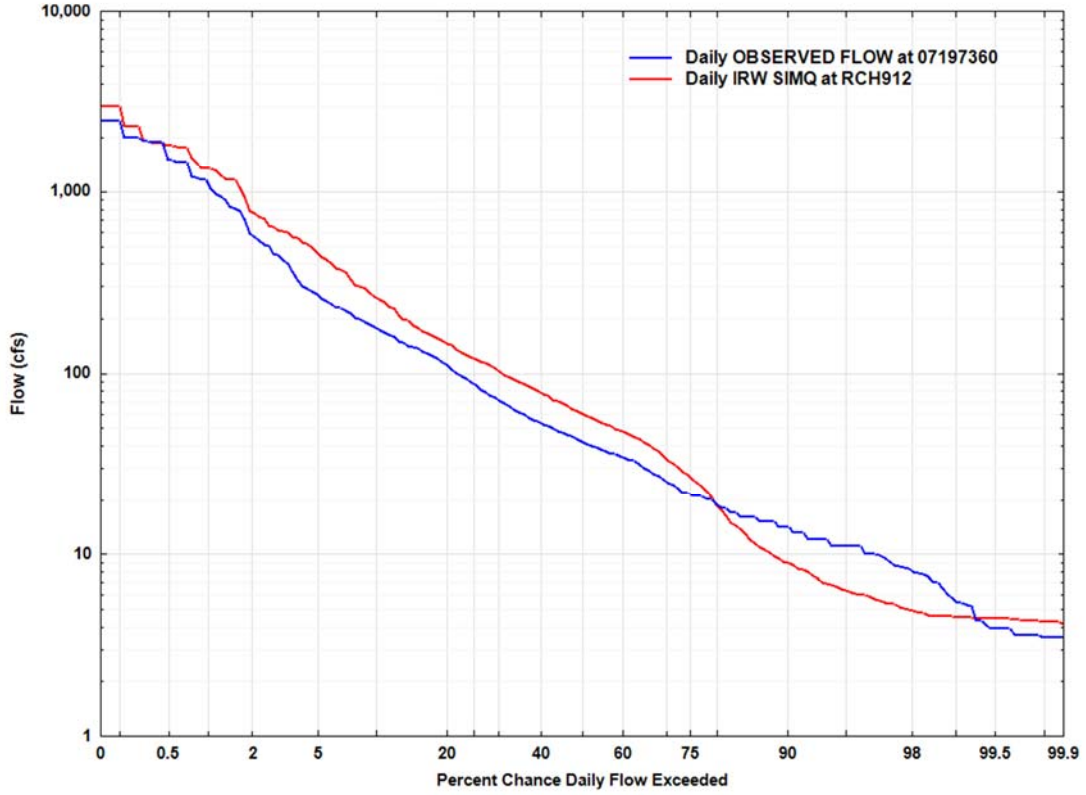

Daily OBSERVED FLOW at 07195430
Daily IRW SIMQ at RCH630
Flow (cfs)
100,000
10,000
1,000
100
10
1
0
0.5
2
5
20
40
60
75
90
98
99.5
99.9
Percent Chance Daily Flow Exceeded


Daily OBSERVED FLOW at 07195500
Daily IRW SIMQ at RCH640
Flow (cfs)
100,000
10,000
1,000
100
10
1
0
0.5
2
5
20
40
60
75
90
98
99.5
99.9
Percent Chance Daily Flow Exceeded


Daily OBSERVED FLOW at 07196900
Daily IRW SIMQ at RCH706
Flow (cfs)
10,000
1,000
100
10
1
0
0.5
2
5
20
40
60
75
90
98
99.5
99.9
Percent Chance Daily Flow Exceeded

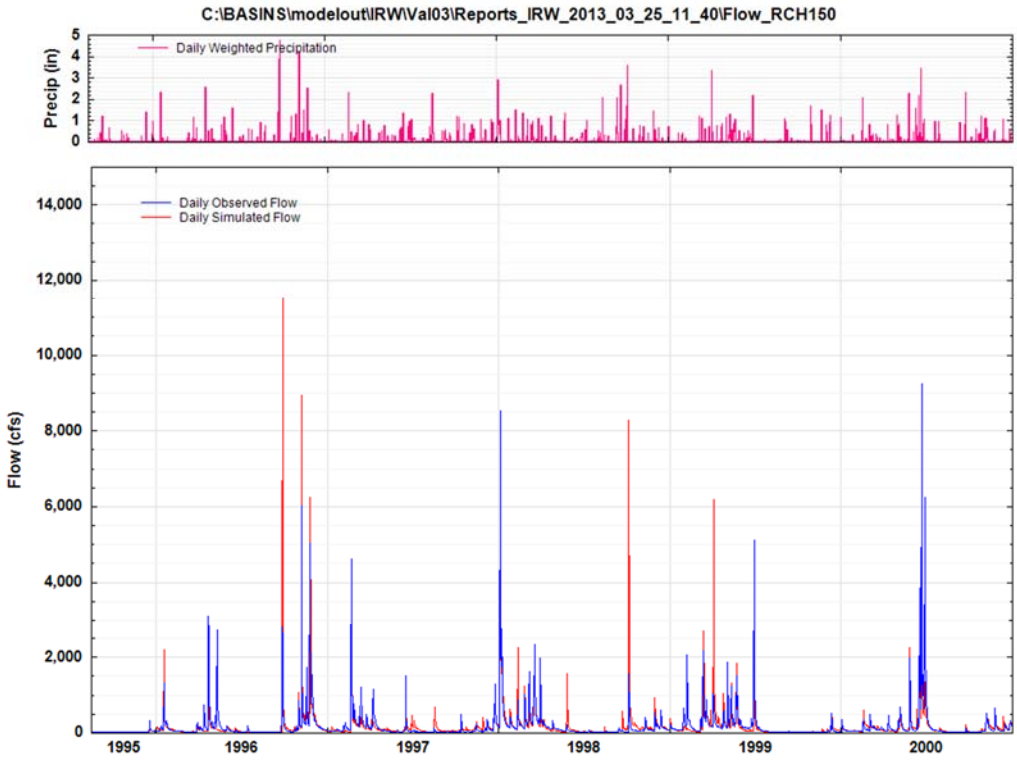

Daily OBSERVED FLOW at 07197000
Daily IRW SIMQ at RCH746
Flow (cfs)
100,000
10,000
1,000
100
10
1
0
0.5
2
5
20
40
60
75
90
98
99.5
99.9
Percent Chance Daily Flow Exceeded

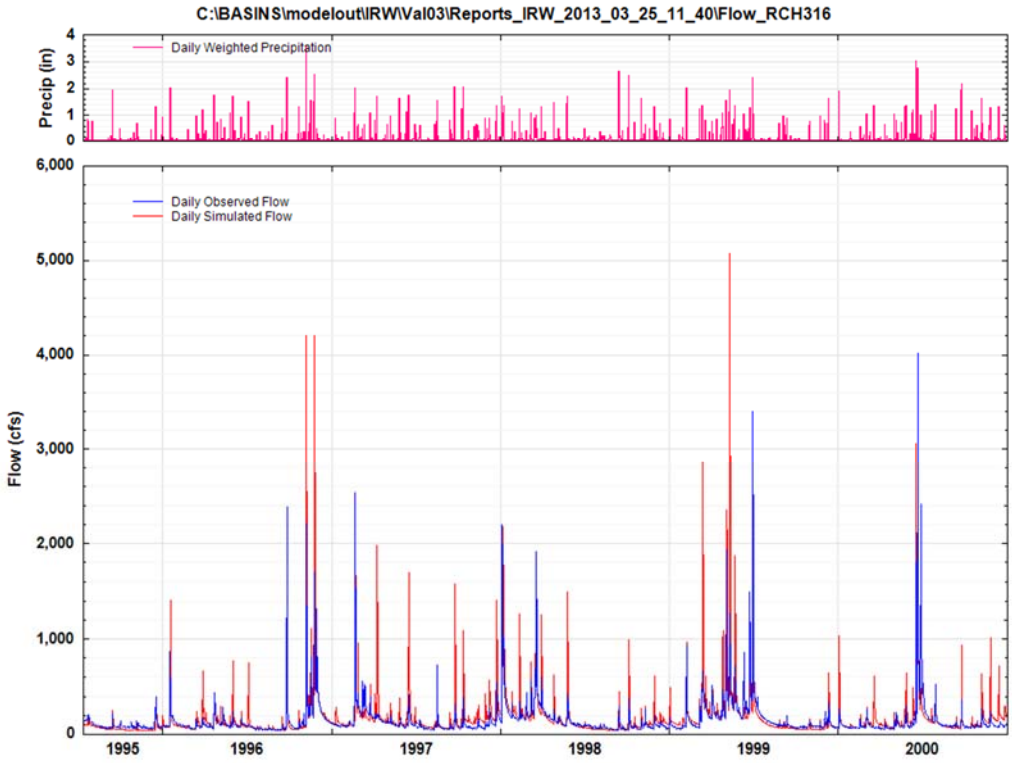

Daily OBSERVED FLOW at 07196500
Daily IRW SIMQ at RCH870
Flow (cfs)
100,000
10,000
1,000
100
10
1
0
0.5
2
5
20
40
60
75
90
98
99.5
99.9
Percent Chance Daily Flow Exceeded

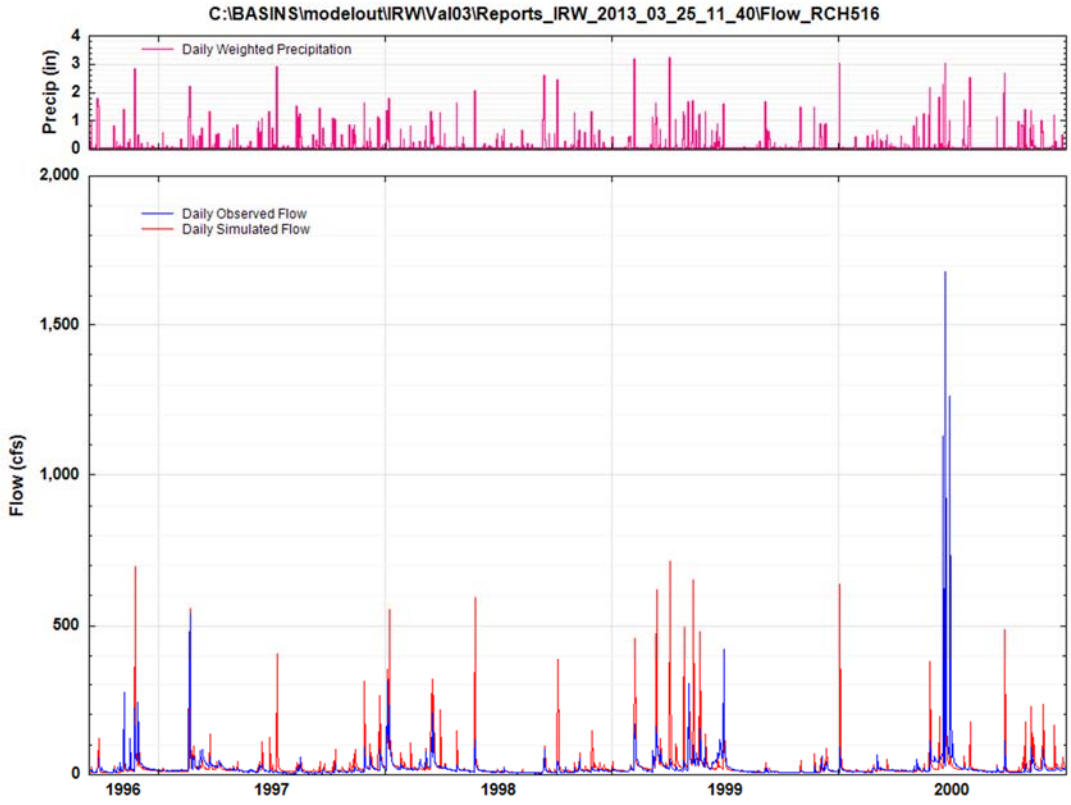

Daily OBSERVED FLOW at 07197360
Daily IRW SIMQ at RCH912
Flow (cfs)
10,000
1,000
100
10
1
0
0.5
2
5
20
40
60
75
90
98
99.5
99.9
Percent Chance Daily Flow Exceeded

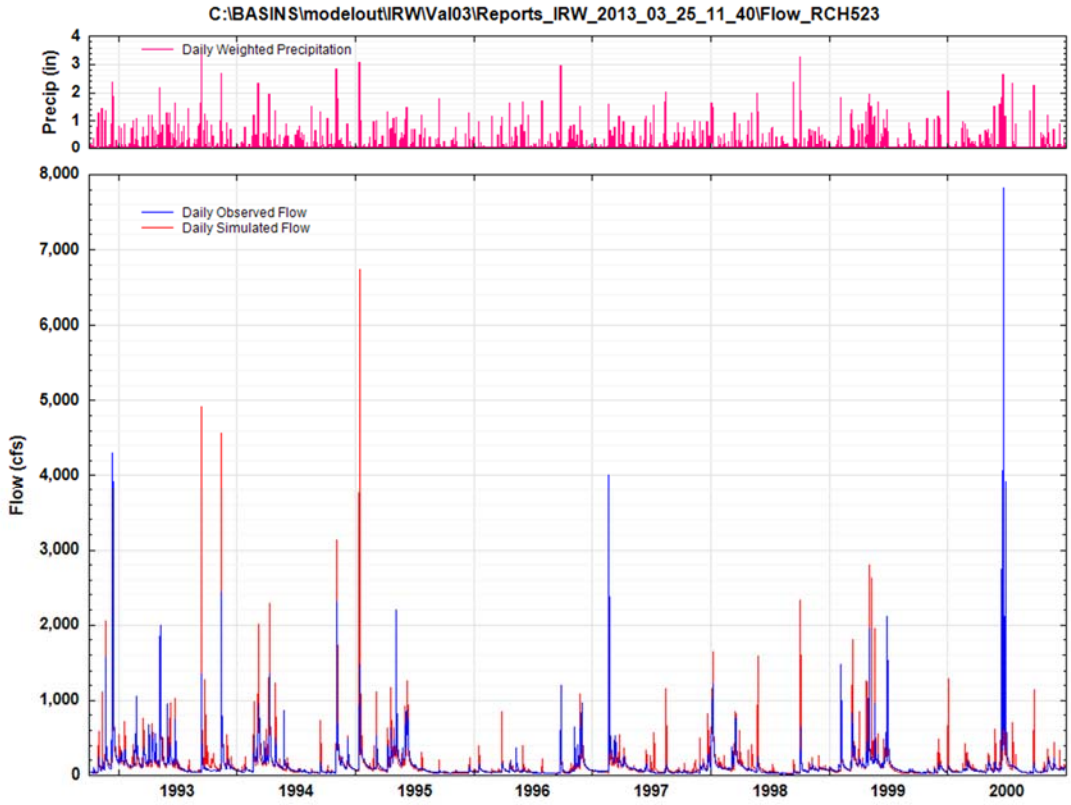
A.2.4 Time Series

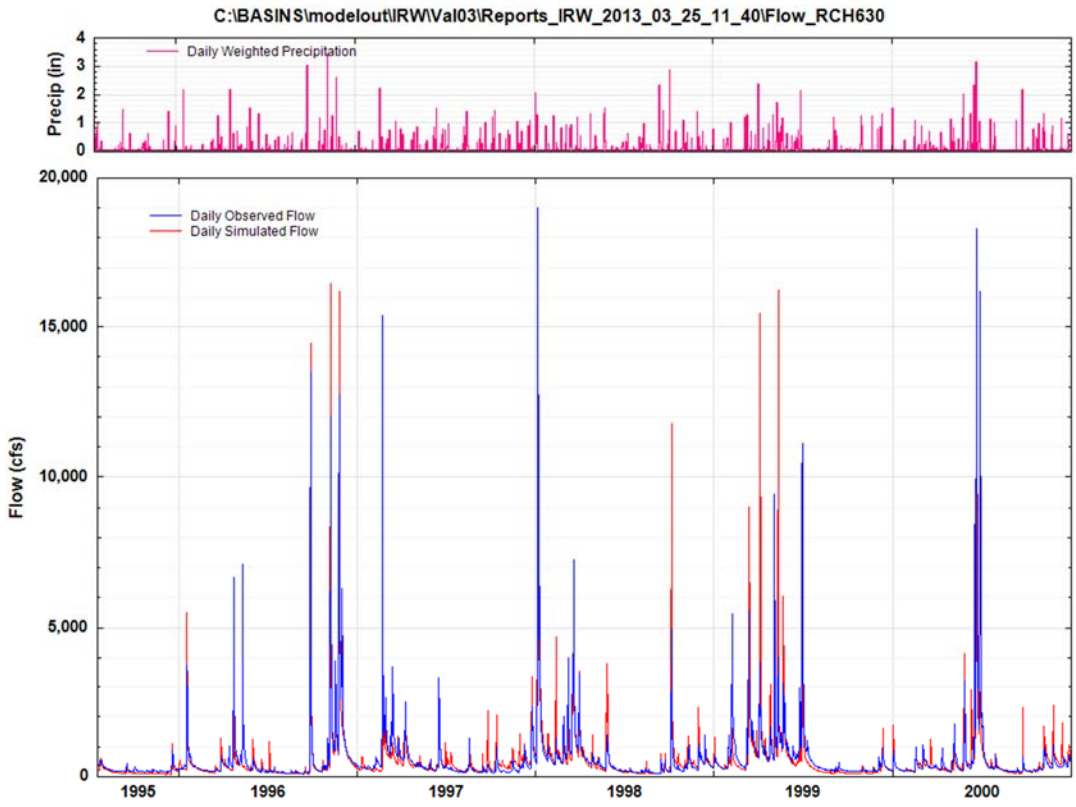
Arithmetic Plots

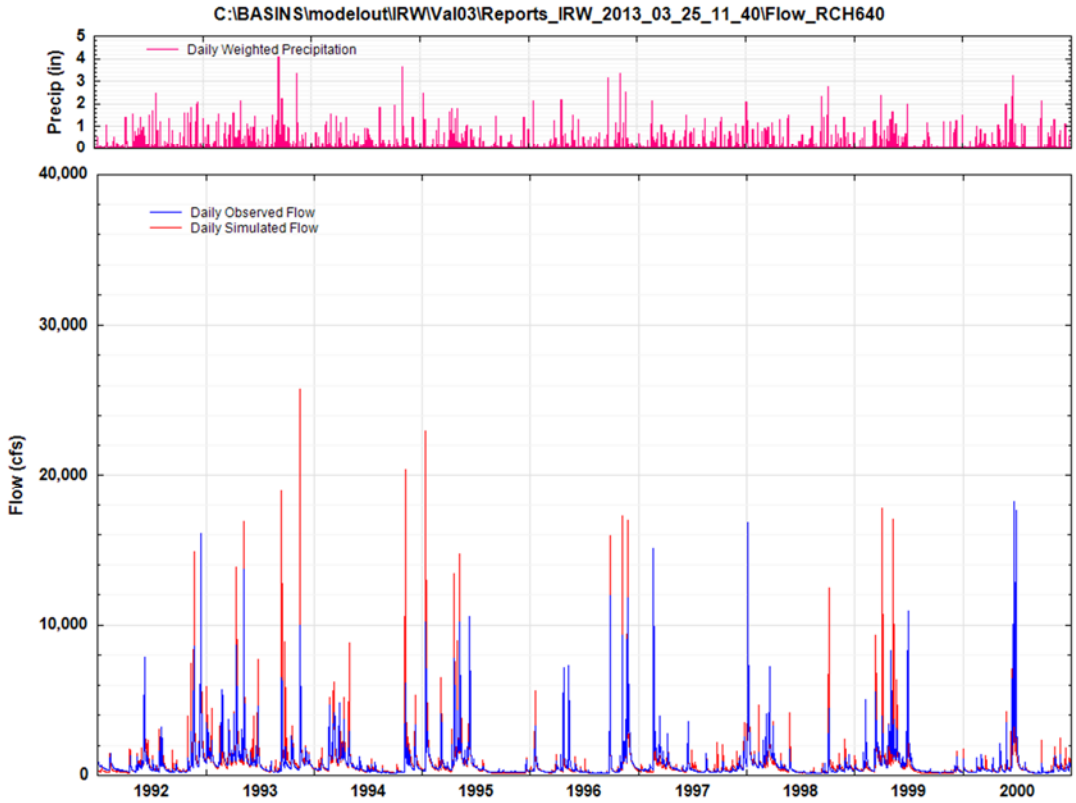


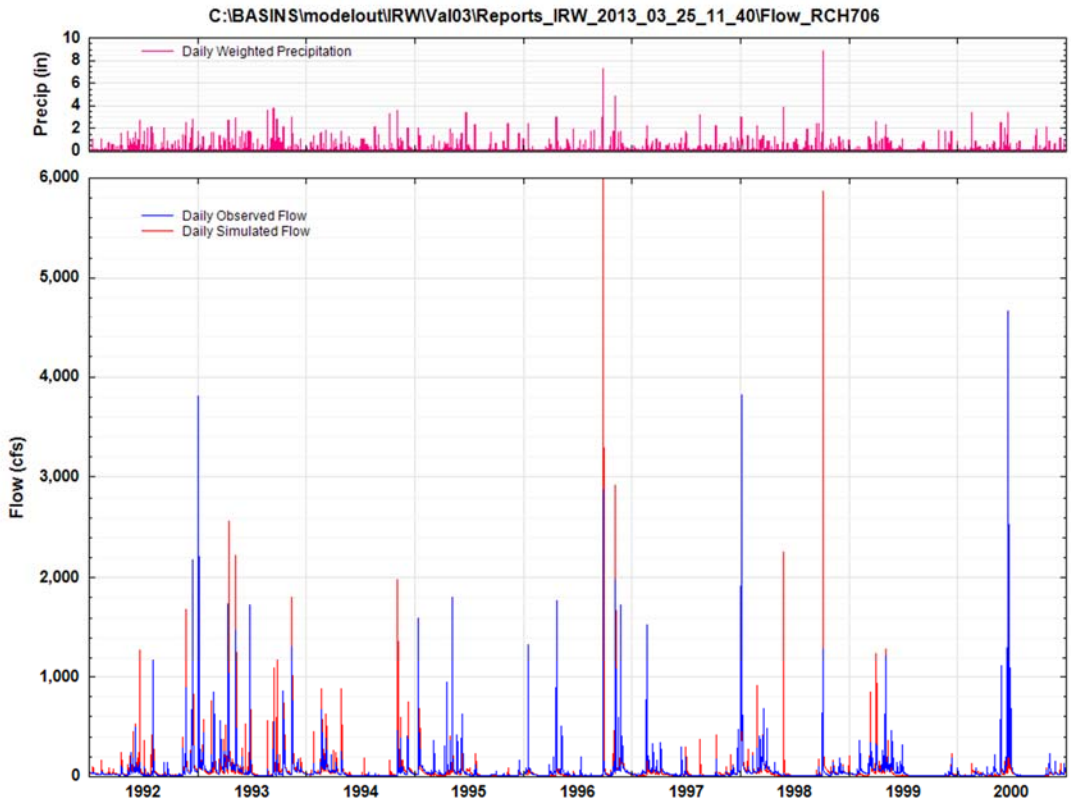


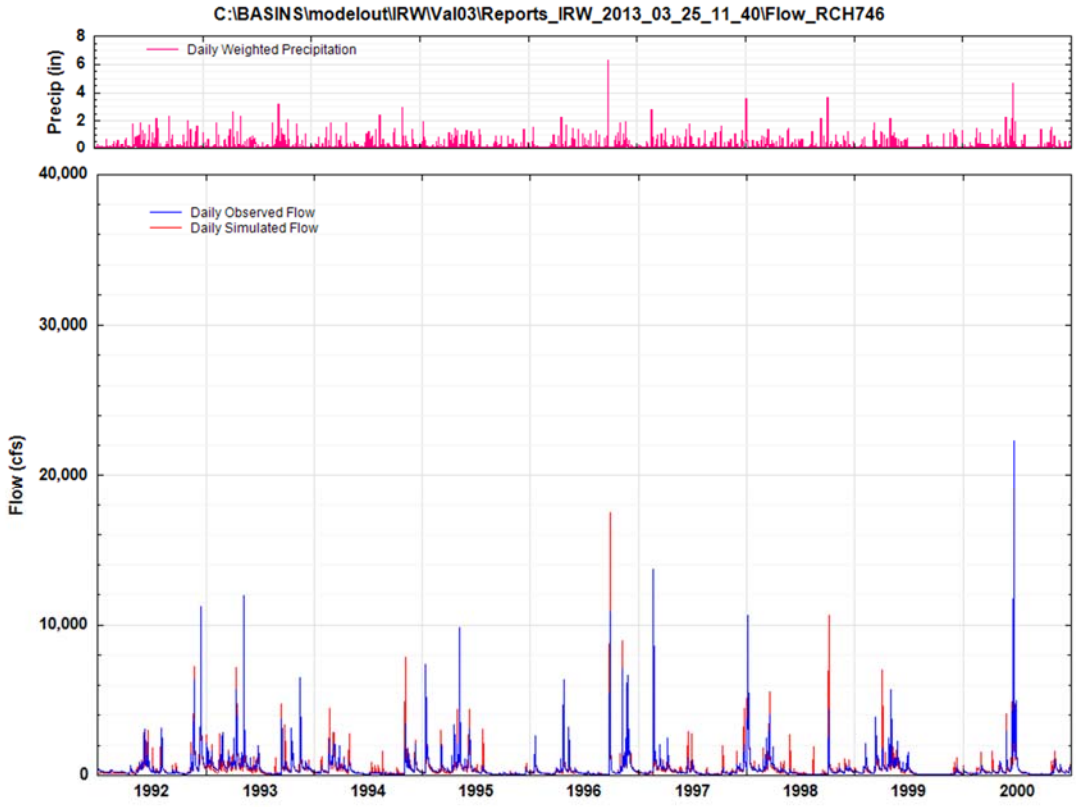

C:\BASINS\modelout\IRW\Val03\Reports_IRW_2013_03_25_11_40\Flow_RCH516
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
1996
1997
1998
1999
2000

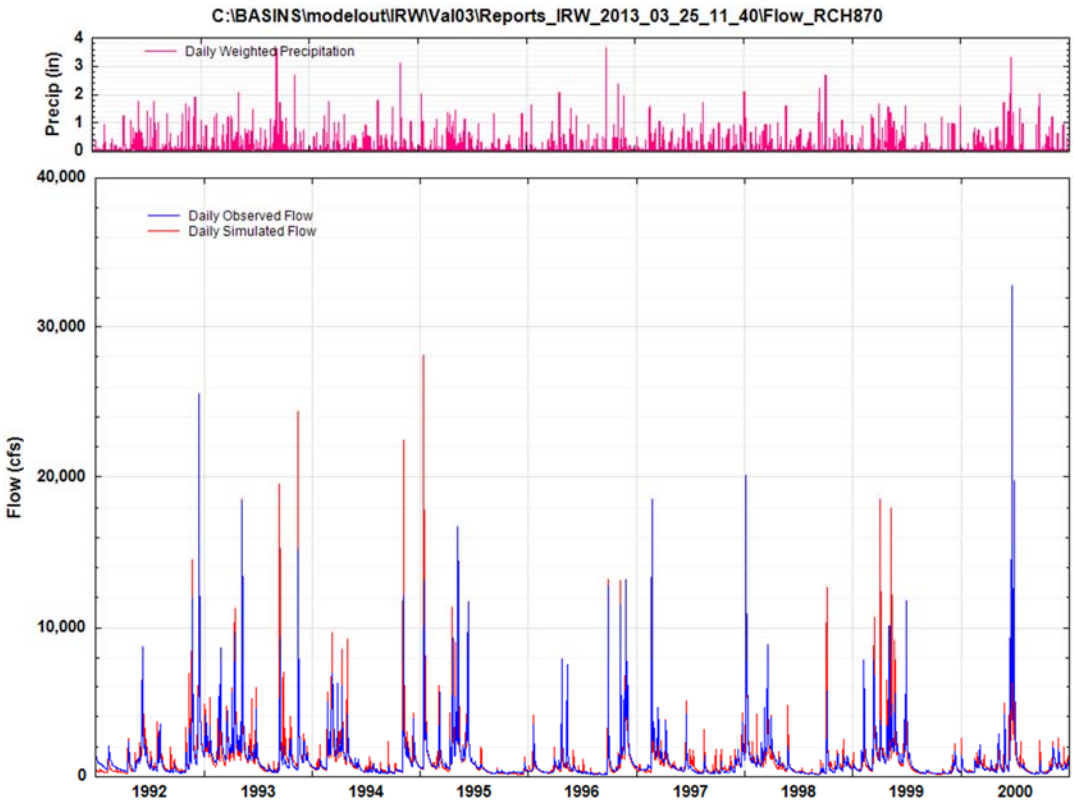

C:\BASINS\modelout\IRW\Val03\Reports_IRW_2013_03_25_11_40\Flow_RCH523
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
1993
1994
1995
1996
1997
1998
1999
2000

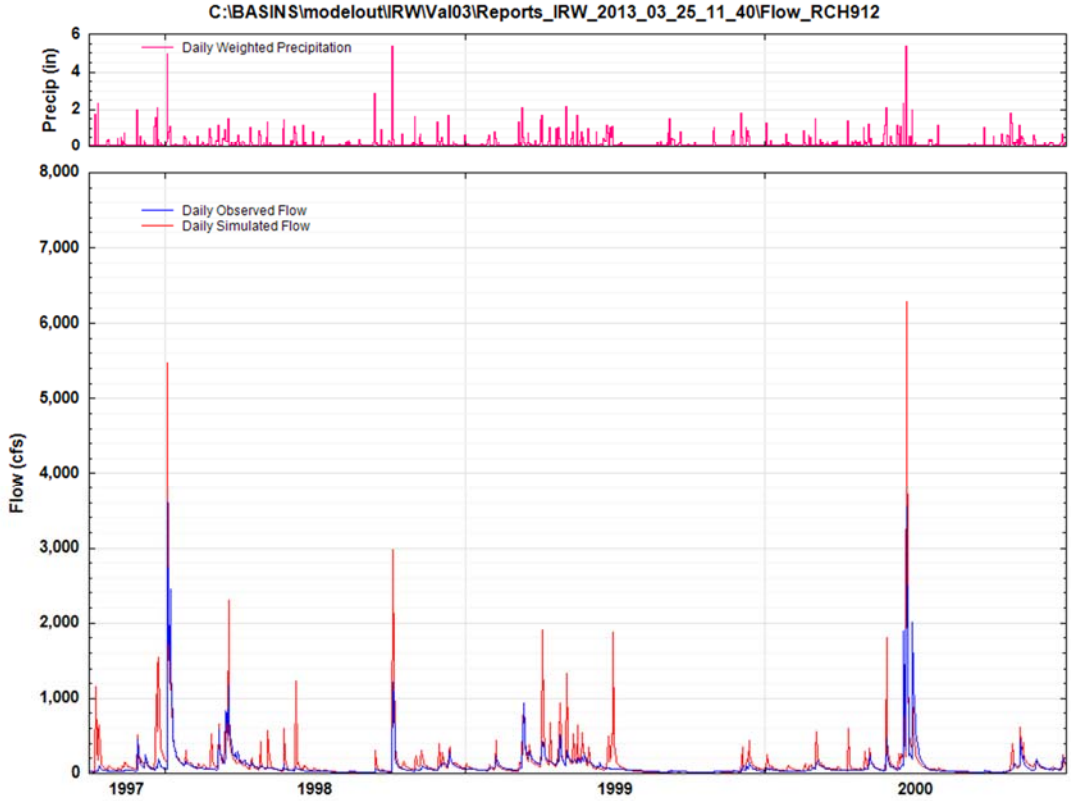

C:\BASINS\modelout\IRW\Val03\Reports_IRW_2013_03_25_11_40\Flow_RCH630
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
1995
1996
1997
1998
1999
2000


C:\BASINS\modelout\IRW\Val03\Reports_IRW_2013_03_25_11_40\Flow_RCH640
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
1992
1993
1994
1995
1996
1997
1998
1999
2000

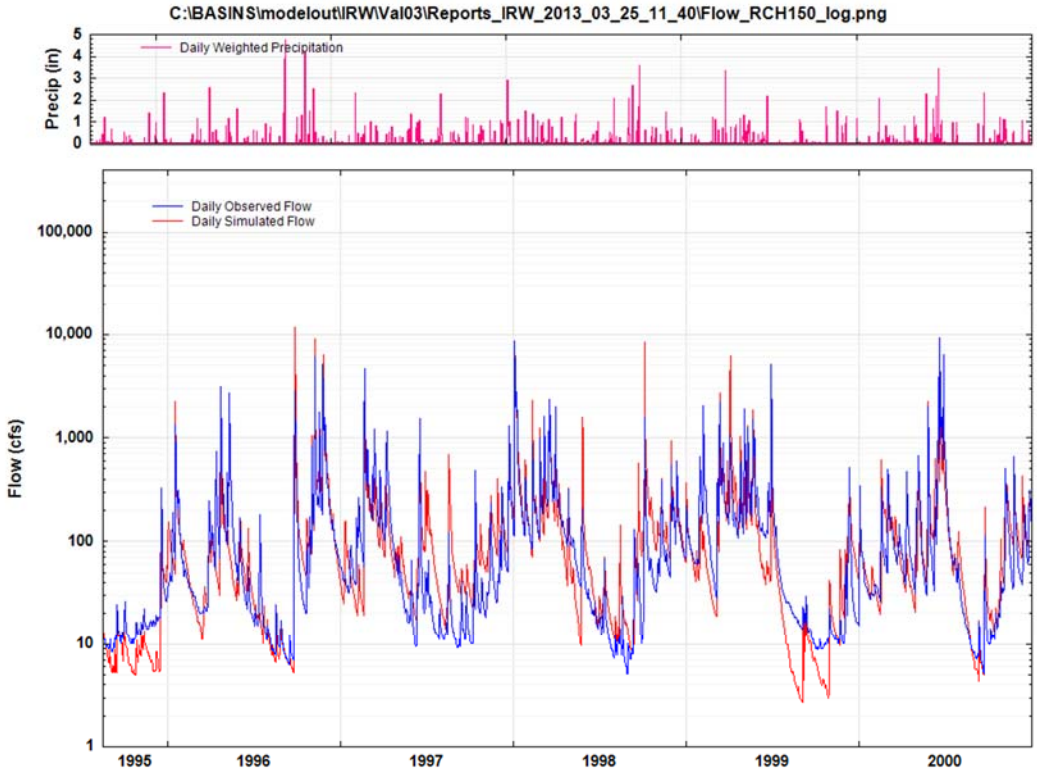

C:\BASINS\modelout\IRW\Val03\Reports_IRW_2013_03_25_11_40\Flow_RCH706
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
1992
1993
1994
1995
1996
1997
1998
1999
2000

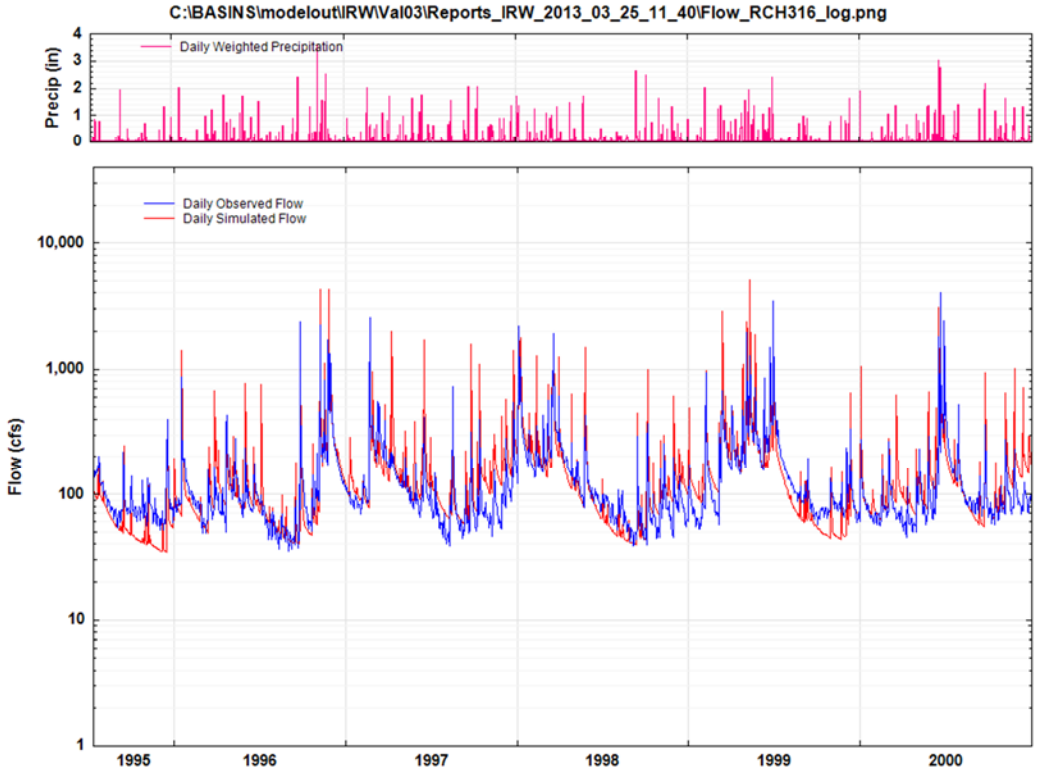

C:\BASINS\modelout\IRW\Val03\Reports_IRW_2013_03_25_11_40\Flow_RCH746
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
1992
1993
1994
1995
1996
1997
1998
1999
2000

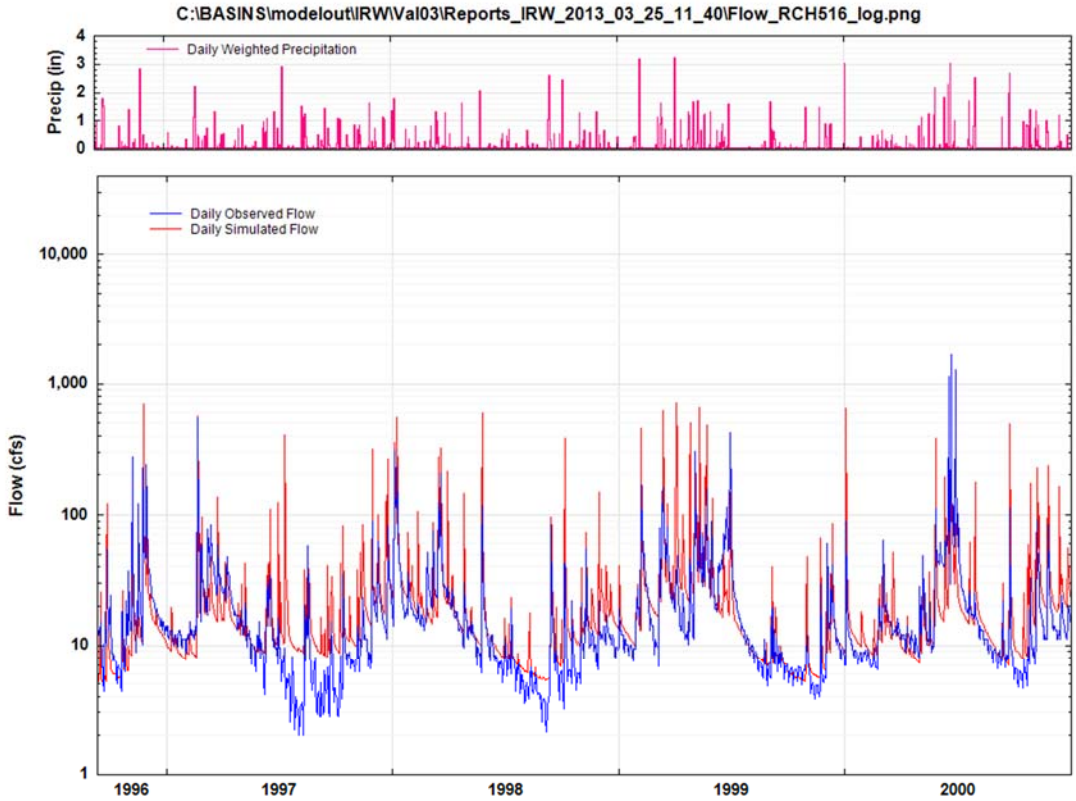

C:\BASINS\modelout\IRW\Val03\Reports_IRW_2013_03_25_11_40\Flow_RCH870
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
1992
1993
1994
1995
1996
1997
1998
1999
2000

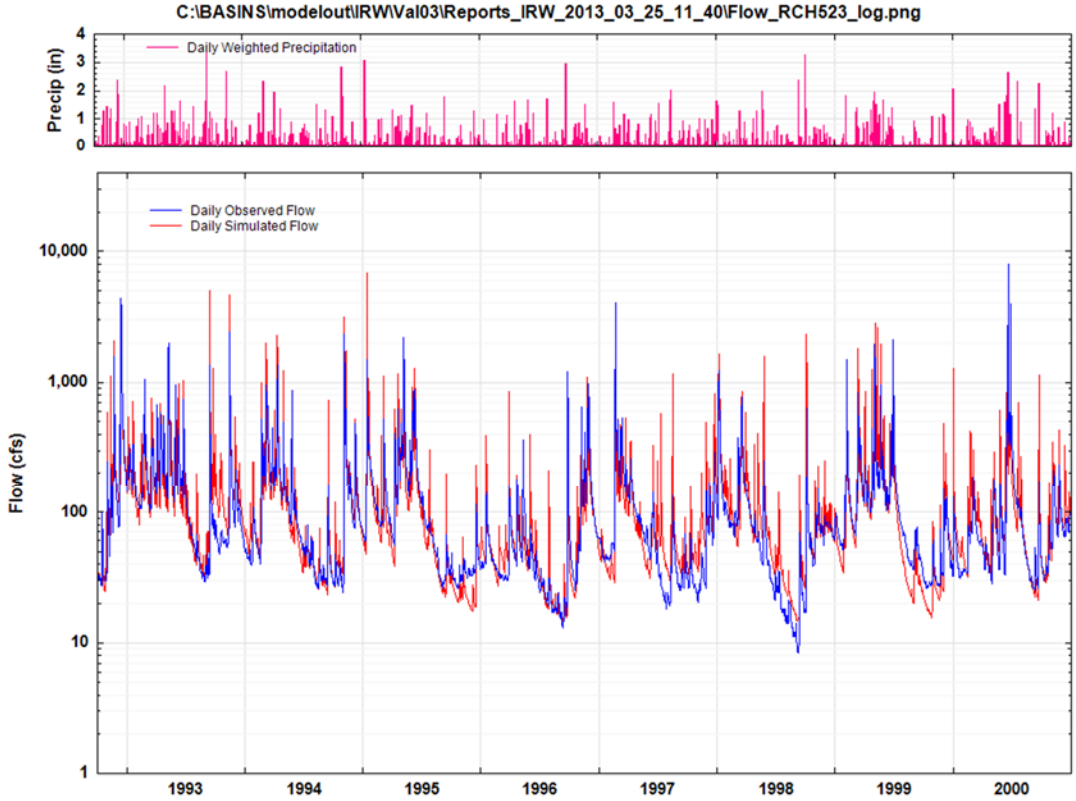

C:\BASINS\modelout\IRW\Val03\Reports_IRW_2013_03_25_11_40\Flow_RCH912
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
1997
1998
1999
2000

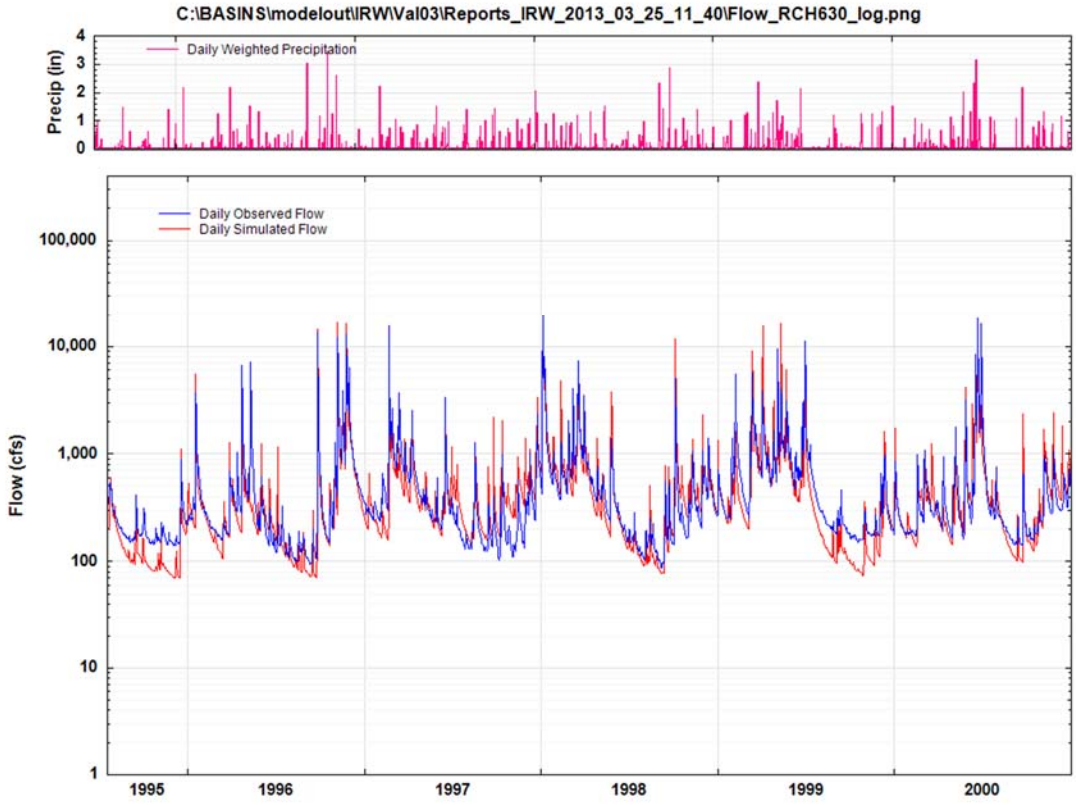
Log Plots

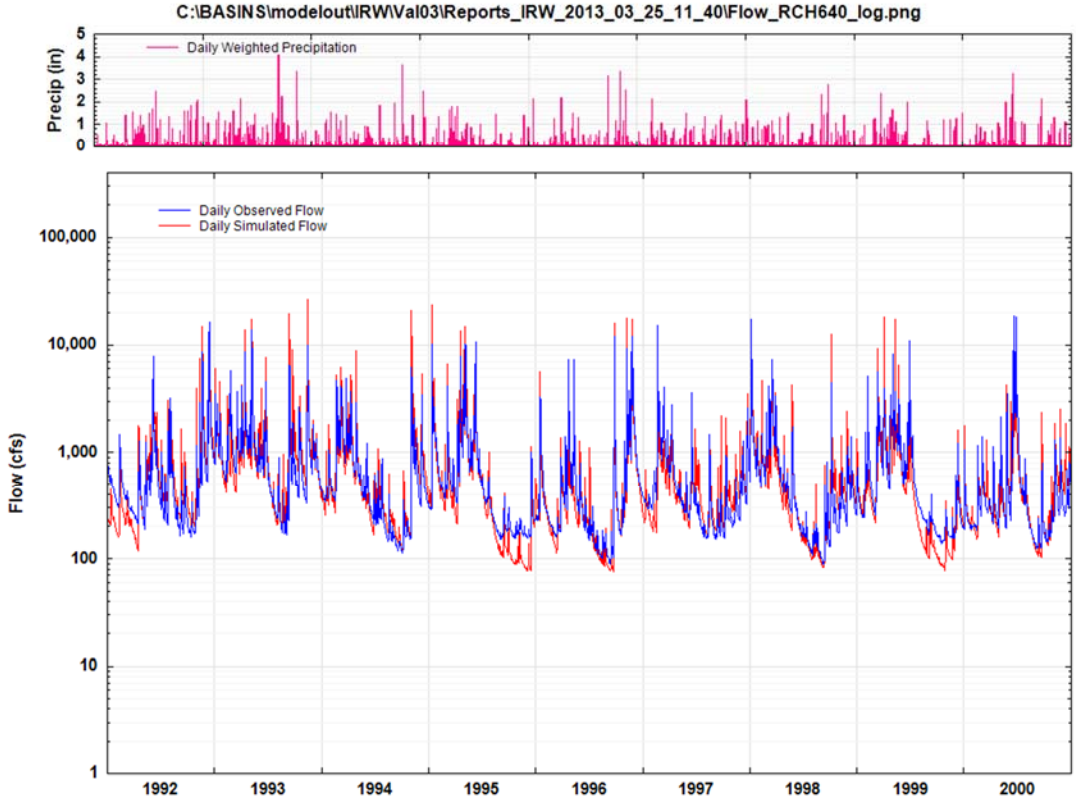

C:\BASINS\modelout\IRW\Val03\Reports_IRW_2013_03_25_11_40\Flow_RCH150_log.png
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
100,000
10,000
1,000
100
10
1
1995
1996
1997
1998
1999
2000

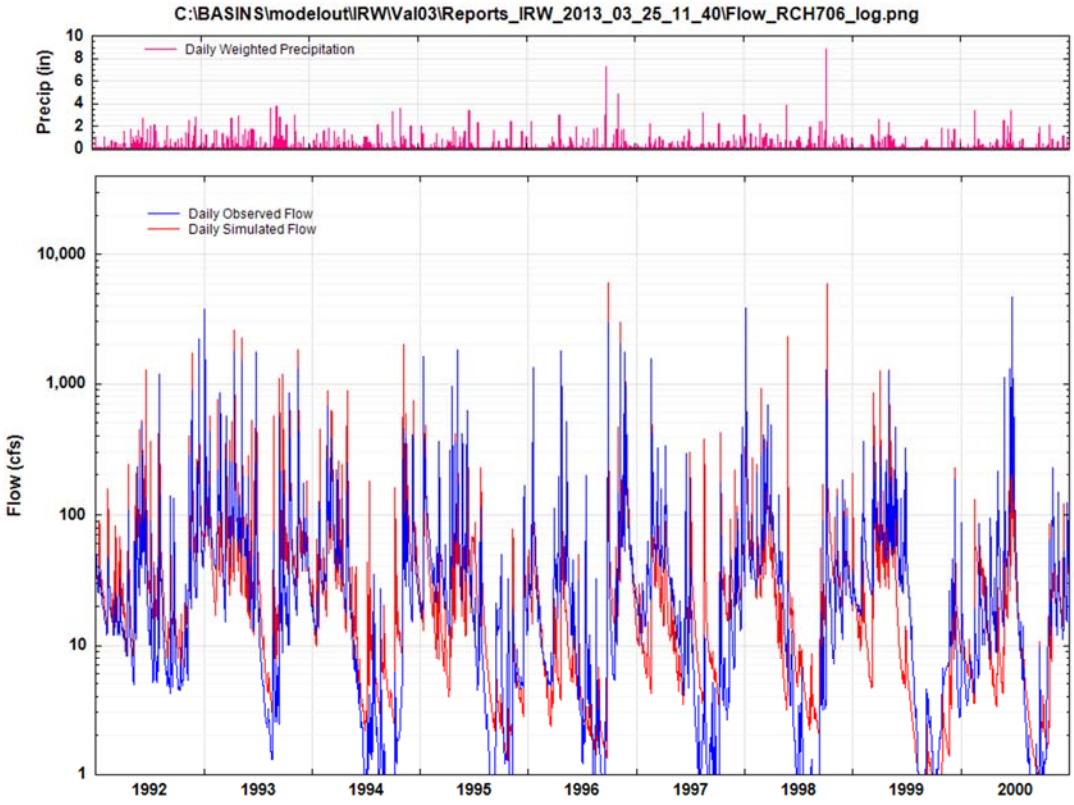

C:\BASINS\modelout\IRW\Val03\Reports_IRW_2013_03_25_11_40\Flow_RCH316_log.png
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
10,000
1,000
100
10
1
1995
1996
1997
1998
1999
2000

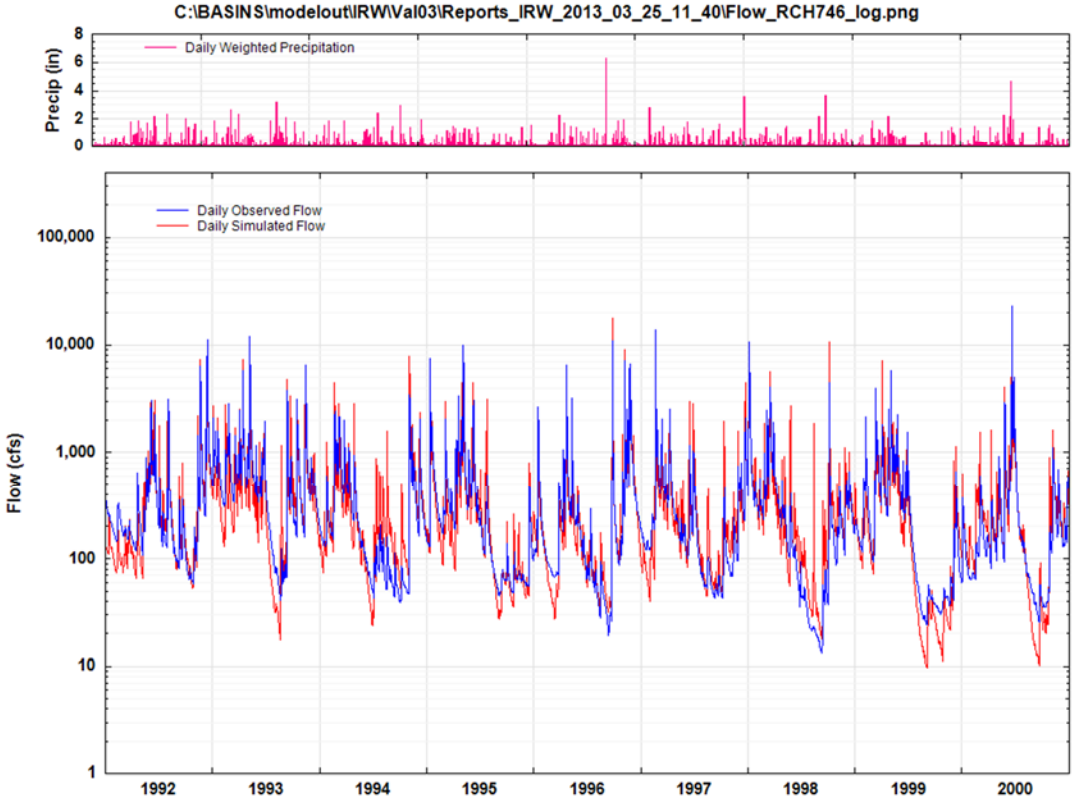

C:\BASINS\modelout\IRW\Val03\Reports_IRW_2013_03_25_11_40\Flow_RCH516_log.png
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
1996
1997
1998
1999
2000

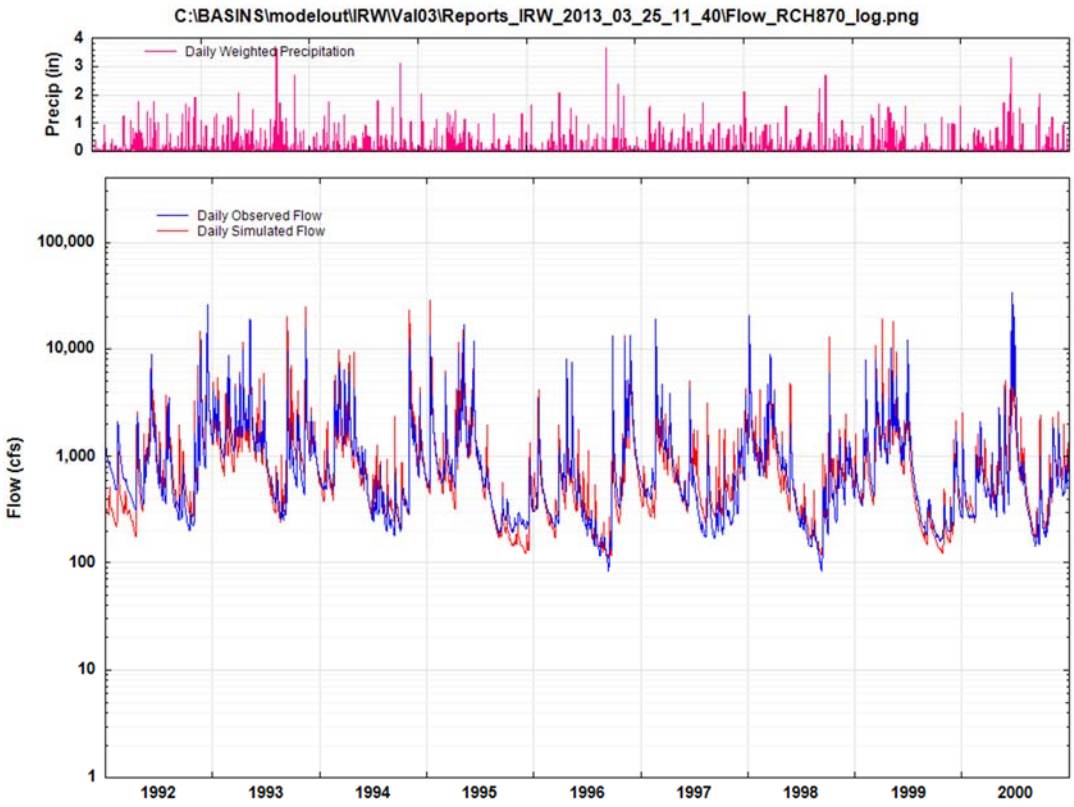

C:\BASINS\modelout\IRW\Val03\Reports_IRW_2013_03_25_11_40\Flow_RCH523_log.png
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
1993
1994
1995
1996
1997
1998
1999
2000

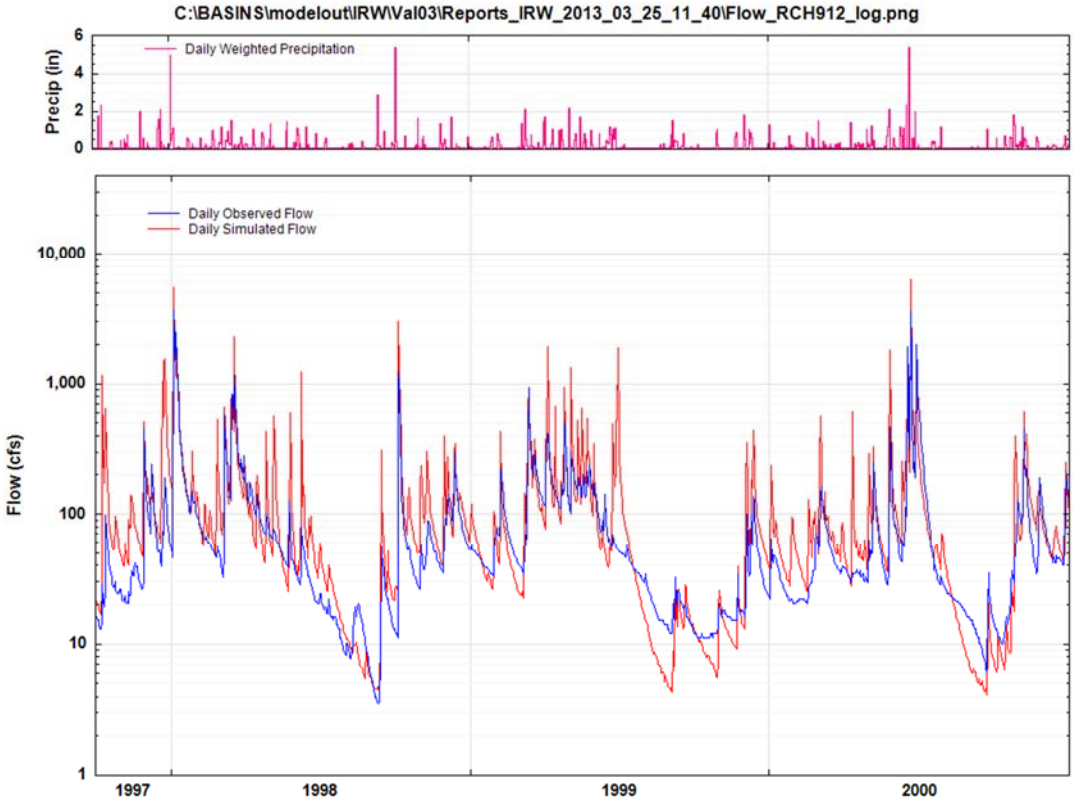

C:\BASINS\modelout\IRW\Val03\Reports_IRW_2013_03_25_11_40\Flow_RCH630_log.png
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
1995
1996
1997
1998
1999
2000


C:\BASINS\modelout\IRW\Val03\Reports_IRW_2013_03_25_11_40\Flow_RCH640_log.png
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
1992
1993
1994
1995
1996
1997
1998
1999
2000


C:\BASINS\modelout\IRW\Val03\Reports_IRW_2013_03_25_11_40\Flow_RCH706_log.png
Precip (in)
Daily Weighted Precipitation
Flow (cfs)
Daily Observed Flow
Daily Simulated Flow
1992
1993
1994
1995
1996
1997
1998
1999
2000


C:\BASINS\modelout\IRW\Val03\Reports_IRW_2013_03_25_11_40\Flow_RCH746_log.png
Precip (in)
Daily Weighted Precipitation
Flow (cfs)
Daily Observed Flow
Daily Simulated Flow
1992
1993
1994
1995
1996
1997
1998
1999
2000

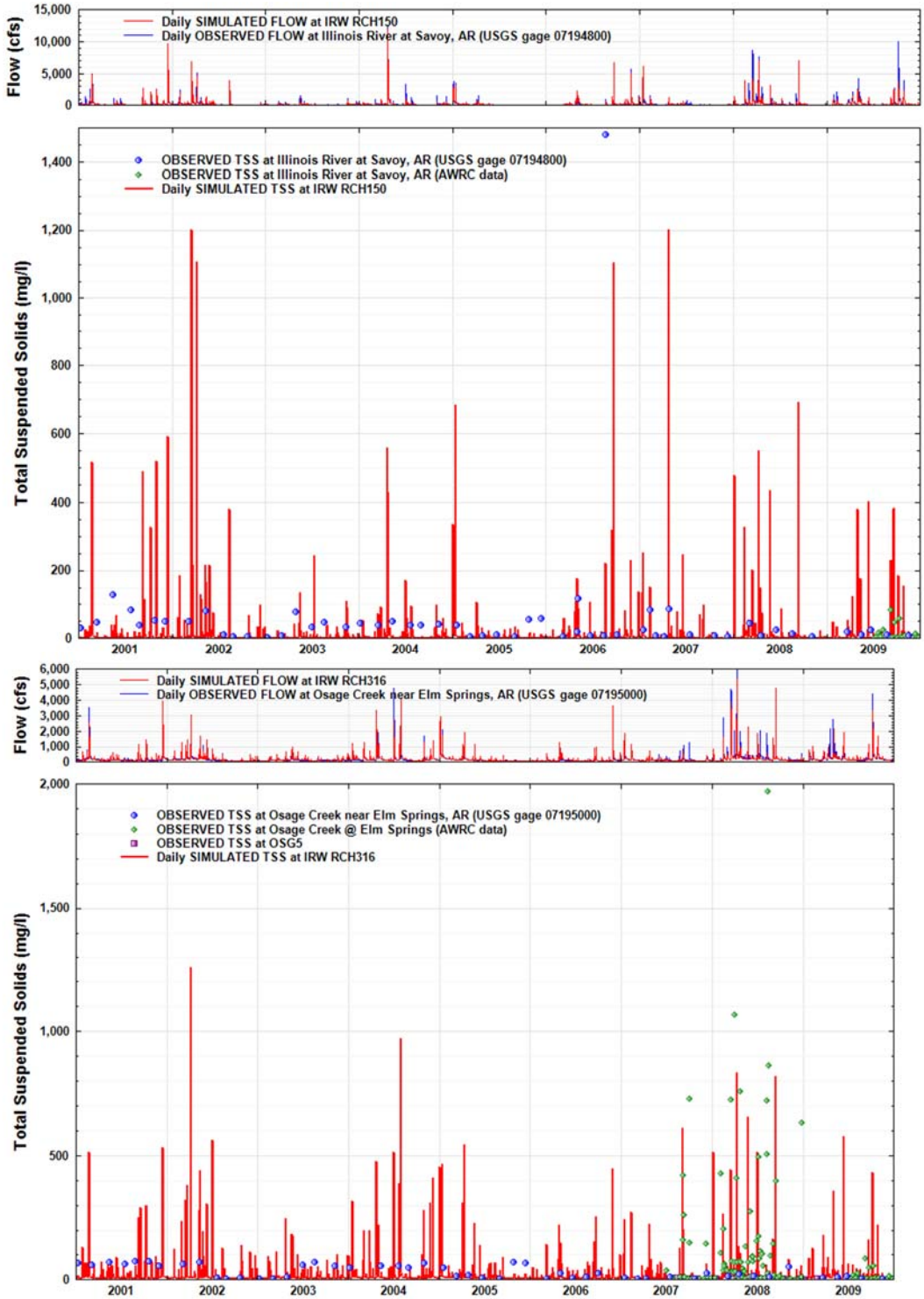

C:\BASINS\modelout\IRW\Val03\Reports_IRW_2013_03_25_11_40\Flow_RCH870_log.png
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
100,000
10,000
1,000
100
10
1
1992
1993
1994
1995
1996
1997
1998
1999
2000

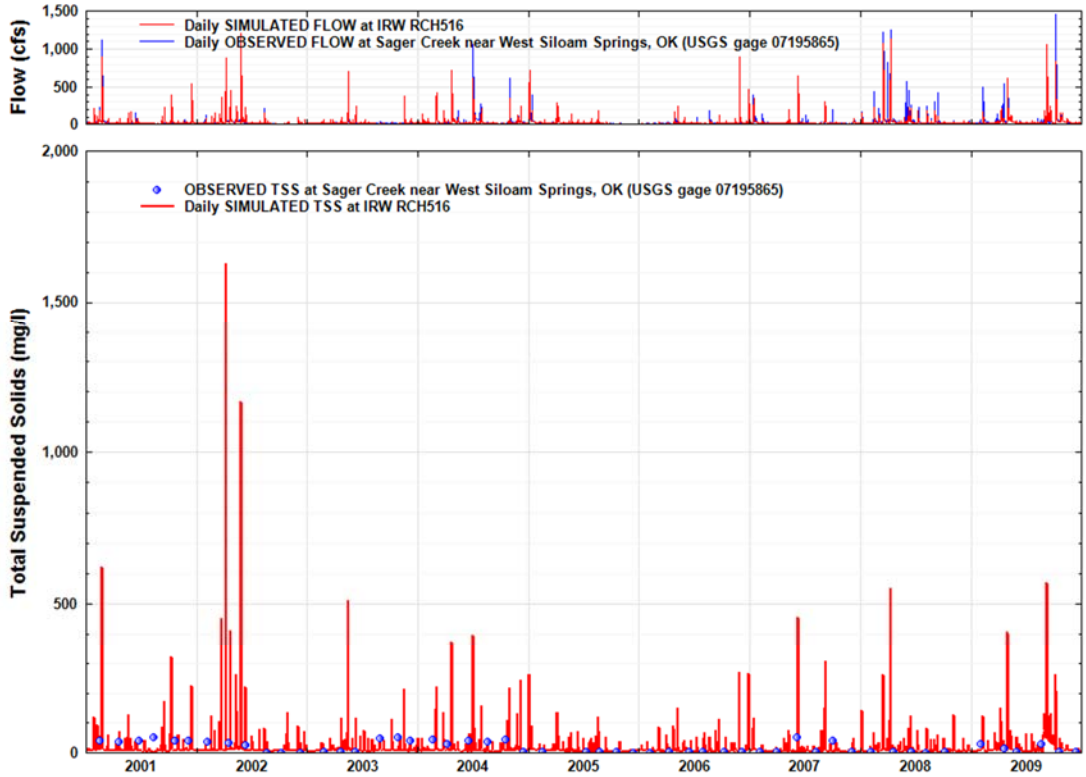

C:\BASINS\modelout\IRW\Val03\Reports_IRW_2013_03_25_11_40\Flow_RCH912_log.png
Daily Weighted Precipitation
Precip (in)
Daily Observed Flow
Daily Simulated Flow
Flow (cfs)
10,000
1,000
100
10
1
1997
1998
1999
2000

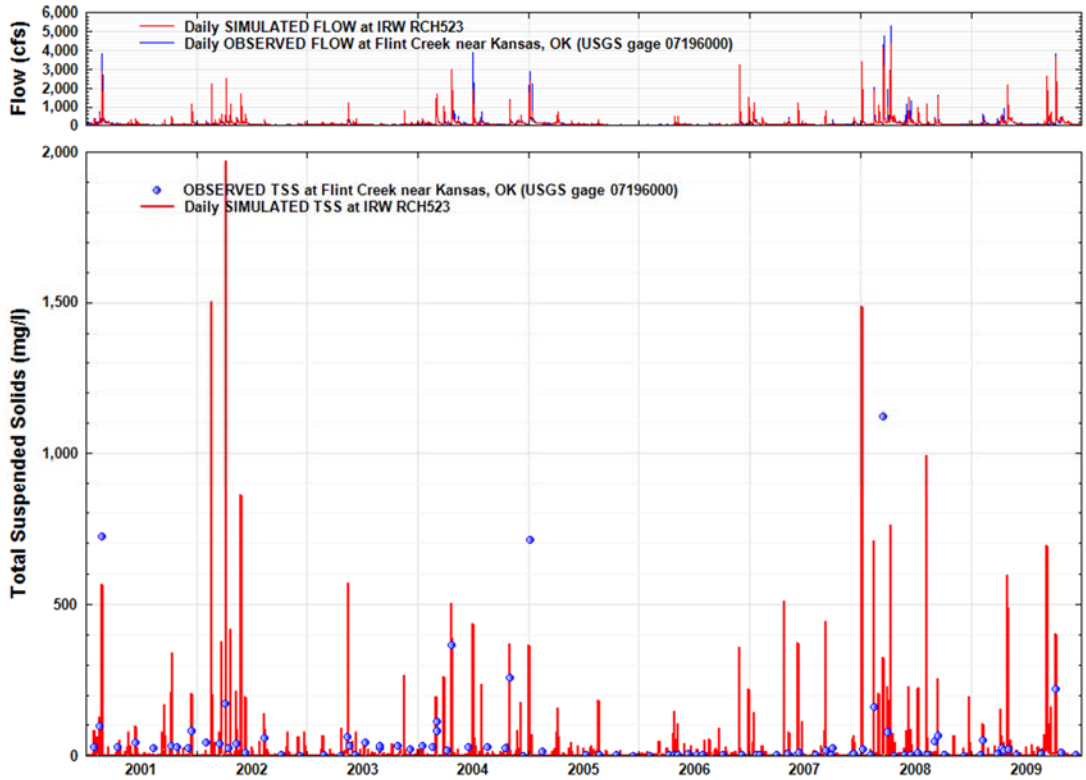
APPENDIX B
SEDIMENT RESULTS

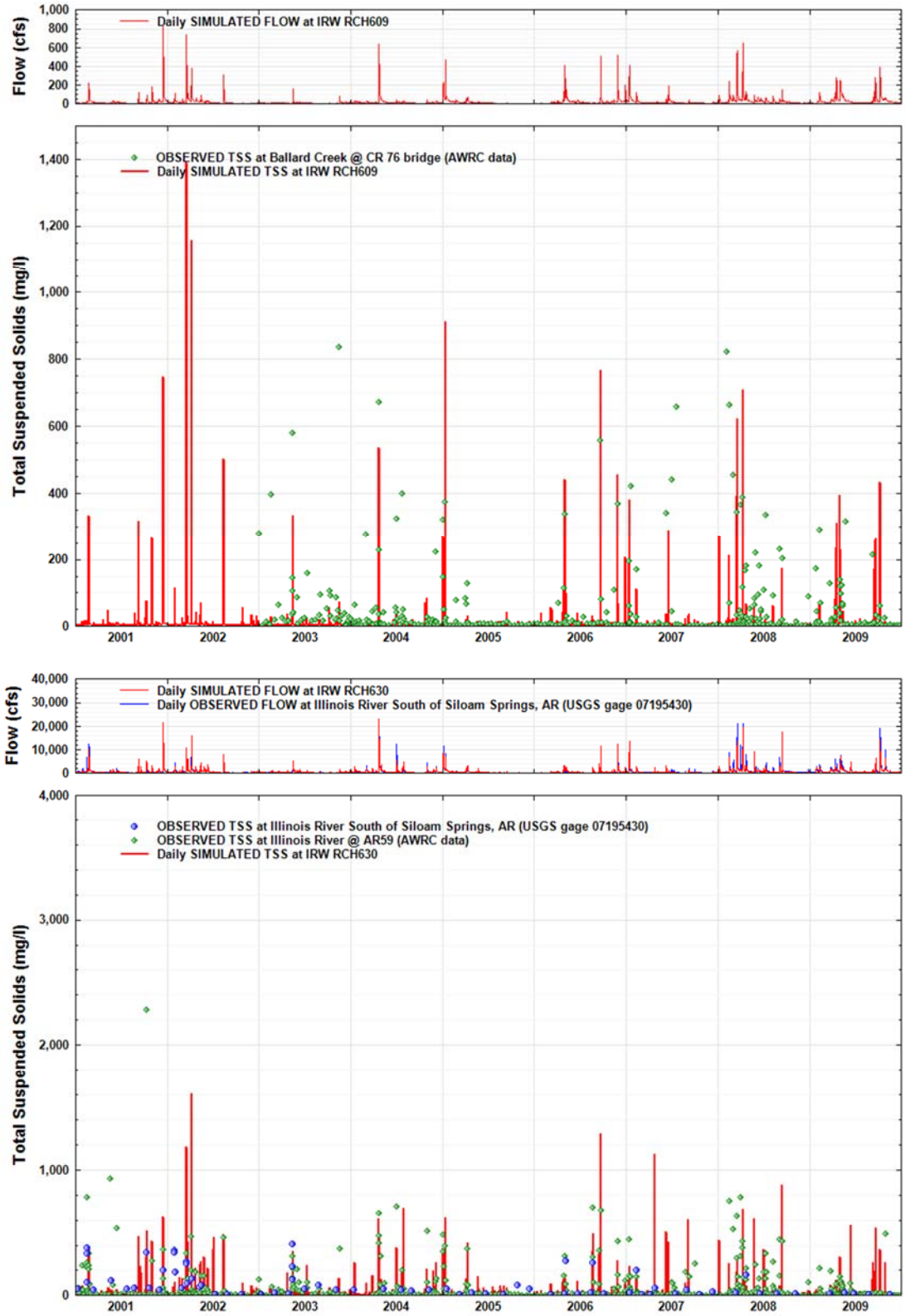
B.1 CALIBRATION

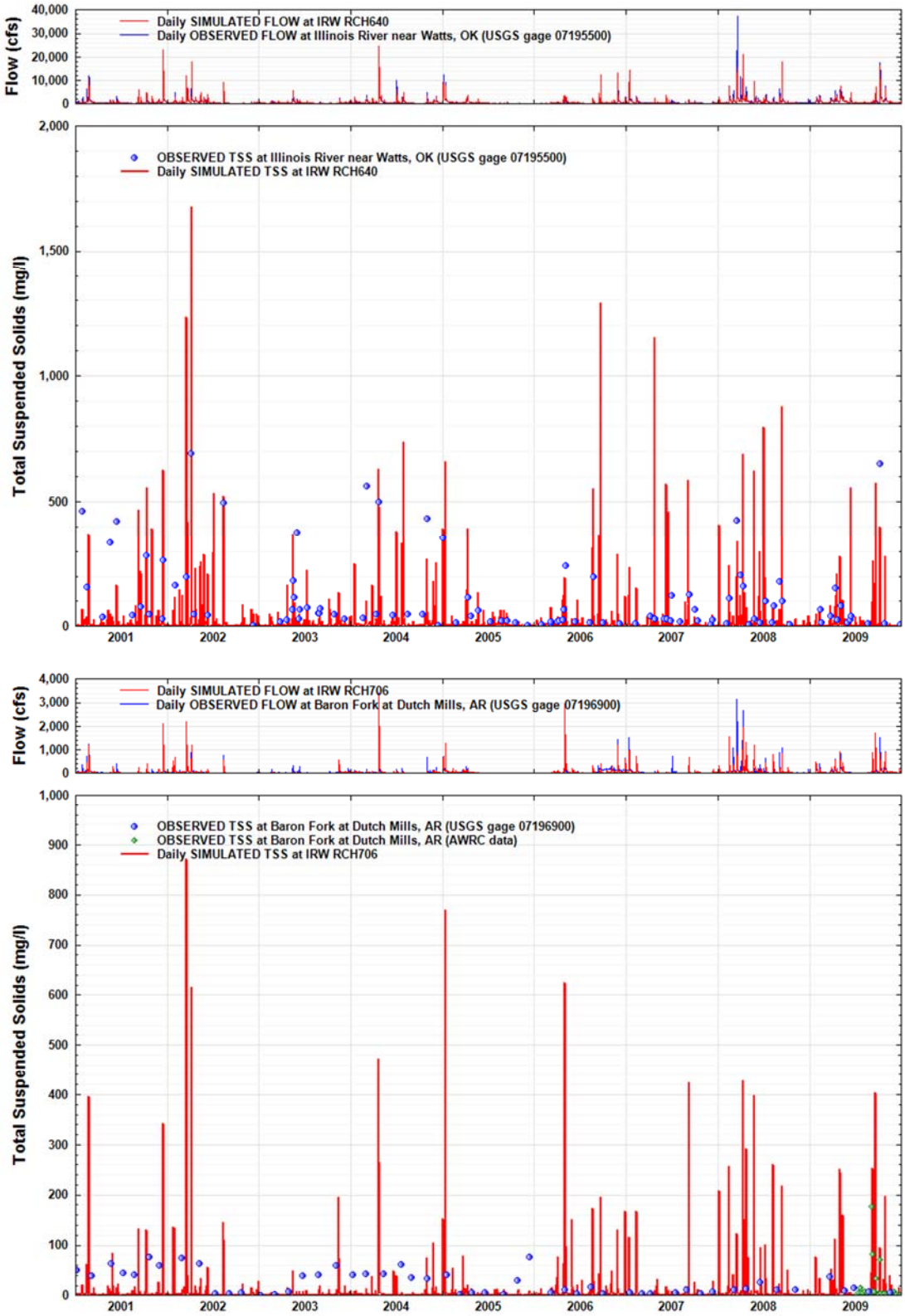
B.1.1 Arithmetic Plots

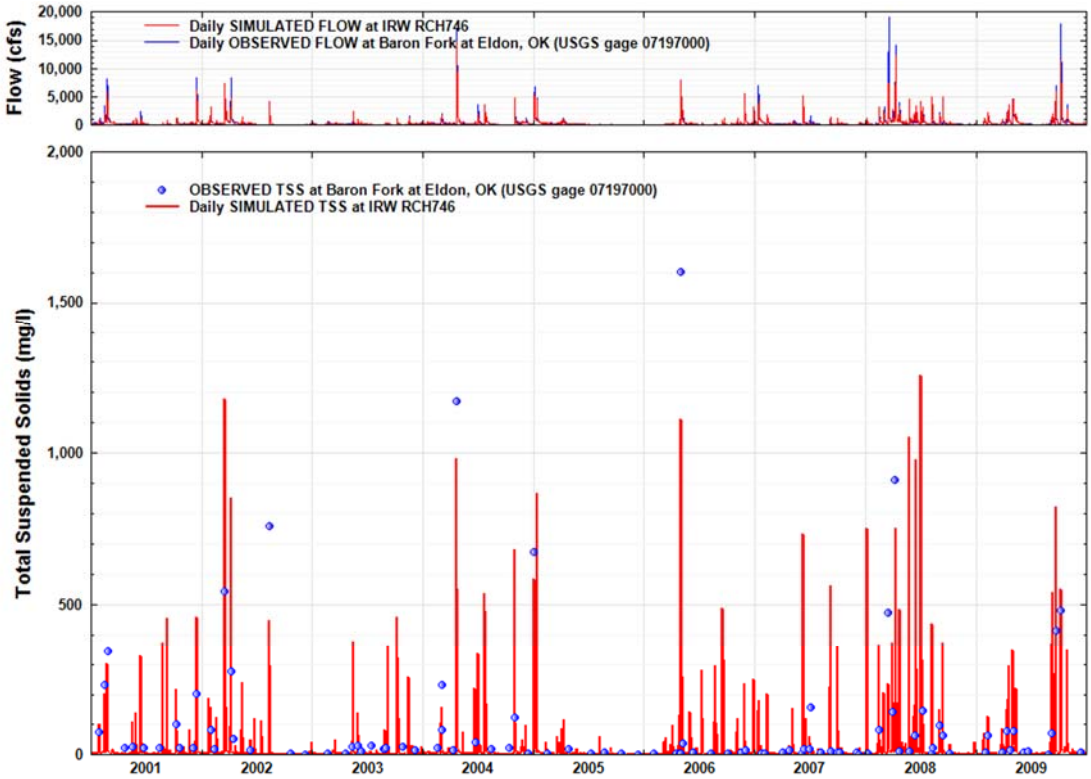


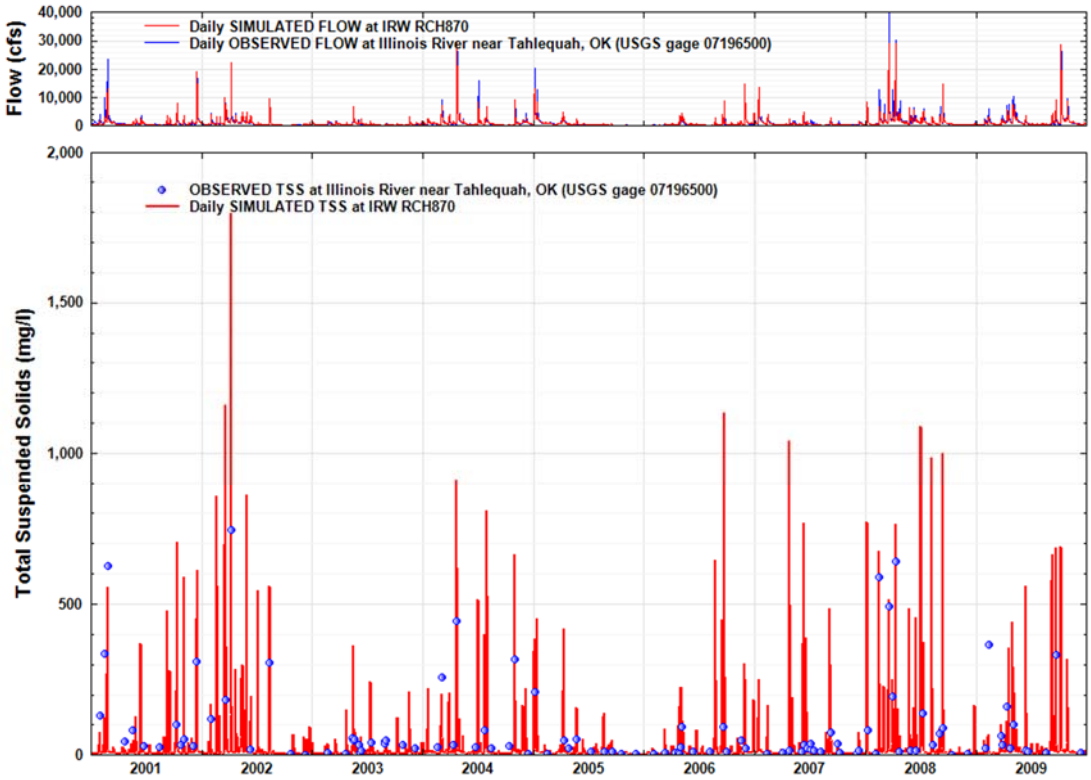

Flow (cfs)
Daily SIMULATED FLOW at IRW RCH516
Daily OBSERVED FLOW at Sager Creek near West Siloam Springs, OK (USGS gage 07195865)
Total Suspended Solids (mg/l)
OBSERVED TSS at Sager Creek near West Siloam Springs, OK (USGS gage 07195865)
Daily SIMULATED TSS at IRW RCH516
2001
2002
2003
2004
2005
2006
2007
2008
2009

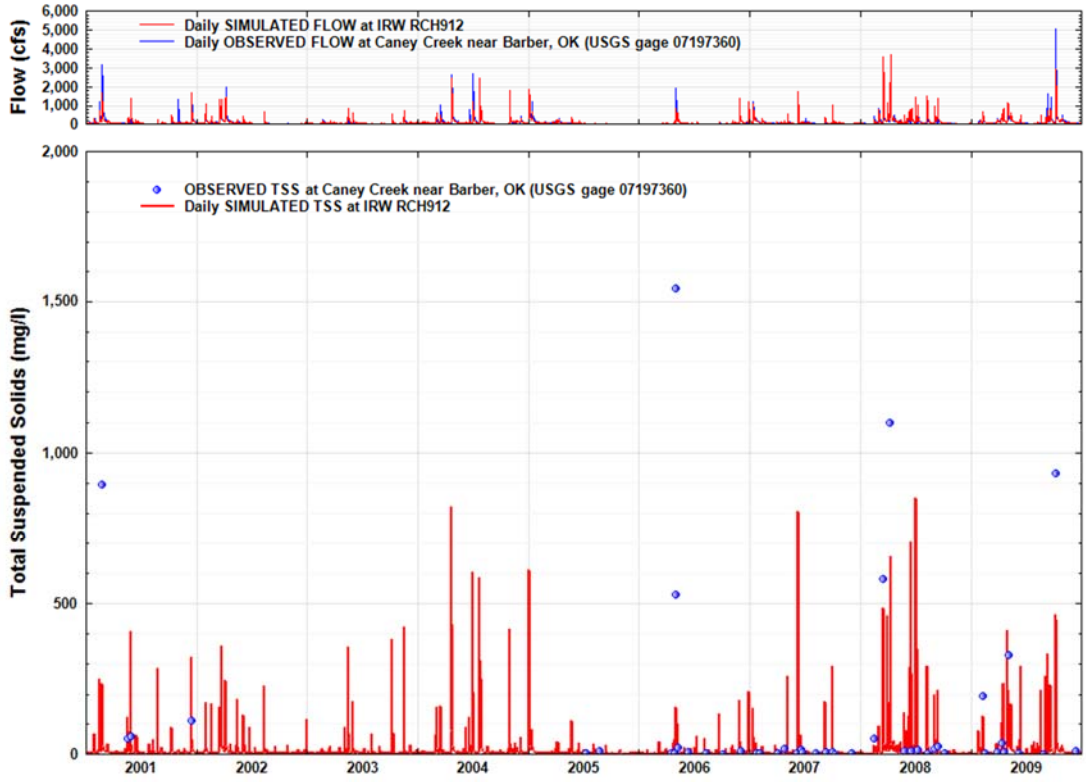

Flow (cfs)
Daily SIMULATED FLOW at IRW RCH523
Daily OBSERVED FLOW at Flint Creek near Kansas, OK (USGS gage 07196000)
Total Suspended Solids (mg/l)
OBSERVED TSS at Flint Creek near Kansas, OK (USGS gage 07196000)
Daily SIMULATED TSS at IRW RCH523
2001
2002
2003
2004
2005
2006
2007
2008
2009


Flow (cfs)
Daily SIMULATED FLOW at IRW RCH609
Total Suspended Solids (mg/l)
OBSERVED TSS at Ballard Creek @ CR 76 bridge (AWRC data)
Daily SIMULATED TSS at IRW RCH609
Flow (cfs)
Daily SIMULATED FLOW at IRW RCH630
Daily OBSERVED FLOW at Illinois River South of Siloam Springs, AR (USGS gage 07195430)
Total Suspended Solids (mg/l)
OBSERVED TSS at Illinois River South of Siloam Springs, AR (USGS gage 07195430)
OBSERVED TSS at Illinois River @ AR59 (AWRC data)
Daily SIMULATED TSS at IRW RCH630
2001
2002
2003
2004
2005
2006
2007
2008
2009

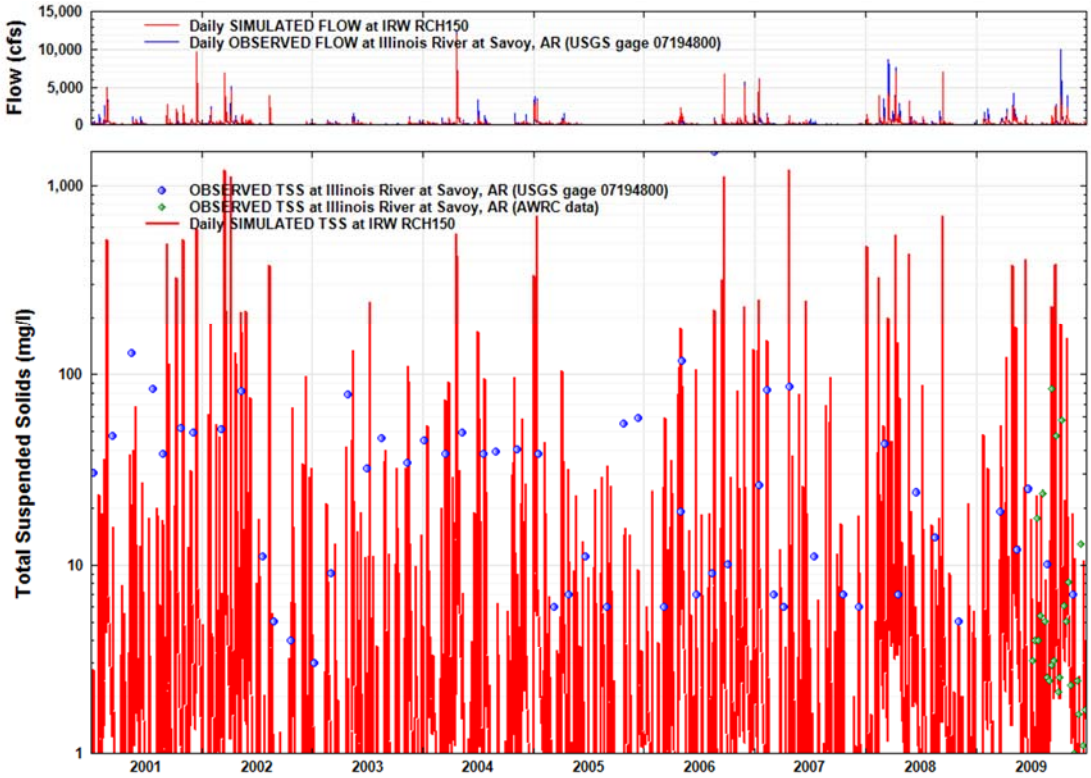

Flow (cfs)
Daily SIMULATED FLOW at IRW RCH640
Daily OBSERVED FLOW at Illinois River near Watts, OK (USGS gage 07195500)
Total Suspended Solids (mg/l)
OBSERVED TSS at Illinois River near Watts, OK (USGS gage 07195500)
Daily SIMULATED TSS at IRW RCH640
Flow (cfs)
Daily SIMULATED FLOW at IRW RCH706
Daily OBSERVED FLOW at Baron Fork at Dutch Mills, AR (USGS gage 07196900)
Total Suspended Solids (mg/l)
OBSERVED TSS at Baron Fork at Dutch Mills, AR (USGS gage 07196900)
OBSERVED TSS at Baron Fork at Dutch Mills, AR (AWRC data)
Daily SIMULATED TSS at IRW RCH706
2001
2002
2003
2004
2005
2006
2007
2008
2009

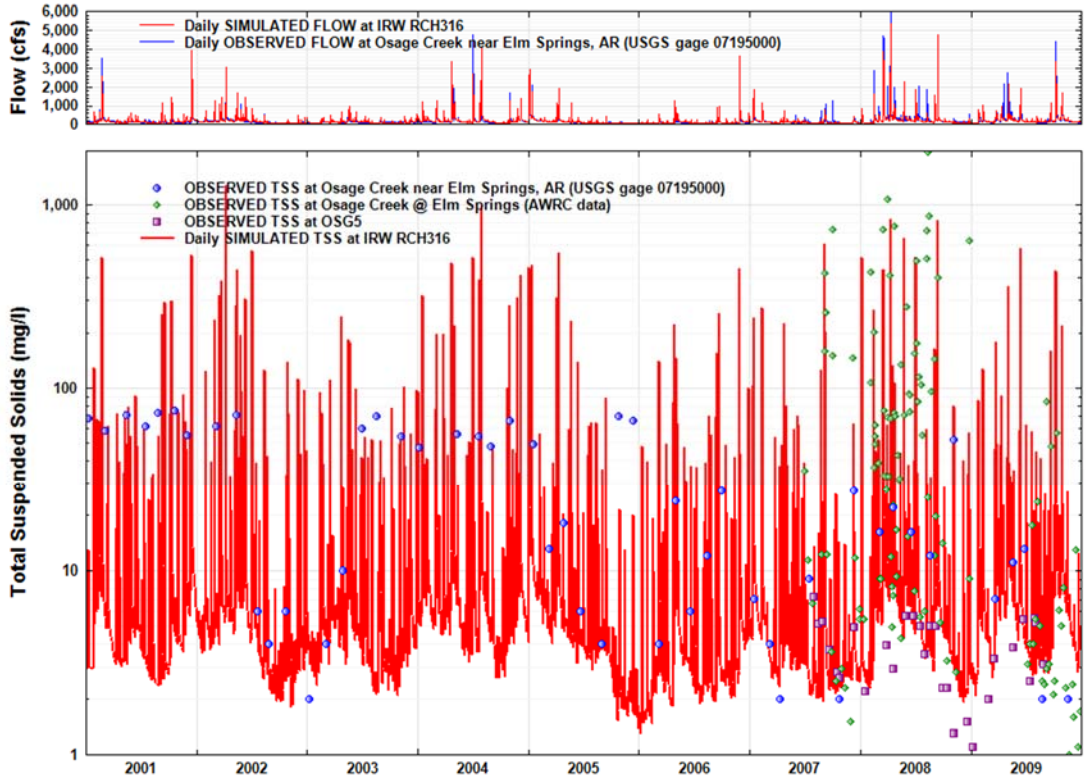

Flow (cfs)
Daily SIMULATED FLOW at IRW RCH746
Daily OBSERVED FLOW at Baron Fork at Eldon, OK (USGS gage 07197000)
Total Suspended Solids (mg/l)
OBSERVED TSS at Baron Fork at Eldon, OK (USGS gage 07197000)
Daily SIMULATED TSS at IRW RCH746
2001
2002
2003
2004
2005
2006
2007
2008
2009

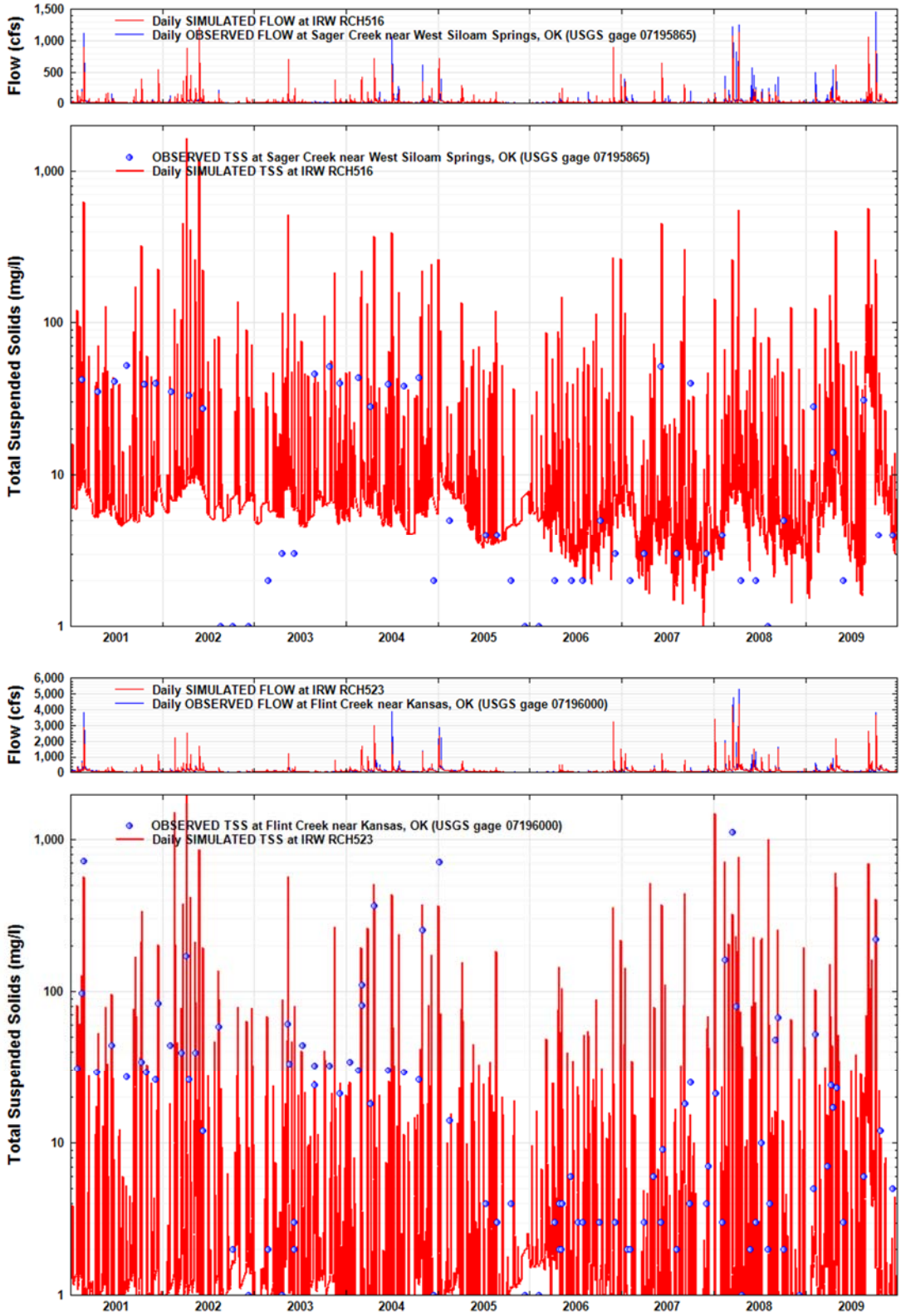

Flow (cfs)
Daily SIMULATED FLOW at IRW RCH870
Daily OBSERVED FLOW at Illinois River near Tahlequah, OK (USGS gage 07196500)
Total Suspended Solids (mg/l)
OBSERVED TSS at Illinois River near Tahlequah, OK (USGS gage 07196500)
Daily SIMULATED TSS at IRW RCH870
2001
2002
2003
2004
2005
2006
2007
2008
2009

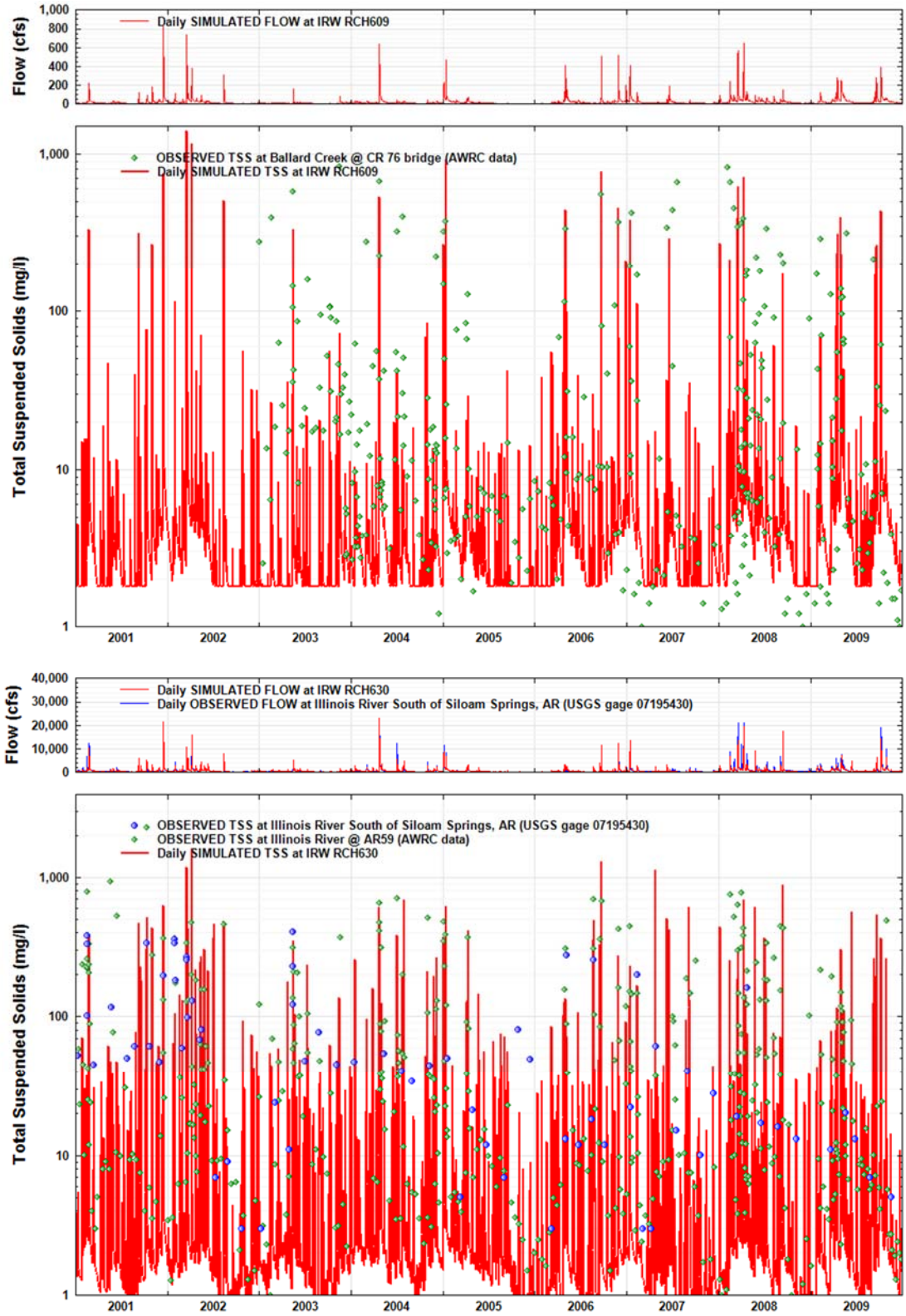

Flow (cfs)
6,000
5,000
4,000
3,000
2,000
1,000
0
Daily SIMULATED FLOW at IRW RCH912
Daily OBSERVED FLOW at Caney Creek near Barber, OK (USGS gage 07197360)
Total Suspended Solids (mg/l)
2,000
1,500
1,000
500
0
OBSERVED TSS at Caney Creek near Barber, OK (USGS gage 07197360)
Daily SIMULATED TSS at IRW RCH912
2001
2002
2003
2004
2005
2006
2007
2008
2009

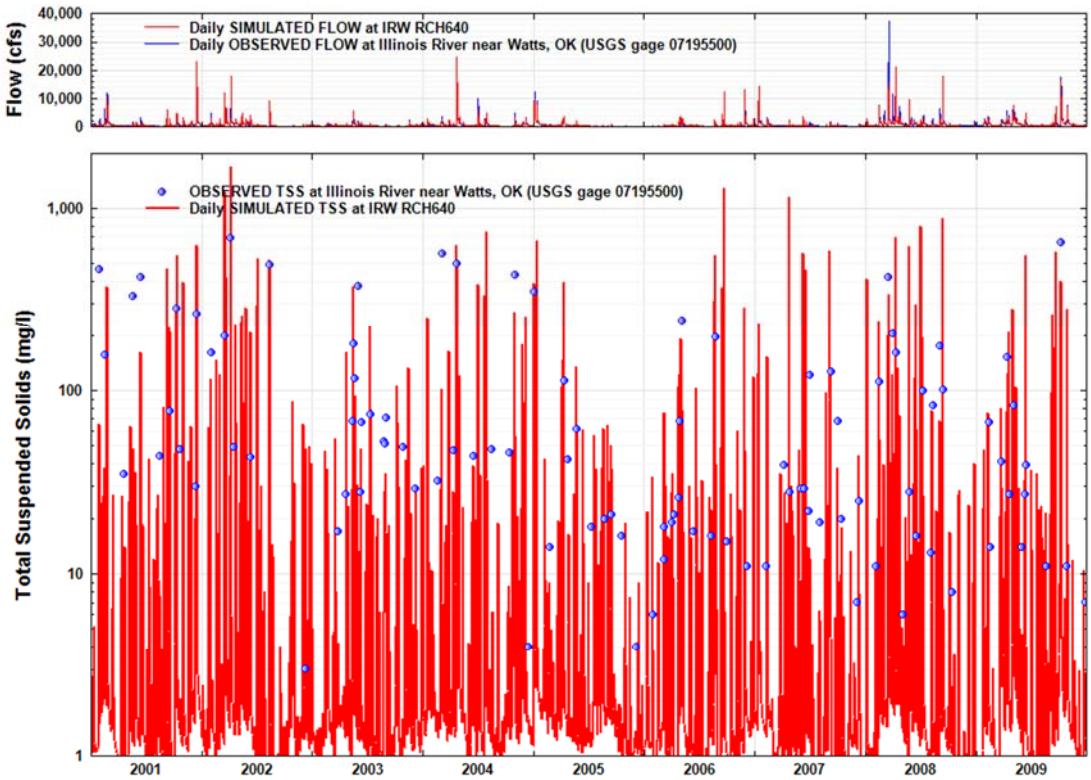
B.1.2 Log Plots

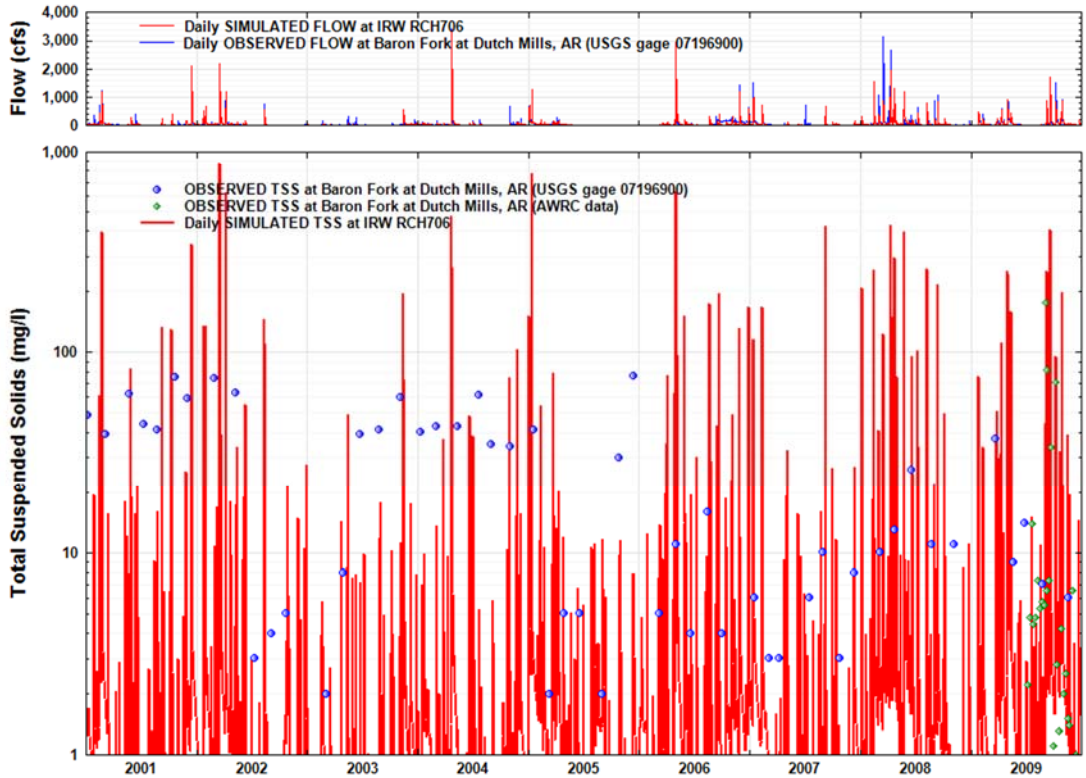


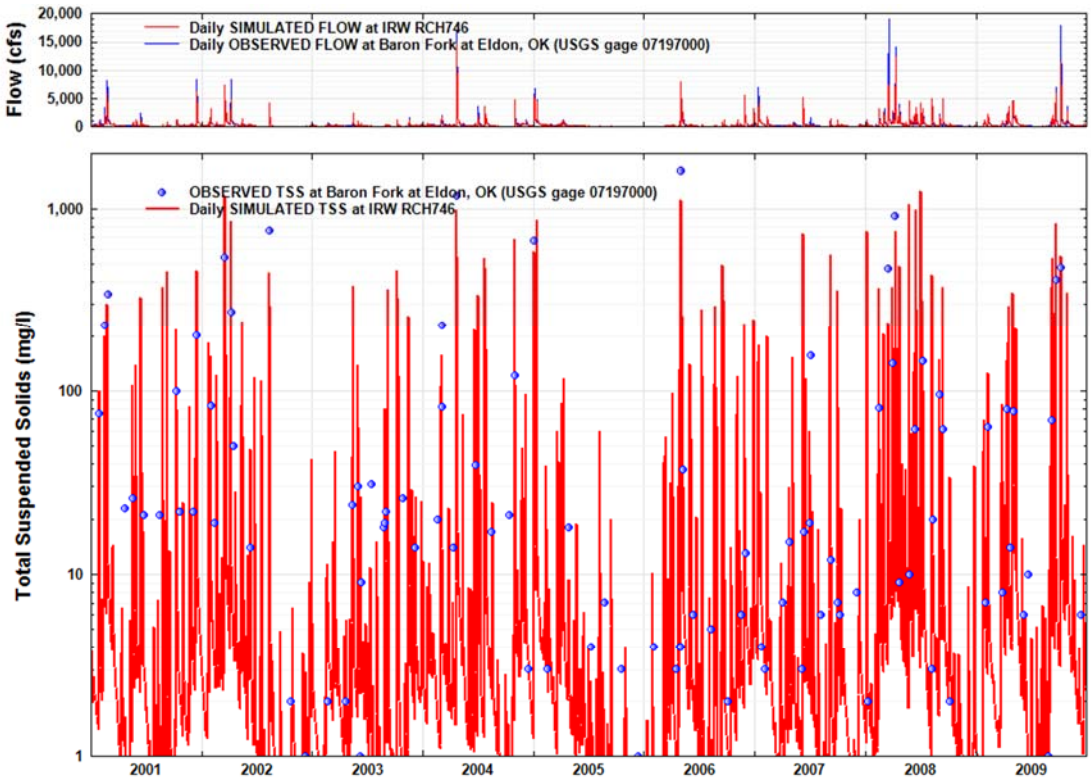


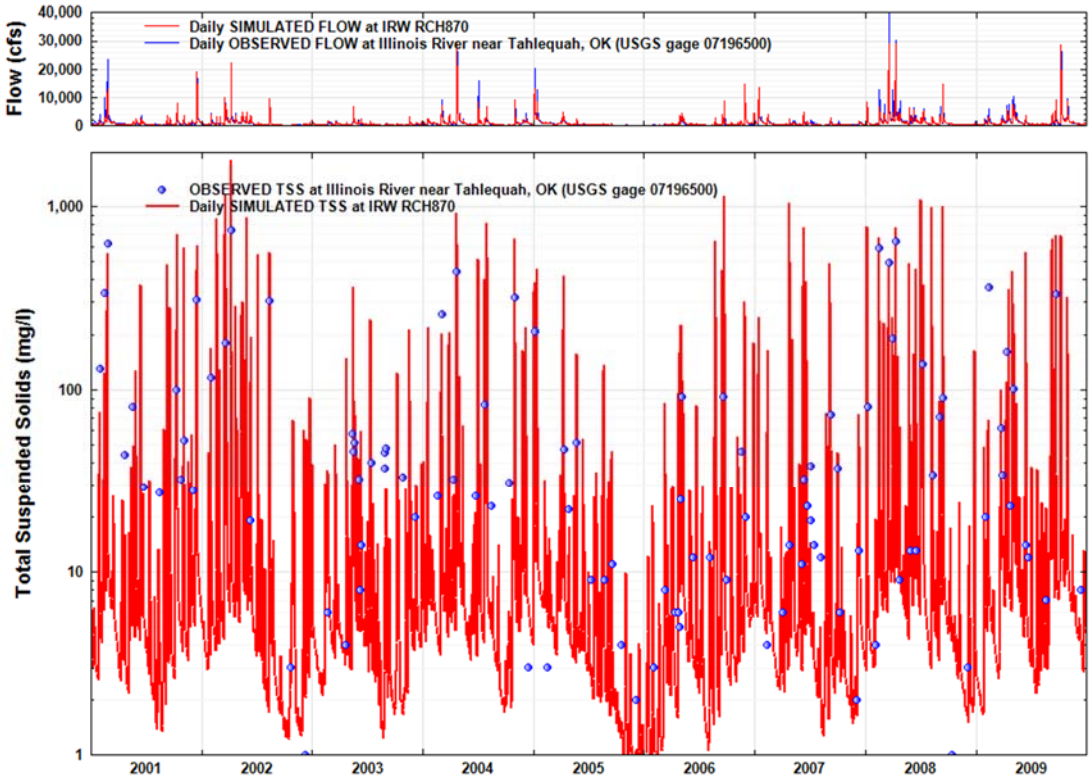

Flow (cfs)
Daily SIMULATED FLOW at IRW RCH516
Daily OBSERVED FLOW at Sager Creek near West Siloam Springs, OK (USGS gage 07195865)
Total Suspended Solids (mg/l)
OBSERVED TSS at Sager Creek near West Siloam Springs, OK (USGS gage 07195865)
Daily SIMULATED TSS at IRW RCH516
Flow (cfs)
Daily SIMULATED FLOW at IRW RCH523
Daily OBSERVED FLOW at Flint Creek near Kansas, OK (USGS gage 07196000)
Total Suspended Solids (mg/l)
OBSERVED TSS at Flint Creek near Kansas, OK (USGS gage 07196000)
Daily SIMULATED TSS at IRW RCH523
2001
2002
2003
2004
2005
2006
2007
2008
2009

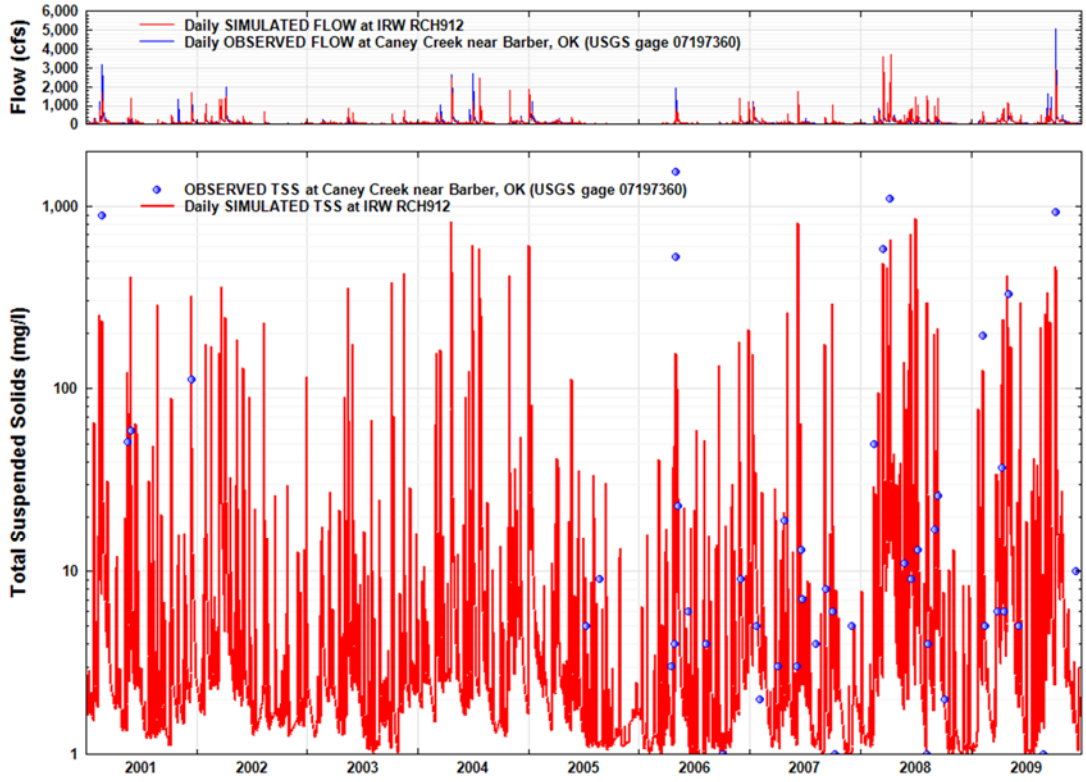

Flow (cfs)
Daily SIMULATED FLOW at IRW RCH609
Total Suspended Solids (mg/l)
OBSERVED TSS at Ballard Creek @ CR 76 bridge (AWRC data)
Daily SIMULATED TSS at IRW RCH609
Flow (cfs)
Daily SIMULATED FLOW at IRW RCH630
Daily OBSERVED FLOW at Illinois River South of Siloam Springs, AR (USGS gage 07195430)
Total Suspended Solids (mg/l)
OBSERVED TSS at Illinois River South of Siloam Springs, AR (USGS gage 07195430)
OBSERVED TSS at Illinois River @ AR59 (AWRC data)
Daily SIMULATED TSS at IRW RCH630
2001
2002
2003
2004
2005
2006
2007
2008
2009


Flow (cfs)
Daily SIMULATED FLOW at IRW RCH640
Daily OBSERVED FLOW at Illinois River near Watts, OK (USGS gage 07195500)
Total Suspended Solids (mg/l)
OBSERVED TSS at Illinois River near Watts, OK (USGS gage 07195500)
Daily SIMULATED TSS at IRW RCH640
2001
2002
2003
2004
2005
2006
2007
2008
2009


Flow (cfs)
Daily SIMULATED FLOW at IRW RCH706
Daily OBSERVED FLOW at Baron Fork at Dutch Mills, AR (USGS gage 07196900)
Total Suspended Solids (mg/l)
OBSERVED TSS at Baron Fork at Dutch Mills, AR (USGS gage 07196900)
OBSERVED TSS at Baron Fork at Dutch Mills, AR (AWRC data)
Daily SIMULATED TSS at IRW RCH706
2001
2002
2003
2004
2005
2006
2007
2008
2009

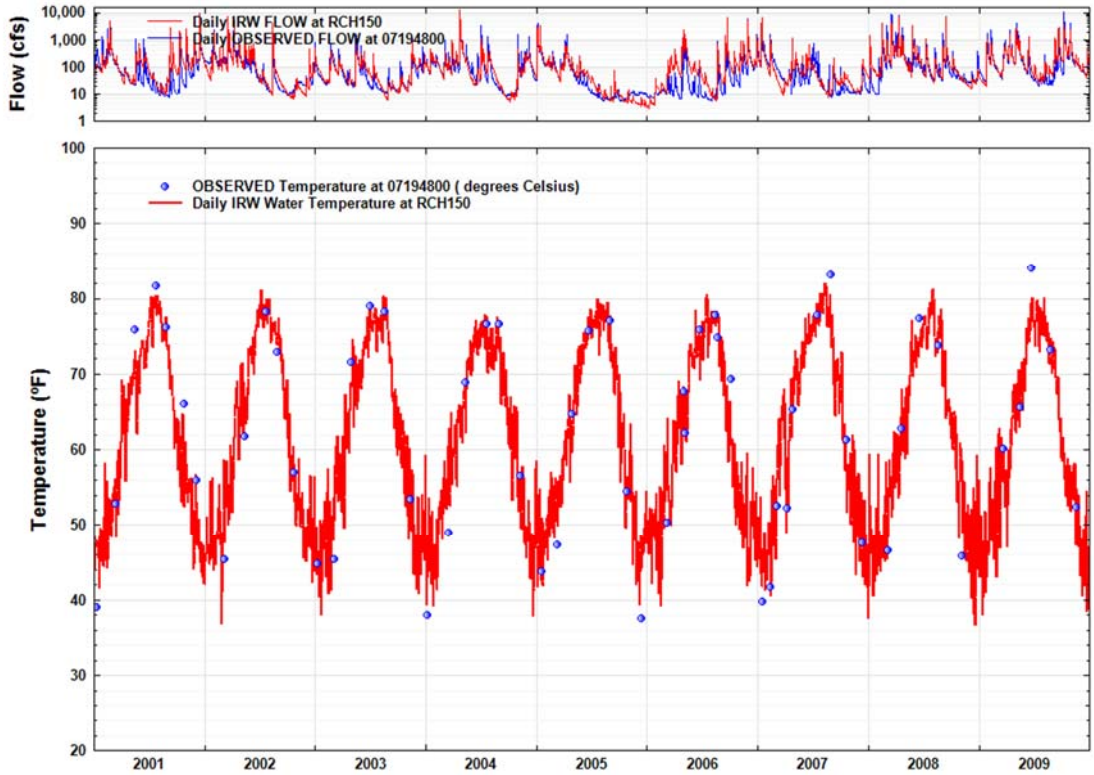

Flow (cfs)
20,000
15,000
10,000
5,000
0
Daily SIMULATED FLOW at IRW RCH746
Daily OBSERVED FLOW at Baron Fork at Eldon, OK (USGS gage 07197000)
Total Suspended Solids (mg/l)
1,000
100
10
1
OBSERVED TSS at Baron Fork at Eldon, OK (USGS gage 07197000)
Daily SIMULATED TSS at IRW RCH746
2001
2002
2003
2004
2005
2006
2007
2008
2009

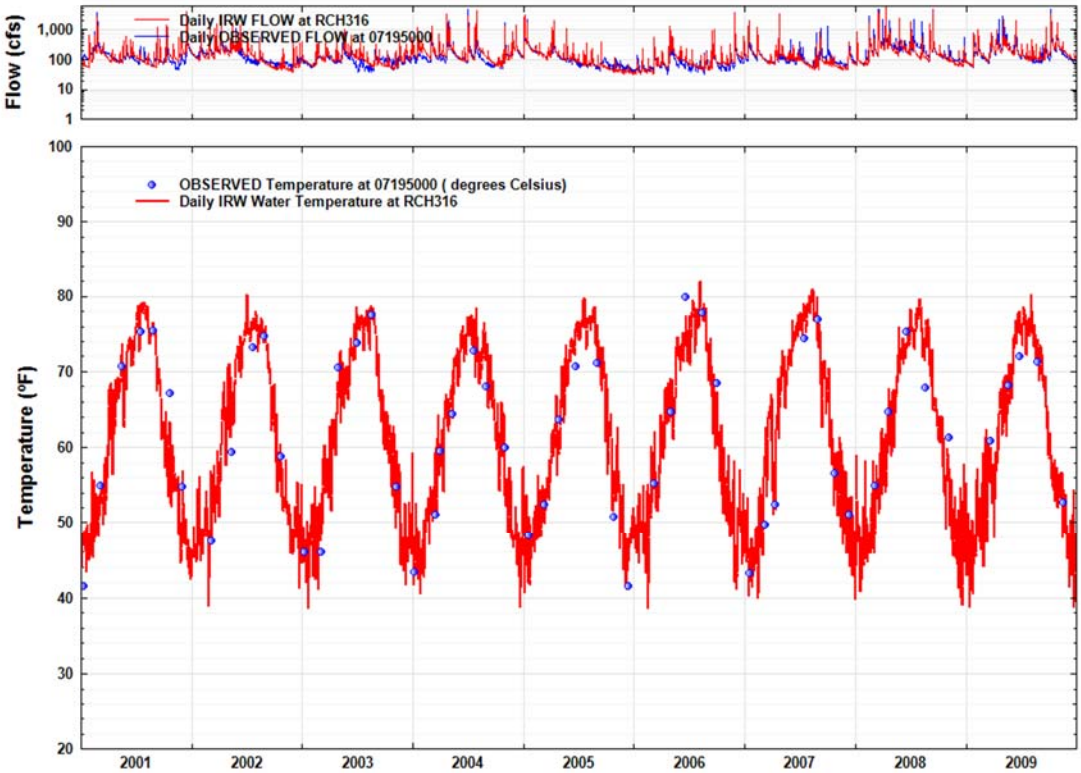

Flow (cfs)
40,000
30,000
20,000
10,000
0
Daily SIMULATED FLOW at IRW RCH870
Daily OBSERVED FLOW at Illinois River near Tahlequah, OK (USGS gage 07196500)
Total Suspended Solids (mg/l)
1,000
100
10
1
OBSERVED TSS at Illinois River near Tahlequah, OK (USGS gage 07196500)
Daily SIMULATED TSS at IRW RCH870
2001
2002
2003
2004
2005
2006
2007
2008
2009

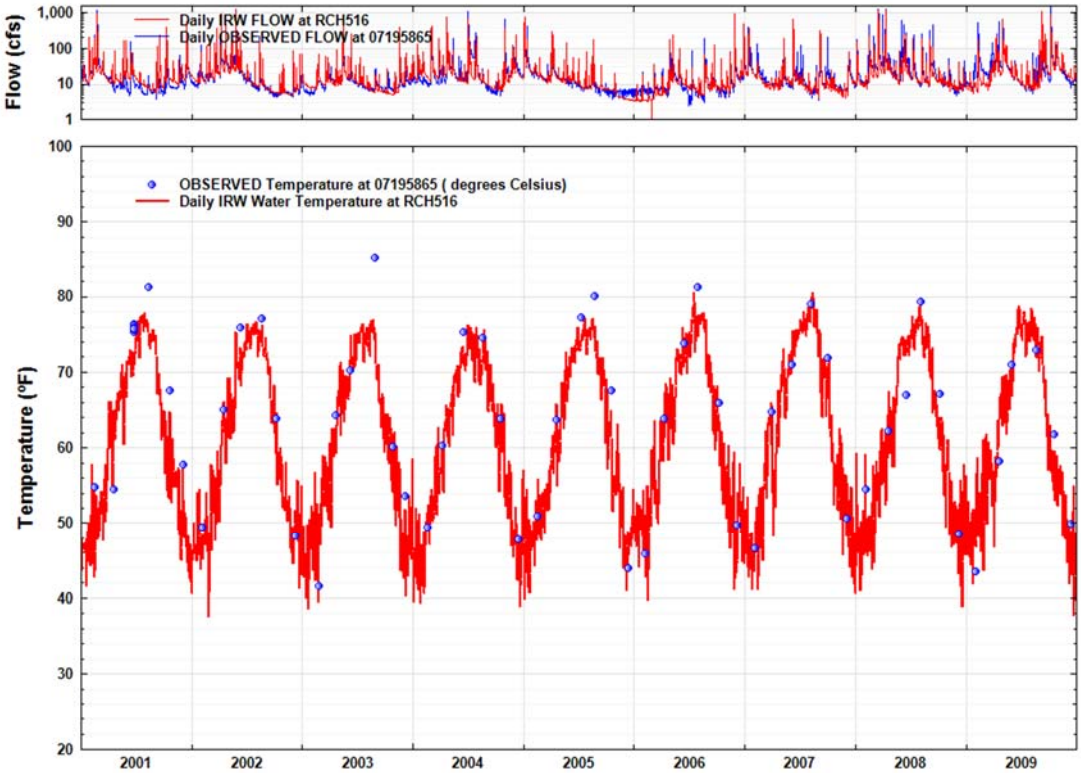

Flow (cfs)
6,000
5,000
4,000
3,000
2,000
1,000
0
Daily SIMULATED FLOW at IRW RCH912
Daily OBSERVED FLOW at Caney Creek near Barber, OK (USGS gage 07197360)
Total Suspended Solids (mg/l)
1,000
100
10
1
OBSERVED TSS at Caney Creek near Barber, OK (USGS gage 07197360)
Daily SIMULATED TSS at IRW RCH912
2001
2002
2003
2004
2005
2006
2007
2008
2009

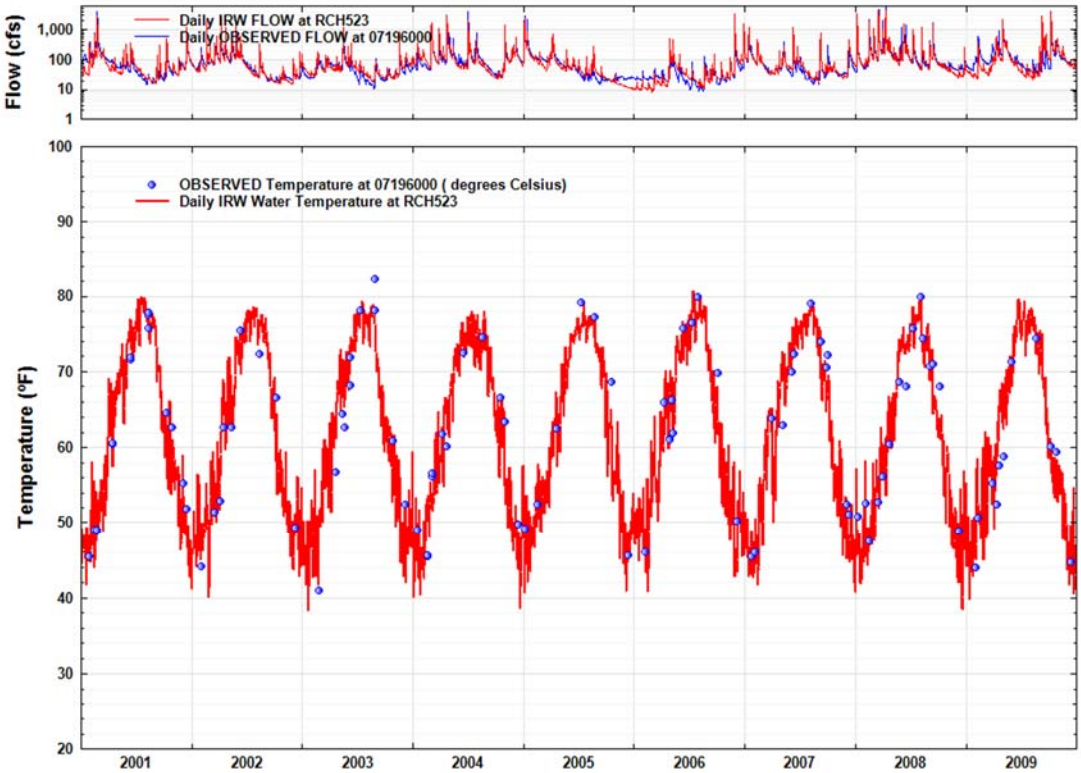
APPENDIX C
WATER TEMPERATURE RESULTS

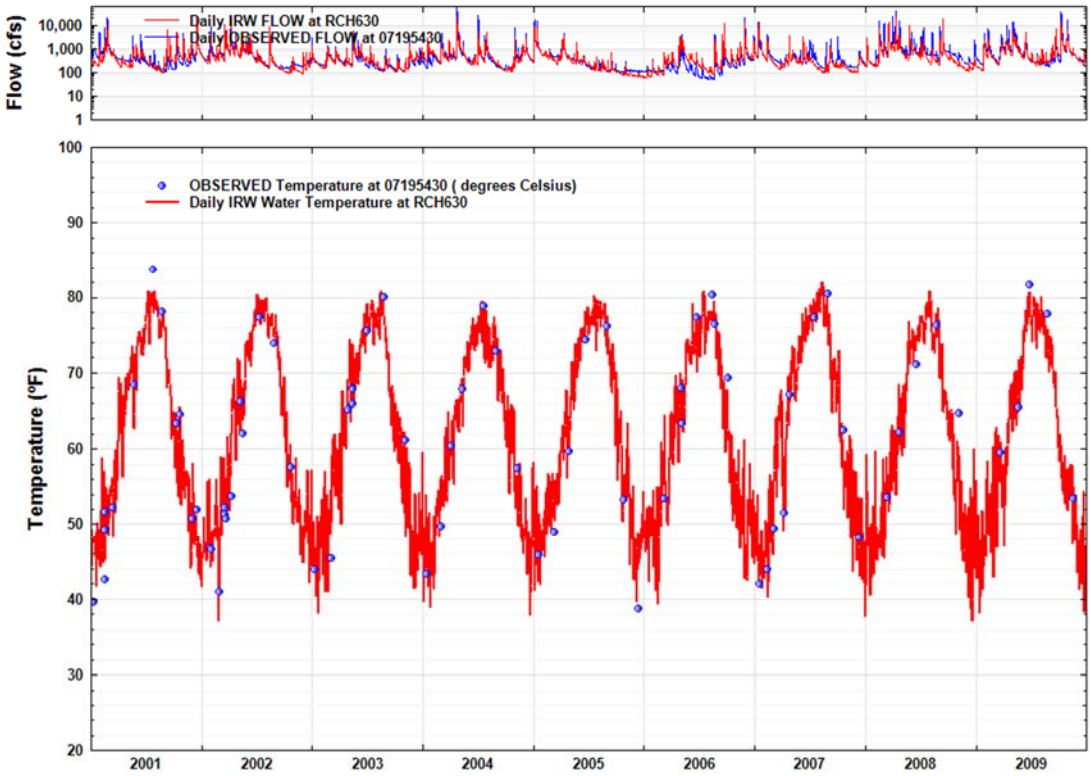
C.1 CALIBRATION

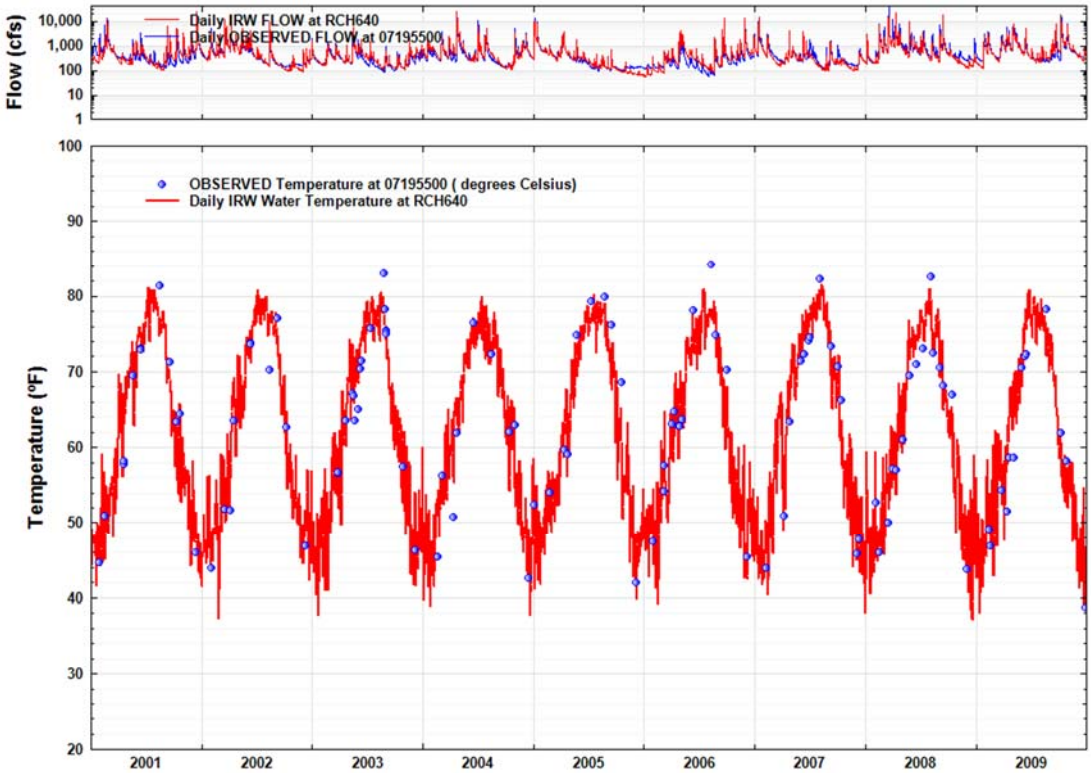


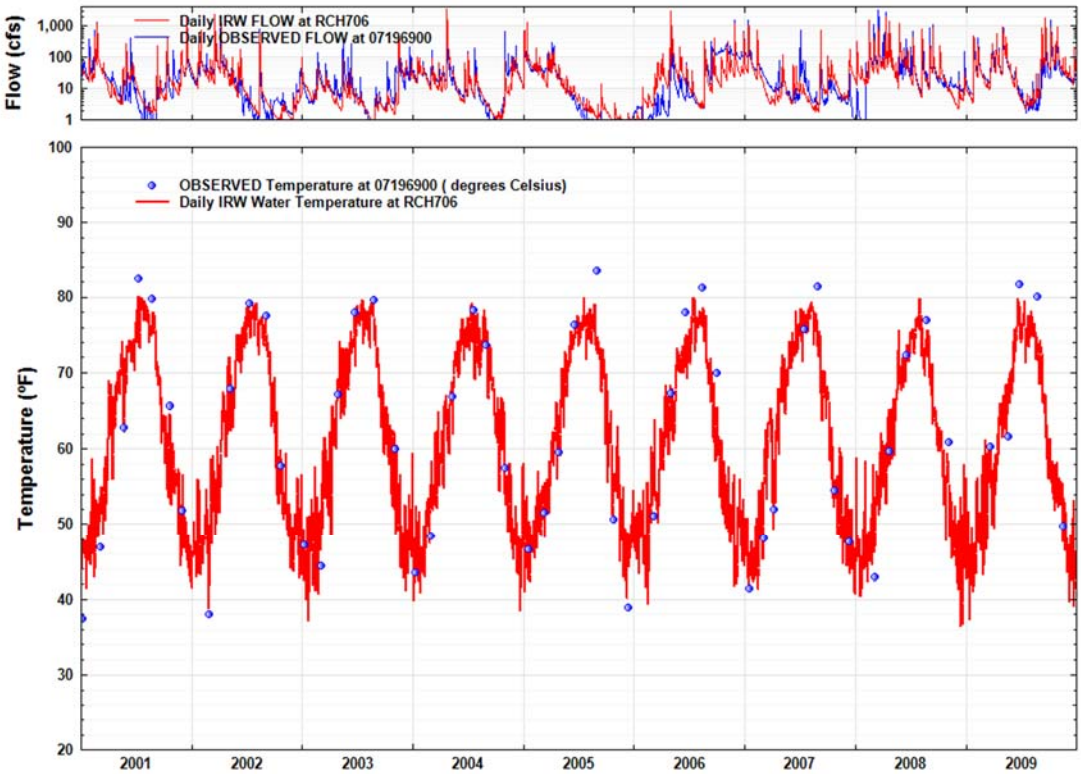

Daily IRW FLOW at RCH316
Daily OBSERVED FLOW at 07195000
Flow (cfs)
1,000
100
10
1
OBSERVED Temperature at 07195000 (degrees Celsius)
Daily IRW Water Temperature at RCH316
Temperature (ºF)
100
90
80
70
60
50
40
30
20
2001
2002
2003
2004
2005
2006
2007
2008
2009

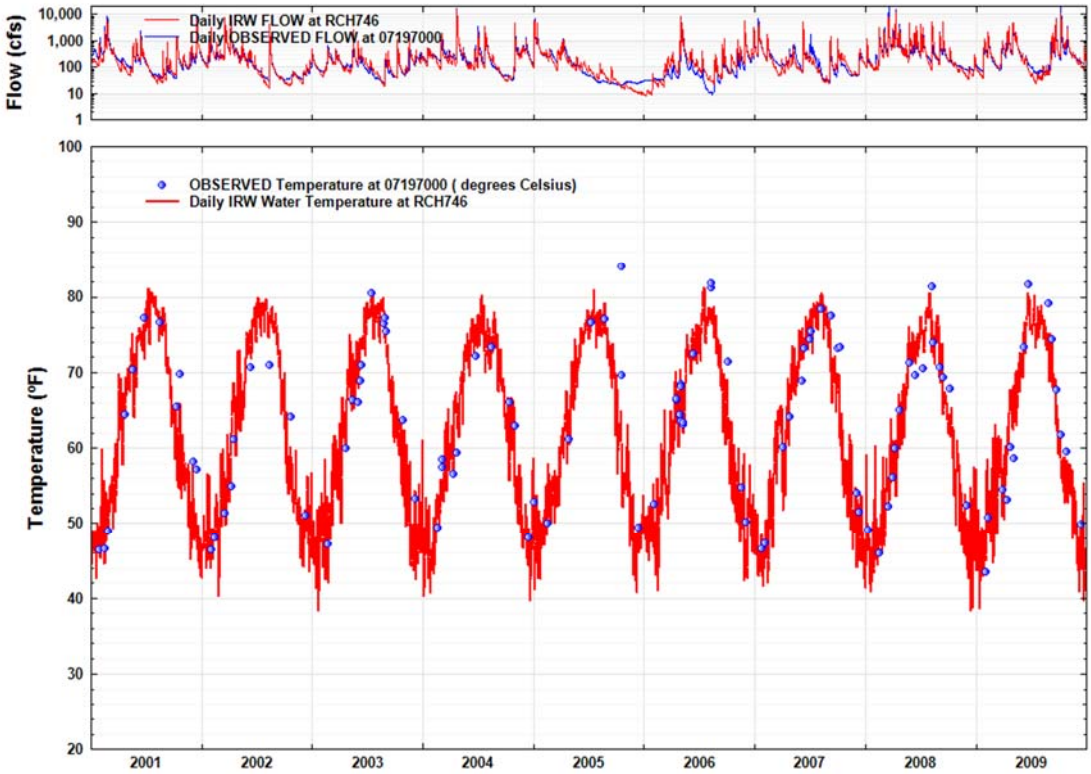

Daily IRW FLOW at RCH516
Daily OBSERVED FLOW at 07195865
Flow (cfs)
1,000
100
10
1
OBSERVED Temperature at 07195865 (degrees Celsius)
Daily IRW Water Temperature at RCH516
Temperature (ºF)
100
90
80
70
60
50
40
30
20
2001
2002
2003
2004
2005
2006
2007
2008
2009

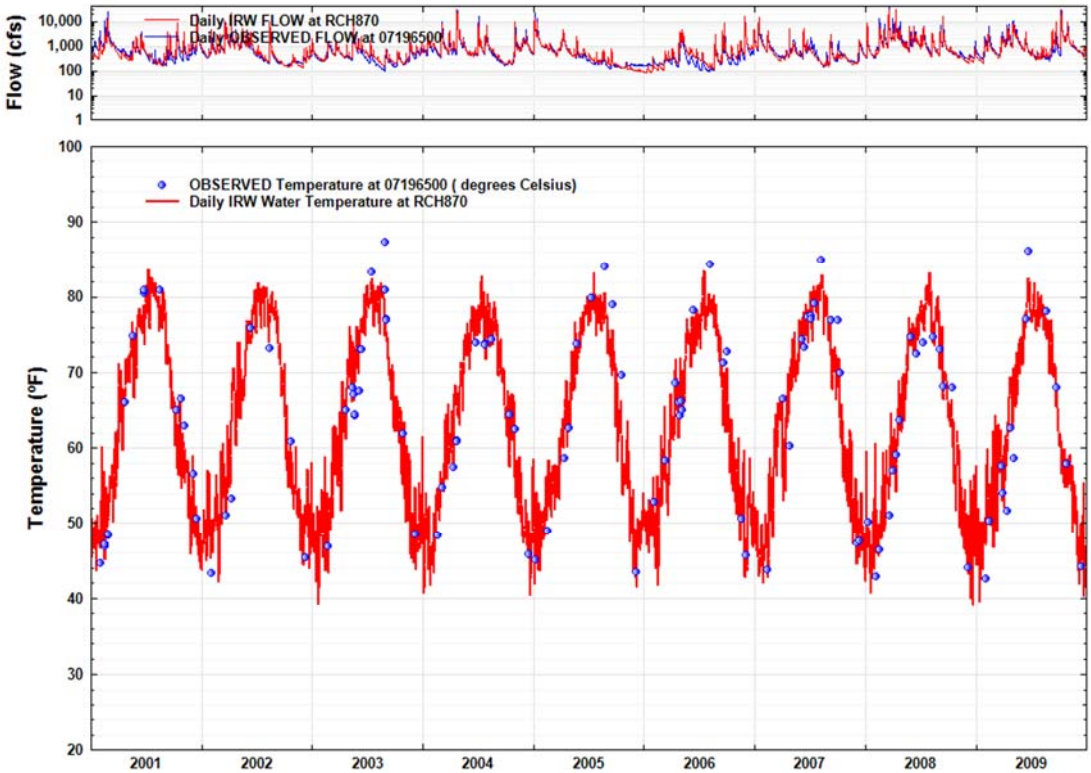

Daily IRW FLOW at RCH523
Daily OBSERVED FLOW at 07196000
Flow (cfs)
1,000
100
10
1
OBSERVED Temperature at 07196000 (degrees Celsius)
Daily IRW Water Temperature at RCH523
Temperature (ºF)
100
90
80
70
60
50
40
30
20
2001
2002
2003
2004
2005
2006
2007
2008
2009

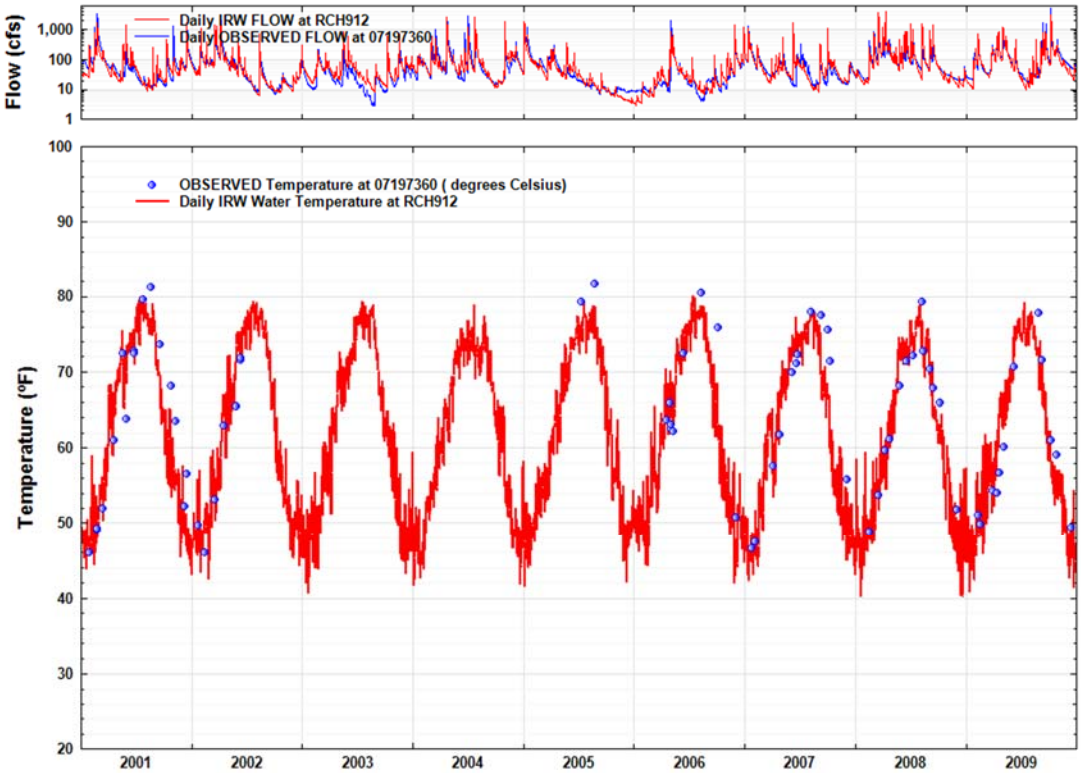

Daily IRW FLOW at RCH630
Daily OBSERVED FLOW at 07195430
Flow (cfs)
10,000
1,000
100
10
1
OBSERVED Temperature at 07195430 (degrees Celsius)
Daily IRW Water Temperature at RCH630
Temperature (ºF)
100
90
80
70
60
50
40
30
20
2001
2002
2003
2004
2005
2006
2007
2008
2009


Flow (cfs)
Daily IRW FLOW at RCH640
Daily OBSERVED FLOW at 07195500
OBSERVED Temperature at 07195500 (degrees Celsius)
Daily IRW Water Temperature at RCH640
Temperature (ºF)
2001
2002
2003
2004
2005
2006
2007
2008
2009

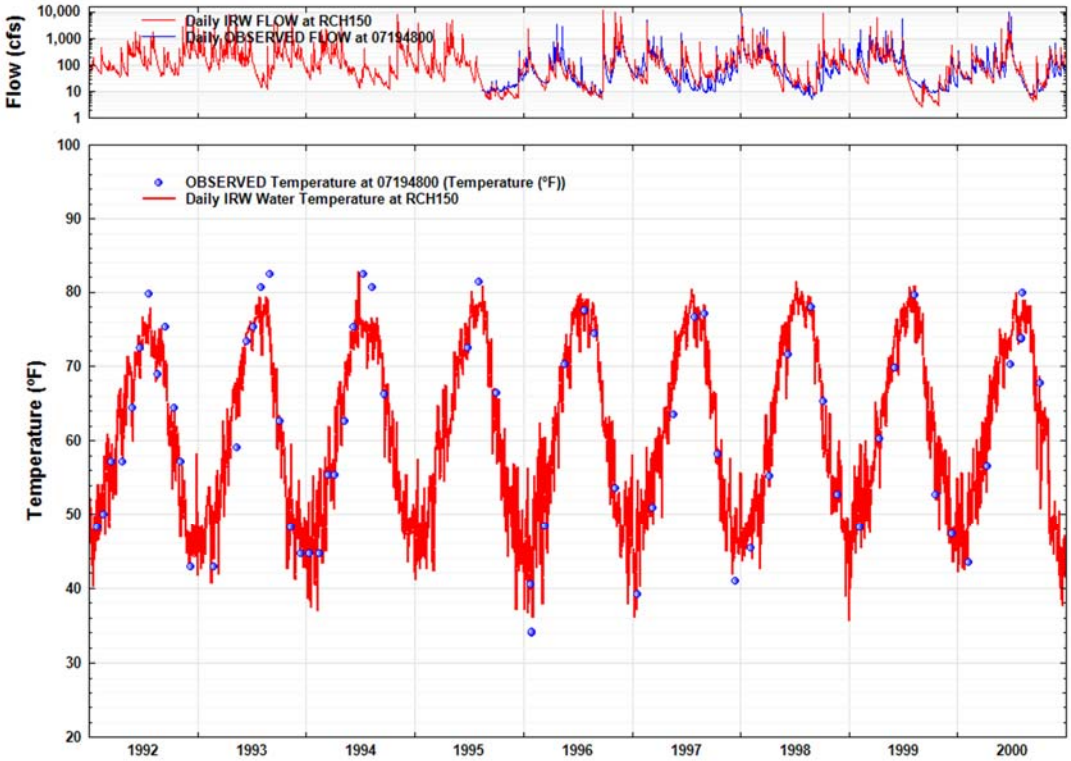

Flow (cfs)
Daily IRW FLOW at RCH706
Daily OBSERVED FLOW at 07196900
OBSERVED Temperature at 07196900 (degrees Celsius)
Daily IRW Water Temperature at RCH706
Temperature (ºF)
2001
2002
2003
2004
2005
2006
2007
2008
2009

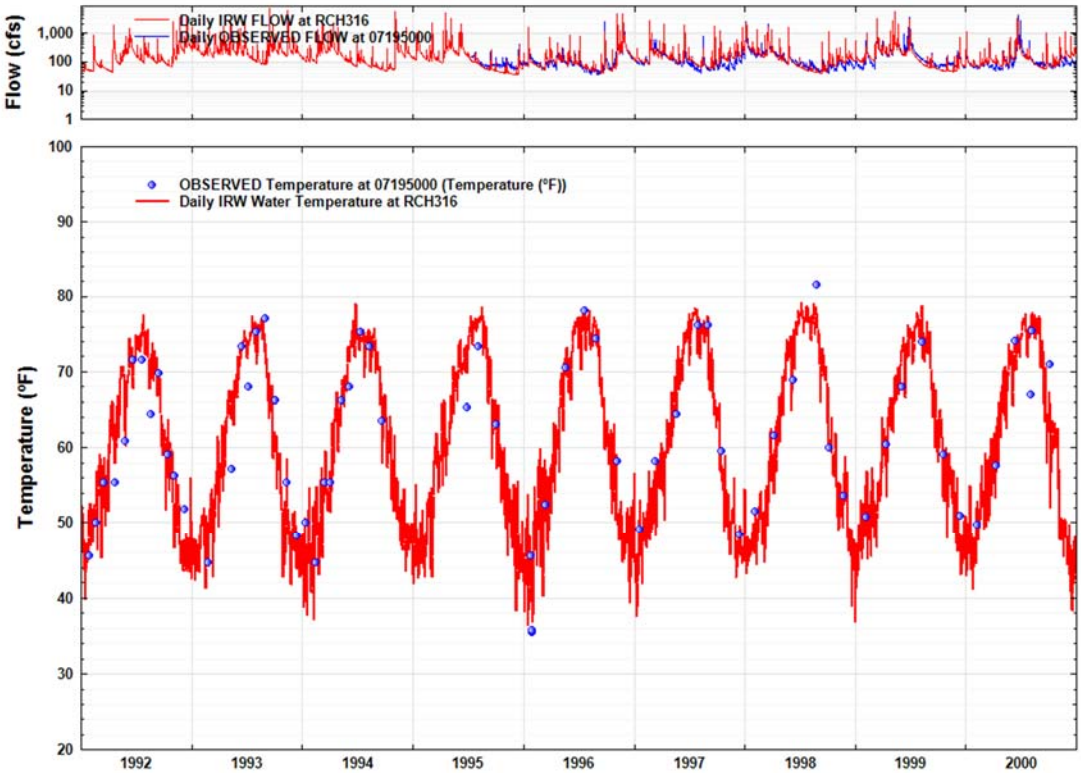

Flow (cfs)
Daily IRW FLOW at RCH746
Daily OBSERVED FLOW at 07197000
Temperature (°F)
OBSERVED Temperature at 07197000 (degrees Celsius)
Daily IRW Water Temperature at RCH746
2001
2002
2003
2004
2005
2006
2007
2008
2009

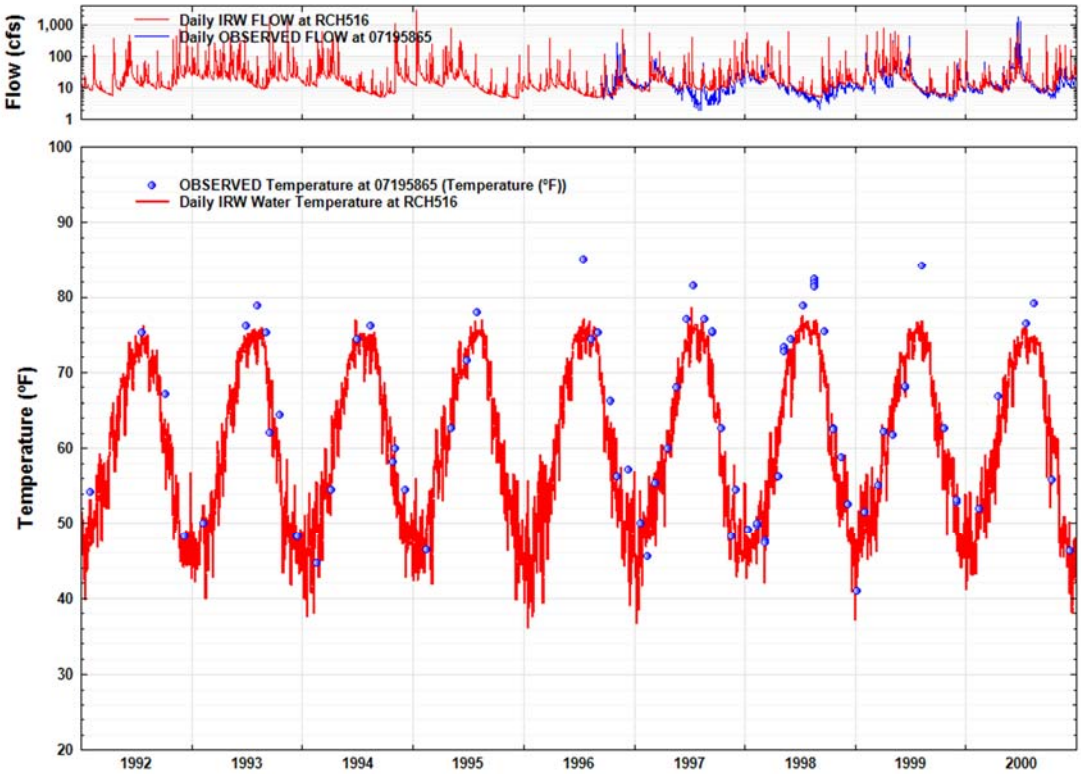

Flow (cfs)
Daily IRW FLOW at RCH870
Daily OBSERVED FLOW at 07196500
Temperature (°F)
OBSERVED Temperature at 07196500 (degrees Celsius)
Daily IRW Water Temperature at RCH870
2001
2002
2003
2004
2005
2006
2007
2008
2009

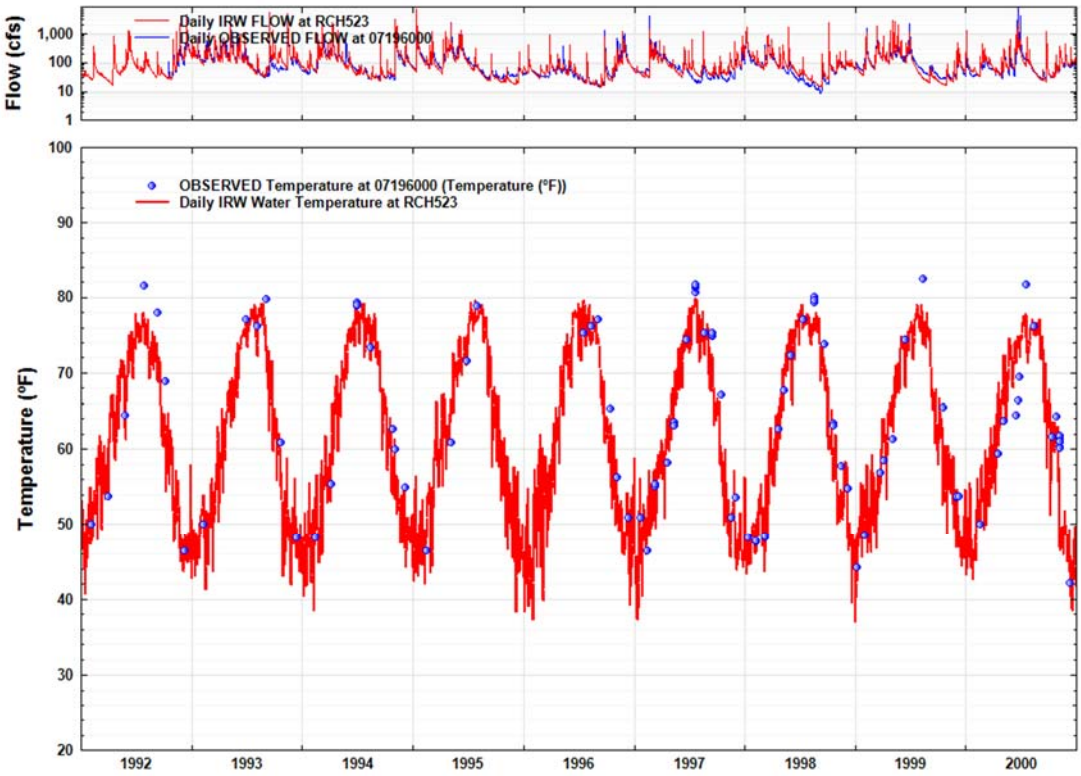


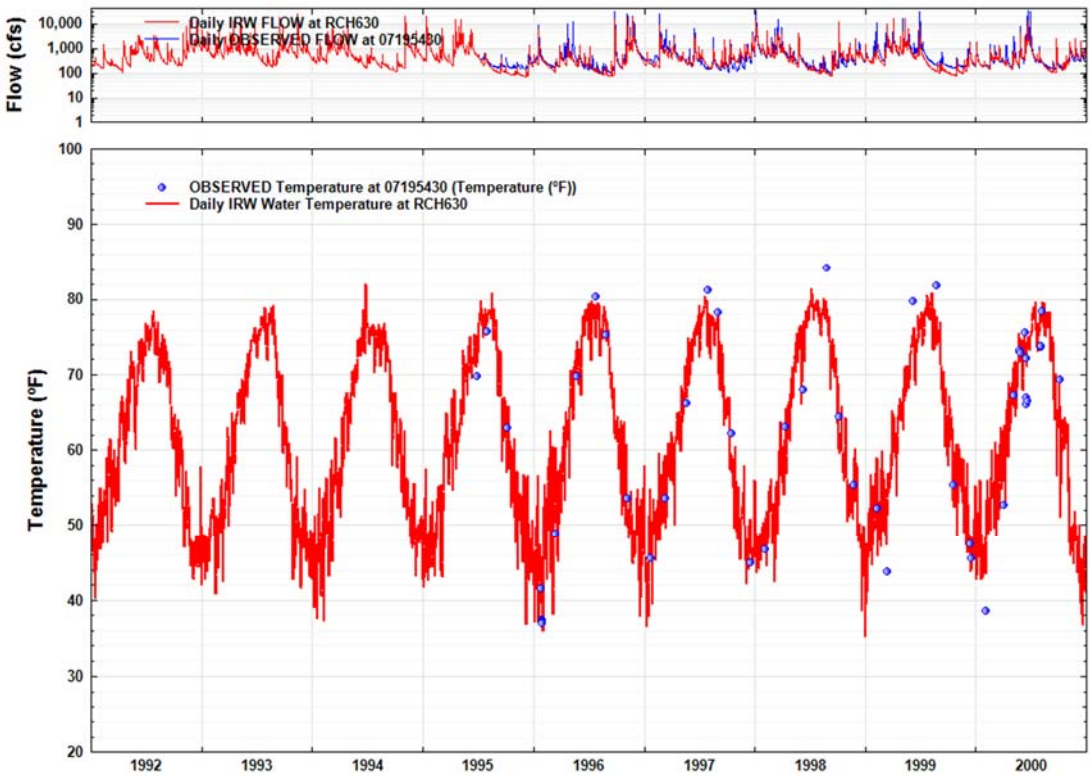
C.2 VALIDATION

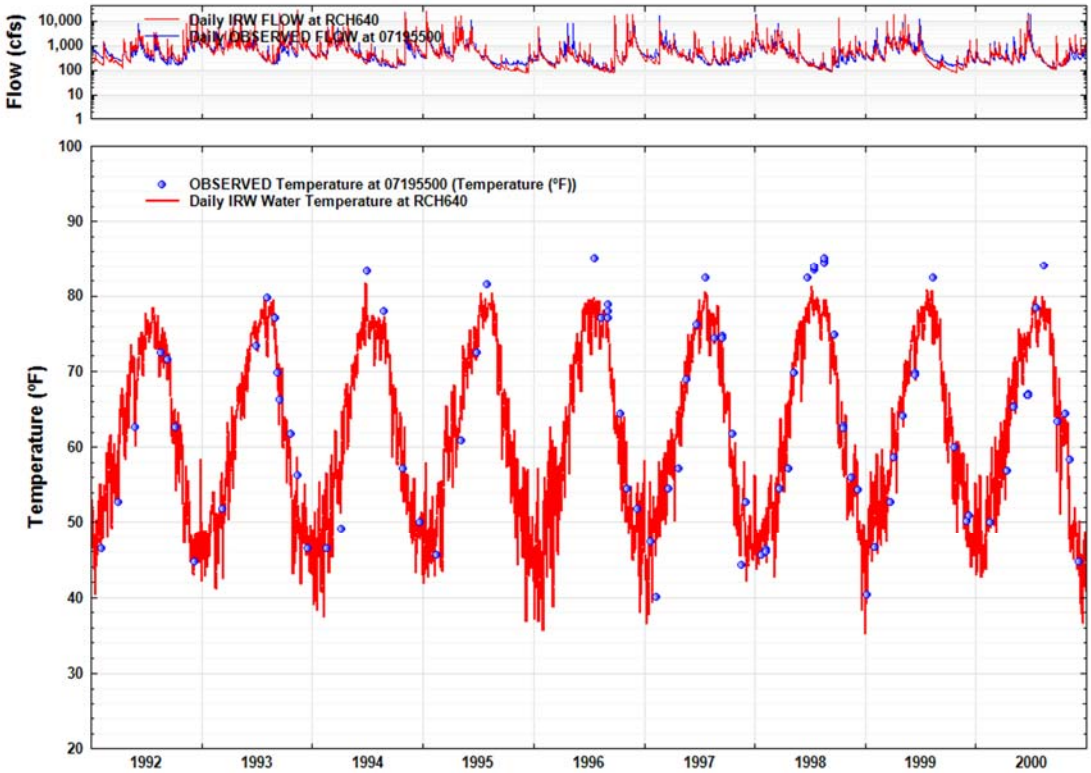


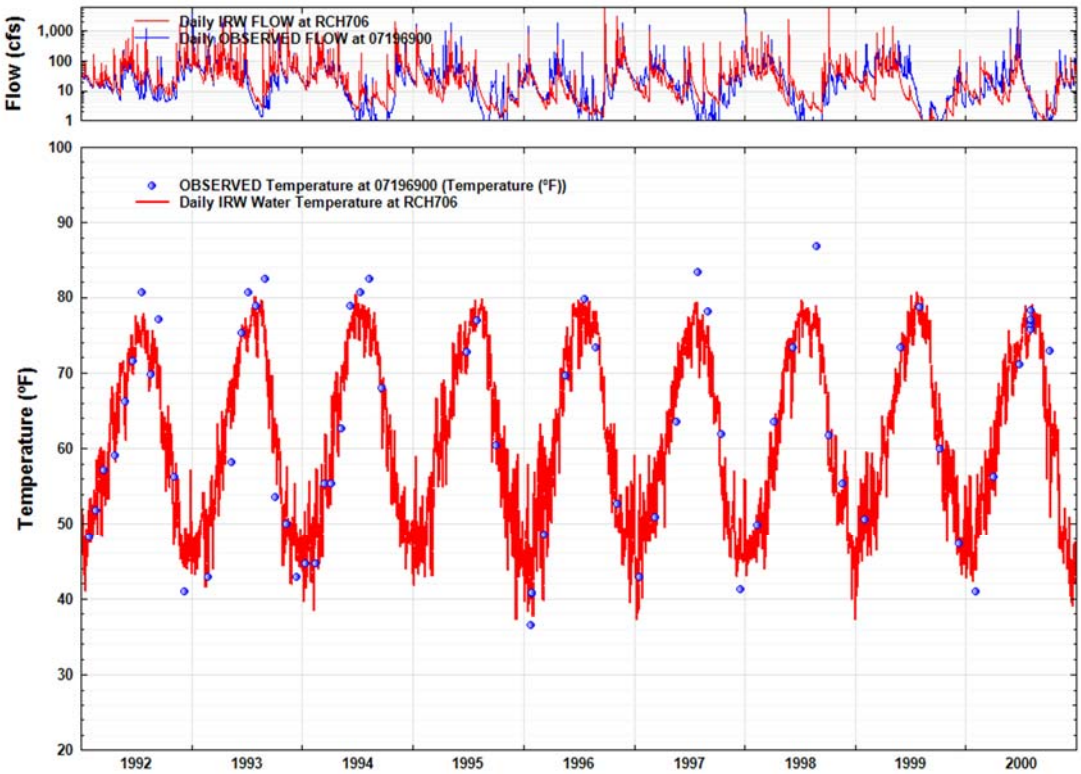

Daily IRW FLOW at RCH316
Daily OBSERVED FLOW at 07195000
Flow (cfs)
1,000
100
10
1
OBSERVED Temperature at 07195000 (Temperature (°F))
Daily IRW Water Temperature at RCH316
Temperature (°F)
100
90
80
70
60
50
40
30
20
1992
1993
1994
1995
1996
1997
1998
1999
2000

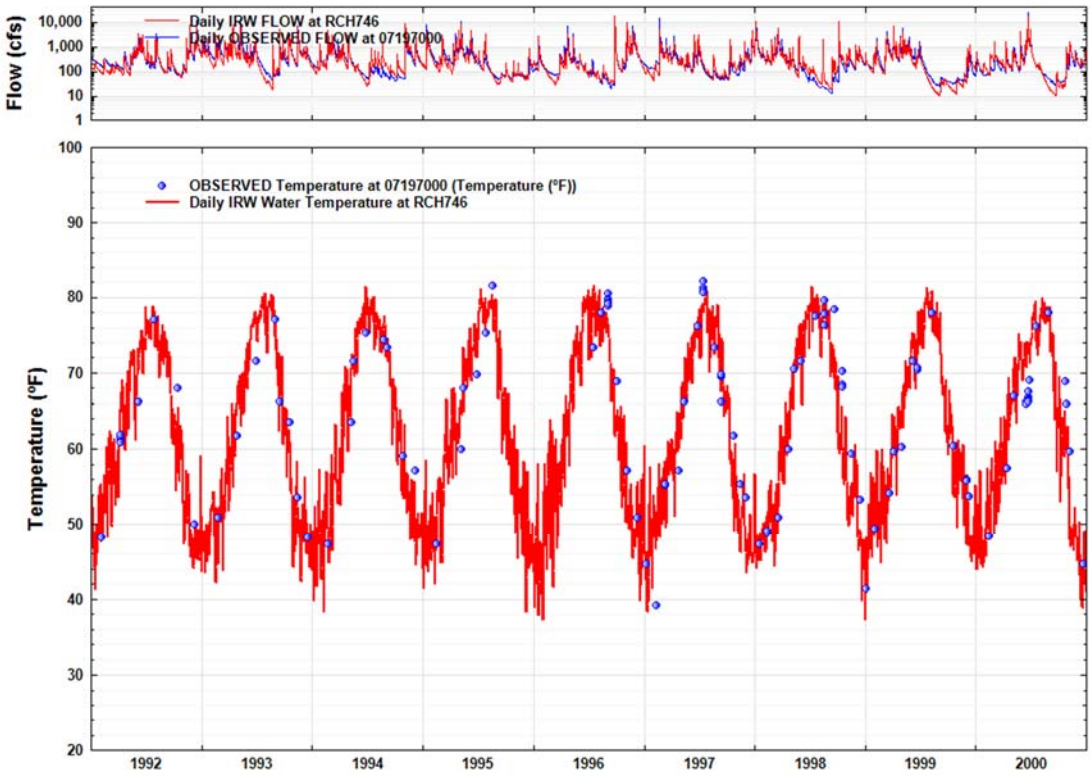

Daily IRW FLOW at RCH516
Daily OBSERVED FLOW at 07195865
Flow (cfs)
1,000
100
10
1
OBSERVED Temperature at 07195865 (Temperature (°F))
Daily IRW Water Temperature at RCH516
Temperature (°F)
100
90
80
70
60
50
40
30
20
1992
1993
1994
1995
1996
1997
1998
1999
2000

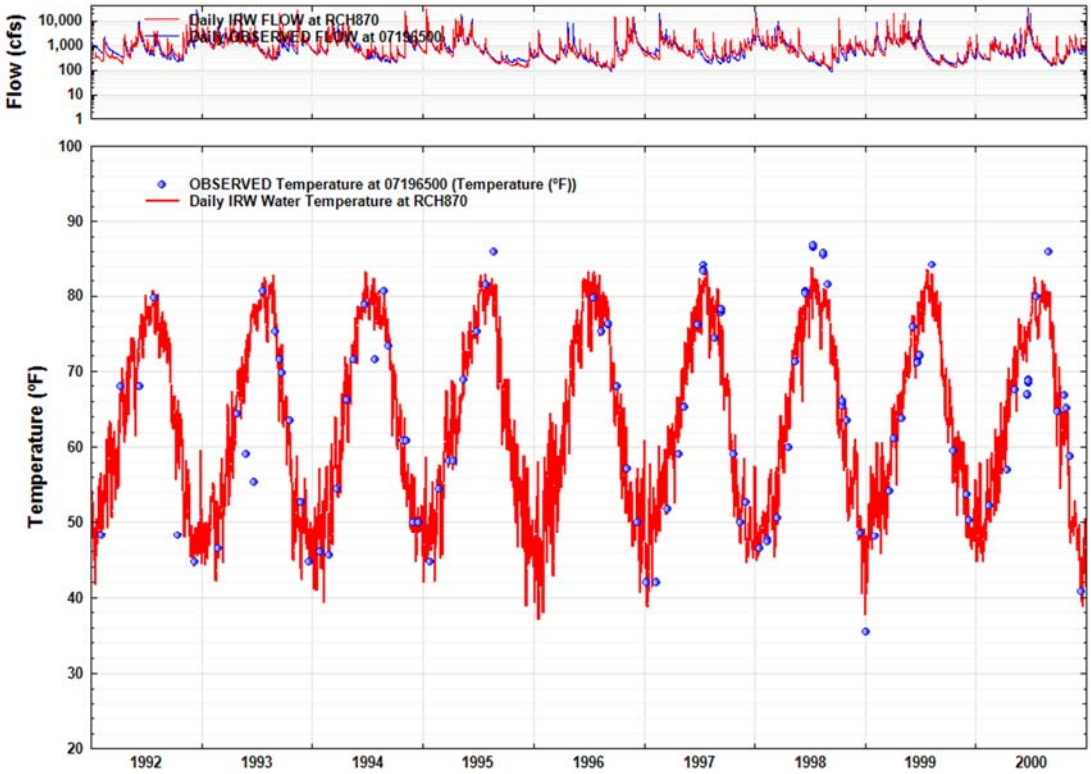

Daily IRW FLOW at RCH523
Daily OBSERVED FLOW at 07196000
Flow (cfs)
1,000
100
10
1
OBSERVED Temperature at 07196000 (Temperature (°F))
Daily IRW Water Temperature at RCH523
Temperature (°F)
100
90
80
70
60
50
40
30
20
1992
1993
1994
1995
1996
1997
1998
1999
2000

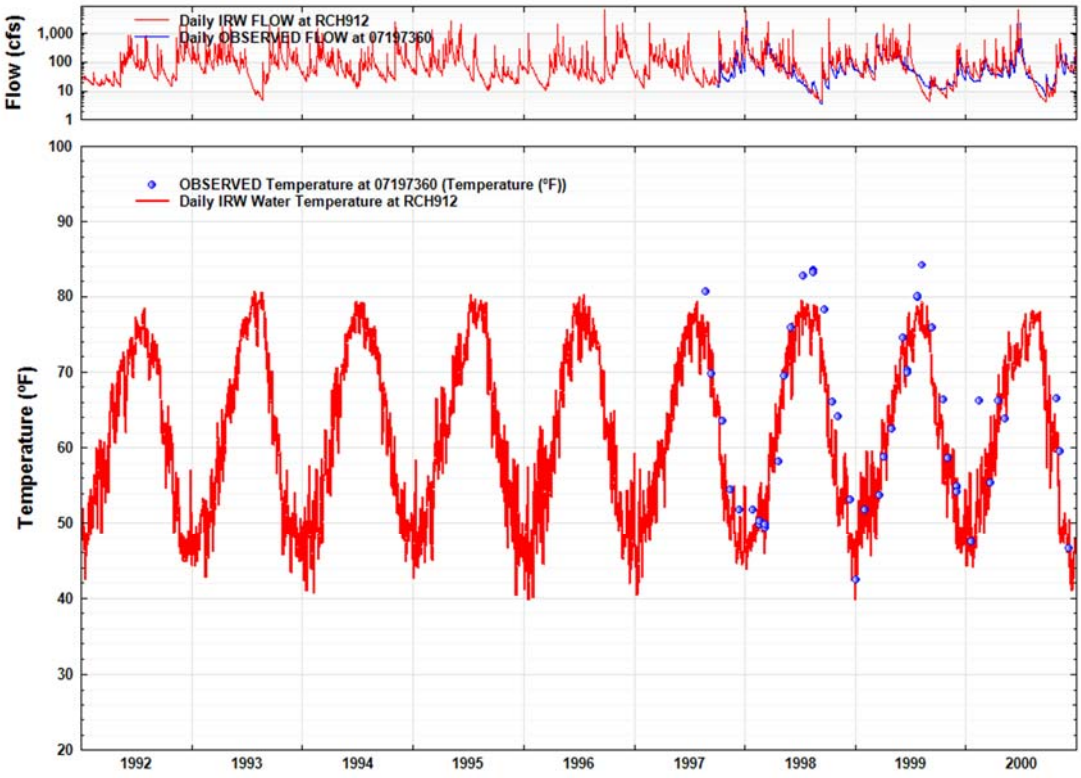

Daily IRW FLOW at RCH630
Daily OBSERVED FLOW at 07195430
Flow (cfs)
10,000
1,000
100
10
1
OBSERVED Temperature at 07195430 (Temperature (°F))
Daily IRW Water Temperature at RCH630
Temperature (°F)
100
90
80
70
60
50
40
30
20
1992
1993
1994
1995
1996
1997
1998
1999
2000


Flow (cfs)
Daily IRW FLOW at RCH640
Daily OBSERVED FLOW at 07195500
OBSERVED Temperature at 07195500 (Temperature (°F))
Daily IRW Water Temperature at RCH640
Temperature (°F)
1992
1993
1994
1995
1996
1997
1998
1999
2000


Flow (cfs)
Daily IRW FLOW at RCH706
Daily OBSERVED FLOW at 07196900
OBSERVED Temperature at 07196900 (Temperature (°F))
Daily IRW Water Temperature at RCH706
Temperature (°F)
1992
1993
1994
1995
1996
1997
1998
1999
2000


Flow (cfs)
Daily IRW FLOW at RCH746
Daily OBSERVED FLOW at 07197000
OBSERVED Temperature at 07197000 (Temperature (°F))
Daily IRW Water Temperature at RCH746
Temperature (°F)
1992
1993
1994
1995
1996
1997
1998
1999
2000


Flow (cfs)
Daily IRW FLOW at RCH870
Daily OBSERVED FLOW at 07196500
OBSERVED Temperature at 07196500 (Temperature (°F))
Daily IRW Water Temperature at RCH870
Temperature (°F)
1992
1993
1994
1995
1996
1997
1998
1999
2000


Daily IRW FLOW at RCH912
Daily OBSERVED FLOW at 07197360
Flow (cfs)
1,000
100
10
1
OBSERVED Temperature at 07197360 (Temperature (°F))
Daily IRW Water Temperature at RCH912
Temperature (°F)
100
90
80
70
60
50
40
30
20
1992
1993
1994
1995
1996
1997
1998
1999
2000

APPENDIX D
LAND USES AND PERVIOUS/IMPERVIOUS TOTALS

Land Uses		Pervious											Impervious		
Metric	Nonpoint Source Constituent	Forest	Pasture1	Pasture1 Litter	Pasture2	Pasture3	Grass/ Shrub/ Barren	Developed, Open	Developed, Low	Developed, Med/High	Wetlands	Cropland	Developed, Open	Developed, Low	Developed, Med/High
Mean	BOD	2.498	15.725	22.731	17.923	18.607	7.275	7.754	9.982	13.426	1.990	31.059	9.881	14.112	16.231
	NO3	3.776	8.121	2.663	8.024	7.941	6.434	8.340	9.557	10.925	2.754	18.144	2.256	3.609	4.059
	NH3	0.172	0.468	0.365	0.480	0.491	0.535	0.795	0.799	0.794	0.101	0.744	0.480	0.761	0.860
	LabileOrgN	0.132	0.833	1.204	0.949	0.985	0.385	0.410	0.528	0.711	0.105	1.644	0.523	0.747	0.859
	RefractoryOrgN	0.300	1.249	1.805	1.423	1.478	0.873	0.931	1.198	1.611	0.239	3.727	1.186	1.694	1.948
	TN	4.379	10.670	6.036	10.877	10.895	8.227	10.476	12.082	14.041	3.199	24.260	4.445	6.810	7.726
	PO4	0.033	0.566	2.470	0.572	0.584	0.456	0.223	0.281	0.348	0.012	0.859	0.263	0.378	0.416
	LabileOrgP	0.018	0.115	0.167	0.131	0.136	0.053	0.057	0.073	0.098	0.015	0.228	0.072	0.103	0.119
	RefractoryOrgP	0.029	0.343	0.503	0.391	0.407	0.084	0.089	0.115	0.154	0.023	0.357	0.114	0.162	0.187
	TP	0.080	1.024	3.140	1.094	1.127	0.593	0.369	0.469	0.601	0.050	1.443	0.449	0.643	0.722
Min	BOD	1.519	6.181	6.349	6.521	7.573	5.101	5.58	7.192	9.758	0.958	19.88	9.596	13.701	15.757
	NO3	2.282	5.837	1.731	5.748	5.667	4.772	6.194	7.141	8.191	1.278	12.976	2.158	3.452	3.883
	NH3	0.061	0.23	0.18	0.227	0.217	0.294	0.502	0.502	0.504	0.036	0.38	0.469	0.742	0.839
	LabileOrgN	0.08	0.327	0.336	0.345	0.401	0.27	0.295	0.381	0.517	0.051	1.053	0.508	0.725	0.834
	RefractoryOrgN	0.182	0.491	0.504	0.518	0.601	0.612	0.67	0.863	1.171	0.115	2.386	1.152	1.644	1.891
	TN	2.626	6.942	2.766	6.955	6.992	6.058	7.765	8.986	10.47	1.48	16.83	4.29	6.569	7.454
	PO4	0.019	0.282	0.457	0.279	0.291	0.234	0.131	0.166	0.2	0.005	0.434	0.25	0.358	0.395
	LabileOrgP	0.011	0.045	0.047	0.048	0.055	0.037	0.041	0.053	0.071	0.007	0.146	0.07	0.1	0.115
	RefractoryOrgP	0.017	0.132	0.13	0.139	0.162	0.059	0.064	0.083	0.112	0.011	0.229	0.11	0.158	0.181
	TP	0.047	0.49	0.727	0.527	0.54	0.33	0.25	0.313	0.393	0.023	0.809	0.43	0.617	0.692
Max	BOD	4.863	33.123	60.406	35.85	40.873	9.677	10.707	13.545	17.753	3.696	46.715	10.714	15.303	17.6
	NO3	6.882	12.418	4.591	12.264	12.123	9.294	12.094	13.846	15.851	5.235	27.017	2.541	4.065	4.573
	NH3	0.478	1.377	1.095	1.434	1.42	0.907	1.191	1.185	1.178	0.258	1.44	0.511	0.809	0.915
	LabileOrgN	0.257	1.754	3.198	1.898	2.164	0.512	0.567	0.717	0.94	0.196	2.473	0.567	0.81	0.932
	RefractoryOrgN	0.584	2.631	4.797	2.847	3.246	1.161	1.285	1.625	2.13	0.444	5.606	1.286	1.836	2.112
	TN	8.12	18.18	13.681	18.13	18.118	11.874	15.051	17.288	20.033	6.1	36.536	4.905	7.52	8.532
	PO4	0.063	1.262	6.641	1.252	1.277	0.7	0.411	0.471	0.592	0.024	1.584	0.301	0.432	0.477
	LabileOrgP	0.036	0.243	0.443	0.263	0.299	0.071	0.078	0.099	0.13	0.027	0.342	0.078	0.112	0.129
	RefractoryOrgP	0.056	0.674	1.158	0.771	0.877	0.111	0.123	0.156	0.204	0.043	0.537	0.123	0.176	0.202
	TP	0.155	2.179	8.242	2.176	2.281	0.855	0.585	0.7	0.911	0.094	2.403	0.502	0.72	0.808

Land Uses		Pervious											Impervious		
Metric	Nonpoint Source Constituent	Forest	Pasture1	Pasture1 Litter	Pasture2	Pasture3	Grass/ Shrub/ Barren	Developed, Open	Developed, Low	Developed, Med/High	Wetlands	Cropland	Developed, Open	Developed, Low	Developed, Med/High
MetSeg 100	BOD	3.1	22.218	30.95	21.786	25.011	8.488	9.075	11.706	15.995	2.453	40.607	9.812	14.014	16.118
	NO3	4.813	9.04	2.902	8.922	8.855	7.332	9.778	11.262	13.077	3.689	19.677	2.232	3.571	4.017
	NH3	0.262	0.606	0.494	0.623	0.63	0.609	0.867	0.869	0.86	0.106	0.942	0.478	0.757	0.856
	LabileOrgN	0.164	1.176	1.639	1.154	1.324	0.449	0.48	0.62	0.847	0.13	2.15	0.519	0.742	0.853
	RefractoryOrgN	0.372	1.765	2.458	1.73	1.986	1.019	1.089	1.405	1.919	0.294	4.873	1.177	1.682	1.934
	TN	5.611	12.587	7.493	12.429	12.795	9.409	12.214	14.156	16.703	4.219	27.642	4.406	6.752	7.66
	PO4	0.048	0.565	3.029	0.558	0.567	0.602	0.264	0.341	0.422	0.014	1.346	0.261	0.373	0.412
	LabileOrgP	0.023	0.163	0.227	0.16	0.183	0.062	0.066	0.086	0.117	0.018	0.297	0.072	0.103	0.118
	RefractoryOrgP	0.036	0.515	0.778	0.503	0.578	0.098	0.104	0.135	0.184	0.028	0.467	0.113	0.161	0.185
	TP	0.107	1.243	4.034	1.221	1.328	0.762	0.434	0.562	0.723	0.06	2.11	0.446	0.637	0.715
MetSeg 120	BOD	2.096	8.67	12.481	8.744	10.204	8.444	8.274	10.832	15.38	1.578	26.689	9.71	13.869	15.952
	NO3	3.256	6.321	2.223	6.233	6.178	6.236	8.021	9.098	10.423	2.196	17.633	2.199	3.518	3.958
	NH3	0.078	0.347	0.291	0.344	0.349	0.467	0.744	0.759	0.746	0.063	0.524	0.474	0.751	0.849
	LabileOrgN	0.111	0.459	0.661	0.463	0.54	0.447	0.438	0.573	0.814	0.084	1.413	0.514	0.734	0.844
	RefractoryOrgN	0.252	0.689	0.991	0.694	0.81	1.013	0.993	1.3	1.846	0.189	3.203	1.165	1.664	1.914
	TN	3.697	7.816	4.166	7.734	7.877	8.163	10.196	11.73	13.829	2.532	22.773	4.352	6.667	7.565
	PO4	0.023	0.331	1.786	0.343	0.346	0.389	0.203	0.249	0.321	0.009	0.525	0.256	0.367	0.405
	LabileOrgP	0.015	0.064	0.091	0.064	0.075	0.062	0.061	0.079	0.113	0.012	0.196	0.071	0.102	0.117
	RefractoryOrgP	0.024	0.201	0.32	0.203	0.237	0.097	0.095	0.125	0.177	0.018	0.307	0.112	0.16	0.183
	TP	0.062	0.596	2.197	0.61	0.658	0.548	0.359	0.453	0.611	0.039	1.028	0.439	0.629	0.705
MetSeg 140	BOD	2.943	21.487	36.992	21.188	23.226	7.138	7.224	9.415	12.904	2.333	29.332	10.272	14.666	16.867
	NO3	4.317	8.649	3.019	8.459	8.328	6.59	8.15	9.405	10.792	3.067	19.387	2.381	3.809	4.286
	NH3	0.188	0.772	0.558	0.833	0.842	0.617	0.871	0.867	0.858	0.077	0.791	0.495	0.784	0.886
	LabileOrgN	0.156	1.138	1.959	1.122	1.23	0.378	0.382	0.498	0.683	0.124	1.553	0.544	0.776	0.893
	RefractoryOrgN	0.353	1.706	2.938	1.683	1.845	0.857	0.867	1.13	1.549	0.28	3.52	1.233	1.76	2.024
	TN	5.014	12.265	8.474	12.097	12.245	8.442	10.27	11.9	13.882	3.548	25.251	4.653	7.129	8.089
	PO4	0.037	0.978	3.913	0.979	0.997	0.475	0.207	0.261	0.342	0.013	0.778	0.279	0.4	0.441
	LabileOrgP	0.022	0.157	0.271	0.155	0.17	0.052	0.053	0.069	0.095	0.017	0.215	0.075	0.107	0.124
	RefractoryOrgP	0.034	0.435	0.693	0.428	0.468	0.082	0.083	0.108	0.148	0.027	0.337	0.118	0.169	0.194
	TP	0.093	1.57	4.877	1.562	1.635	0.609	0.343	0.438	0.585	0.057	1.33	0.472	0.676	0.759

Land Uses		Pervious											Impervious		
Metric	Nonpoint Source Constituent	Forest	Pasture1	Pasture1 Litter	Pasture2	Pasture3	Grass/ Shrub/ Barren	Developed, Open	Developed, Low	Developed, Med/High	Wetlands	Cropland	Developed, Open	Developed, Low	Developed, Med/High
MetSeg 160	BOD	2.618	14.333	26.849	14.184	16.437	7.494	8.961	11.188	14.906	2.166	33.312	9.813	14.016	16.12
	NO3	4.143	8.551	3.674	8.434	8.373	6.663	9.663	11.024	12.709	3.182	18.488	2.232	3.57	4.016
	NH3	0.192	0.543	0.512	0.539	0.542	0.505	0.705	0.714	0.711	0.082	0.715	0.478	0.757	0.856
	LabileOrgN	0.139	0.759	1.422	0.751	0.87	0.397	0.474	0.592	0.789	0.115	1.764	0.52	0.742	0.853
	RefractoryOrgN	0.314	1.138	2.132	1.127	1.305	0.899	1.075	1.343	1.789	0.26	3.998	1.178	1.682	1.934
	TN	4.788	10.991	7.74	10.851	11.09	8.464	11.917	13.673	15.998	3.639	24.965	4.408	6.751	7.659
	PO4	0.036	0.438	4.607	0.429	0.445	0.478	0.216	0.278	0.334	0.012	0.964	0.26	0.373	0.411
	LabileOrgP	0.019	0.105	0.197	0.104	0.12	0.055	0.066	0.082	0.109	0.016	0.244	0.072	0.103	0.118
	RefractoryOrgP	0.03	0.327	0.716	0.322	0.374	0.086	0.103	0.129	0.171	0.025	0.383	0.113	0.161	0.185
	TP	0.085	0.87	5.52	0.855	0.939	0.619	0.385	0.489	0.614	0.053	1.591	0.445	0.637	0.714
MetSeg 180	BOD	2.822	14.935	21.096	14.939	17.163	7.92	8.687	11.2	15.103	2.25	37.408	9.833	14.043	16.152
	NO3	4.471	9.066	3.049	8.953	8.886	7.053	9.333	10.753	12.373	3.285	19.056	2.239	3.582	4.03
	NH3	0.197	0.525	0.404	0.519	0.526	0.541	0.818	0.816	0.815	0.117	0.847	0.479	0.758	0.857
	LabileOrgN	0.149	0.791	1.117	0.791	0.909	0.419	0.46	0.593	0.8	0.119	1.98	0.521	0.743	0.855
	RefractoryOrgN	0.339	1.186	1.675	1.186	1.363	0.95	1.042	1.344	1.812	0.27	4.489	1.18	1.685	1.938
	TN	5.156	11.568	6.245	11.449	11.684	8.963	11.653	13.506	15.8	3.791	26.372	4.419	6.768	7.68
	PO4	0.04	0.564	2.881	0.55	0.565	0.496	0.246	0.319	0.392	0.013	1.171	0.261	0.375	0.413
	LabileOrgP	0.021	0.109	0.155	0.109	0.126	0.058	0.064	0.082	0.111	0.016	0.274	0.072	0.103	0.118
	RefractoryOrgP	0.032	0.322	0.466	0.322	0.37	0.091	0.1	0.129	0.174	0.026	0.43	0.113	0.162	0.186
	TP	0.093	0.995	3.502	0.981	1.061	0.645	0.41	0.53	0.677	0.055	1.875	0.446	0.64	0.717
MetSeg 200	BOD	2.005	7.757	12.065	8.009	9.37	6.615	7.143	8.84	11.751	1.536	26.36	9.69	13.84	15.918
	NO3	2.749	6.136	2.213	6.063	6.015	5.747	7.563	8.546	9.675	1.979	16.724	2.192	3.506	3.944
	NH3	0.081	0.262	0.221	0.263	0.265	0.448	0.768	0.791	0.793	0.078	0.659	0.473	0.75	0.848
	LabileOrgN	0.106	0.411	0.639	0.424	0.496	0.35	0.378	0.468	0.622	0.081	1.396	0.513	0.733	0.843
	RefractoryOrgN	0.241	0.616	0.958	0.636	0.744	0.794	0.857	1.061	1.41	0.184	3.163	1.163	1.661	1.91
	TN	3.177	7.425	4.031	7.386	7.52	7.339	9.566	10.866	12.5	2.322	21.942	4.341	6.65	7.545
	PO4	0.023	0.447	2.548	0.447	0.451	0.337	0.187	0.223	0.286	0.009	0.655	0.255	0.366	0.403
	LabileOrgP	0.015	0.057	0.088	0.059	0.069	0.048	0.052	0.065	0.086	0.011	0.193	0.071	0.101	0.117
	RefractoryOrgP	0.023	0.166	0.265	0.172	0.201	0.076	0.082	0.102	0.135	0.018	0.303	0.111	0.159	0.183
	TP	0.061	0.67	2.901	0.678	0.721	0.461	0.321	0.39	0.507	0.038	1.151	0.437	0.626	0.703

Land Uses		Pervious											Impervious		
Metric	Nonpoint Source Constituent	Forest	Pasture1	Pasture1 Litter	Pasture2	Pasture3	Grass/ Shrub/ Barren	Developed, Open	Developed, Low	Developed, Med/High	Wetlands	Cropland	Developed, Open	Developed, Low	Developed, Med/High
MetSeg 20	BOD	3.2	21.981	30.836	35.85	40.873	8.537	9.219	12.204	16.921	3.027	43.505	10.074	14.388	16.549
	NO3	5.316	8.479	2.885	8.369	8.237	7.754	9.389	10.768	12.324	4.317	21.837	2.323	3.716	4.18
	NH3	0.478	0.792	0.576	0.82	0.826	0.87	1.191	1.185	1.178	0.258	1.397	0.487	0.772	0.872
	LabileOrgN	0.169	1.164	1.633	1.898	2.164	0.452	0.488	0.646	0.896	0.16	2.303	0.533	0.762	0.876
	RefractoryOrgN	0.384	1.746	2.449	2.847	3.246	1.024	1.106	1.465	2.031	0.363	5.221	1.209	1.727	1.986
	TN	6.347	12.181	7.543	13.934	14.473	10.1	12.174	14.064	16.429	5.098	30.758	4.552	6.977	7.914
	PO4	0.05	1.078	4.256	1.096	1.105	0.63	0.411	0.471	0.592	0.023	1.584	0.272	0.39	0.43
	LabileOrgP	0.023	0.161	0.226	0.263	0.299	0.063	0.068	0.089	0.124	0.022	0.319	0.074	0.105	0.121
	RefractoryOrgP	0.037	0.472	0.659	0.771	0.877	0.098	0.106	0.14	0.195	0.035	0.5	0.116	0.165	0.19
	TP	0.11	1.711	5.141	2.13	2.281	0.791	0.585	0.7	0.911	0.08	2.403	0.462	0.66	0.741
MetSeg 220	BOD	1.961	8.659	11.142	8.975	10.483	6.58	7.088	9.009	12.051	1.512	26.613	9.714	13.874	15.957
	NO3	2.743	6.291	1.989	6.222	6.158	5.709	7.509	8.594	9.754	1.898	16.596	2.199	3.517	3.957
	NH3	0.082	0.293	0.225	0.299	0.296	0.438	0.739	0.744	0.744	0.057	0.624	0.474	0.751	0.849
	LabileOrgN	0.104	0.458	0.59	0.475	0.555	0.348	0.375	0.477	0.638	0.08	1.409	0.514	0.734	0.845
	RefractoryOrgN	0.235	0.688	0.885	0.713	0.833	0.79	0.851	1.081	1.446	0.181	3.194	1.166	1.665	1.915
	TN	3.164	7.73	3.689	7.709	7.842	7.285	9.474	10.896	12.582	2.216	21.823	4.353	6.667	7.566
	PO4	0.023	0.435	1.603	0.439	0.45	0.354	0.192	0.235	0.303	0.009	0.688	0.256	0.367	0.404
	LabileOrgP	0.014	0.063	0.082	0.066	0.077	0.048	0.052	0.066	0.088	0.011	0.195	0.071	0.102	0.117
	RefractoryOrgP	0.023	0.186	0.239	0.194	0.226	0.076	0.082	0.104	0.139	0.017	0.306	0.112	0.16	0.184
	TP	0.06	0.684	1.924	0.699	0.753	0.478	0.326	0.405	0.53	0.037	1.189	0.439	0.629	0.705
MetSeg 240	BOD	1.959	14.583	18.029	14.781	15.947	6.572	7.064	8.981	12.261	1.505	25.741	9.697	13.85	15.93
	NO3	3.051	6.136	2.039	6.072	6.042	5.905	7.621	8.682	9.952	2.088	16.237	2.198	3.516	3.955
	NH3	0.068	0.262	0.214	0.257	0.261	0.387	0.684	0.693	0.68	0.051	0.584	0.473	0.75	0.847
	LabileOrgN	0.104	0.772	0.955	0.783	0.844	0.348	0.374	0.475	0.649	0.08	1.363	0.513	0.733	0.843
	RefractoryOrgN	0.235	1.158	1.432	1.174	1.267	0.789	0.848	1.078	1.471	0.181	3.089	1.164	1.662	1.912
	TN	3.458	8.328	4.64	8.286	8.414	7.429	9.527	10.928	12.752	2.4	21.273	4.348	6.661	7.557
	PO4	0.022	0.426	1.308	0.421	0.429	0.377	0.204	0.252	0.326	0.008	0.598	0.256	0.367	0.404
	LabileOrgP	0.014	0.107	0.132	0.108	0.117	0.048	0.052	0.066	0.09	0.011	0.189	0.071	0.101	0.117
	RefractoryOrgP	0.023	0.327	0.401	0.332	0.357	0.076	0.081	0.103	0.141	0.017	0.296	0.112	0.159	0.183
	TP	0.059	0.86	1.841	0.861	0.903	0.501	0.337	0.421	0.557	0.036	1.083	0.439	0.627	0.704

Land Uses		Pervious											Impervious		
Metric	Nonpoint Source Constituent	Forest	Pasture1	Pasture1 Litter	Pasture2	Pasture3	Grass/ Shrub/ Barren	Developed, Open	Developed, Low	Developed, Med/High	Wetlands	Cropland	Developed, Open	Developed, Low	Developed, Med/High
MetSeg 260	BOD	1.867	7.874	8.774	7.879	10.178	6.358	6.606	8.525	11.575	1.422	24.449	9.77	13.955	16.05
	NO3	3.059	5.926	1.731	5.859	5.823	5.702	7.309	8.449	9.728	2.084	15.972	2.219	3.55	3.994
	NH3	0.061	0.33	0.233	0.335	0.345	0.398	0.684	0.674	0.66	0.06	0.453	0.476	0.754	0.852
	LabileOrgN	0.099	0.417	0.465	0.417	0.539	0.337	0.35	0.451	0.613	0.075	1.294	0.517	0.739	0.85
	RefractoryOrgN	0.224	0.625	0.697	0.626	0.808	0.763	0.793	1.023	1.389	0.171	2.934	1.172	1.675	1.926
	TN	3.443	7.298	3.126	7.237	7.515	7.2	9.136	10.597	12.39	2.39	20.653	4.384	6.718	7.622
	PO4	0.02	0.382	1.039	0.38	0.408	0.375	0.171	0.22	0.278	0.008	0.449	0.259	0.371	0.409
	LabileOrgP	0.014	0.058	0.064	0.058	0.075	0.047	0.048	0.062	0.085	0.01	0.179	0.072	0.102	0.118
	RefractoryOrgP	0.021	0.16	0.18	0.16	0.206	0.073	0.076	0.098	0.133	0.016	0.281	0.112	0.16	0.185
	TP	0.055	0.6	1.283	0.598	0.689	0.495	0.295	0.38	0.496	0.034	0.909	0.443	0.633	0.712
MetSeg 280	BOD	2.409	11.619	13.014	13.236	14.639	7.438	7.547	9.702	13.173	2.294	33.95	9.863	14.087	16.202
	NO3	4.075	6.694	1.919	6.564	6.488	6.442	8.284	9.462	10.757	3.285	18.432	2.246	3.592	4.041
	NH3	0.19	0.381	0.278	0.402	0.448	0.593	0.913	0.921	0.917	0.11	0.901	0.48	0.761	0.86
	LabileOrgN	0.128	0.615	0.689	0.701	0.775	0.394	0.4	0.514	0.697	0.121	1.797	0.522	0.746	0.858
	RefractoryOrgN	0.289	0.923	1.034	1.051	1.163	0.893	0.906	1.164	1.581	0.275	4.074	1.184	1.69	1.944
	TN	4.682	8.613	3.92	8.718	8.874	8.322	10.503	12.061	13.952	3.791	25.204	4.432	6.789	7.703
	PO4	0.035	0.514	1.295	0.513	0.555	0.52	0.228	0.282	0.364	0.014	1.079	0.262	0.376	0.414
	LabileOrgP	0.018	0.085	0.095	0.097	0.107	0.054	0.055	0.071	0.097	0.017	0.249	0.072	0.103	0.119
	RefractoryOrgP	0.028	0.237	0.266	0.269	0.298	0.086	0.087	0.112	0.151	0.026	0.39	0.113	0.162	0.186
	TP	0.081	0.836	1.656	0.879	0.96	0.66	0.37	0.465	0.612	0.057	1.718	0.447	0.641	0.719
MetSeg 300	BOD	1.844	6.181	6.349	6.521	7.573	6.183	6.815	8.62	11.374	1.415	24.185	9.802	14	16.102
	NO3	2.796	5.941	1.746	5.847	5.77	5.705	7.489	8.6	9.739	1.829	16.367	2.222	3.554	3.998
	NH3	0.067	0.237	0.18	0.245	0.259	0.425	0.701	0.699	0.7	0.051	0.43	0.478	0.757	0.855
	LabileOrgN	0.098	0.327	0.336	0.345	0.401	0.327	0.361	0.456	0.602	0.075	1.28	0.519	0.741	0.852
	RefractoryOrgN	0.221	0.491	0.504	0.518	0.601	0.742	0.818	1.034	1.365	0.17	2.902	1.176	1.68	1.932
	TN	3.182	6.996	2.766	6.955	7.031	7.199	9.369	10.789	12.406	2.125	20.979	4.395	6.732	7.637
	PO4	0.021	0.383	0.683	0.387	0.406	0.307	0.162	0.2	0.254	0.008	0.447	0.259	0.37	0.408
	LabileOrgP	0.014	0.045	0.047	0.048	0.055	0.045	0.05	0.063	0.083	0.01	0.177	0.072	0.103	0.118
	RefractoryOrgP	0.021	0.132	0.13	0.139	0.162	0.071	0.078	0.099	0.131	0.016	0.278	0.113	0.161	0.185
	TP	0.056	0.56	0.86	0.574	0.623	0.423	0.29	0.362	0.468	0.034	0.902	0.444	0.634	0.711

Land Uses		Pervious											Impervious		
Metric	Nonpoint Source Constituent	Forest	Pasture1	Pasture1 Litter	Pasture2	Pasture3	Grass/ Shrub/ Barren	Developed, Open	Developed, Low	Developed, Med/High	Wetlands	Cropland	Developed, Open	Developed, Low	Developed, Med/High
MetSeg 320	BOD	3.063	27.083	38.621	28.944	23.623	7.912	9.123	11.631	15.41	2.867	36.847	10.228	14.606	16.798
	NO3	4.236	8.597	2.513	8.498	8.404	7.087	9.791	11.132	12.767	3.997	22.432	2.382	3.81	4.287
	NH3	0.249	0.875	0.662	0.908	0.938	0.688	0.908	0.921	0.913	0.148	1.281	0.493	0.781	0.882
	LabileOrgN	0.162	1.434	2.045	1.532	1.251	0.419	0.483	0.616	0.816	0.152	1.951	0.542	0.773	0.889
	RefractoryOrgN	0.368	2.151	3.067	2.299	1.876	0.949	1.095	1.396	1.849	0.344	4.422	1.227	1.753	2.016
	TN	5.015	13.057	8.287	13.237	12.469	9.143	12.277	14.065	16.345	4.641	30.086	4.644	7.117	8.074
	PO4	0.04	0.966	3.598	0.977	0.986	0.491	0.267	0.335	0.393	0.017	1.15	0.281	0.403	0.444
	LabileOrgP	0.022	0.198	0.283	0.212	0.173	0.058	0.067	0.085	0.113	0.021	0.27	0.075	0.107	0.123
	RefractoryOrgP	0.035	0.537	0.737	0.573	0.468	0.091	0.105	0.134	0.177	0.033	0.424	0.118	0.168	0.193
	TP	0.097	1.701	4.618	1.762	1.627	0.64	0.439	0.554	0.683	0.071	1.844	0.474	0.678	0.76
MetSeg 340	BOD	2.006	13.204	22.551	13.415	15.317	6.514	6.974	8.929	12.251	1.5	28.237	9.721	13.885	15.969
	NO3	3.103	5.97	2.315	5.877	5.827	5.902	7.494	8.53	9.757	2.183	16.289	2.206	3.53	3.97
	NH3	0.082	0.284	0.246	0.28	0.293	0.415	0.702	0.709	0.7	0.076	0.57	0.474	0.751	0.849
	LabileOrgN	0.106	0.699	1.194	0.71	0.811	0.345	0.369	0.473	0.649	0.079	1.495	0.515	0.735	0.845
	RefractoryOrgN	0.241	1.049	1.791	1.065	1.216	0.782	0.837	1.071	1.47	0.18	3.388	1.167	1.666	1.916
	TN	3.532	8.002	5.546	7.932	8.147	7.444	9.402	10.783	12.576	2.518	21.742	4.362	6.682	7.58
	PO4	0.022	0.324	2.111	0.316	0.332	0.391	0.215	0.264	0.345	0.009	0.724	0.257	0.368	0.406
	LabileOrgP	0.015	0.097	0.165	0.098	0.112	0.048	0.051	0.065	0.09	0.011	0.207	0.071	0.102	0.117
	RefractoryOrgP	0.023	0.321	0.62	0.325	0.371	0.075	0.08	0.103	0.141	0.017	0.325	0.112	0.16	0.184
	TP	0.06	0.742	2.896	0.739	0.815	0.514	0.346	0.432	0.576	0.037	1.256	0.44	0.63	0.707
MetSeg 360	BOD	2.487	22.279	21.766	22.751	24.624	7.206	7.583	9.821	13.557	1.742	31.557	9.643	13.773	15.841
	NO3	3.509	6.193	1.918	6.13	6.106	6.241	7.842	8.924	10.17	2.495	17.518	2.185	3.495	3.932
	NH3	0.108	0.325	0.24	0.327	0.328	0.469	0.781	0.791	0.785	0.103	0.662	0.471	0.746	0.843
	LabileOrgN	0.132	1.18	1.152	1.205	1.304	0.382	0.401	0.52	0.718	0.092	1.671	0.511	0.729	0.839
	RefractoryOrgN	0.298	1.769	1.729	1.807	1.956	0.865	0.91	1.179	1.627	0.209	3.787	1.157	1.653	1.901
	TN	4.047	9.467	5.039	9.469	9.694	7.957	9.934	11.414	13.3	2.899	23.638	4.324	6.623	7.515
	PO4	0.033	0.568	0.676	0.571	0.576	0.48	0.279	0.33	0.43	0.012	0.864	0.255	0.365	0.402
	LabileOrgP	0.018	0.163	0.159	0.167	0.18	0.053	0.056	0.072	0.099	0.013	0.231	0.071	0.101	0.116
	RefractoryOrgP	0.029	0.475	0.429	0.485	0.524	0.083	0.087	0.113	0.156	0.02	0.363	0.111	0.158	0.182
	TP	0.08	1.206	1.264	1.223	1.28	0.616	0.422	0.515	0.685	0.045	1.458	0.437	0.624	0.7

Land Uses		Pervious											Impervious		
Metric	Nonpoint Source Constituent	Forest	Pasture1	Pasture1 Litter	Pasture2	Pasture3	Grass/ Shrub/ Barren	Developed, Open	Developed, Low	Developed, Med/High	Wetlands	Cropland	Developed, Open	Developed, Low	Developed, Med/High
MetSeg 380	BOD	2.351	7.746	12.957	11.469	10.7	7.738	9.07	11.627	14.803	1.987	26.002	9.749	13.924	16.015
	NO3	3.76	11.029	3.687	10.962	10.877	6.587	9.34	10.766	12.303	2.602	17.246	2.213	3.54	3.982
	NH3	0.077	0.23	0.203	0.227	0.217	0.294	0.536	0.533	0.532	0.057	0.631	0.475	0.753	0.851
	LabileOrgN	0.124	0.41	0.686	0.607	0.567	0.41	0.48	0.616	0.784	0.105	1.377	0.516	0.737	0.848
	RefractoryOrgN	0.282	0.615	1.029	0.911	0.85	0.929	1.088	1.395	1.776	0.238	3.12	1.17	1.671	1.922
	TN	4.243	12.284	5.605	12.707	12.511	8.22	11.444	13.31	15.395	3.002	22.374	4.374	6.701	7.603
	PO4	0.03	0.296	1.529	0.304	0.298	0.392	0.196	0.276	0.296	0.011	0.558	0.258	0.369	0.407
	LabileOrgP	0.017	0.057	0.095	0.084	0.078	0.057	0.066	0.085	0.108	0.015	0.19	0.071	0.102	0.117
	RefractoryOrgP	0.027	0.166	0.264	0.245	0.227	0.089	0.104	0.134	0.17	0.023	0.299	0.112	0.16	0.184
	TP	0.074	0.519	1.888	0.633	0.603	0.538	0.366	0.495	0.574	0.049	1.047	0.441	0.631	0.708
MetSeg 400	BOD	2.729	26.959	40.185	30.893	33.786	7.531	6.972	9.35	12.968	2.055	34.592	9.703	13.859	15.94
	NO3	4.277	8.237	3.115	8.155	8.024	6.366	7.508	8.612	9.74	2.937	17.693	2.205	3.528	3.968
	NH3	0.246	0.588	0.468	0.604	0.614	0.701	0.936	0.938	0.938	0.146	0.86	0.473	0.75	0.848
	LabileOrgN	0.144	1.427	2.128	1.636	1.789	0.399	0.369	0.495	0.687	0.109	1.831	0.514	0.734	0.844
	RefractoryOrgN	0.327	2.141	3.191	2.454	2.683	0.904	0.837	1.122	1.556	0.247	4.151	1.164	1.663	1.913
	TN	4.994	12.393	8.902	12.849	13.11	8.37	9.65	11.167	12.921	3.439	24.535	4.356	6.675	7.573
	PO4	0.041	0.671	3.665	0.689	0.708	0.653	0.272	0.338	0.442	0.014	1.14	0.257	0.369	0.406
	LabileOrgP	0.02	0.198	0.294	0.226	0.248	0.055	0.051	0.068	0.095	0.015	0.253	0.071	0.102	0.117
	RefractoryOrgP	0.031	0.647	1.051	0.741	0.813	0.087	0.08	0.108	0.149	0.024	0.398	0.112	0.159	0.183
	TP	0.092	1.516	5.01	1.656	1.769	0.795	0.403	0.514	0.686	0.053	1.791	0.44	0.63	0.706
MetSeg 40	BOD	2.707	25.905	44.139	32.51	31.525	7.122	7.044	9.271	12.713	2.266	33.849	9.684	13.833	15.91
	NO3	3.781	7.814	3.011	7.695	7.574	6.293	7.57	8.647	9.779	3.174	17.93	2.203	3.524	3.964
	NH3	0.245	0.504	0.418	0.515	0.515	0.748	0.986	0.994	0.995	0.195	0.811	0.472	0.748	0.846
	LabileOrgN	0.143	1.372	2.337	1.721	1.669	0.377	0.373	0.491	0.673	0.12	1.792	0.513	0.732	0.842
	RefractoryOrgN	0.325	2.057	3.505	2.582	2.504	0.855	0.845	1.113	1.526	0.272	4.062	1.162	1.66	1.909
	TN	4.494	11.747	9.271	12.513	12.262	8.273	9.774	11.245	12.973	3.761	24.595	4.35	6.664	7.561
	PO4	0.038	0.827	4.581	0.843	0.864	0.555	0.268	0.321	0.415	0.015	1.123	0.257	0.368	0.406
	LabileOrgP	0.02	0.19	0.323	0.238	0.231	0.052	0.052	0.068	0.093	0.017	0.248	0.071	0.101	0.117
	RefractoryOrgP	0.031	0.575	1.008	0.721	0.698	0.082	0.081	0.107	0.146	0.026	0.389	0.111	0.159	0.183
	TP	0.089	1.592	5.912	1.802	1.793	0.689	0.401	0.496	0.654	0.058	1.76	0.439	0.628	0.706

Land Uses		Pervious											Impervious		
Metric	Nonpoint Source Constituent	Forest	Pasture1	Pasture1 Litter	Pasture2	Pasture3	Grass/ Shrub/ Barren	Developed, Open	Developed, Low	Developed, Med/High	Wetlands	Cropland	Developed, Open	Developed, Low	Developed, Med/High
MetSeg 420	BOD	2.416	20.412	28.812	22.038	21.658	7.003	7.329	9.514	13.149	2.069	31.08	9.735	13.904	15.992
	NO3	3.843	7.394	2.653	7.344	7.238	6.29	8.046	9.238	10.69	2.993	17.233	2.214	3.542	3.985
	NH3	0.272	0.531	0.411	0.544	0.576	0.579	0.846	0.848	0.835	0.125	0.881	0.475	0.752	0.85
	LabileOrgN	0.128	1.081	1.526	1.167	1.147	0.371	0.388	0.504	0.696	0.11	1.645	0.515	0.736	0.847
	RefractoryOrgN	0.29	1.621	2.288	1.75	1.72	0.84	0.88	1.142	1.578	0.248	3.73	1.168	1.669	1.919
	TN	4.533	10.627	6.878	10.805	10.681	8.08	10.16	11.732	13.799	3.476	23.489	4.372	6.699	7.601
	PO4	0.044	0.791	3.307	0.793	0.823	0.486	0.225	0.284	0.365	0.013	0.955	0.258	0.37	0.408
	LabileOrgP	0.018	0.15	0.211	0.161	0.159	0.051	0.054	0.07	0.096	0.015	0.228	0.071	0.102	0.117
	RefractoryOrgP	0.028	0.433	0.624	0.468	0.46	0.081	0.084	0.109	0.151	0.024	0.357	0.112	0.16	0.184
	TP	0.09	1.374	4.142	1.422	1.442	0.618	0.363	0.463	0.612	0.052	1.54	0.441	0.632	0.709
MetSeg 440	BOD	1.519	8.603	10.501	11.474	10	5.301	5.58	7.192	9.758	0.958	19.88	9.624	13.746	15.81
	NO3	2.288	7.514	2.112	7.419	7.365	4.772	6.194	7.141	8.191	1.278	12.976	2.169	3.47	3.903
	NH3	0.076	0.293	0.194	0.299	0.304	0.369	0.606	0.601	0.591	0.036	0.415	0.471	0.746	0.843
	LabileOrgN	0.08	0.455	0.556	0.607	0.529	0.281	0.295	0.381	0.517	0.051	1.053	0.51	0.728	0.837
	RefractoryOrgN	0.182	0.683	0.834	0.911	0.794	0.636	0.67	0.863	1.171	0.115	2.386	1.155	1.65	1.897
	TN	2.626	8.945	3.696	9.236	8.992	6.058	7.765	8.986	10.47	1.48	16.83	4.305	6.594	7.48
	PO4	0.019	0.318	1.093	0.31	0.307	0.313	0.149	0.187	0.241	0.005	0.434	0.252	0.361	0.398
	LabileOrgP	0.011	0.063	0.077	0.084	0.073	0.039	0.041	0.053	0.071	0.007	0.146	0.071	0.101	0.116
	RefractoryOrgP	0.017	0.205	0.261	0.274	0.239	0.061	0.064	0.083	0.112	0.011	0.229	0.111	0.158	0.182
	TP	0.047	0.586	1.431	0.668	0.619	0.413	0.254	0.323	0.424	0.023	0.809	0.434	0.62	0.696
MetSeg 460	BOD	2.916	10.364	10.147	15.25	14.294	9.488	10.446	13.545	17.281	2.456	35.756	9.947	14.207	16.34
	NO3	4.519	12.085	3.177	11.997	11.893	7.651	10.666	12.284	14.035	3.224	19.836	2.272	3.634	4.088
	NH3	0.157	0.312	0.21	0.296	0.295	0.423	0.702	0.702	0.7	0.124	0.782	0.483	0.765	0.865
	LabileOrgN	0.154	0.549	0.537	0.807	0.757	0.502	0.553	0.717	0.915	0.13	1.893	0.527	0.752	0.865
	RefractoryOrgN	0.35	0.823	0.806	1.211	1.135	1.139	1.254	1.625	2.074	0.295	4.291	1.194	1.705	1.961
	TN	5.18	13.769	4.73	14.311	14.08	9.715	13.175	15.328	17.724	3.773	26.802	4.476	6.856	7.779
	PO4	0.04	0.403	0.457	0.401	0.398	0.581	0.245	0.349	0.374	0.015	0.989	0.265	0.38	0.419
	LabileOrgP	0.021	0.076	0.074	0.112	0.105	0.07	0.077	0.099	0.127	0.018	0.262	0.073	0.104	0.12
	RefractoryOrgP	0.034	0.217	0.196	0.319	0.299	0.109	0.12	0.156	0.199	0.028	0.411	0.114	0.163	0.188
	TP	0.095	0.696	0.727	0.832	0.802	0.76	0.442	0.604	0.7	0.061	1.662	0.452	0.647	0.727

Land Uses		Pervious											Impervious		
Metric	Nonpoint Source Constituent	Forest	Pasture1	Pasture1 Litter	Pasture2	Pasture3	Grass/ Shrub/ Barren	Developed, Open	Developed, Low	Developed, Med/High	Wetlands	Cropland	Developed, Open	Developed, Low	Developed, Med/High
MetSeg 480	BOD	2.688	10.777	16.594	16.86	15.858	9.017	8.609	11.724	15.082	2.307	31.485	9.933	14.188	16.318
	NO3	4.263	11.881	3.694	11.715	11.576	7.074	8.86	10.256	11.735	3.004	18.561	2.269	3.629	4.083
	NH3	0.101	0.411	0.347	0.356	0.351	0.475	0.785	0.783	0.779	0.08	0.728	0.482	0.764	0.864
	LabileOrgN	0.142	0.571	0.879	0.893	0.84	0.477	0.456	0.621	0.798	0.122	1.667	0.526	0.751	0.864
	RefractoryOrgN	0.323	0.856	1.318	1.339	1.259	1.082	1.033	1.407	1.81	0.277	3.778	1.192	1.703	1.958
	TN	4.829	13.719	6.238	14.303	14.026	9.108	11.134	13.067	15.122	3.483	24.734	4.469	6.847	7.769
	PO4	0.034	0.478	2.77	0.463	0.441	0.642	0.262	0.383	0.409	0.013	0.803	0.265	0.38	0.418
	LabileOrgP	0.02	0.079	0.122	0.124	0.116	0.066	0.063	0.086	0.11	0.017	0.231	0.073	0.104	0.12
	RefractoryOrgP	0.031	0.231	0.364	0.362	0.341	0.104	0.099	0.135	0.173	0.027	0.362	0.114	0.163	0.188
	TP	0.085	0.788	3.256	0.949	0.898	0.812	0.424	0.604	0.692	0.057	1.396	0.452	0.647	0.726
MetSeg 500	BOD	2.141	6.98	10.8	8.277	8.156	6.597	7.387	9.441	12.62	1.696	26.027	9.887	14.122	16.243
	NO3	3.277	6.579	2.378	6.498	6.447	6.3	8.108	9.415	10.795	2.356	17.187	2.258	3.612	4.063
	NH3	0.08	0.273	0.231	0.264	0.264	0.382	0.69	0.681	0.672	0.071	0.595	0.481	0.761	0.86
	LabileOrgN	0.113	0.37	0.572	0.438	0.432	0.349	0.391	0.5	0.668	0.09	1.378	0.523	0.748	0.86
	RefractoryOrgN	0.257	0.554	0.858	0.657	0.648	0.792	0.886	1.133	1.514	0.204	3.123	1.187	1.695	1.949
	TN	3.727	7.776	4.039	7.857	7.791	7.823	10.075	11.729	13.649	2.721	22.283	4.449	6.816	7.732
	PO4	0.023	0.293	1.766	0.289	0.291	0.311	0.177	0.225	0.282	0.01	0.568	0.264	0.378	0.416
	LabileOrgP	0.016	0.051	0.079	0.061	0.06	0.048	0.054	0.069	0.092	0.012	0.191	0.072	0.103	0.119
	RefractoryOrgP	0.025	0.165	0.283	0.195	0.192	0.076	0.085	0.109	0.145	0.02	0.299	0.114	0.162	0.187
	TP	0.064	0.509	2.128	0.545	0.543	0.435	0.316	0.403	0.519	0.042	1.058	0.45	0.643	0.722
MetSeg 520	BOD	2.66	22.083	25.331	26.778	30.149	7.389	7.209	9.473	13.033	1.821	34.869	9.84	14.054	16.165
	NO3	3.724	12.368	3.357	12.185	12.065	6.303	7.709	8.866	10.127	2.384	18.443	2.237	3.578	4.025
	NH3	0.269	0.663	0.439	0.701	0.719	0.623	0.89	0.897	0.895	0.113	0.725	0.479	0.758	0.857
	LabileOrgN	0.141	1.169	1.341	1.418	1.596	0.391	0.382	0.502	0.69	0.096	1.846	0.521	0.744	0.856
	RefractoryOrgN	0.319	1.754	2.012	2.127	2.394	0.887	0.865	1.137	1.564	0.218	4.184	1.181	1.687	1.94
	TN	4.453	15.954	7.149	16.431	16.774	8.204	9.846	11.402	13.276	2.811	25.198	4.418	6.767	7.678
	PO4	0.045	0.747	2.579	0.752	0.755	0.523	0.247	0.309	0.397	0.012	1.101	0.26	0.373	0.411
	LabileOrgP	0.019	0.162	0.186	0.196	0.221	0.054	0.053	0.069	0.095	0.013	0.255	0.072	0.103	0.118
	RefractoryOrgP	0.031	0.507	0.596	0.615	0.696	0.085	0.083	0.109	0.15	0.021	0.401	0.113	0.162	0.186
	TP	0.095	1.416	3.361	1.563	1.672	0.662	0.383	0.487	0.642	0.046	1.757	0.445	0.638	0.715

Land Uses		Pervious											Impervious		
Metric	Nonpoint Source Constituent	Forest	Pasture1	Pasture1 Litter	Pasture2	Pasture3	Grass/ Shrub/ Barren	Developed, Open	Developed, Low	Developed, Med/High	Wetlands	Cropland	Developed, Open	Developed, Low	Developed, Med/High
MetSeg 540	BOD	1.685	6.455	6.936	7.994	7.995	5.855	6.598	8.266	10.911	1.26	24.373	9.791	13.984	16.084
	NO3	2.589	5.837	1.731	5.748	5.667	5.508	7.285	8.326	9.429	1.684	15.265	2.213	3.541	3.983
	NH3	0.065	0.25	0.188	0.259	0.267	0.409	0.689	0.693	0.693	0.064	0.38	0.478	0.757	0.855
	LabileOrgN	0.089	0.342	0.367	0.423	0.423	0.31	0.349	0.438	0.578	0.067	1.29	0.518	0.74	0.851
	RefractoryOrgN	0.202	0.513	0.551	0.635	0.635	0.703	0.792	0.992	1.309	0.151	2.925	1.175	1.678	1.93
	TN	2.945	6.942	2.837	7.065	6.992	6.93	9.115	10.449	12.009	1.966	19.86	4.384	6.716	7.619
	PO4	0.022	0.357	0.727	0.38	0.385	0.277	0.155	0.191	0.242	0.009	0.509	0.257	0.369	0.406
	LabileOrgP	0.012	0.047	0.051	0.059	0.059	0.043	0.048	0.061	0.08	0.009	0.179	0.072	0.102	0.118
	RefractoryOrgP	0.019	0.132	0.141	0.164	0.164	0.067	0.076	0.095	0.125	0.014	0.28	0.113	0.161	0.185
	TP	0.053	0.536	0.919	0.603	0.608	0.387	0.279	0.347	0.447	0.032	0.968	0.442	0.632	0.709
MetSeg 560	BOD	3.148	19.307	33.701	22.235	21.614	8.133	7.795	9.801	13.14	2.385	33.732	10.427	14.893	17.13
	NO3	4.873	10.571	3.416	10.386	10.313	7.583	8.819	9.996	11.339	3.253	21.595	2.434	3.894	4.38
	NH3	0.236	0.452	0.38	0.489	0.505	0.622	0.899	0.917	0.914	0.081	0.72	0.501	0.793	0.897
	LabileOrgN	0.167	1.022	1.784	1.177	1.144	0.431	0.413	0.519	0.696	0.126	1.786	0.552	0.788	0.907
	RefractoryOrgN	0.378	1.533	2.677	1.766	1.717	0.976	0.935	1.176	1.577	0.286	4.048	1.251	1.787	2.056
	TN	5.654	13.578	8.257	13.818	13.679	9.612	11.066	12.608	14.526	3.746	28.149	4.738	7.262	8.24
	PO4	0.039	0.71	3.076	0.708	0.723	0.488	0.214	0.266	0.335	0.014	0.801	0.287	0.411	0.453
	LabileOrgP	0.023	0.141	0.247	0.163	0.158	0.06	0.057	0.072	0.096	0.017	0.247	0.076	0.109	0.125
	RefractoryOrgP	0.036	0.408	0.672	0.47	0.457	0.094	0.09	0.113	0.151	0.027	0.388	0.12	0.171	0.197
	TP	0.098	1.259	3.995	1.341	1.338	0.642	0.361	0.451	0.582	0.058	1.436	0.483	0.691	0.775
MetSeg 580	BOD	1.965	7.049	8.384	8.437	8.389	6.496	7.168	8.938	11.869	1.529	26.764	9.885	14.119	16.239
	NO3	3.091	6.04	1.839	5.965	5.911	5.968	7.811	8.878	10.078	2.065	16.757	2.248	3.595	4.044
	NH3	0.074	0.245	0.19	0.234	0.249	0.44	0.718	0.731	0.729	0.067	0.44	0.481	0.762	0.861
	LabileOrgN	0.104	0.373	0.444	0.447	0.444	0.344	0.379	0.473	0.628	0.081	1.417	0.523	0.747	0.86
	RefractoryOrgN	0.236	0.56	0.666	0.67	0.666	0.779	0.86	1.073	1.424	0.184	3.212	1.186	1.694	1.949
	TN	3.505	7.218	3.139	7.316	7.27	7.531	9.768	11.155	12.859	2.397	21.826	4.438	6.798	7.714
	PO4	0.024	0.282	0.948	0.279	0.294	0.353	0.178	0.219	0.276	0.009	0.534	0.262	0.375	0.414
	LabileOrgP	0.014	0.052	0.061	0.062	0.061	0.048	0.053	0.065	0.087	0.011	0.196	0.072	0.103	0.119
	RefractoryOrgP	0.023	0.156	0.199	0.186	0.185	0.075	0.082	0.103	0.136	0.018	0.308	0.114	0.162	0.187
	TP	0.061	0.49	1.208	0.527	0.54	0.476	0.313	0.387	0.499	0.038	1.038	0.448	0.64	0.72

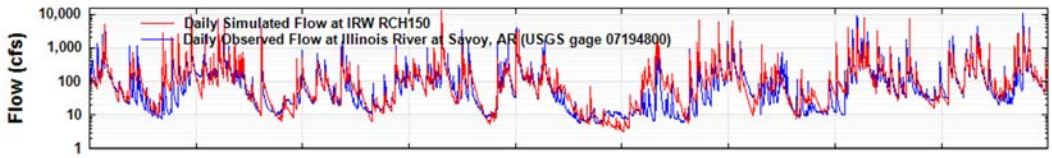
Land Uses		Pervious											Impervious		
Metric	Nonpoint Source Constituent	Forest	Pasture1	Pasture1 Litter	Pasture2	Pasture3	Grass/ Shrub/ Barren	Developed, Open	Developed, Low	Developed, Med/High	Wetlands	Cropland	Developed, Open	Developed, Low	Developed, Med/High
MetSeg 600	BOD	1.791	17.575	21.353	20.477	20.152	5.936	5.974	7.89	10.691	1.156	27.376	9.606	13.72	15.78
	NO3	2.632	7.957	2.141	7.864	7.809	5.124	6.438	7.432	8.39	1.579	13.754	2.158	3.452	3.883
	NH3	0.126	0.319	0.204	0.341	0.355	0.444	0.672	0.669	0.672	0.057	0.554	0.47	0.745	0.842
	LabileOrgN	0.095	0.93	1.131	1.084	1.067	0.314	0.316	0.418	0.566	0.061	1.449	0.509	0.726	0.835
	RefractoryOrgN	0.215	1.396	1.696	1.626	1.6	0.712	0.717	0.947	1.283	0.139	3.285	1.153	1.646	1.894
	TN	3.068	10.602	5.172	10.915	10.831	6.594	8.143	9.466	10.911	1.836	19.042	4.29	6.569	7.454
	PO4	0.025	0.407	1.394	0.425	0.431	0.415	0.197	0.246	0.318	0.007	0.8	0.25	0.358	0.395
	LabileOrgP	0.013	0.129	0.156	0.15	0.148	0.043	0.044	0.058	0.078	0.008	0.201	0.07	0.101	0.116
	RefractoryOrgP	0.021	0.42	0.527	0.49	0.482	0.068	0.069	0.091	0.123	0.013	0.315	0.11	0.158	0.181
	TP	0.059	0.956	2.077	1.065	1.061	0.526	0.31	0.395	0.519	0.028	1.316	0.43	0.617	0.692
MetSeg 60	BOD	3.243	25.872	40.124	30.976	34.653	8.229	8.591	11.276	15.845	2.425	38.544	9.811	14.013	16.117
	NO3	4.719	9.686	3.738	9.869	9.728	7.042	9.207	10.508	12.181	3.641	20.674	2.24	3.583	4.031
	NH3	0.384	0.557	0.466	0.589	0.628	0.825	1.059	1.07	1.056	0.235	1.105	0.477	0.756	0.855
	LabileOrgN	0.172	1.37	2.124	1.64	1.835	0.436	0.455	0.597	0.839	0.128	2.041	0.519	0.742	0.853
	RefractoryOrgN	0.389	2.055	3.187	2.46	2.752	0.988	1.031	1.353	1.901	0.291	4.625	1.177	1.682	1.934
	TN	5.664	13.668	9.515	14.558	14.943	9.291	11.752	13.528	15.977	4.295	28.445	4.413	6.763	7.673
	PO4	0.047	0.567	3.733	0.618	0.682	0.7	0.311	0.392	0.505	0.017	1.289	0.262	0.375	0.414
	LabileOrgP	0.024	0.19	0.294	0.227	0.254	0.06	0.063	0.083	0.116	0.018	0.282	0.072	0.103	0.118
	RefractoryOrgP	0.037	0.615	1.052	0.736	0.827	0.095	0.099	0.13	0.182	0.028	0.443	0.113	0.161	0.185
	TP	0.108	1.372	5.079	1.581	1.763	0.855	0.473	0.605	0.803	0.063	2.014	0.447	0.639	0.717
MetSeg 620	BOD	2.506	12.915	21.583	14.532	13.908	6.779	7.162	8.952	11.803	2.045	28.463	10.154	14.499	16.676
	NO3	3.832	7.618	2.539	7.473	7.367	6.426	8.128	9.309	10.594	2.643	18.552	2.340	3.743	4.211
	NH3	0.150	0.516	0.398	0.578	0.600	0.530	0.730	0.731	0.726	0.051	0.641	0.491	0.777	0.879
	LabileOrgN	0.133	0.684	1.143	0.769	0.736	0.359	0.379	0.474	0.625	0.108	1.507	0.538	0.768	0.883
	RefractoryOrgN	0.301	1.026	1.714	1.154	1.105	0.814	0.859	1.074	1.416	0.245	3.416	1.219	1.740	2.001
	TN	4.416	9.844	5.794	9.974	9.808	8.129	10.096	11.588	13.361	3.047	24.116	4.588	7.028	7.974
	PO4	0.029	0.74	3.63	0.771	0.773	0.383	0.153	0.189	0.239	0.011	0.665	0.274	0.393	0.433
	LabileOrgP	0.018	0.095	0.158	0.106	0.102	0.05	0.052	0.066	0.086	0.015	0.209	0.074	0.106	0.122
	RefractoryOrgP	0.029	0.266	0.428	0.299	0.286	0.078	0.082	0.103	0.136	0.024	0.327	0.117	0.167	0.192
	TP	0.076	1.101	4.216	1.176	1.161	0.511	0.287	0.358	0.461	0.05	1.201	0.465	0.666	0.747

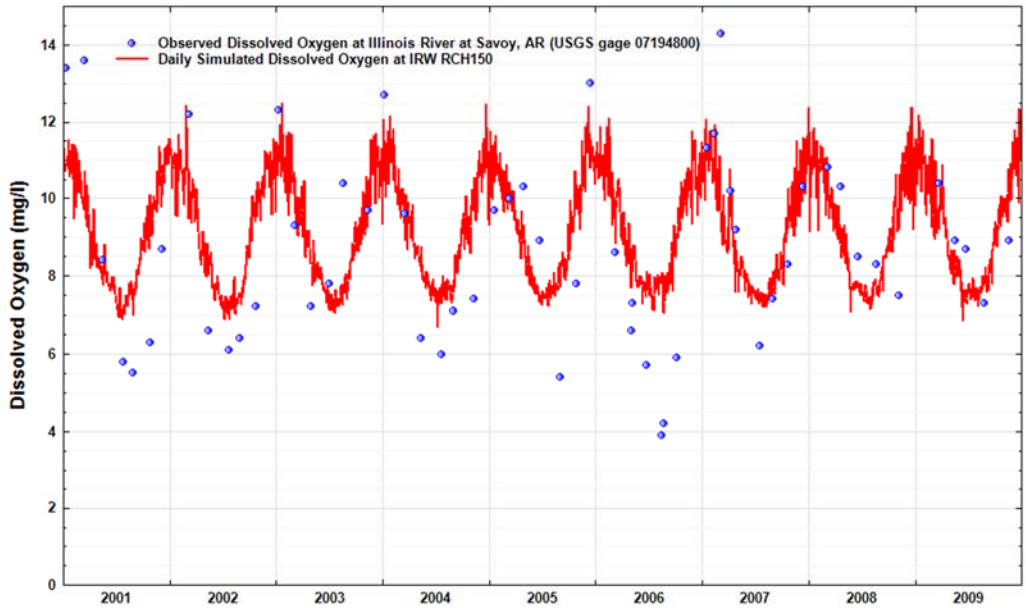
Land Uses		Pervious											Impervious		
Metric	Nonpoint Source Constituent	Forest	Pasture1	Pasture1 Litter	Pasture2	Pasture3	Grass/ Shrub/ Barren	Developed, Open	Developed, Low	Developed, Med/High	Wetlands	Cropland	Developed, Open	Developed, Low	Developed, Med/High
MetSeg 640	BOD	1.65	10.897	13.519	11.532	11.531	5.101	6.343	7.836	10.235	1.434	25.399	9.596	13.701	15.757
	NO3	2.282	6.443	2.145	6.365	6.344	5.014	7.044	8.039	9.156	1.979	14.849	2.177	3.483	3.919
	NH3	0.133	0.455	0.372	0.485	0.505	0.395	0.502	0.502	0.504	0.083	0.641	0.469	0.742	0.839
	LabileOrgN	0.087	0.577	0.716	0.611	0.61	0.27	0.336	0.415	0.542	0.076	1.345	0.508	0.725	0.834
	RefractoryOrgN	0.198	0.865	1.074	0.916	0.916	0.612	0.761	0.94	1.228	0.172	3.048	1.152	1.644	1.891
	TN	2.7	8.34	4.307	8.377	8.375	6.291	8.643	9.896	11.43	2.31	19.883	4.306	6.594	7.483
	PO4	0.024	0.458	1.928	0.496	0.517	0.234	0.131	0.166	0.2	0.009	0.782	0.254	0.364	0.401
	LabileOrgP	0.012	0.08	0.099	0.084	0.084	0.037	0.046	0.057	0.075	0.011	0.186	0.07	0.1	0.115
	RefractoryOrgP	0.019	0.218	0.262	0.231	0.231	0.059	0.073	0.09	0.118	0.016	0.292	0.11	0.158	0.181
	TP	0.055	0.756	2.289	0.811	0.832	0.33	0.25	0.313	0.393	0.036	1.26	0.434	0.622	0.697
MetSeg 660	BOD	4.863	33.123	60.406	33.478	34.559	9.677	10.707	13.475	17.753	3.696	46.715	10.714	15.303	17.6
	NO3	6.882	12.418	4.591	12.264	12.123	9.294	12.094	13.846	15.851	5.235	27.017	2.541	4.065	4.573
	NH3	0.397	1.377	1.095	1.434	1.42	0.907	1.105	1.112	1.112	0.225	1.44	0.511	0.809	0.915
	LabileOrgN	0.257	1.754	3.198	1.773	1.83	0.512	0.567	0.713	0.94	0.196	2.473	0.567	0.81	0.932
	RefractoryOrgN	0.584	2.631	4.797	2.659	2.745	1.161	1.285	1.617	2.13	0.444	5.606	1.286	1.836	2.112
	TN	8.12	18.18	13.681	18.13	18.118	11.874	15.051	17.288	20.033	6.1	36.536	4.905	7.52	8.532
	PO4	0.063	1.262	6.641	1.252	1.277	0.593	0.26	0.334	0.395	0.024	1.455	0.301	0.432	0.477
	LabileOrgP	0.036	0.243	0.443	0.245	0.253	0.071	0.078	0.099	0.13	0.027	0.342	0.078	0.112	0.129
	RefractoryOrgP	0.056	0.674	1.158	0.679	0.702	0.111	0.123	0.155	0.204	0.043	0.537	0.123	0.176	0.202
	TP	0.155	2.179	8.242	2.176	2.232	0.775	0.461	0.588	0.729	0.094	2.334	0.502	0.72	0.808
MetSeg 80	BOD	3.064	23.054	33.12	25.045	20.423	7.299	8.531	11.222	14.802	2.523	31.249	10.33	14.754	16.97
	NO3	4.326	8.519	2.414	8.397	8.257	6.663	9.164	10.6	12.126	3.267	20.542	2.396	3.834	4.312
	NH3	0.198	0.625	0.486	0.645	0.672	0.616	0.811	0.802	0.801	0.081	0.827	0.497	0.788	0.89
	LabileOrgN	0.162	1.221	1.754	1.326	1.081	0.386	0.452	0.594	0.784	0.134	1.654	0.547	0.781	0.898
	RefractoryOrgN	0.368	1.831	2.63	1.989	1.622	0.876	1.024	1.347	1.776	0.303	3.75	1.24	1.771	2.036
	TN	5.054	12.196	7.284	12.357	11.632	8.541	11.451	13.343	15.487	3.785	26.773	4.68	7.174	8.136
	PO4	0.042	0.669	2.363	0.684	0.681	0.452	0.253	0.328	0.385	0.014	0.803	0.281	0.403	0.444
	LabileOrgP	0.022	0.169	0.243	0.183	0.15	0.053	0.062	0.082	0.108	0.018	0.229	0.076	0.108	0.124
	RefractoryOrgP	0.035	0.472	0.624	0.511	0.417	0.084	0.098	0.129	0.17	0.029	0.359	0.119	0.17	0.195
	TP	0.099	1.31	3.23	1.378	1.248	0.589	0.413	0.539	0.663	0.061	1.391	0.476	0.681	0.763

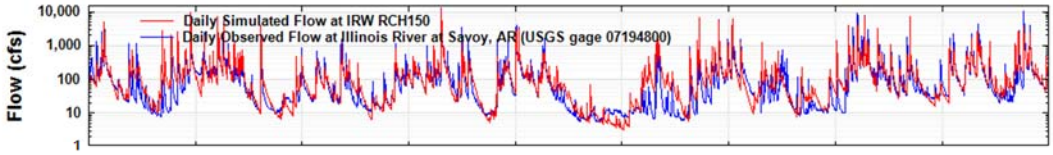
APPENDIX E
WATER QUALITY RESULTS

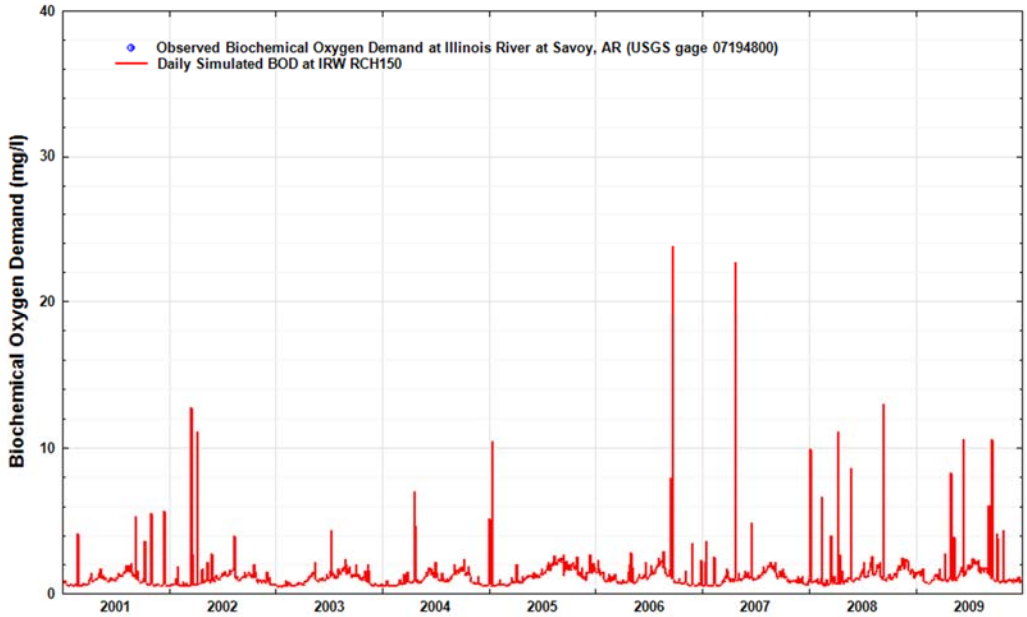
E.1 RCH150 – Illinois River at Savoy, AR EE-2
E.2 RCH316 – Osage Creek near Elm Springs, AR EE-7
E.3 RCH516 – Sager Creek near West Siloam Springs, OK EE-12
E.4 RCH523 – Flint Creek near Kansas, OK EE-17
E.5 RCH609 – Ballard Creek at CR 76 Bridge EE-22
E.6 RCH630 – Illinois River South of Siloam Springs, AR EE-25
E.7 RCH640 – Illinois River near Watts, OK EE-30
E.8 RCH706 – Baron Fork at Dutch Mills, AR EE-35
E.9 RCH746 – Baron Fork at Eldon, OK EE-40
E.10 RCH870 – Illinois River near Tahlequah, OK EE-45
E.11 RCH912 – Caney Creek near Barber, OK EE-50

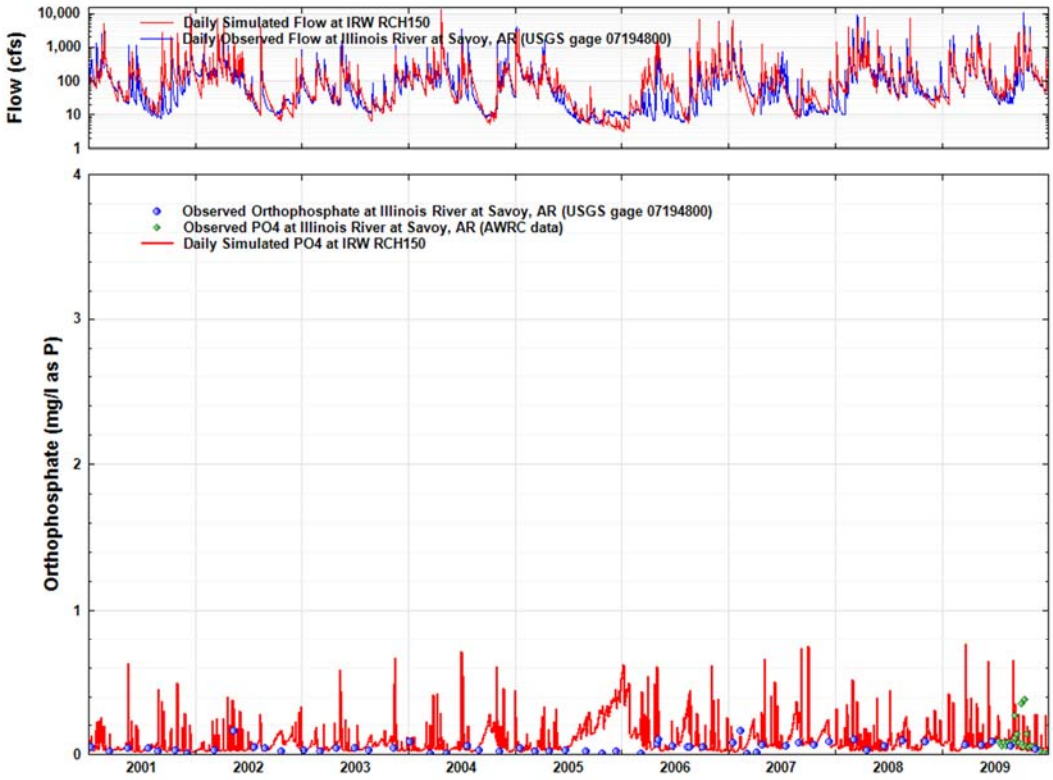
E.1 RCH150 – ILLINOIS RIVER AT SAVOY, AR

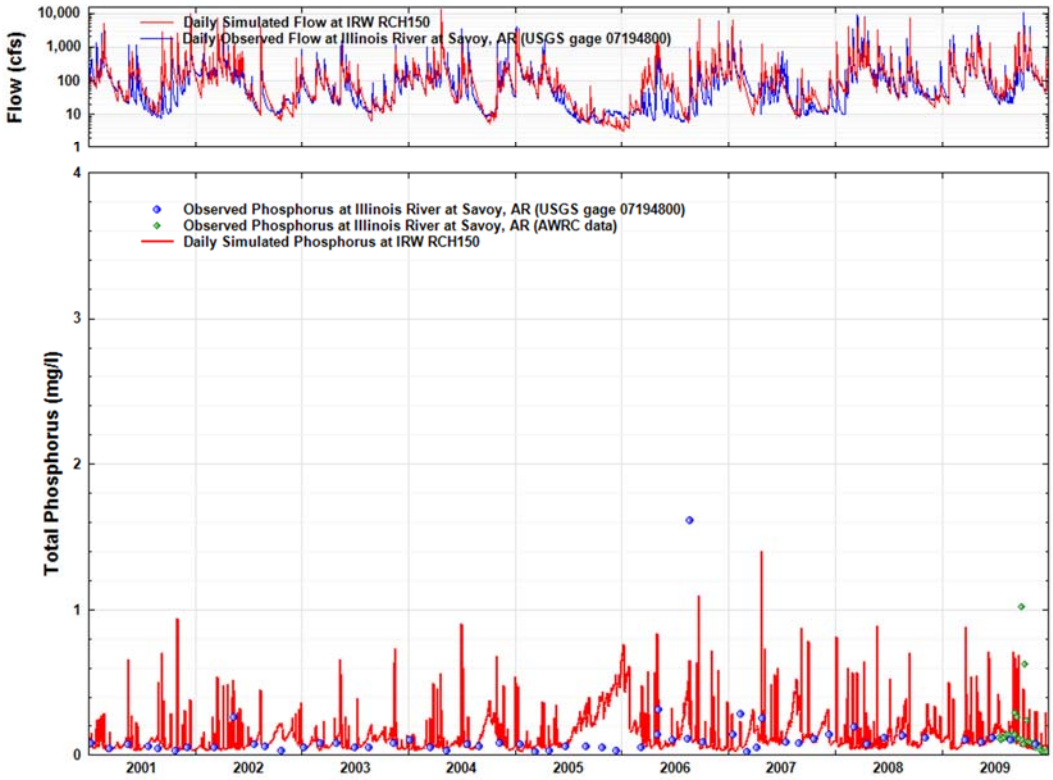


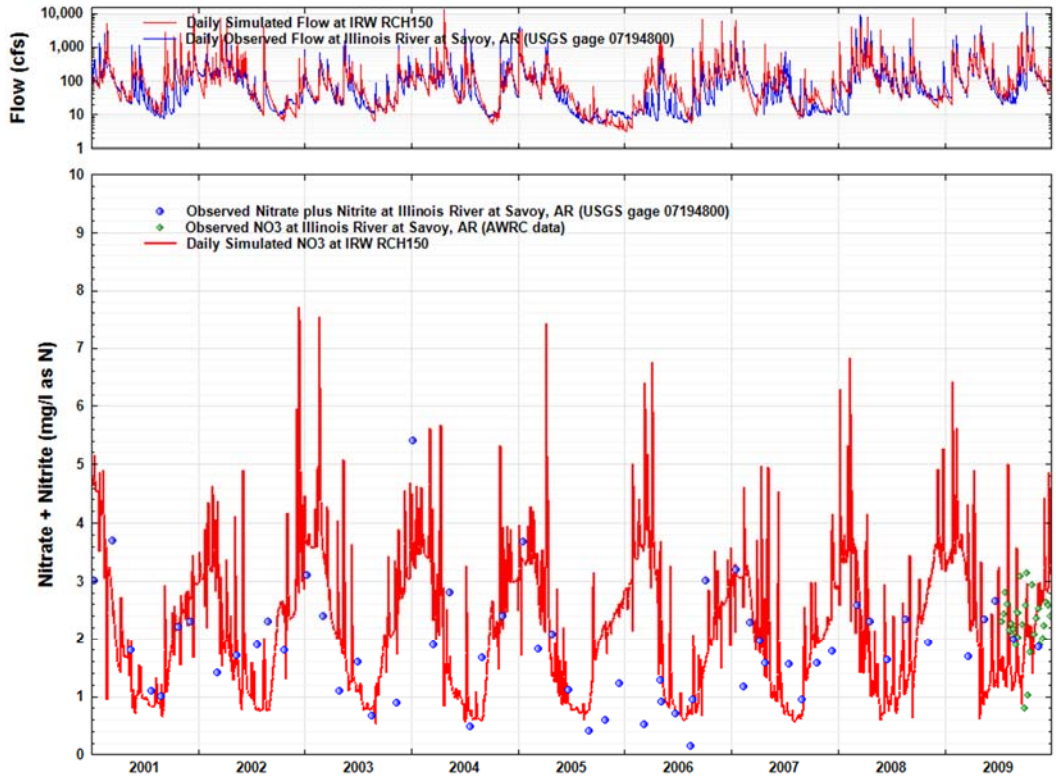


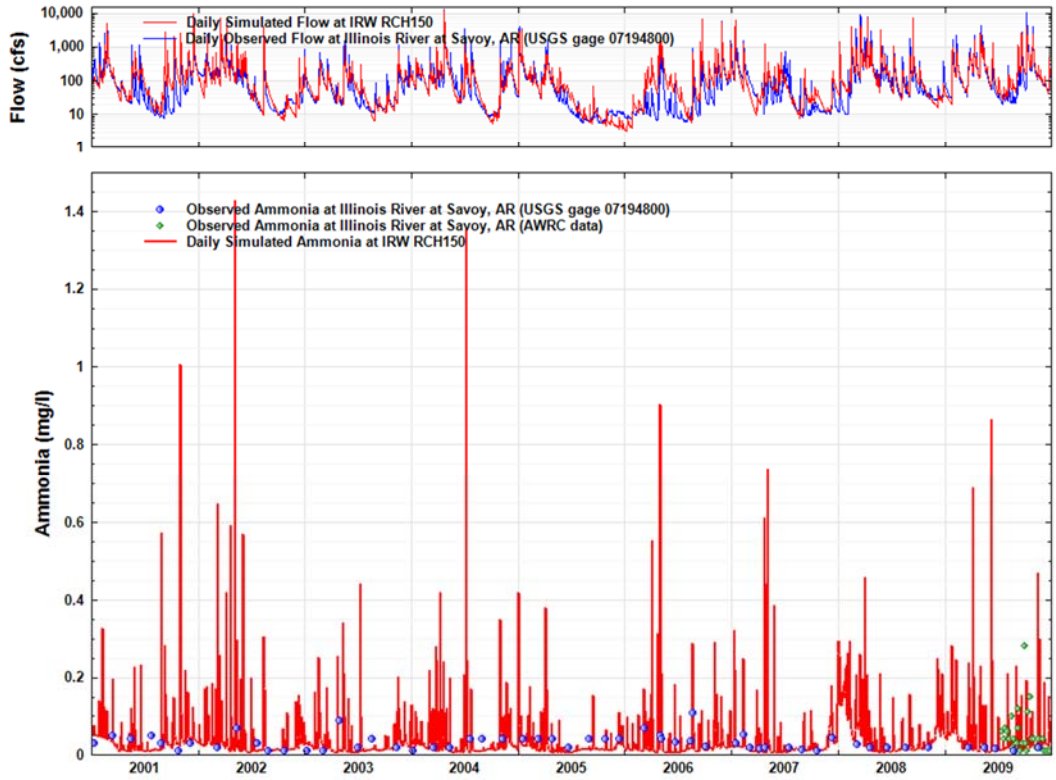


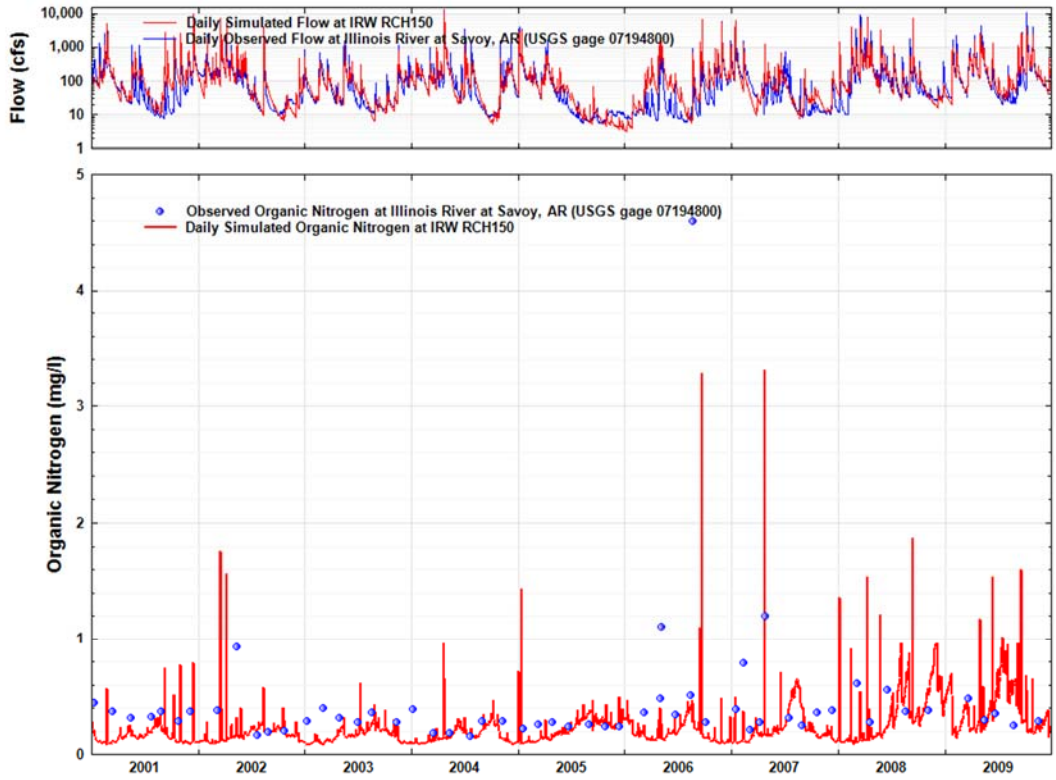


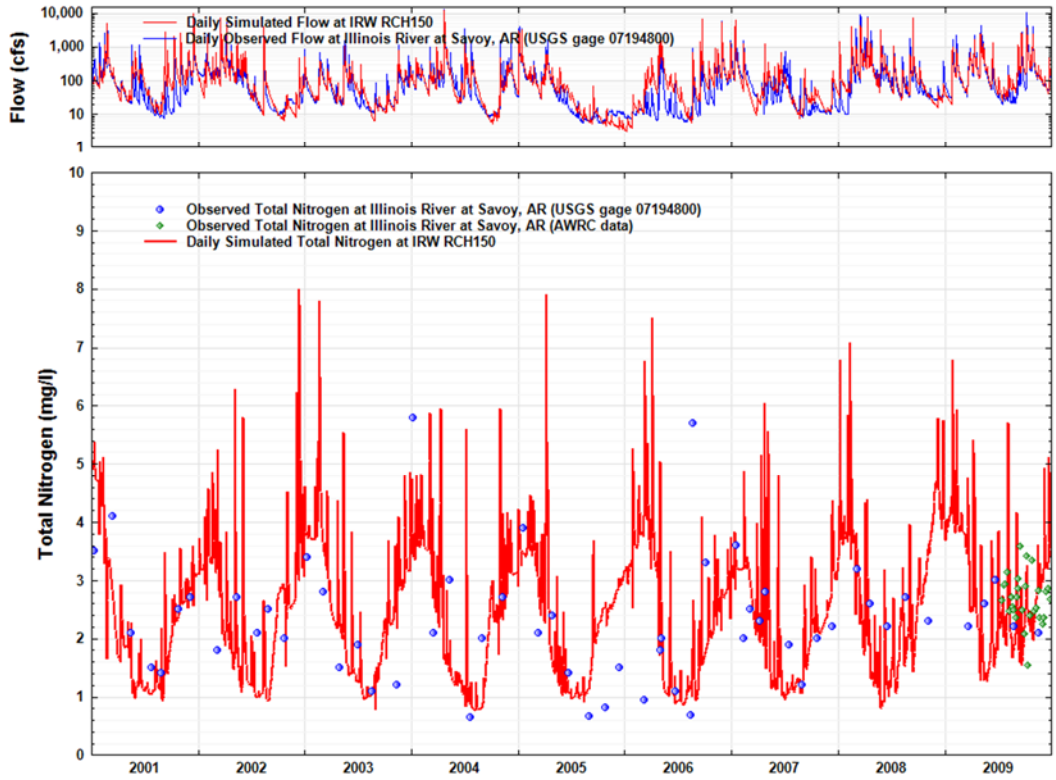

Daily Simulated Flow at IRW RCH150
Daily Observed Flow at Illinois River at Savoy, AR (USGS gage 07194800)
Flow (cfs)
10,000
1,000
100
10
1
Observed Orthophosphate at Illinois River at Savoy, AR (USGS gage 07194800)
Observed PO4 at Illinois River at Savoy, AR (AWRC data)
Daily Simulated PO4 at IRW RCH150
Orthophosphate (mg/l as P)
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

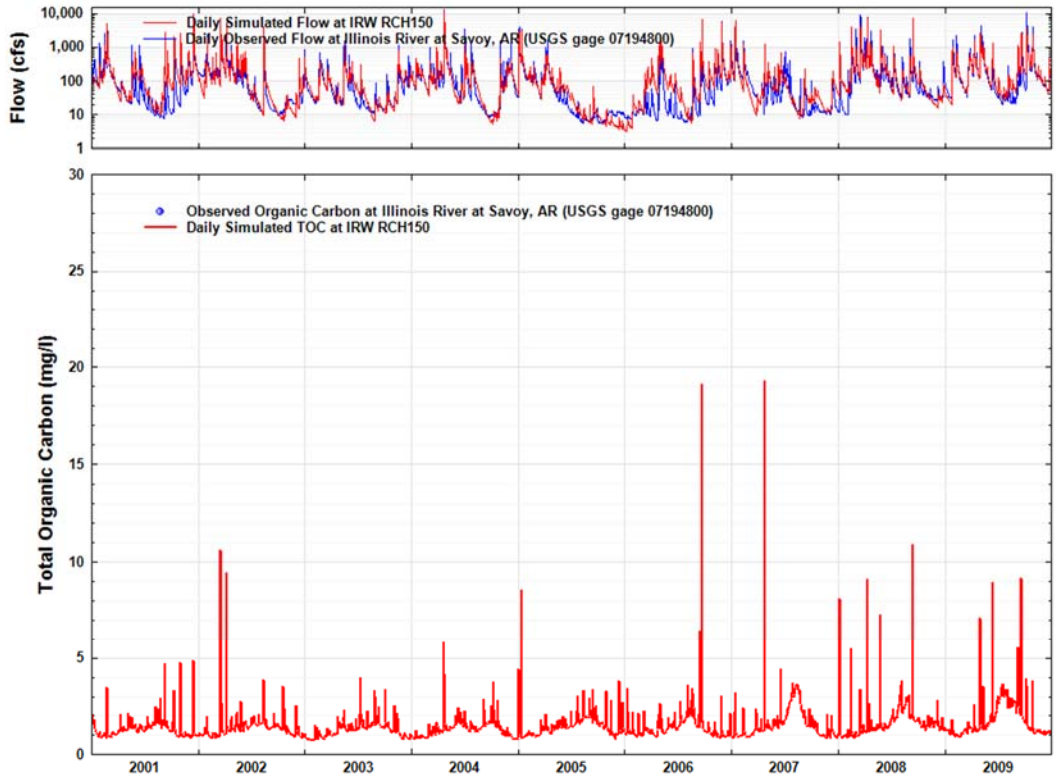

Daily Simulated Flow at IRW RCH150
Daily Observed Flow at Illinois River at Savoy, AR (USGS gage 07194800)
Flow (cfs)
10,000
1,000
100
10
1
Observed Phosphorus at Illinois River at Savoy, AR (USGS gage 07194800)
Observed Phosphorus at Illinois River at Savoy, AR (AWRC data)
Daily Simulated Phosphorus at IRW RCH150
Total Phosphorus (mg/l)
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

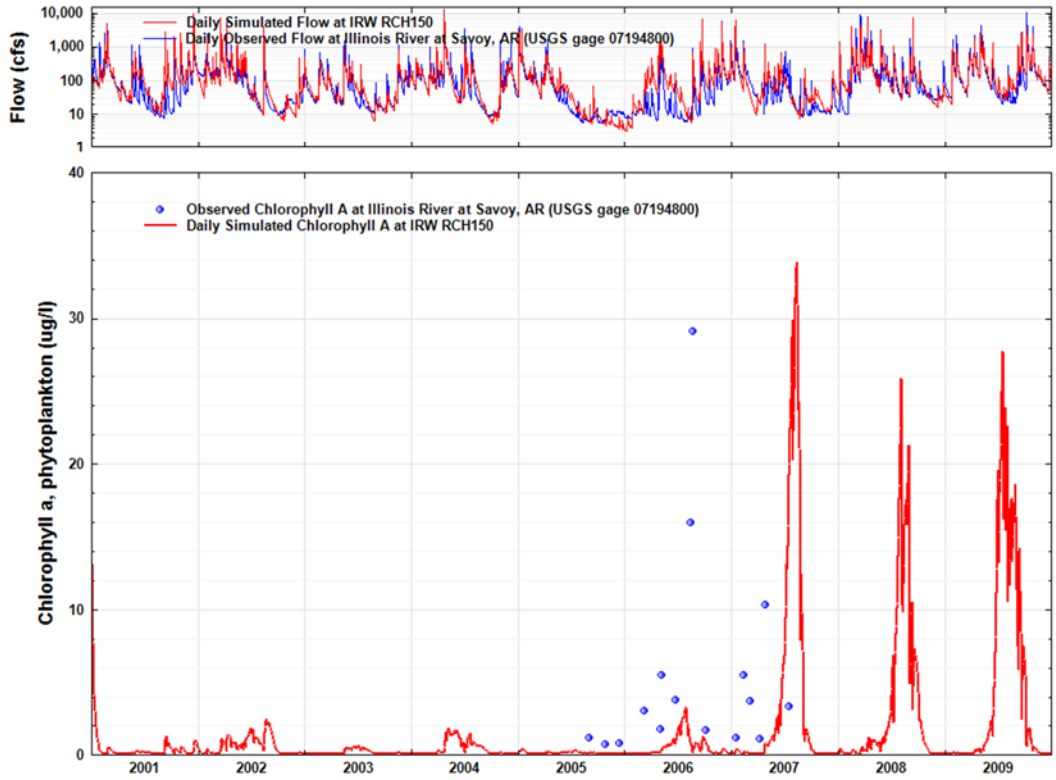

Daily Simulated Flow at IRW RCH150
Daily Observed Flow at Illinois River at Savoy, AR (USGS gage 07194800)
Flow (cfs)
10,000
1,000
100
10
1
Observed Nitrate plus Nitrite at Illinois River at Savoy, AR (USGS gage 07194800)
Observed NO3 at Illinois River at Savoy, AR (AWRC data)
Daily Simulated NO3 at IRW RCH150
Nitrate + Nitrite (mg/l as N)
10
9
8
7
6
5
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009


Daily Simulated Flow at IRW RCH150
Daily Observed Flow at Illinois River at Savoy, AR (USGS gage 07194800)
Flow (cfs)
10,000
1,000
100
10
1
Observed Ammonia at Illinois River at Savoy, AR (USGS gage 07194800)
Observed Ammonia at Illinois River at Savoy, AR (AWRC data)
Daily Simulated Ammonia at IRW RCH150
Ammonia (mg/l)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

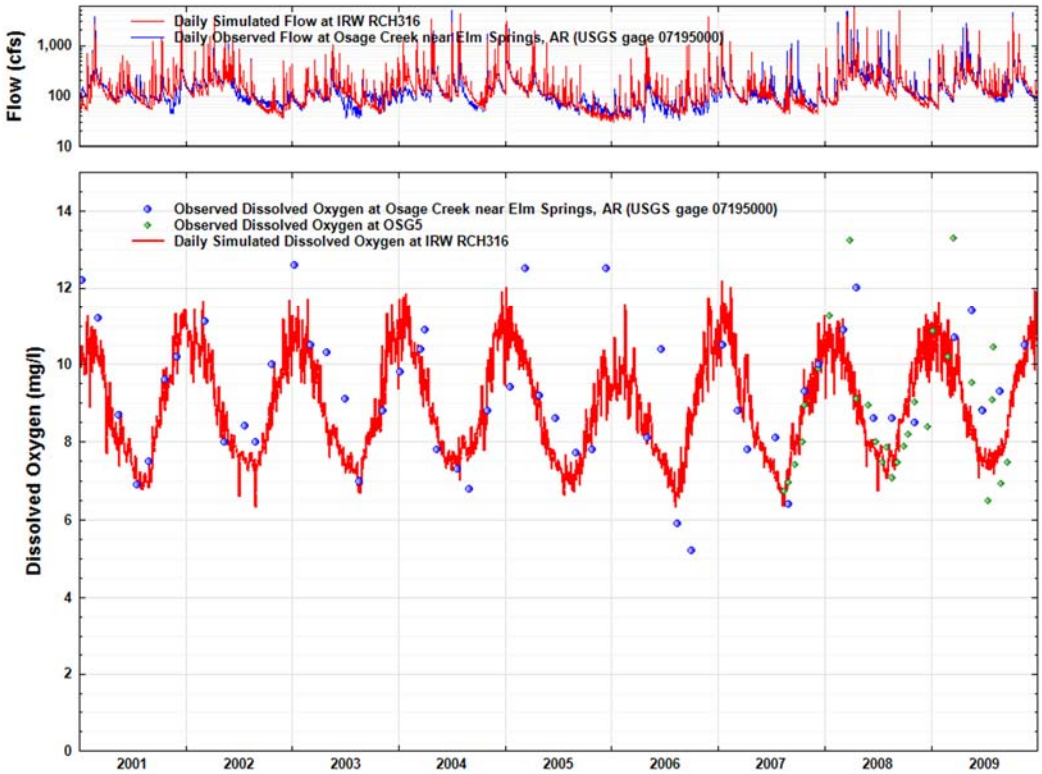

Daily Simulated Flow at IRW RCH150
Daily Observed Flow at Illinois River at Savoy, AR (USGS gage 07194800)
Flow (cfs)
10,000
1,000
100
10
1
Observed Organic Nitrogen at Illinois River at Savoy, AR (USGS gage 07194800)
Daily Simulated Organic Nitrogen at IRW RCH150
Organic Nitrogen (mg/l)
5
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

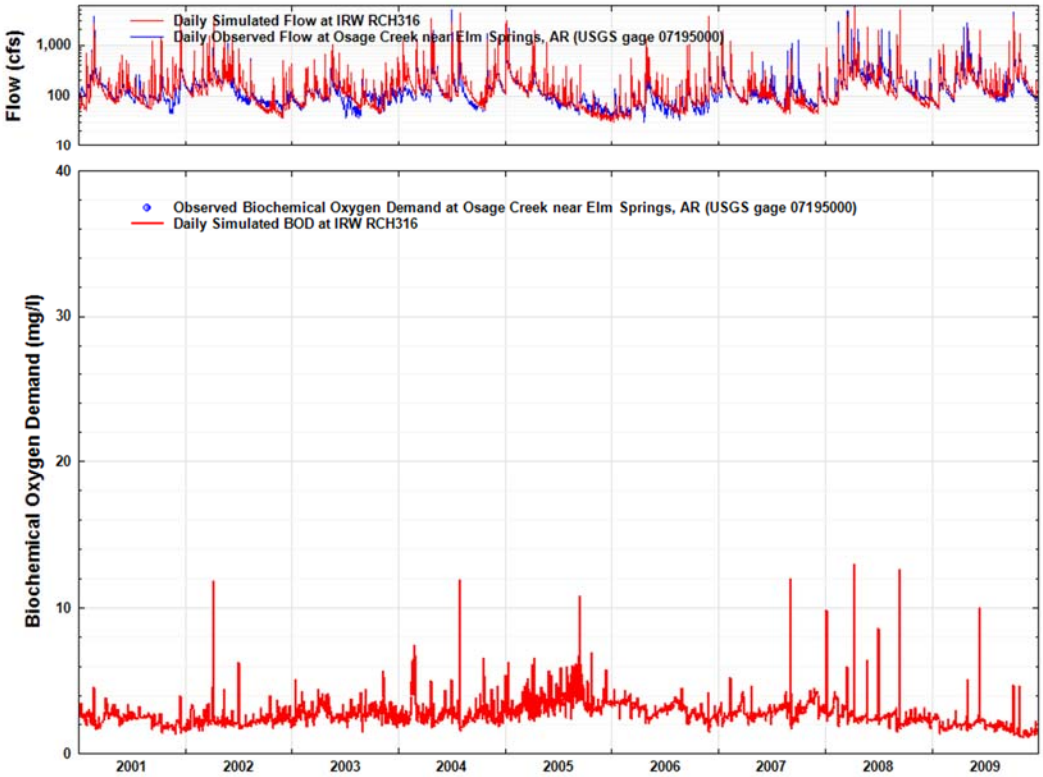

Daily Simulated Flow at IRW RCH150
Daily Observed Flow at Illinois River at Savoy, AR (USGS gage 07194800)
Flow (cfs)
10,000
1,000
100
10
1
Observed Total Nitrogen at Illinois River at Savoy, AR (USGS gage 07194800)
Observed Total Nitrogen at Illinois River at Savoy, AR (AWRC data)
Daily Simulated Total Nitrogen at IRW RCH150
Total Nitrogen (mg/l)
10
9
8
7
6
5
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

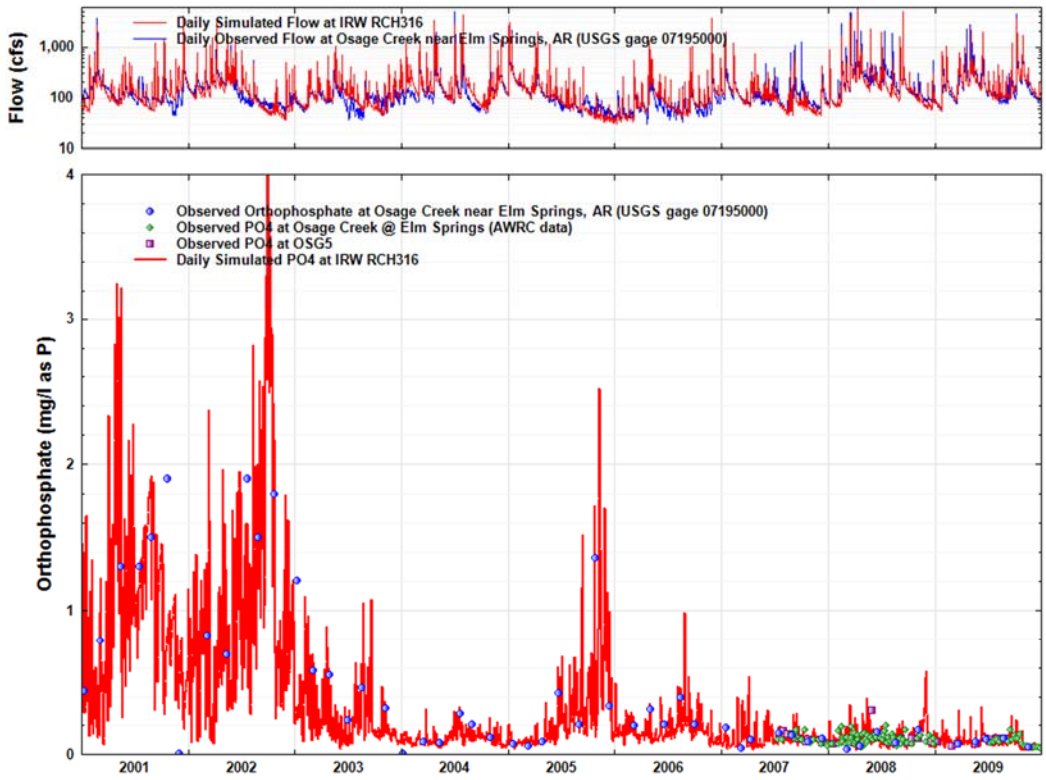

Flow (cfs)
Daily Simulated Flow at IRW RCH150
Daily Observed Flow at Illinois River at Savoy, AR (USGS gage 07194800)
Total Organic Carbon (mg/l)
Observed Organic Carbon at Illinois River at Savoy, AR (USGS gage 07194800)
Daily Simulated TOC at IRW RCH150
2001
2002
2003
2004
2005
2006
2007
2008
2009

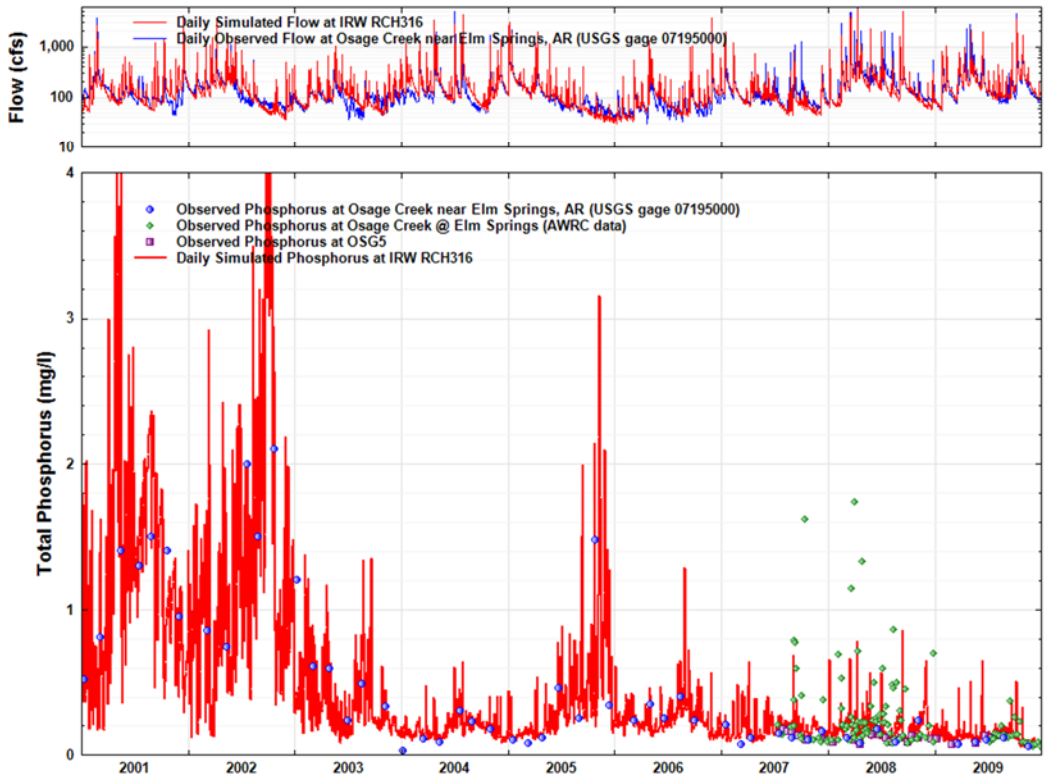

Flow (cfs)
Daily Simulated Flow at IRW RCH150
Daily Observed Flow at Illinois River at Savoy, AR (USGS gage 07194800)
Chlorophyll a, phytoplankton (ug/l)
Observed Chlorophyll A at Illinois River at Savoy, AR (USGS gage 07194800)
Daily Simulated Chlorophyll A at IRW RCH150
2001
2002
2003
2004
2005
2006
2007
2008
2009

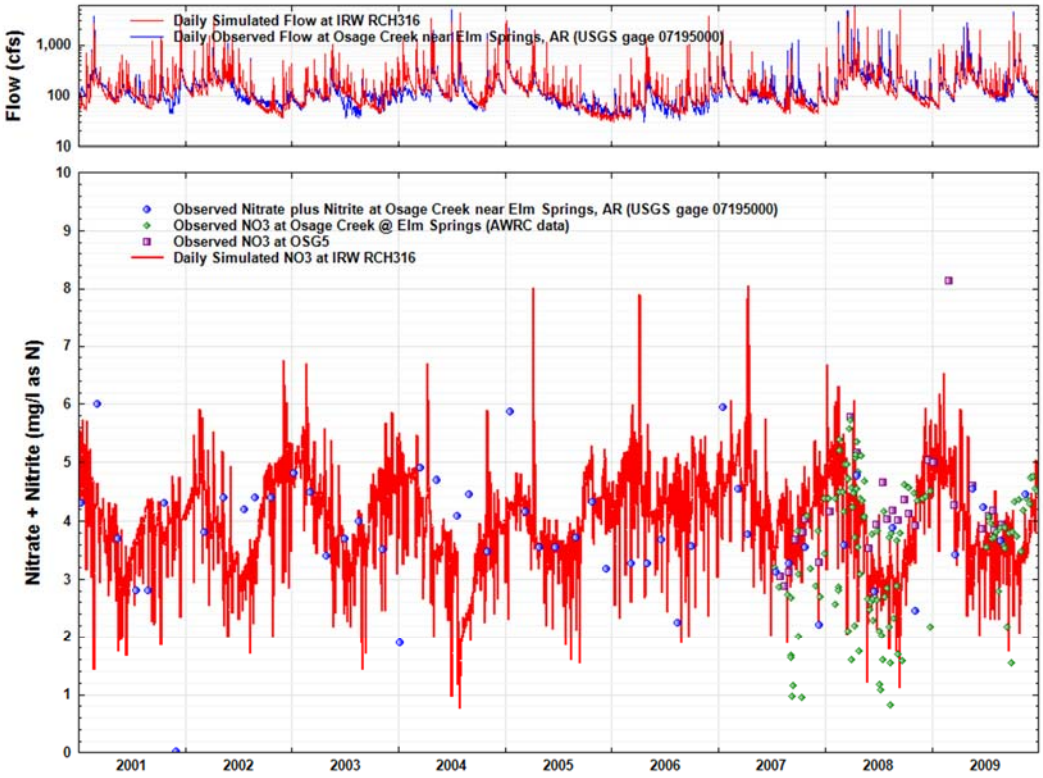
E.2 RCH316 – OSAGE CREEK NEAR ELM SPRINGS, AR

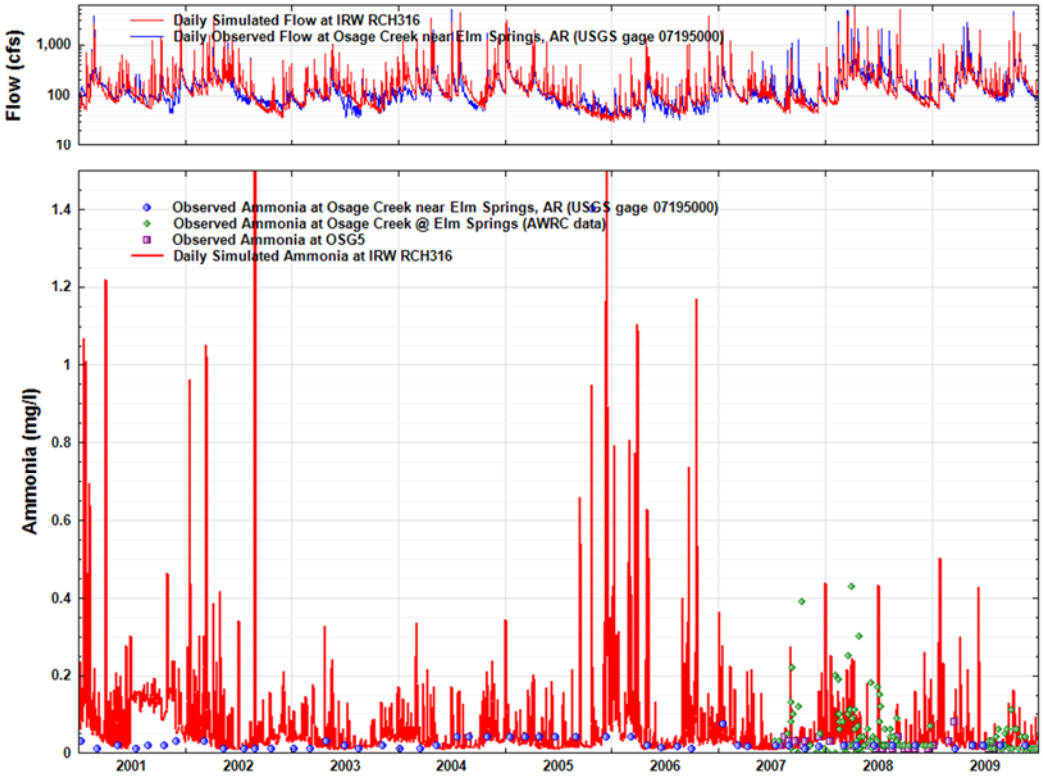


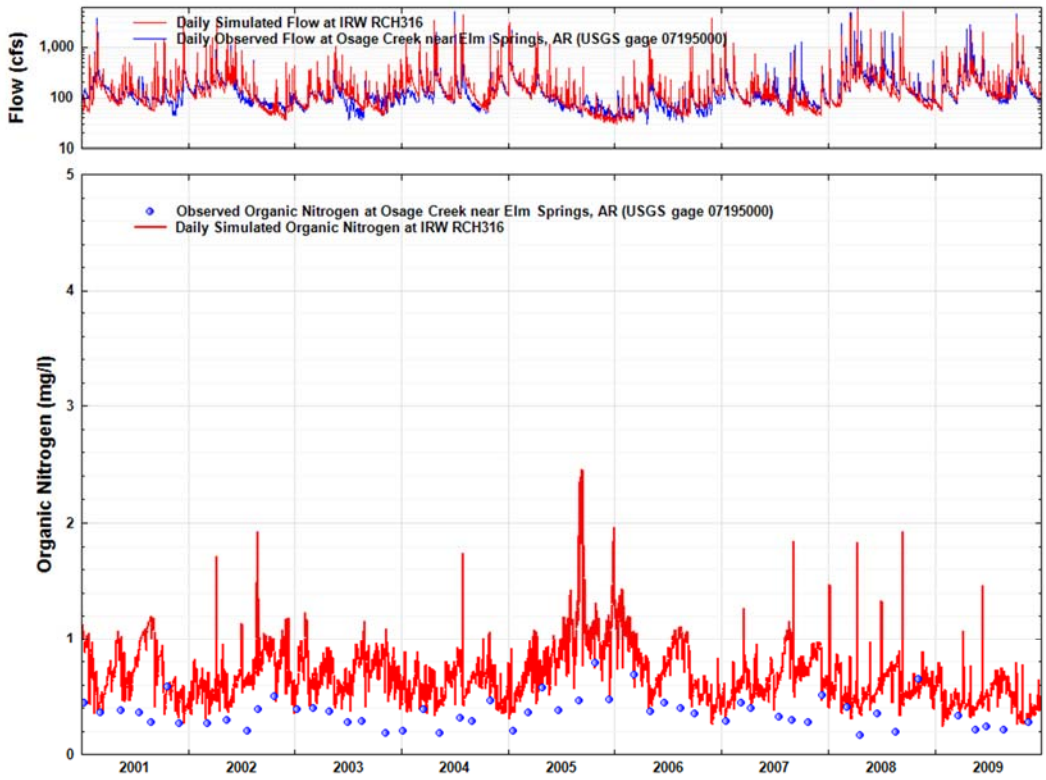


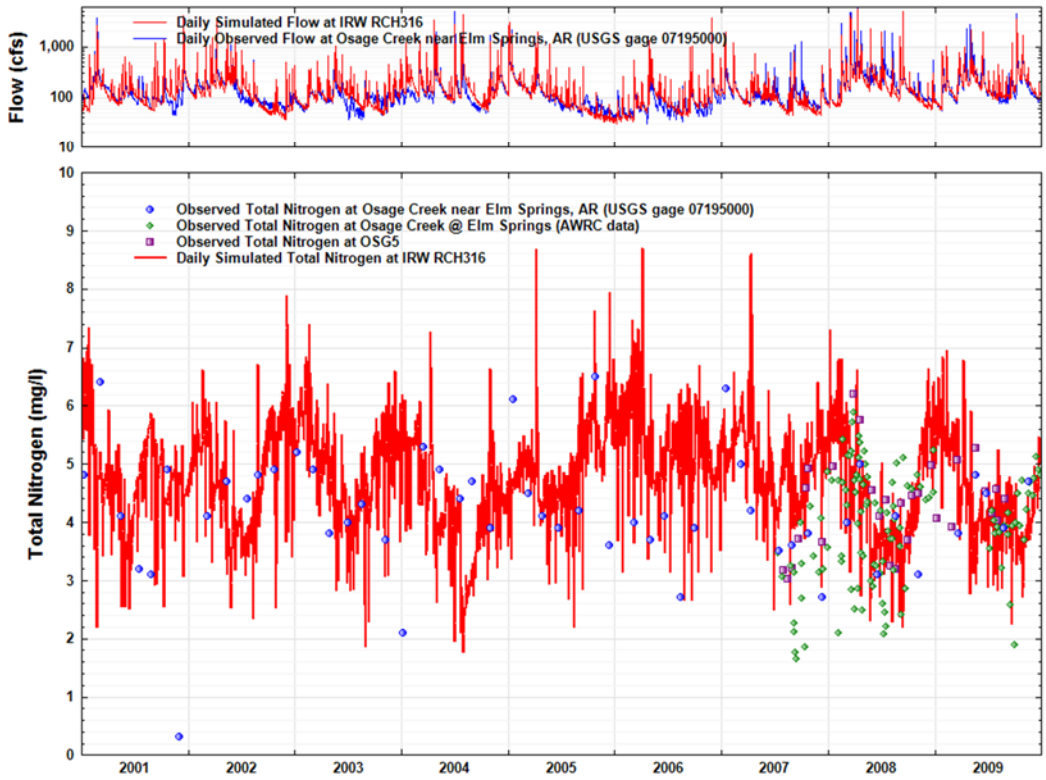

Daily Simulated Flow at IRW RCH316
Daily Observed Flow at Osage Creek near Elm Springs, AR (USGS gage 07195000)
Flow (cfs)
1,000
100
10
Observed Orthophosphate at Osage Creek near Elm Springs, AR (USGS gage 07195000)
Observed PO4 at Osage Creek @ Elm Springs (AWRC data)
Observed PO4 at OSG5
Daily Simulated PO4 at IRW RCH316
Orthophosphate (mg/l as P)
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

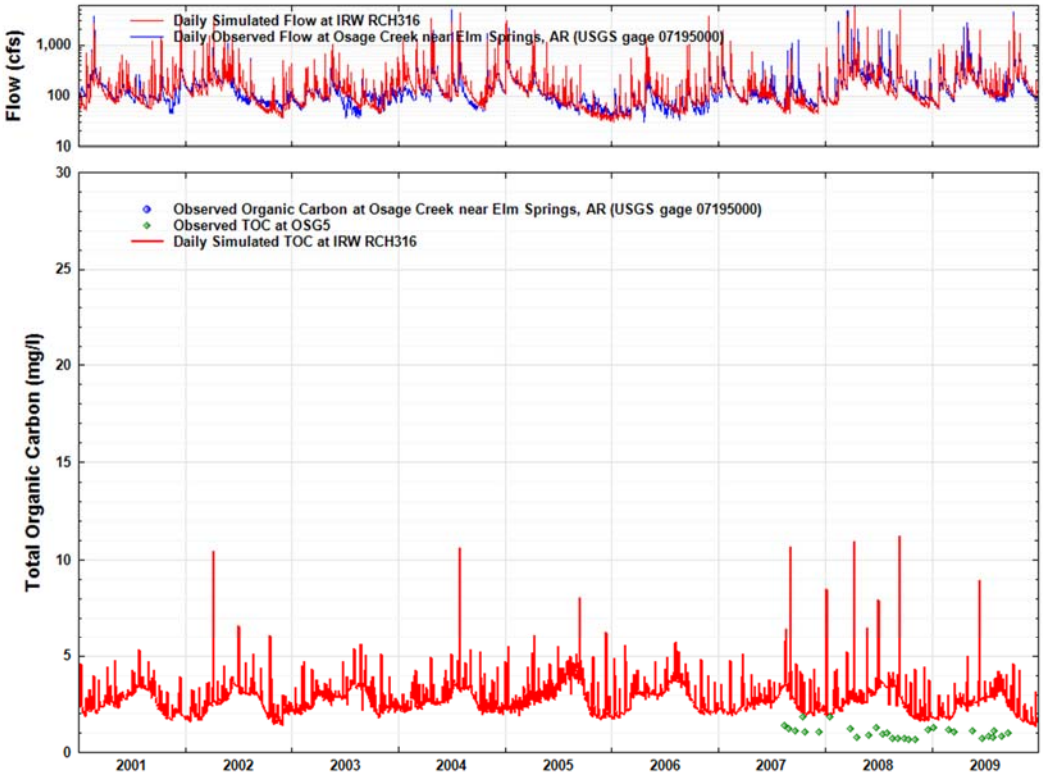

Daily Simulated Flow at IRW RCH316
Daily Observed Flow at Osage Creek near Elm Springs, AR (USGS gage 07195000)
Flow (cfs)
1,000
100
10
Observed Phosphorus at Osage Creek near Elm Springs, AR (USGS gage 07195000)
Observed Phosphorus at Osage Creek @ Elm Springs (AWRC data)
Observed Phosphorus at OSG5
Daily Simulated Phosphorus at IRW RCH316
Total Phosphorus (mg/l)
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

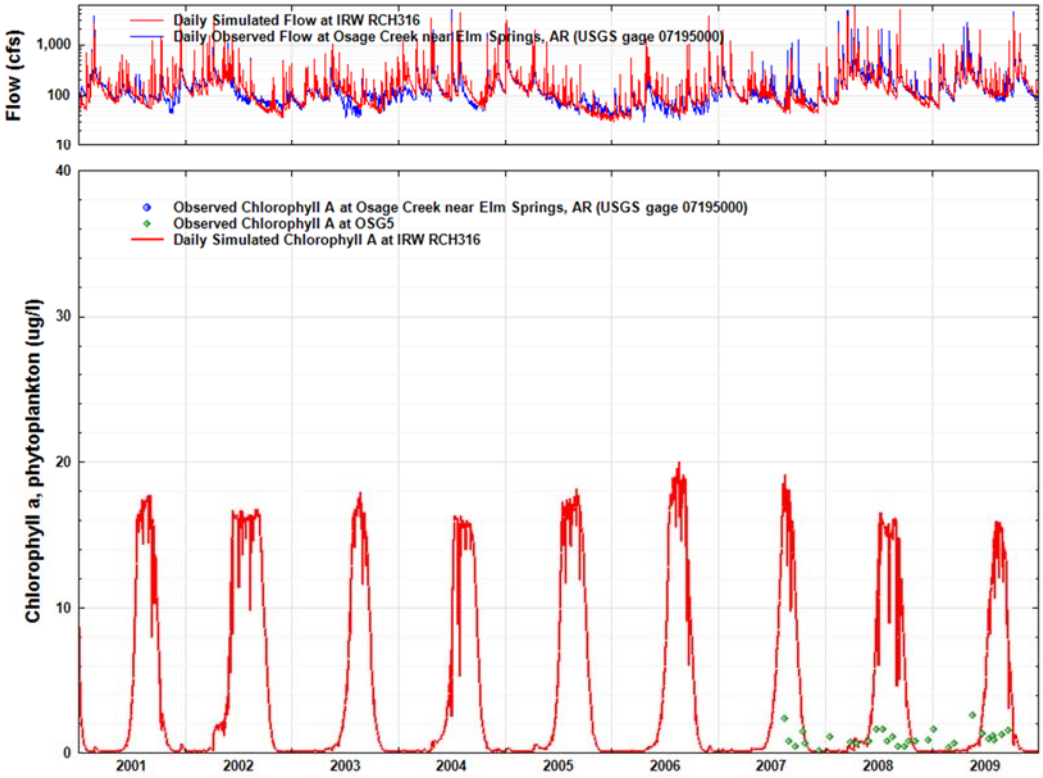

Daily Simulated Flow at IRW RCH316
Daily Observed Flow at Osage Creek near Elm Springs, AR (USGS gage 07195000)
Flow (cfs)
Observed Nitrate plus Nitrite at Osage Creek near Elm Springs, AR (USGS gage 07195000)
Observed NO3 at Osage Creek @ Elm Springs (AWRC data)
Observed NO3 at OSG5
Daily Simulated NO3 at IRW RCH316
Nitrate + Nitrite (mg/l as N)
2001
2002
2003
2004
2005
2006
2007
2008
2009


Daily Simulated Flow at IRW RCH316
Daily Observed Flow at Osage Creek near Elm Springs, AR (USGS gage 07195000)
Flow (cfs)
Observed Ammonia at Osage Creek near Elm Springs, AR (USGS gage 07195000)
Observed Ammonia at Osage Creek @ Elm Springs (AWRC data)
Observed Ammonia at OSG5
Daily Simulated Ammonia at IRW RCH316
Ammonia (mg/l)
2001
2002
2003
2004
2005
2006
2007
2008
2009

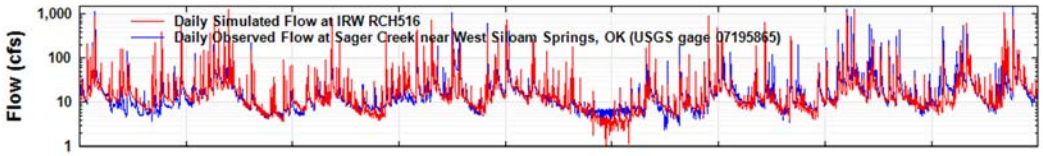

Daily Simulated Flow at IRW RCH316
Daily Observed Flow at Osage Creek near Elm Springs, AR (USGS gage 07195000)
Flow (cfs)
1,000
100
10
Observed Organic Nitrogen at Osage Creek near Elm Springs, AR (USGS gage 07195000)
Daily Simulated Organic Nitrogen at IRW RCH316
Organic Nitrogen (mg/l)
0
1
2
3
4
5
2001
2002
2003
2004
2005
2006
2007
2008
2009

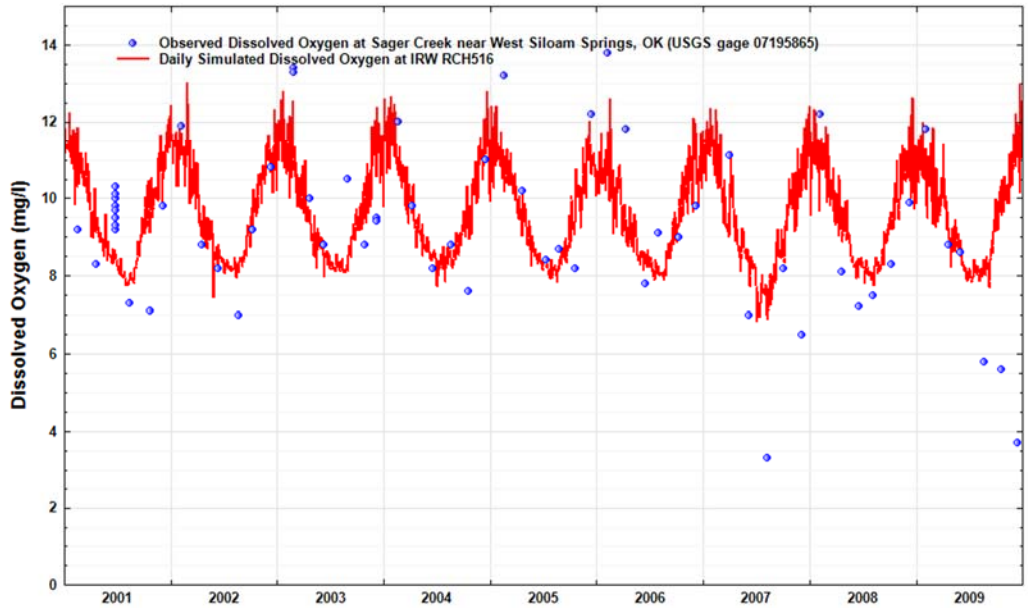

Daily Simulated Flow at IRW RCH316
Daily Observed Flow at Osage Creek near Elm Springs, AR (USGS gage 07195000)
Flow (cfs)
1,000
100
10
Observed Total Nitrogen at Osage Creek near Elm Springs, AR (USGS gage 07195000)
Observed Total Nitrogen at Osage Creek @ Elm Springs (AWRC data)
Observed Total Nitrogen at OSG5
Daily Simulated Total Nitrogen at IRW RCH316
Total Nitrogen (mg/l)
0
1
2
3
4
5
6
7
8
9
10
2001
2002
2003
2004
2005
2006
2007
2008
2009

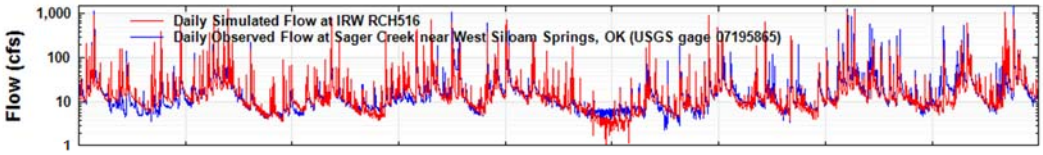

Daily Simulated Flow at IRW RCH316
Daily Observed Flow at Osage Creek near Elm Springs, AR (USGS gage 07195000)
Flow (cfs)
1,000
100
10
Observed Organic Carbon at Osage Creek near Elm Springs, AR (USGS gage 07195000)
Observed TOC at OSG5
Daily Simulated TOC at IRW RCH316
Total Organic Carbon (mg/l)
30
25
20
15
10
5
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

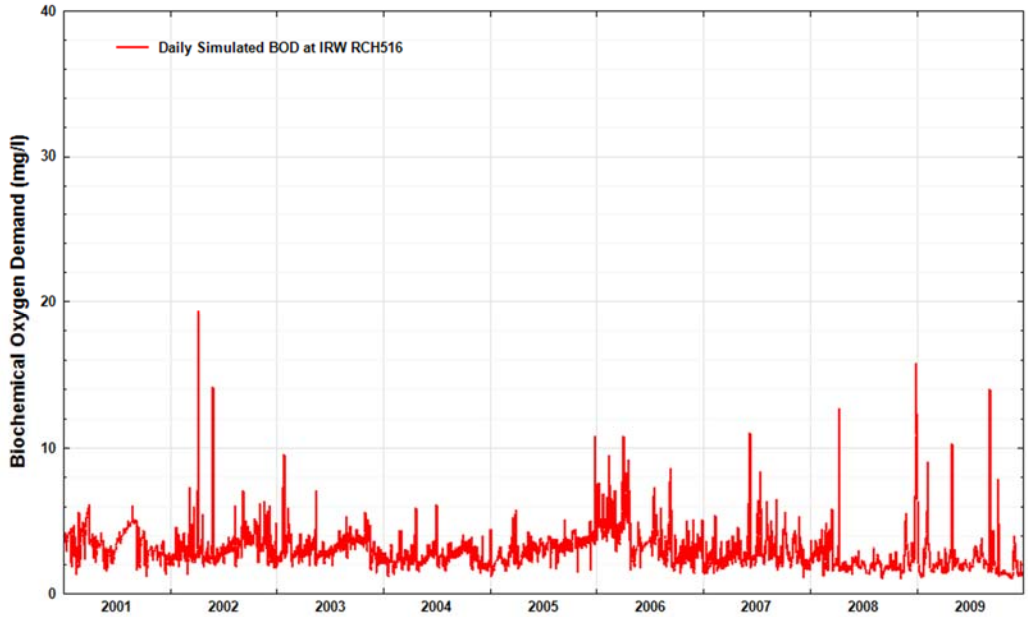

Daily Simulated Flow at IRW RCH316
Daily Observed Flow at Osage Creek near Elm Springs, AR (USGS gage 07195000)
Flow (cfs)
1,000
100
10
Observed Chlorophyll A at Osage Creek near Elm Springs, AR (USGS gage 07195000)
Observed Chlorophyll A at OSG5
Daily Simulated Chlorophyll A at IRW RCH316
Chlorophyll a, phytoplankton (ug/l)
40
30
20
10
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

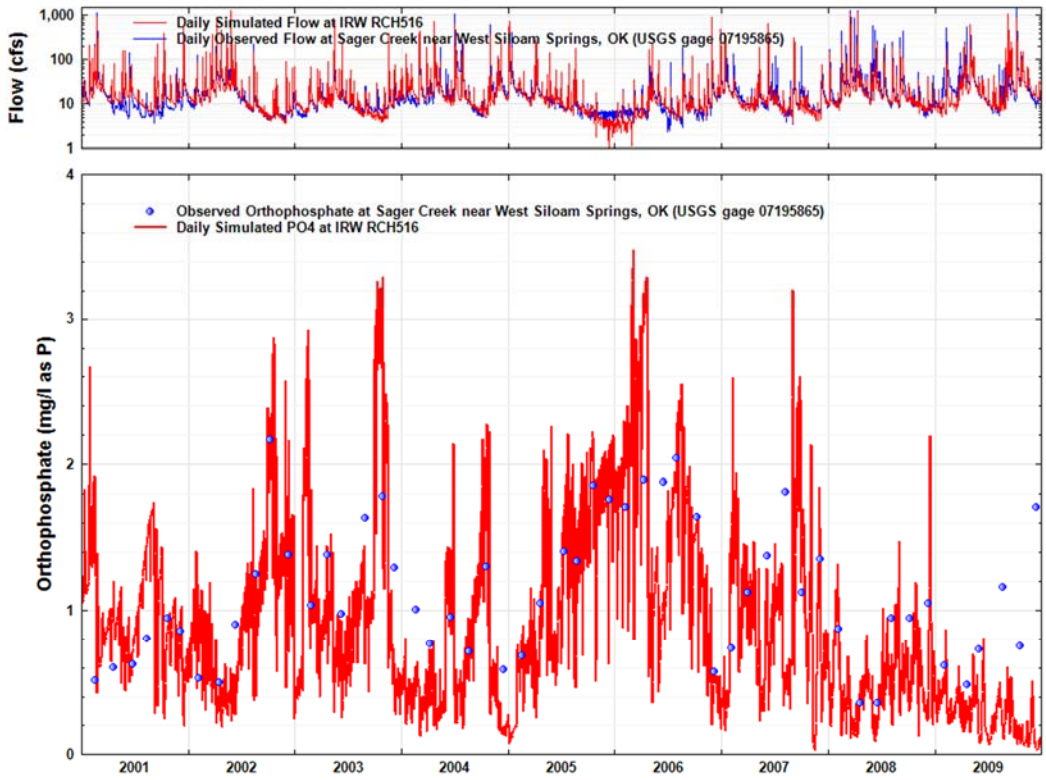
E.3 RCH516 – SAGER CREEK NEAR WEST SILOAM SPRINGS, OK

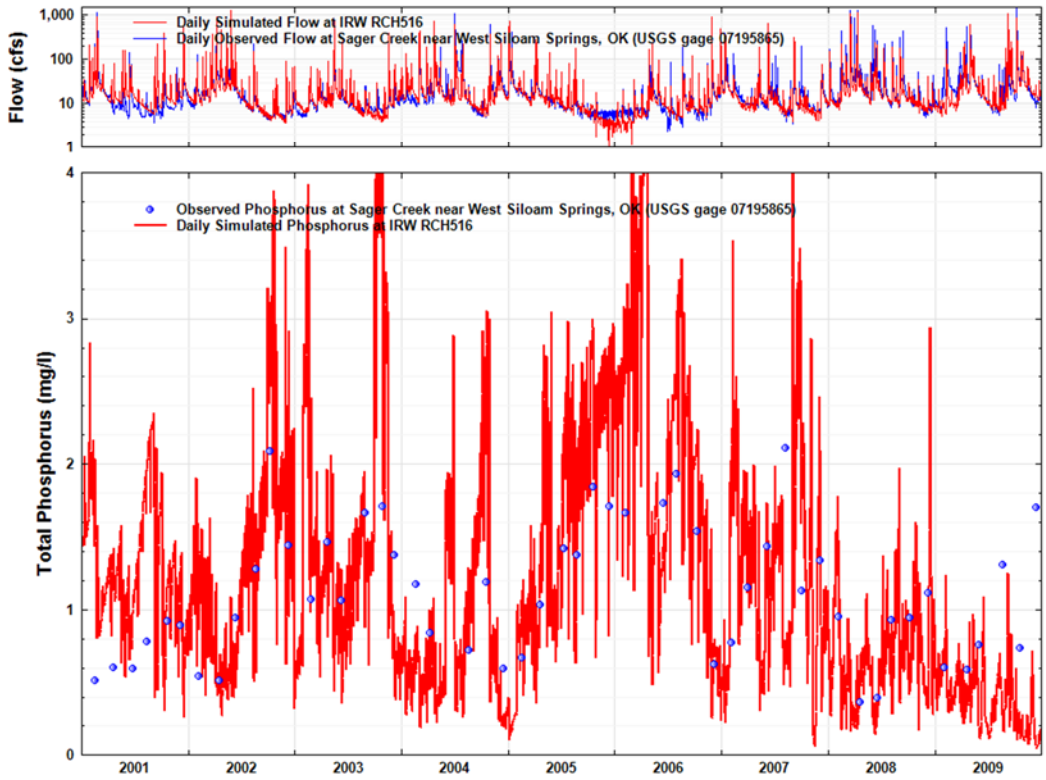


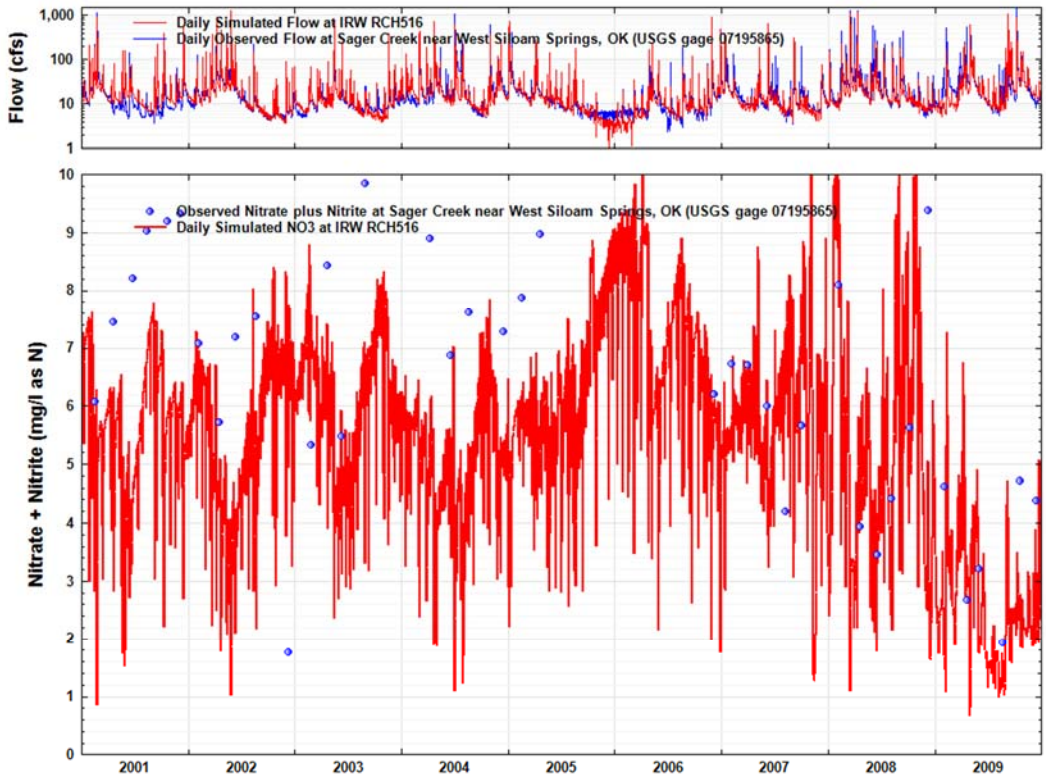


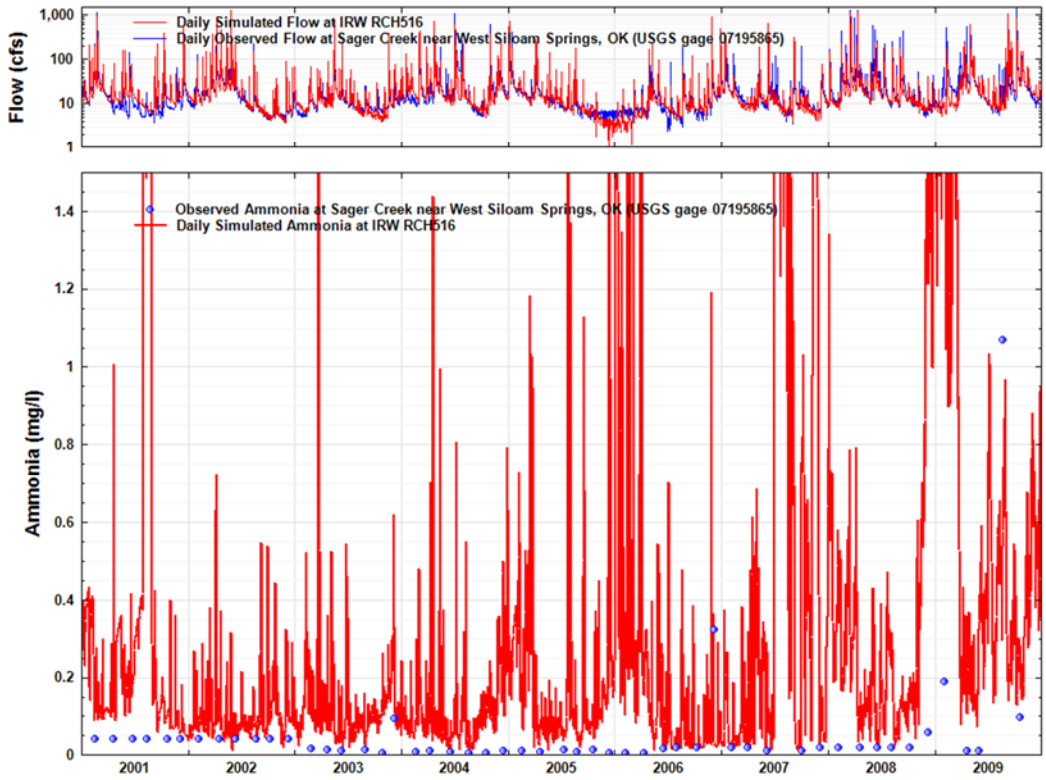


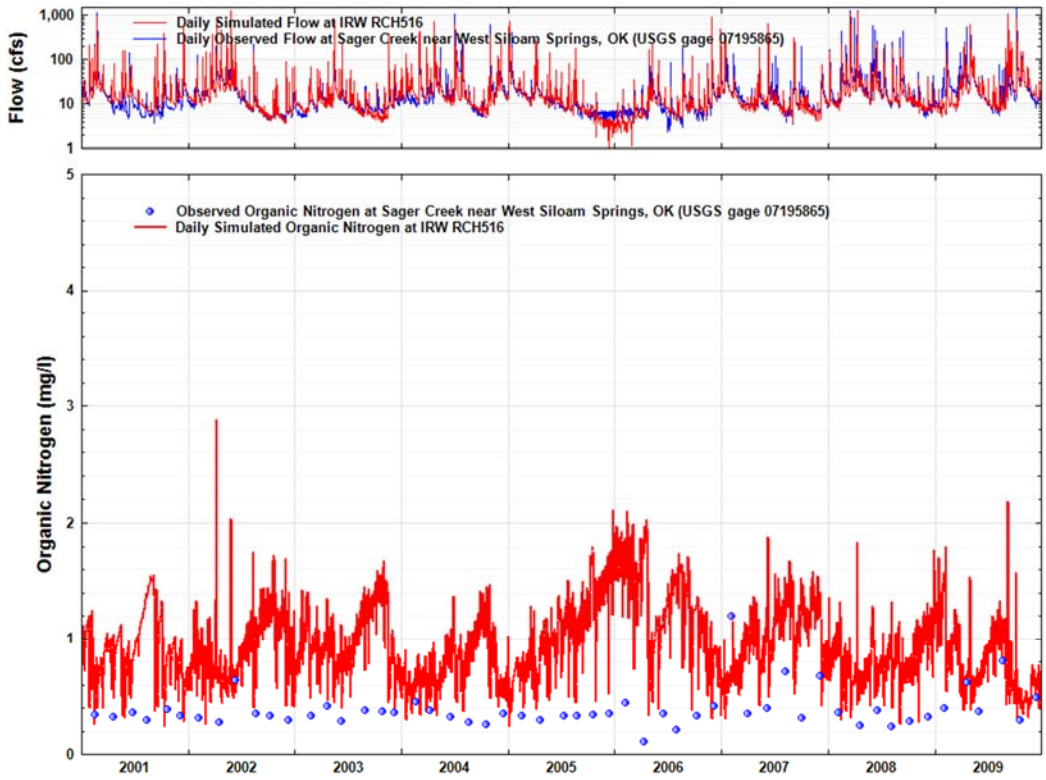


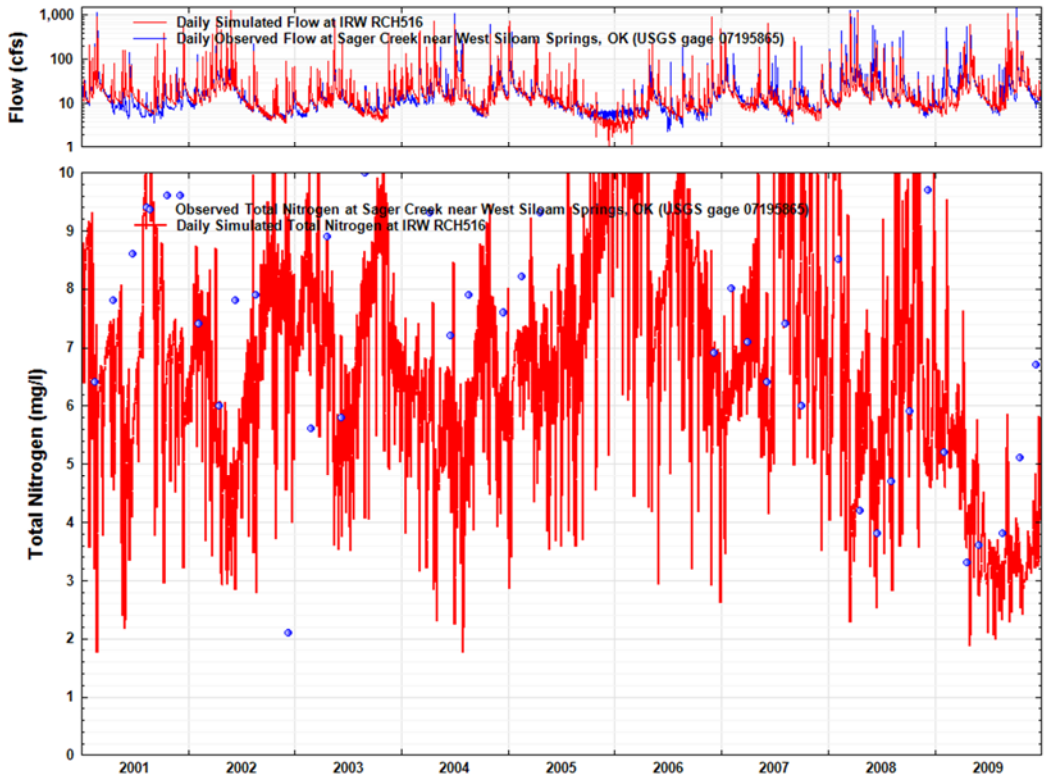

Daily Simulated Flow at IRW RCH516
Daily Observed Flow at Sager Creek near West Siloam Springs, OK (USGS gage 07195865)
Flow (cfs)
1,000
100
10
1
Observed Orthophosphate at Sager Creek near West Siloam Springs, OK (USGS gage 07195865)
Daily Simulated PO4 at IRW RCH516
Orthophosphate (mg/l as P)
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

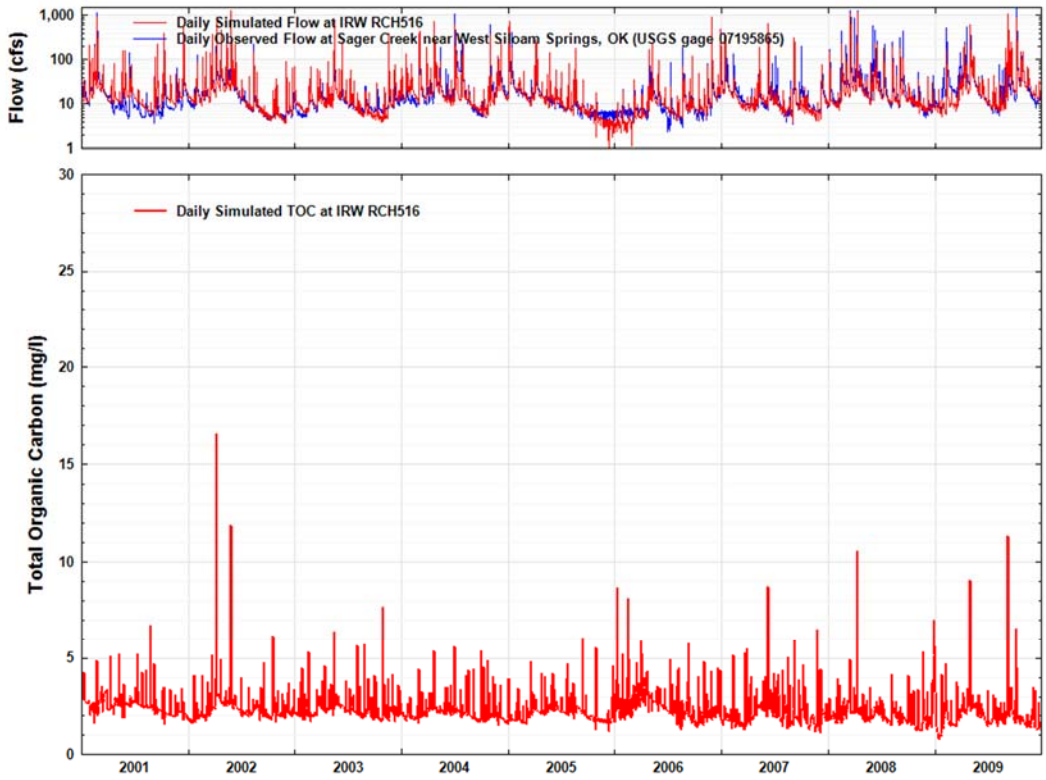

Daily Simulated Flow at IRW RCH516
Daily Observed Flow at Sager Creek near West Siloam Springs, OK (USGS gage 07195865)
Flow (cfs)
1,000
100
10
1
Observed Phosphorus at Sager Creek near West Siloam Springs, OK (USGS gage 07195865)
Daily Simulated Phosphorus at IRW RCH516
Total Phosphorus (mg/l)
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

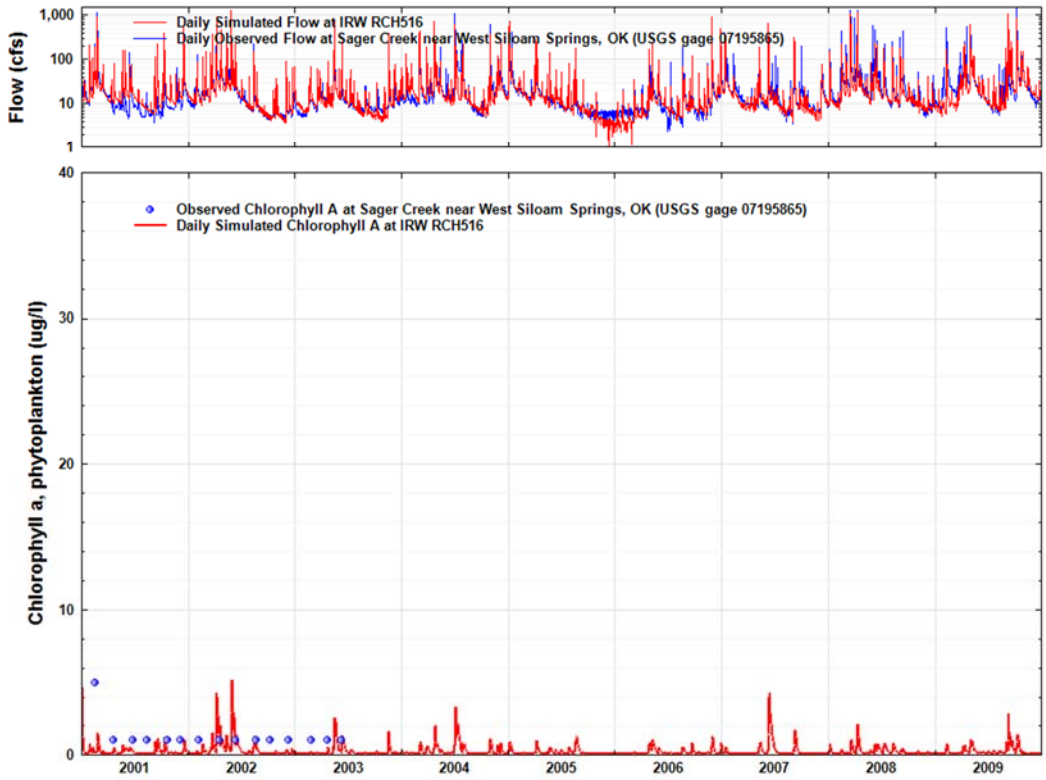

Daily Simulated Flow at IRW RCH516
Daily Observed Flow at Sager Creek near West Siloam Springs, OK (USGS gage 07195865)
Flow (cfs)
Observed Nitrate plus Nitrite at Sager Creek near West Siloam Springs, OK (USGS gage 07195865)
Daily Simulated NO3 at IRW RCH516
Nitrate + Nitrite (mg/l as N)
2001
2002
2003
2004
2005
2006
2007
2008
2009


Daily Simulated Flow at IRW RCH516
Daily Observed Flow at Sager Creek near West Siloam Springs, OK (USGS gage 07195865)
Flow (cfs)
Observed Ammonia at Sager Creek near West Siloam Springs, OK (USGS gage 07195865)
Daily Simulated Ammonia at IRW RCH516
Ammonia (mg/l)
2001
2002
2003
2004
2005
2006
2007
2008
2009

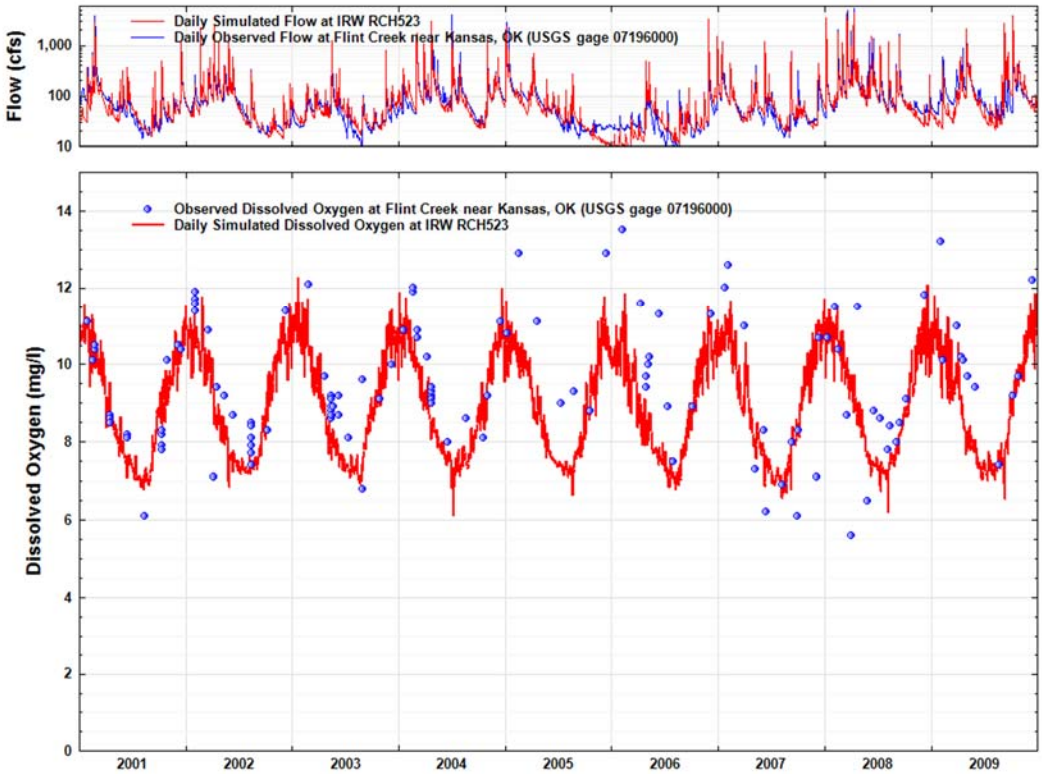

Daily Simulated Flow at IRW RCH516
Daily Observed Flow at Sager Creek near West Siloam Springs, OK (USGS gage 07195865)
Flow (cfs)
1,000
100
10
1
Observed Organic Nitrogen at Sager Creek near West Siloam Springs, OK (USGS gage 07195865)
Daily Simulated Organic Nitrogen at IRW RCH516
Organic Nitrogen (mg/l)
5
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

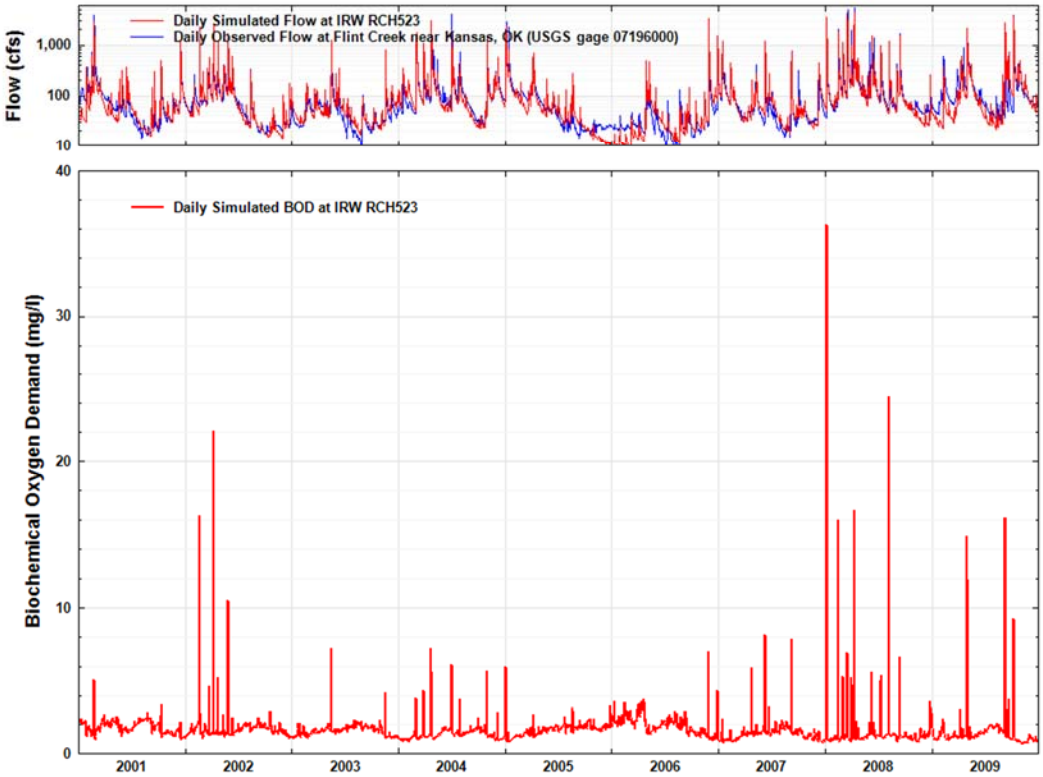

Daily Simulated Flow at IRW RCH516
Daily Observed Flow at Sager Creek near West Siloam Springs, OK (USGS gage 07195865)
Flow (cfs)
1,000
100
10
1
Observed Total Nitrogen at Sager Creek near West Siloam Springs, OK (USGS gage 07195865)
Daily Simulated Total Nitrogen at IRW RCH516
Total Nitrogen (mg/l)
10
9
8
7
6
5
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

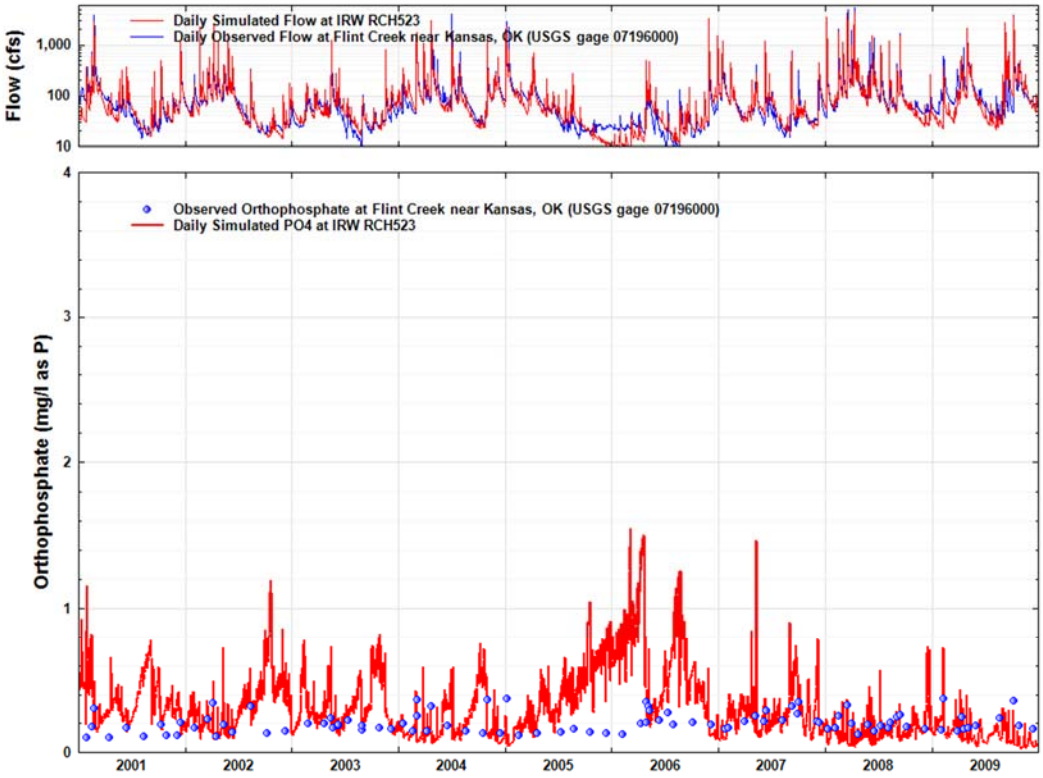

Daily Simulated Flow at IRW RCH516
Daily Observed Flow at Sager Creek near West Siloam Springs, OK (USGS gage 07195865)
Flow (cfs)
1,000
100
10
1
Daily Simulated TOC at IRW RCH516
Total Organic Carbon (mg/l)
30
25
20
15
10
5
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

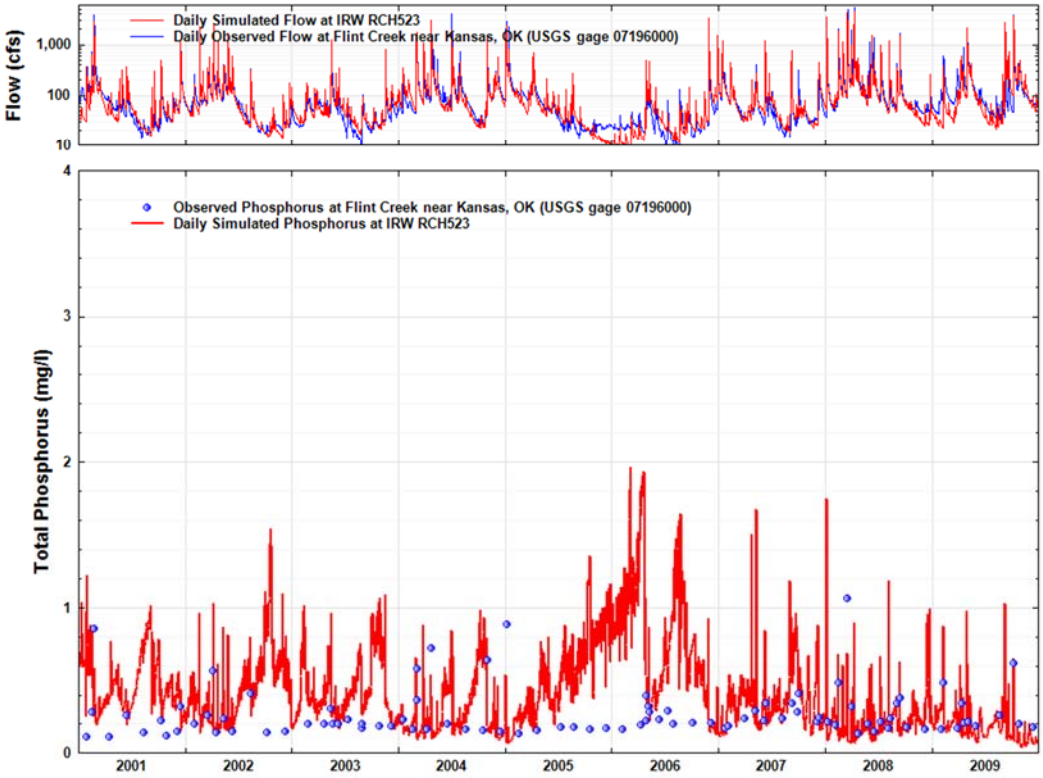

Daily Simulated Flow at IRW RCH516
Daily Observed Flow at Sager Creek near West Siloam Springs, OK (USGS gage 07195865)
Flow (cfs)
1,000
100
10
1
Observed Chlorophyll A at Sager Creek near West Siloam Springs, OK (USGS gage 07195865)
Daily Simulated Chlorophyll A at IRW RCH516
Chlorophyll a, phytoplankton (ug/l)
40
30
20
10
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

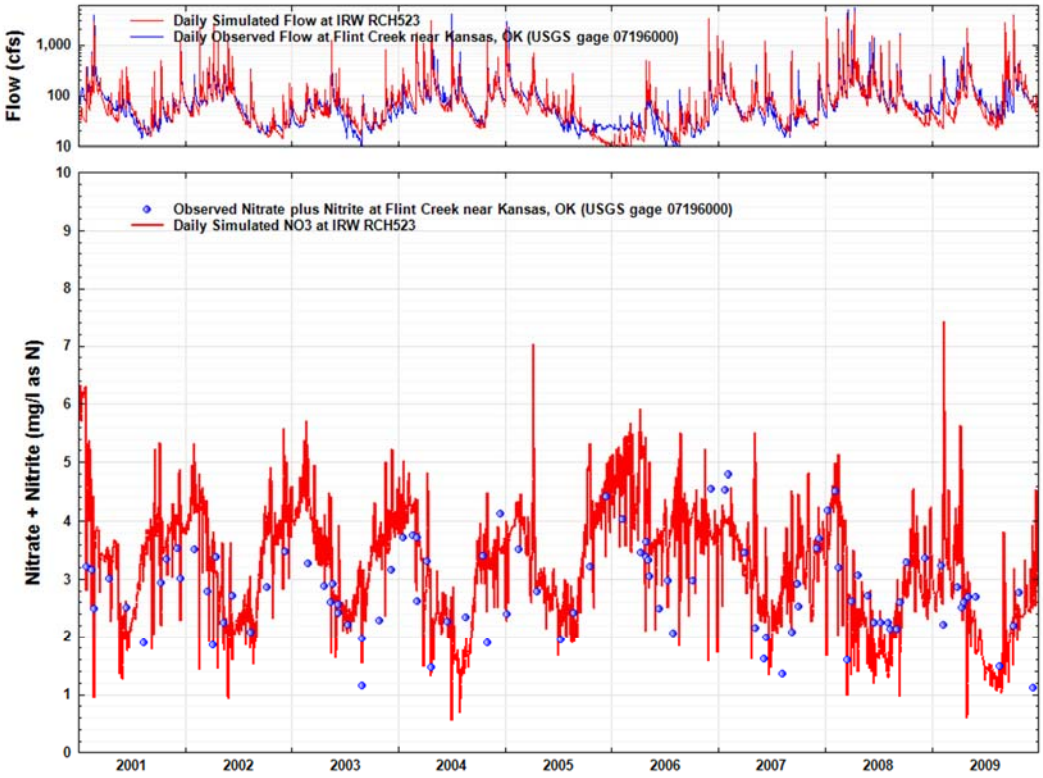
E.4 RCH523 – FLINT CREEK NEAR KANSAS, OK

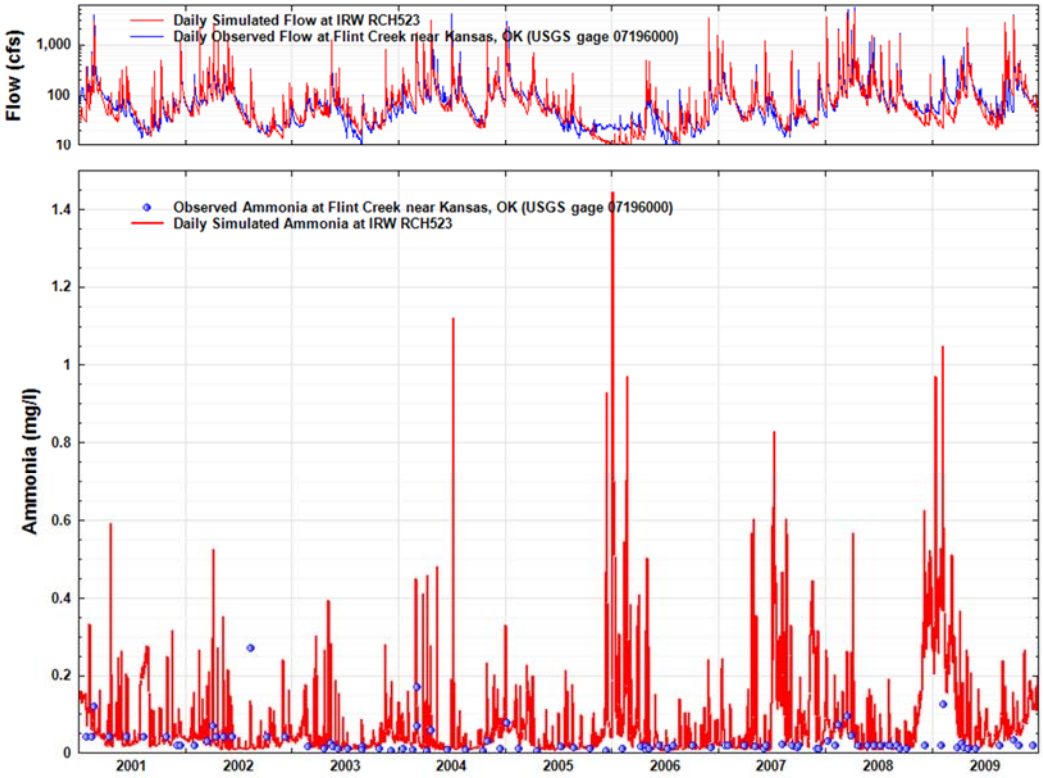


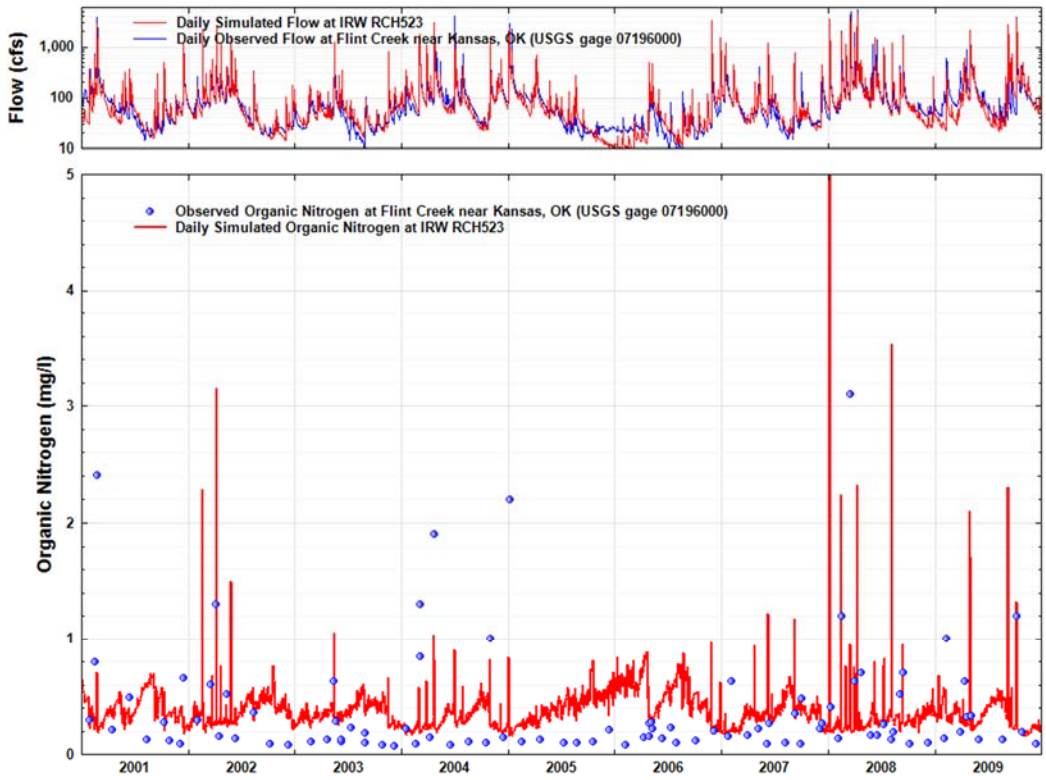


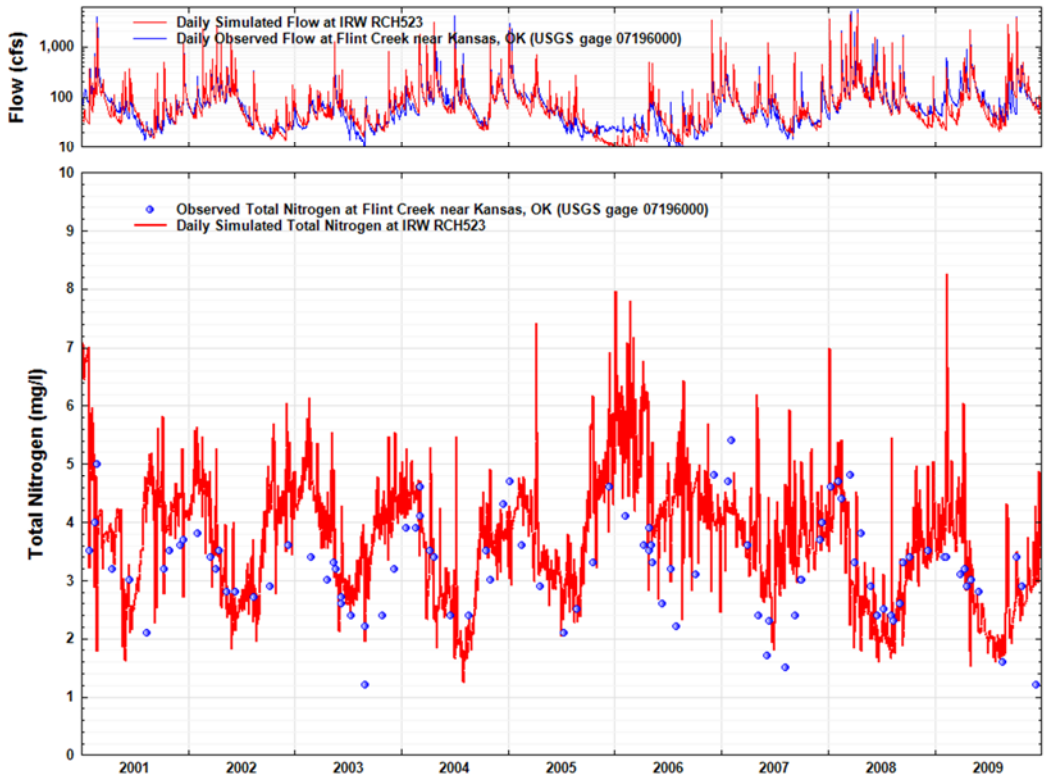

Daily Simulated Flow at IRW RCH523
Daily Observed Flow at Flint Creek near Kansas, OK (USGS gage 07196000)
Flow (cfs)
1,000
100
10
Observed Orthophosphate at Flint Creek near Kansas, OK (USGS gage 07196000)
Daily Simulated PO4 at IRW RCH523
Orthophosphate (mg/l as P)
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

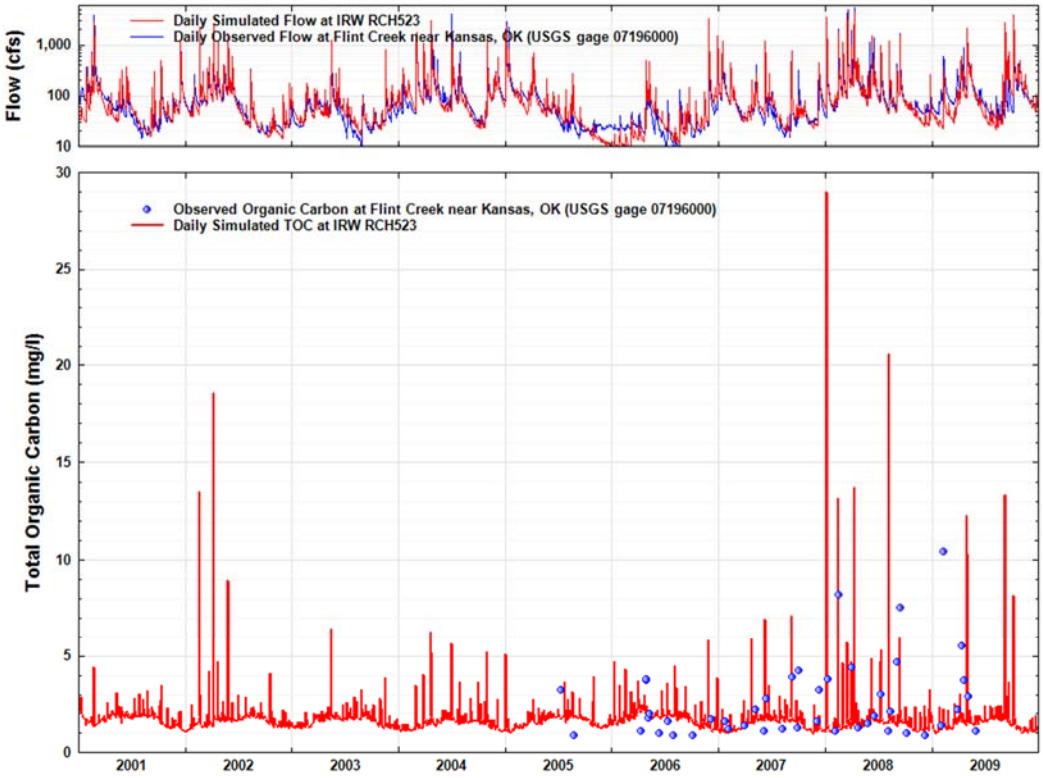

Daily Simulated Flow at IRW RCH523
Daily Observed Flow at Flint Creek near Kansas, OK (USGS gage 07196000)
Flow (cfs)
1,000
100
10
Observed Phosphorus at Flint Creek near Kansas, OK (USGS gage 07196000)
Daily Simulated Phosphorus at IRW RCH523
Total Phosphorus (mg/l)
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

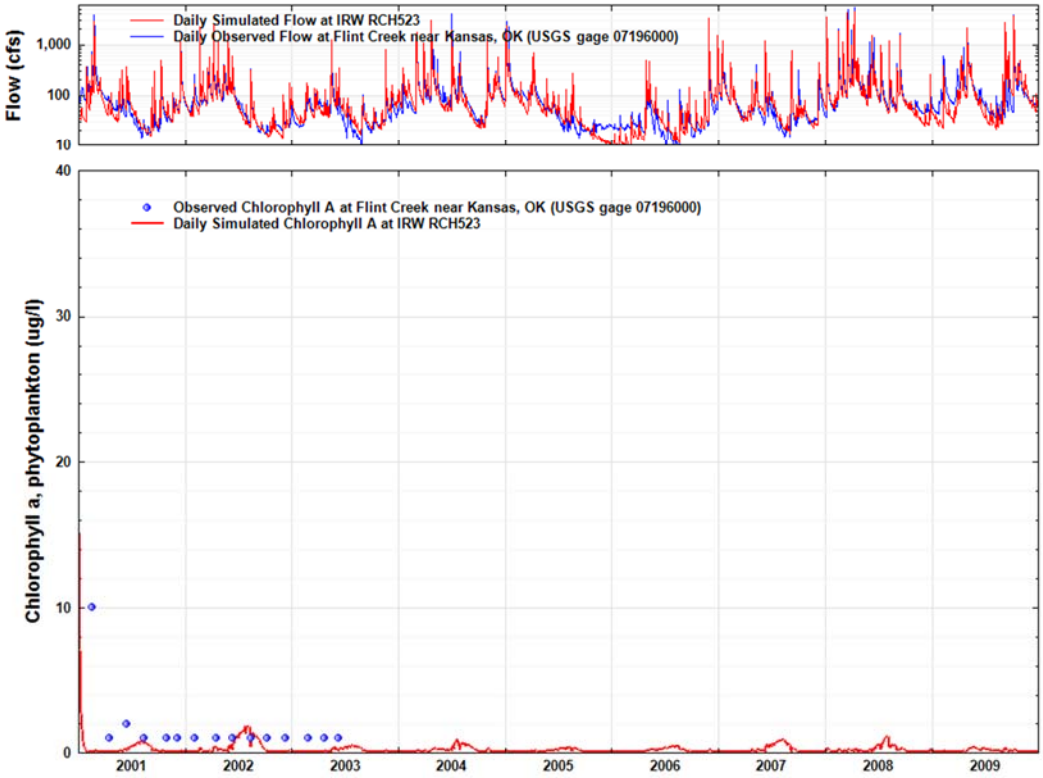

Daily Simulated Flow at IRW RCH523
Daily Observed Flow at Flint Creek near Kansas, OK (USGS gage 07196000)
Flow (cfs)
1,000
100
10
Observed Nitrate plus Nitrite at Flint Creek near Kansas, OK (USGS gage 07196000)
Daily Simulated NO3 at IRW RCH523
Nitrate + Nitrite (mg/l as N)
0
1
2
3
4
5
6
7
8
9
10
2001
2002
2003
2004
2005
2006
2007
2008
2009


Daily Simulated Flow at IRW RCH523
Daily Observed Flow at Flint Creek near Kansas, OK (USGS gage 07196000)
Flow (cfs)
1,000
100
10
Observed Ammonia at Flint Creek near Kansas, OK (USGS gage 07196000)
Daily Simulated Ammonia at IRW RCH523
Ammonia (mg/l)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
2001
2002
2003
2004
2005
2006
2007
2008
2009

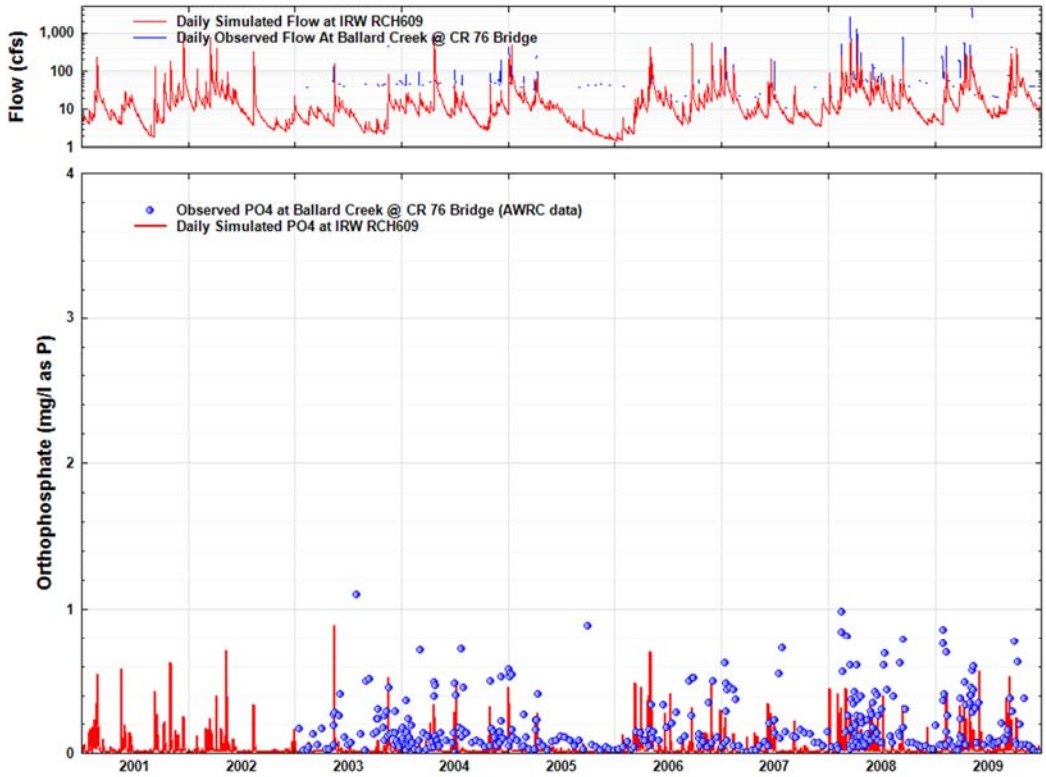

Daily Simulated Flow at IRW RCH523
Daily Observed Flow at Flint Creek near Kansas, OK (USGS gage 07196000)
Flow (cfs)
1,000
100
10
Observed Organic Nitrogen at Flint Creek near Kansas, OK (USGS gage 07196000)
Daily Simulated Organic Nitrogen at IRW RCH523
Organic Nitrogen (mg/l)
0
1
2
3
4
5
2001
2002
2003
2004
2005
2006
2007
2008
2009

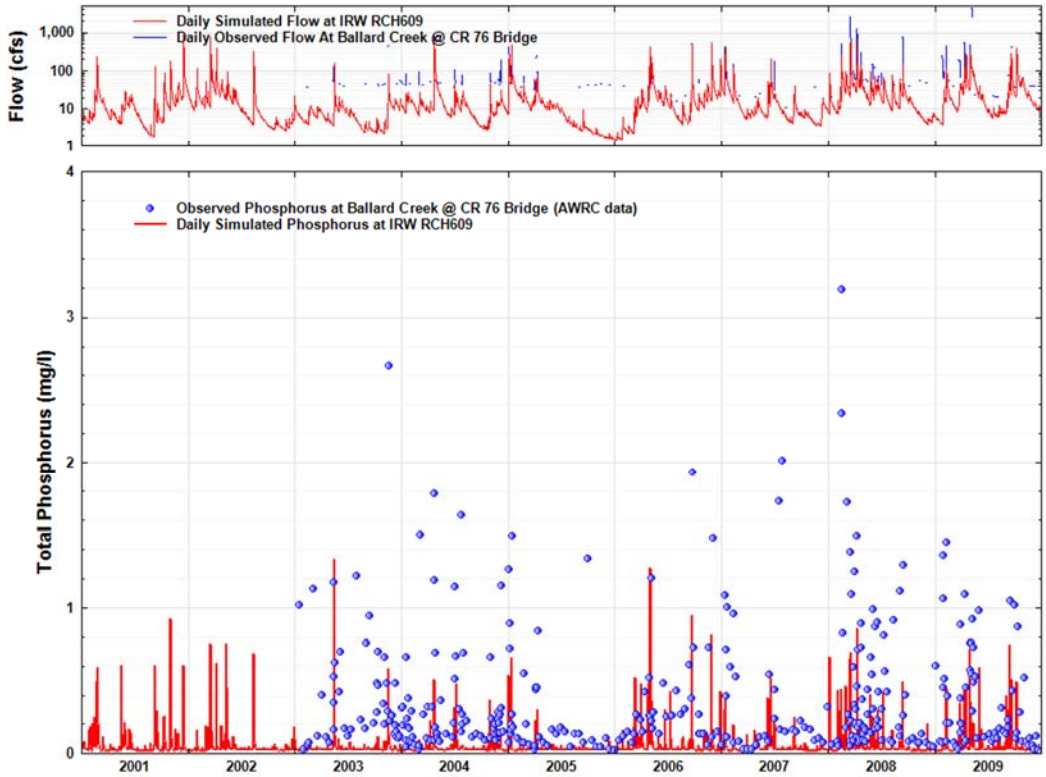

Daily Simulated Flow at IRW RCH523
Daily Observed Flow at Flint Creek near Kansas, OK (USGS gage 07196000)
Flow (cfs)
1,000
100
10
Observed Total Nitrogen at Flint Creek near Kansas, OK (USGS gage 07196000)
Daily Simulated Total Nitrogen at IRW RCH523
Total Nitrogen (mg/l)
0
1
2
3
4
5
6
7
8
9
10
2001
2002
2003
2004
2005
2006
2007
2008
2009

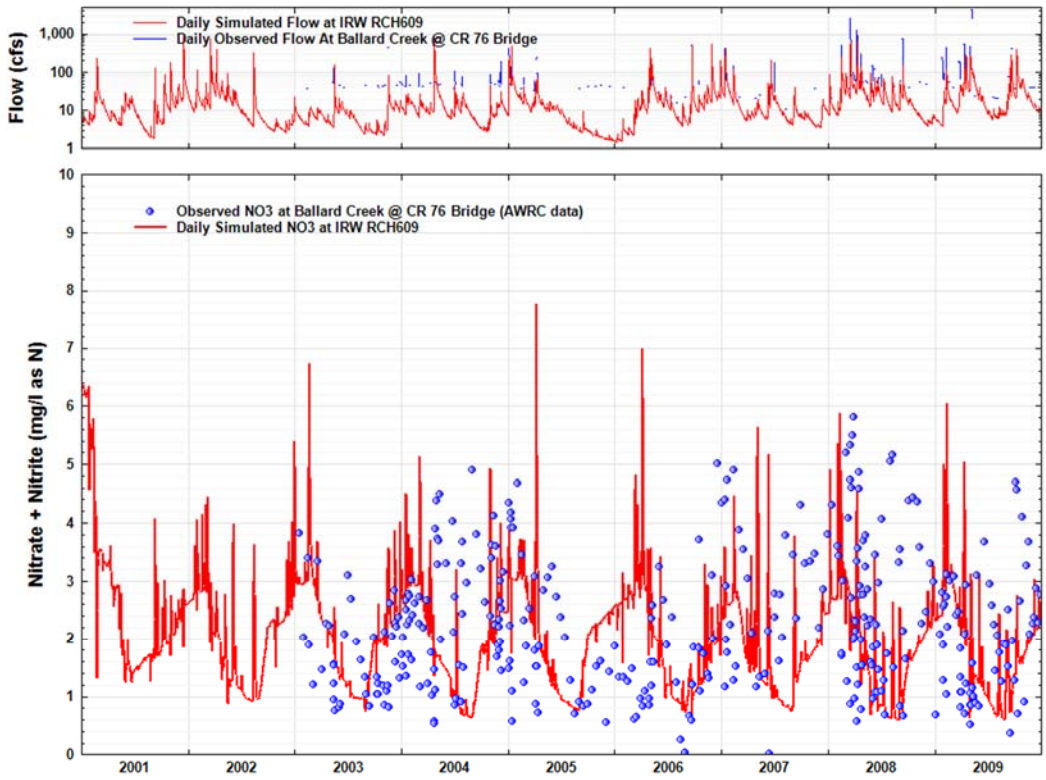

Daily Simulated Flow at IRW RCH523
Daily Observed Flow at Flint Creek near Kansas, OK (USGS gage 07196000)
Flow (cfs)
1,000
100
10
Observed Organic Carbon at Flint Creek near Kansas, OK (USGS gage 07196000)
Daily Simulated TOC at IRW RCH523
Total Organic Carbon (mg/l)
30
25
20
15
10
5
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

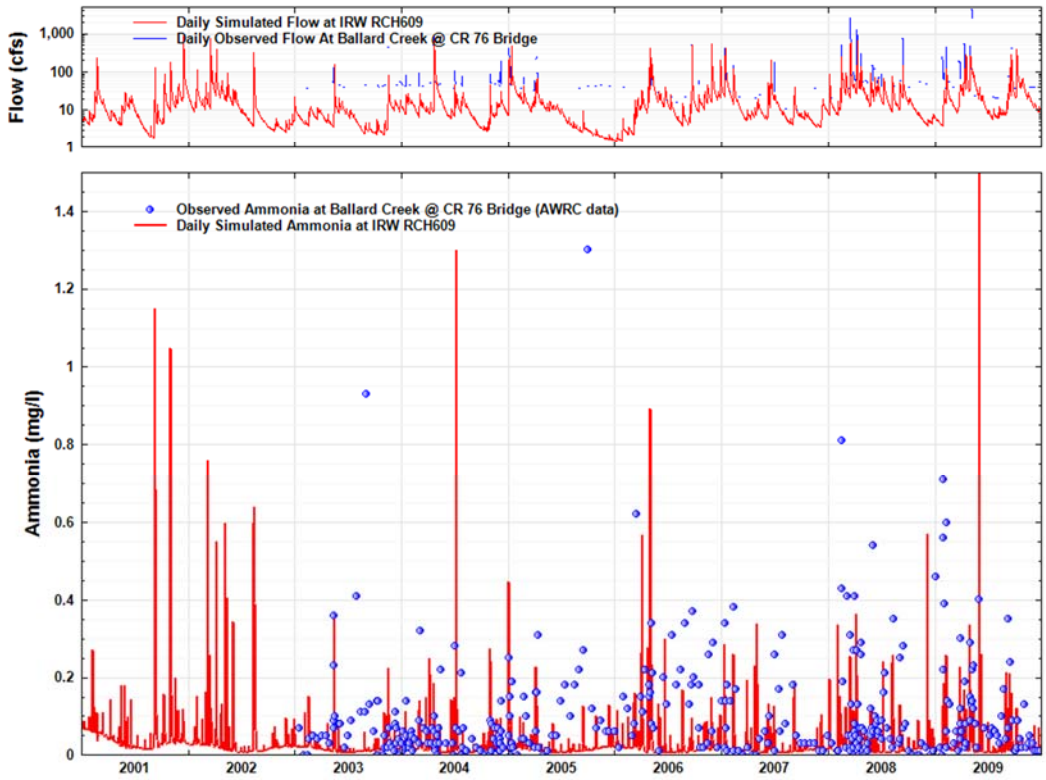

Daily Simulated Flow at IRW RCH523
Daily Observed Flow at Flint Creek near Kansas, OK (USGS gage 07196000)
Flow (cfs)
1,000
100
10
Observed Chlorophyll A at Flint Creek near Kansas, OK (USGS gage 07196000)
Daily Simulated Chlorophyll A at IRW RCH523
Chlorophyll a, phytoplankton (ug/l)
40
30
20
10
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

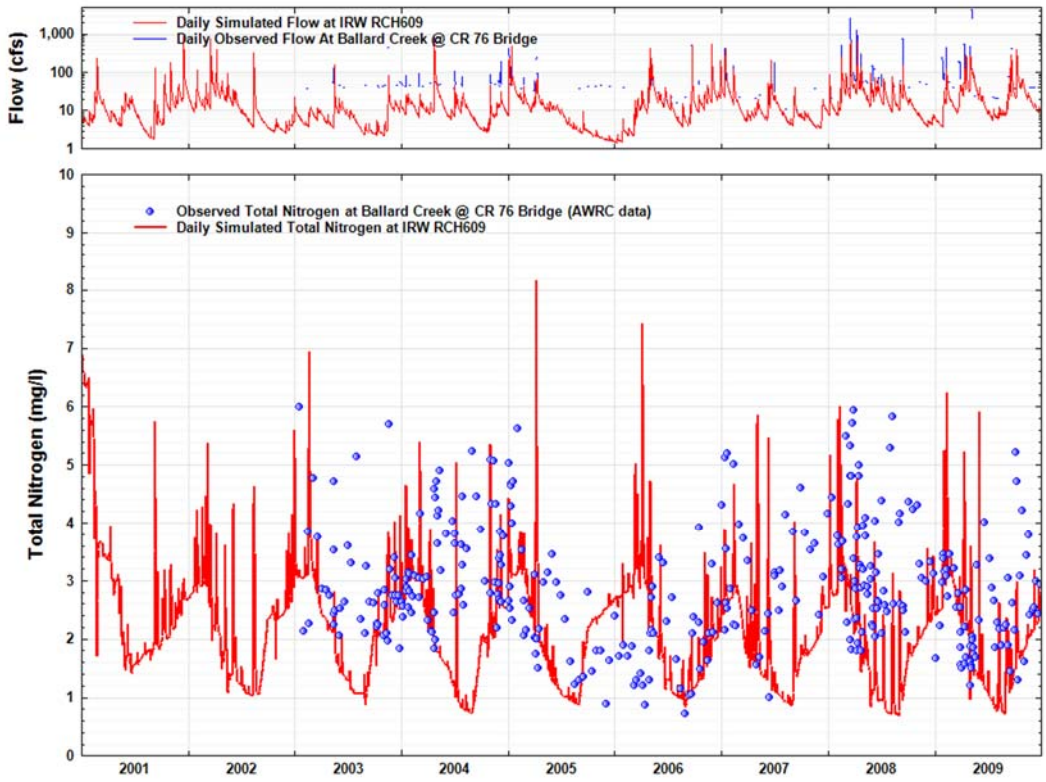
E.5 RCH609 – BALLARD CREEK AT CR 76 BRIDGE



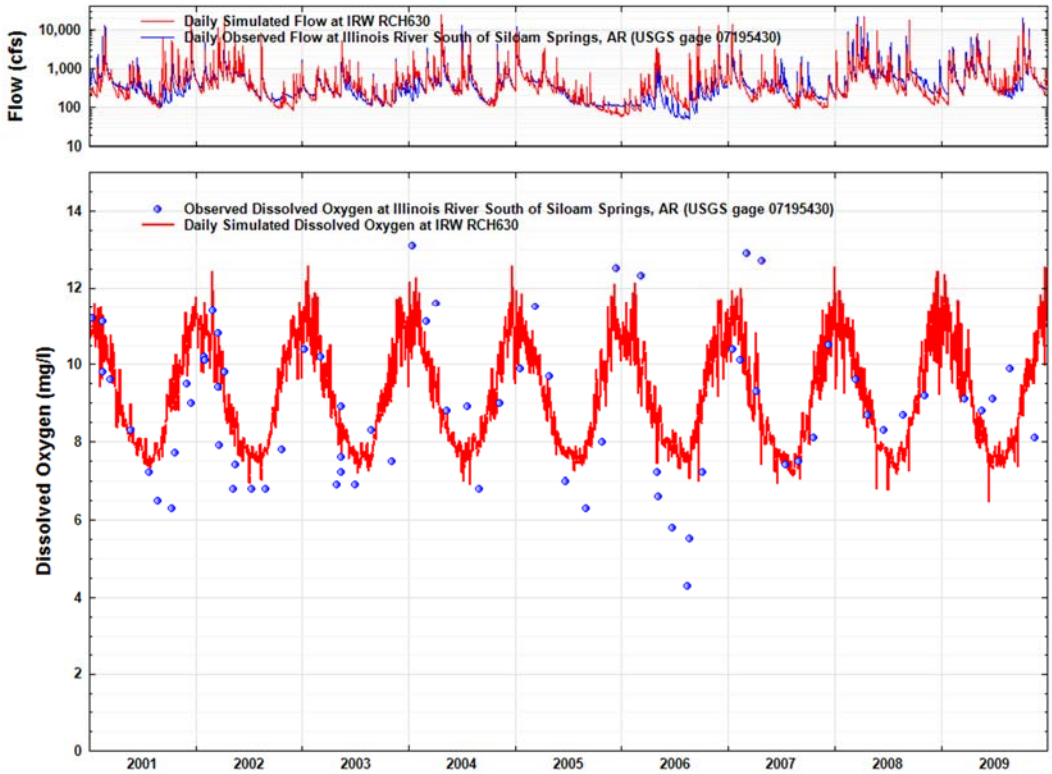


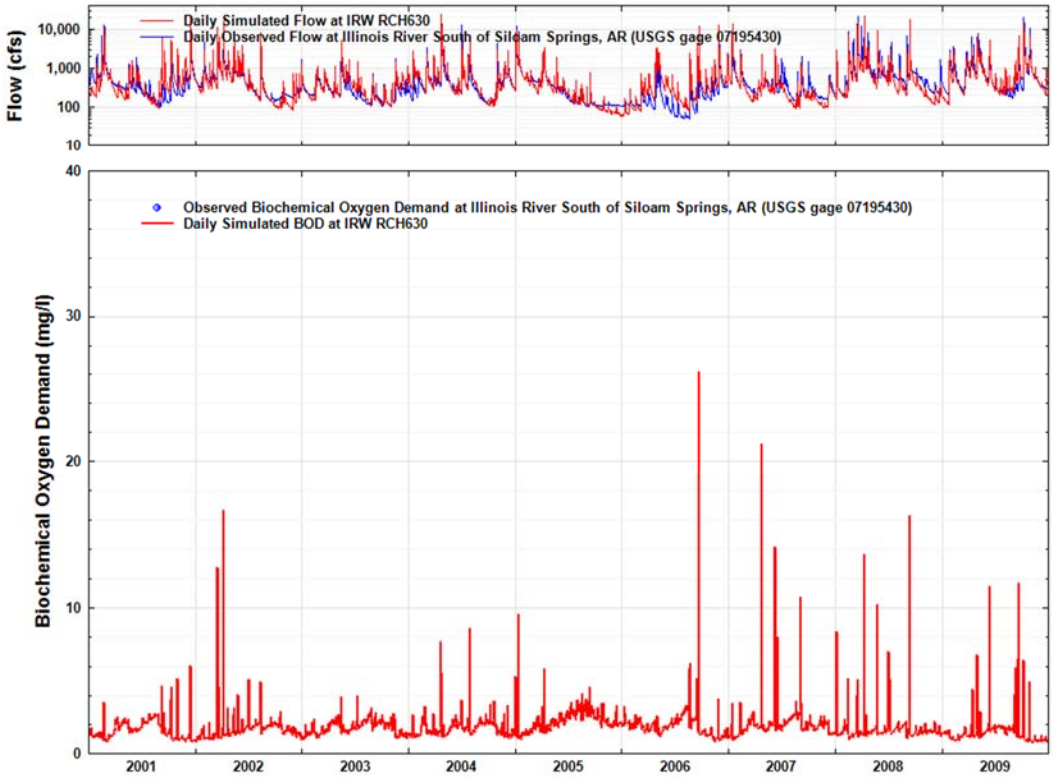

Daily Simulated Flow at IRW RCH609
Daily Observed Flow At Ballard Creek @ CR 76 Bridge
Flow (cfs)
1,000
100
10
1
Observed NO3 at Ballard Creek @ CR 76 Bridge (AWRC data)
Daily Simulated NO3 at IRW RCH609
Nitrate + Nitrite (mg/l as N)
10
9
8
7
6
5
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

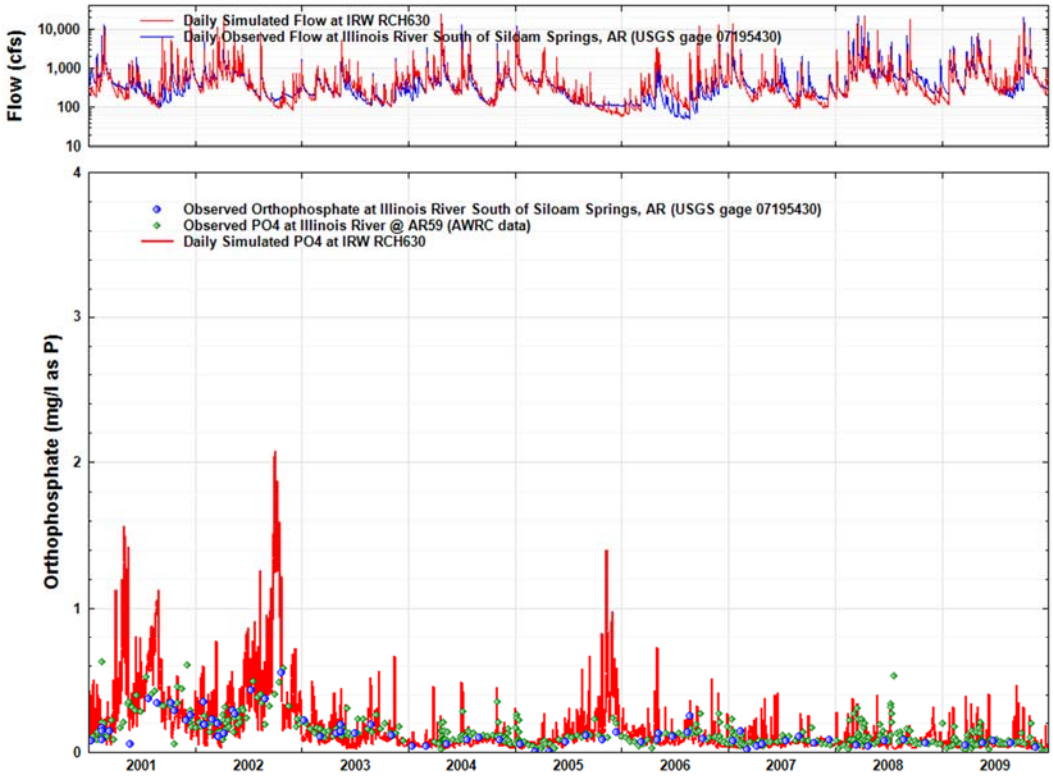

Daily Simulated Flow at IRW RCH609
Daily Observed Flow At Ballard Creek @ CR 76 Bridge
Flow (cfs)
1,000
100
10
1
Observed Ammonia at Ballard Creek @ CR 76 Bridge (AWRC data)
Daily Simulated Ammonia at IRW RCH609
Ammonia (mg/l)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

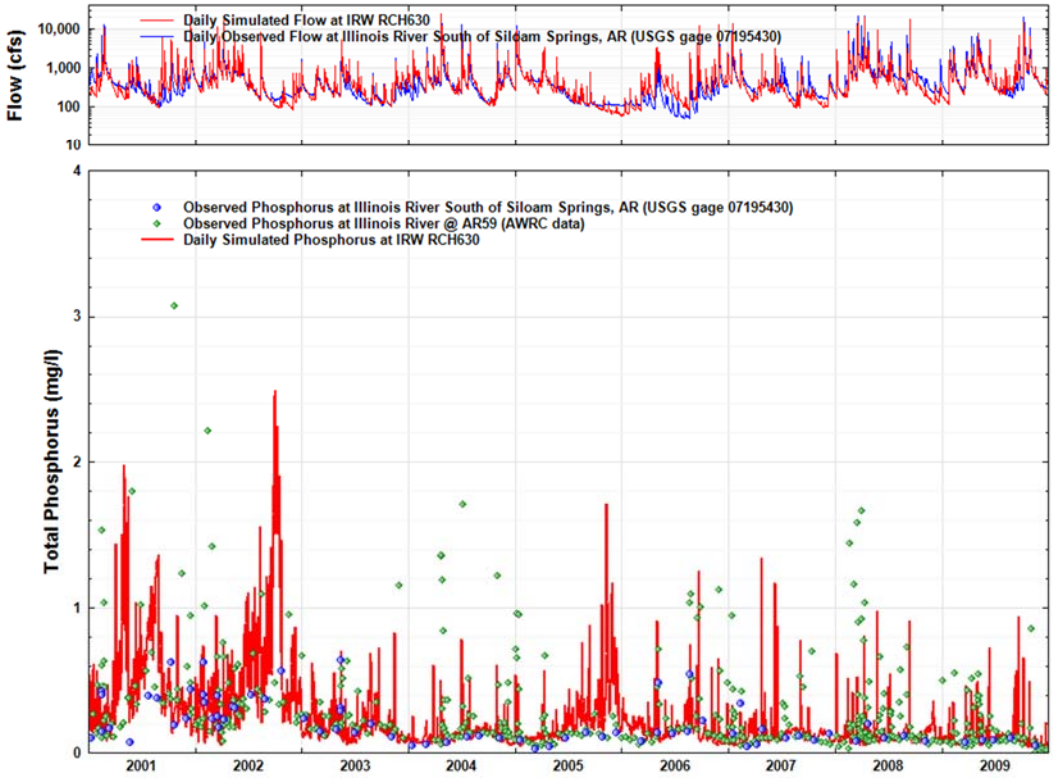

Daily Simulated Flow at IRW RCH609
Daily Observed Flow At Ballard Creek @ CR 76 Bridge
Flow (cfs)
1,000
100
10
1
Observed Total Nitrogen at Ballard Creek @ CR 76 Bridge (AWRC data)
Daily Simulated Total Nitrogen at IRW RCH609
Total Nitrogen (mg/l)
10
9
8
7
6
5
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

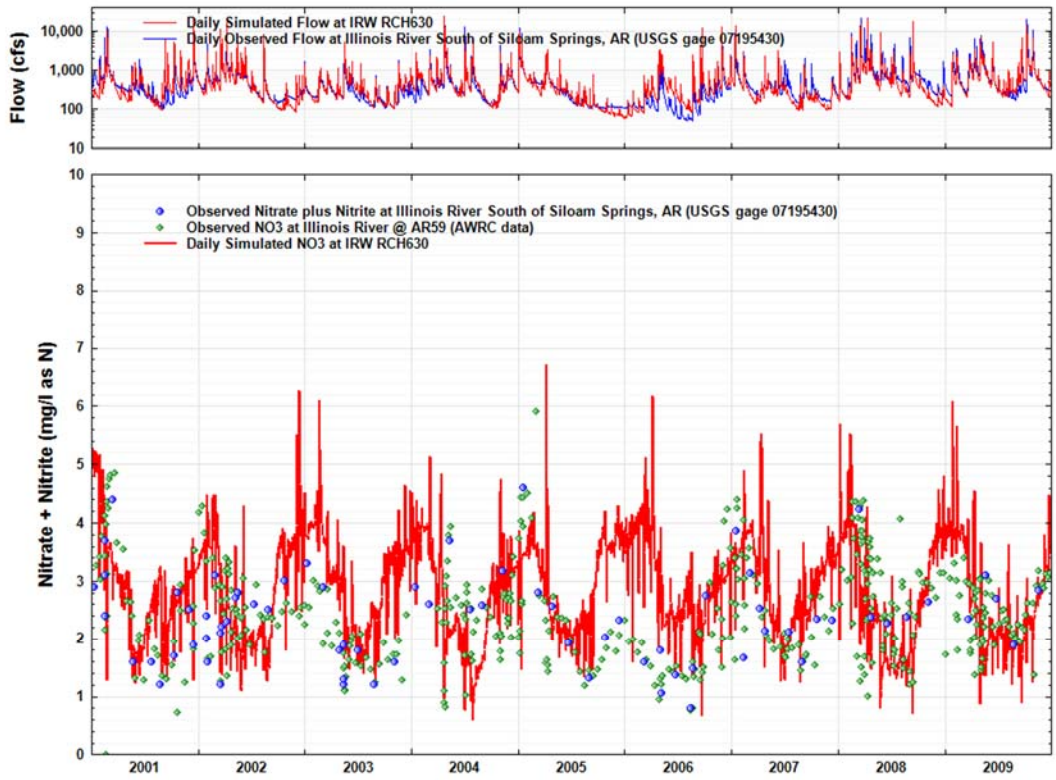
E.6 RCH630 – ILLINOIS RIVER SOUTH OF SILOAM SPRINGS, AR

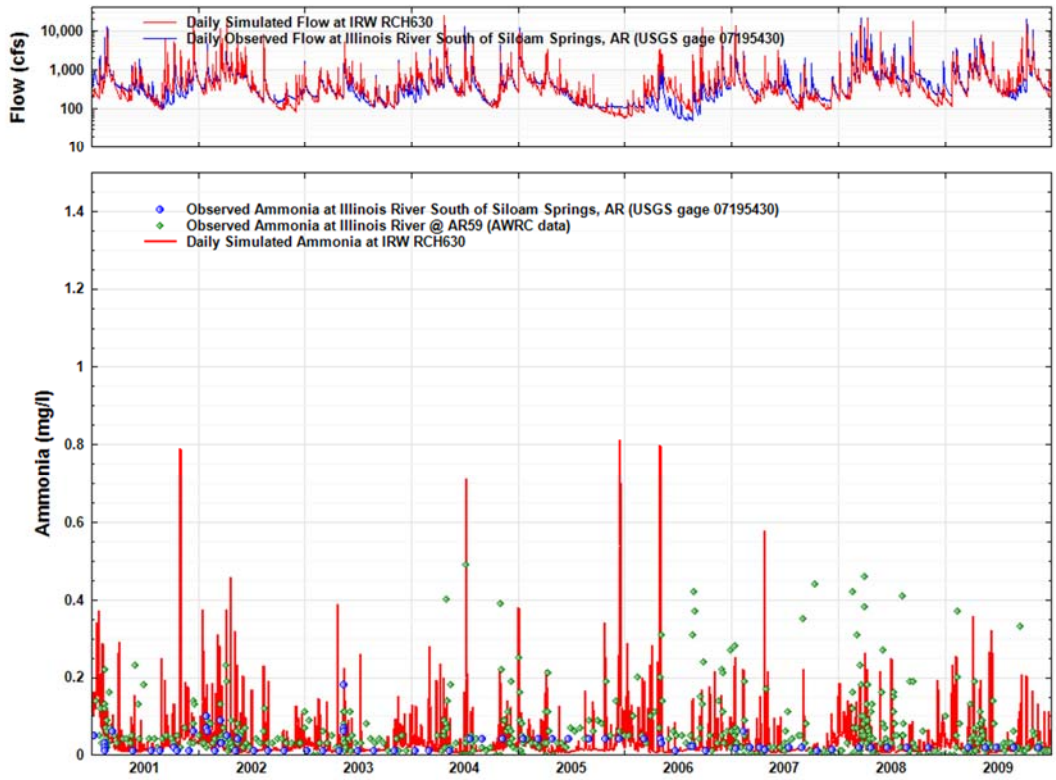


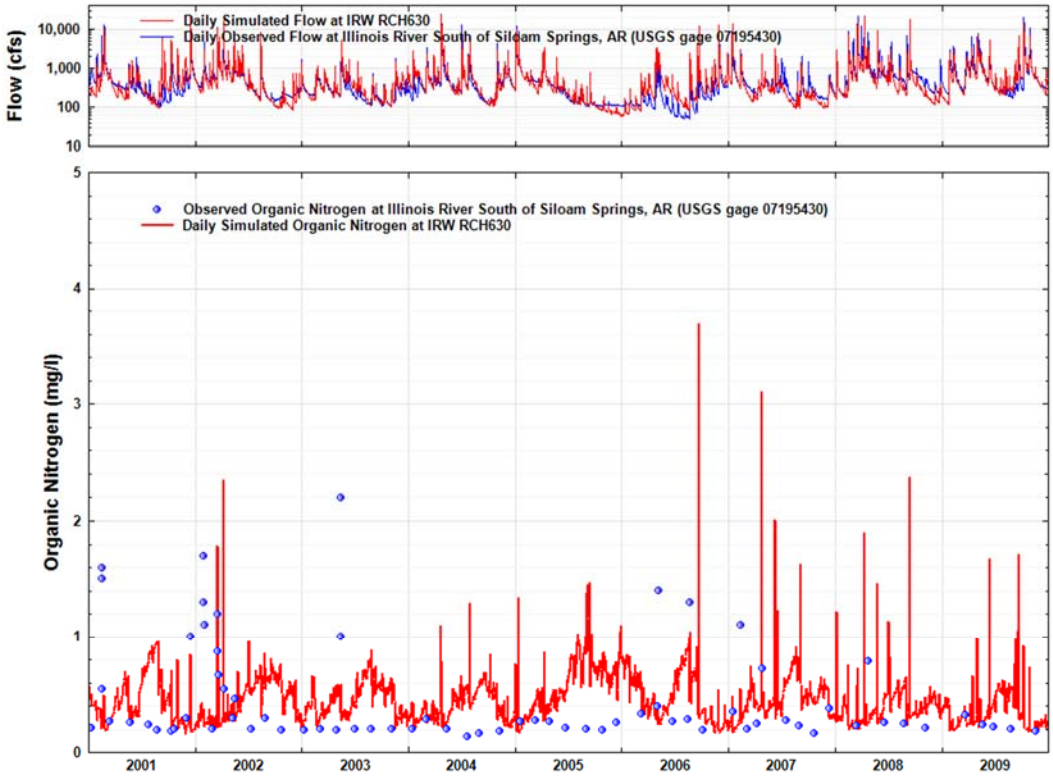


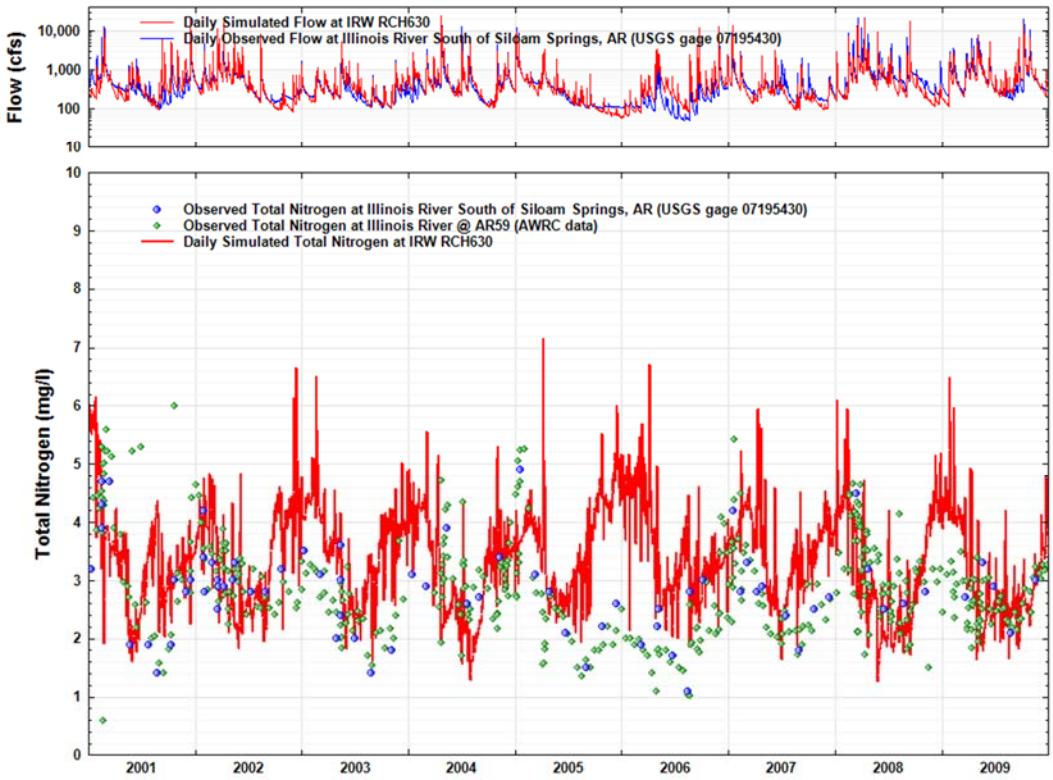

Daily Simulated Flow at IRW RCH630
Daily Observed Flow at Illinois River South of Siloam Springs, AR (USGS gage 07195430)
Flow (cfs)
10,000
1,000
100
10
Observed Orthophosphate at Illinois River South of Siloam Springs, AR (USGS gage 07195430)
Observed PO4 at Illinois River @ AR59 (AWRC data)
Daily Simulated PO4 at IRW RCH630
Orthophosphate (mg/l as P)
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

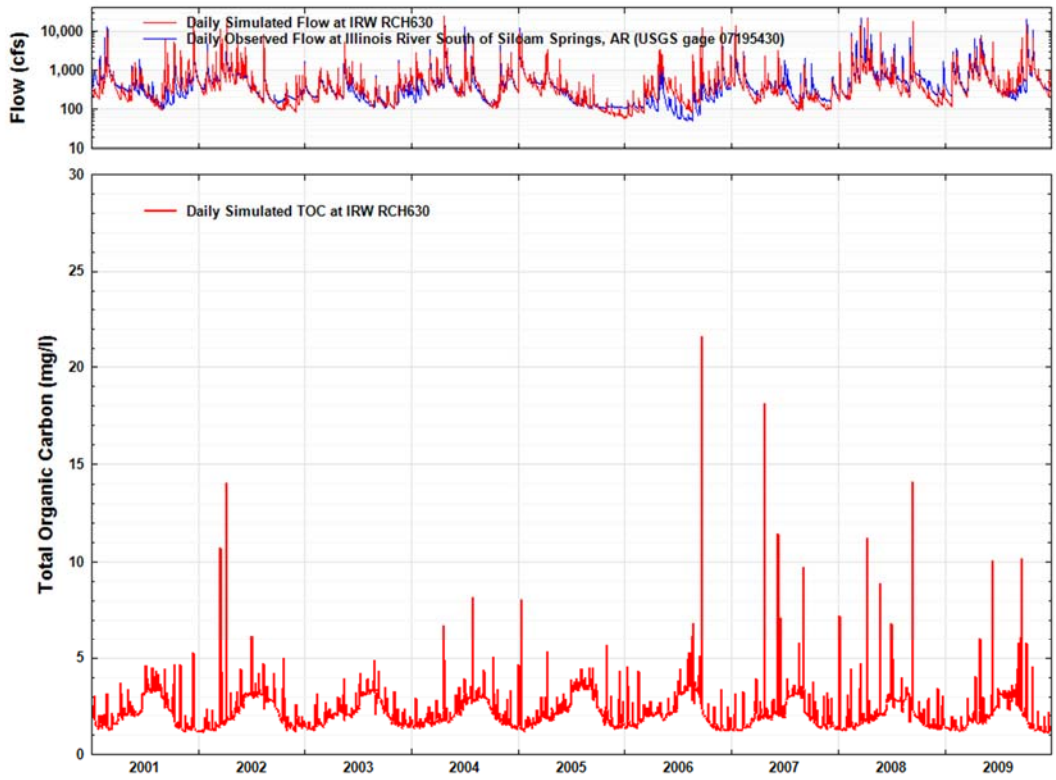

Daily Simulated Flow at IRW RCH630
Daily Observed Flow at Illinois River South of Siloam Springs, AR (USGS gage 07195430)
Flow (cfs)
10,000
1,000
100
10
Observed Phosphorus at Illinois River South of Siloam Springs, AR (USGS gage 07195430)
Observed Phosphorus at Illinois River @ AR59 (AWRC data)
Daily Simulated Phosphorus at IRW RCH630
Total Phosphorus (mg/l)
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

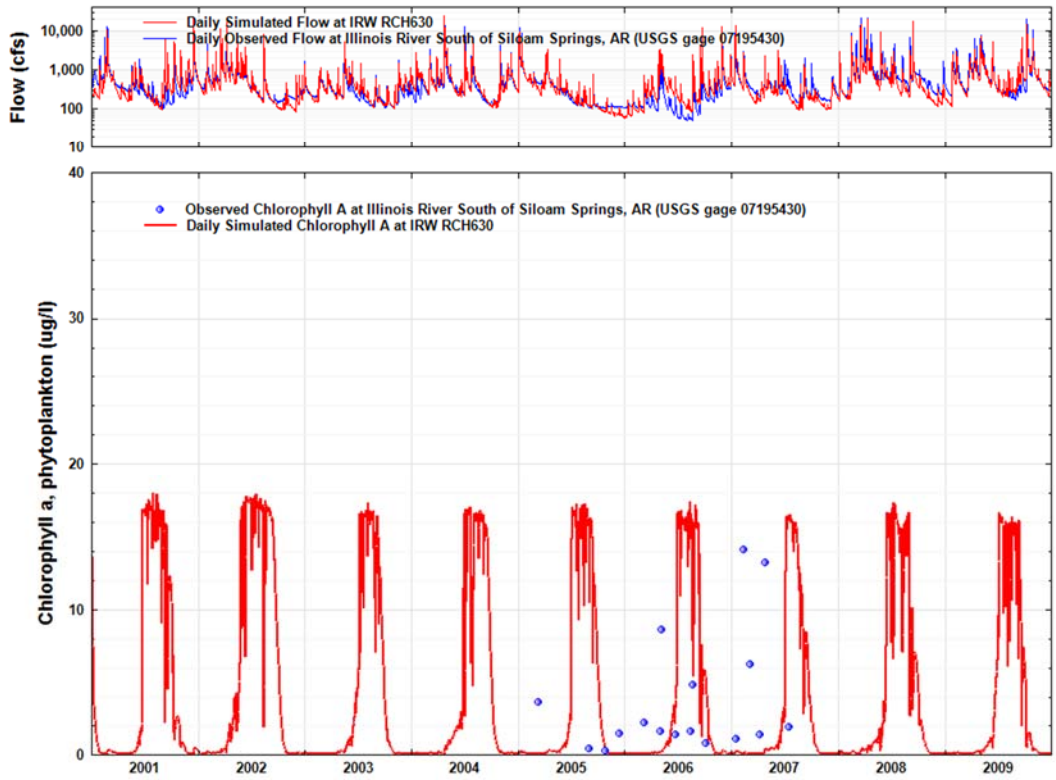

Daily Simulated Flow at IRW RCH630
Daily Observed Flow at Illinois River South of Siloam Springs, AR (USGS gage 07195430)
Flow (cfs)
10,000
1,000
100
10
Observed Nitrate plus Nitrite at Illinois River South of Siloam Springs, AR (USGS gage 07195430)
Observed NO3 at Illinois River @ AR59 (AWRC data)
Daily Simulated NO3 at IRW RCH630
Nitrate + Nitrite (mg/l as N)
0
1
2
3
4
5
6
7
8
9
10
2001
2002
2003
2004
2005
2006
2007
2008
2009


Daily Simulated Flow at IRW RCH630
Daily Observed Flow at Illinois River South of Siloam Springs, AR (USGS gage 07195430)
Flow (cfs)
10,000
1,000
100
10
Observed Ammonia at Illinois River South of Siloam Springs, AR (USGS gage 07195430)
Observed Ammonia at Illinois River @ AR59 (AWRC data)
Daily Simulated Ammonia at IRW RCH630
Ammonia (mg/l)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
2001
2002
2003
2004
2005
2006
2007
2008
2009

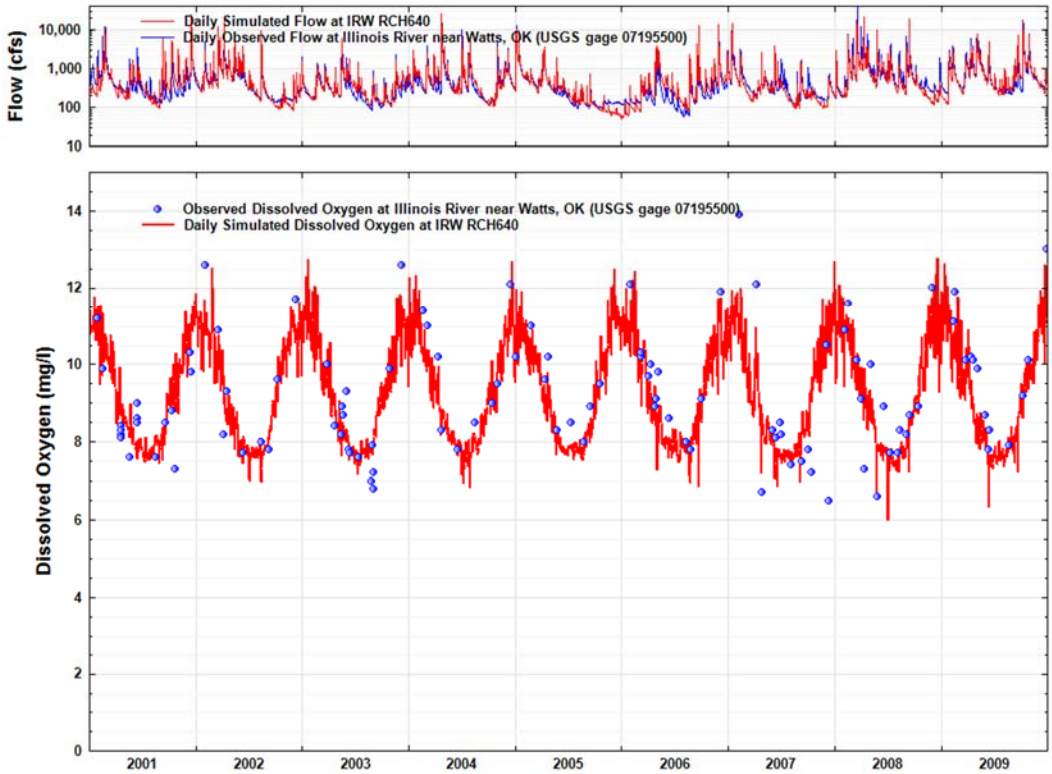

Daily Simulated Flow at IRW RCH630
Daily Observed Flow at Illinois River South of Siloam Springs, AR (USGS gage 07195430)
Flow (cfs)
10,000
1,000
100
10
Observed Organic Nitrogen at Illinois River South of Siloam Springs, AR (USGS gage 07195430)
Daily Simulated Organic Nitrogen at IRW RCH630
Organic Nitrogen (mg/l)
0
1
2
3
4
5
2001
2002
2003
2004
2005
2006
2007
2008
2009

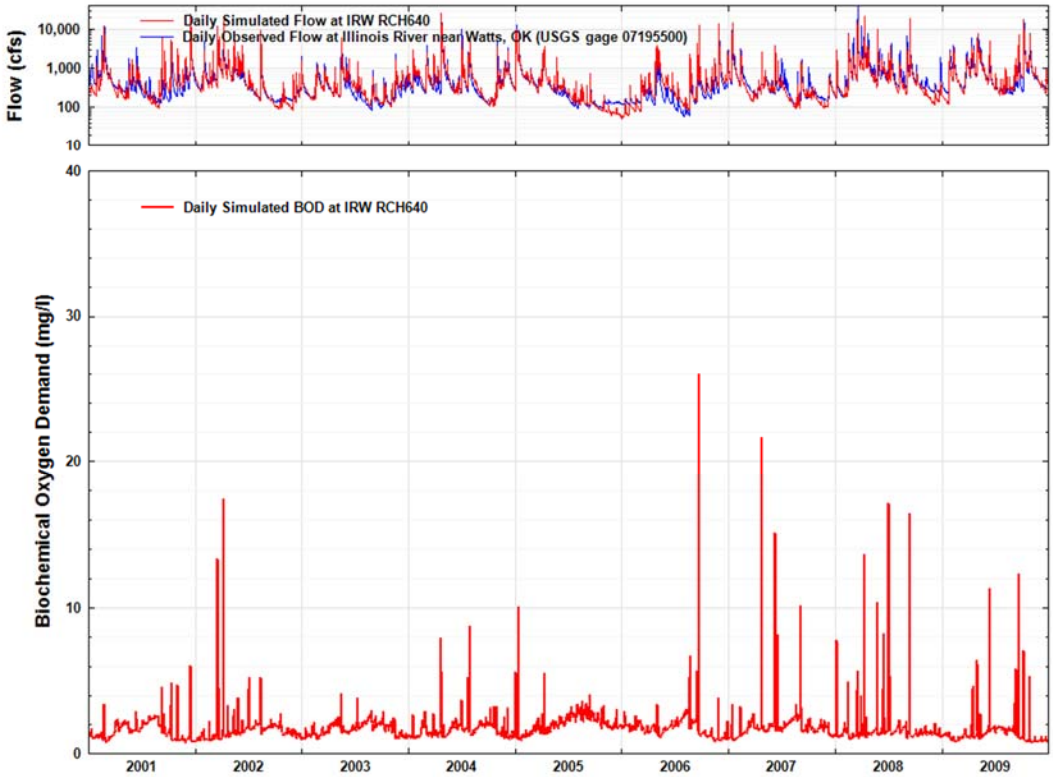

Daily Simulated Flow at IRW RCH630
Daily Observed Flow at Illinois River South of Siloam Springs, AR (USGS gage 07195430)
Flow (cfs)
10,000
1,000
100
10
Observed Total Nitrogen at Illinois River South of Siloam Springs, AR (USGS gage 07195430)
Observed Total Nitrogen at Illinois River @ AR59 (AWRC data)
Daily Simulated Total Nitrogen at IRW RCH630
Total Nitrogen (mg/l)
0
1
2
3
4
5
6
7
8
9
10
2001
2002
2003
2004
2005
2006
2007
2008
2009

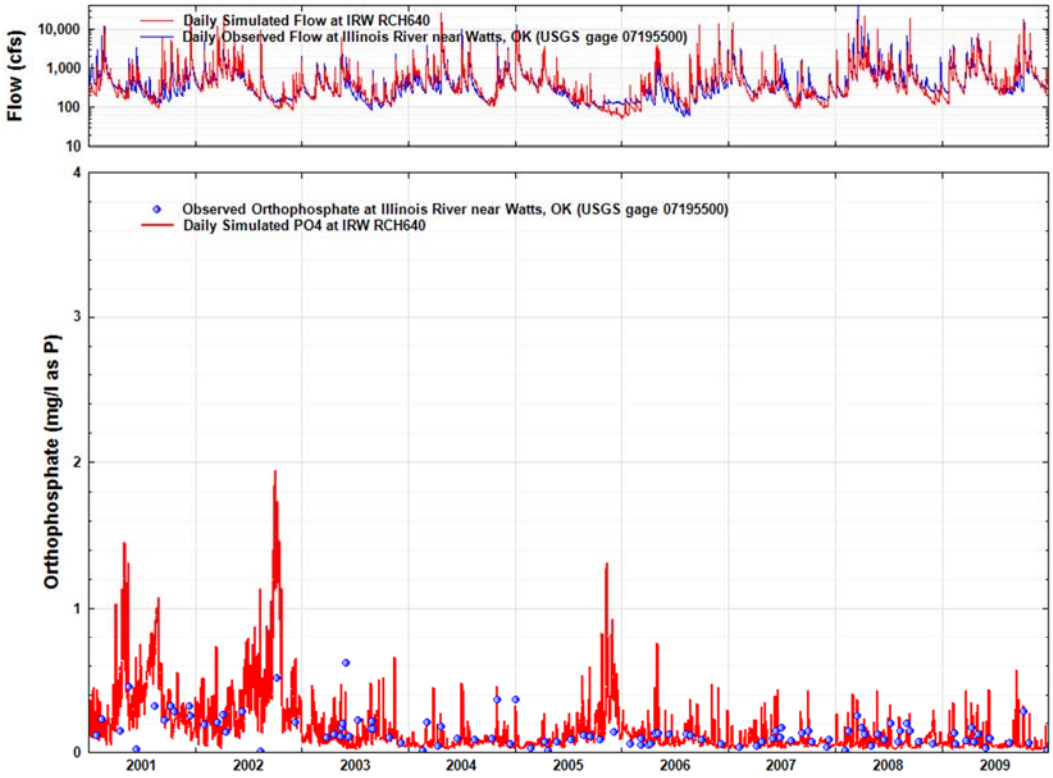

Daily Simulated Flow at IRW RCH630
Daily Observed Flow at Illinois River South of Siloam Springs, AR (USGS gage 07195430)
Flow (cfs)
10,000
1,000
100
10
Daily Simulated TOC at IRW RCH630
Total Organic Carbon (mg/l)
30
25
20
15
10
5
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

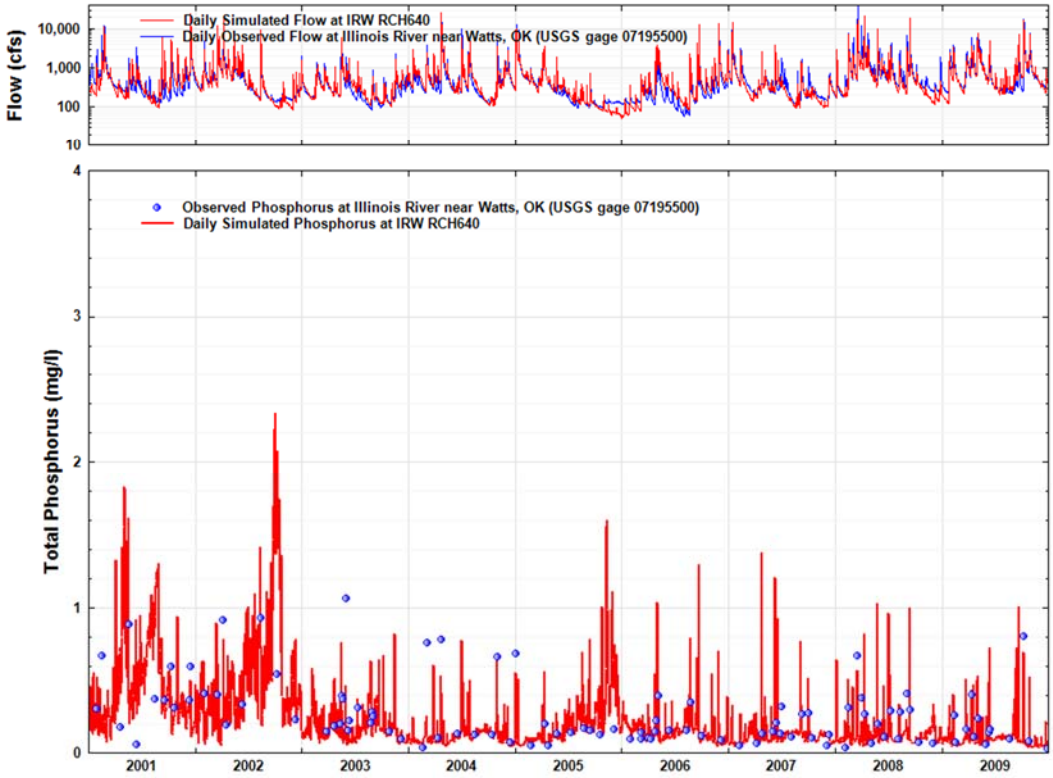

Daily Simulated Flow at IRW RCH630
Daily Observed Flow at Illinois River South of Siloam Springs, AR (USGS gage 07195430)
Flow (cfs)
10,000
1,000
100
10
Observed Chlorophyll A at Illinois River South of Siloam Springs, AR (USGS gage 07195430)
Daily Simulated Chlorophyll A at IRW RCH630
Chlorophyll a, phytoplankton (ug/l)
40
30
20
10
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

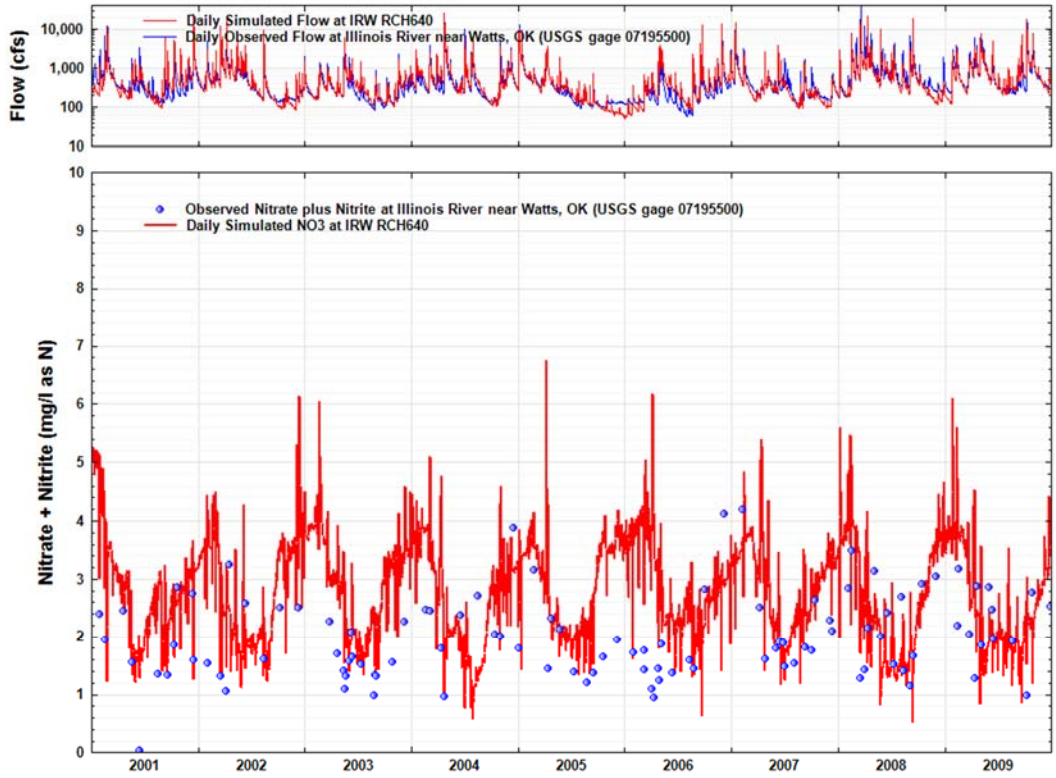
E.7 RCH640 – ILLINOIS RIVER NEAR WATTS, OK

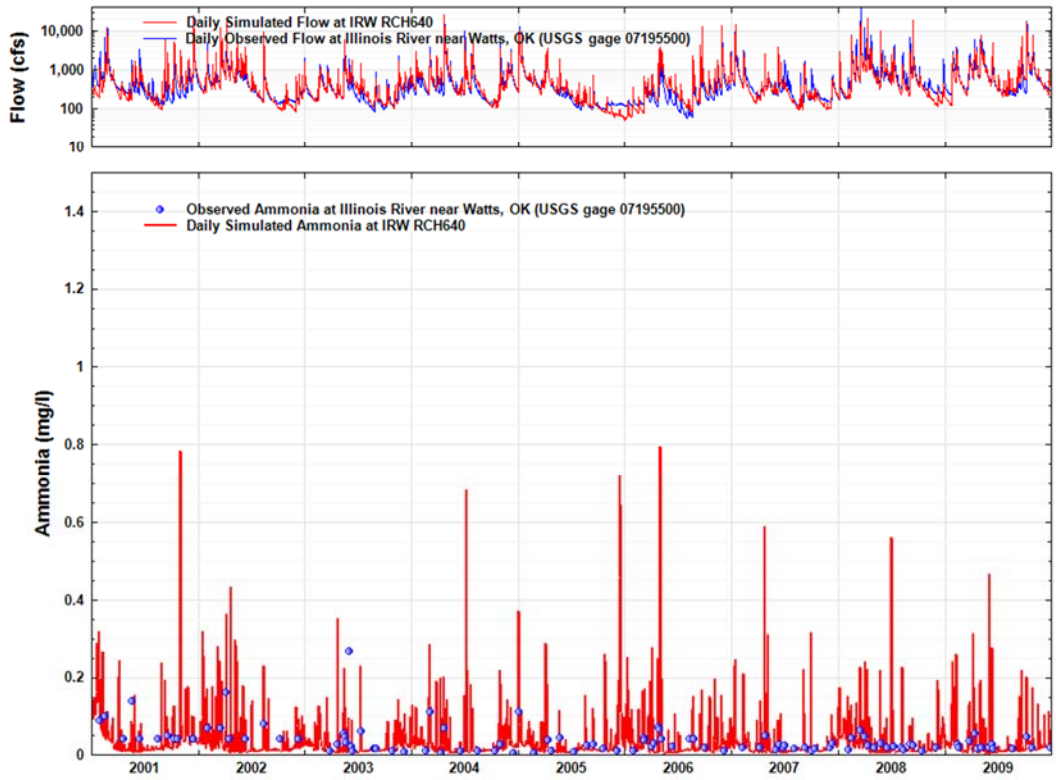


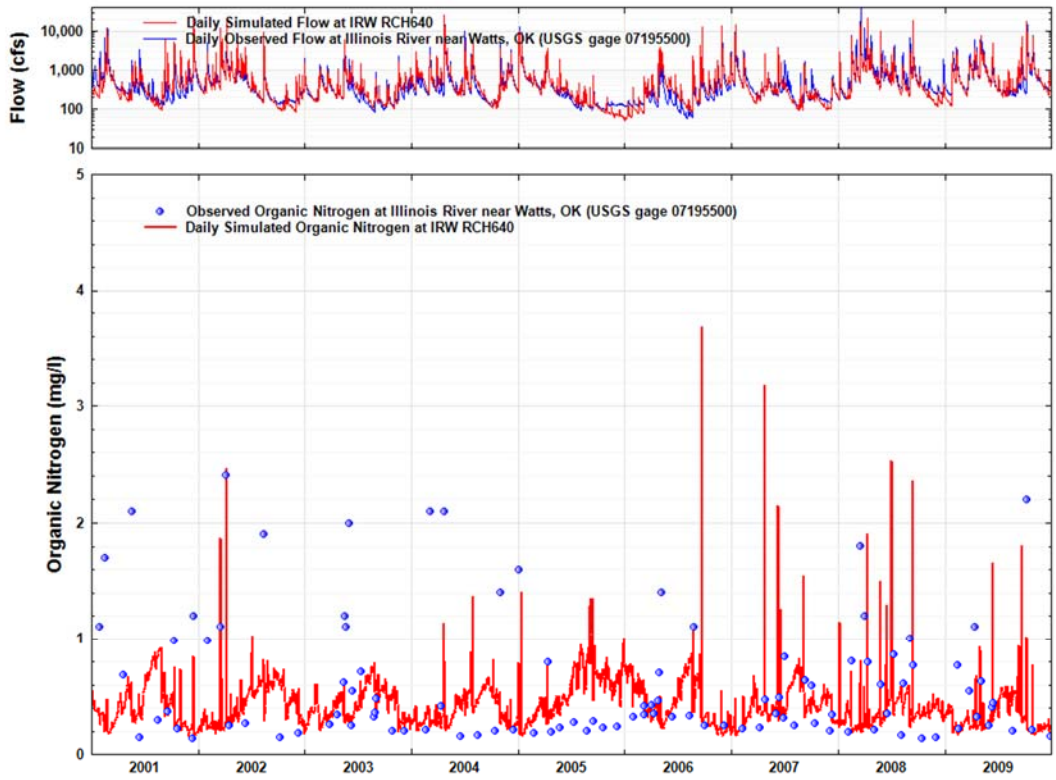


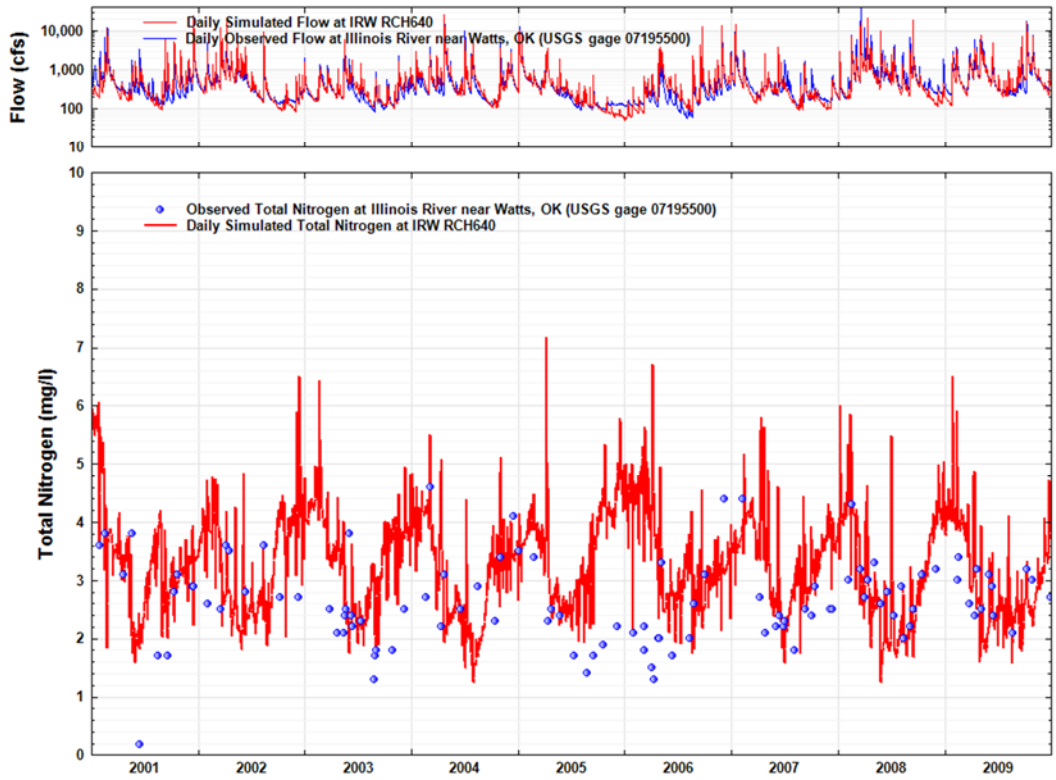

Daily Simulated Flow at IRW RCH640
Daily Observed Flow at Illinois River near Watts, OK (USGS gage 07195500)
Flow (cfs)
10,000
1,000
100
10
Observed Orthophosphate at Illinois River near Watts, OK (USGS gage 07195500)
Daily Simulated PO4 at IRW RCH640
Orthophosphate (mg/l as P)
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

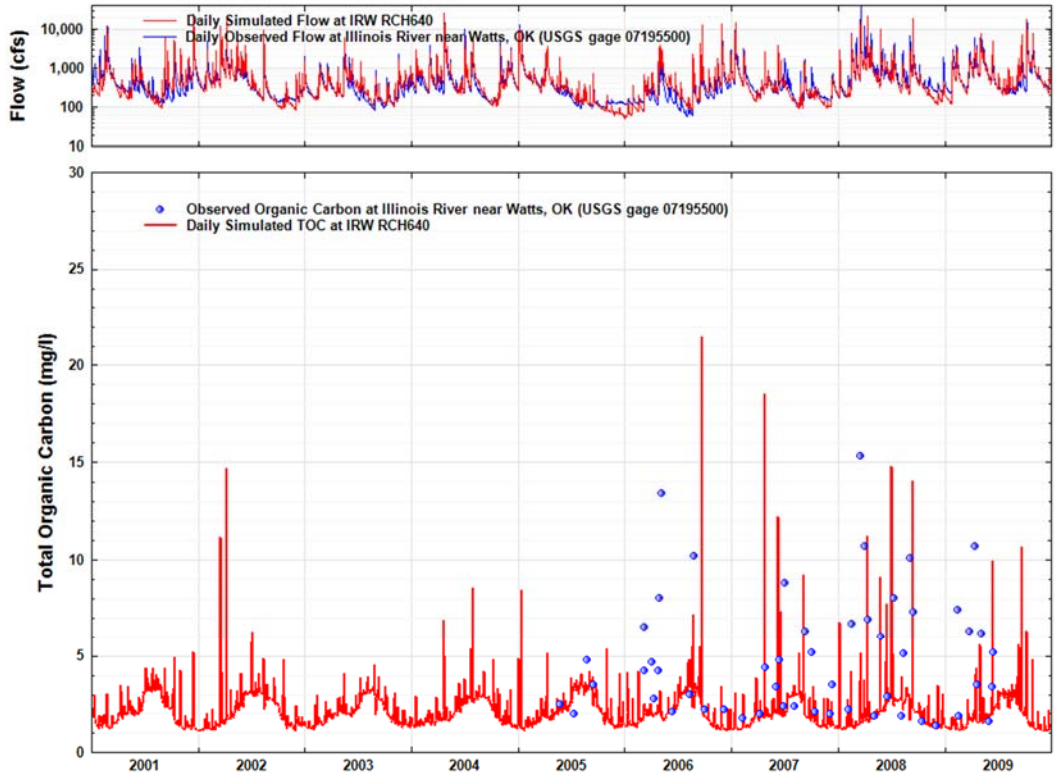

Daily Simulated Flow at IRW RCH640
Daily Observed Flow at Illinois River near Watts, OK (USGS gage 07195500)
Flow (cfs)
10,000
1,000
100
10
Observed Phosphorus at Illinois River near Watts, OK (USGS gage 07195500)
Daily Simulated Phosphorus at IRW RCH640
Total Phosphorus (mg/l)
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

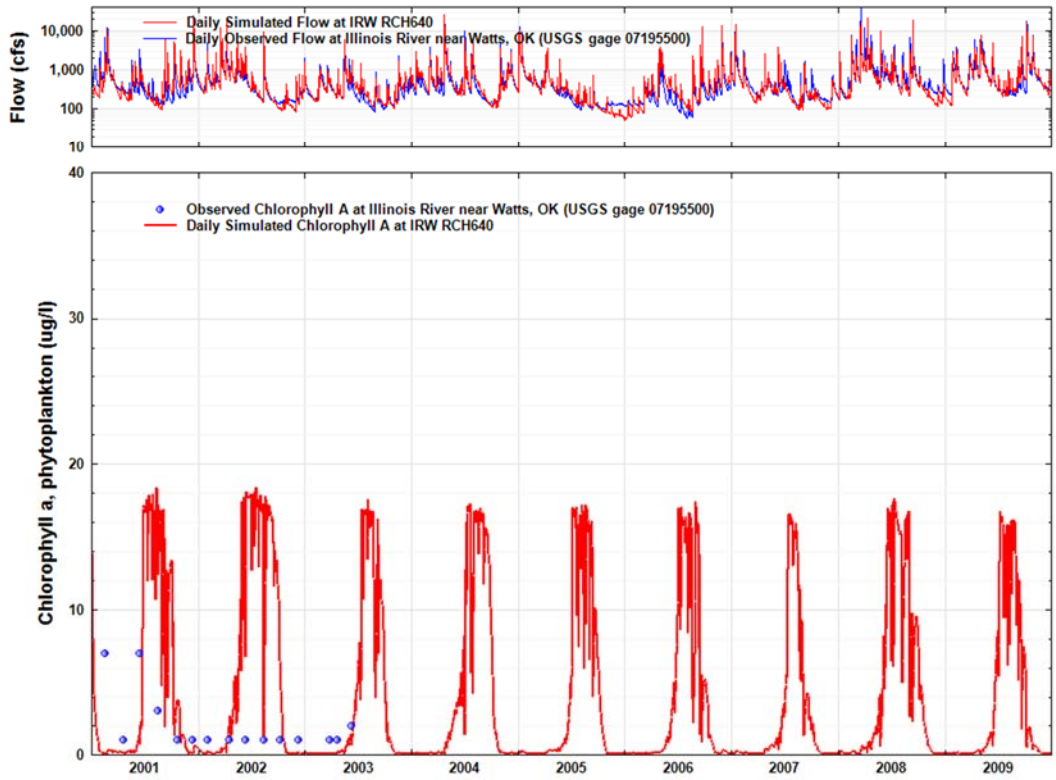

Daily Simulated Flow at IRW RCH640
Daily Observed Flow at Illinois River near Watts, OK (USGS gage 07195500)
Flow (cfs)
10,000
1,000
100
10
Observed Nitrate plus Nitrite at Illinois River near Watts, OK (USGS gage 07195500)
Daily Simulated NO3 at IRW RCH640
Nitrate + Nitrite (mg/l as N)
0
1
2
3
4
5
6
7
8
9
10
2001
2002
2003
2004
2005
2006
2007
2008
2009


Daily Simulated Flow at IRW RCH640
Daily Observed Flow at Illinois River near Watts, OK (USGS gage 07195500)
Flow (cfs)
10,000
1,000
100
10
Observed Ammonia at Illinois River near Watts, OK (USGS gage 07195500)
Daily Simulated Ammonia at IRW RCH640
Ammonia (mg/l)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
2001
2002
2003
2004
2005
2006
2007
2008
2009

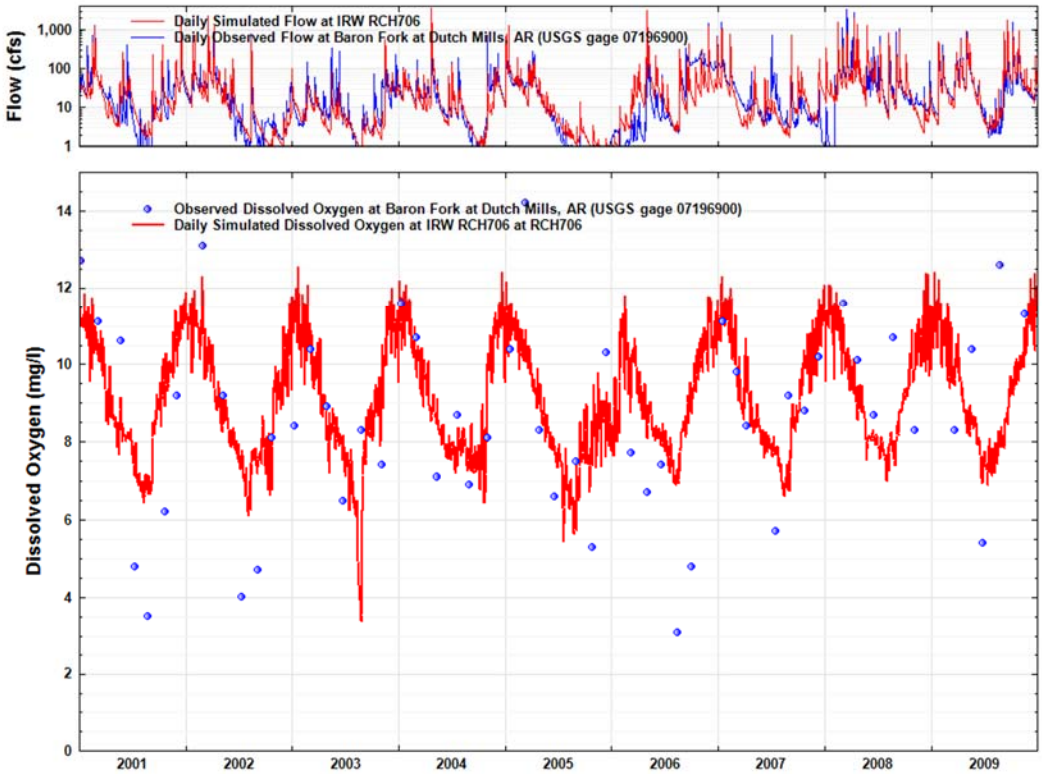

Daily Simulated Flow at IRW RCH640
Daily Observed Flow at Illinois River near Watts, OK (USGS gage 07195500)
Flow (cfs)
10,000
1,000
100
10
Observed Organic Nitrogen at Illinois River near Watts, OK (USGS gage 07195500)
Daily Simulated Organic Nitrogen at IRW RCH640
Organic Nitrogen (mg/l)
5
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

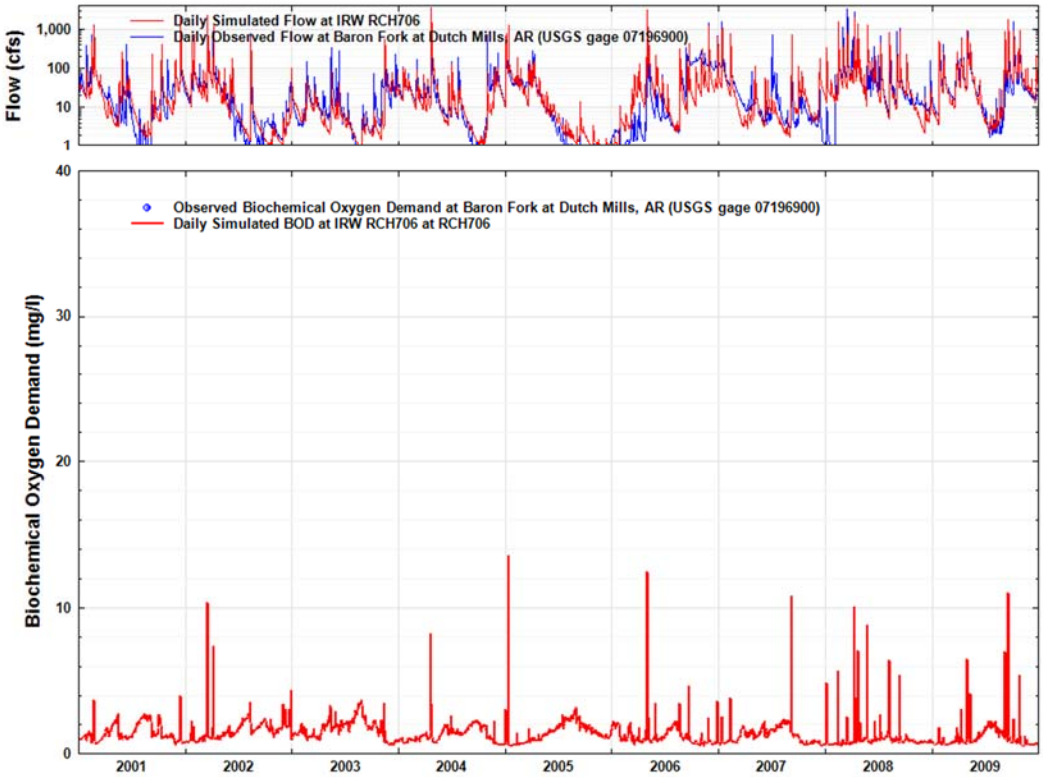

Daily Simulated Flow at IRW RCH640
Daily Observed Flow at Illinois River near Watts, OK (USGS gage 07195500)
Flow (cfs)
10,000
1,000
100
10
Observed Total Nitrogen at Illinois River near Watts, OK (USGS gage 07195500)
Daily Simulated Total Nitrogen at IRW RCH640
Total Nitrogen (mg/l)
10
9
8
7
6
5
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

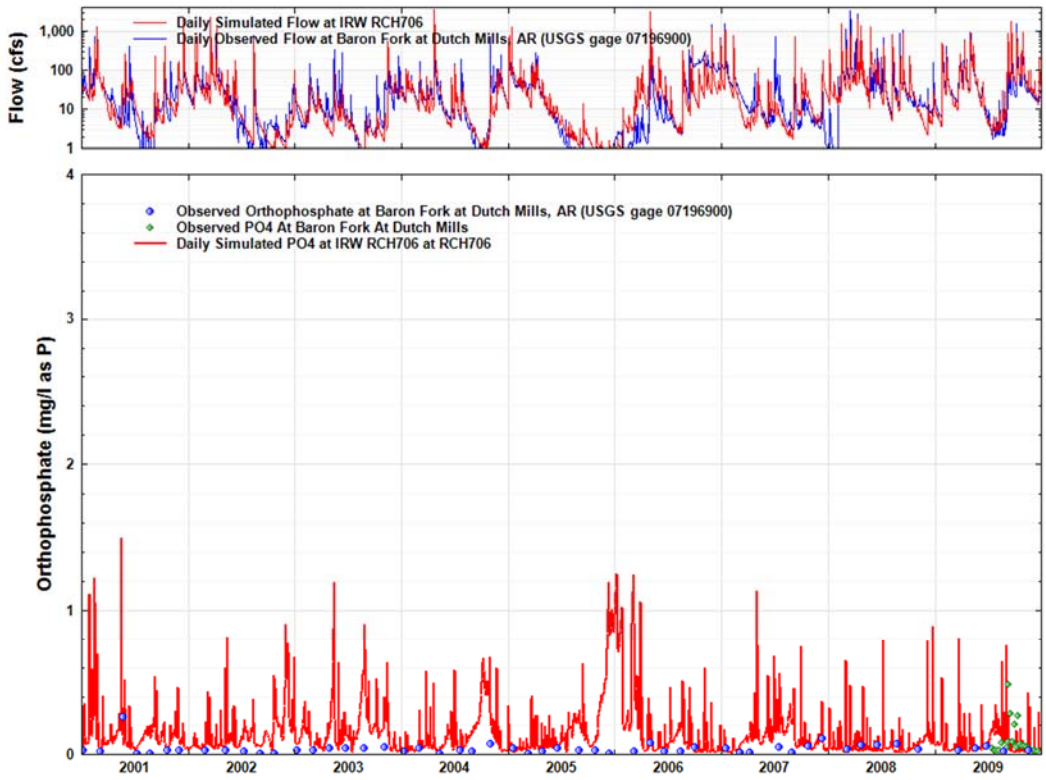

Daily Simulated Flow at IRW RCH640
Daily Observed Flow at Illinois River near Watts, OK (USGS gage 07195500)
Flow (cfs)
10,000
1,000
100
10
Observed Organic Carbon at Illinois River near Watts, OK (USGS gage 07195500)
Daily Simulated TOC at IRW RCH640
Total Organic Carbon (mg/l)
30
25
20
15
10
5
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

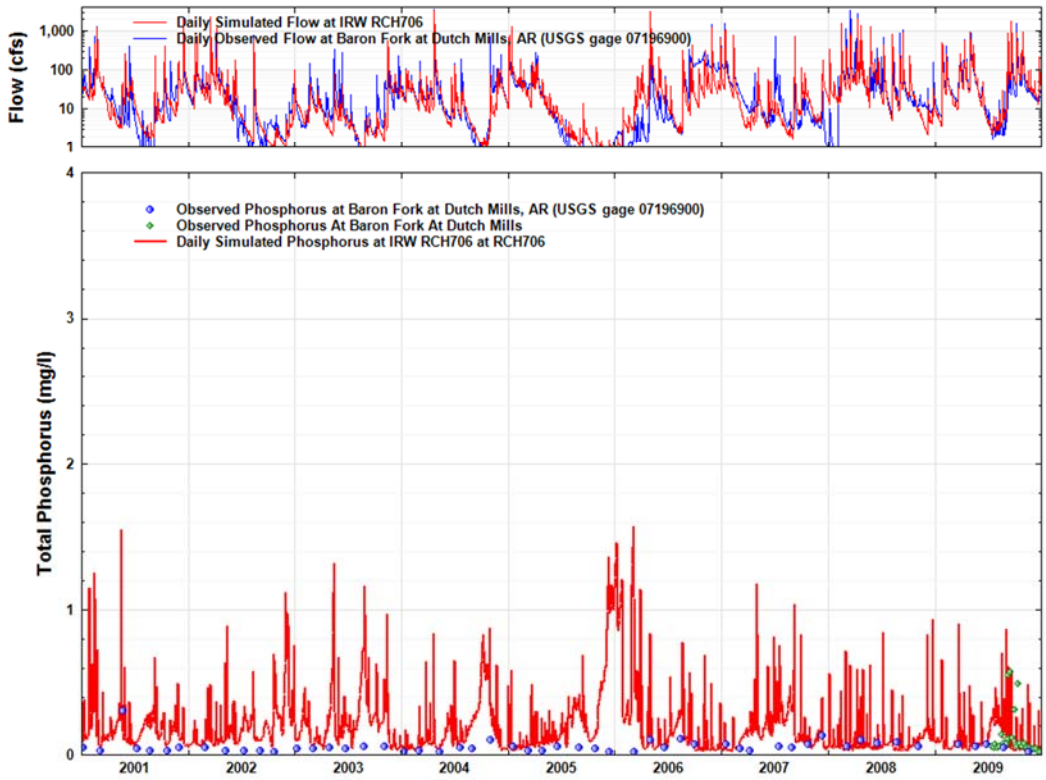

Daily Simulated Flow at IRW RCH640
Daily Observed Flow at Illinois River near Watts, OK (USGS gage 07195500)
Flow (cfs)
10,000
1,000
100
10
Observed Chlorophyll A at Illinois River near Watts, OK (USGS gage 07195500)
Daily Simulated Chlorophyll A at IRW RCH640
Chlorophyll a, phytoplankton (ug/l)
40
30
20
10
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

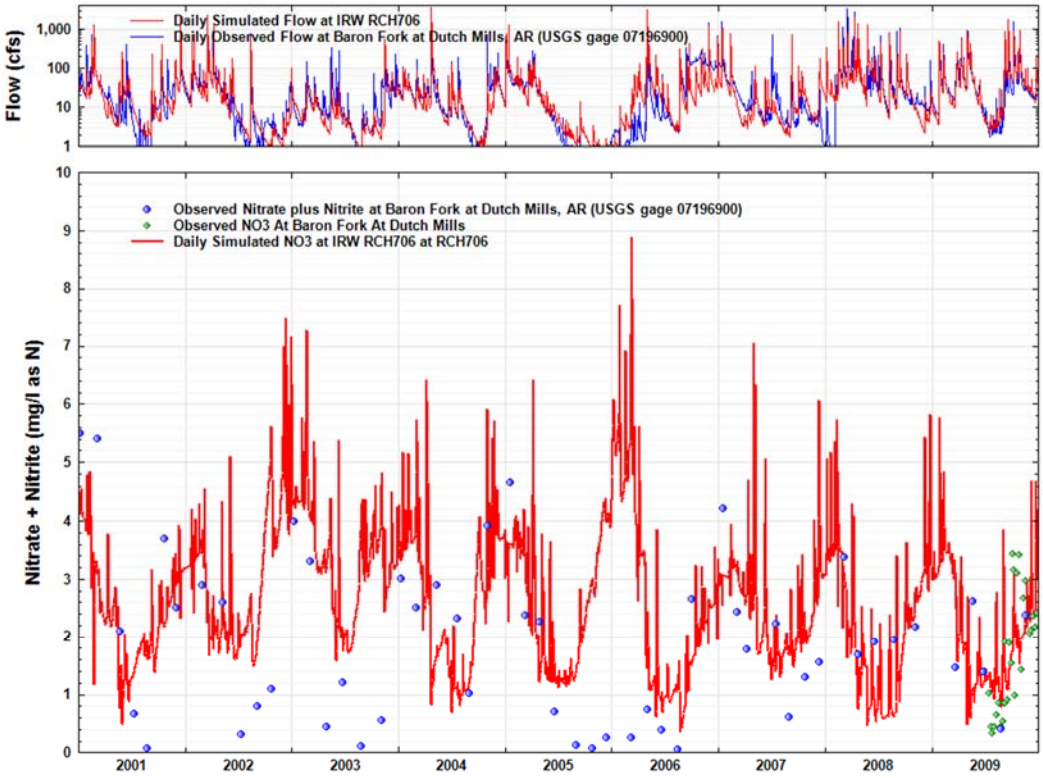
E.8 RCH706 – BARON FORK AT DUTCH MILLS, AR

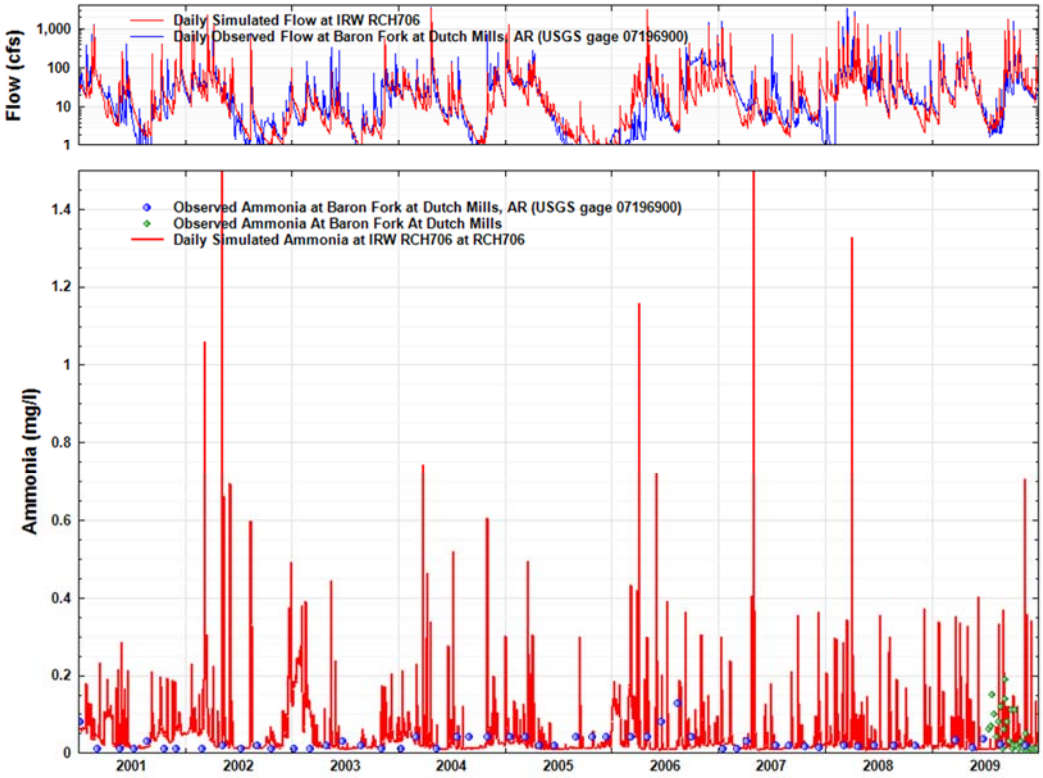


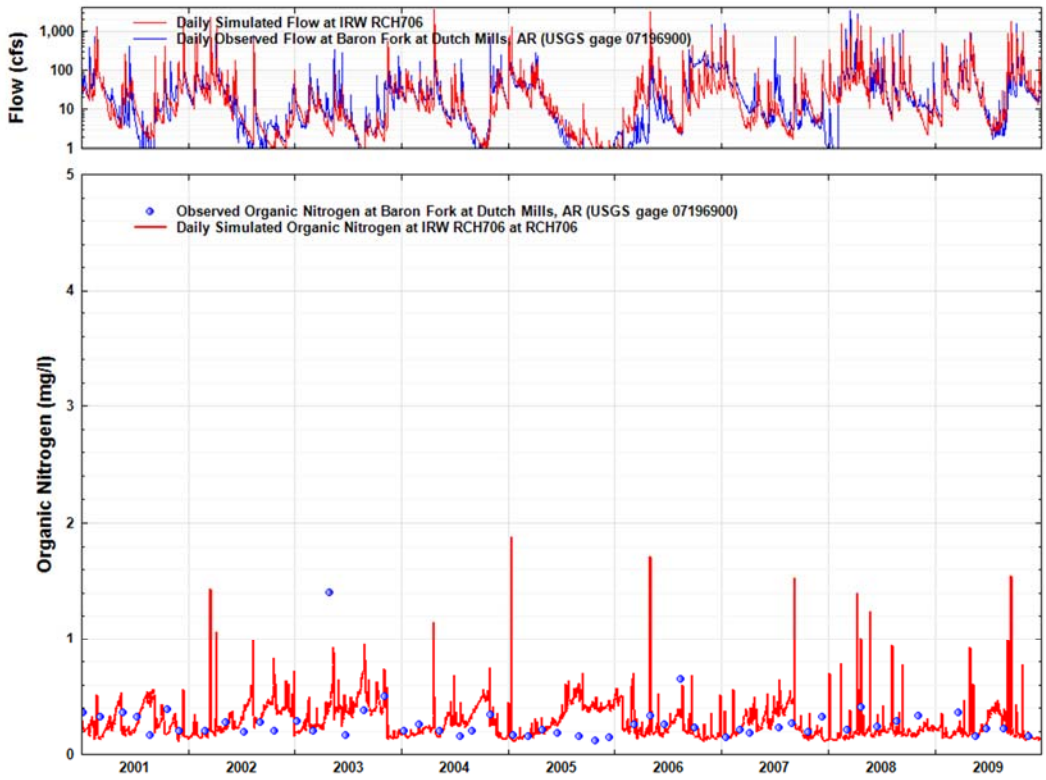


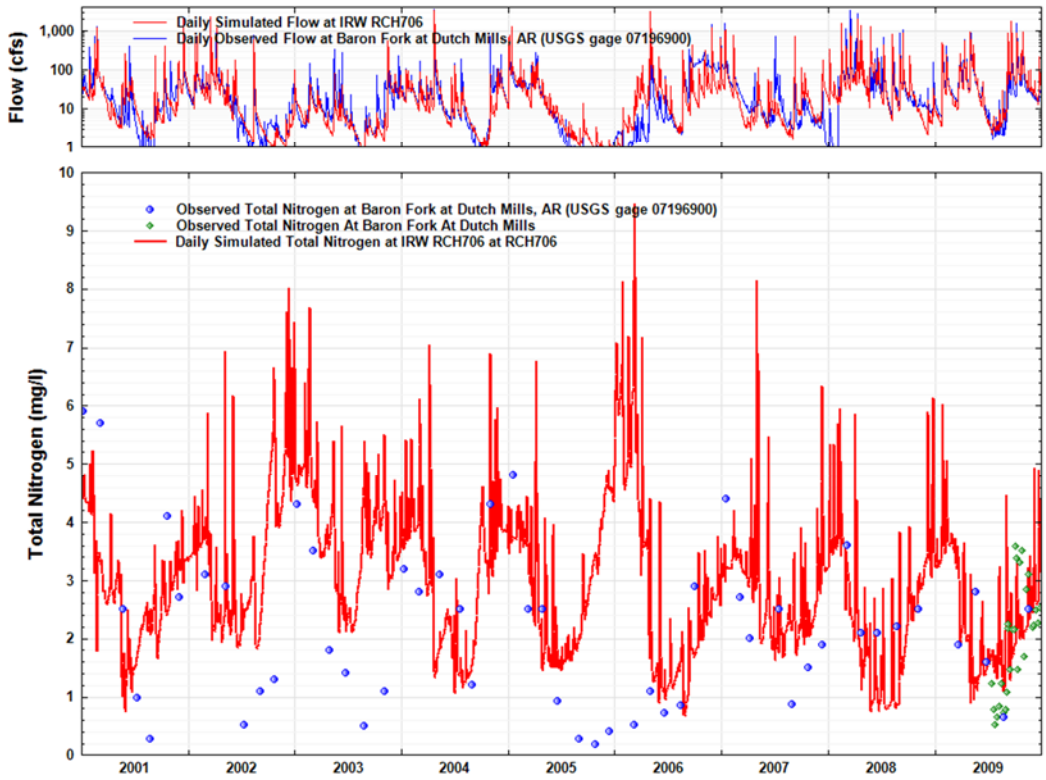

Daily Simulated Flow at IRW RCH706
Daily Observed Flow at Baron Fork at Dutch Mills, AR (USGS gage 07196900)
Flow (cfs)
1,000
100
10
1
Observed Orthophosphate at Baron Fork at Dutch Mills, AR (USGS gage 07196900)
Observed PO4 At Baron Fork At Dutch Mills
Daily Simulated PO4 at IRW RCH706 at RCH706
Orthophosphate (mg/l as P)
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

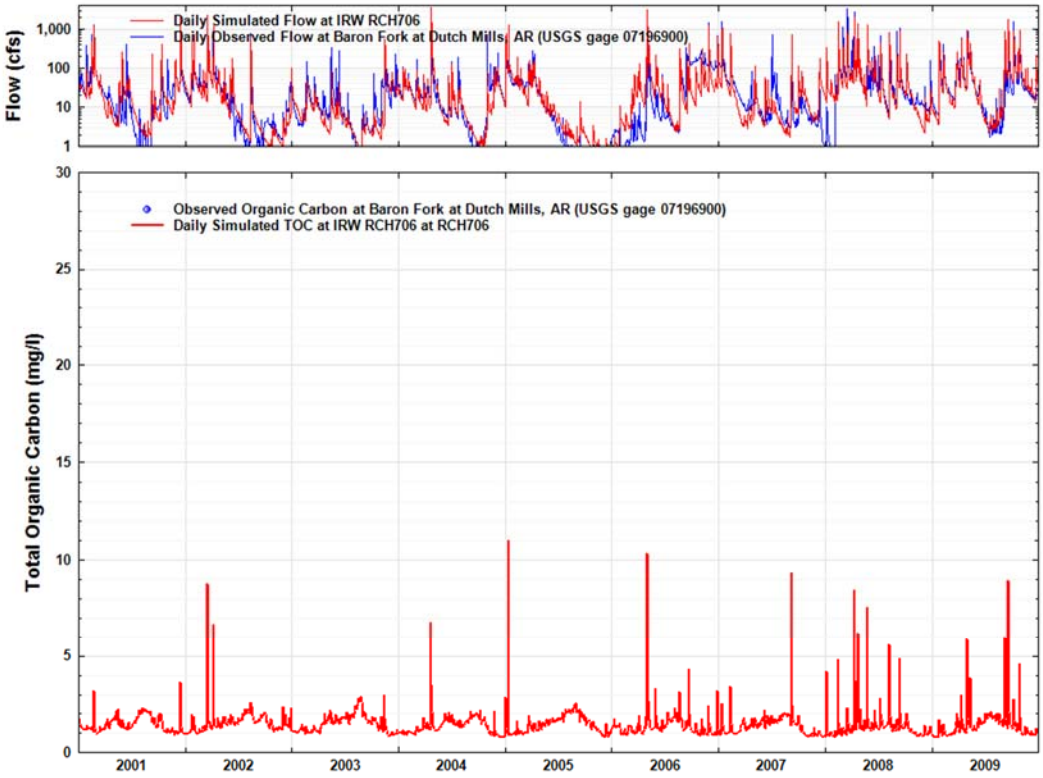

Daily Simulated Flow at IRW RCH706
Daily Observed Flow at Baron Fork at Dutch Mills, AR (USGS gage 07196900)
Flow (cfs)
1,000
100
10
1
Observed Phosphorus at Baron Fork at Dutch Mills, AR (USGS gage 07196900)
Observed Phosphorus At Baron Fork At Dutch Mills
Daily Simulated Phosphorus at IRW RCH706 at RCH706
Total Phosphorus (mg/l)
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

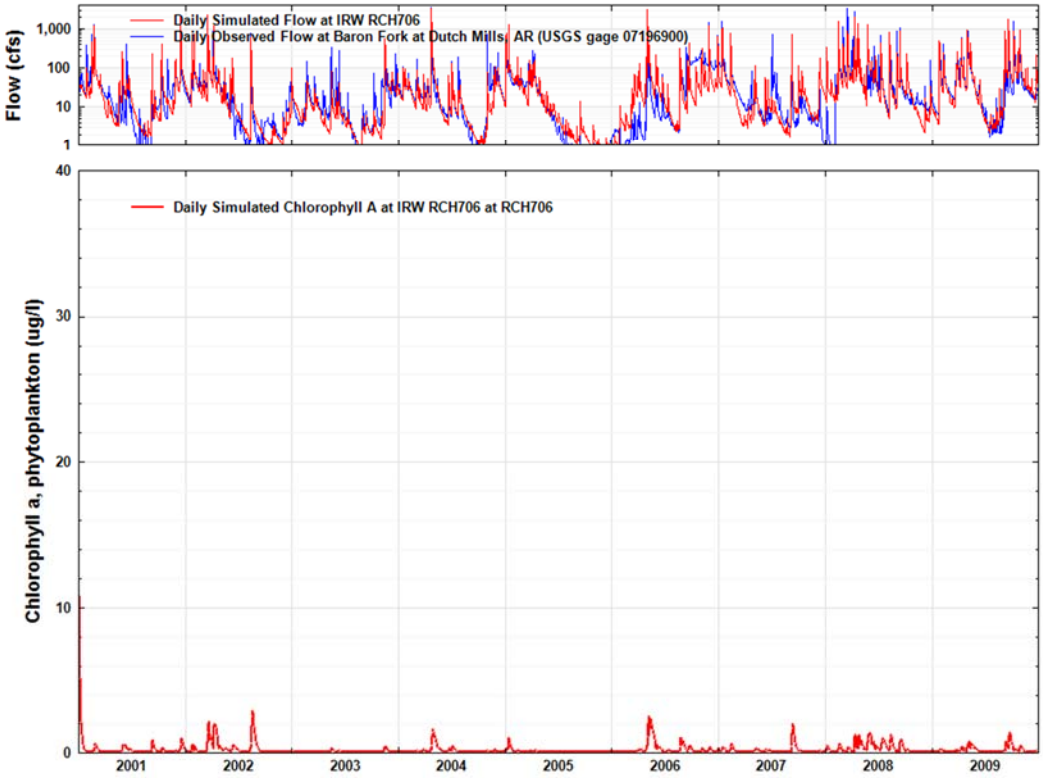

Daily Simulated Flow at IRW RCH706
Daily Observed Flow at Baron Fork at Dutch Mills, AR (USGS gage 07196900)
Flow (cfs)
1,000
100
10
1
Observed Nitrate plus Nitrite at Baron Fork at Dutch Mills, AR (USGS gage 07196900)
Observed NO3 At Baron Fork At Dutch Mills
Daily Simulated NO3 at IRW RCH706 at RCH706
Nitrate + Nitrite (mg/l as N)
10
9
8
7
6
5
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009


Daily Simulated Flow at IRW RCH706
Daily Observed Flow at Baron Fork at Dutch Mills, AR (USGS gage 07196900)
Flow (cfs)
1,000
100
10
1
Observed Ammonia at Baron Fork at Dutch Mills, AR (USGS gage 07196900)
Observed Ammonia At Baron Fork At Dutch Mills
Daily Simulated Ammonia at IRW RCH706 at RCH706
Ammonia (mg/l)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

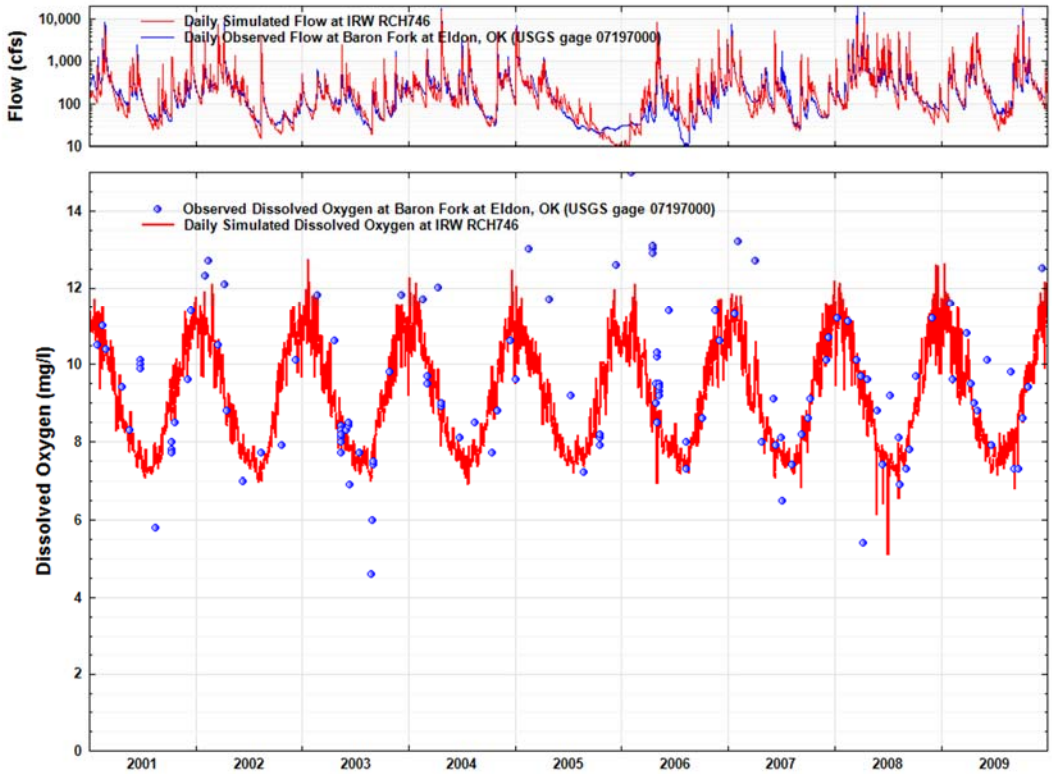

Daily Simulated Flow at IRW RCH706
Daily Observed Flow at Baron Fork at Dutch Mills, AR (USGS gage 07196900)
Flow (cfs)
1,000
100
10
1
Observed Organic Nitrogen at Baron Fork at Dutch Mills, AR (USGS gage 07196900)
Daily Simulated Organic Nitrogen at IRW RCH706 at RCH706
Organic Nitrogen (mg/l)
5
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

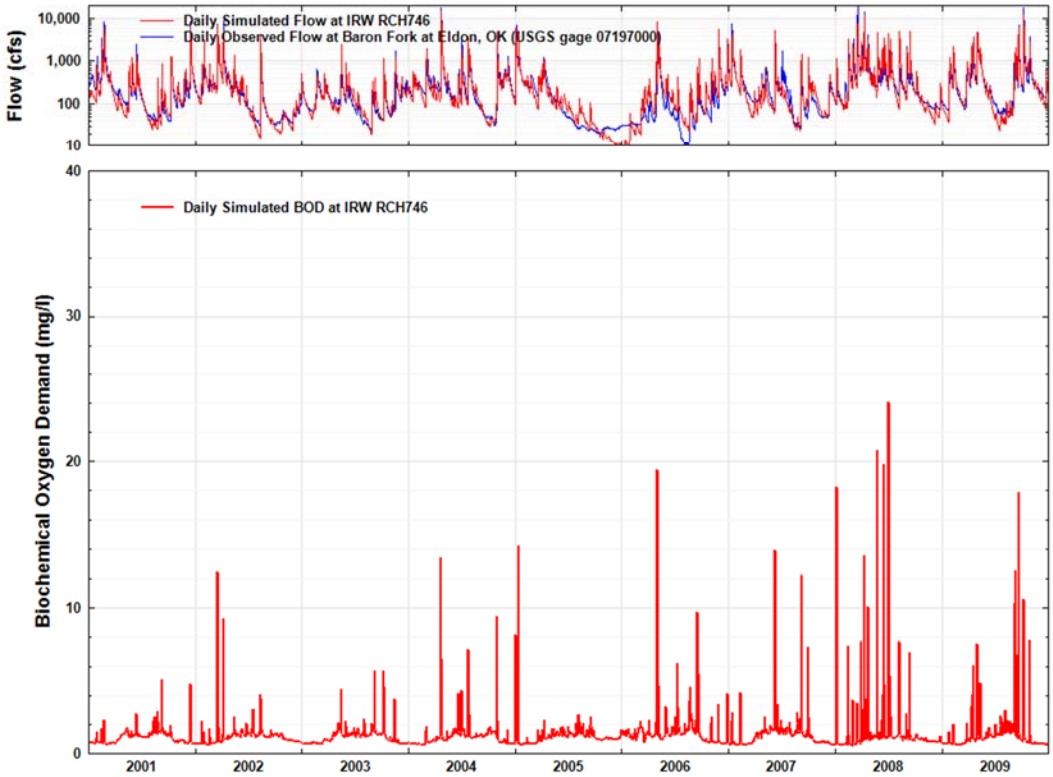

Daily Simulated Flow at IRW RCH706
Daily Observed Flow at Baron Fork at Dutch Mills, AR (USGS gage 07196900)
Flow (cfs)
1,000
100
10
1
Observed Total Nitrogen at Baron Fork at Dutch Mills, AR (USGS gage 07196900)
Observed Total Nitrogen At Baron Fork At Dutch Mills
Daily Simulated Total Nitrogen at IRW RCH706 at RCH706
Total Nitrogen (mg/l)
10
9
8
7
6
5
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

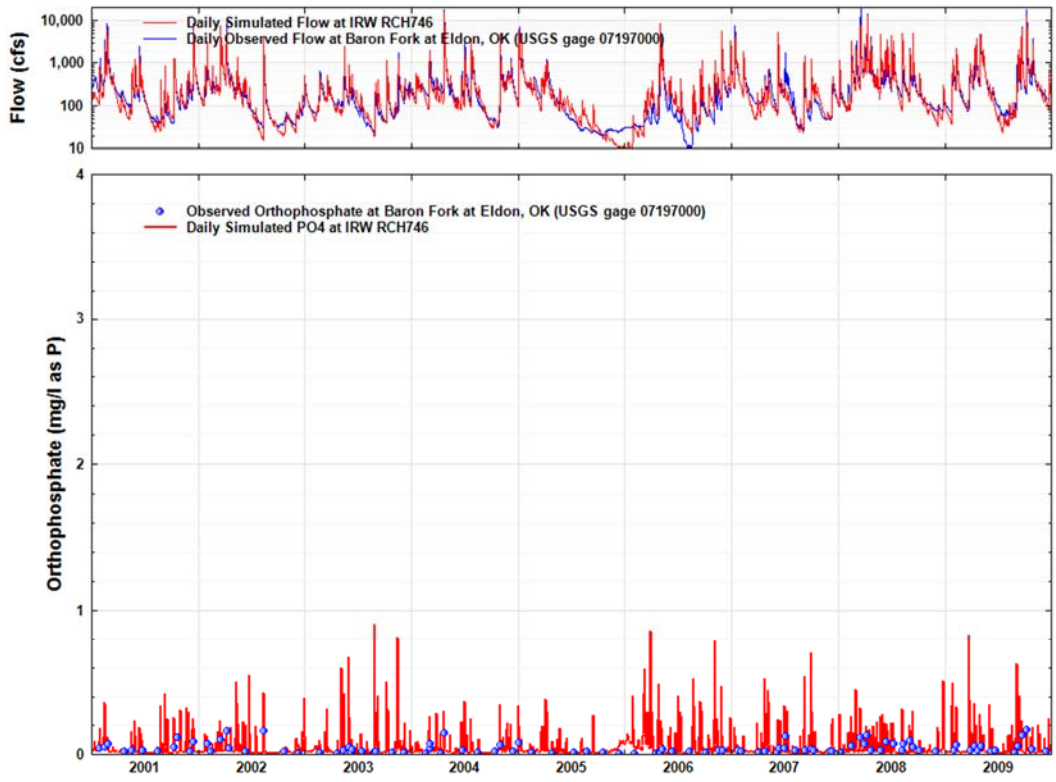

Daily Simulated Flow at IRW RCH706
Daily Observed Flow at Baron Fork at Dutch Mills, AR (USGS gage 07196900)
Flow (cfs)
1,000
100
10
1
Observed Organic Carbon at Baron Fork at Dutch Mills, AR (USGS gage 07196900)
Daily Simulated TOC at IRW RCH706 at RCH706
Total Organic Carbon (mg/l)
30
25
20
15
10
5
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

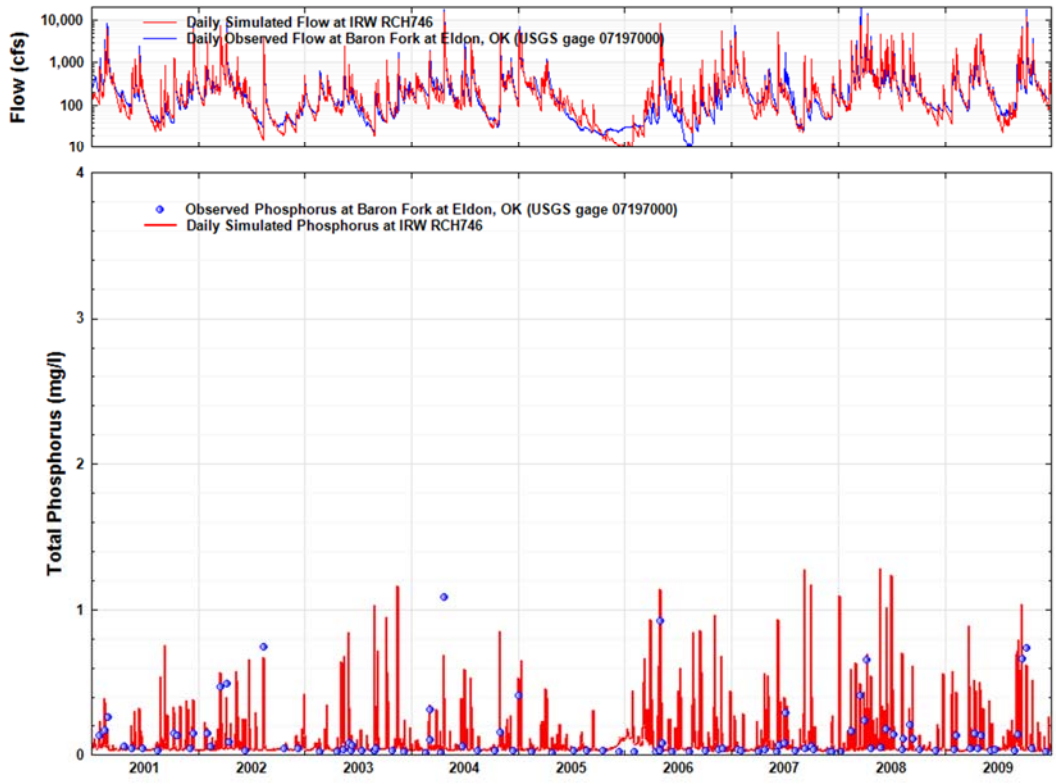

Daily Simulated Flow at IRW RCH706
Daily Observed Flow at Baron Fork at Dutch Mills, AR (USGS gage 07196900)
Flow (cfs)
1,000
100
10
1
Daily Simulated Chlorophyll A at IRW RCH706 at RCH706
Chlorophyll a, phytoplankton (ug/l)
40
30
20
10
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

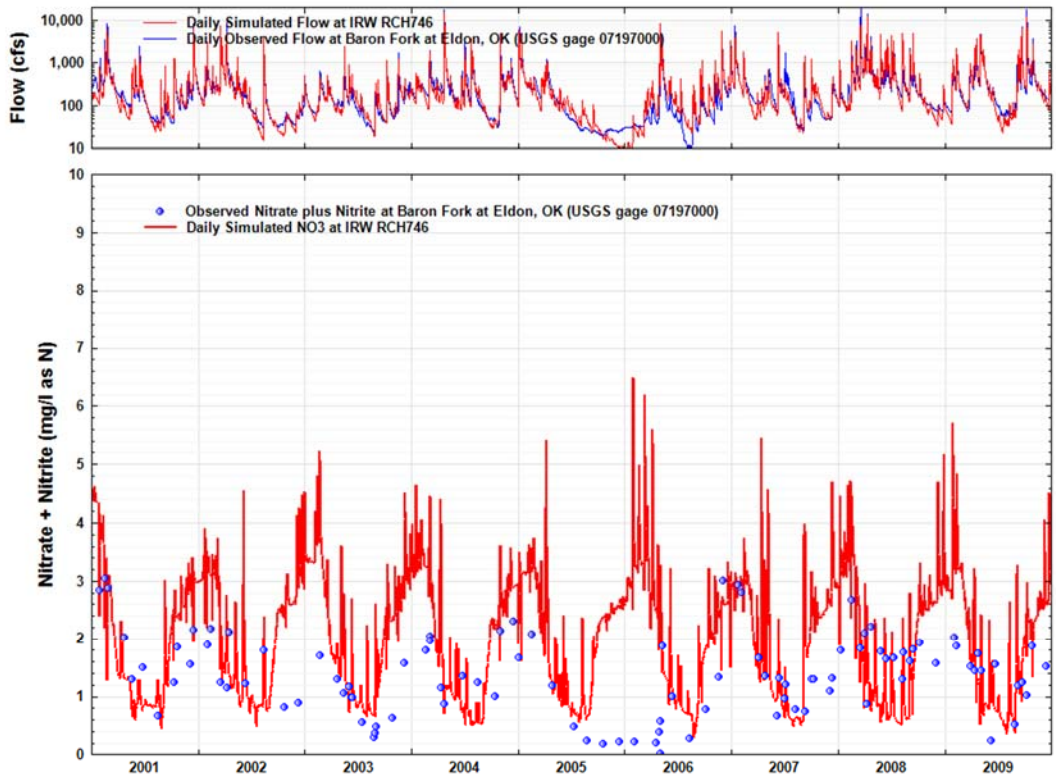
E.9 RCH746 – BARON FORK AT ELDON, OK

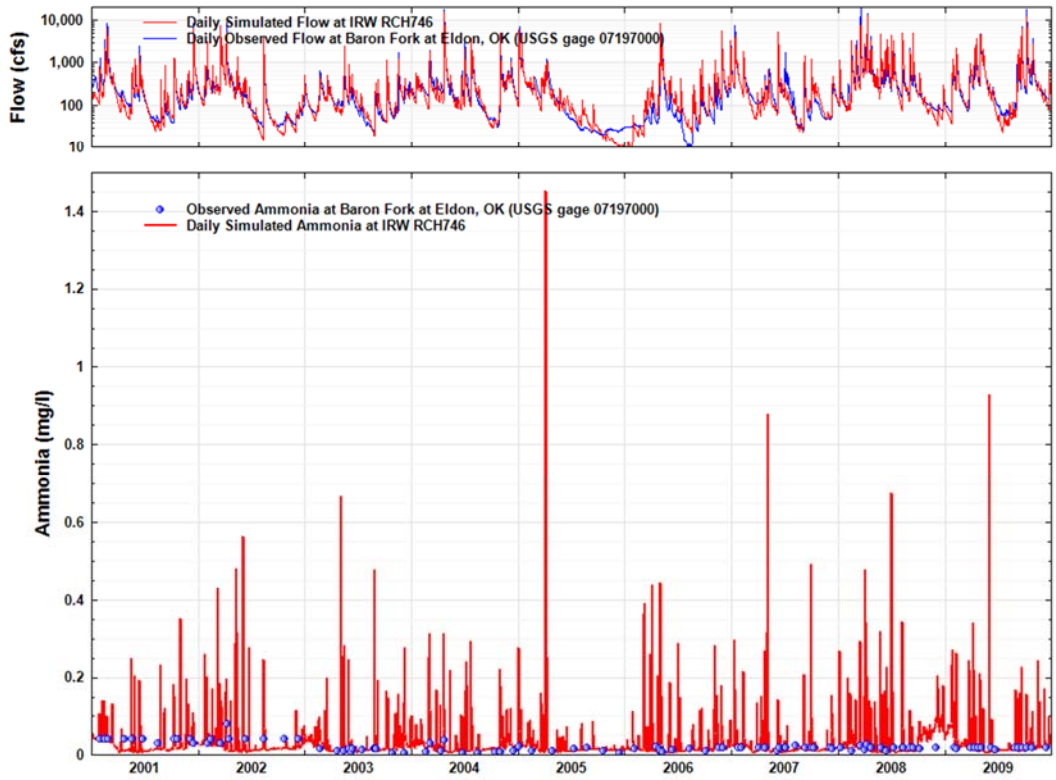


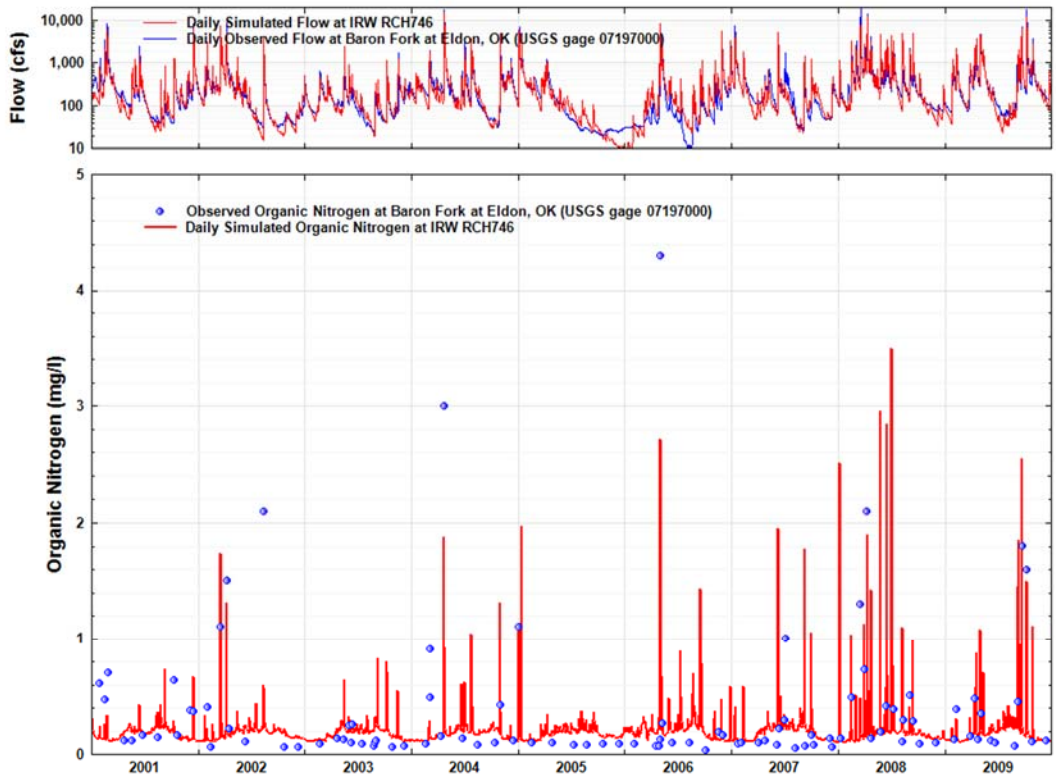


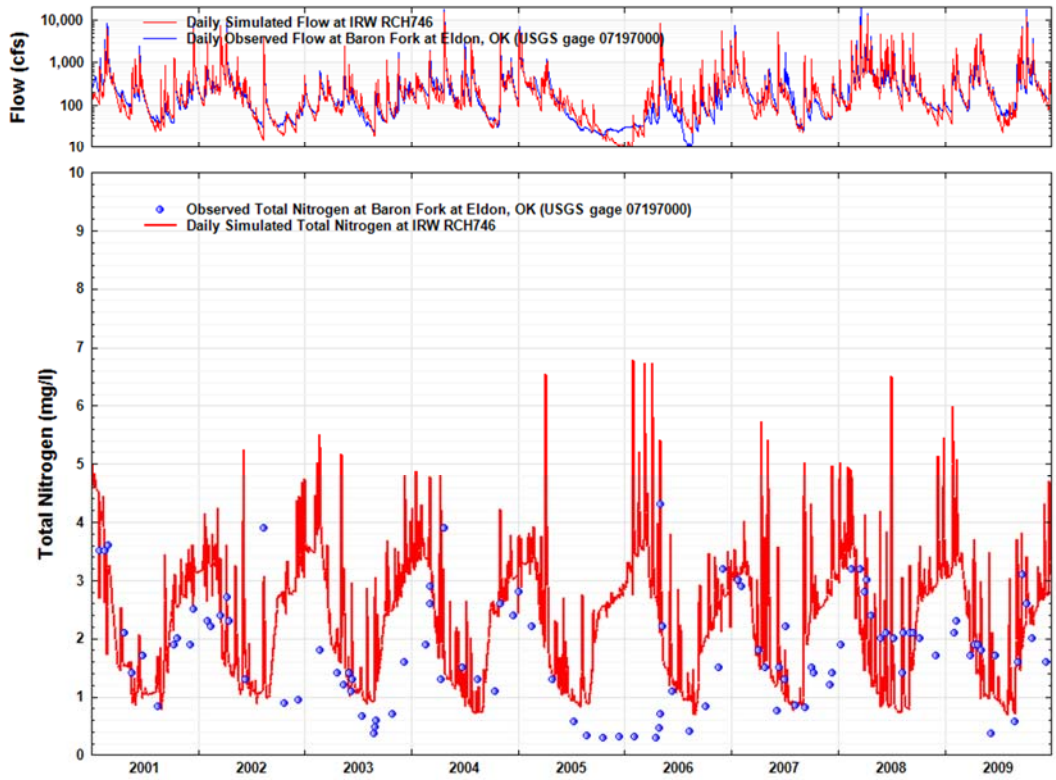

Daily Simulated Flow at IRW RCH746
Daily Observed Flow at Baron Fork at Eldon, OK (USGS gage 07197000)
Flow (cfs)
10,000
1,000
100
10
Observed Orthophosphate at Baron Fork at Eldon, OK (USGS gage 07197000)
Daily Simulated PO4 at IRW RCH746
Orthophosphate (mg/l as P)
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

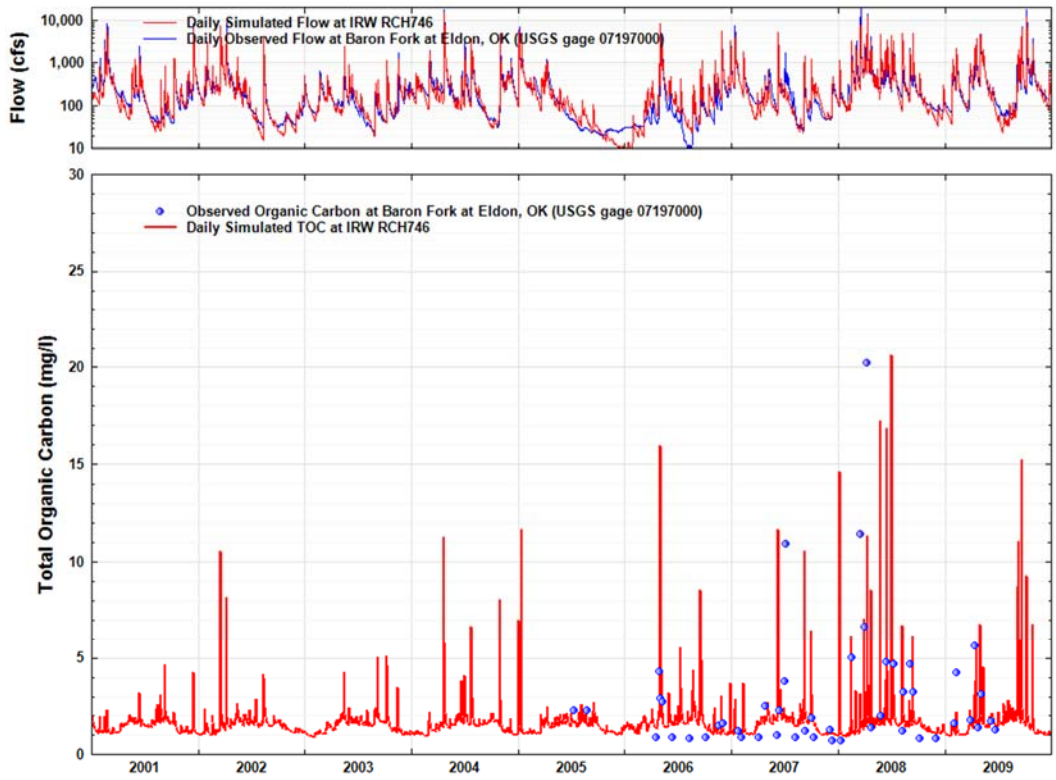

Daily Simulated Flow at IRW RCH746
Daily Observed Flow at Baron Fork at Eldon, OK (USGS gage 07197000)
Flow (cfs)
10,000
1,000
100
10
Observed Phosphorus at Baron Fork at Eldon, OK (USGS gage 07197000)
Daily Simulated Phosphorus at IRW RCH746
Total Phosphorus (mg/l)
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

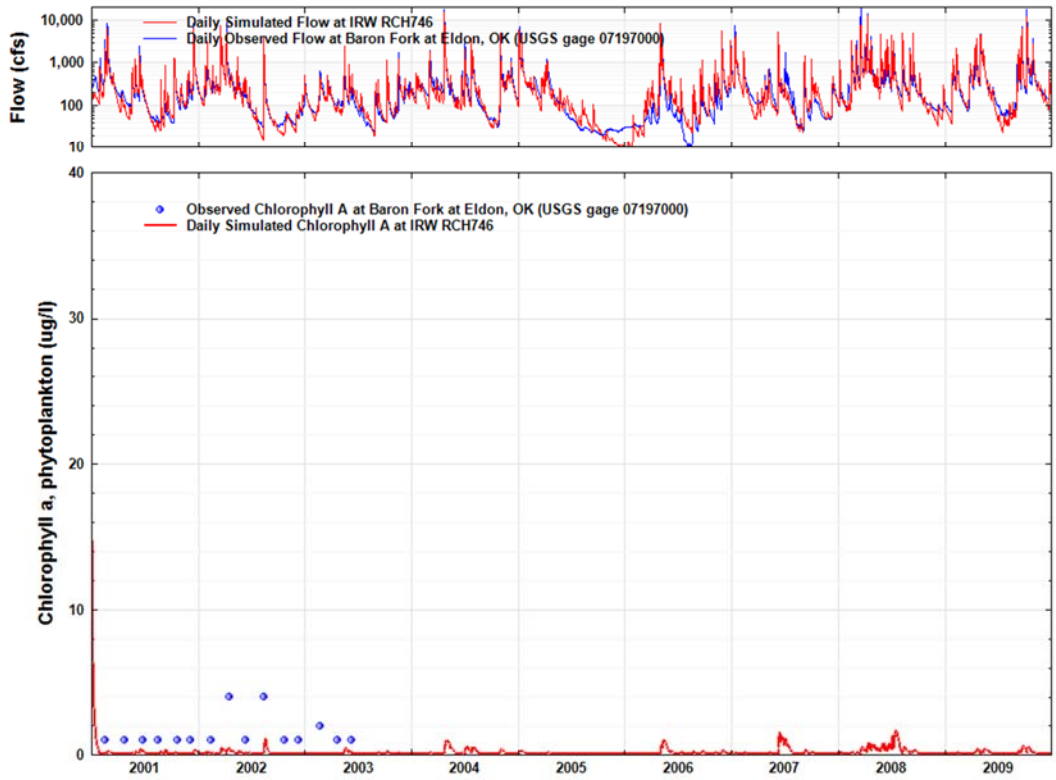

Daily Simulated Flow at IRW RCH746
Daily Observed Flow at Baron Fork at Eldon, OK (USGS gage 07197000)
Flow (cfs)
10,000
1,000
100
10
Observed Nitrate plus Nitrite at Baron Fork at Eldon, OK (USGS gage 07197000)
Daily Simulated NO3 at IRW RCH746
Nitrate + Nitrite (mg/l as N)
0
1
2
3
4
5
6
7
8
9
10
2001
2002
2003
2004
2005
2006
2007
2008
2009


Daily Simulated Flow at IRW RCH746
Daily Observed Flow at Baron Fork at Eldon, OK (USGS gage 07197000)
Flow (cfs)
10,000
1,000
100
10
Observed Ammonia at Baron Fork at Eldon, OK (USGS gage 07197000)
Daily Simulated Ammonia at IRW RCH746
Ammonia (mg/l)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
2001
2002
2003
2004
2005
2006
2007
2008
2009

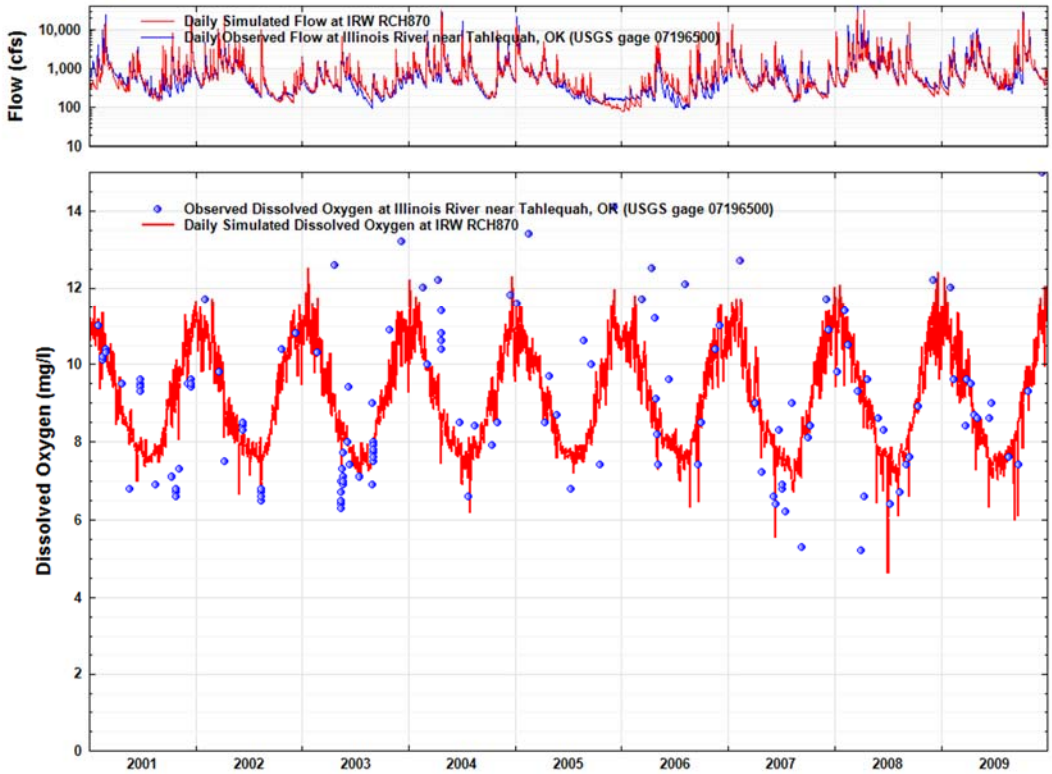

Daily Simulated Flow at IRW RCH746
Daily Observed Flow at Baron Fork at Eldon, OK (USGS gage 07197000)
Flow (cfs)
10,000
1,000
100
10
Observed Organic Nitrogen at Baron Fork at Eldon, OK (USGS gage 07197000)
Daily Simulated Organic Nitrogen at IRW RCH746
Organic Nitrogen (mg/l)
0
1
2
3
4
5
2001
2002
2003
2004
2005
2006
2007
2008
2009

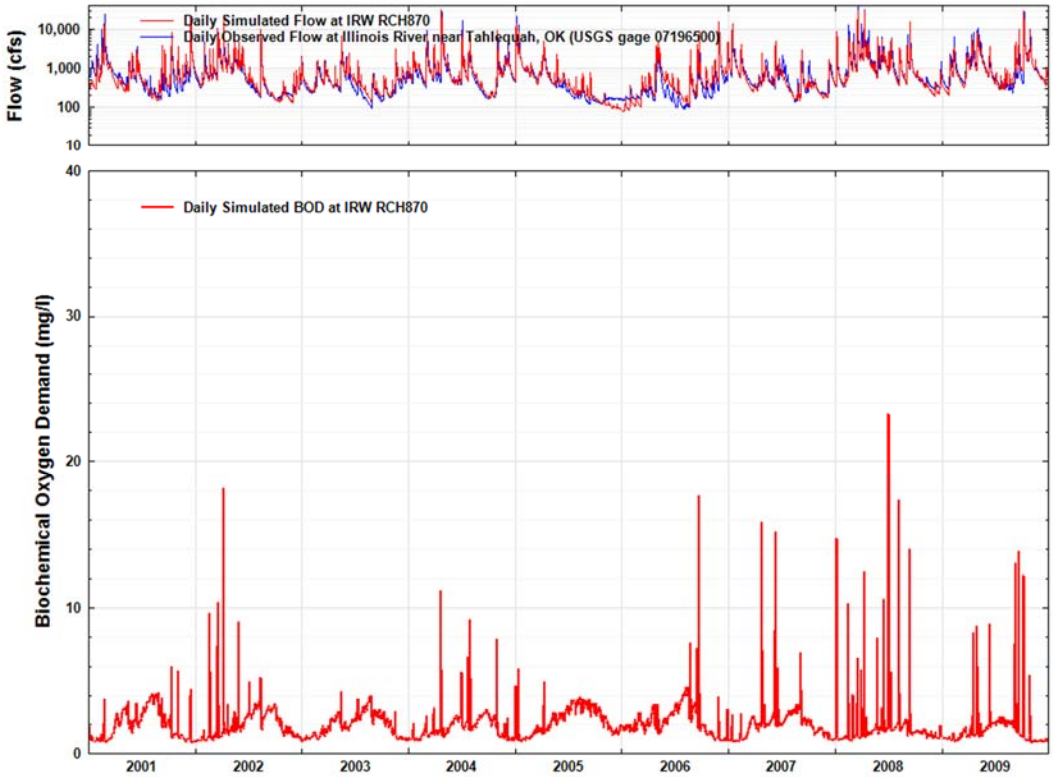

Daily Simulated Flow at IRW RCH746
Daily Observed Flow at Baron Fork at Eldon, OK (USGS gage 07197000)
Flow (cfs)
10,000
1,000
100
10
Observed Total Nitrogen at Baron Fork at Eldon, OK (USGS gage 07197000)
Daily Simulated Total Nitrogen at IRW RCH746
Total Nitrogen (mg/l)
0
1
2
3
4
5
6
7
8
9
10
2001
2002
2003
2004
2005
2006
2007
2008
2009

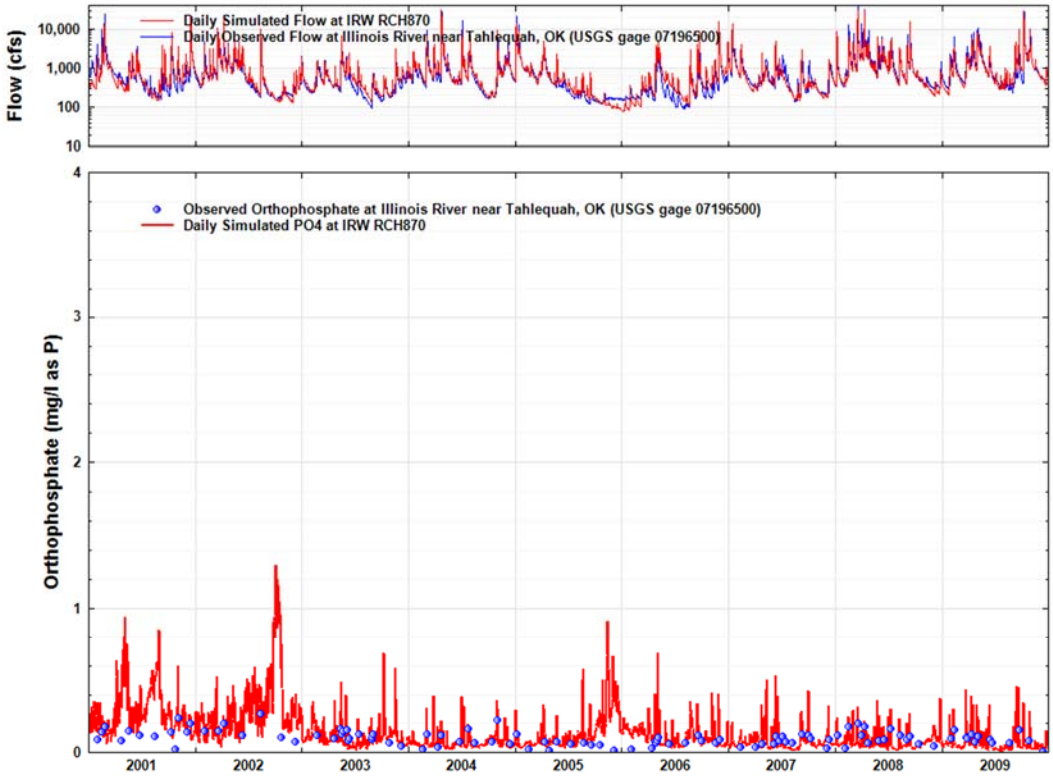

Daily Simulated Flow at IRW RCH746
Daily Observed Flow at Baron Fork at Eldon, OK (USGS gage 07197000)
Flow (cfs)
10,000
1,000
100
10
Observed Organic Carbon at Baron Fork at Eldon, OK (USGS gage 07197000)
Daily Simulated TOC at IRW RCH746
Total Organic Carbon (mg/l)
30
25
20
15
10
5
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

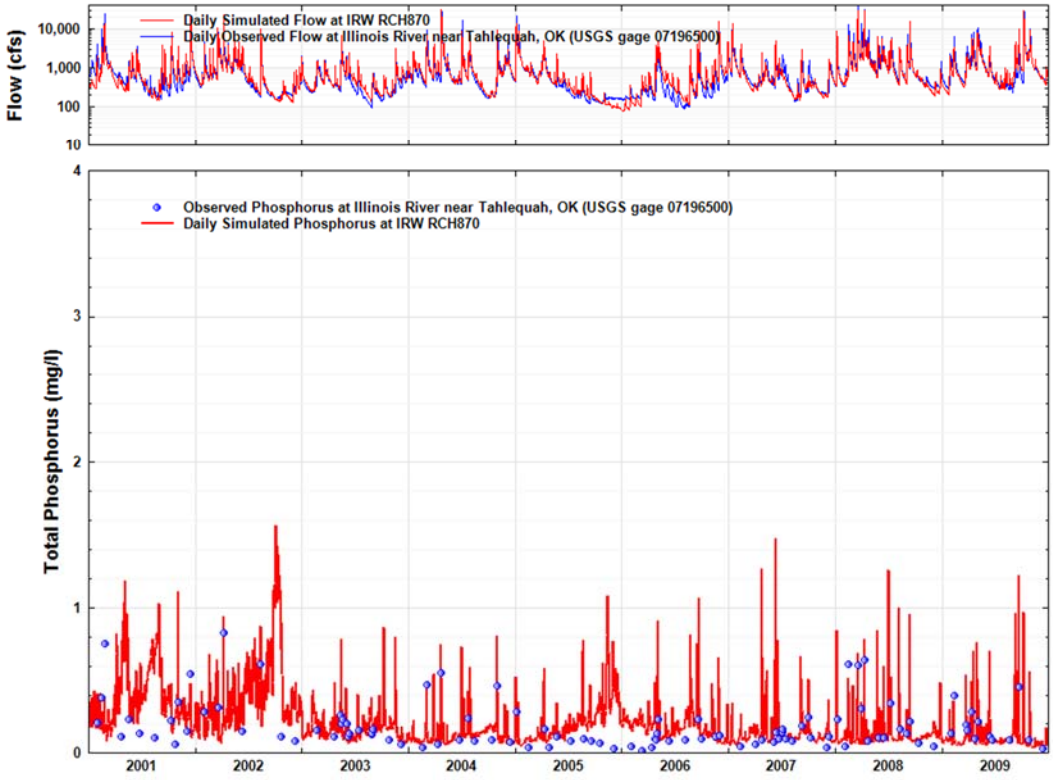

Daily Simulated Flow at IRW RCH746
Daily Observed Flow at Baron Fork at Eldon, OK (USGS gage 07197000)
Flow (cfs)
10,000
1,000
100
10
Observed Chlorophyll A at Baron Fork at Eldon, OK (USGS gage 07197000)
Daily Simulated Chlorophyll A at IRW RCH746
Chlorophyll a, phytoplankton (ug/l)
40
30
20
10
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

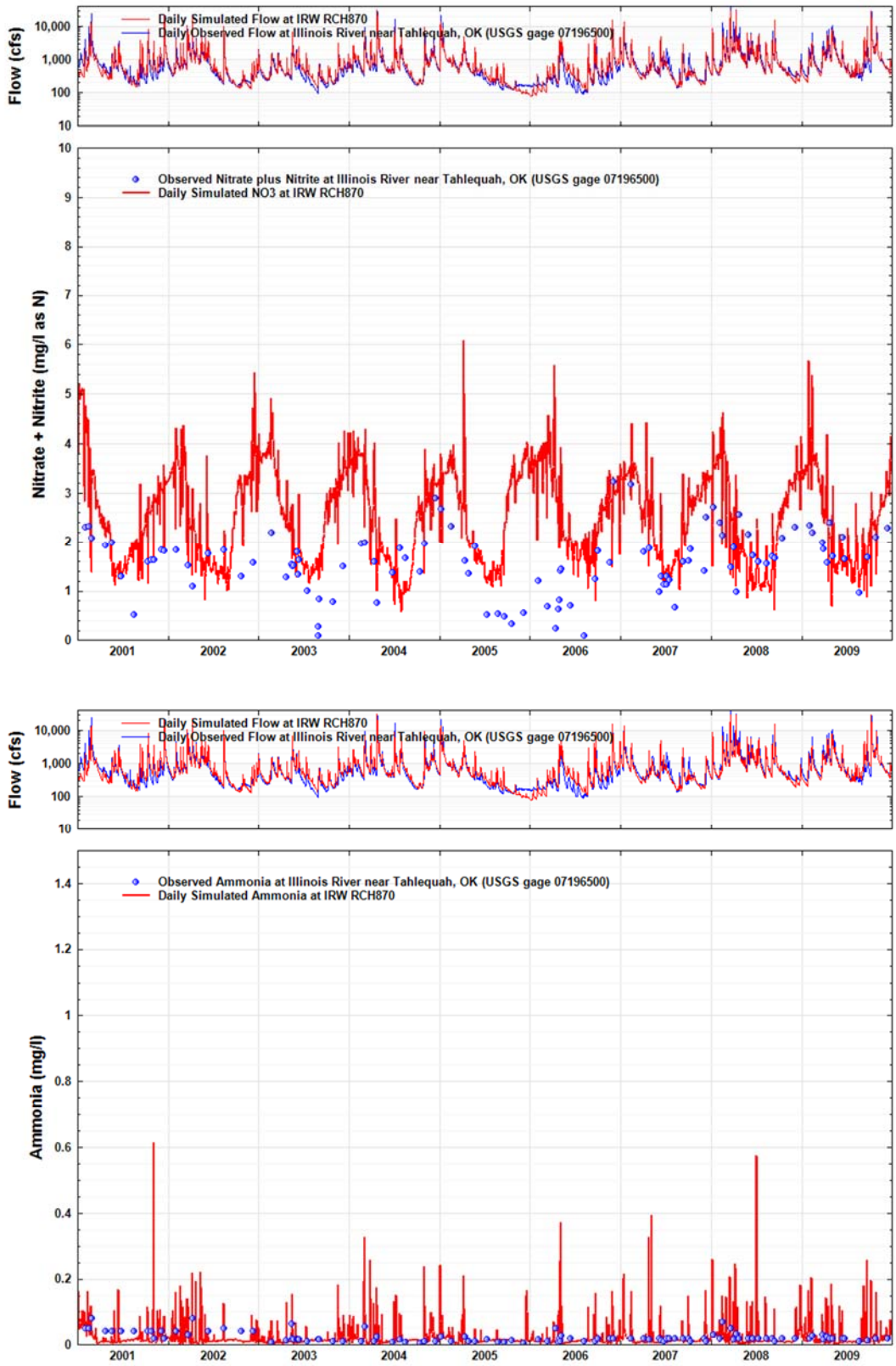
E.10 RCH870 – ILLINOIS RIVER NEAR TAHLEQUAH, OK

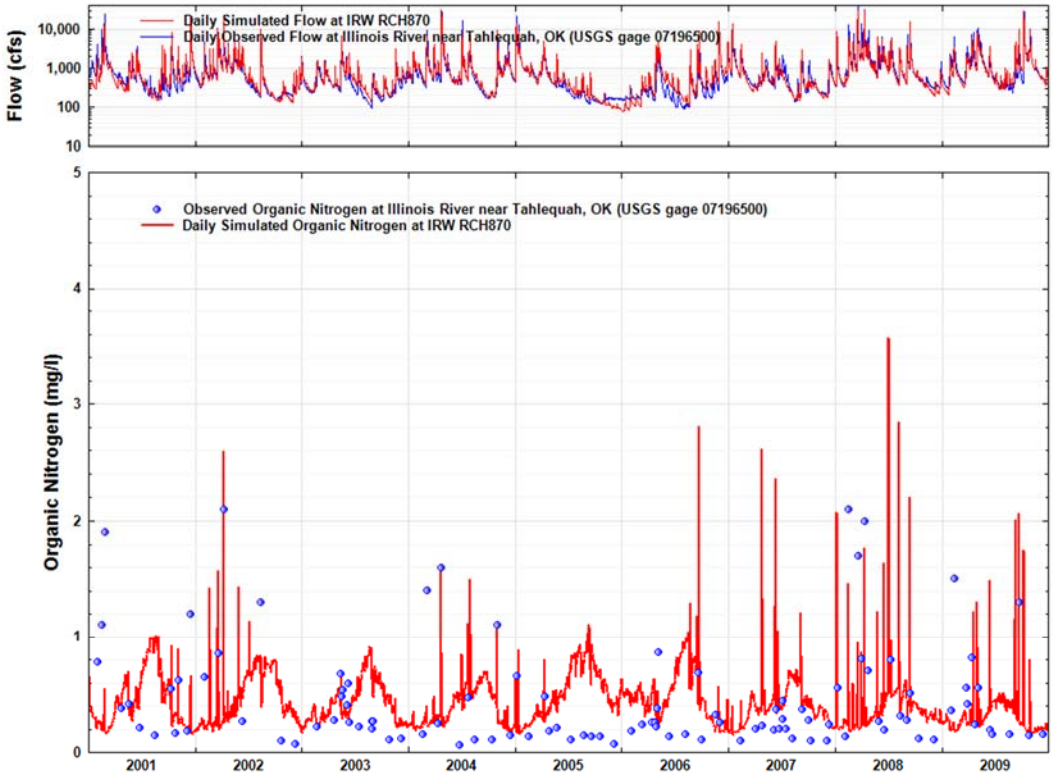


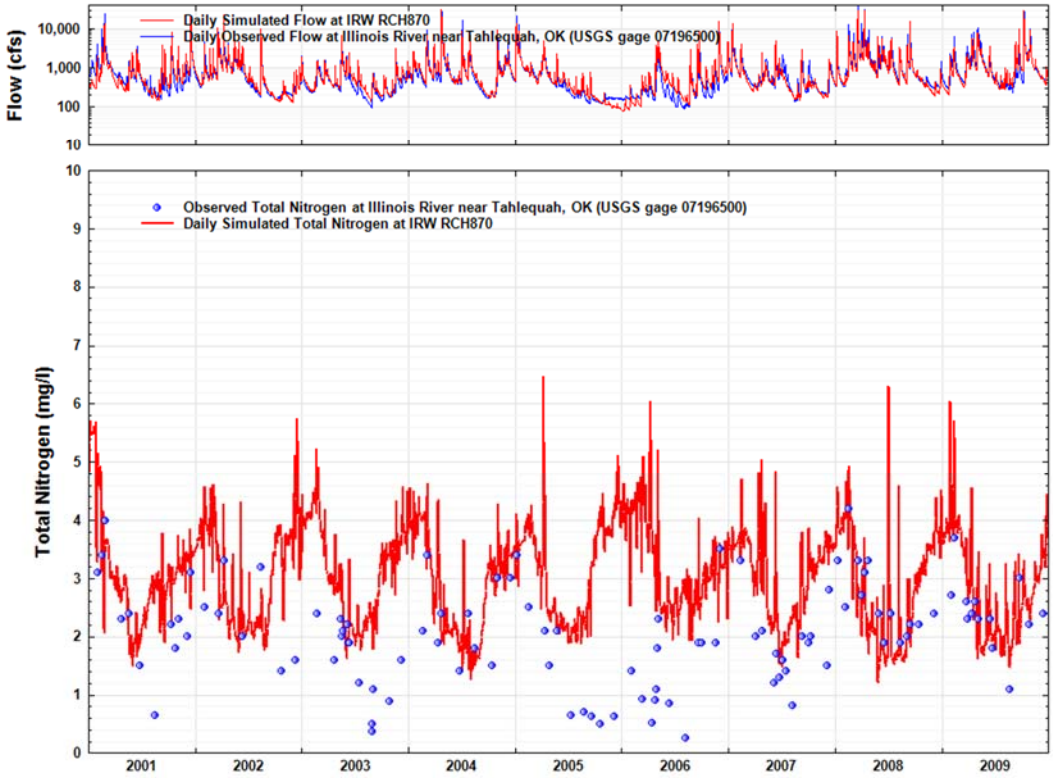


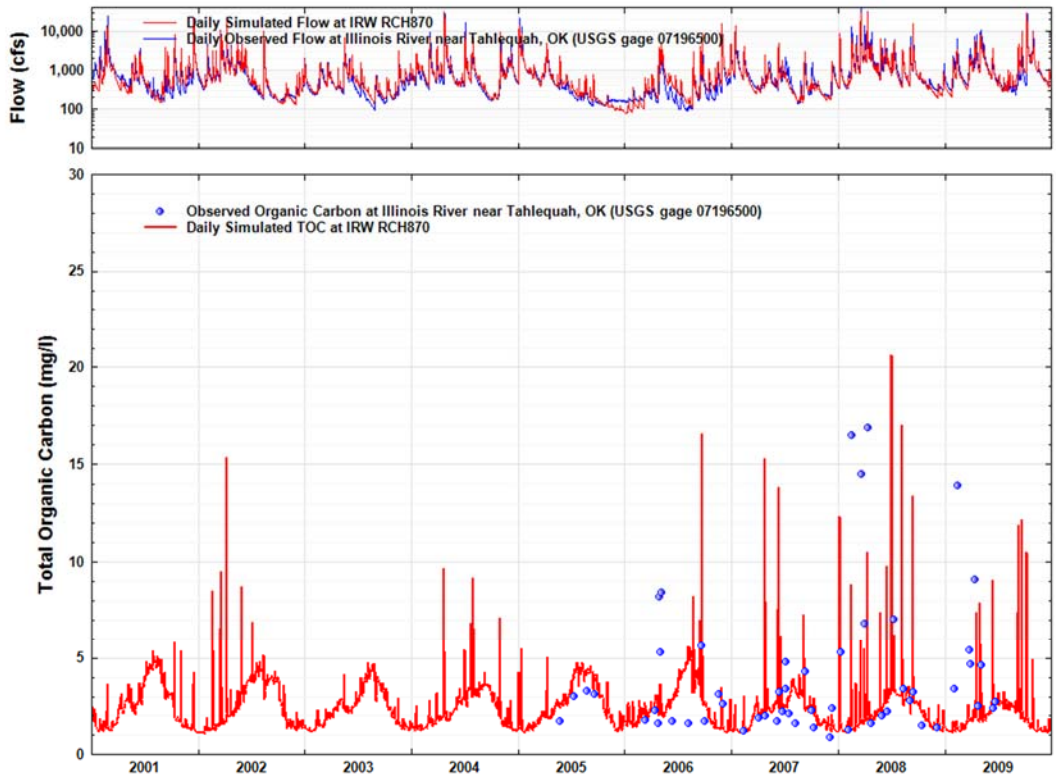

Daily Simulated Flow at IRW RCH870
Daily Observed Flow at Illinois River near Tahlequah, OK (USGS gage 07196500)
Flow (cfs)
10,000
1,000
100
10
Observed Orthophosphate at Illinois River near Tahlequah, OK (USGS gage 07196500)
Daily Simulated PO4 at IRW RCH870
Orthophosphate (mg/l as P)
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

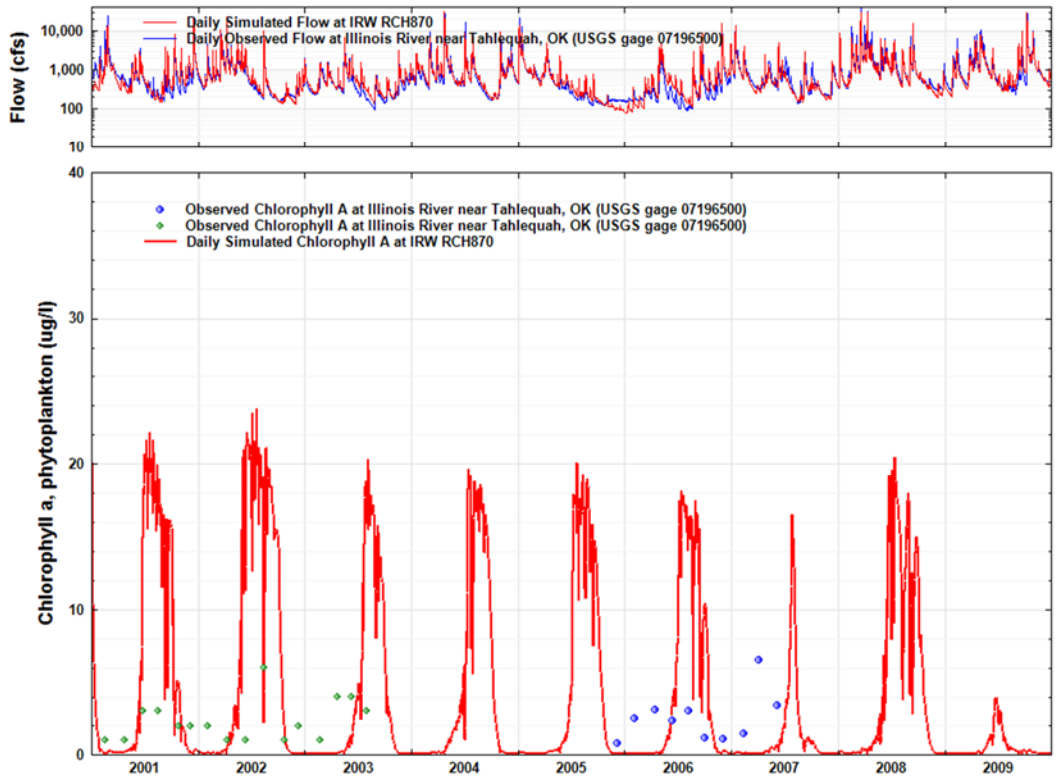

Daily Simulated Flow at IRW RCH870
Daily Observed Flow at Illinois River near Tahlequah, OK (USGS gage 07196500)
Flow (cfs)
10,000
1,000
100
10
Observed Phosphorus at Illinois River near Tahlequah, OK (USGS gage 07196500)
Daily Simulated Phosphorus at IRW RCH870
Total Phosphorus (mg/l)
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009


Daily Simulated Flow at IRW RCH870
Daily Observed Flow at Illinois River near Tahlequah, OK (USGS gage 07196500)
Flow (cfs)
Observed Nitrate plus Nitrite at Illinois River near Tahlequah, OK (USGS gage 07196500)
Daily Simulated NO3 at IRW RCH870
Nitrate + Nitrite (mg/l as N)
Daily Simulated Flow at IRW RCH870
Daily Observed Flow at Illinois River near Tahlequah, OK (USGS gage 07196500)
Flow (cfs)
Observed Ammonia at Illinois River near Tahlequah, OK (USGS gage 07196500)
Daily Simulated Ammonia at IRW RCH870
Ammonia (mg/l)
2001
2002
2003
2004
2005
2006
2007
2008
2009

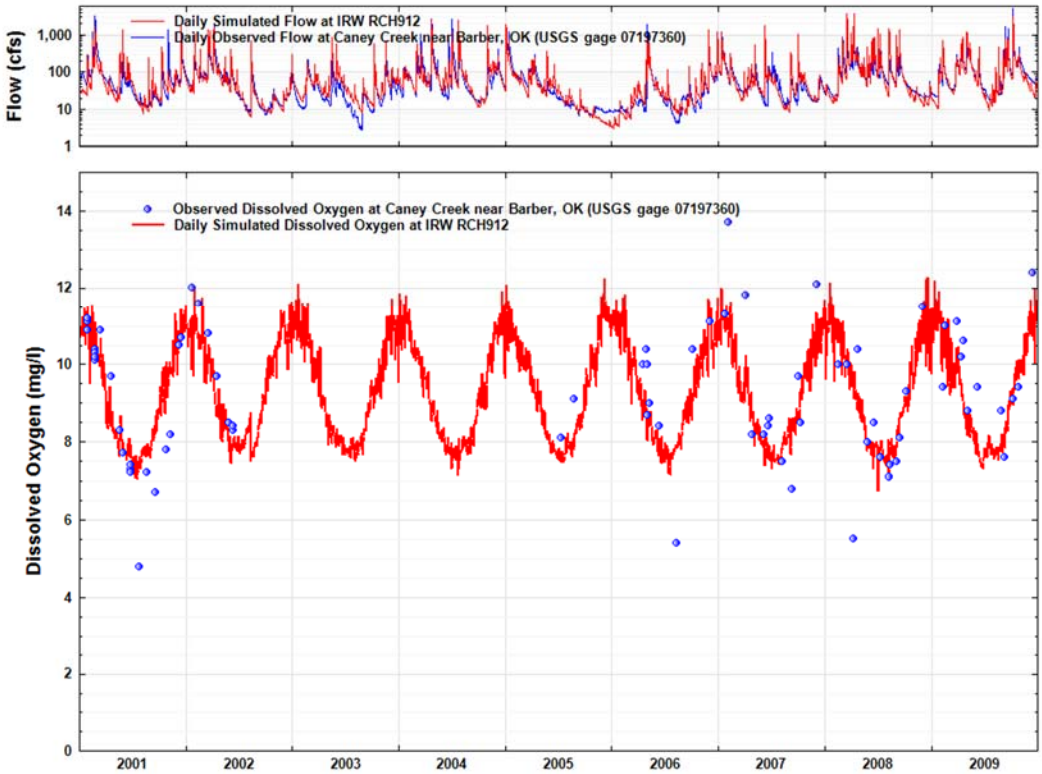

Daily Simulated Flow at IRW RCH870
Daily Observed Flow at Illinois River near Tahlequah, OK (USGS gage 07196500)
Flow (cfs)
10,000
1,000
100
10
Observed Organic Nitrogen at Illinois River near Tahlequah, OK (USGS gage 07196500)
Daily Simulated Organic Nitrogen at IRW RCH870
Organic Nitrogen (mg/l)
0
1
2
3
4
5
2001
2002
2003
2004
2005
2006
2007
2008
2009

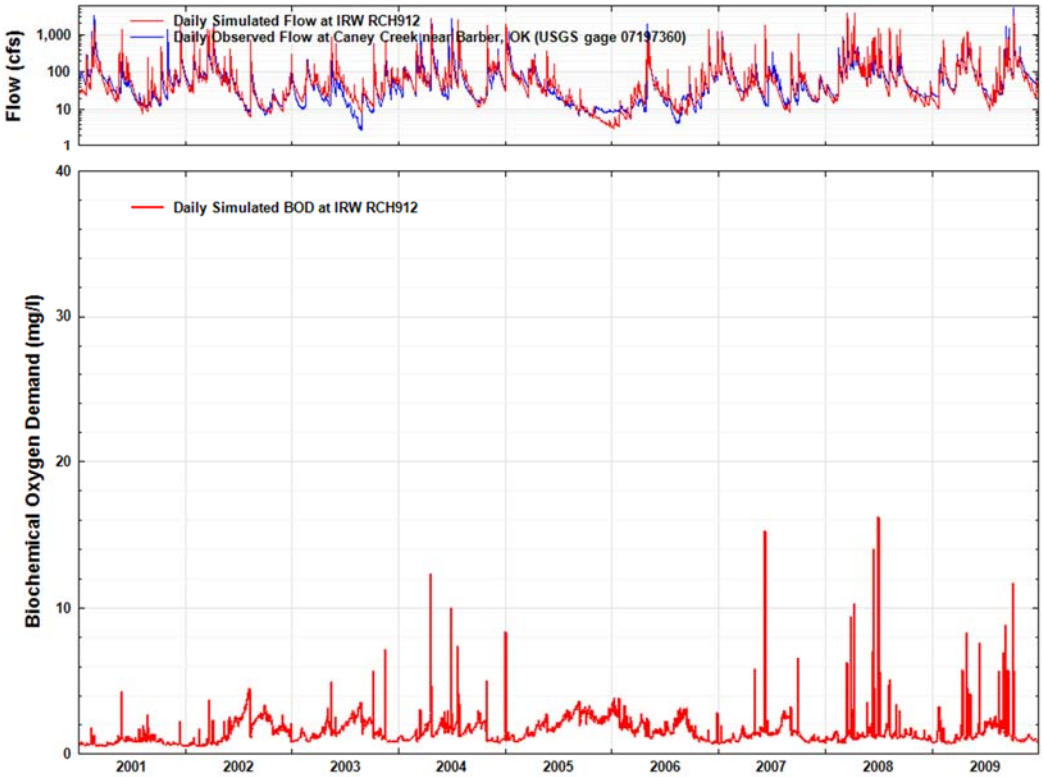

Daily Simulated Flow at IRW RCH870
Daily Observed Flow at Illinois River near Tahlequah, OK (USGS gage 07196500)
Flow (cfs)
10,000
1,000
100
10
Observed Total Nitrogen at Illinois River near Tahlequah, OK (USGS gage 07196500)
Daily Simulated Total Nitrogen at IRW RCH870
Total Nitrogen (mg/l)
0
1
2
3
4
5
6
7
8
9
10
2001
2002
2003
2004
2005
2006
2007
2008
2009

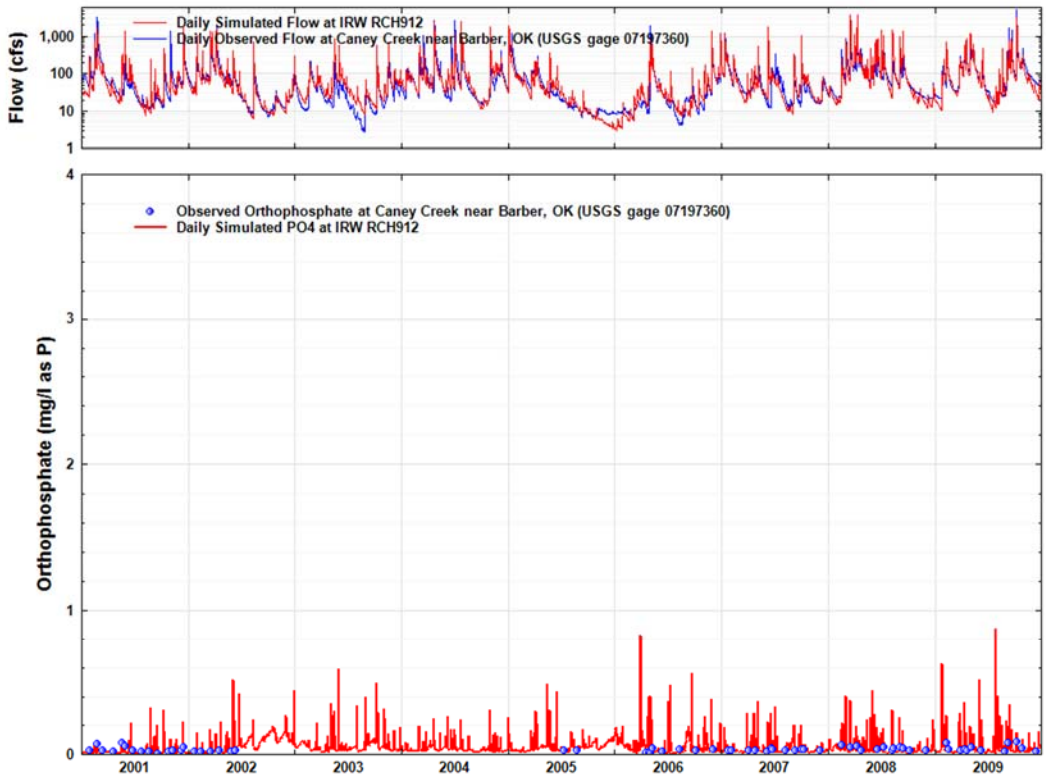

Daily Simulated Flow at IRW RCH870
Daily Observed Flow at Illinois River near Tahlequah, OK (USGS gage 07196500)
Flow (cfs)
10,000
1,000
100
10
Observed Organic Carbon at Illinois River near Tahlequah, OK (USGS gage 07196500)
Daily Simulated TOC at IRW RCH870
Total Organic Carbon (mg/l)
30
25
20
15
10
5
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

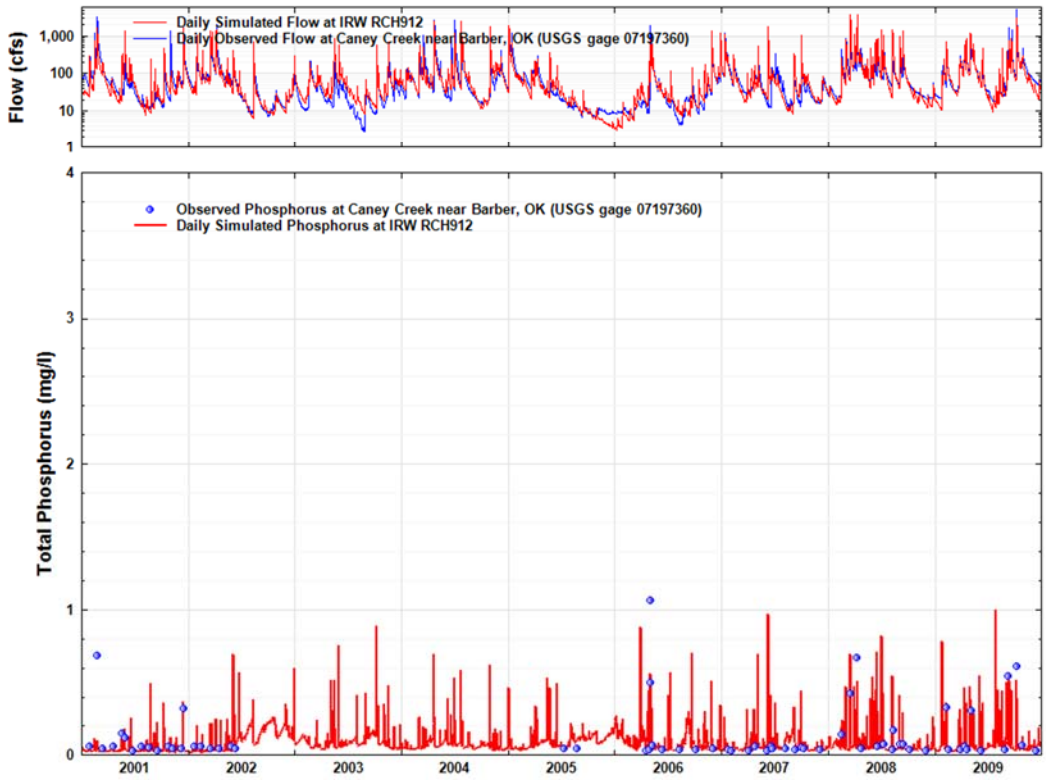

Daily Simulated Flow at IRW RCH870
Daily Observed Flow at Illinois River near Tahlequah, OK (USGS gage 07196500)
Flow (cfs)
10,000
1,000
100
10
Observed Chlorophyll A at Illinois River near Tahlequah, OK (USGS gage 07196500)
Observed Chlorophyll A at Illinois River near Tahlequah, OK (USGS gage 07196500)
Daily Simulated Chlorophyll A at IRW RCH870
Chlorophyll a, phytoplankton (ug/l)
40
30
20
10
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

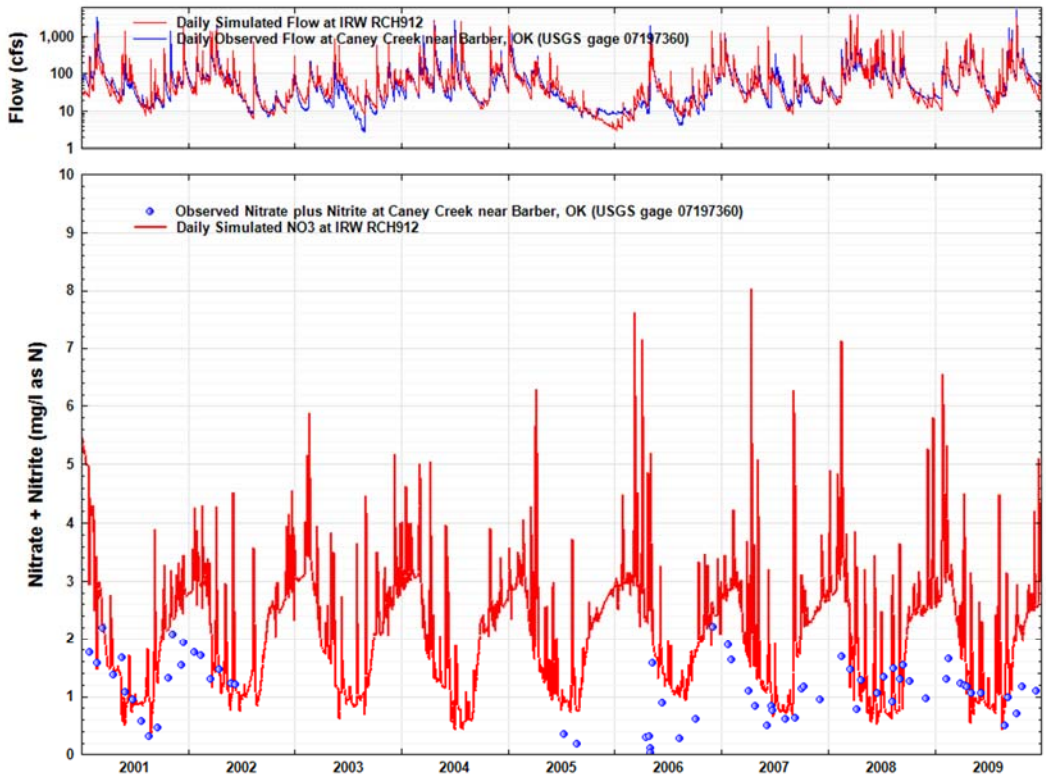
E.11 RCH912 – CANEY CREEK NEAR BARBER, OK

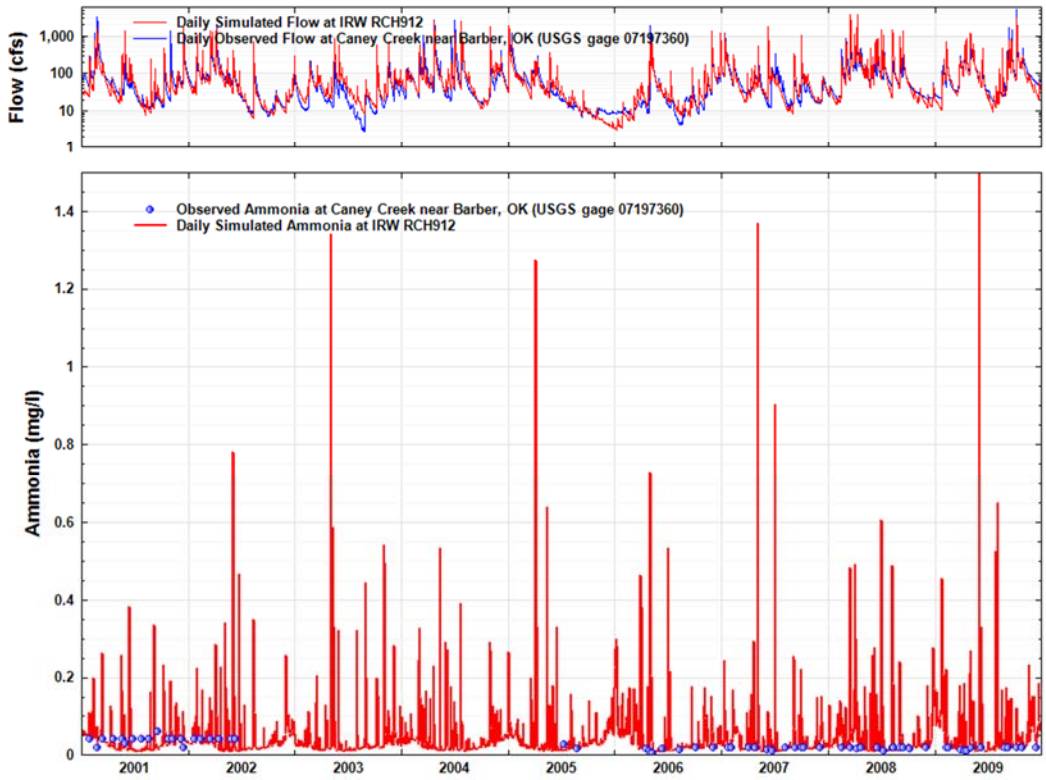


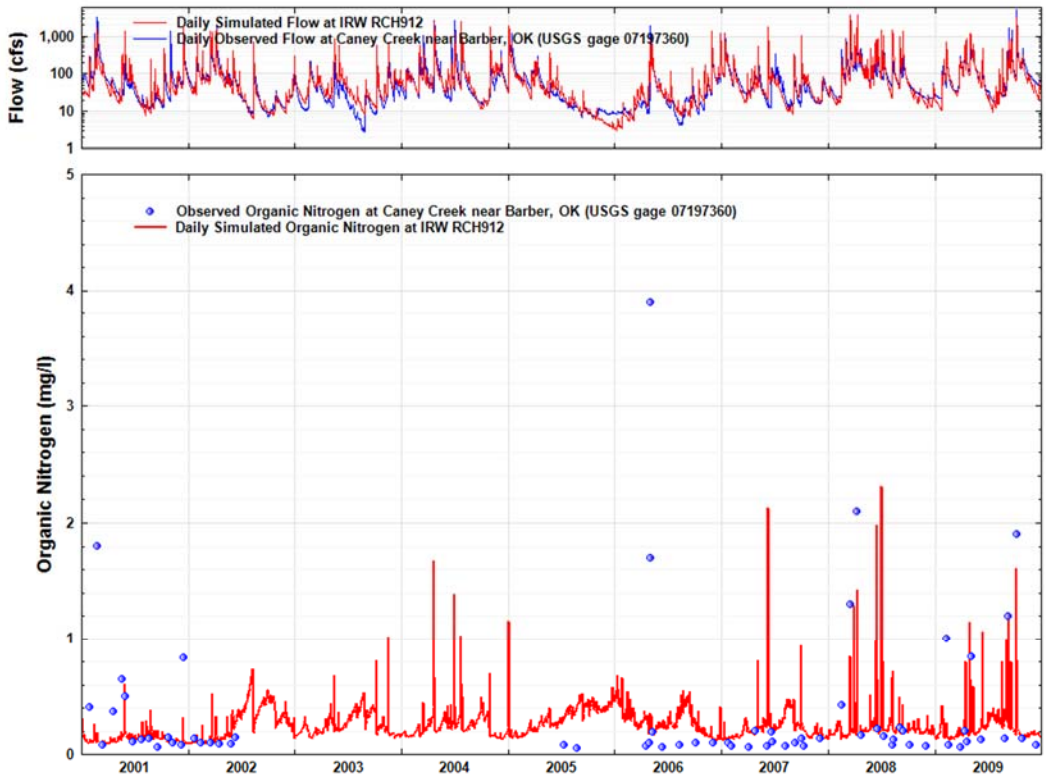


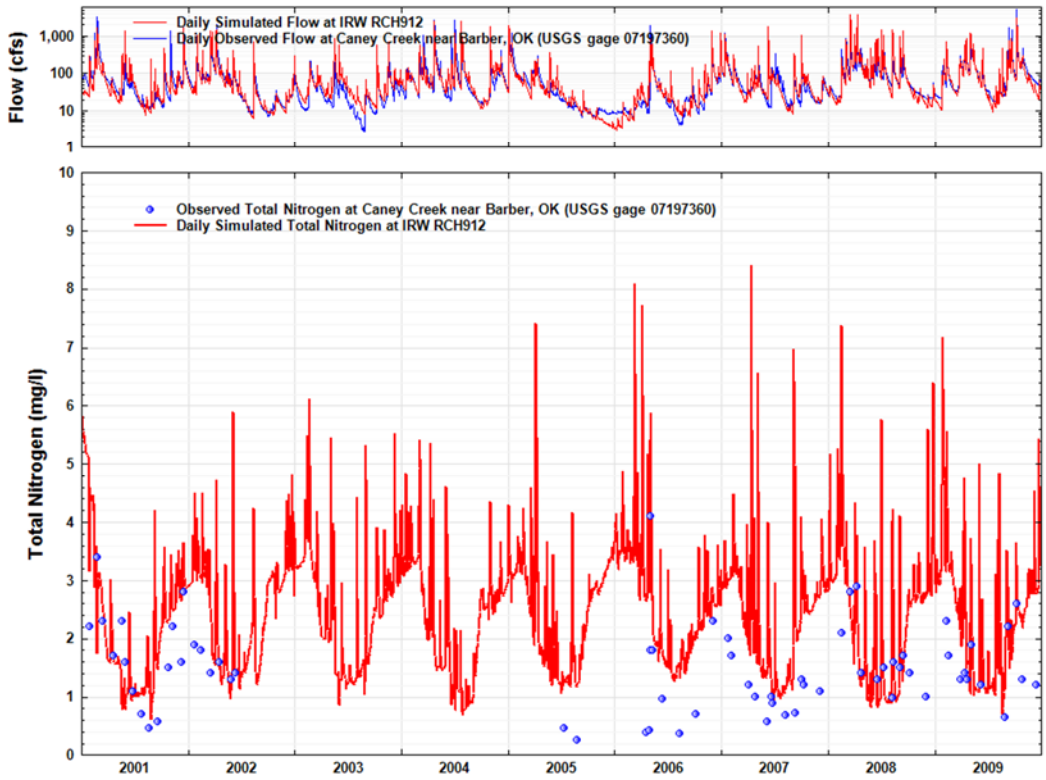

Daily Simulated Flow at IRW RCH912
Daily Observed Flow at Caney Creek near Barber, OK (USGS gage 07197360)
Flow (cfs)
1,000
100
10
1
Observed Orthophosphate at Caney Creek near Barber, OK (USGS gage 07197360)
Daily Simulated PO4 at IRW RCH912
Orthophosphate (mg/l as P)
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

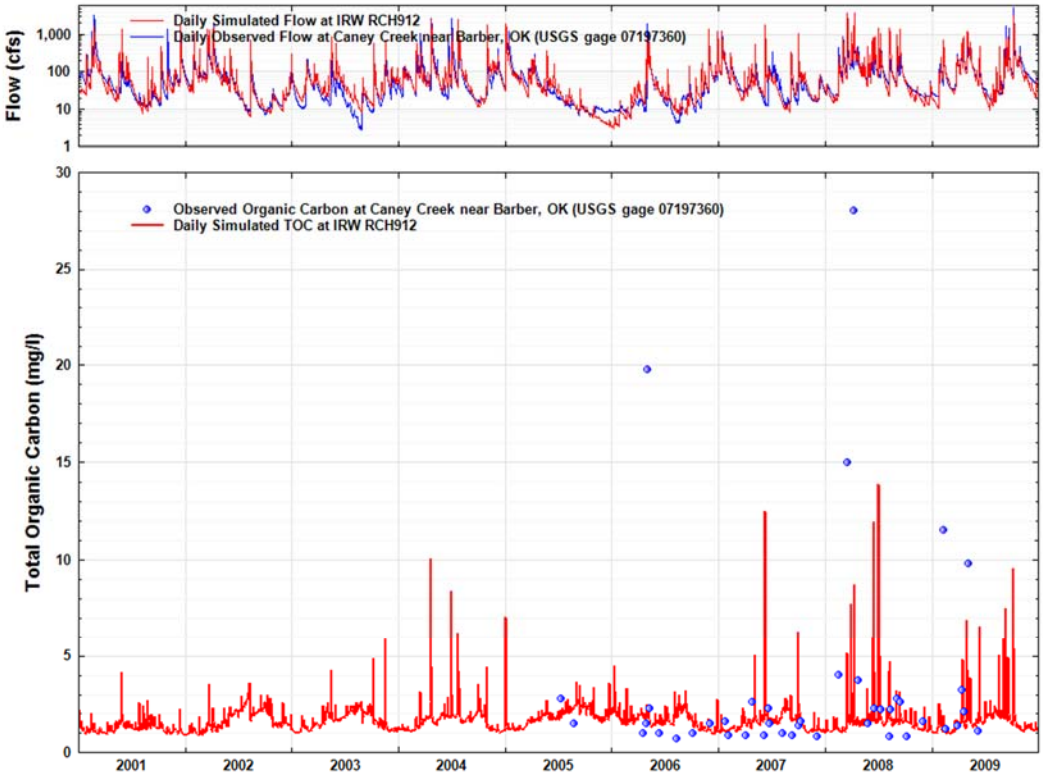

Daily Simulated Flow at IRW RCH912
Daily Observed Flow at Caney Creek near Barber, OK (USGS gage 07197360)
Flow (cfs)
1,000
100
10
1
Observed Phosphorus at Caney Creek near Barber, OK (USGS gage 07197360)
Daily Simulated Phosphorus at IRW RCH912
Total Phosphorus (mg/l)
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

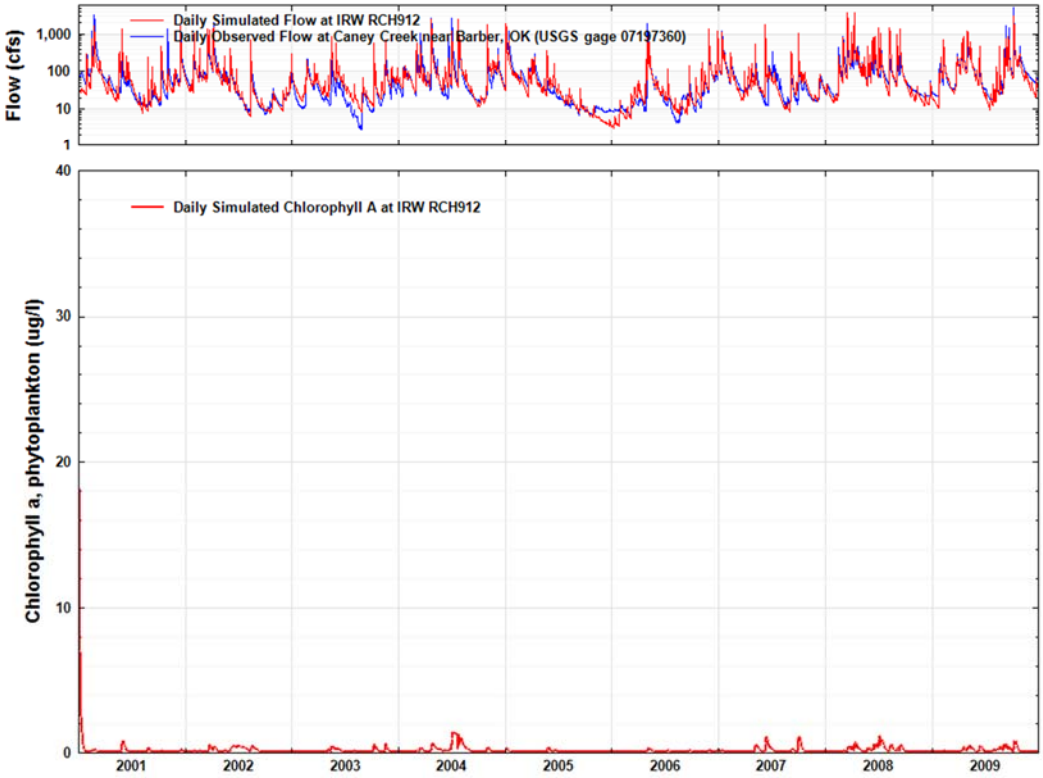

Daily Simulated Flow at IRW RCH912
Daily Observed Flow at Caney Creek near Barber, OK (USGS gage 07197360)
Flow (cfs)
1,000
100
10
1
Observed Nitrate plus Nitrite at Caney Creek near Barber, OK (USGS gage 07197360)
Daily Simulated NO3 at IRW RCH912
Nitrate + Nitrite (mg/l as N)
10
9
8
7
6
5
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009


Daily Simulated Flow at IRW RCH912
Daily Observed Flow at Caney Creek near Barber, OK (USGS gage 07197360)
Flow (cfs)
1,000
100
10
1
Observed Ammonia at Caney Creek near Barber, OK (USGS gage 07197360)
Daily Simulated Ammonia at IRW RCH912
Ammonia (mg/l)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2001
2002
2003
2004
2005
2006
2007
2008
2009


Daily Simulated Flow at IRW RCH912
Daily Observed Flow at Caney Creek near Barber, OK (USGS gage 07197360)
Flow (cfs)
1,000
100
10
1
Observed Organic Nitrogen at Caney Creek near Barber, OK (USGS gage 07197360)
Daily Simulated Organic Nitrogen at IRW RCH912
Organic Nitrogen (mg/l)
5
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009


Daily Simulated Flow at IRW RCH912
Daily Observed Flow at Caney Creek near Barber, OK (USGS gage 07197360)
Flow (cfs)
1,000
100
10
1
Observed Total Nitrogen at Caney Creek near Barber, OK (USGS gage 07197360)
Daily Simulated Total Nitrogen at IRW RCH912
Total Nitrogen (mg/l)
10
9
8
7
6
5
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009


Daily Simulated Flow at IRW RCH912
Daily Observed Flow at Caney Creek near Barber, OK (USGS gage 07197360)
Flow (cfs)
1,000
100
10
1
Observed Organic Carbon at Caney Creek near Barber, OK (USGS gage 07197360)
Daily Simulated TOC at IRW RCH912
Total Organic Carbon (mg/l)
30
25
20
15
10
5
0
2001
2002
2003
2004
2005
2006
2007
2008
2009


Daily Simulated Flow at IRW RCH912
Daily Observed Flow at Caney Creek near Barber, OK (USGS gage 07197360)
Flow (cfs)
1,000
100
10
1
Daily Simulated Chlorophyll A at IRW RCH912
Chlorophyll a, phytoplankton (ug/l)
40
30
20
10
0
2001
2002
2003
2004
2005
2006
2007
2008
2009

APPENDIX F
SUMMARY OF PROJECT QUALITY ASSURANCE (QA) – QUALITY CONTROL (QC) PROCEDURES RELATED TO DATA ACQUISITION/USE AND MODEL CALIBRATION/VALIDATION

The quality assurance process for this type of study consists of using appropriate data, data analysis procedures, modeling methodology and technology, administrative procedures, and auditing. Simulation models were needed to evaluate point and nonpoint source reduction scenarios in order to meet the State of Oklahoma in-stream total phosphorus criterion for scenic rivers of 0.037 mg P/liter. General consensus was achieved that the existing watershed simulation model HSPF and lake simulation model EFDC (used as a linked modeling system) were sufficient for this purpose, and creation of new models (i.e., model code) was not required. Of critical importance to the overall quality of the IRW project are QA/QC practices for data acquisition/use and model calibration/validation.

F.1 QA/QC FOR IRW DATA ACQUISITION/USE

The modeling study design (described in the IRW Simulation Plan (AQUA TERRA Consultants, 2013)) was developed to represent the full range of physical, chemical, and biological processes of concern for phosphorus generation, fate, and transport in the Illinois River Watershed. Acceptance criteria that were used for this project included data reasonableness, completeness, representativeness, and comparability.

- Data reasonableness: Data sets were checked for reasonableness. Flow gaging data obtained from USGS had already undergone quality review for reasonableness. This was not always the case for water quality data. Both graphical and tabulation methods were used to evaluate potential anomalous entries that may represent data entry or analytical errors. For example, daily time series plots were used to assess the reasonableness of the flow data and consistency across the calibration sites within the IRW. Also, our standard procedures for flow calibration plots include display of precipitation on the 'auxiliary' axis (above the flow plot), so that the relationship between precipitation and flow can be visually evaluated. This was especially critical for the AR sites when initial calibration runs showed numerous spurious, or 'phantom' rain events at selected NEXRAD sites, which were not consistent with either the observed or simulated flow at downstream stations (see discussion in Section 2.1). Then, tabulations of the daily rainfall amounts (in inches) were developed to identify where in the watershed the spurious amounts occurred and when, and how, these amounts compared to neighboring sites. In addition, all dates were checked through queries to ensure that no mistyped dates (e.g., 8/24/1900) and corresponding information were loaded into the models without clarification/justification from the agency from which the data were collected. Similar occurrences of anomalous data with significant impacts are included in discussions within the report (e.g., see Section 4.4 for a data entry correction to AR litter application areas).
- Data completeness: Technically-strong stakeholders were involved from the onset of the project to first supplement and later review the AQUA TERRA Team's efforts in identification, substantiation and refinement of the data that were utilized for modeling. GIS and timeseries data were checked visually. When new datasets were processed for adding to BASINS, the data at the end of the process were checked versus the data at the beginning of the process to ensure accurate and complete importation.

AQUA TERRA provided a GIS database to Region 6 for the Illinois River Watershed. The database includes coverages used for previous modeling studies; relevant coverages contained in the USEPA BASINS modeling system; and supplemental coverages provided by State liaisons. An example of critical stakeholder input occurred following their review of the IRW model segmentation; reviewers at OK DEQ noticed that the 'stateline' stream crossing sites were not accurately located at/close to the actual AR/OK Stateline. The error was traced to the stateline shape file in BASINS downloaded from a state web site.

The time series data that became a part of the modeling database were checked using the 'Summarize' tool of EPA's WDMUtil software (Hummel et al., 2001) to identify missing or potentially faulty data values. As is inevitable for any complex model study, there were some data gaps, most notably for precipitation and other meteorological data records. The WDMUtil 'List' tool was used to fill data gaps by filling in blanks and editing listed time-series values. These data gaps and the assumptions used in filling the gaps were documented in backup technical notes and in the documented procedures within BASINS for this purpose.

- Data representativeness: Sampling station data were checked through queries and mapping to ensure that there were no mistyped geospatial data (e.g., locations outside the watershed or subwatershed in question). If these checks passed, the corresponding information were loaded into the models without the need for clarification from the agency from which the data were collected.
- Data comparability: Data sets were checked with respect to variables of interest, commonality of units of measurement, and similarity in analytical and QA procedures. The current study was preceded by decades of data collection and modeling efforts for the Illinois River Watershed (IRW). (A summary is provided in Section 4.1 of this project's General QAPP.) In data- and modeling-rich areas such as the IRW, the first assessment of data reasonableness can be performed by identifying and evaluating apparent similarities and inconsistencies within or between different datasets for the same watershed. The AQUA TERRA Team further ensured the reasonableness of monitored data by comparing it against like data from similar geographic, seasonal, and sample collection (and modeling) efforts. AQUA TERRA has assembled data and performed modeling for numerous Midwestern watersheds that are characterized by climate, geography/topography and land use mixes similar to the IRW. Reasonableness of data available for the IRW was assessed using a knowledge base that included watersheds in Oklahoma, Texas, Iowa, Missouri, Minnesota and Illinois. While the process of comparison confirmed the similarity of like values for many datasets, in several instances exceptions were noted (either by the Project Team or by the stakeholders) and were brought to the attention of EPA Region 6. These datasets were subjected to a higher level of scrutiny in terms of their source and the QA/QC procedures that were used and documented during their collection and analysis.

Throughout the project data sources underwent review as a part of the ongoing data quality assessment. When quality objectives were provided with data sets that we received from EPA and other agency sources, the corresponding data were assumed to have met those quality objectives. That is to say, we assumed that these data have been subject to the standard QA/QC procedures of the source agency, unless there was evidence to the contrary. When we

encountered data issues of major impact on the modeling (e.g., NEXRAD 'phantom' events), the issues and resolution have been discussed in the body of the report.

Data used in the project were predominantly available in electronic form, although some hardcopy data reports were included. Automated screening methods were used to scan through individual data sets (e.g., generate max, min, mean) and flag data that were outside typical ranges for the data type. AQUA TERRA did not use values outside typically observed ranges to develop model calibration data sets or model kinetic parameters.

F.2 DATA TRANSFER TO EPA

At the time of project completion the AQUA TERRA Team will either save on an external hard drive, or provide an ftp site for download, of all model execution files and output data as digital computer files in a file directory using a standard file-naming convention, or one specified by the EPA Project Manager. In addition, the AQUA TERRA Team will provide all model setup data, scripts, project files, calibration data, and other information used to conduct the HSPF watershed modeling. AQUA TERRA will deliver these data to EPA within 2 weeks of the conclusion of the project. AQUA TERRA will maintain a copy of all project files at the Mountain View, California, office for at least 3 years (unless otherwise directed by the EPA Project Manager). The EPA Project Manager will maintain files, as appropriate, as repositories for information and data used in models and for preparing any reports and documents during the project.

F.3 QA/QC FOR IRW MODEL CALIBRATION/VALIDATION

AQUA TERRA has utilized a systematic planning process to determine the type and quality of output needed for this modeling project. The ultimate test of quality for this study is that the model output is a sufficiently accurate representation of the natural system to (1) address the site-specific study objectives/data quality objectives that were established in the project's Modeling QAPP, and (2) address each of the following specific study objectives, which also serve as the DQOs for the model output:

- Develop a science-based model that enables evaluation of point and nonpoint source reduction scenarios needed to meet the State of Oklahoma in-stream total phosphorus criterion for scenic rivers of 0.037 mg P/liter;
- Ensure that the Watershed Model provides a viable tool for assessing the impacts of alternative phosphorus reduction alternatives within the watershed, both at the AR/OK Stateline and for loadings to Lake Tenkiller.

The determination of whether the DQOs have been achieved is less straightforward for a modeling study than for the more typical sampling and analysis type of study. The usual data quality indicators (e.g., completeness, accuracy, precision) are difficult to apply and in many cases do not adequately characterize model output. Nonetheless, accepted objective techniques were used to evaluate the quality of the model performance and output. These procedures are described in detail in Section 6.2 of the Modeling QAPP (Michael Baker, 2013) and their application is discussed in the Final Report and summarized below.

Model performance criteria provide the numerical basis for answering the question, "Are the model results, as reflected in the calibration and validation comparison, of sufficient quality to be used in decision making for this study?" A **'weight of evidence'** approach was used to judge the acceptance of model results. Multiple model comparisons, both graphical and statistical were performed. The results of these comparisons were evaluated recognizing inherent errors and uncertainty in the model, the input data, and the observations used to assess model acceptance.

Performance evaluations are presented and explained in Section 4 of the Final Report. The performance of the Watershed Model was judged acceptable to satisfy the QA objectives for this project.

References

AQUA TERRA Consultants. 2013. Simulation Plan for Water Quality Modeling and TMDL Development for the Illinois River Watershed. Prepared for US EPA Region 6, Dallas, TX. EPA PO # EP-11-6-000023. Submitted May 24, 2013.

Hummel, P.R., J.L. Kittle, Jr. and M.H. Gray. 2001. WDMUtil - A Tool for Managing Watershed Modeling Time-Series Data: User's Manual. U.S. EPA Office of Water, Washington DC.

Michael Baker, Jr., Inc. 2013. Quality Assurance Program Plan for Illinois River Watershed Nutrient Modeling Development. Prepared for US EPA Region 6, Dallas, TX. EPA Contract EP-C-12-052 Order No. 0002. Submitted September 30, 2013.

APPENDIX G
SUMMARY OF PRECIPITATION AND METEOROLOGIC DATA DEVELOPMENT

Oklahoma Precipitation Data

The original database of precipitation data used for most of the Oklahoma portion of the basin consisted of the stations listed below. These stations are shown in Figure 2-6 in Section 2 of the Main IRW Report (Baker et al., 2015). (Note: station locations for the other meteorological data types discussed below in this appendix can be seen on this map, and are also listed in Table 2-2 of the same report.)

Site Name	Site Number	Source	Start	End	Av Annual Precip (in)
Bentonville 4S	AR030586	BASINS daily	12/31/1947	2/28/2007	46.79
Cookson	31	Mesonet 5-min	1/1/1994	5/26/2010	50.50
Fayetteville Exp Sta*	AR032444	BASINS hourly	4/1/1966	3/31/2006	46.17
Fayetteville Exp Sta*	AR032444	BASINS daily	12/14/1926	8/31/2003	46.17
Mountainburg 2NE	AR035018	BASINS daily	8/31/1985	12/31/2009	50.61
Natural Dam	AR035160	BASINS daily	12/31/1962	12/31/2009	49.39
Odell 2 N*	AR035354	BASINS daily	12/31/1947	12/31/2009	51.56
Kansas 2 NE*	OK344672	BASINS daily	3/31/1959	12/31/2009	48.23
Lyons 2 N*	OK345437	BASINS daily	12/31/1947	9/30/2003	47.75
Rose Tower*	OK347739	BASINS hourly	1/1/1974	12/31/2003	46.79
Stilwell 5 NNW*	OK348506	BASINS daily	9/30/1948	4/30/2003	49.11
Tahlequah*	OK348677	BASINS daily	12/31/1947	12/31/2006	47.64
Tahlequah	92	Mesonet 5-min	1/1/1994	5/26/2010	47.50
Tenkiller Ferry Dam*	OK348769	BASINS hourly	4/1/1949	1/31/1999	46.33
Webbers Falls	103, 132	Mesonet 5-min	1/1/1994	5/26/2010	46.50
Westville	104	Mesonet 5-min	1/1/1994	5/26/2010	48.90

The four Mesonet stations were shifted to local standard time and aggregated from 5 minutes to a one-hour time step. The missing data in each of them were filled using the closest Mesonet stations and BASINS hourly stations. Then the Mesonet stations were extended back to 1991/10/1 using the stations listed below and adjustment multipliers obtained from an isohyetal map of the basin (see Figure 2-7 in Baker et al., 2015. Average annual totals were also obtained from the isohyetal map of the basin) and used to develop ratios.

OK345437	12/31/1947	9/30/2003	LYONS 2 N	BASINS Daily
OK348506	9/30/1948	4/30/2003	STILWELL 5 NNW	BASINS Daily
OK348677	12/31/1947	10/31/2008	TAHLEQUAH	BASINS Daily
OK349445	12/31/1947	5/31/2007	WEBBERS FALLS 5 WSW	BASINS Daily

Lyons 2N was used to extend Cookson. Multiplier = 1.006
Stillwell was used to extend Westville. Multiplier = 0.982
Tahlequah (NWS/BASINS) was used for Tahlequah Mesonet. Multiplier = 1
Webbers Falls 5WSW was used for Webbers Falls Mesonet. Multiplier = 1
Three NWS/BASINS daily stations (Odell 2N, Kansas 2NE, and Stilwell 5NNW) with long periods of record were disaggregated to hourly time step using the available hourly records (BASINS and Mesonet) as templates. In this automated process, the hourly station having the closest daily total to the daily amount in the disaggregated dataset is used as the pattern for that day. Note: the Stilwell 5 NNW (OK348506) station was extended from 2003/4 to 2009/12 using the Westville Mesonet station. A multiplier of 1.022 was applied to Westville based on the isohyetal ratio of the two stations.

The final database of precipitation for the Oklahoma part of the basin consists of the following stations:

Location	Station Name	Start	End
WESTVILLE	Westville - OK Mesonet	1991/10	2010/5/26
TAHLEQUA	Tahlequah - OK Mesonet	1991/10	2010/5/26
COOKSON	Cookson - OK Mesonet	1991/10	2010/5/26
WEBBERS	Webbers Falls - OK Mesonet	1991/10	2010/5/26
AR032444	Fayetteville Exp Station	1921/8/26	2009/12/31
AR035354	Odell 2 N	1947/12/31	2009/12/31
OK344672	Kansas 2 NE	1959/3/31	2009/12/31
OK348506	Stillwell 5 NNW	1948/9/30	2009/12/31

Arkansas Precipitation Data

The precipitation data used for the Arkansas portion of the basin consisted of daily radar-based (NEXRAD) estimates or rainfall at 27 centroids or locations in the basin. These locations are also shown in Figure 2-6 of the report cited above. The NEXRAD data has a period of record of 1981/1 - 2008/12, so they were extended to 2009/12 using four of the available Mesonet and BASINS/NWS precipitation stations that were near to NEXRAD locations. The following list shows the NEXRAD locations (ID #'s) that were extended using each of the four long term stations.

Mesonet/BASINS/NWS Station	NEXRAD Locations
Fayetteville Exp Stn (AR032444)	00,03,12,13,14,16,17,19,20,21,22,23
Westville – Mesonet	05,06,07,09,10
Odell 2N (OK)	08,11,15,18,24,25,26
Kansas 2NE (OK)	01,02,04

Multipliers were applied to generate the filled data based on ratios of the two stations' total rainfall over their common period of record.

The resulting 27 extended daily records were disaggregated to one hour time step using the same procedure described above for the Oklahoma precipitation data. The hourly stations that were utilized/available to provide hourly patterns are listed below:

Fayetteville Exp Stn - AR032444
Tenkiller Ferry Dam -OK348769
Rose Tower - OK347739
Westville - OK Mesonet
Cookson - OK Mesonet
Tahlequah - OK Mesonet
Webbers Falls - OK Mesonet

Solar Radiation Data

The starting database for solar data consisted of the four Oklahoma Mesonet stations (Webbers, Westville, Cookson, Tahlequah) and six NWS stations from BASINS (Siloam Spring AR, Bentonville AR, Rogers AR, Fayetteville Airport AR, Webbers Falls Dam OK, Muskogee/Davis Field OK). The Mesonet stations contained 5 minute data with a period of record of 1994/1 - 2010/5; there were missing periods. The data were in units of watts/m2 and the times were Greenwich Mean Time (GMT). The BASINS/NWS data were hourly timeseries in units of Langleys and a period of record of 1995/1 - 2009/12, and there were no missing data. Hourly

cloud cover data from Fayetteville AP (Drakes Field) were obtained for the period 1990-2009 in order to extend the period of record for solar radiation (and cloud cover) back to 1990.
The Mesonet data were shifted to local standard time, summed to a one-hour time step, and converted to Langleys, the units used in HSPF. The missing Mesonet data were filled using data from both the other Mesonet stations and the NWS/BASINS stations; the filling procedure used the closest available station to the Mesonet station being filled.
The Fayetteville AP cloud cover data was used to generate solar radiation data for 1990-2009, and this dataset was used as the basis for extending the other stations back to 1990. The Mesonet stations were filled from 1990-1993 using the Fayetteville data without adjustment. The three NWS/BASINS stations were filled from 1990-1994 by adjusting the Fayetteville solar data based on the long-term (1995-2009) ratio of the two stations. The factors ranged from 1.020 to 1.047.
The final database of solar radiation used in the model consists of the following stations:

NWS/BASINS

- Siloam Spring (AWOS) - AR723443
- Bentonville (AWOS) - AR723444
- Rogers (AWOS) - AR723449
- Fayetteville FAA Airport - AR032443

Oklahoma Mesonet

- Westville
- Tahlequah
- Cookson
- Webbers Falls

Cloud Cover Data

The starting database for cloud cover data consisted of four NWS stations from BASINS (Siloam Spring AR, Bentonville AR, Rogers AR, Fayetteville Airport AR). The data were hourly timeseries in units of tenths of the sky covered by clouds and a period of record of 1995/1 - 2009/12; there were no missing data. The hourly cloud cover data from Fayetteville AP were obtained for the period 1990-2009 in order to extend the period back to 1990. The data from Fayetteville AP were used without adjustment to fill the 1990-1994 period in the other three stations. The final database of cloud cover data consists of the following stations:

NWS/BASINS

- Siloam Spring (AWOS) - AR723443
- Bentonville (AWOS) - AR723444
- Rogers (AWOS) - AR723449
- Fayetteville FAA Airport - AR032443

Wind Speed Data

The starting database for wind speed data consisted of the four Oklahoma Mesonet stations (Webbers, Westville, Cookson, Tahlequah) and six NWS stations from BASINS (Siloam Spring AR, Bentonville AR, Rogers AR, Fayetteville Airport AR, Webbers Falls Dam OK, Muskogee/Davis Field OK). The Mesonet stations contained 5 minute data with a period of record of 1994/1 - 2010/5; there were missing periods. The BASINS/NWS data were hourly timeseries and various periods of record. Hourly wind speed data from Fayetteville AP (Drakes Field) were obtained for the period 1990-2009 in order to extend the period of record for wind speed back to 1990.

The Mesonet data were shifted to local standard time and summed to one-hour time step. The missing Mesonet data were filled using data from both the other Mesonet stations and the NWS/BASINS stations; the filling procedure used the closest available station to the Mesonet station being filled.
The Fayetteville AP wind speed data was used as the basis for extending the other stations back to 1990. The Mesonet stations were extended from 1990-1993 and the NWS/BASINS stations were extended from 1990-1994 by adjusting the Fayetteville data based on the long-term (1994-2009 or 1995-2009) ratio of the two stations. The factors ranged from 0.83 to 1.20.
The final database of wind speed used in the model consists of the following stations:
NWS/BASINS
- Siloam Spring (AWOS) - AR723443
- Bentonville (AWOS) - AR723444
- Rogers (AWOS) - AR723449
- Fayetteville FAA Airport - AR032443
- Oklahoma Mesonet
- Westville
- Tahlequah
- Cookson
- Webbers Falls

Air Temperature Data
The starting database for air temperature consisted of the following stations:

Location	Station Name	Start	End
AR030586	Bentonville 4 S	1948/1/1	2009/12/31
AR032444	Fayetteville Exp Stn	1921/8/26	2009/12/31
AR035018	Mountainburg 2 NE	1985/9/1	2009/12/31
AR723443	Siloam Spring (AWOS)	1995/1/1	2009/12/31
AR723444	Bentonville AWOS	1995/1/1	2009/12/31
AR723449	Rogers (AWOS)	1995/1/1	2009/12/31
OK348677	Tahlequah	1948/1/1	2008/10/31
OK348506	Stilwell 5 NNW	1960/1/1	2003/4/30
OK349445	Webbers Falls 5WSW	1948/1/1	2007/6/30
OK344672	Kansas 2 NE	1959/4/1	2009/12/31
OK346130	Muskogee	1948/1/1	2009/12/31
WESTVILLE	Westville - OK Mesonet	1994/1/1	2010/5/26
TAHLEQUA	Tahlequah - OK Mesonet	1994/1/1	2010/5/26
COOKSON	Cookson - OK Mesonet	1994/1/1	2010/5/26
WEBBERS	Webbers Falls - OK Mesonet	1994/1/1	2010/5/26

The four Mesonet datasets were processed similarly to the other data types. The time was shifted to local standard time, and the 5 minute data were averaged to one hour. Missing data was filled using the data in both the Mesonet and NWS data; the closest station with good data was used to fill each missing period. The Mesonet datasets were extended back to 1992/1 using 1992-1993 data from the following stations:

Mesonet	Filling Station
Westville	Stilwell 5 NNW (OK348506)
Tahlequah	Tahlequah (OK348677)

Cookson Webbers Falls 5WSW (OK349445)
Webbers Falls Webbers Falls 5WSW (OK349445)
In addition, missing periods in the NWS datasets were filled as follows:

NWS Station	Filling Station	Period Filled
Fayetteville Exp Stn	Siloam Spring (AWOS)	2003/9 - 2009/12
Siloam Spring (AWOS)	Kansas 2 NE	1992/1 - 1994/12
Bentonville AWOS	Bentonville 4 S	1992/1 - 1994/12
Rogers (AWOS)	Bentonville 4 S	1992/1 - 1994/12
Bentonville 4 S	Bentonville AWOS	2007/3 - 2009/12

The final air temperature database consists of the following:

Location	Station Name	Start	End
AR030586	Bentonville 4 S	1948/1/1	2009/12/31
AR032444	Fayetteville Exp Stn	1921/8/26	2009/12/31
AR035018	Mountainburg 2 NE	1985/9/1	2009/12/31
AR723443	Siloam Spring (AWOS)	1992/1/1	2009/12/31
AR723444	Bentonville AWOS	1992/1/1	2009/12/31
AR723449	Rogers (AWOS)	1992/1/1	2009/12/31
OK344672	Kansas 2 NE	1959/4/1	2009/12/31
OK346130	Muskogee	1948/1/1	2009/12/31
WESTVILLE	Westville - OK Mesonet	1992/1/1	2010/5/26
TAHLEQUA	Tahlequah - OK Mesonet	1992/1/1	2010/5/26
COOKSON	Cookson - OK Mesonet	1992/1/1	2010/5/26
WEBBERS	Webbers Falls - OK Mesonet	1992/1/1	2010/5/26

Dewpoint Temperature Data

The starting database for dewpoint temperature consisted of recorded dewpoint temperature at four NWS/BASINS stations (Fayetteville, Siloam Spring, Rogers, Bentonville) (1995/1 - 2009/12), and relative humidity at the four Mesonet stations (Webbers, Westville, Cookson, Tahlequah). The Mesonet data (1994/1 - 2010/5) were shifted to local standard time and missing data points were filled using the other Mesonet stations based on closest distance between stations. The 5-minute relative humidity data were averaged to one hour, and were used, along with air temperature, to compute dewpoint temperature using a standard formula (see below - Magnus formula(e.g., http://www.emory.edu/NMR/mysite06/My%20Stuff/My%20Notes/NMR_lab_dewpoint_airsupply.htm). The resulting dewpoint temperature datasets at the eight stations were extended back to 1990 using the Fayetteville/Drakes Field dewpoint dataset, which was available for 1990-2009; no adjustments were made.

Dewpoint temperature calculations

$T_d = [b * \gamma(T,RH)] / [a - \gamma(T,RH)]$

where

$\gamma(T,RH) = [a*T / (b + T)] + \ln(RH/100)$

a = 17.271

b = 237.7 degC

T = temperature (C)

RH = relative humidity (%)

The final database of dewpoint temperature used in the model consists of the following stations:
NWS/BASINS
Siloam Spring (AWOS) - AR723443
Bentonville (AWOS) - AR723444
Rogers (AWOS) - AR723449
Fayetteville FAA Airport - AR032443

Oklahoma Mesonet
Westville
Tahlequah
Cookson
Webbers Falls

Potential Evapotranspiration (PET) Data

The PET database was developed using the air temperature data. PET timeseries were computed from air temperature using the Hamon method that is used to develop the BASINS PET data. Daily PET was computed from the daily max-min temperatures for each station. The resulting daily PET was disaggregated to hourly data using a standard model based on latitude and time of year. The final PET database consists of the following eleven stations:

Location	Station Name	Start	End
AR030586	Bentonville 4 S	1948/1/1	2009/12/31
AR032444	Fayetteville Exp Stn	1921/8/26	2009/12/31
AR035018	Mountainburg 2 NE	1985/9/1	2009/12/31
AR723443	Siloam Spring (AWOS)	1992/1/1	2009/12/31
AR723449	Rogers (AWOS)	1992/1/1	2009/12/31
OK344672	Kansas 2 NE	1959/4/1	2009/12/31
OK346130	Muskogee	1948/1/1	2009/12/31
WESTVILLE	Westville - OK Mesonet	1992/1/1	2010/5/26
TAHLEQUA	Tahlequah - OK Mesonet	1992/1/1	2010/5/26
COOKSON	Cookson - OK Mesonet	1992/1/1	2010/5/26
WEBBERS	Webbers Falls - OK Mesonet	1992/1/1	2010/5/26

See the Main Report (pg. 18) for further discussion of the PET data development.

APPENDIX H
EFDC WATER QUALITY MODEL PARAMETERS AND KINETIC COEFFICIENTS
TENKILLER FERRY LAKE

Table **Error! No text of specified style in document.**-1. Kinetic Coefficients for Cyanobacteria

	Zones						
Kinetic Coefficient	**Global**	**1**	**2**	**3**	**4**	**5**	**6**
Maximum growth rate for Cyanobacteria (/day)		1.00	1.00	1.00	1.00	1.00	1.40
Basal metabolism rate for Cyanobacteria (/day)		0.06	0.06	0.06	0.06	0.06	0.06
Settling velocity for Cyanobacteria (m/day)		0.30	0.30	0.30	0.30	0.30	0.30
Predation rate on Cyanobacteria (/day)		0.01	0.01	0.01	0.01	0.01	0.01
Carbon-to-Chl ratio for Cyanobacteria (mg C/µg Chl)	0.025						
Nitrogen-to-Carbon ratio for Cyanobacteria (g N/g C)	0.167						
Constant 1 used in determining algae C:P ratio (gC / G P)	42						
Constant 2 used in determining algae C:P ratio (gC / G P)	85						
Constant 3 used in determining algae C:P ratio (gC / G P)	200						
Oxygen-to-Carbon ratio (g O2/g C)	2.67						
Oxygen-to-Nitrogen (NO3) ratio (g O2/g N)	4.33						
N half-saturation constant for Cyanobacteria (mg N/L)	0.025						
P half-saturation constant for Cyanobacteria (mg P/L)	0.005						
Suboptimal temperature coefficient for growth	0.0060						
Superoptimal temperature coefficient for growth	0.0060						
Lower optimal temperature for growth (deg-C)	28						
Upper optimal temperature for growth(deg-C)	35						
Reference temperature for basal metabolism (Deg-C)	20						
Temperature coefficient for basal metabolism	0.0690						
Optimal depth for growth (meters)	1.0						

Table **Error! No text of specified style in document.**-2. Kinetic Coefficients for Diatoms

	Zones						
Kinetic Coefficient	**Global**	**1**	**2**	**3**	**4**	**5**	**6**
Maximum growth rate for diatoms (/day)		1.00	1.00	1.00	1.00	1.00	1.40
Basal metabolism rate for diatoms (/day)		0.05	0.05	0.05	0.05	0.05	0.05
Settling velocity for diatoms (m/day)		0.30	0.30	0.30	0.30	0.30	0.30
Predation rate on diatoms (/day)		0.025	0.025	0.025	0.025	0.025	0.025
Carbon-to-Chl ratio for algae:diatoms (mg C/µg Chl)	0.025						
Nitrogen-to-Carbon ratio for diatoms (g N/g C)	0.167						
Constant 1 used in determining algae C:P ratio (gC / G P)	42						
Constant 2 used in determining algae C:P ratio (gC / G P)	85						
Constant 3 used in determining algae C:P ratio (gC / G P)	200						
Oxygen-to-Carbon ratio (g O2/g C)	2.67						
Oxygen-to-Nitrogen (NO3) ratio (g O2/g N)	4.33						
N half-saturation constant for diatoms (mg N/L)	0.065						
P half-saturation constant for diatoms (mg P/L)	0.005						
Suboptimal temperature coefficient for growth	0.0025						
Superoptimal temperature coefficient for growth	0.0120						
Lower optimal temperature for growth (deg-C)	15						
Upper optimal temperature for growth(deg-C)	20						
Reference temperature for basal metabolism (Deg-C)	20						
Temperature coefficient for basal metabolism	0.0690						
Optimal depth for growth (meters)	1.0						

Table **Error! No text of specified style in document.**-3. Kinetic Coefficients for Green Algae

	Zones						
Kinetic Coefficient	**Global**	**1**	**2**	**3**	**4**	**5**	**6**
Maximum growth rate for greens (/day)		1.00	1.00	1.00	1.00	1.00	1.40
Basal metabolism rate for greens (/day)		0.08	0.08	0.08	0.08	0.08	0.08
Settling velocity for greens (m/day)		0.30	0.30	0.30	0.30	0.30	0.30
Predation rate on greens (/day)		0.05	0.05	0.05	0.05	0.05	0.05
Carbon-to-Chl ratio for algae:greens (mg C/µg Chl)	0.025						
Nitrogen-to-Carbon ratio for greens (g N/g C)	0.167						
Constant 1 used in determining algae C:P ratio (gC / G P)	42						
Constant 2 used in determining algae C:P ratio (gC / G P)	85						
Constant 3 used in determining algae C:P ratio (gC / G P)	200						
Oxygen-to-Carbon ratio (g O2/g C)	2.67						
Oxygen-to-Nitrogen (NO3) ratio (g O2/g N)	4.33						
N half-saturation constant for greens (mg N/L)	0.045						
P half-saturation constant for greens (mg P/L)	0.005						
Suboptimal temperature coefficient for growth	0.0100						
Superoptimal temperature coefficient for growth	0.0100						
Lower optimal temperature for growth (deg-C)	20						
Upper optimal temperature for growth(deg-C)	26						
Reference temperature for basal metabolism (Deg-C)	20						
Temperature coefficient for basal metabolism	0.0690						
Optimal depth for growth (meters)	1.0						

Table **Error! No text of specified style in document.**-4. Light Attenuation Coefficients

	Zones						
Kinetic Coefficient	**Global**	**1**	**2**	**3**	**4**	**5**	**6**
Background light extinction coefficient (1/m)		0.45	0.45	0.45	0.45	0.45	0.45
Light extinction due to TSS (1/m per mg/L)	0.052						
Light extinction due to chlorophyll a (1/m per mg/L)	0.031						
Light extinction due to POC (1/m per mg/L)	0.078						
Photosynthetic Fraction of Incident Light (PAR)	0.43						

Table **Error! No text of specified style in document.**-5. Kinetic Coefficients for Organic Carbon

	Zones						
Kinetic Coefficient	**Global**	**1**	**2**	**3**	**4**	**5**	**6**
Algae predation, carbon fraction to RPOC	0.28						
Algae predation, carbon fraction to LPOC	0.12						
Algae predation, carbon fraction to DOC	0.60						
Fraction of basal metabolism excreted as DOC, cyanobacteria	1.00						
Fraction of basal metabolism excreted as DOC, diatoms	1.00						
Fraction of basal metabolism excreted as DOC, greens	1.00						
Oxygen half-sat constant for algae DOC excretion, cyanobacteria (g O2/m^3)	0.50						
Oxygen half-sat constant for algae DOC excretion, diatoms (g O2/m^3)	0.50						
Oxygen half-sat constant for algae DOC excretion, greens (g O2/m^3)	0.50						
Minimum dissolution rate of RPOC (/day)	0.0025						
Minimum dissolution rate of LPOC (/day)	0.0375						
Minimum heterotrophic respiration rate of DOC (/day)	0.005						
Constant relating RPOC Diss. rate to total Chl-a	0.00						
Constant relating LPOC Diss. rate to total Chl-a	0.00						
Constant relating DOC Resp. rate to total Chl-a	0.00						
Reference temperature for dissolution (deg C)	20.00						
Reference temperature for mineralization (deg C)	20.00						
Temperature effect coefficient for dissolution	0.069						
Temperature effect coefficient for mineralization	0.069						
Half-Saturation constant for denitrification (g N/m^3)	0.10						
Ratio of denitrification rate to oxic DOC respiration rate	0.50						
Settling velocity for RPOC (m/day)		0.5	0.5	0.5	0.5	0.5	0.5
Settling velocity for LPOC (m/day)		0.5	0.5	0.5	0.5	0.5	0.5

Table **Error! No text of specified style in document.**-6. Kinetic Coefficients for Organic Phosphorus

	Zones						
Kinetic Coefficient	**Global**	**1**	**2**	**3**	**4**	**5**	**6**
Algae predation, phosphorus fraction to RPOP	0.21						
Algae predation, phosphorus fraction to LPOP	0.09						
Algae predation, phosphorus fraction to DOP	0.20						
Fraction of metabolized P produced as RPOP, cyanobacteria	0.0						
Fraction of metabolized P produced as RPOP, diatoms	0.0						
Fraction of metabolized P produced as RPOP, greens	0.0						
Fraction of metabolized P produced as LPOP, cyanobacteria	0.0						
Fraction of metabolized P produced as LPOP, diatoms	0.0						
Fraction of metabolized P produced as LPOP, greens	0.0						
Fraction of metabolized P produced as DOP, cyanobacteria	1.0						
Fraction of metabolized P produced as DOP, diatoms	1.0						
Fraction of metabolized P produced as DOP, greens	1.0						
Minimum hydrolysis rate of RPOP (/day)	0.005						
Minimum hydrolysis rate of LPOP (/day)	0.075						
Minimum mineralization rate of DOP (/day)	0.10						
Constant relating hydrolysis rate of RPOP to algae	0.00						
Constant relating hydrolysis rate of LPOP to algae	0.00						
Constant relating mineralization rate of DOP to algae	0.20						
Settling velocity for RPOP (m/day)		0.5	0.5	0.5	0.5	0.5	0.5
Settling velocity for LPOP (m/day)		0.5	0.5	0.5	0.5	0.5	0.5

Table **Error! No text of specified style in document.**-7. Kinetic Coefficients for Total Phosphate

	Zones						
Kinetic Coefficient	**Global**	**1**	**2**	**3**	**4**	**5**	**6**
Algae predation, phosphorus fraction to Inorganic-P	0.5						
Fraction of metabolized P produced as P4T, cyanobacteria	0.0						
Fraction of metabolized P produced as P4T, diatoms	0.0						
Fraction of metabolized P produced as P4T, greens	0.0						
Partition coefficient for sorbed/dissolved PO4 (to TSS or TAM)	0.01						

Table **Error! No text of specified style in document.**-8. Kinetic Coefficients for Organic Nitrogen

	Zones						
Kinetic Coefficient	**Global**	**1**	**2**	**3**	**4**	**5**	**6**
Algae predation, nitrogen fraction to RPON	0.28						
Algae predation, nitrogen fraction to LPON	0.12						
Algae predation, nitrogen fraction to DON	0.35						
Fraction of metabolized N produced as RPON, cyanobacteria	0.075						
Fraction of metabolized N produced as RPON, diatoms	0.075						
Fraction of metabolized N produced as RPON, greens	0.075						
Fraction of metabolized N produced as LPON, cyanobacteria	0.075						
Fraction of metabolized N produced as LPON, diatoms	0.075						
Fraction of metabolized N produced as LPON, greens	0.075						
Fraction of metabolized N produced as DON, cyanobacteria	0.25						
Fraction of metabolized N produced as DON, diatoms	0.25						
Fraction of metabolized N produced as DON, greens	0.25						
Minimum hydrolysis rate of RPON (/day)	0.005						
Minimum hydrolysis rate of LPON (/day)	0.100						
Minimum mineralization rate of DON (/day)	0.030						
Constant relating hydrolysis rate of RPON to algae	0.000						
Constant relating hydrolysis rate of LPON to algae	0.000						
Constant relating mineralization rate of DON to algae	0.000						
Settling velocity for RPON (m/day)		0.5	0.5	0.5	0.5	0.5	0.5
Settling velocity for LPON (m/day)		0.5	0.5	0.5	0.5	0.5	0.5

Table **Error! No text of specified style in document.**-9. Kinetic Coefficients for Organic Ammonia and Nitrate/Nitrite

	Zones						
Kinetic Coefficient	**Global**	**1**	**2**	**3**	**4**	**5**	**6**
Algae predation, nitrogen fraction to DIN	0.25						
Fraction of metabolized N produced as DIN, cyanobacteria	0.60						
Fraction of metabolized N produced as DIN, diatoms	0.60						
Fraction of metabolized N produced as DIN, greens	0.60						
Mass NO3 reduces per DOC oxidized (gN / g C)	0.933						
Maximum nitrification rate (gN /m3 /day)	0.075						
Oxygen half-Sat constant for nitrification (gO2 / m3)	1.00						
NH4 half-saturation constant for nitrification (gN / m3)	1.00						
Reference temperature for nitrification (deg C)	21.00						
Suboptimal temperature coefficient for nitrification	0.0450						

Superoptimal temperature coefficient for nitrification	0.0045						

Table **Error! No text of specified style in document.**-10. Kinetic Coefficients for Chemical Oxygen Demand

	Zones						
Kinetic Coefficient	**Global**	**1**	**2**	**3**	**4**	**5**	**6**
Oxygen Half-Sat constant for COD decay (mg/L O_2)	1.50						
COD decay rate (/day)	0.10						
Reference temperature for COD decay (deg C)	20.00						
Temperature rate constant for COD decay	0.041						

Table **Error! No text of specified style in document.**-11. Kinetic Coefficients for Dissolved Oxygen

	Zones						
Kinetic Coefficient	**Global**	**1**	**2**	**3**	**4**	**5**	**6**
Reaeration Rate constant (3.933 for O'Connor-Dobbins; 5.32 for Owen-Gibbs		3.933	3.933	3.933	3.933	5.32	5.32
Reaeration Adjustment Factor		1	1	1	1	1	1
Temperature rate constant for reaeration	1.024						

APPENDIX I
EFDC SEDIMENT DIAGENESIS MODEL PARAMETERS AND KINETIC COEFFICIENTS TENKILLER FERRY LAKE

Table **Error! No text of specified style in document.**-1. Kinetic Coefficients for Nutrient Recycle Fractions of Cyanobacteria

Kinetic Coefficient	Global	Zone1	Zone2	Zone3	Zone4	Zone5	Zone6
Fraction of PON from cyanobacteria group routed to G1 class	0.65						
Fraction of PON from cyanobacteria group routed to G2 class	0.25						
Fraction of PON from cyanobacteria group routed to G3 class	0.10						
Fraction of POP from cyanobacteria group routed to G1 class	0.65						
Fraction of POP from cyanobacteria group routed to G2 class	0.20						
Fraction of POP from cyanobacteria group routed to G3 class	0.15						
Fraction of POC from cyanobacteria group routed to G1 class	0.65						
Fraction of POC from cyanobacteria group routed to G2 class	0.20						
Fraction of POC from cyanobacteria group routed to G3 class	0.15						

Table **Error! No text of specified style in document.**-2. Kinetic Coefficients for Nutrient Recycle Fractions of Diatom

Kinetic Coefficient	Global	Zone1	Zone2	Zone3	Zone4	Zone5	Zone6
Fraction of PON from diatoms algae group routed to G1 class	0.65						
Fraction of PON from diatoms algae group routed to G2 class	0.25						
Fraction of PON from diatoms algae group routed to G3 class	0.10						
Fraction of POP from diatoms algae group routed to G1 class	0.65						
Fraction of POP from diatoms algae group routed to G2 class	0.20						
Fraction of POP from diatoms algae group routed to G3 class	0.15						
Fraction of POC from diatoms algae group routed to G1 class	0.65						
Fraction of POC from diatoms algae group routed to G2 class	0.20						
Fraction of POC from diatoms algae group routed to G3 class	0.15						

Table **Error! No text of specified style in document.**-3. Kinetic Coefficients for Nutrient Recycle Fractions of Green Algae

Kinetic Coefficient	Global	Zone1	Zone2	Zone3	Zone4	Zone5	Zone6
Fraction of PON from green algae group routed to G1 class	0.65						
Fraction of PON from green algae group routed to G2 class	0.25						
Fraction of PON from green algae group routed to G3 class	0.10						
Fraction of POP from green algae group routed to G1 class	0.65						
Fraction of POP from green algae group routed to G2 class	0.20						
Fraction of POP from green algae group routed to G3 class	0.15						
Fraction of POC from green algae group routed to G1 class	0.65						
Fraction of POC from green algae group routed to G2 class	0.20						
Fraction of POC from green algae group routed to G3 class	0.15						

Table **Error! No text of specified style in document.**-4. Kinetic Coefficients for Sediment Diagenesis Parameters

Kinetic Coefficient	Global	Zone1	Zone2	Zone3	Zone4	Zone5	Zone6
Decay rate of PON at 20 deg C in Layer 2 for G1 class (/day)	0.035						
Decay rate of PON at 20 deg C in Layer 2 for G2 class (/day)	0.0018						
Decay rate of PON at 20 deg C in Layer 2 for G3 class (/day)	0.00						
Decay rate of POP at 20 deg C in Layer 2 for G1 class (/day)	0.035						
Decay rate of POP at 20 deg C in Layer 2 for G2 class (/day)	0.0018						
Decay rate of POP at 20 deg C in Layer 2 for G3 class (/day)	0.00						
Decay rate of POC at 20 deg C in Layer 2 for G1 class (/day)	0.035						
Decay rate of POC at 20 deg C in Layer 2 for G2 class (/day)	0.0018						
Decay rate of POC at 20 deg C in Layer 2 for G3 class (/day)	0.00						
Constant for temperature adjustment for KPON1 (unit less)	1.10						
Constant for temperature adjustment for KPON2 (unit less)	1.175						
Constant for temperature adjustment for KPON3 (unit less)	1.00						
Constant for temperature adjustment for KPOP1 (unit less)	1.10						
Constant for temperature adjustment for KPOP2 (unit less)	1.175						
Constant for temperature adjustment for KPOP3 (unit less)	1.00						
Constant for temperature adjustment for KPOC1 (unit less)	1.10						
Constant for temperature adjustment for KPOC2 (unit less)	1.175						
Constant for temperature adjustment for KPOC3 (unit less)	1.00						
SOD scaling factor		5.0	6.0	1.0	1.0	1.0	0.4

Table **Error! No text of specified style in document.**-5. Kinetic Coefficients for Sediment Bed Parameters

Kinetic Coefficient	Global	Zone1	Zone2	Zone3	Zone4	Zone5	Zone6
Sediment thickness (m)		0.10	0.10	0.10	0.10	0.10	0.10
Burial rate (cm/yr.)		0.25	0.25	0.25	0.25	0.25	0.25
Initial sediment temperature	10.0						

Table **Error! No text of specified style in document.**-6. Kinetic Coefficients for Solid-Related Parameters

Kinetic Coefficient	Global	Zone1	Zone2	Zone3	Zone4	Zone5	Zone6
Solid concentrations in Layer 1 (Kg/L)	0.50						
Solid concentrations in Layer 2 (Kg/L)	0.50						
Constant for temperature adjustment for Dd (unit less)	1.15						
Constant for temperature adjustment for Dp (unit less)	1.15						
Reference concentration for GPOC(1)	100						
Particle mixing half-saturation constant for oxygen (mg/L)	4.0						
Minimum diffusion coefficient for particle mixing (m2/d)	6.0E-06						

Table **Error! No text of specified style in document.**-7. Kinetic Coefficients for Mixing-Related Parameters

Kinetic Coefficient	Global	Zone1	Zone2	Zone3	Zone4	Zone5	Zone6
Diffusion coefficient in porewater (m2/day)		0.0012	0.0012	0.0012	0.0012	0.0005	0.0012
Particle mixing apparent diffusion coefficient (m2/day)		0.00012	0.00012	0.00012	0.00012	0.00006	0.00012
Diffusion coefficient for sediment temperature	9.0E-08						

Table **Error! No text of specified style in document.**-8. Kinetic Coefficients for Benthic Stress Parameters

Kinetic Coefficient	Global	Zone1	Zone2	Zone3	Zone4	Zone5	Zone6
Initial accumulated benthic stress (days)	5.00						
1st order decay of accumulated benthic stress (/day)	0.01						

Table **Error! No text of specified style in document.**-9. Kinetic Coefficients for Ammonium-Related Parameters

Kinetic Coefficient	Global	Zone1	Zone2	Zone3	Zone4	Zone5	Zone6
Partition coefficient for NH4 in aerobic conditions (1/kg)	1						
Partition coefficient for NH4 in anaerobic conditions (1/kg)	1						
Nitrification half-Sat. constant for ammonium (gN /m3)	0.728						
Nitrification half-Sat. constant for dissolved oxygen (gO2 /m3)	0.37						
Constant for temperature adjustment for KNH4 (unit less)	1.125						
Optimal nitrification velocity (20 deg C) (m/day)		0.13	0.05	0.13	0.13	0.26	0.26
Coefficient for oxygen consumed by nitrification (g O2/gN)	4.571						

Table **Error! No text of specified style in document.**-10. Kinetic Coefficients for Nitrate-Related Parameters

Kinetic Coefficient	Global	Zone1	Zone2	Zone3	Zone4	Zone5	Zone6
Denitrification velocity, layer 1 (20 deg C) (m/day)		0.20	0.20	0.20	0.20	0.20	0.20
Denitrification velocity, layer 2 (20 deg C) (m/day)		0.25	0.25	0.25	0.25	0.25	0.25
Constant for temperature adjustment for KNO3 (unit less)	1.08						
Coefficient for oxygen consumed by denitrification (g O2/gN)	2.857						

Table **Error! No text of specified style in document.**-11. Kinetic Coefficients for Phosphate-Related Parameters

Kinetic Coefficient	Global	Zone1	Zone2	Zone3	Zone4	Zone5	Zone6
Partition coefficient for PO4 in anaerobic conditions (1/kg)	25						
Critical dissolved oxygen for PO4 sorption (mg/L)	2						
PO4 sorption enhancement factor		900	900	300	300	900	900

Table **Error! No text of specified style in document.**-12. Kinetic Coefficients for Sulfide-Related Parameters

Kinetic Coefficient	Global	Zone1	Zone2	Zone3	Zone4	Zone5	Zone6
Partition coefficient for H2S in Layer 1 (1/kg)	100						
Partition coefficient for H2S in Layer 2 (1/kg)	100						
Reaction velocity for dissolved sulfide oxidation in Layer 1 at 20 deg C (m/day)	0.2						
Reaction velocity for particulate sulfide oxidation in Layer 1 at 20 deg C (m/day)	0.4						
Constant for temperature adjustment for Kh2Sd1 and Kh2Sp1 (unit less)	1.17						
Constant to normalize the sulfide oxidation rate for oxygen (mg O2/L)	4						
Reaction velocity of methane oxidation in Layer 1 at 20 deg C (m/day)	0.35						
Constant for temperature adjustment for KCH4 (unit less)	1.035						

Critical salinity; < then CH4 is produced, > then H2S is produced (g/L)	1						
Coefficient for oxygen consumed by H2S oxidation (g O2/gC)	2.667						

APPENDIX J
TIME SERIES PLOTS FOR MODEL CALIBRATION
TENKILLER FERRY LAKE

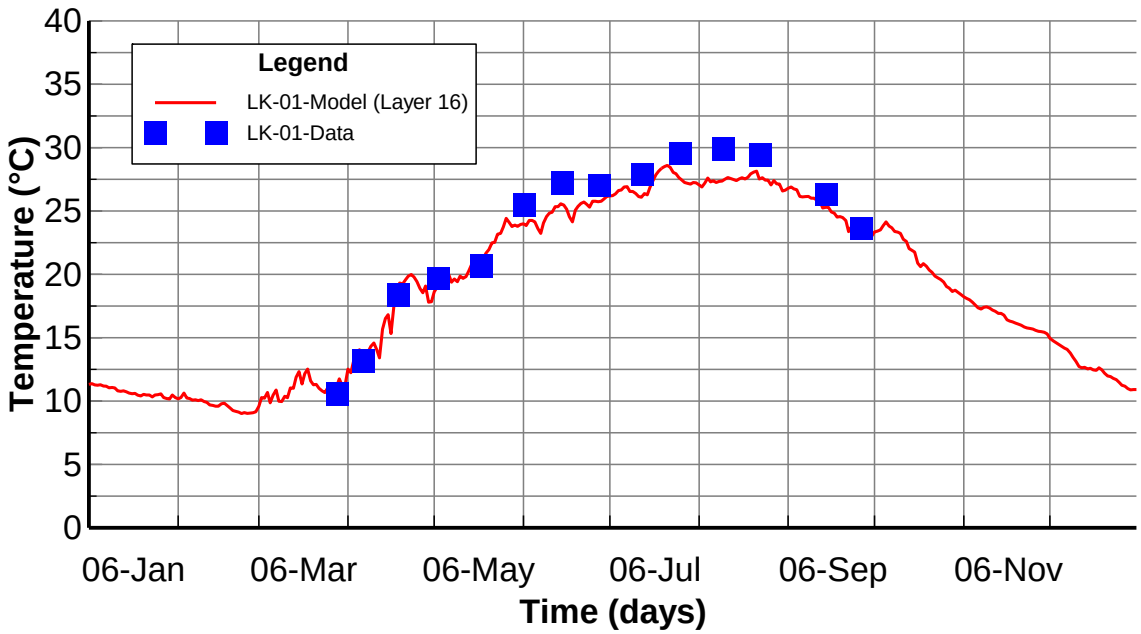


Figure **Error! No text of specified style in document.**.1. Surface Layer Water Temperature Calibration Plot at Station LK-01

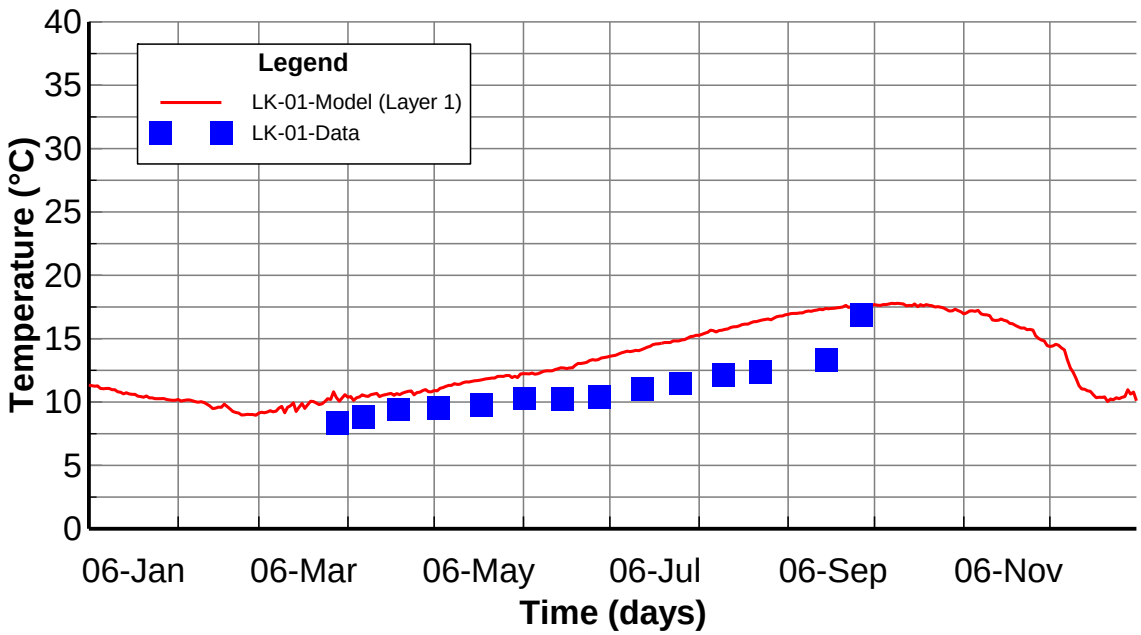


Figure **Error! No text of specified style in document.**.2. Bottom Layer Water Temperature Calibration Plot at Station LK-01

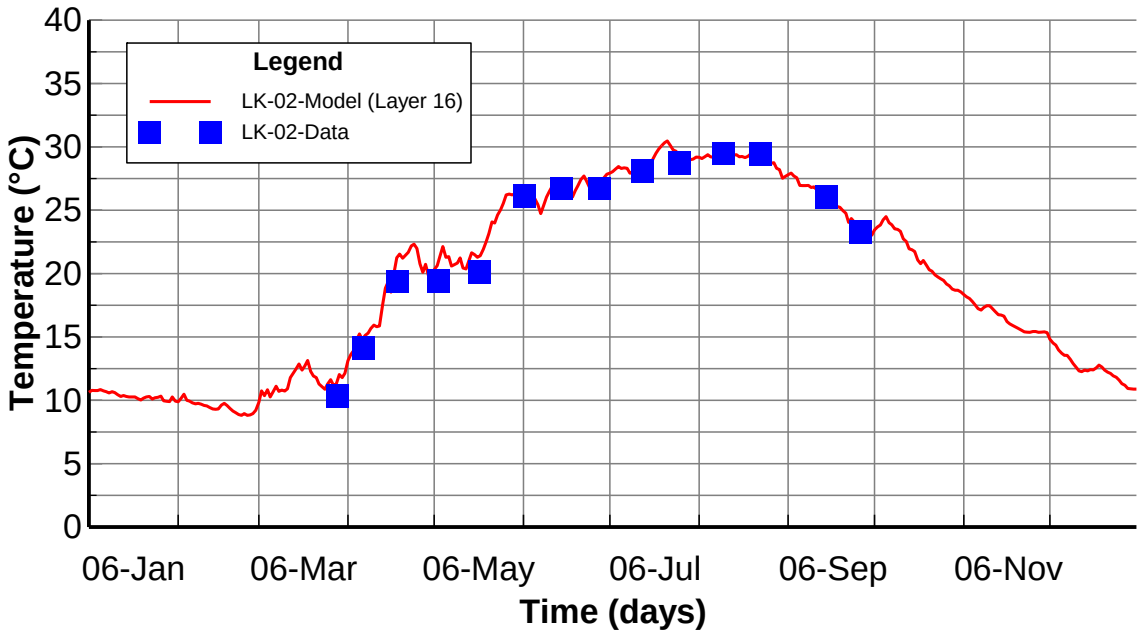


Figure **Error! No text of specified style in document.**.3. Surface Layer Water Temperature Calibration Plot at Station LK-02

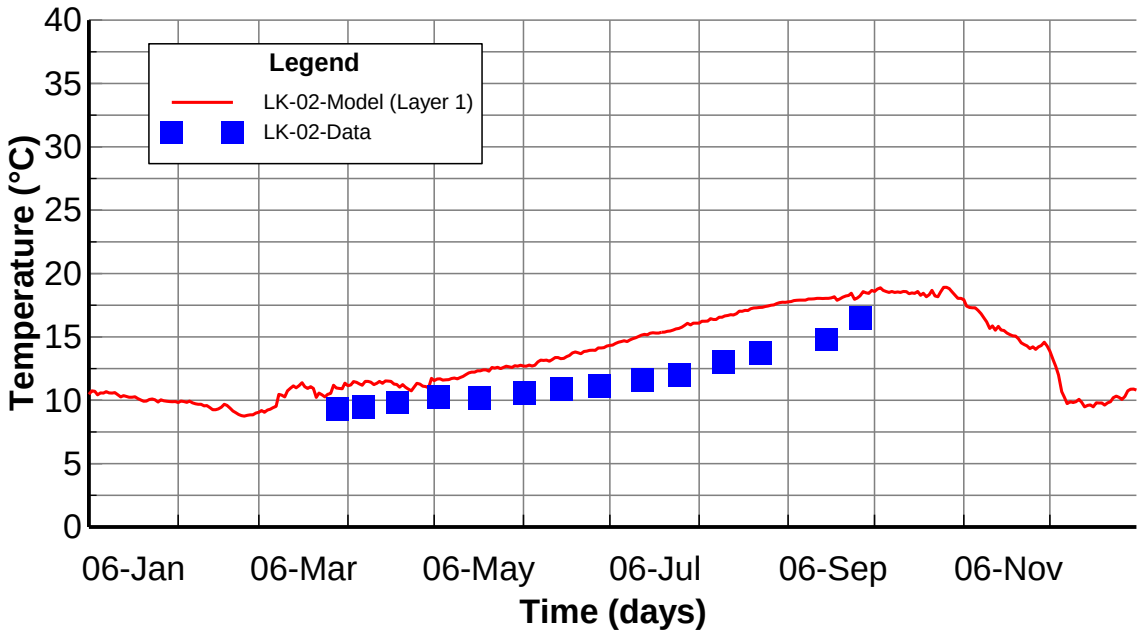


Figure **Error! No text of specified style in document.**.4. Bottom Layer Water Temperature Calibration Plot at Station LK-02

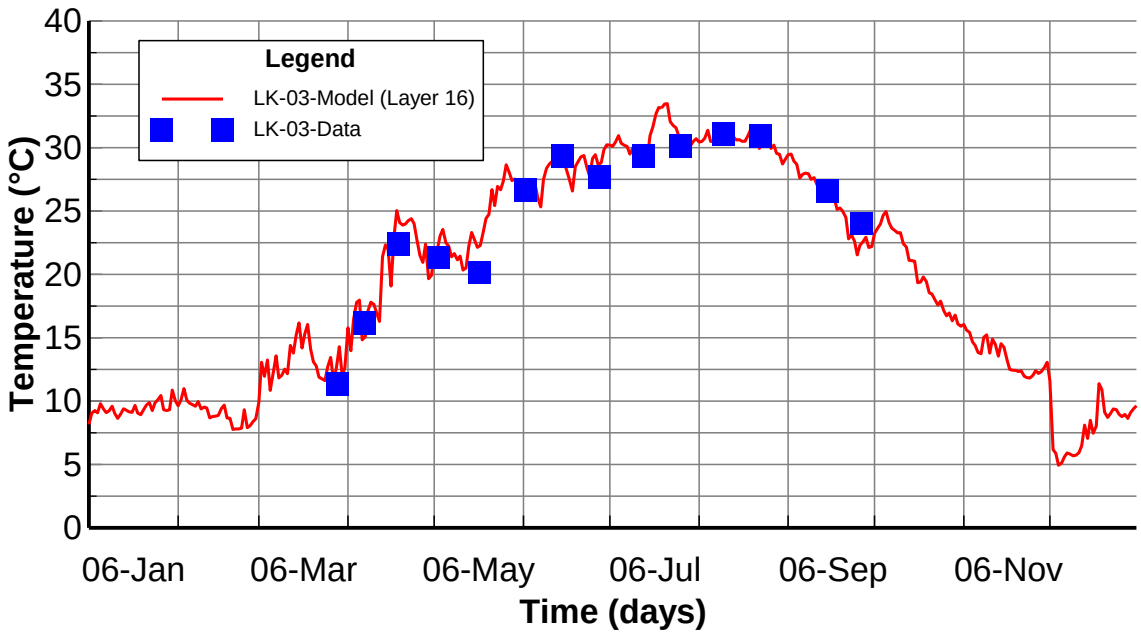


Figure **Error! No text of specified style in document.**.5. Surface Layer Water Temperature Calibration Plot at Station LK-03

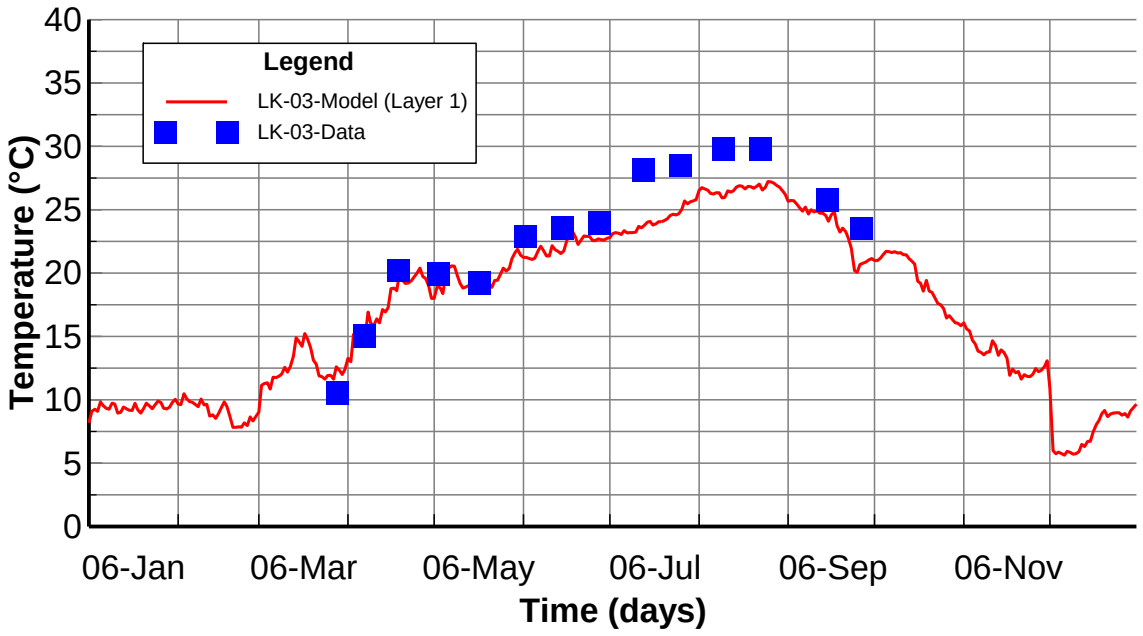


Figure **Error! No text of specified style in document.**.6. Bottom Layer Water Temperature Calibration Plot at Station LK-03

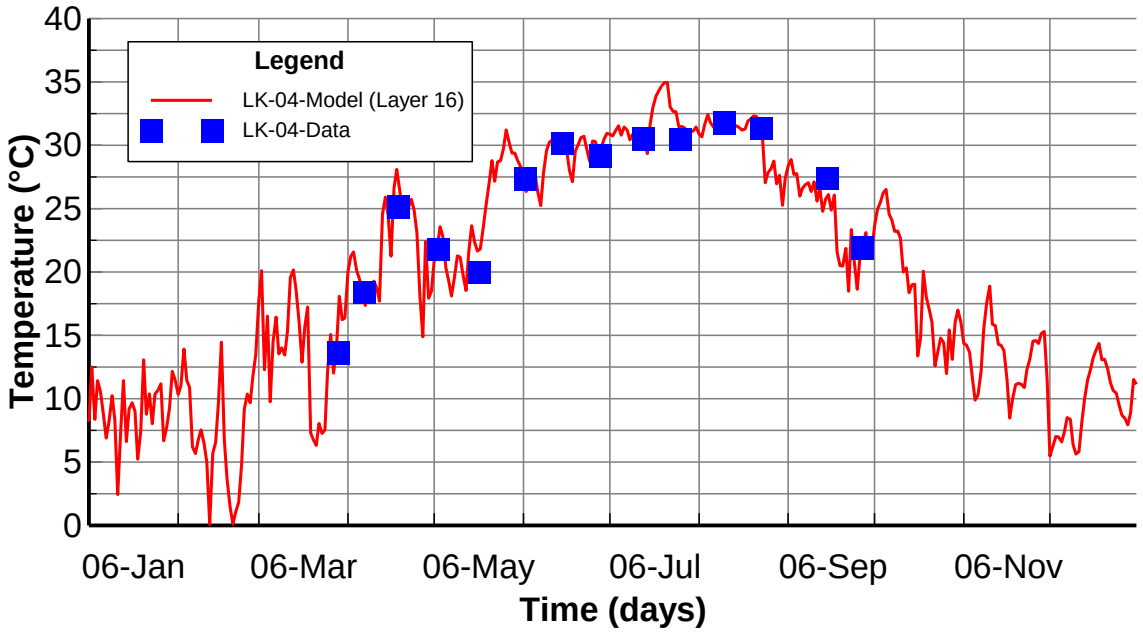


Figure **Error! No text of specified style in document.**.7. Surface Layer Water Temperature Calibration Plot at Station LK-04

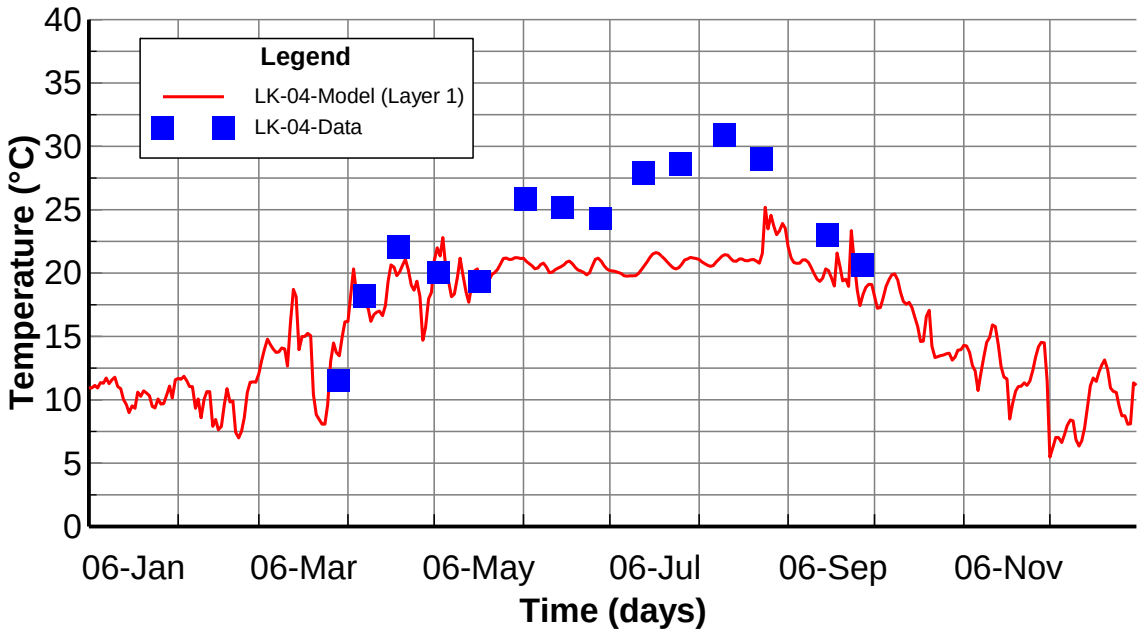


Figure **Error! No text of specified style in document.**.8. Bottom Layer Water Temperature Calibration Plot at Station LK-04

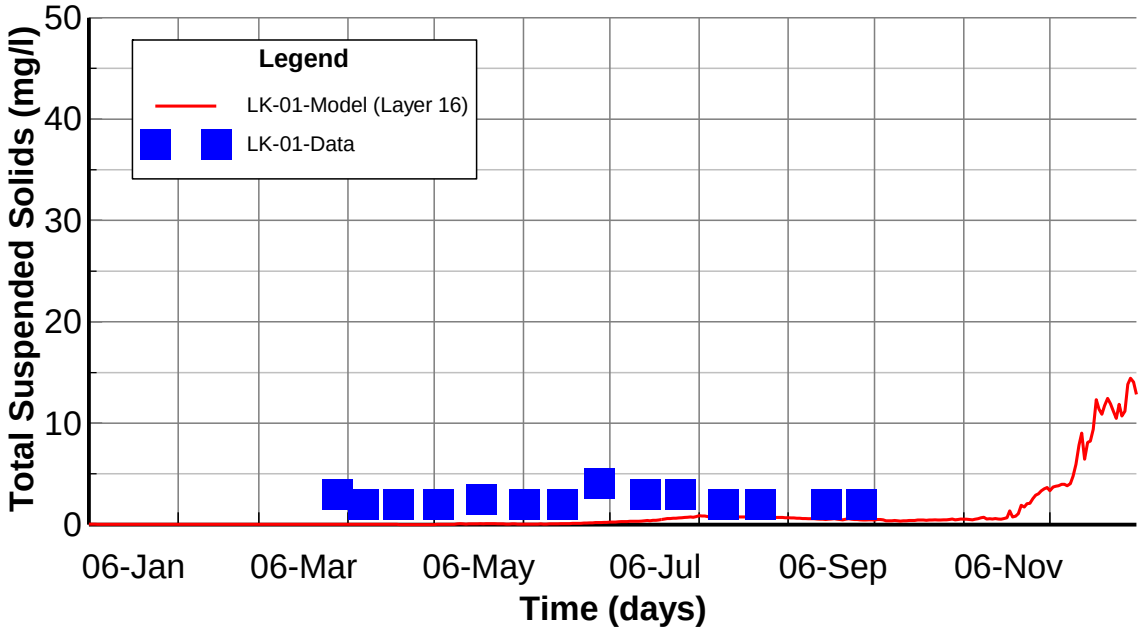


Figure **Error! No text of specified style in document.**.9. Surface Layer TSS Calibration Plot at Station LK-01

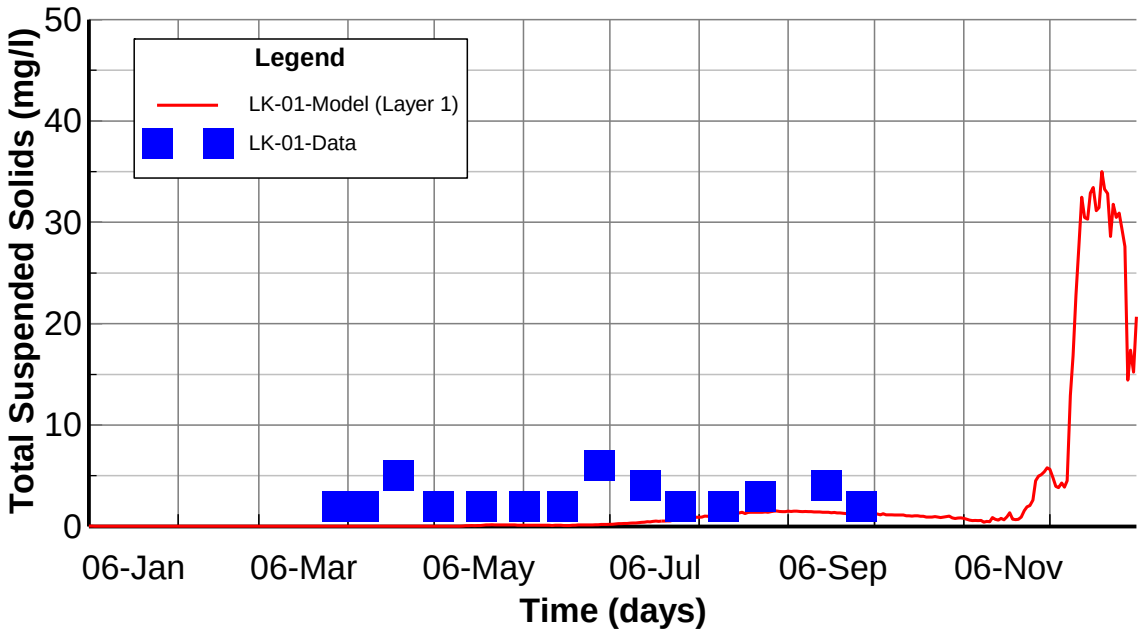


Figure **Error! No text of specified style in document.**.10. Bottom Layer TSS Calibration Plot at Station LK-01

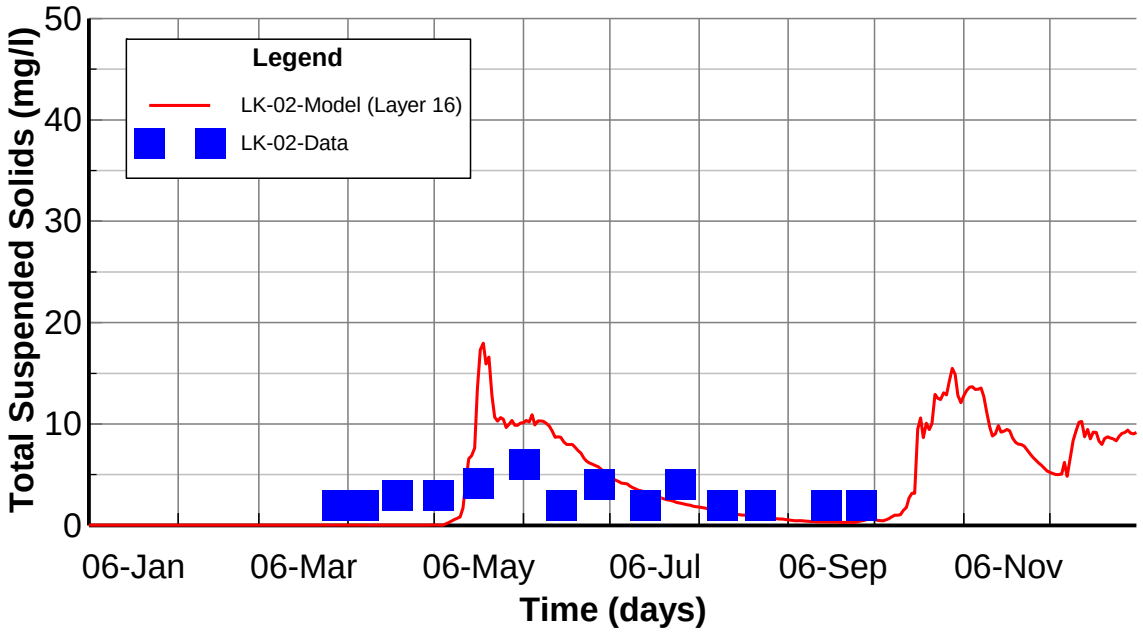


Figure **Error! No text of specified style in document.**.11. Surface Layer TSS Calibration Plot at Station LK-02

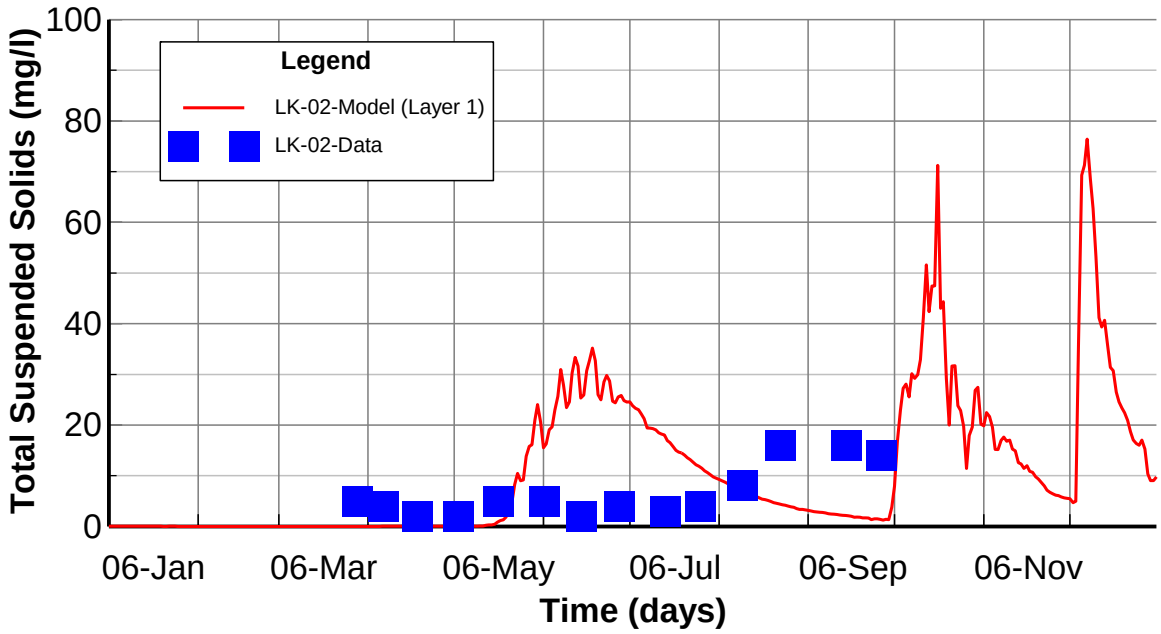


Figure **Error! No text of specified style in document.**.12. Bottom Layer TSS Calibration Plot at Station LK-02

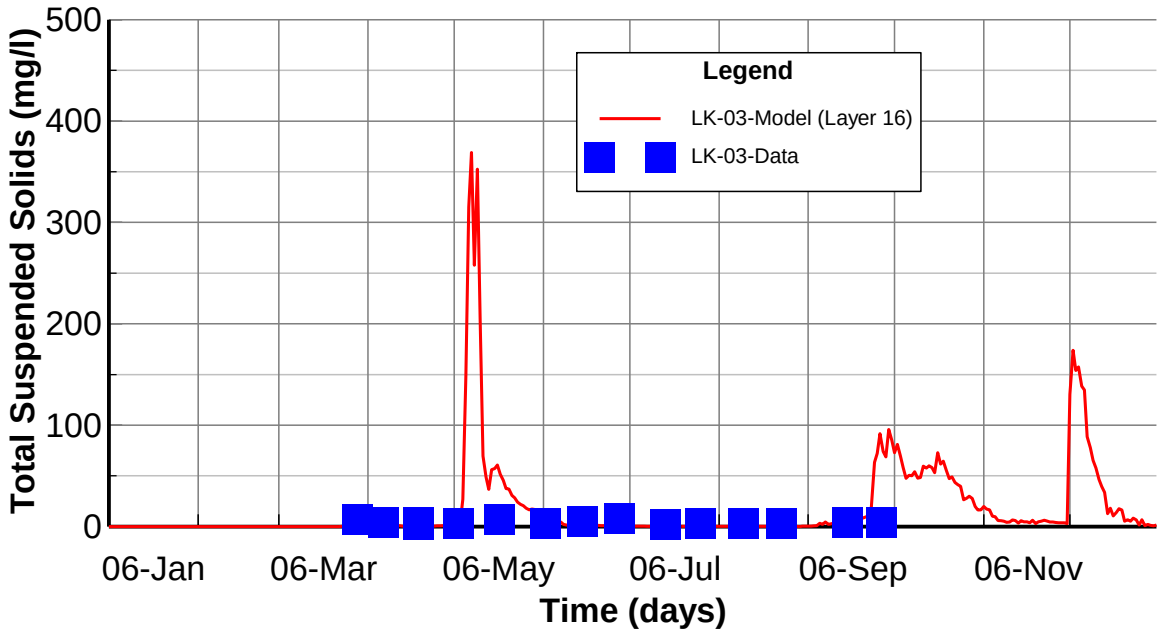


Figure **Error! No text of specified style in document.**.13. Surface Layer TSS Calibration Plot at Station LK-03

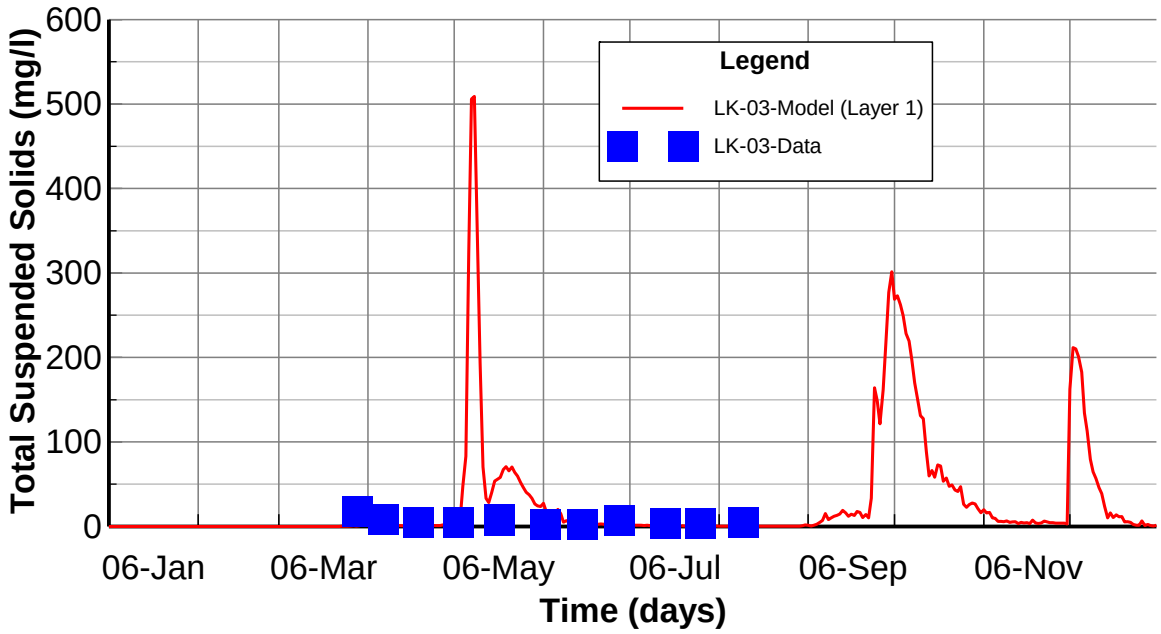


Figure **Error! No text of specified style in document.**.14. Bottom Layer TSS Calibration Plot at Station LK-03

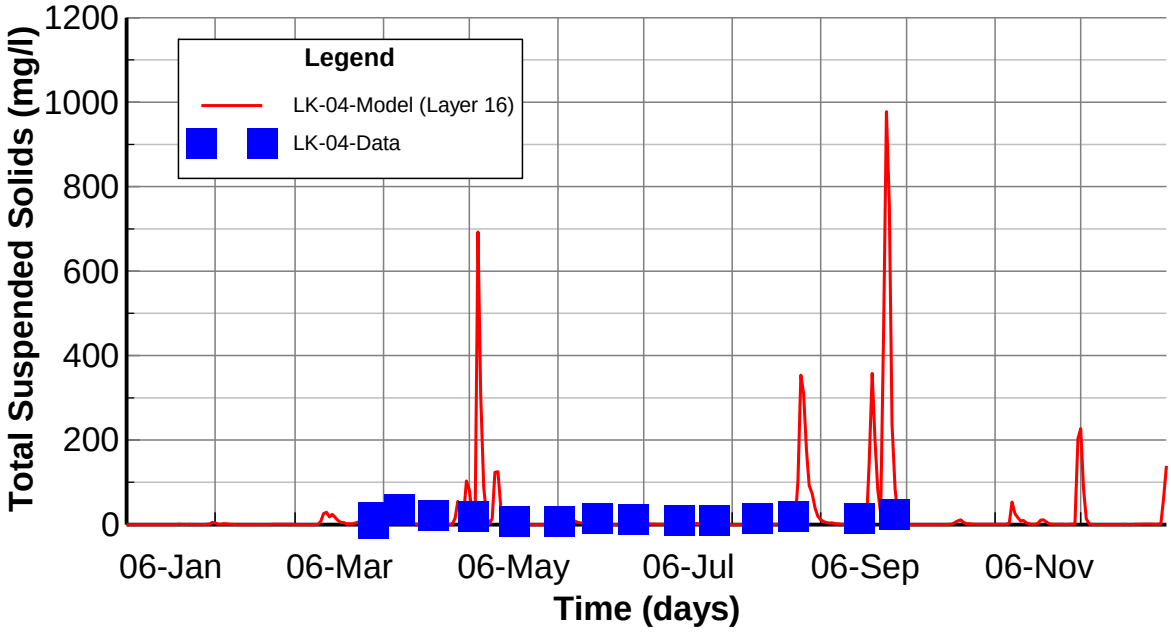


Figure **Error! No text of specified style in document.**.15. Surface Layer TSS Calibration Plot at Station LK-04

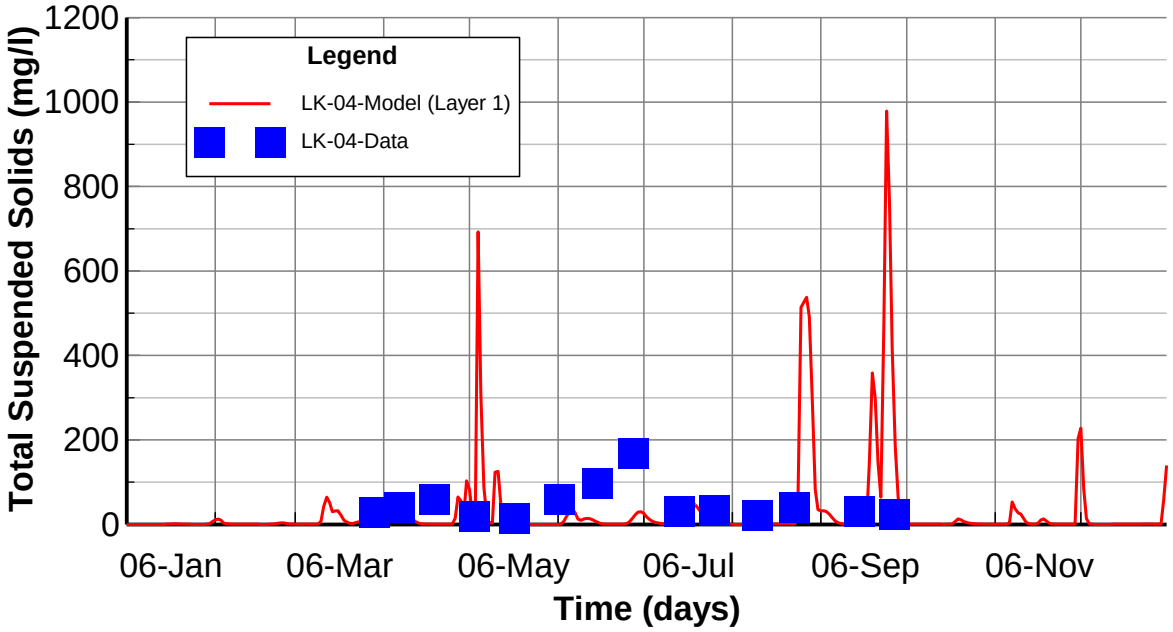


Figure **Error! No text of specified style in document.**.16. Bottom Layer TSS Calibration Plot at Station LK-04

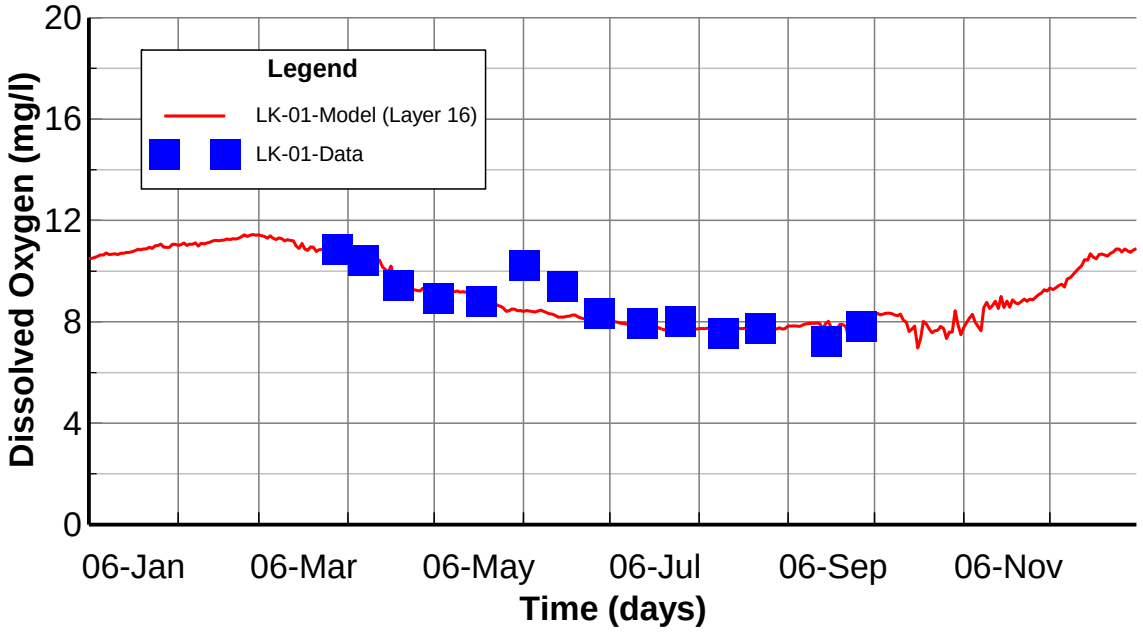


Figure **Error! No text of specified style in document.**.17. Surface Layer Dissolved Oxygen Calibration Plot at Station LK-01

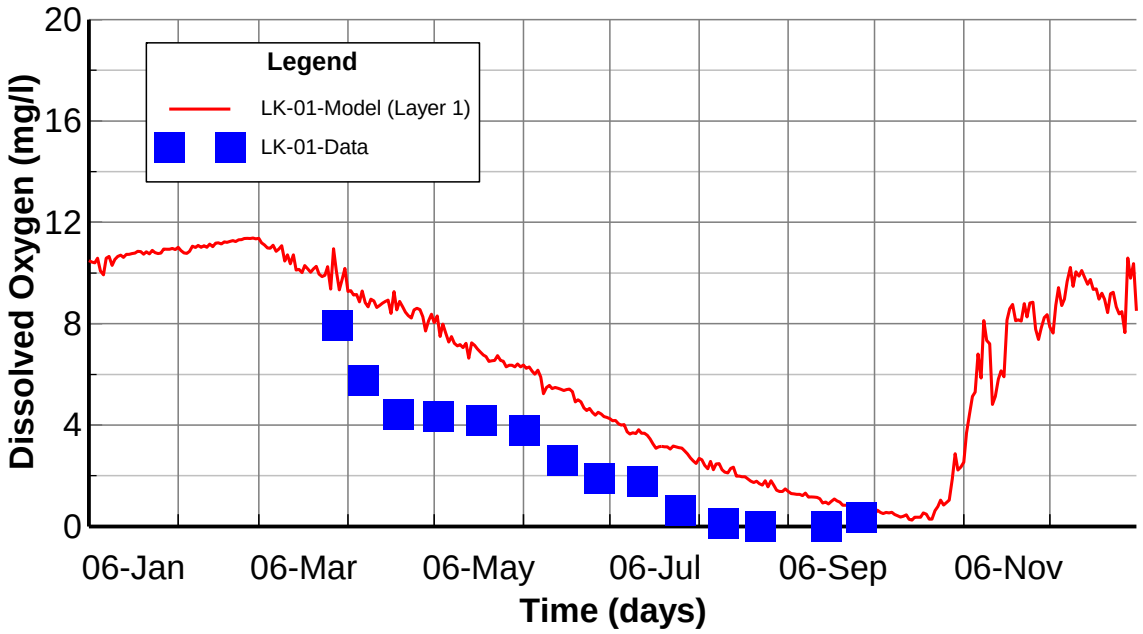


Figure **Error! No text of specified style in document.**.18. Bottom Layer Dissolved Oxygen Calibration Plot at Station LK-01

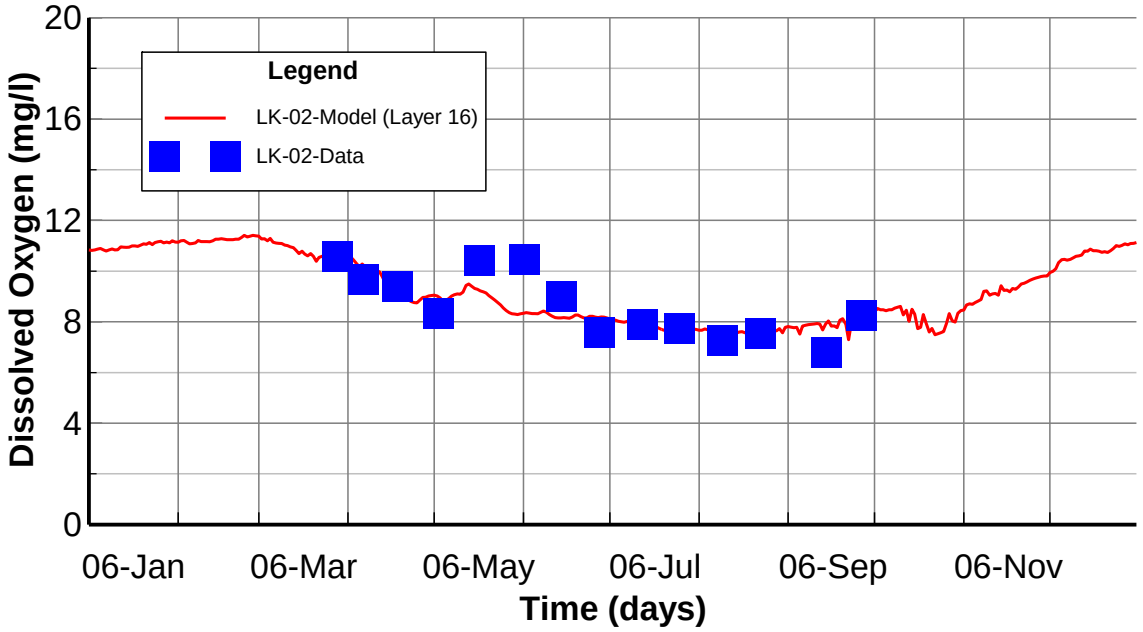


Figure **Error! No text of specified style in document.**.19. Surface Layer Dissolved Oxygen Calibration Plot at Station LK-02

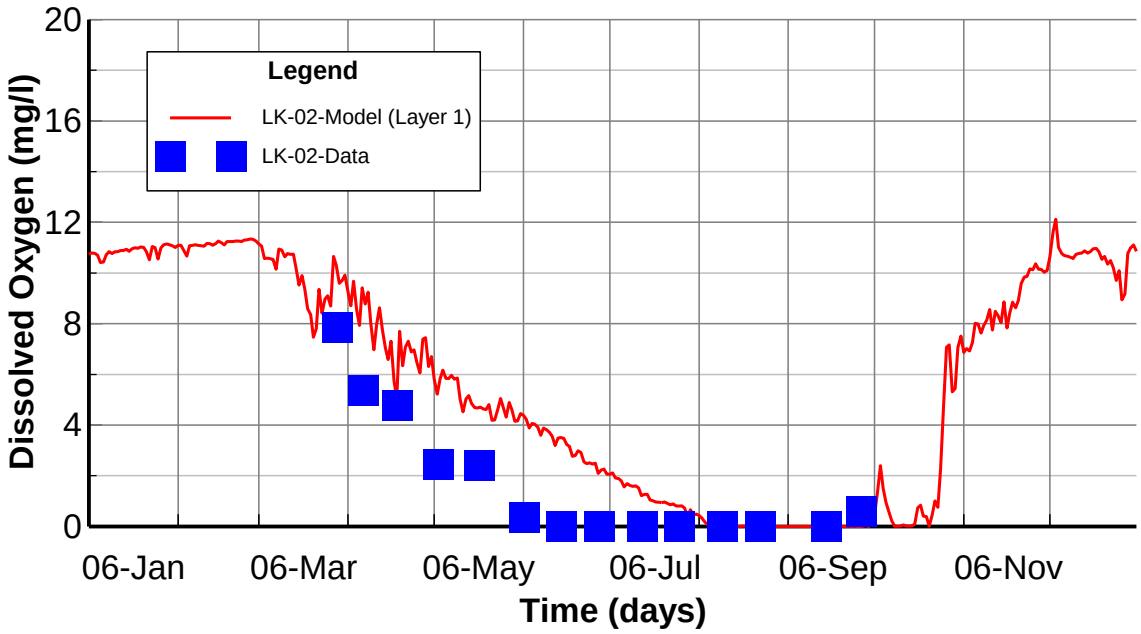


Figure **Error! No text of specified style in document.**.20. Bottom Layer Dissolved Oxygen Calibration Plot at Station LK-02

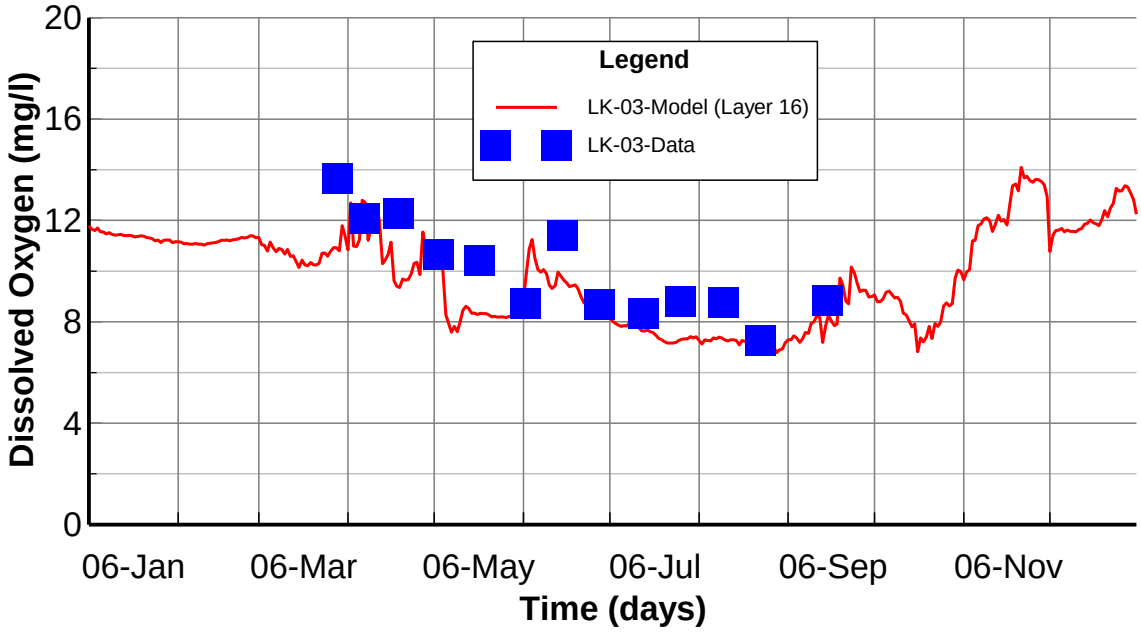


Figure **Error! No text of specified style in document.**.21. Surface Layer Dissolved Oxygen Calibration Plot at Station LK-03

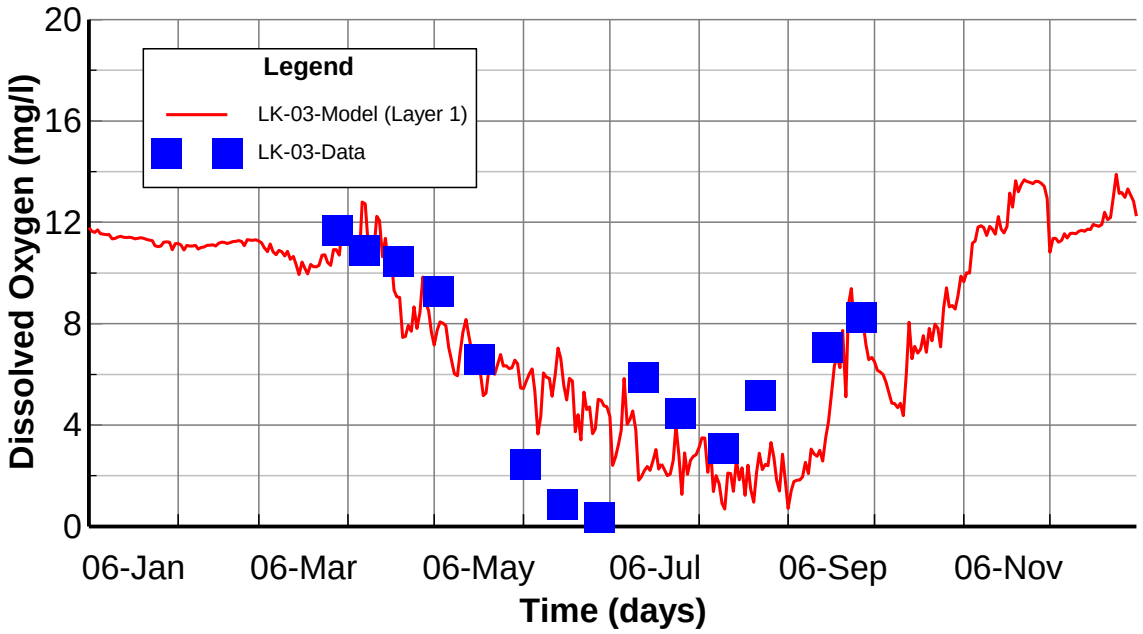


Figure **Error! No text of specified style in document.**.22. Bottom Layer Dissolved Oxygen Calibration Plot at Station LK-03

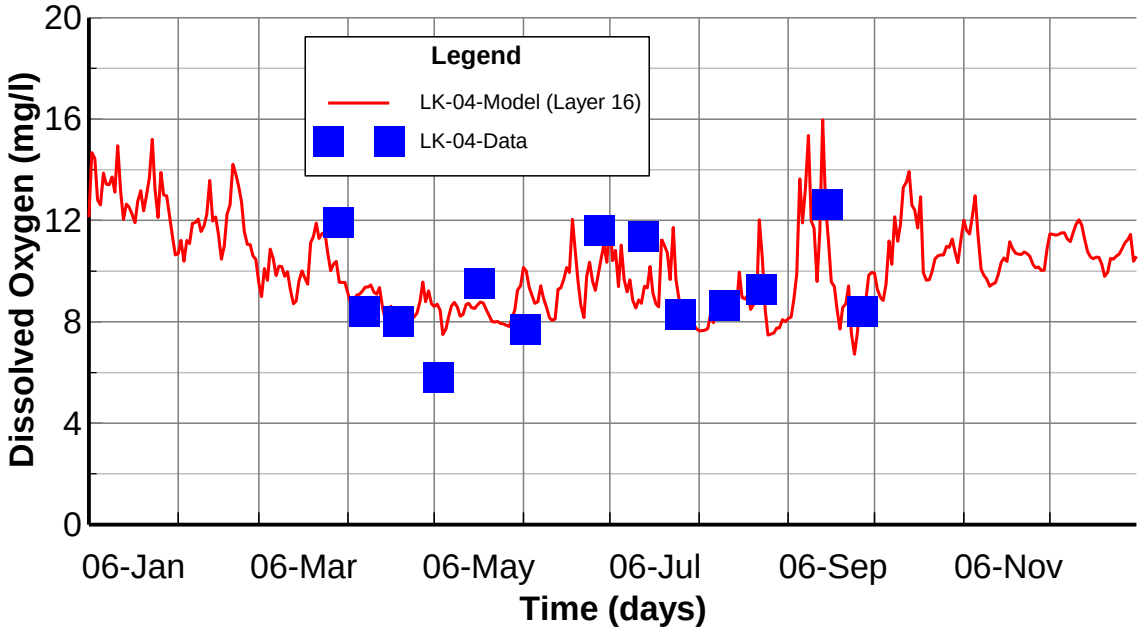


Figure **Error! No text of specified style in document.**.23. Surface Layer Dissolved Oxygen Calibration Plot at Station LK-04

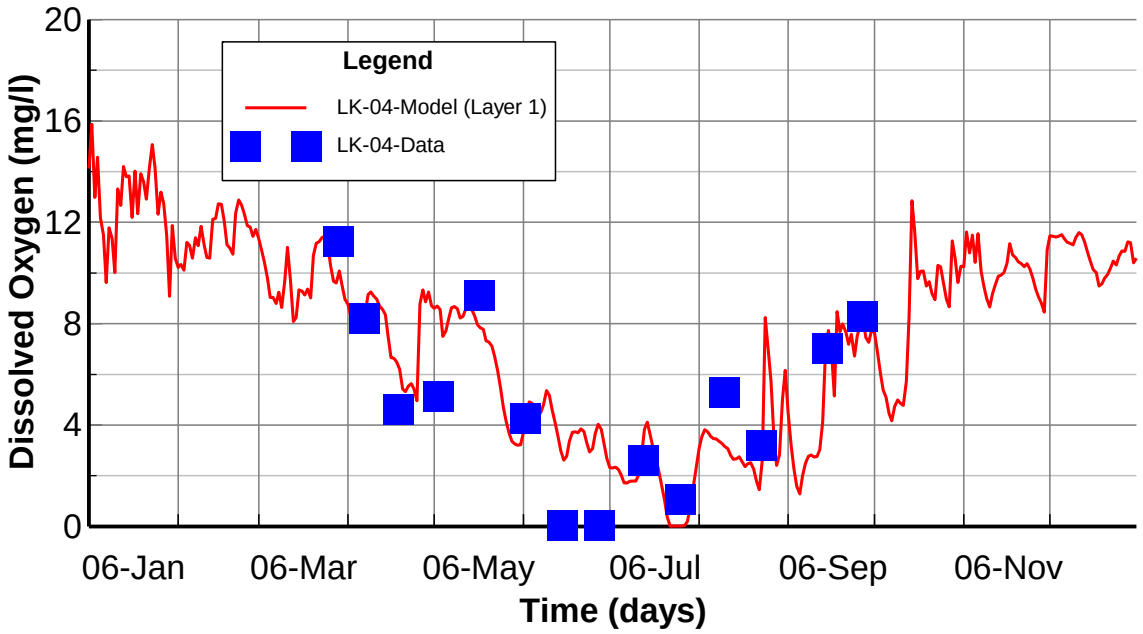


Figure **Error! No text of specified style in document.**.24. Bottom Layer Dissolved Oxygen Calibration Plot at Station LK-04

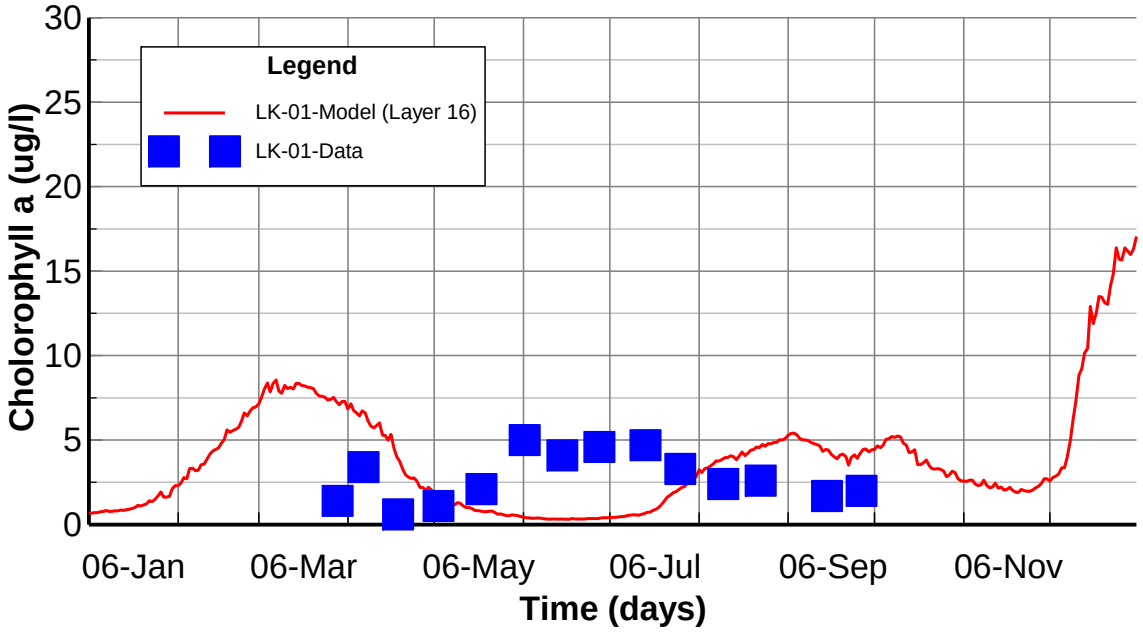


Figure **Error! No text of specified style in document.**.25. Surface Layer Chlorophyll a Calibration Plot at Station LK-01

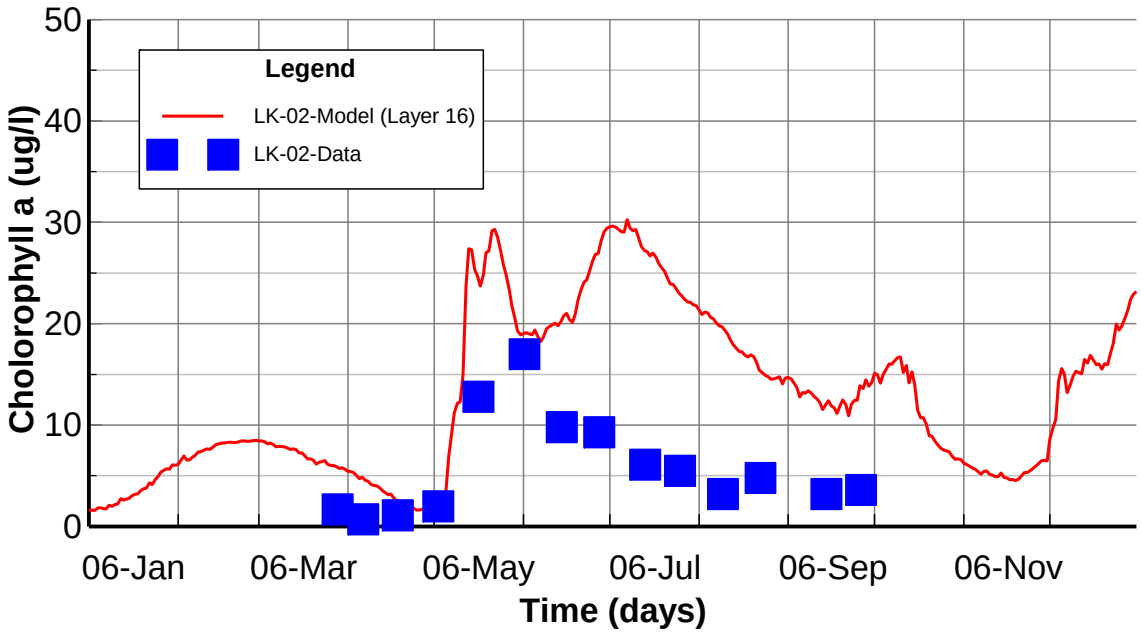


Figure **Error! No text of specified style in document.**.26. Surface Layer Chlorophyll a Calibration Plot at Station LK-02

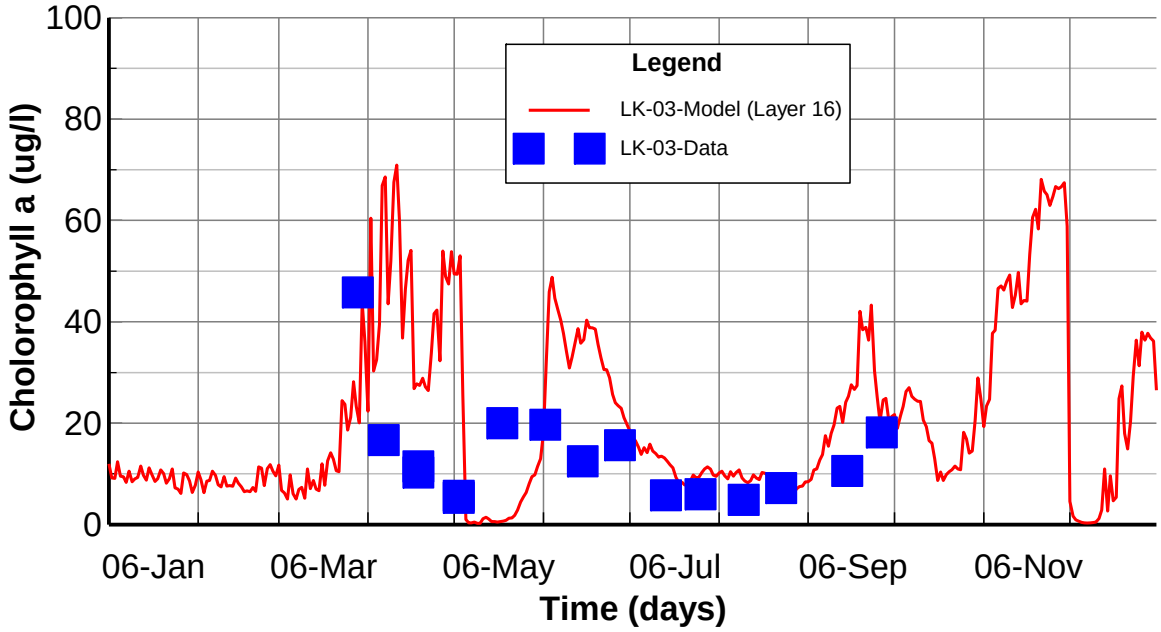


Figure **Error! No text of specified style in document.**.27. Surface Layer Chlorophyll a Calibration Plot at Station LK-03

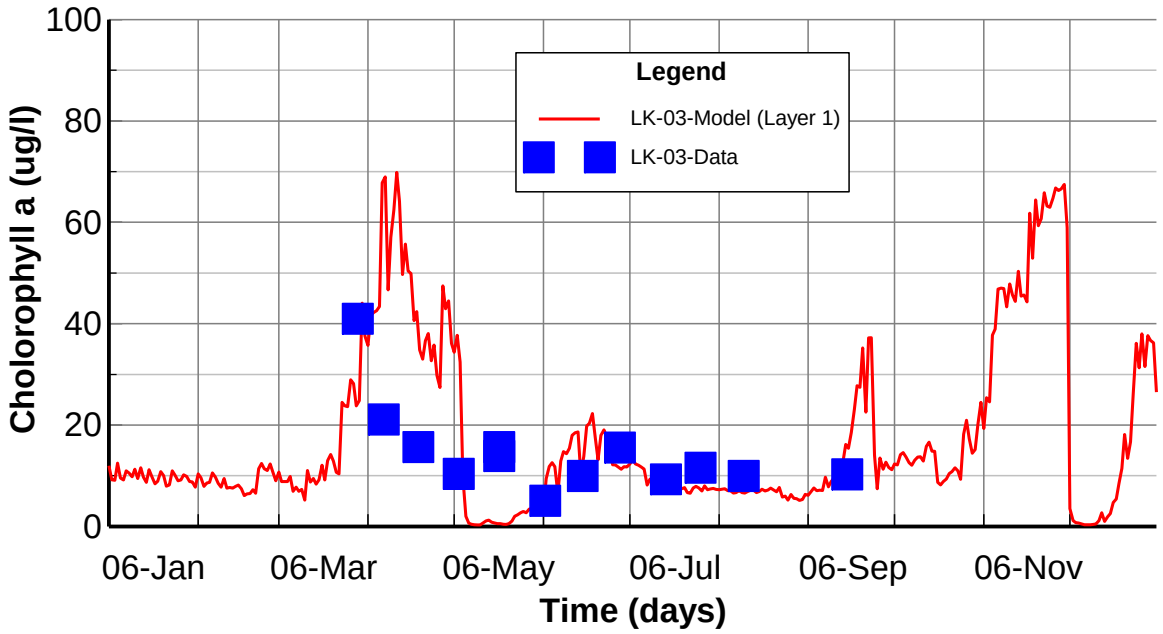


Figure **Error! No text of specified style in document.**.28. Bottom Layer Chlorophyll a Calibration Plot at Station LK-03

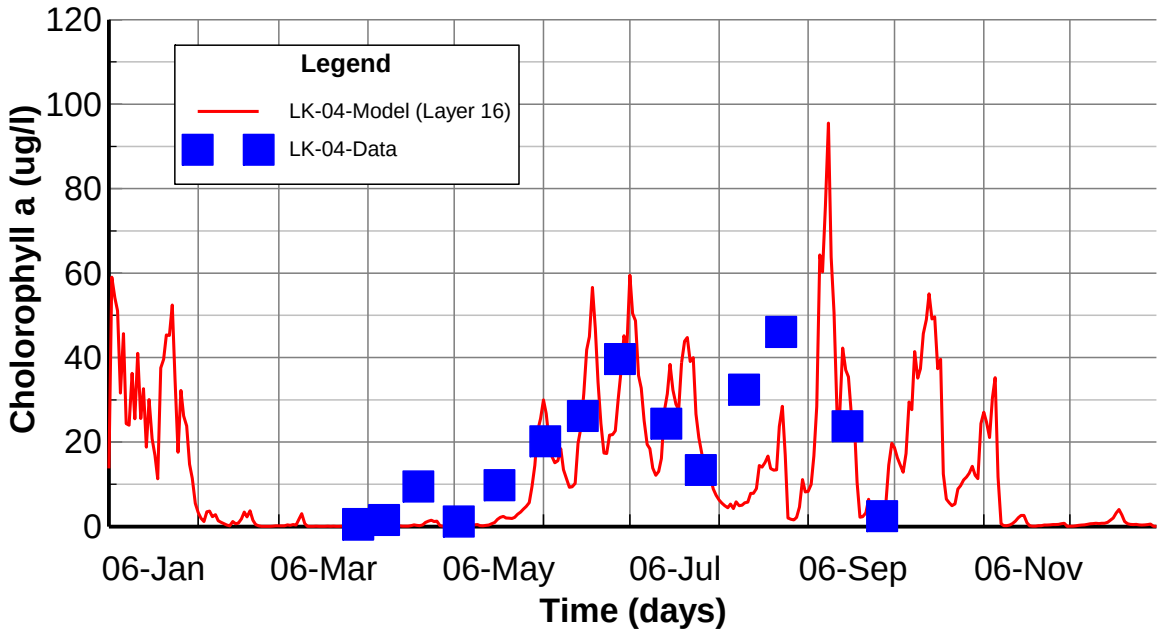


Figure **Error! No text of specified style in document.**.29. Surface Layer Chlorophyll a Calibration Plot at Station LK-04

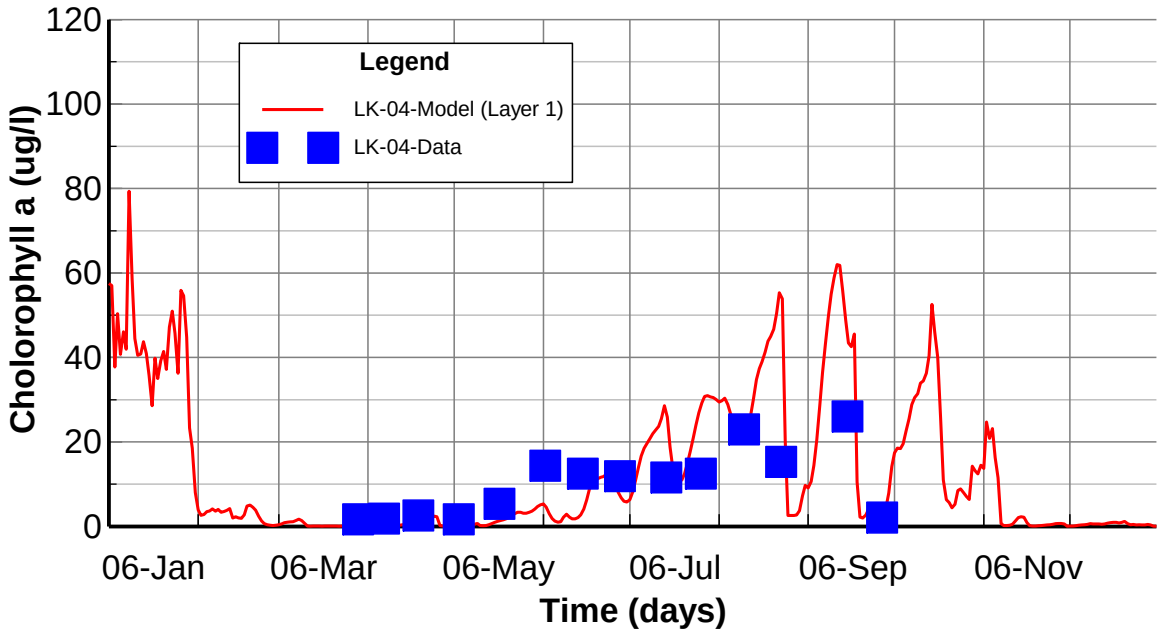


Figure **Error! No text of specified style in document.**.30. Bottom Layer Chlorophyll a Calibration Plot at Station LK-04

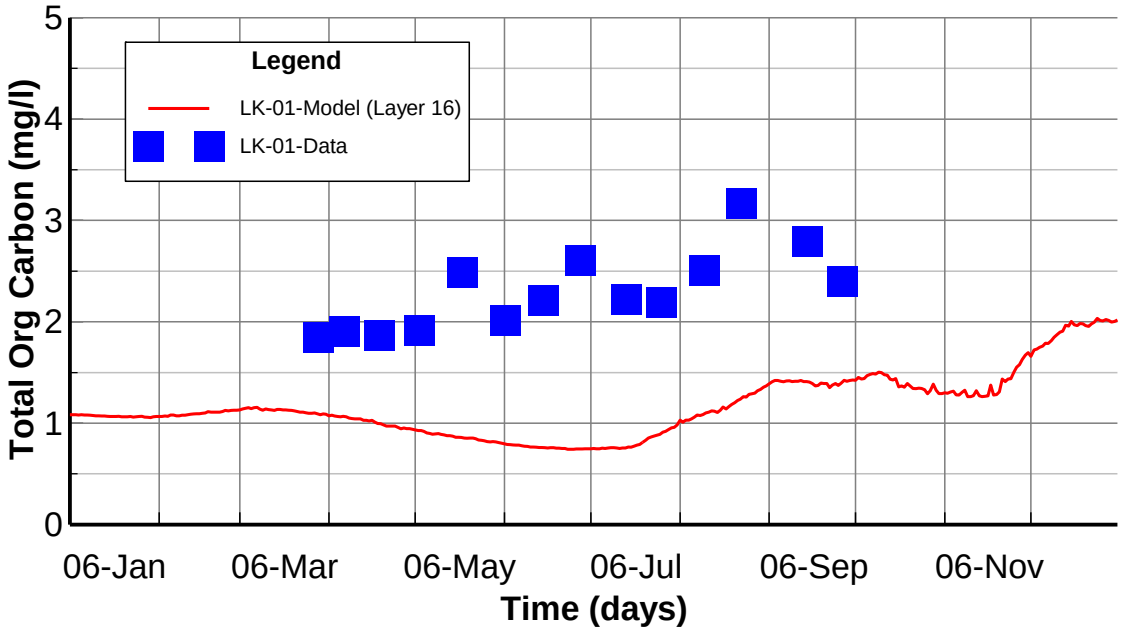


Figure **Error! No text of specified style in document.**.31. Surface Layer TOC Calibration Plots at Station LK-01

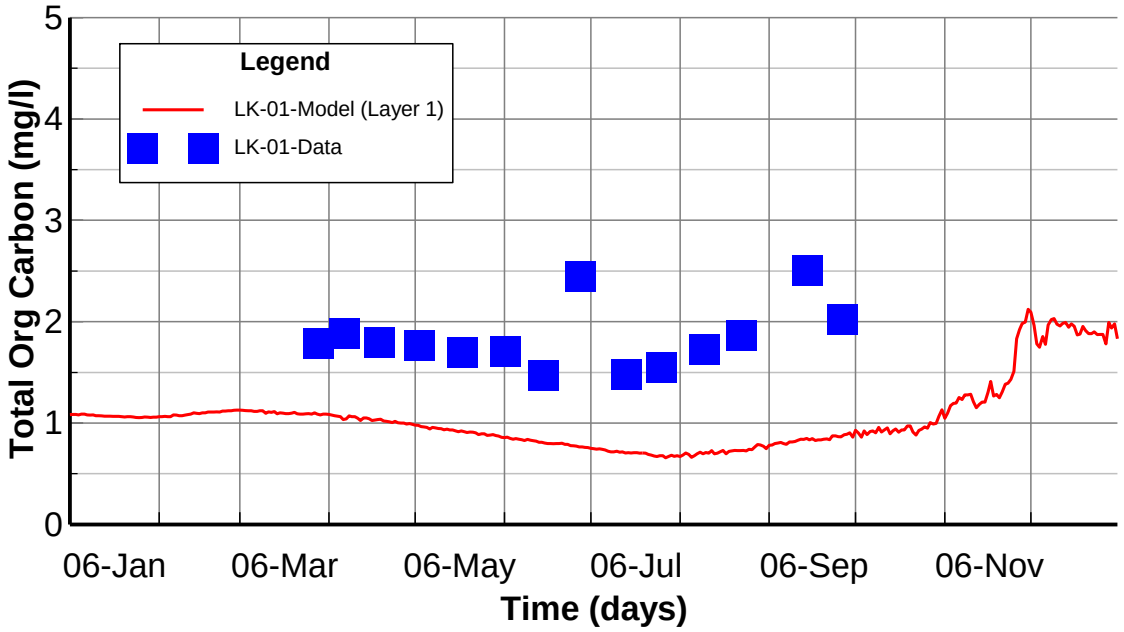


Figure **Error! No text of specified style in document.**.32. Bottom Layer TOC Calibration Plots at Station LK-01

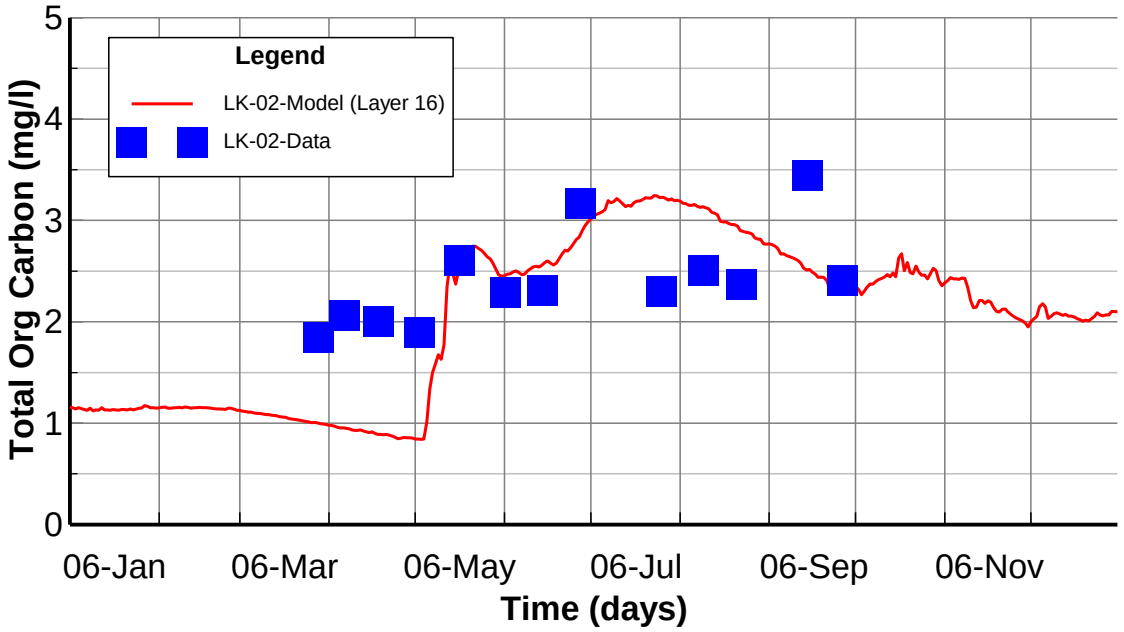


Figure **Error! No text of specified style in document.**.33. Surface Layer TOC Calibration Plots at Station LK-02

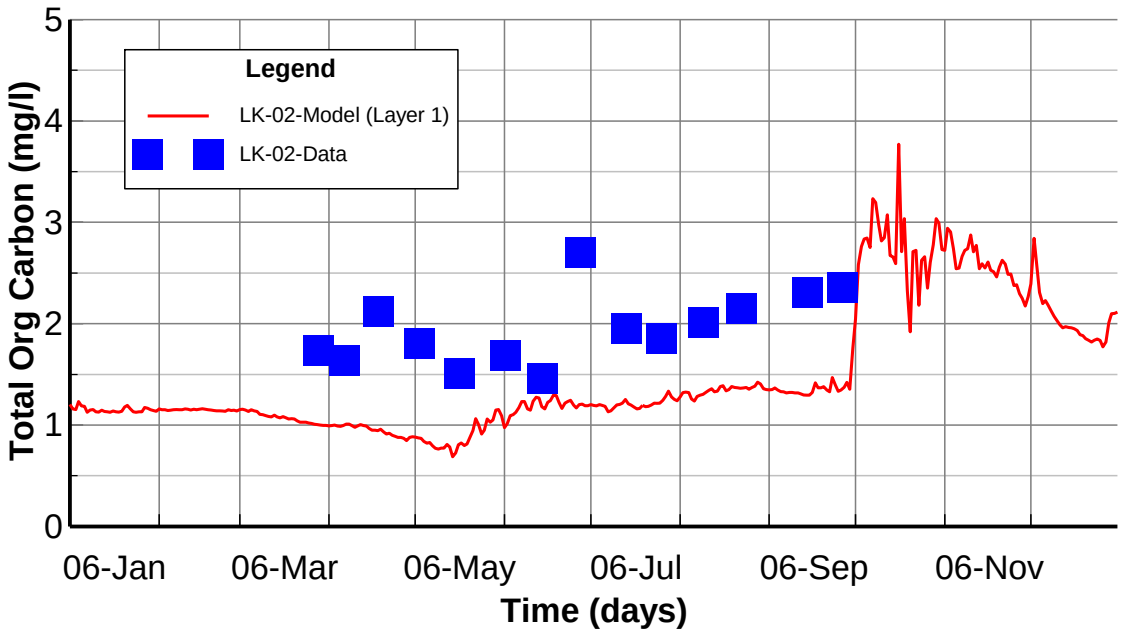


Figure **Error! No text of specified style in document.**.34. Bottom Layer TOC Calibration Plots at Station LK-02

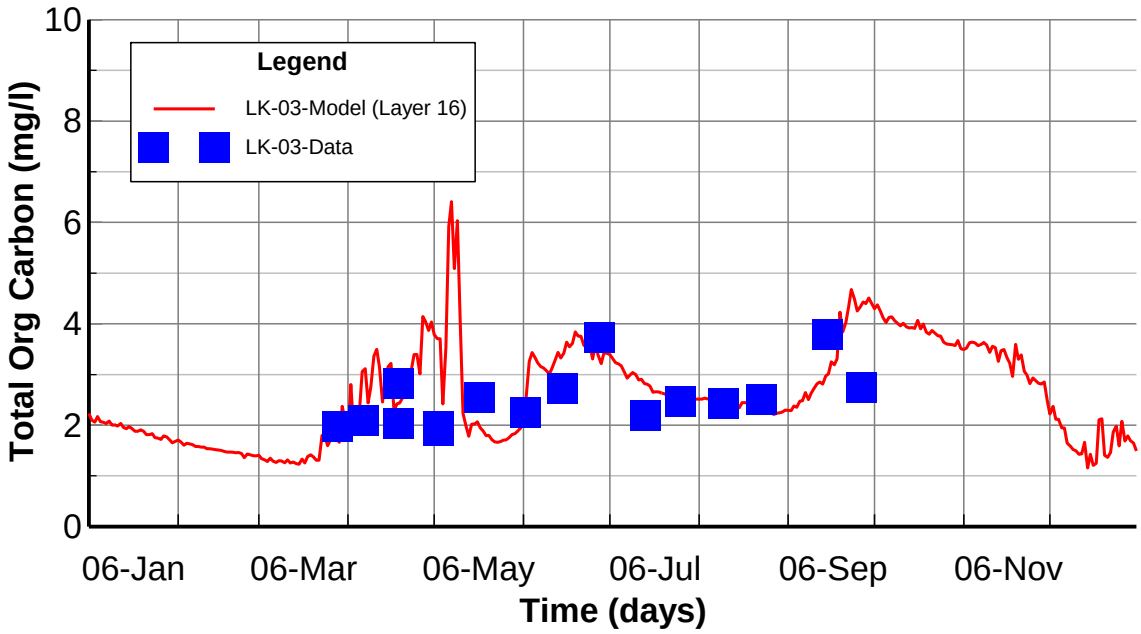


Figure **Error! No text of specified style in document.**.35. Surface Layer TOC Calibration Plots at Station LK-03

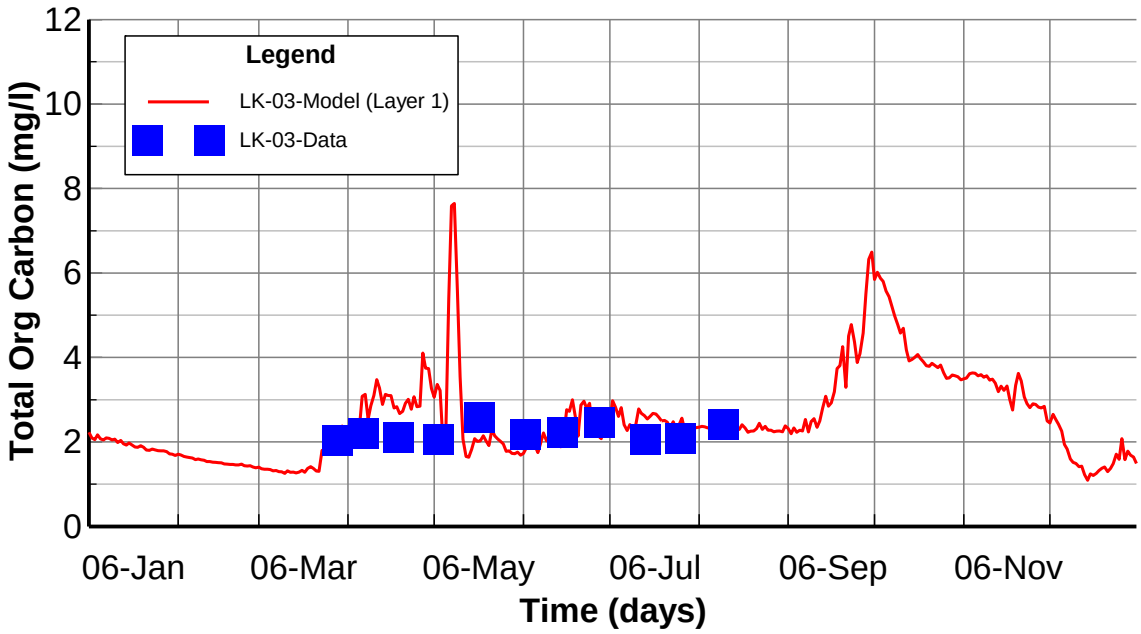


Figure **Error! No text of specified style in document.**.36. Bottom Layer TOC Calibration Plots at Station LK-03

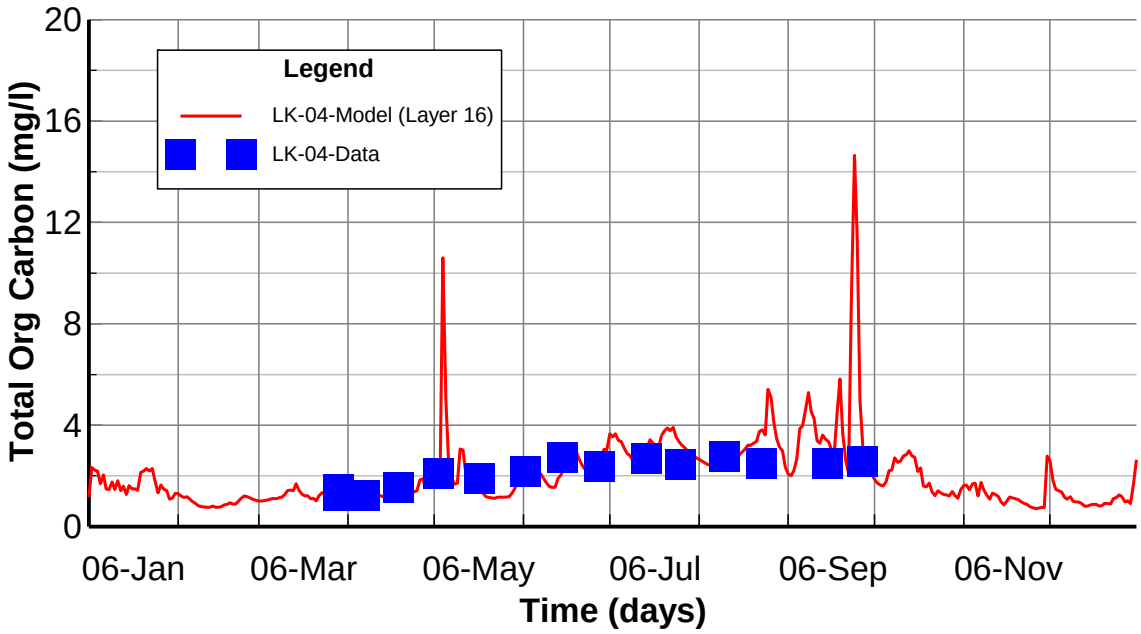


Figure **Error! No text of specified style in document.**.37. Surface Layer TOC Calibration Plots at Station LK-04

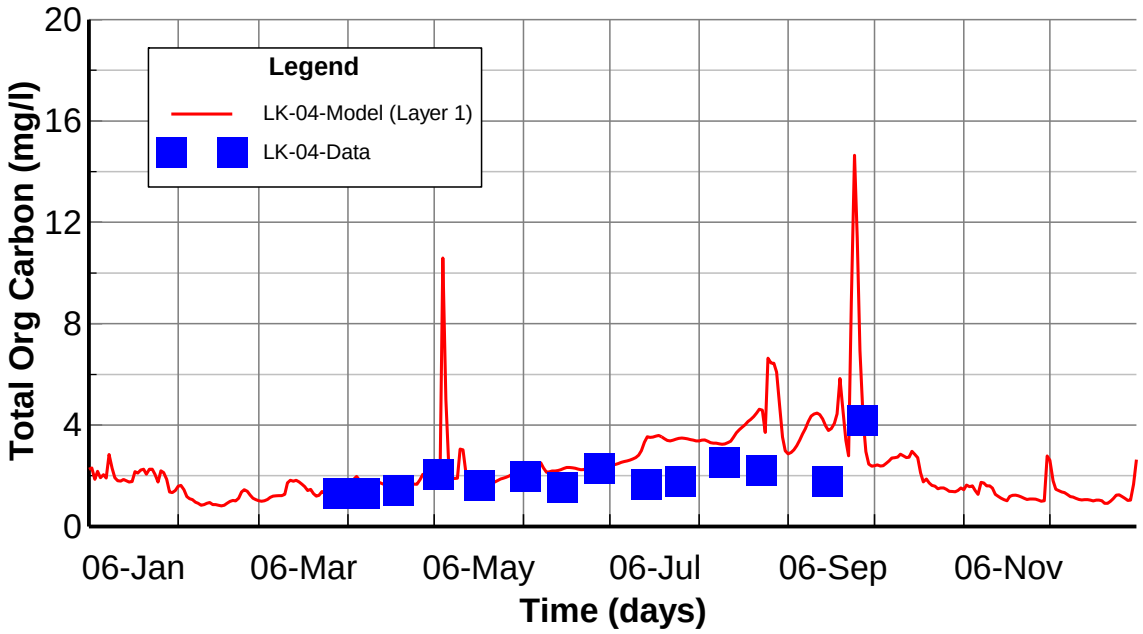


Figure **Error! No text of specified style in document.**.38. Bottom Layer TOC Calibration Plots at Station LK-04

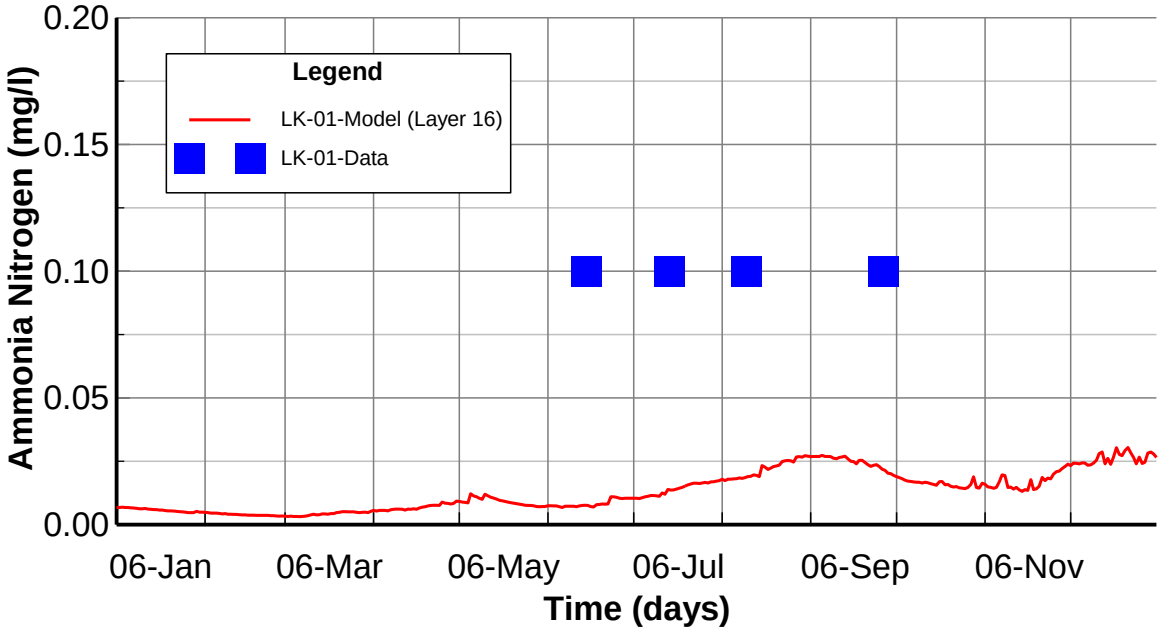


Figure **Error! No text of specified style in document.**.39. Surface Layer NH4 Calibration Plots at Station LK-01

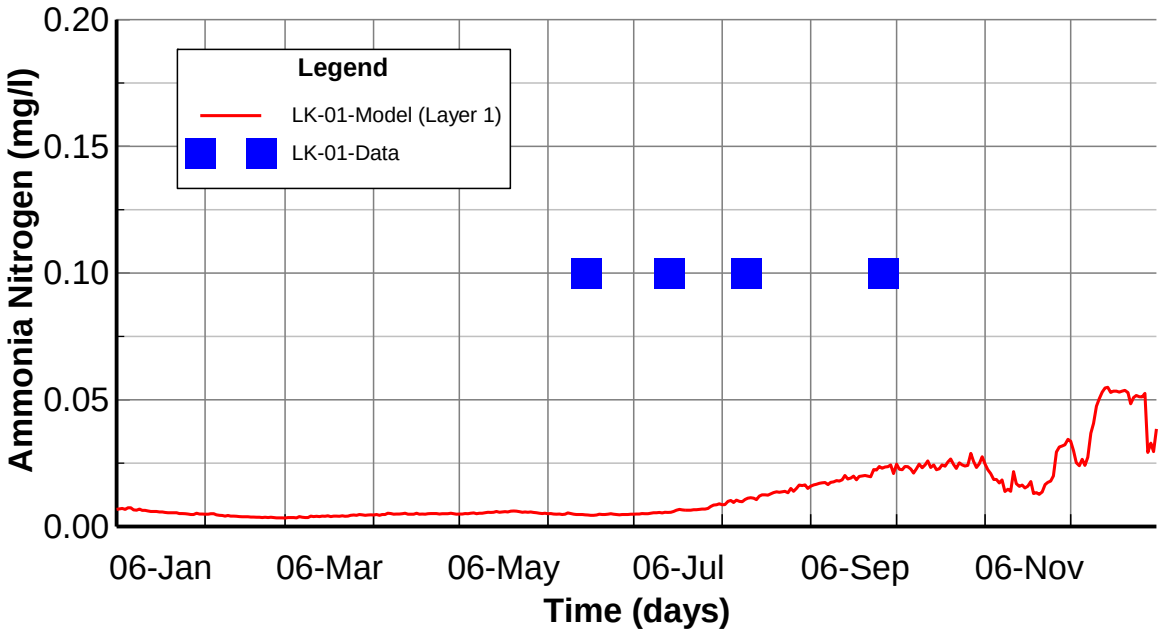


Figure **Error! No text of specified style in document.**.40. Bottom Layer NH4 Calibration Plots at Station LK-01

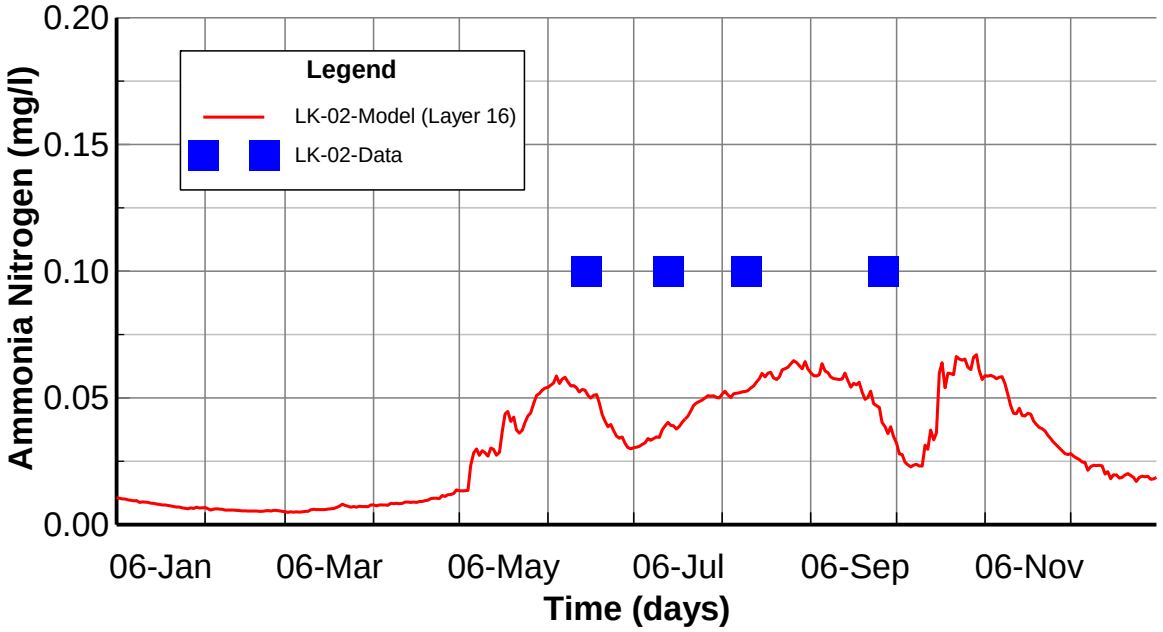


Figure **Error! No text of specified style in document.**.41. Surface Layer NH4 Calibration Plots at Station LK-02

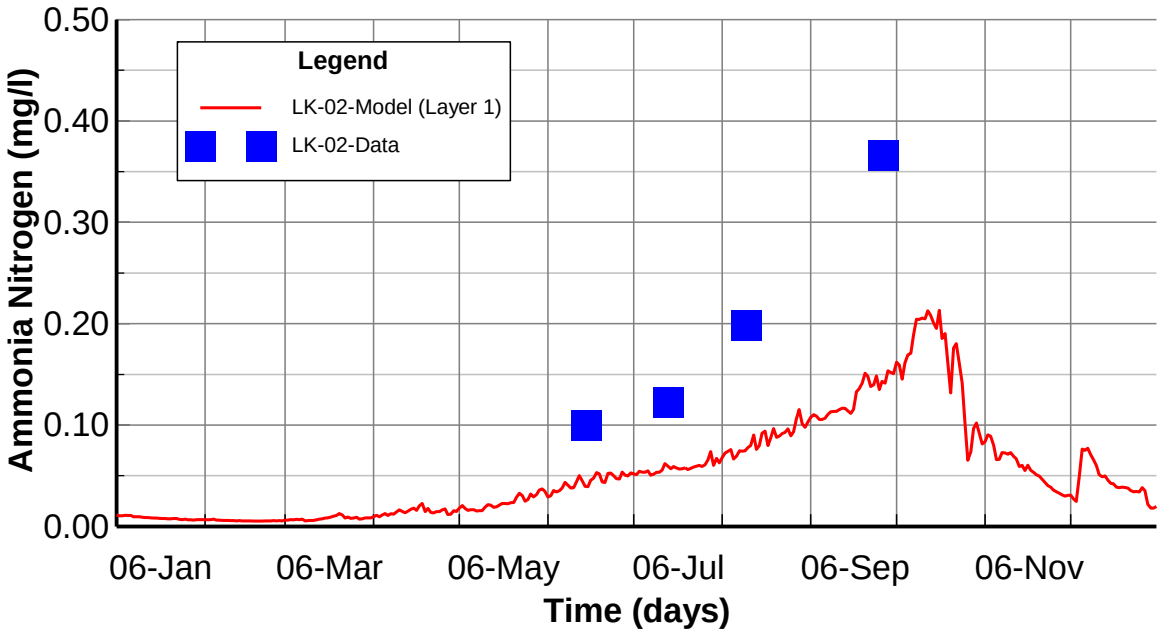


Figure **Error! No text of specified style in document.**.42. Bottom Layer NH4 Calibration Plots at Station LK-02

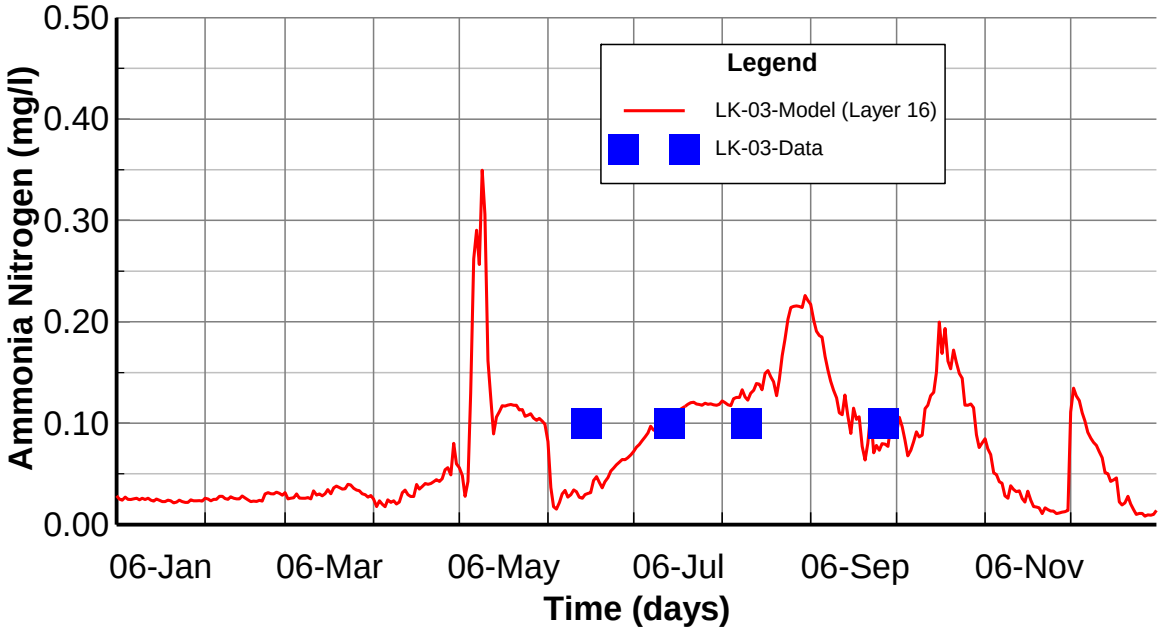


Figure **Error! No text of specified style in document.**.43. Surface Layer NH4 Calibration Plots at Station LK-03

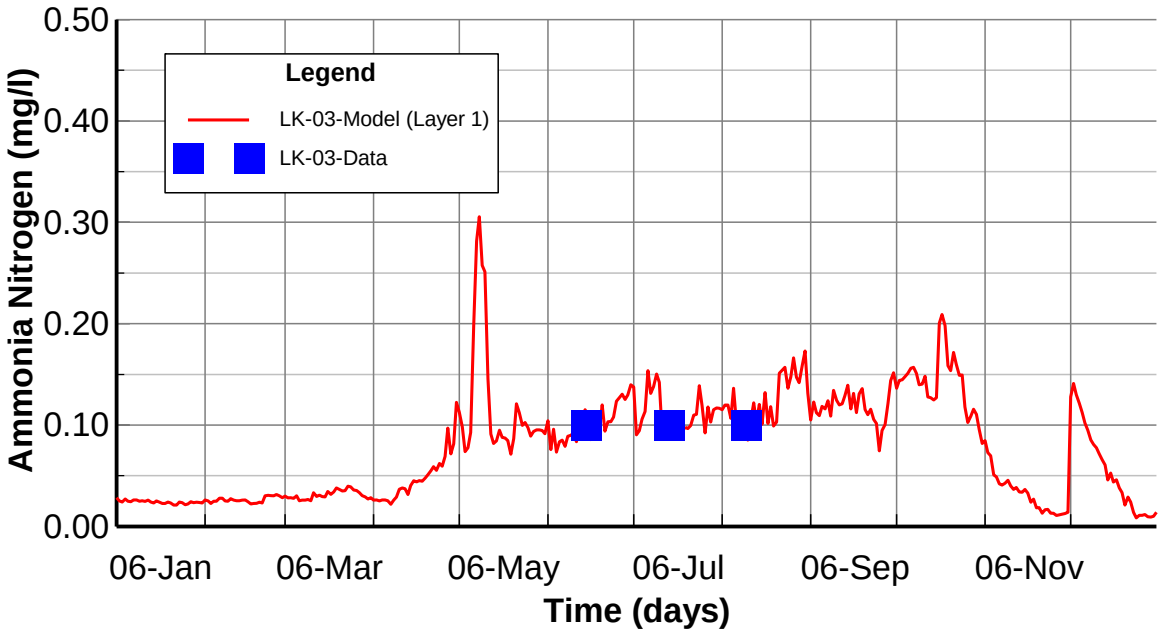


Figure **Error! No text of specified style in document.**.44. Bottom Layer NH4 Calibration Plots at Station LK-03

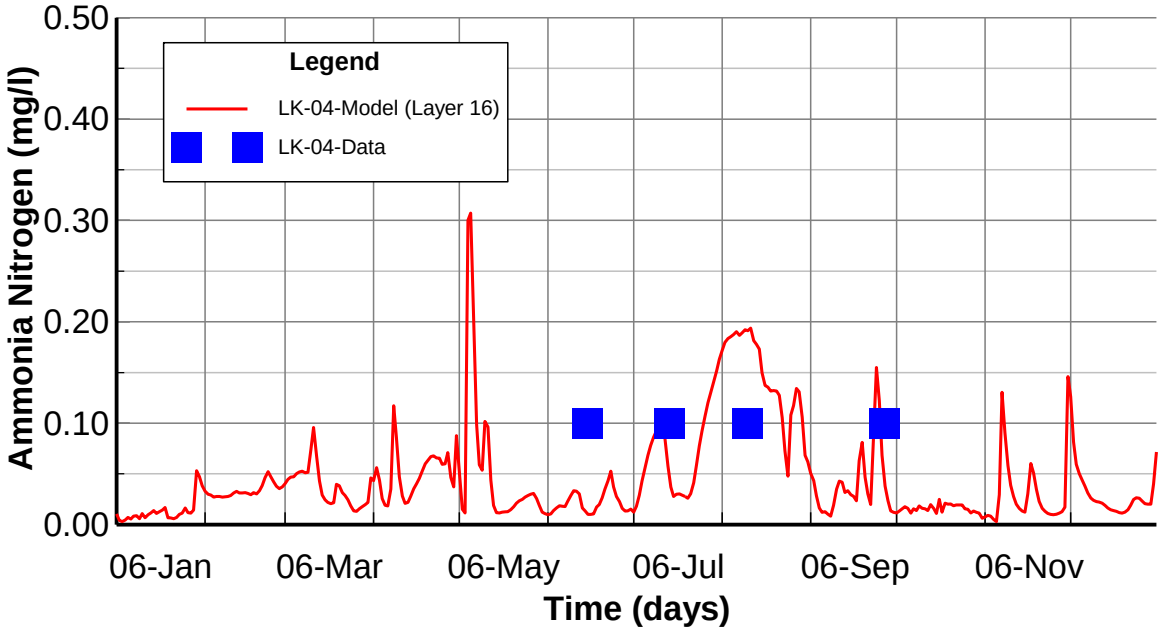


Figure **Error! No text of specified style in document.**.45. Surface Layer NH4 Calibration Plots at Station LK-04

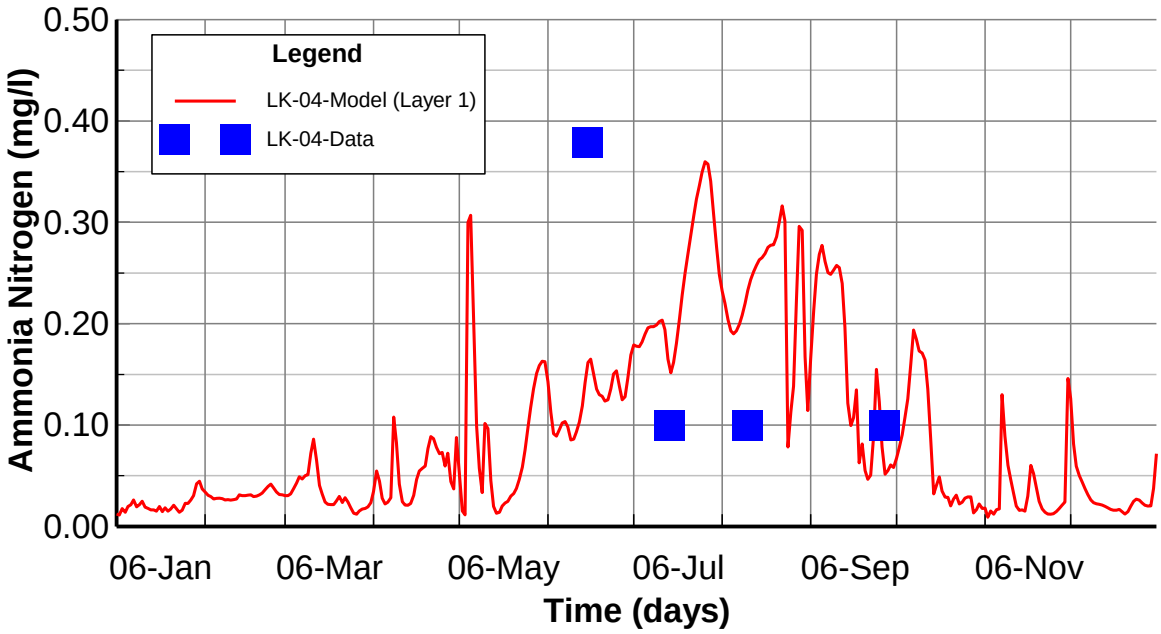


Figure **Error! No text of specified style in document.**.46. Bottom Layer NH4 Calibration Plots at Station LK-04

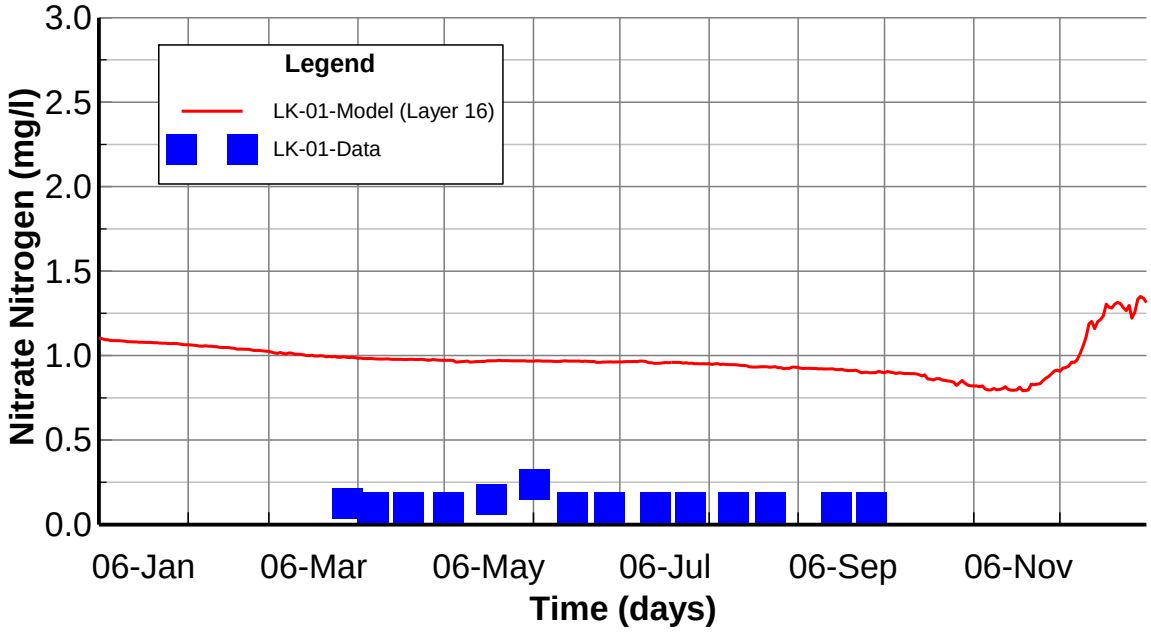


Figure **Error! No text of specified style in document.**.47. Surface Layer NO3 Calibration Plots at Station LK-01

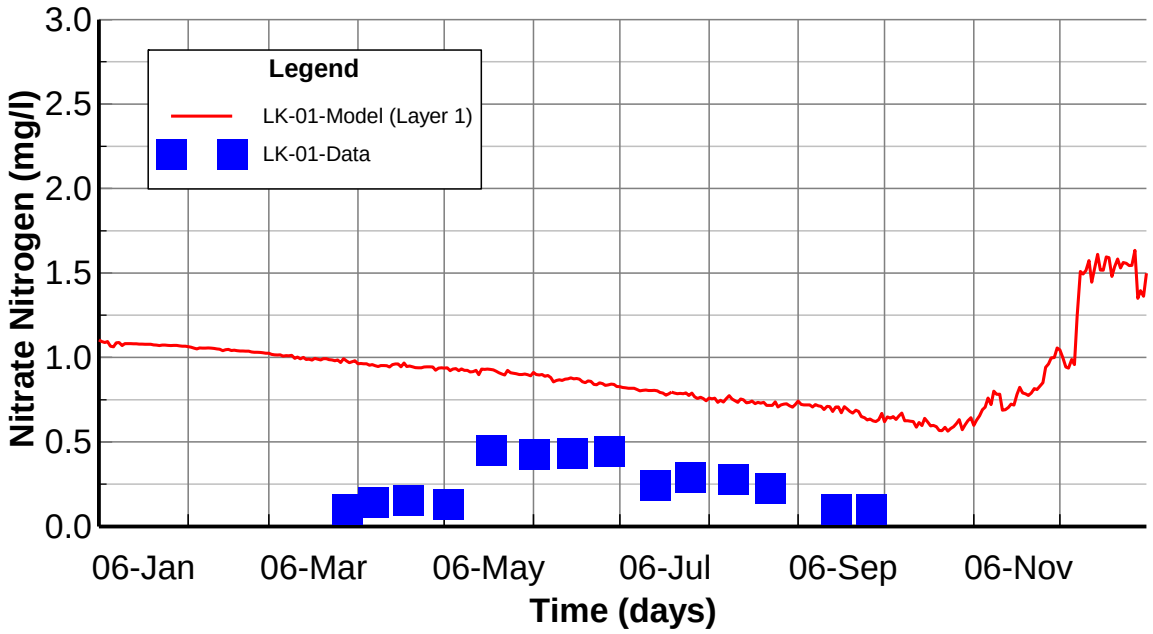


Figure **Error! No text of specified style in document.**.48. Bottom Layer NO3 Calibration Plots at Station LK-01

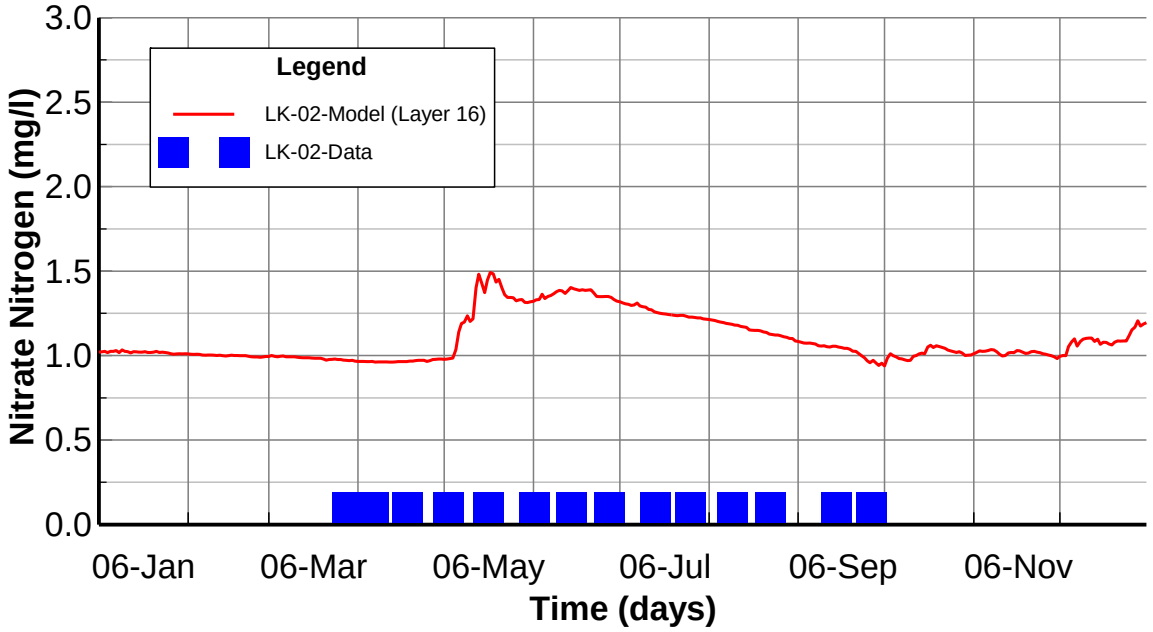


Figure **Error! No text of specified style in document.**.49. Surface Layer NO3 Calibration Plots at Station LK-02

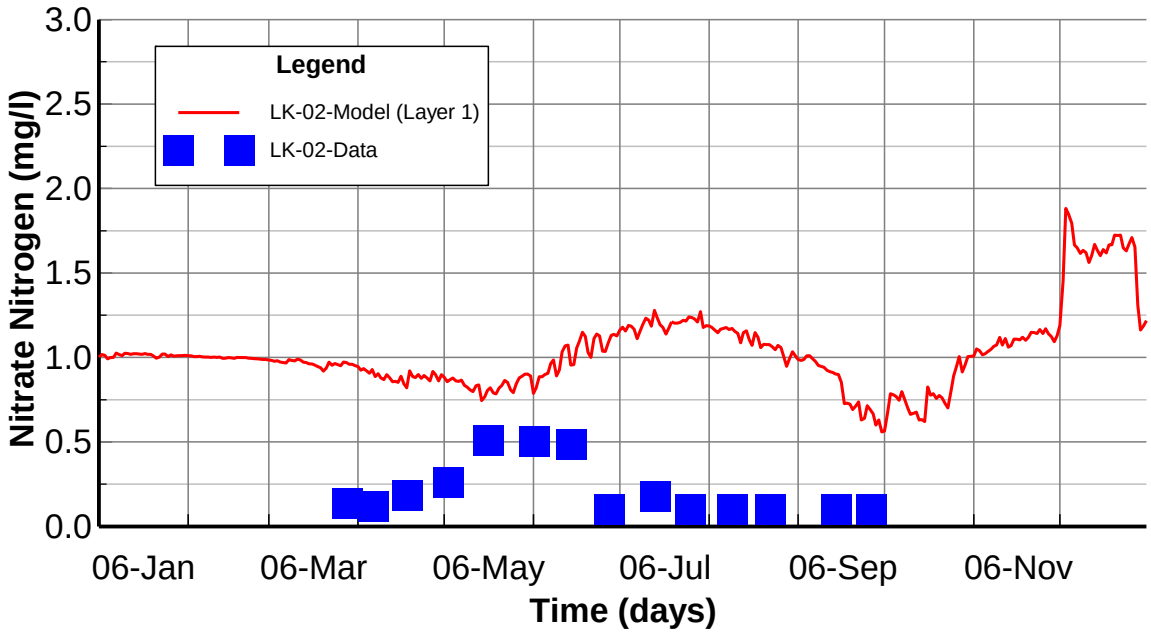


Figure **Error! No text of specified style in document.**.50. Bottom Layer NO3 Calibration Plots at Station LK-02

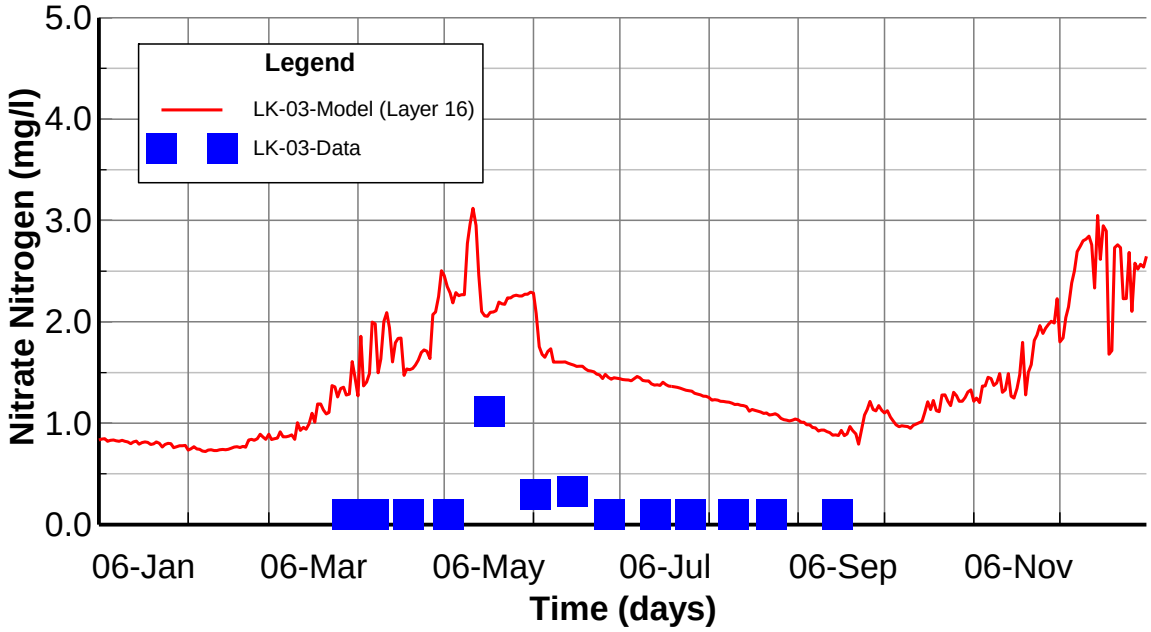


Figure **Error! No text of specified style in document.**.51. Surface Layer NO3 Calibration Plots at Station LK-03

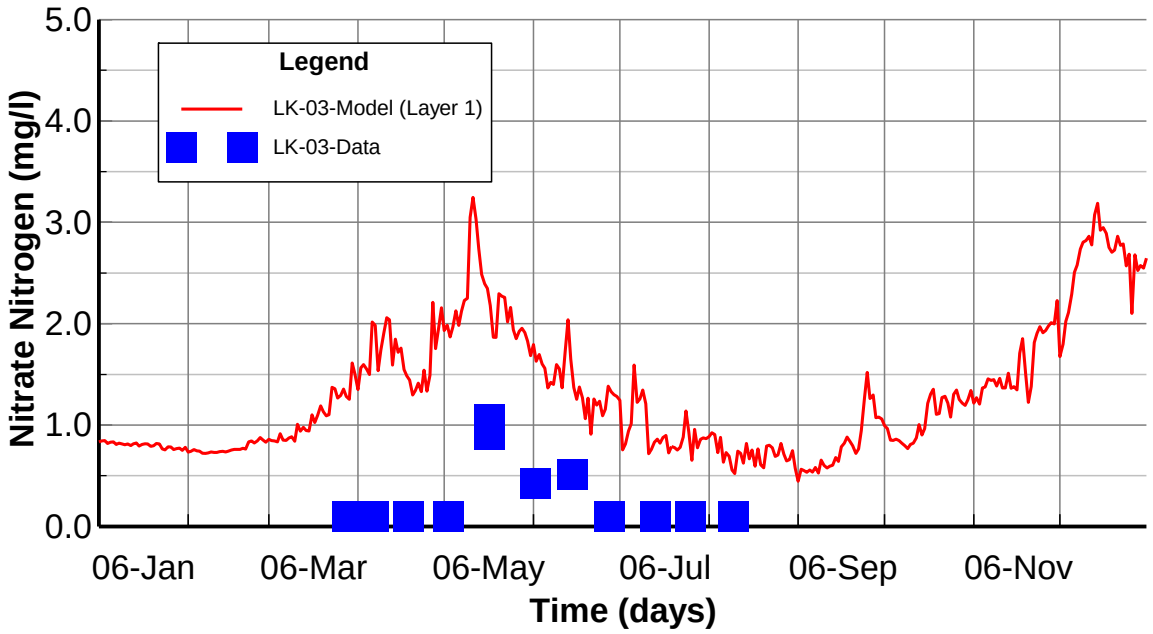


Figure **Error! No text of specified style in document.**.52. Bottom Layer NO3 Calibration Plots at Station LK-03

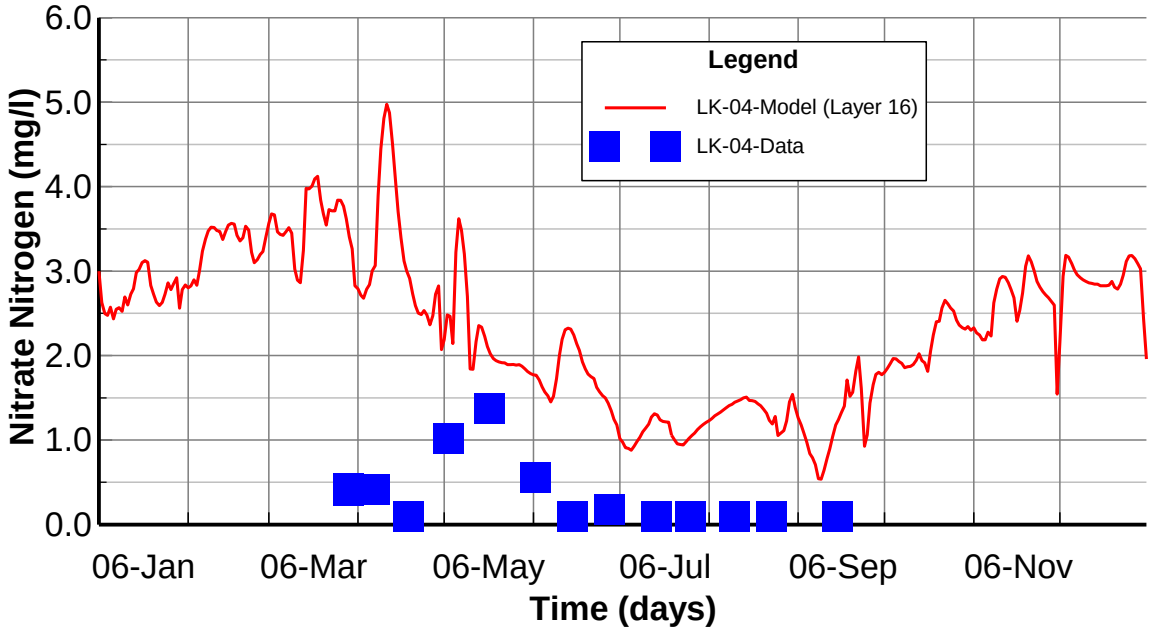


Figure **Error! No text of specified style in document.**.53. Surface Layer NO3 Calibration Plots at Station LK-04

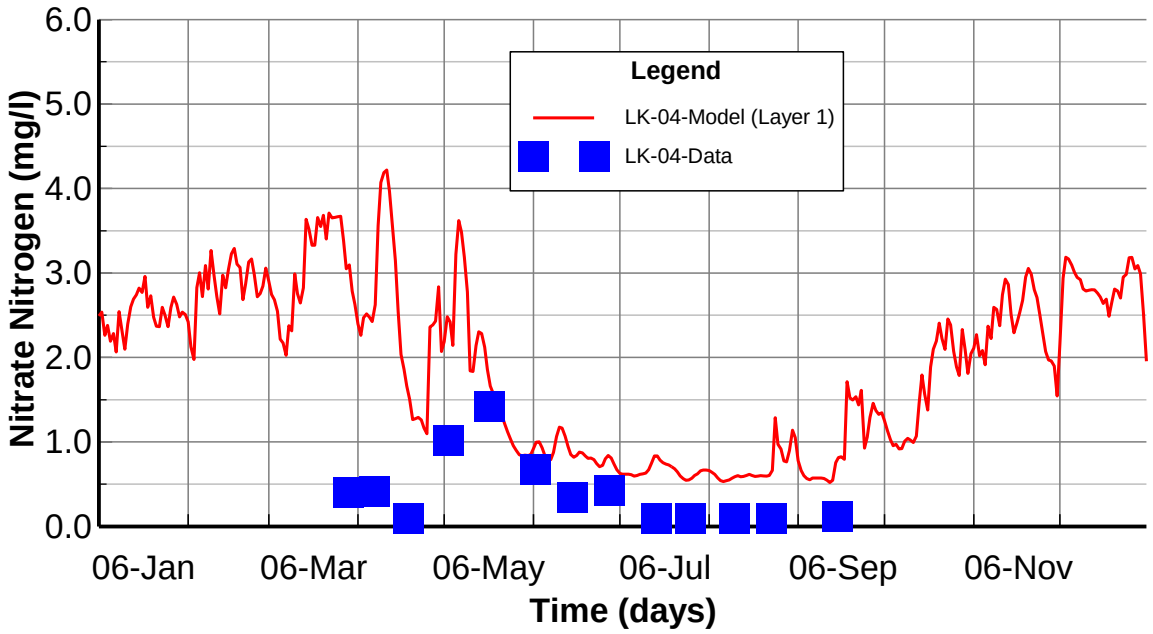


Figure **Error! No text of specified style in document.**.54. Bottom Layer NO3 Calibration Plots at Station LK-04

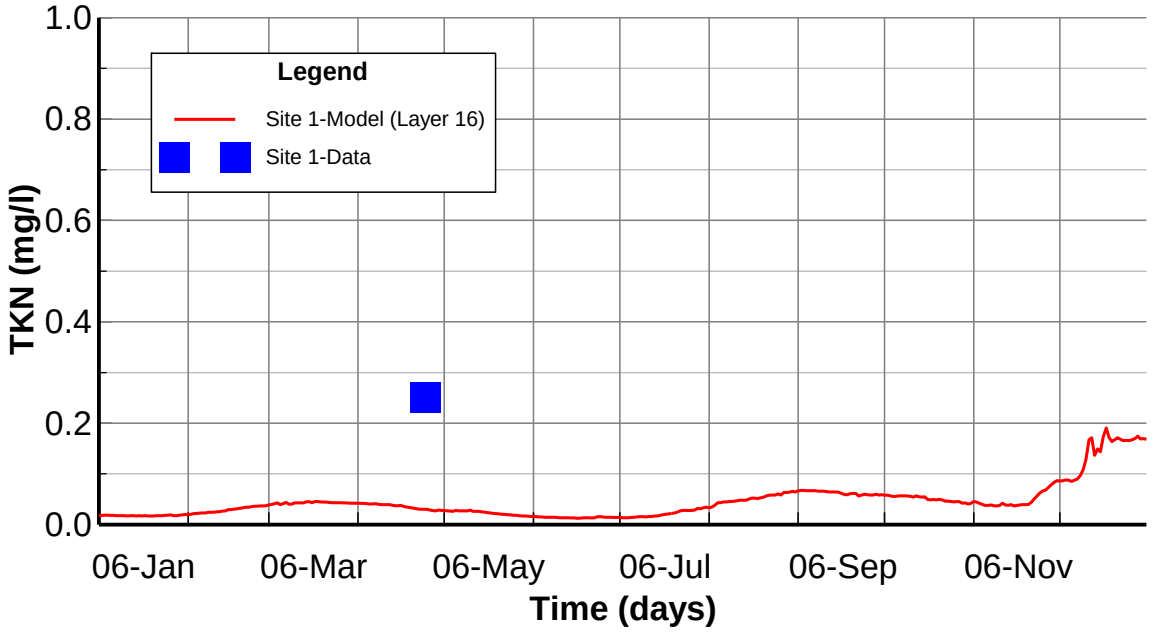


Figure **Error! No text of specified style in document.**.55. Surface Layer TKN Calibration Plots at Station Site 1

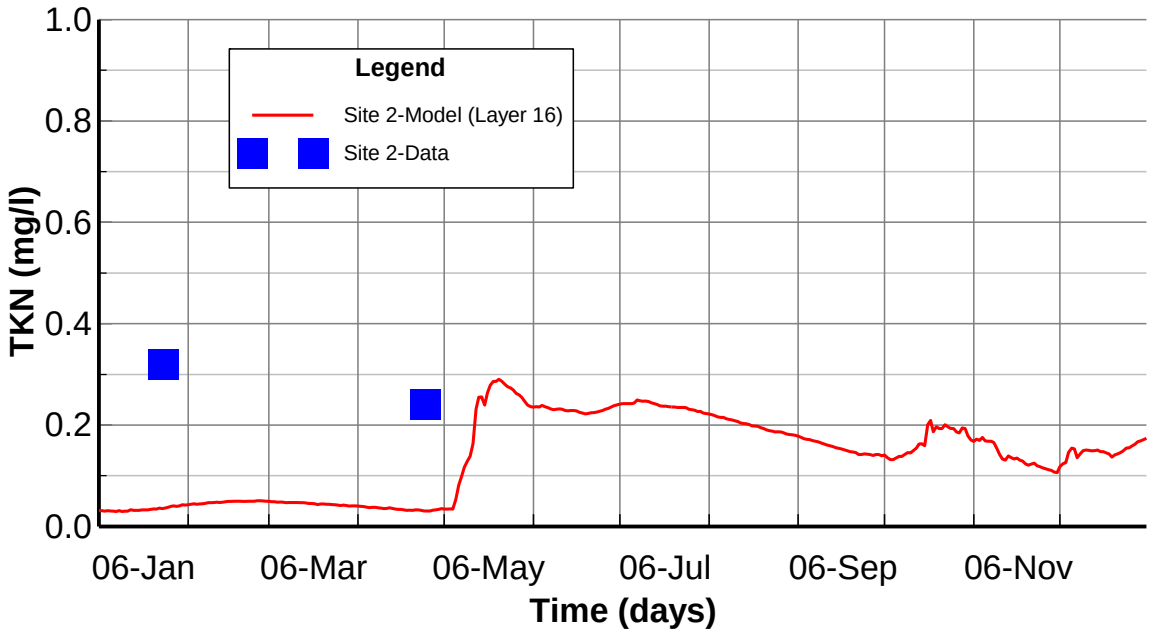


Figure **Error! No text of specified style in document.**.56. Surface Layer TKN Calibration Plots at Station Site 2

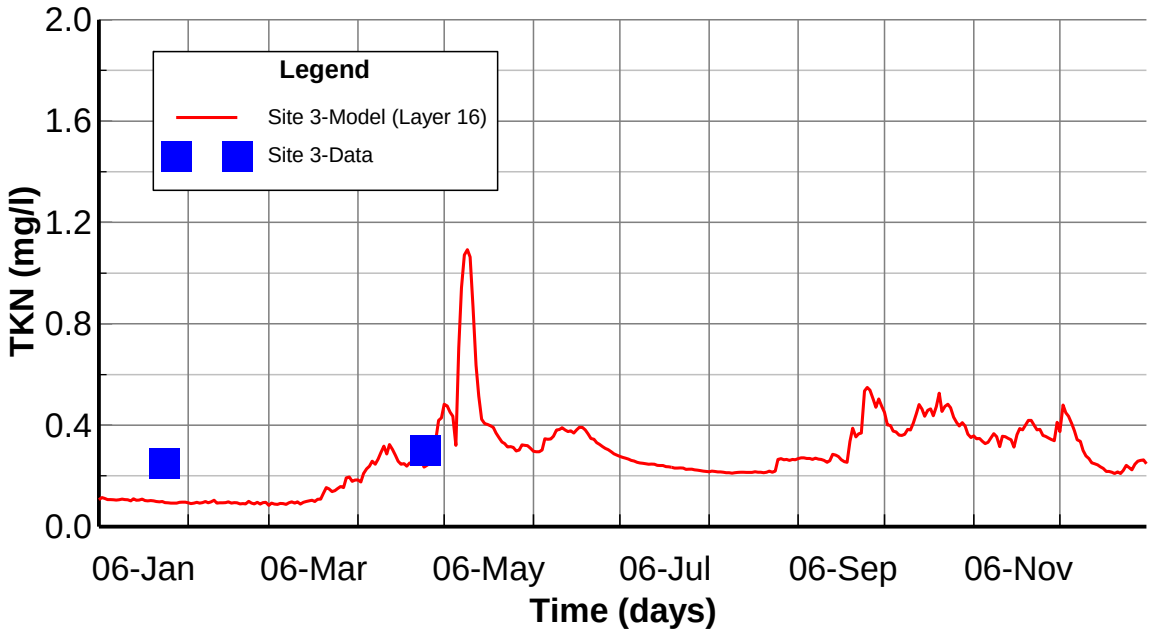


Figure **Error! No text of specified style in document.**.57. Surface Layer TKN Calibration Plots at Station Site 3

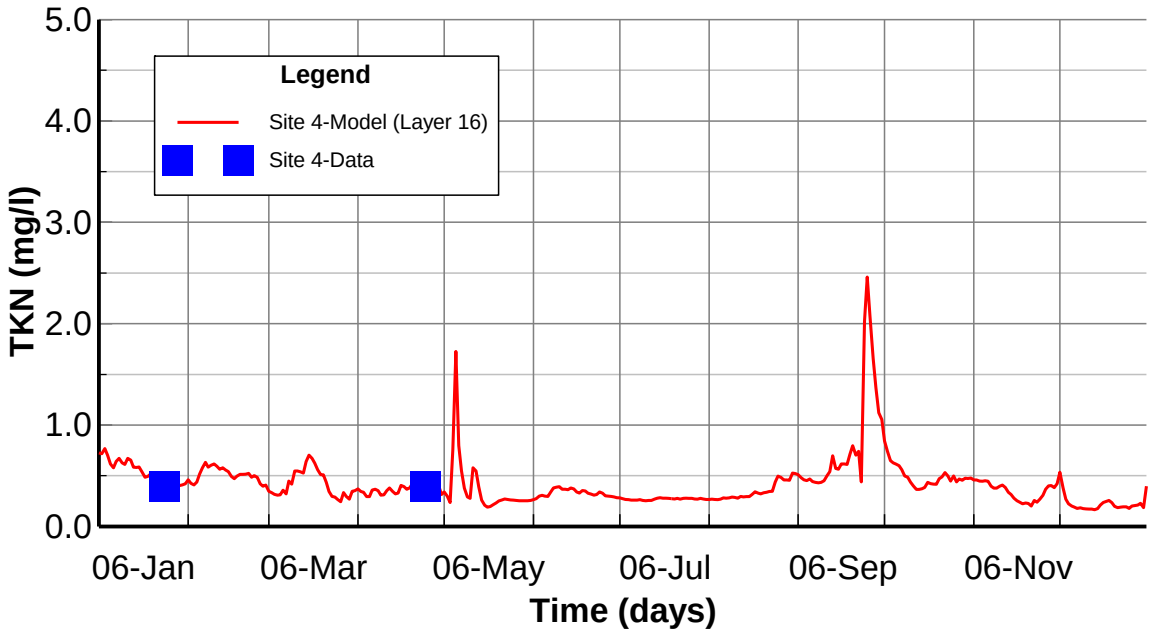


Figure **Error! No text of specified style in document.**.58. Surface Layer TKN Calibration Plots at Station Site 4

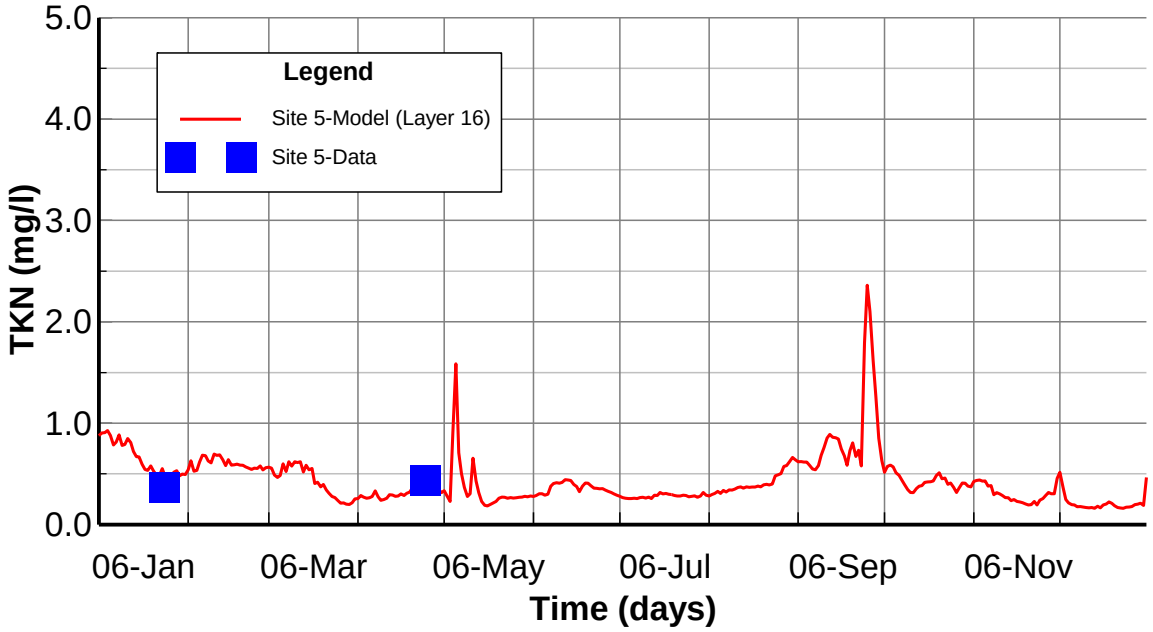


Figure **Error! No text of specified style in document.**.59. Surface Layer TKN Calibration Plots at Station Site 5

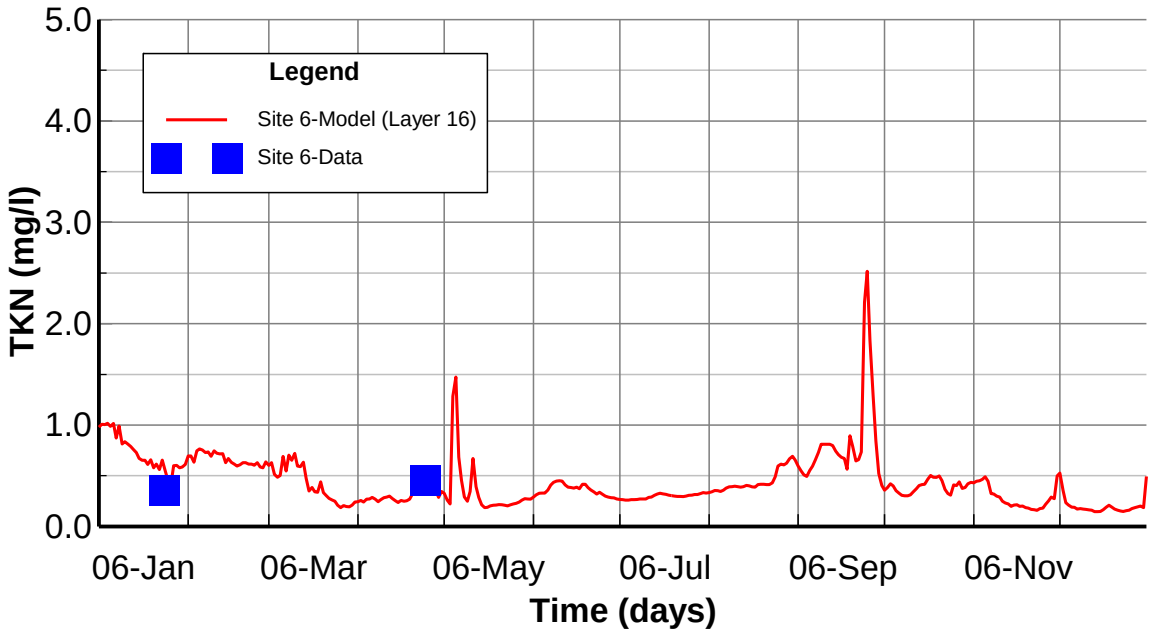


Figure **Error! No text of specified style in document.**.60. Surface Layer TKN Calibration Plots at Station Site 6

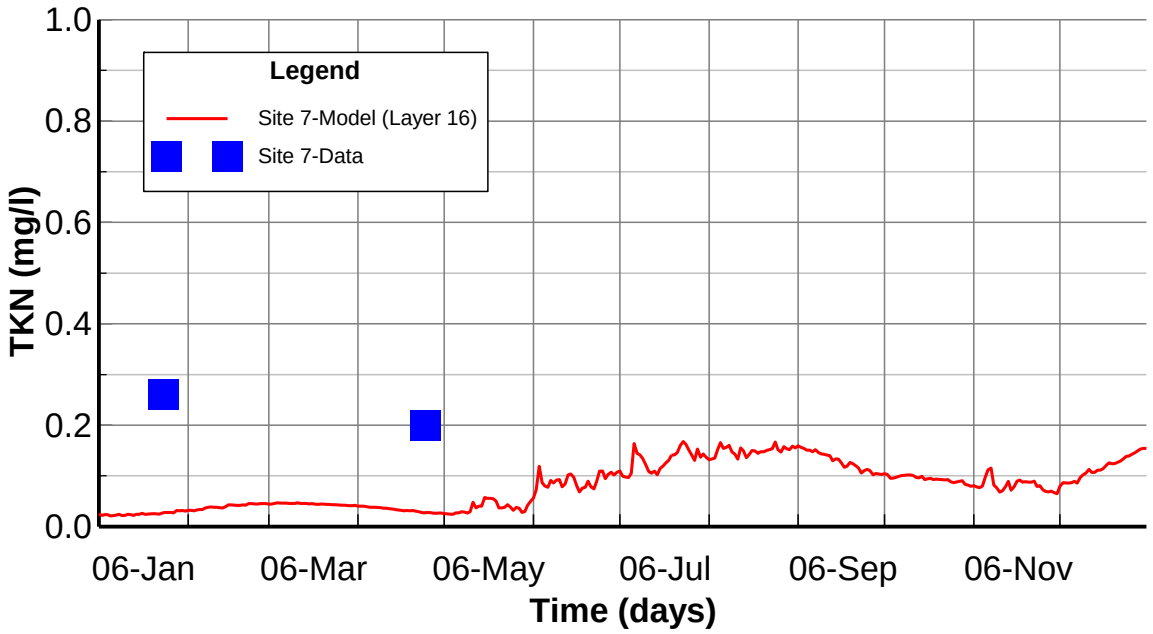


Figure **Error! No text of specified style in document.**.61. Surface Layer TKN Calibration Plots at Station Site 7

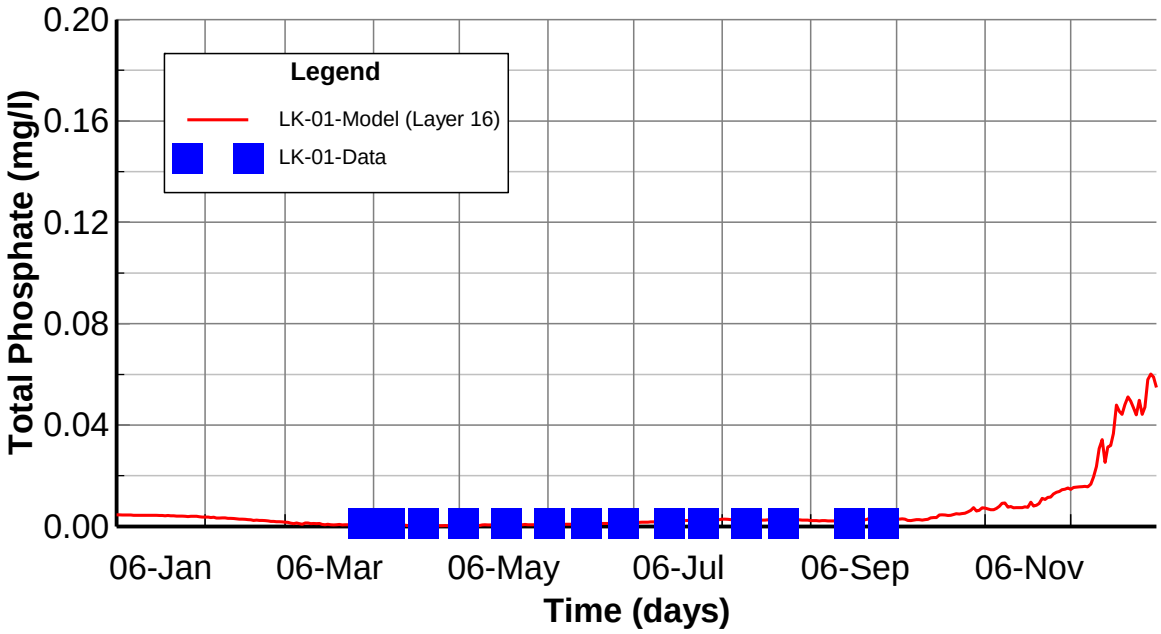


Figure **Error! No text of specified style in document.**.62. Surface Layer TPO4 Calibration Plots at Station LK-01

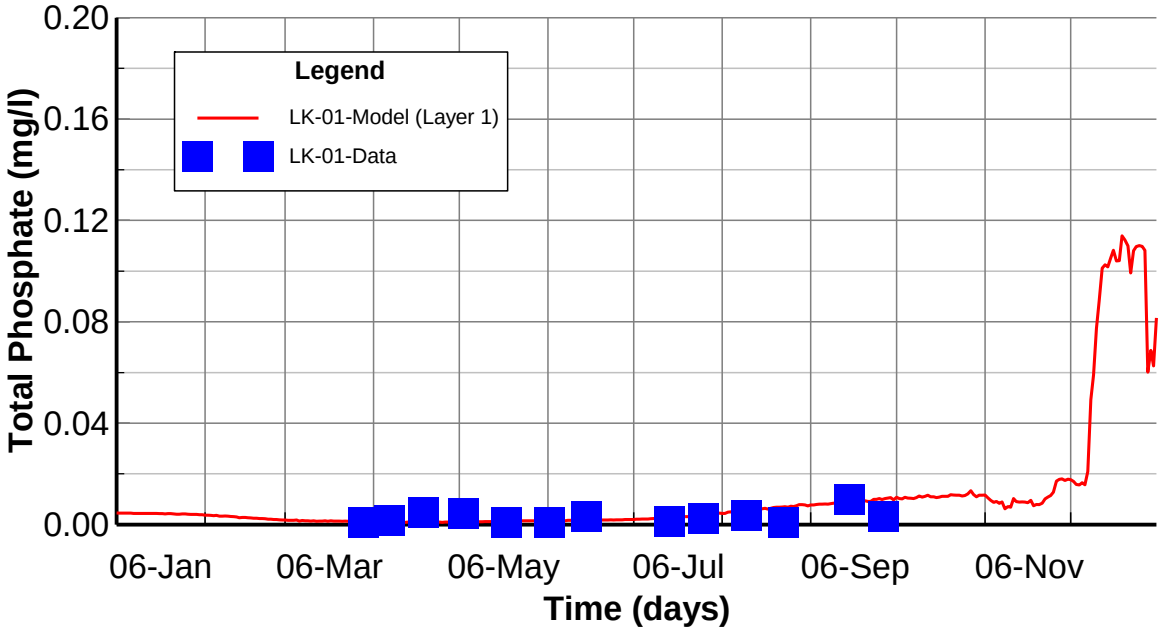


Figure **Error! No text of specified style in document.**.63. Bottom Layer TPO4 Calibration Plots at Station LK-01

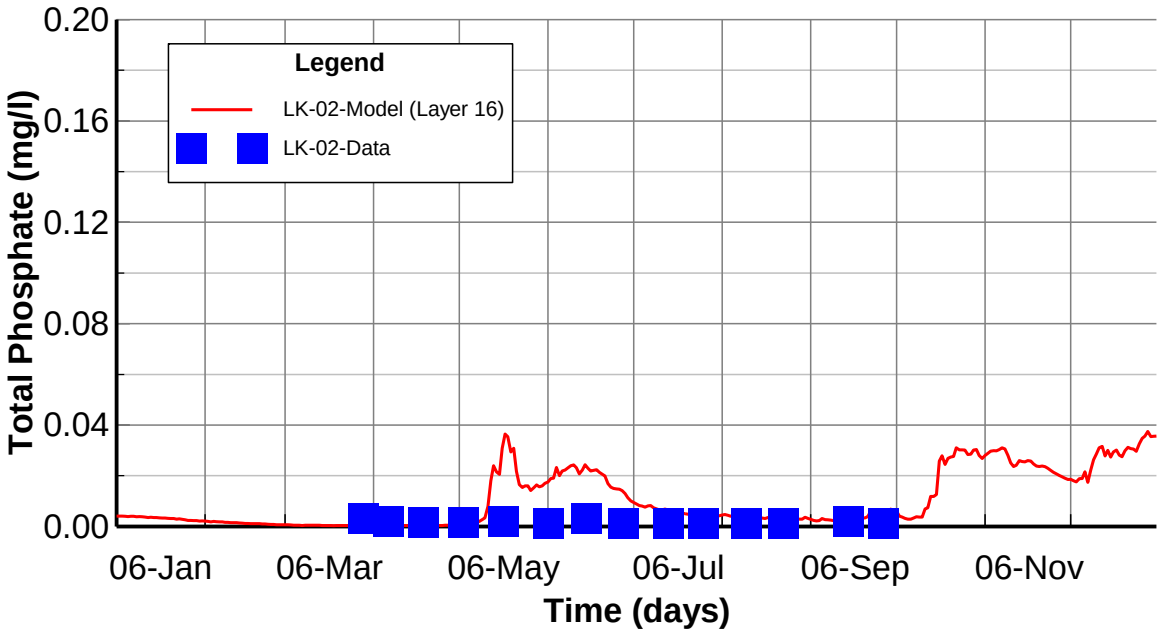


Figure **Error! No text of specified style in document.**.64. Surface Layer TPO4 Calibration Plots at Station LK-02

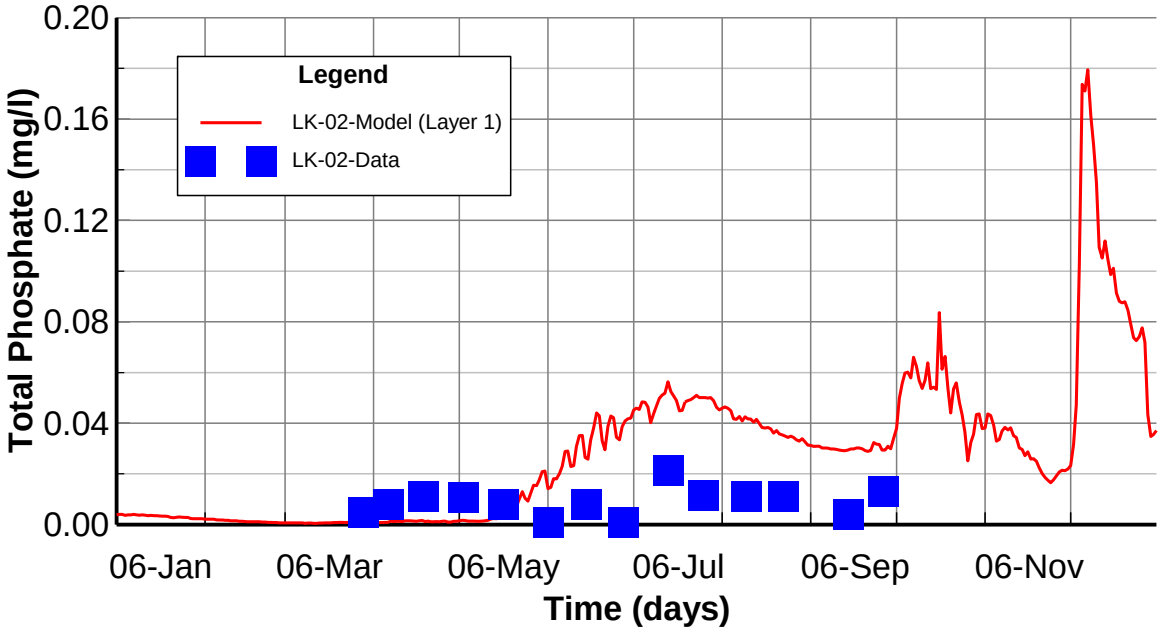


Figure **Error! No text of specified style in document.**.65. Bottom Layer TPO4 Calibration Plots at Station LK-02

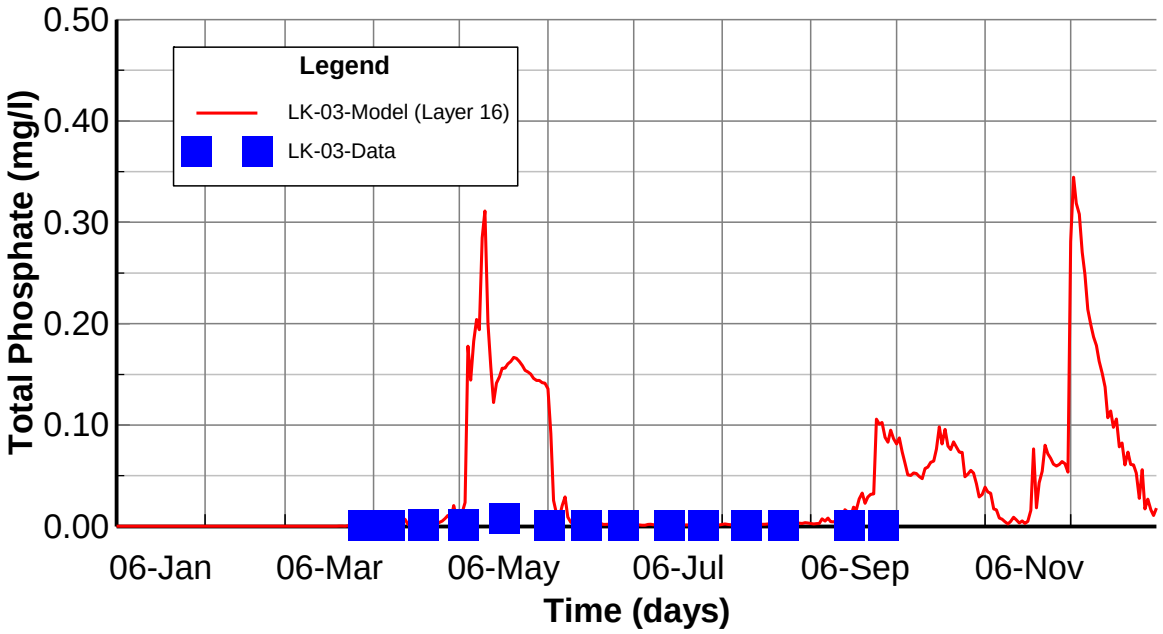


Figure **Error! No text of specified style in document.**.66. Surface Layer TPO4 Calibration Plots at Station LK-03

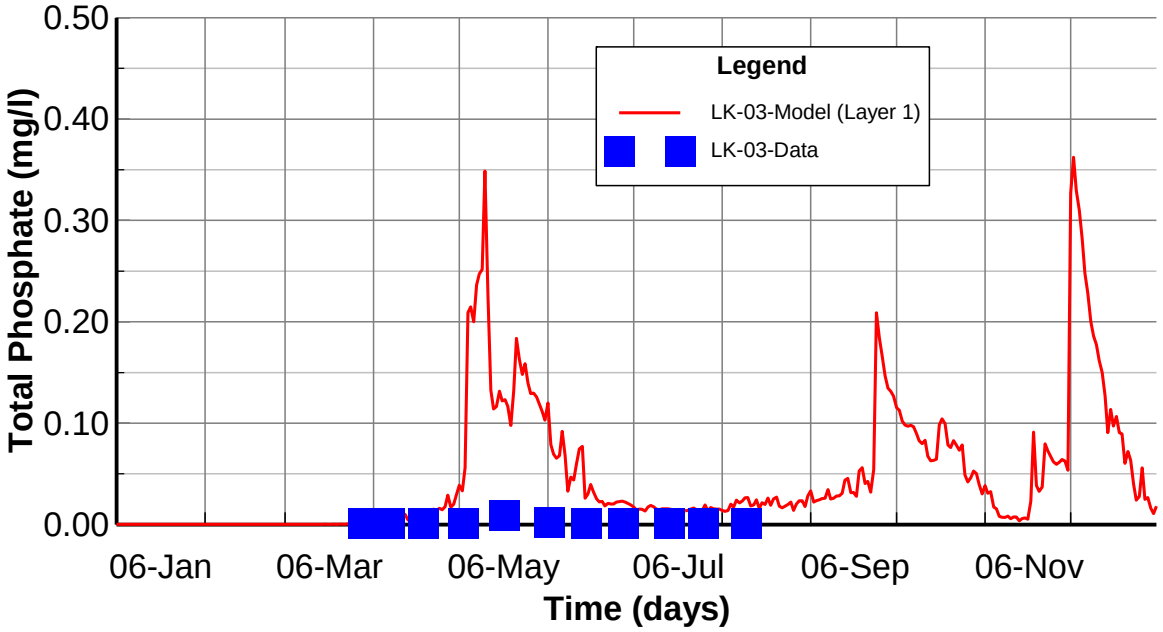


Figure **Error! No text of specified style in document.**.67. Bottom Layer TPO4 Calibration Plots at Station LK-03

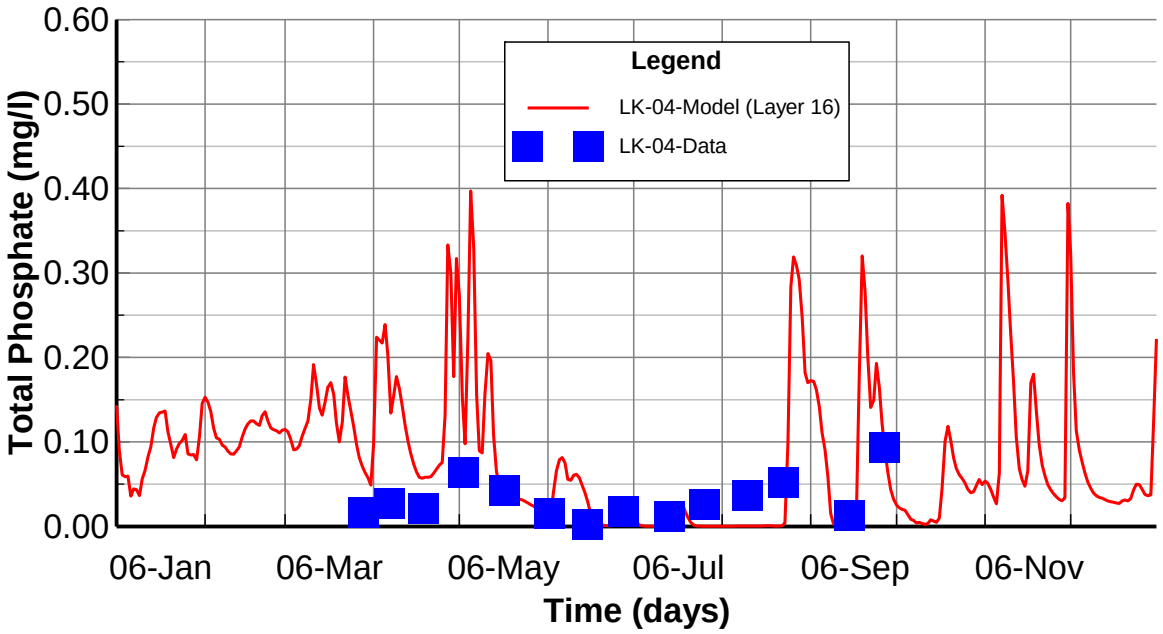


Figure **Error! No text of specified style in document.**.68. Surface Layer TPO4 Calibration Plots at Station LK-04

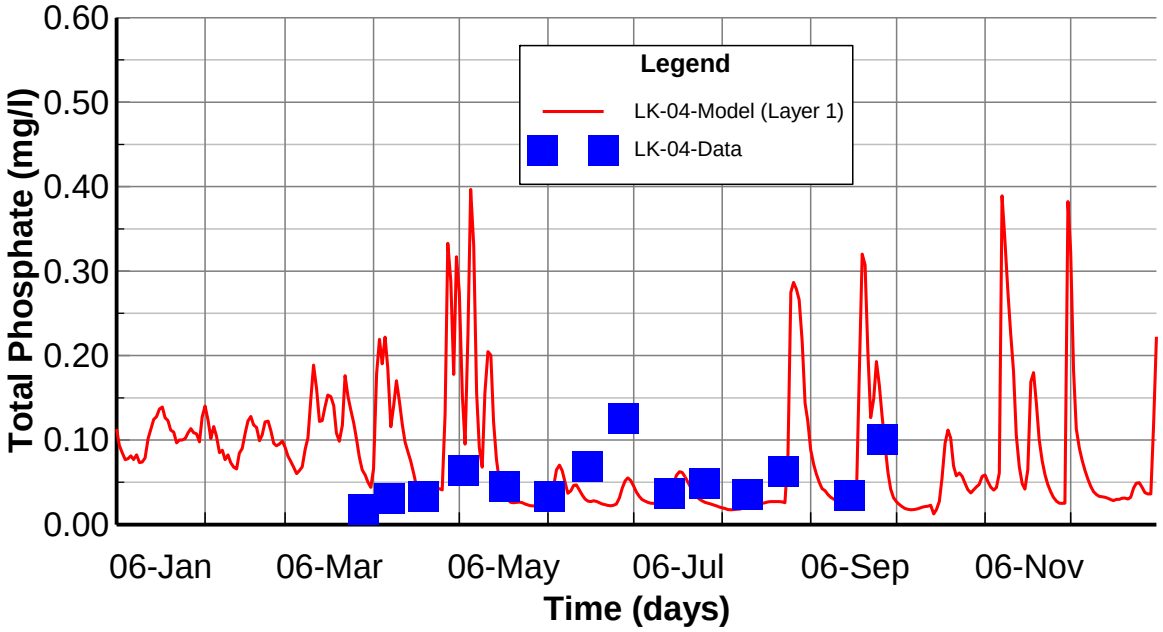


Figure **Error! No text of specified style in document.**.69. Bottom Layer TPO4 Calibration Plots at Station LK-04

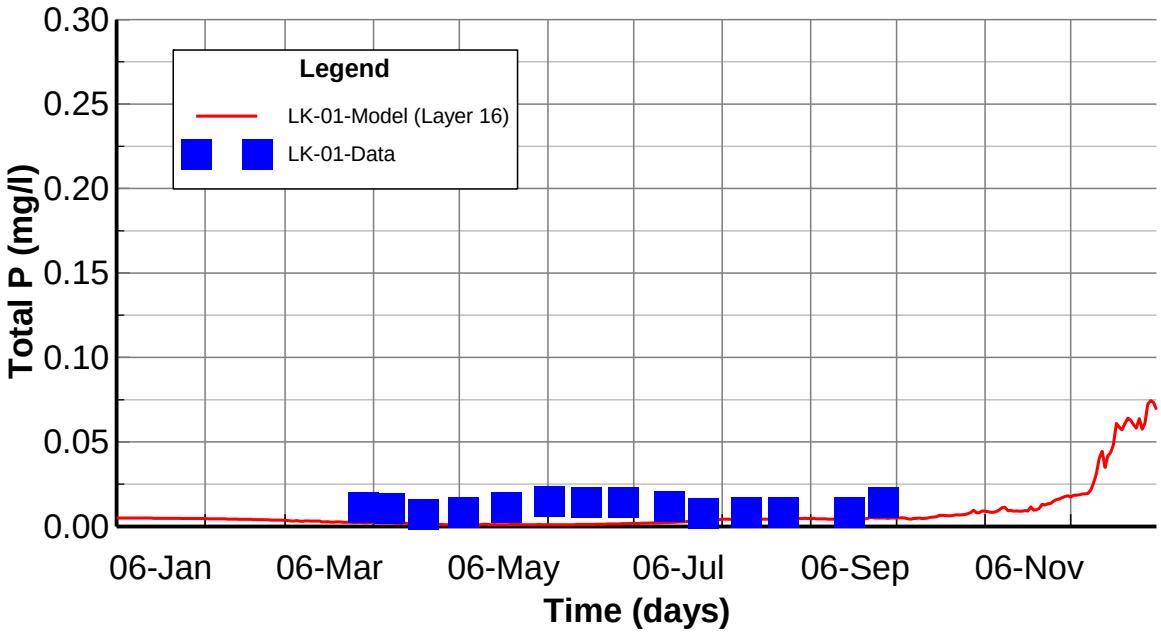


Figure **Error! No text of specified style in document.**.70. Surface Layer TP Calibration Plots at Station LK-01

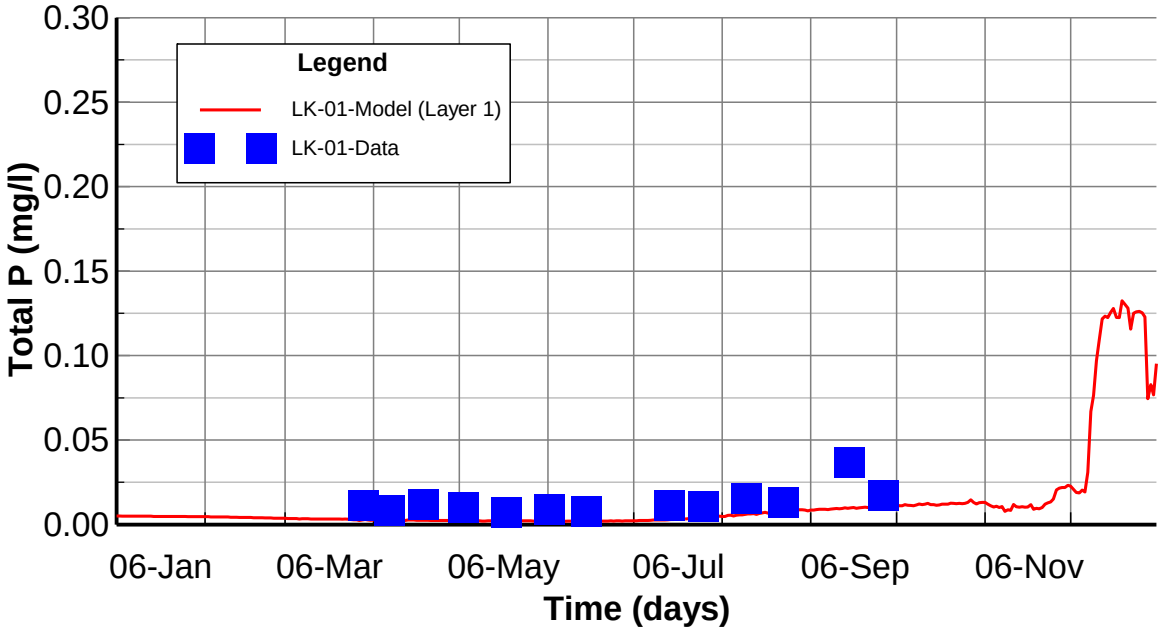


Figure **Error! No text of specified style in document.**.71. Bottom Layer TP Calibration Plots at Station LK-01

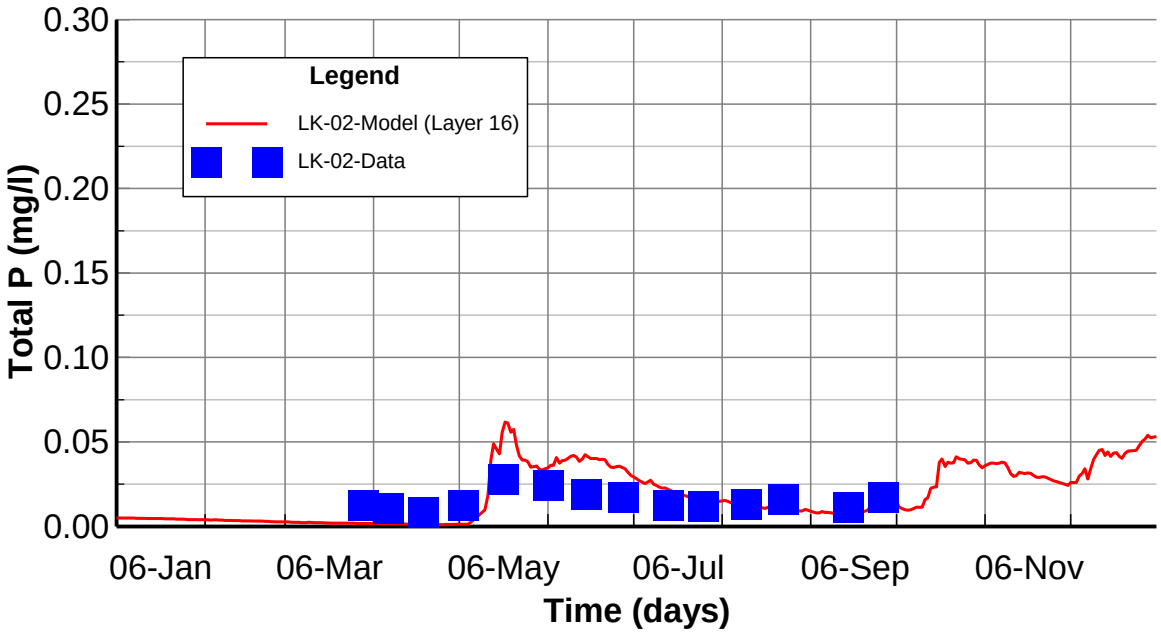


Figure **Error! No text of specified style in document.**.72. Surface Layer TP Calibration Plots at Station LK-02

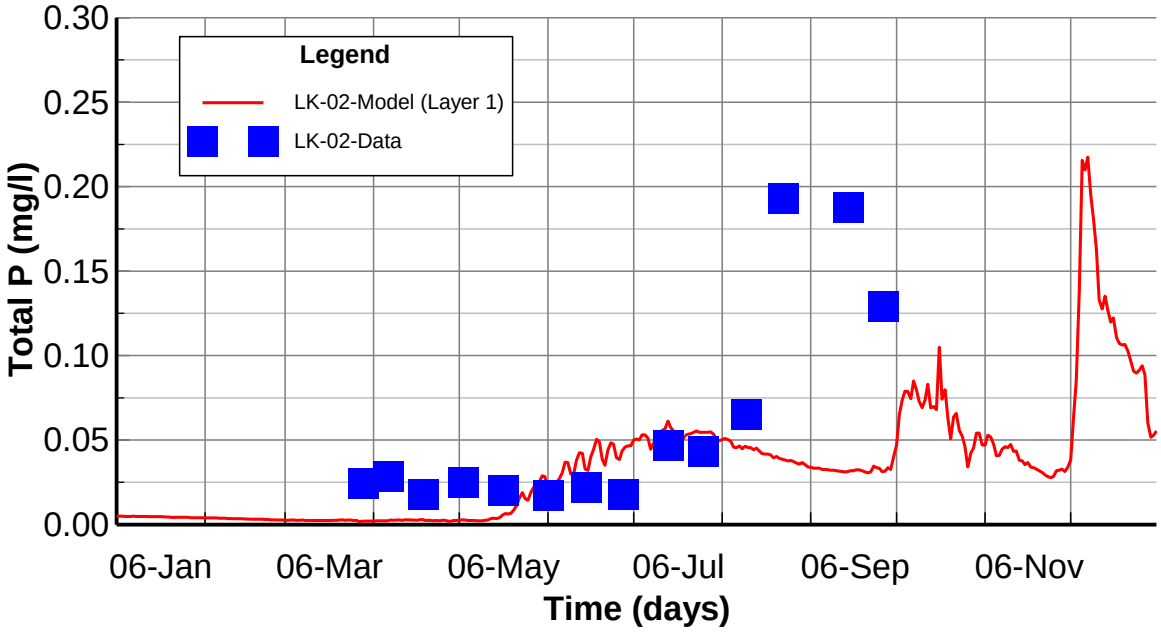


Figure **Error! No text of specified style in document.**.73. Bottom Layer TP Calibration Plots at Station LK-02

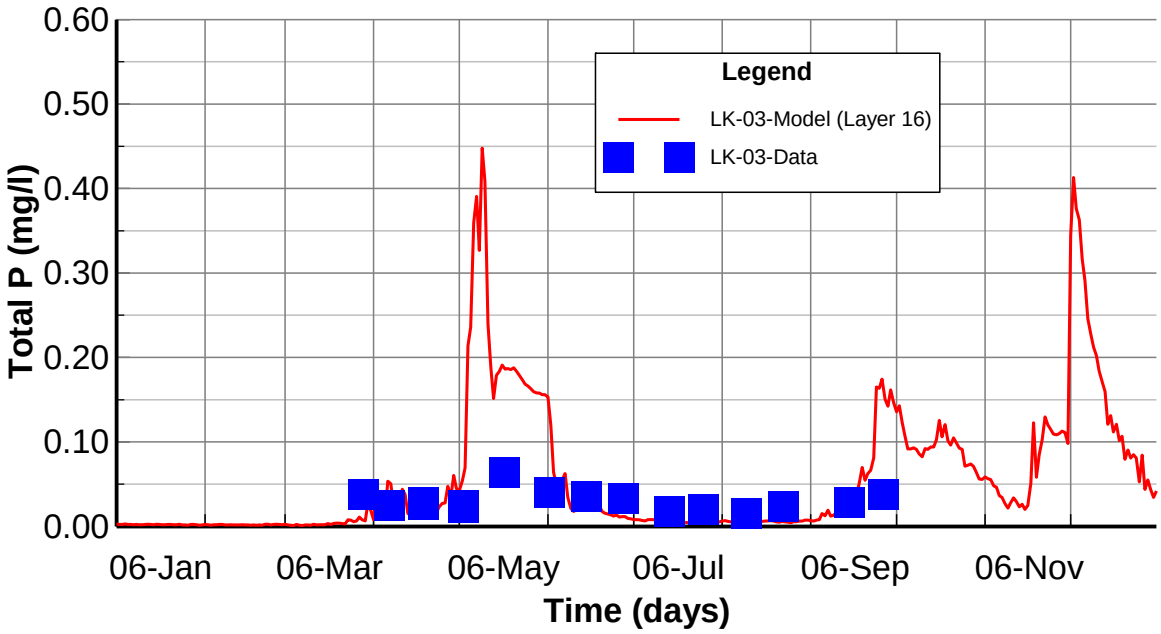


Figure **Error! No text of specified style in document.**.74. Surface Layer TP Calibration Plots at Station LK-03

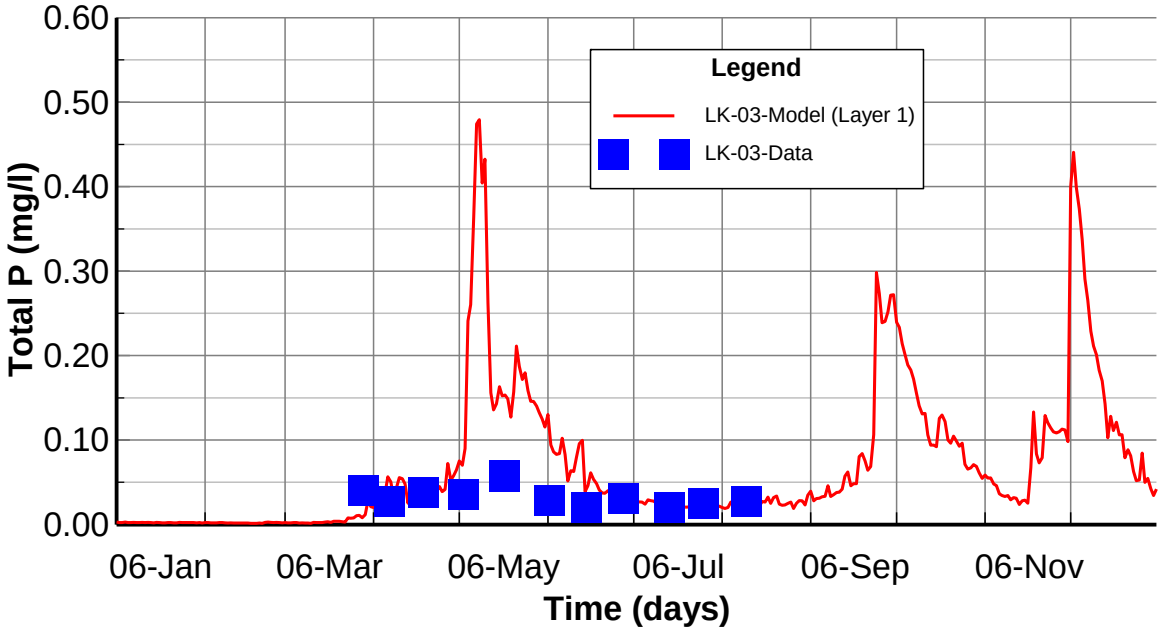


Figure **Error! No text of specified style in document.**.75. Bottom Layer TP Calibration Plots at Station LK-03

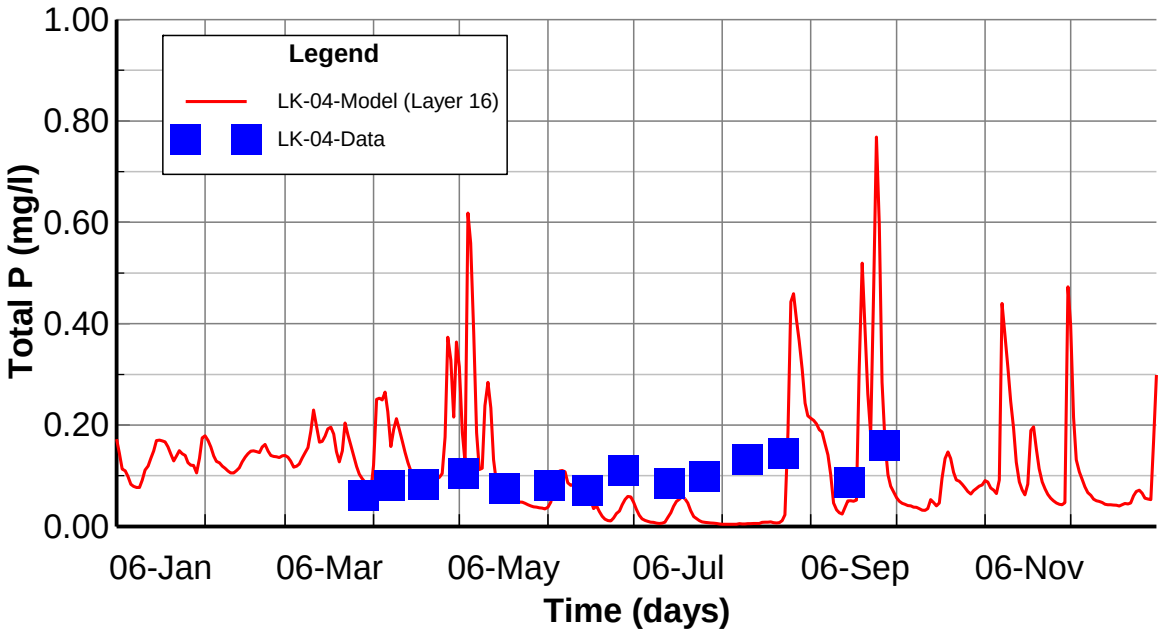


Figure **Error! No text of specified style in document.**.76. Surface Layer TP Calibration Plots at Station LK-04

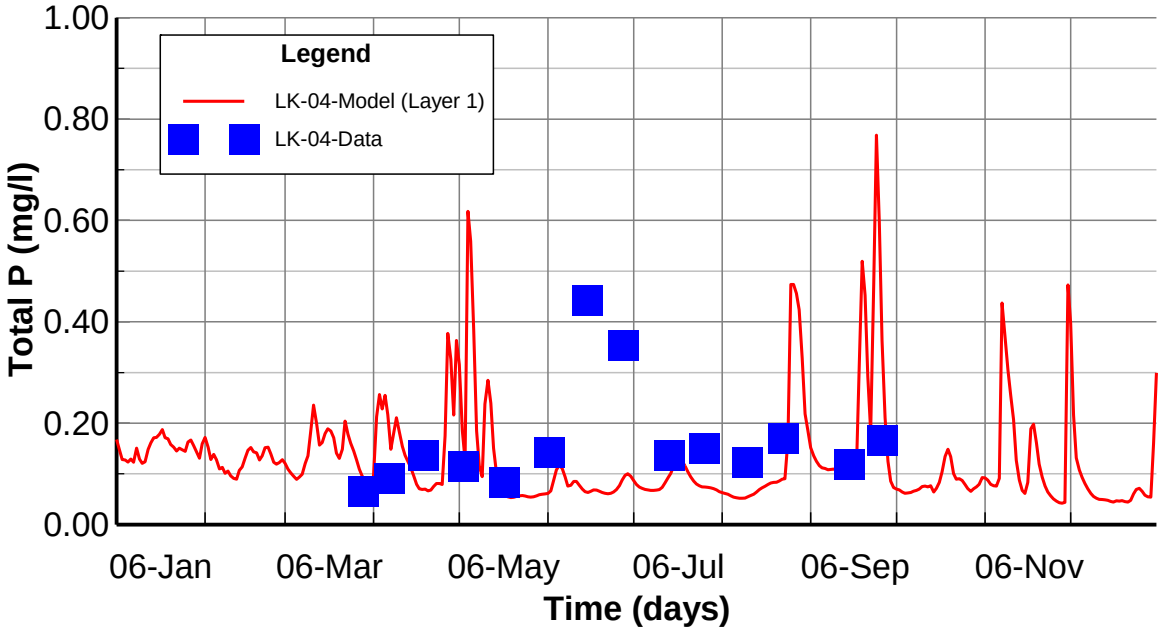


Figure **Error! No text of specified style in document.**.77. Bottom Layer TP Calibration Plots at Station LK-04

APPENDIX K
TIME SERIES PLOTS FOR MODEL VALIDATION
TENKILLER FERRY LAKE

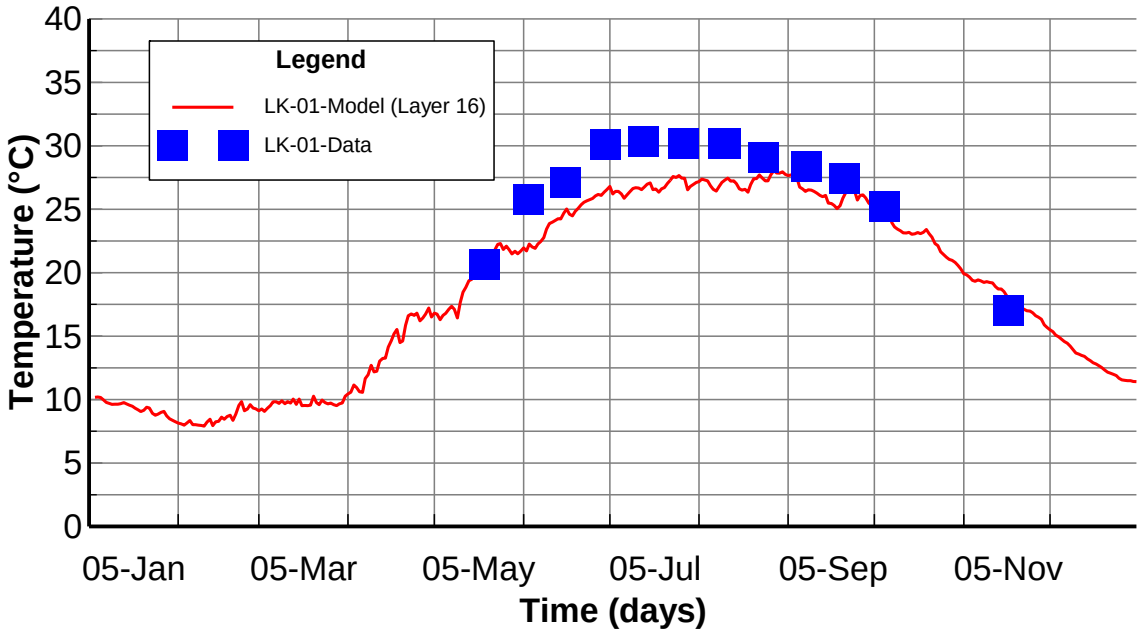


Figure **Error! No text of specified style in document.**.1. Surface Layer Water Temperature Validation Plot at Station LK-01

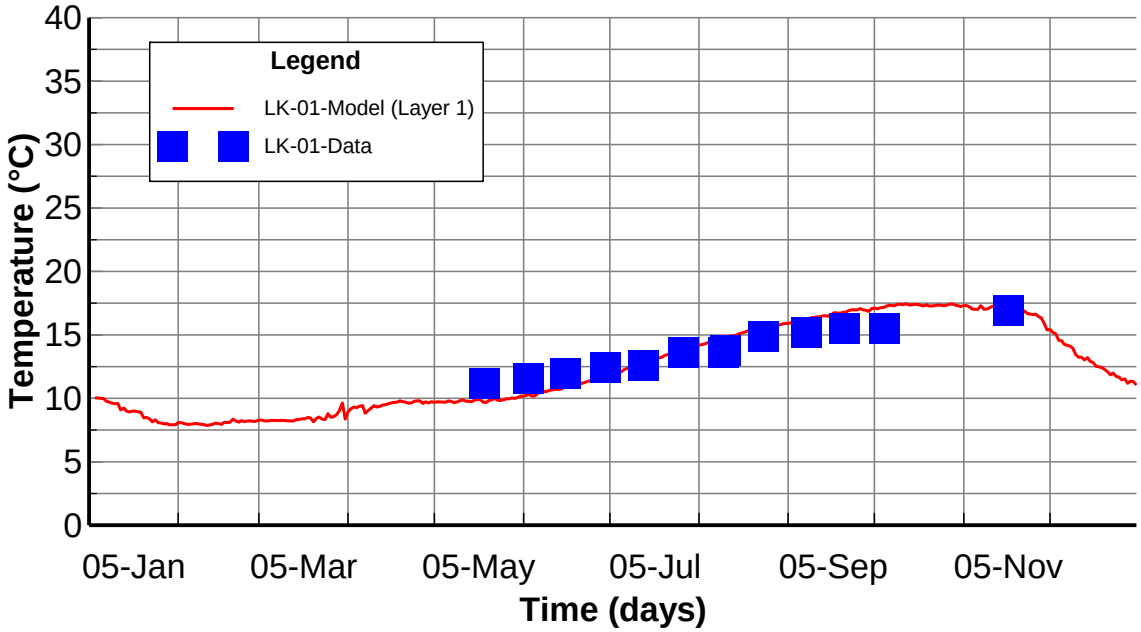


Figure **Error! No text of specified style in document.**.2. Bottom Layer Water Temperature Validation Plot at Station LK-01

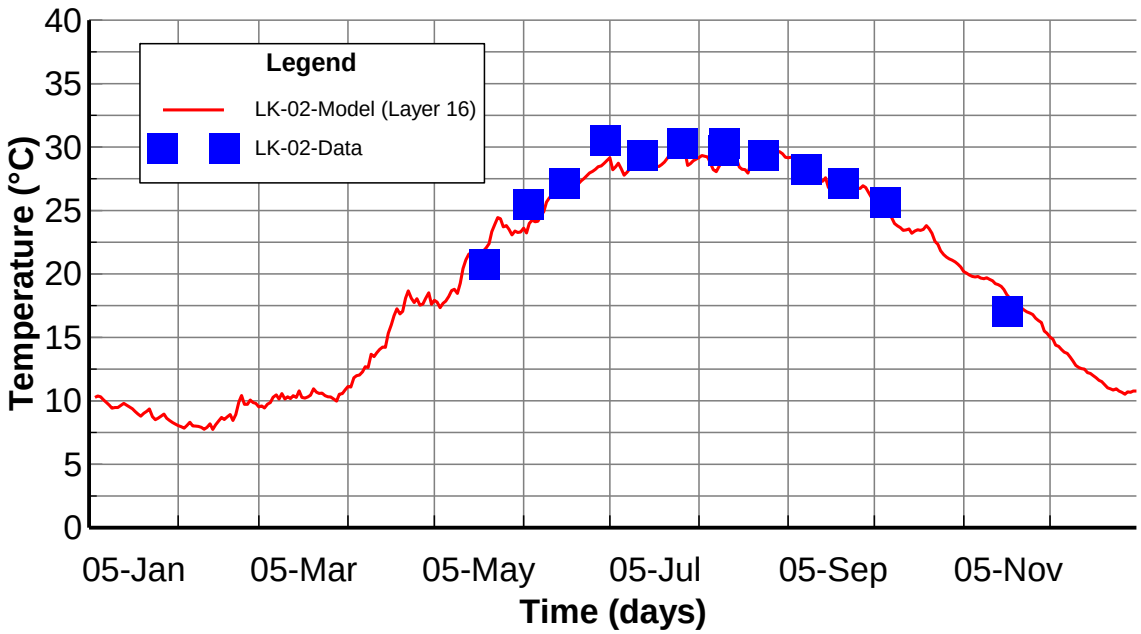


Figure **Error! No text of specified style in document.**.3. Surface Layer Water Temperature Validation Plot at Station LK-02

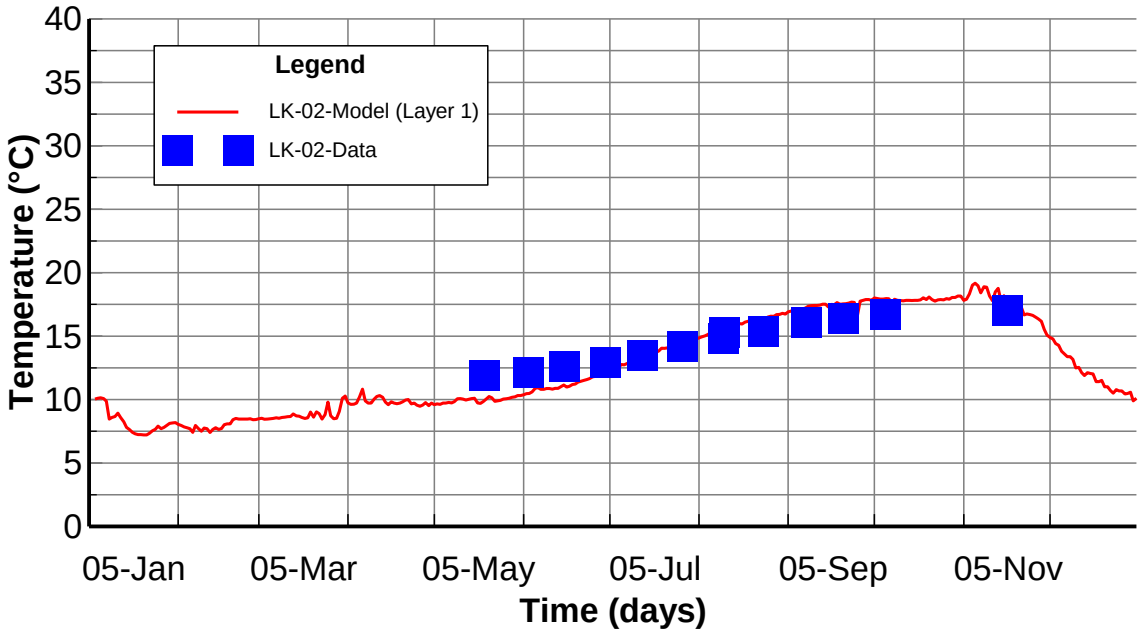


Figure **Error! No text of specified style in document.**.4. Bottom Layer Water Temperature Validation Plot at Station LK-02

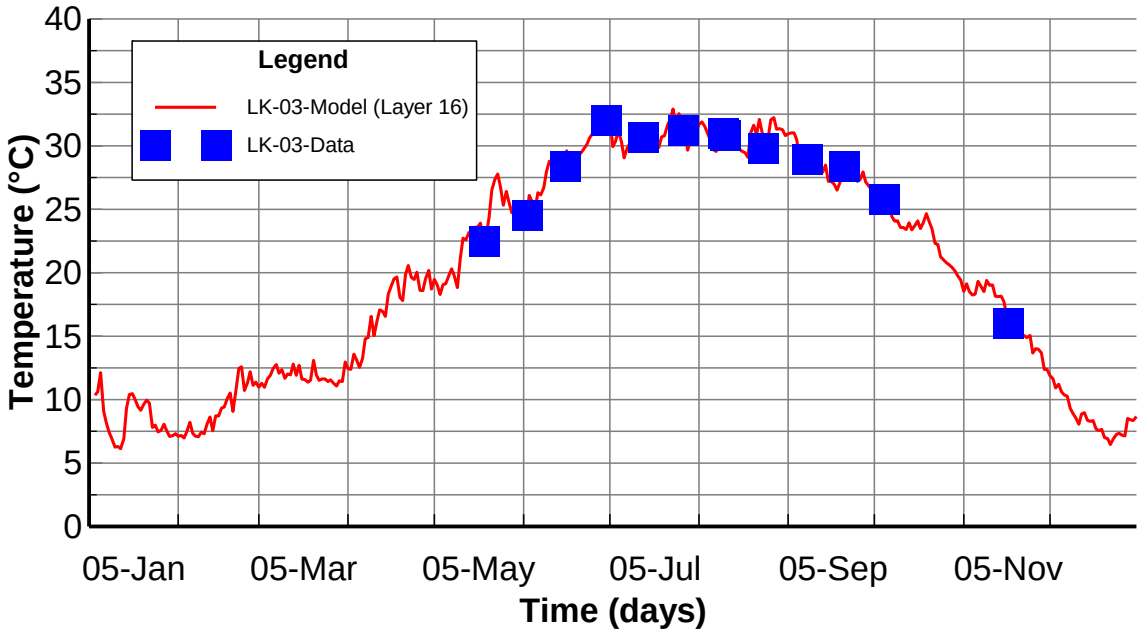


Figure **Error! No text of specified style in document.**.5. Surface Layer Water Temperature Validation Plot at Station LK-03

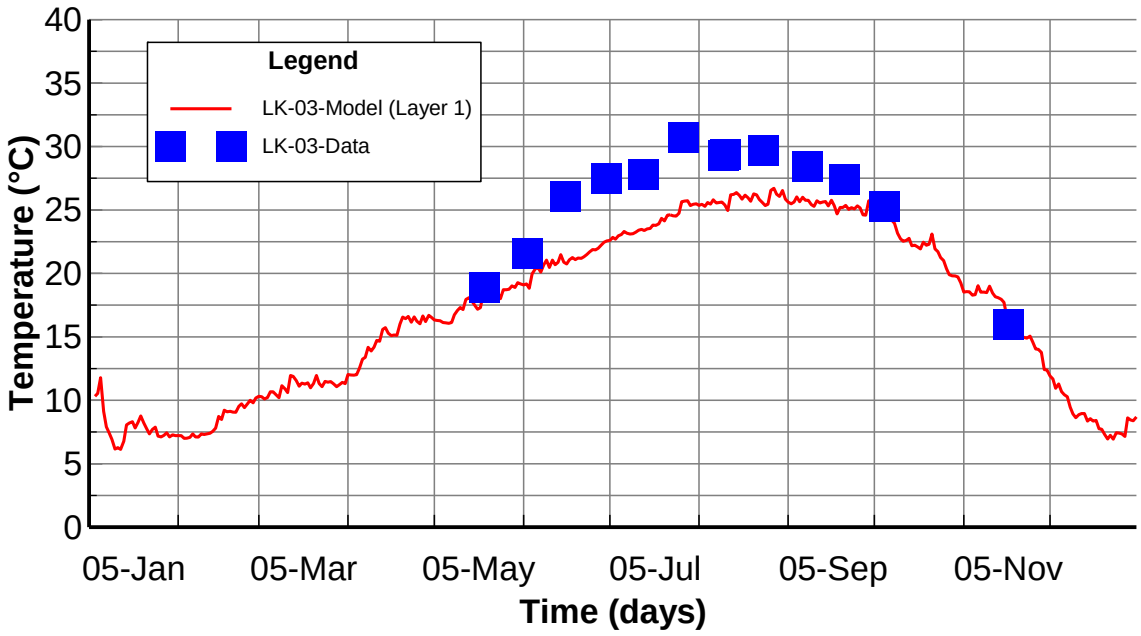


Figure **Error! No text of specified style in document.**.6. Bottom Layer Water Temperature Validation Plot at Station LK-03

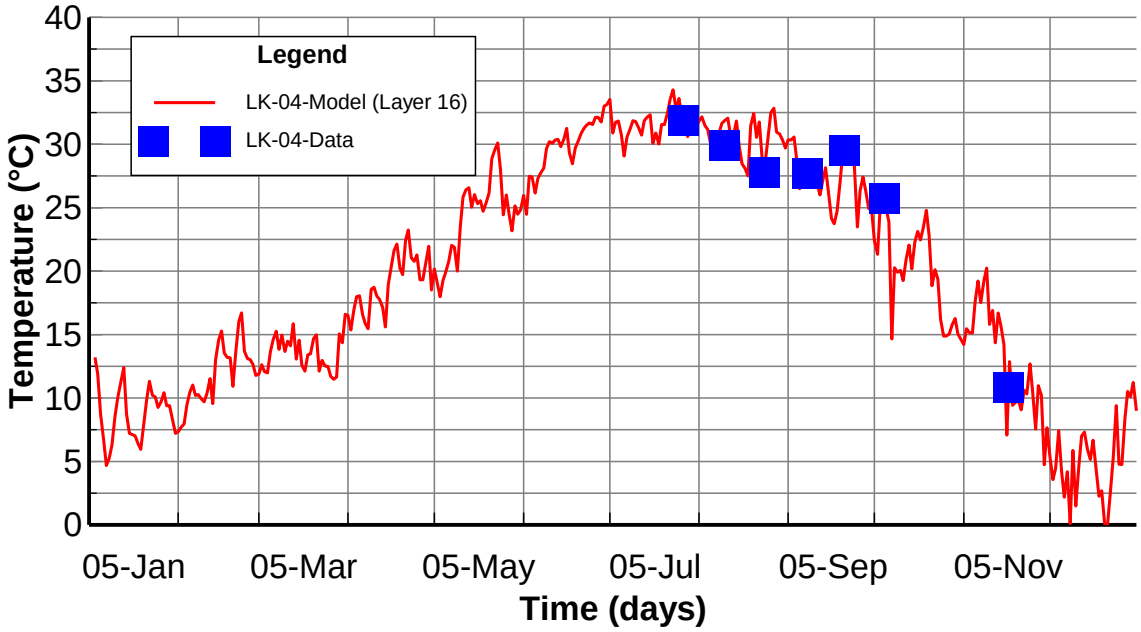


Figure **Error! No text of specified style in document.**.7. Surface Layer Water Temperature Validation Plot at Station LK-04

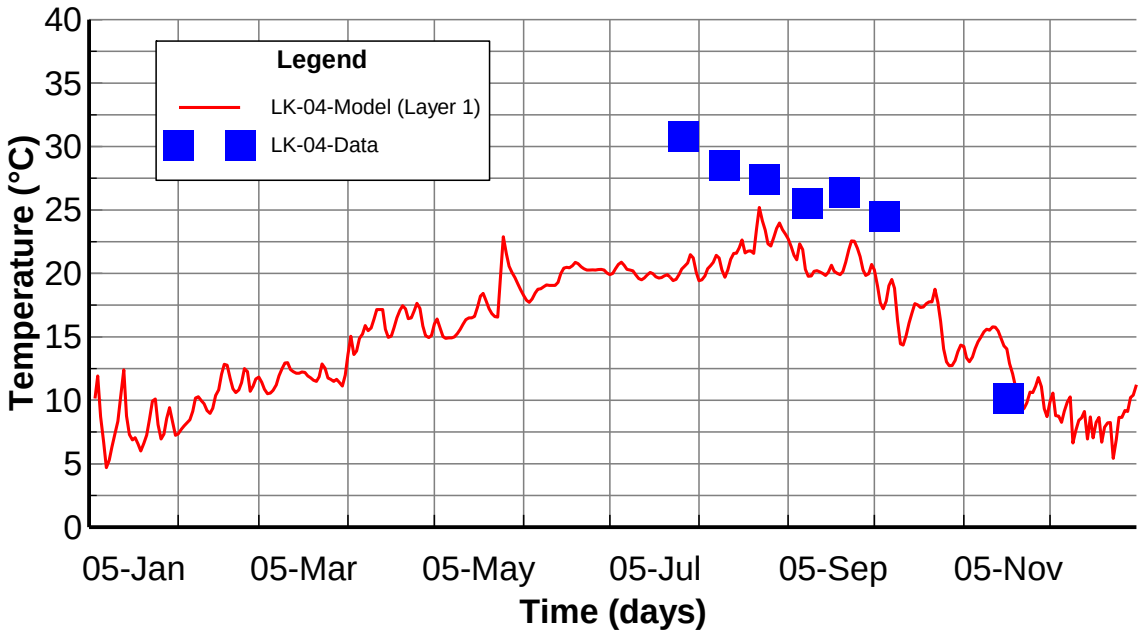


Figure **Error! No text of specified style in document.**.8. Bottom Layer Water Temperature Validation Plot at Station LK-04

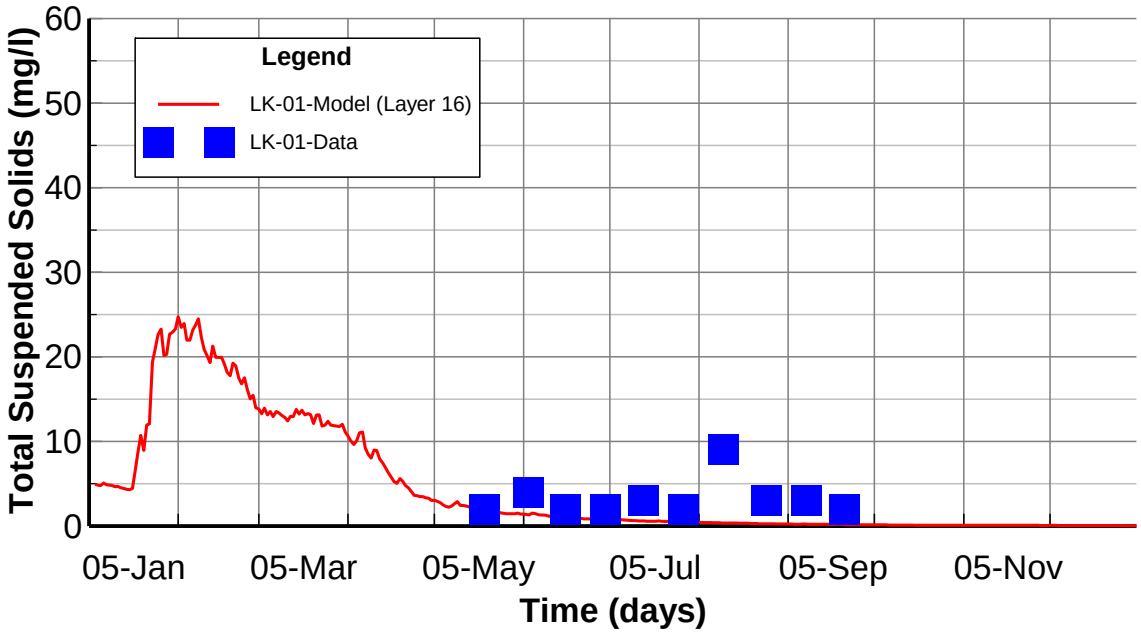


Figure **Error! No text of specified style in document.**.9. Surface Layer TSS Validation Plot at Station LK-01

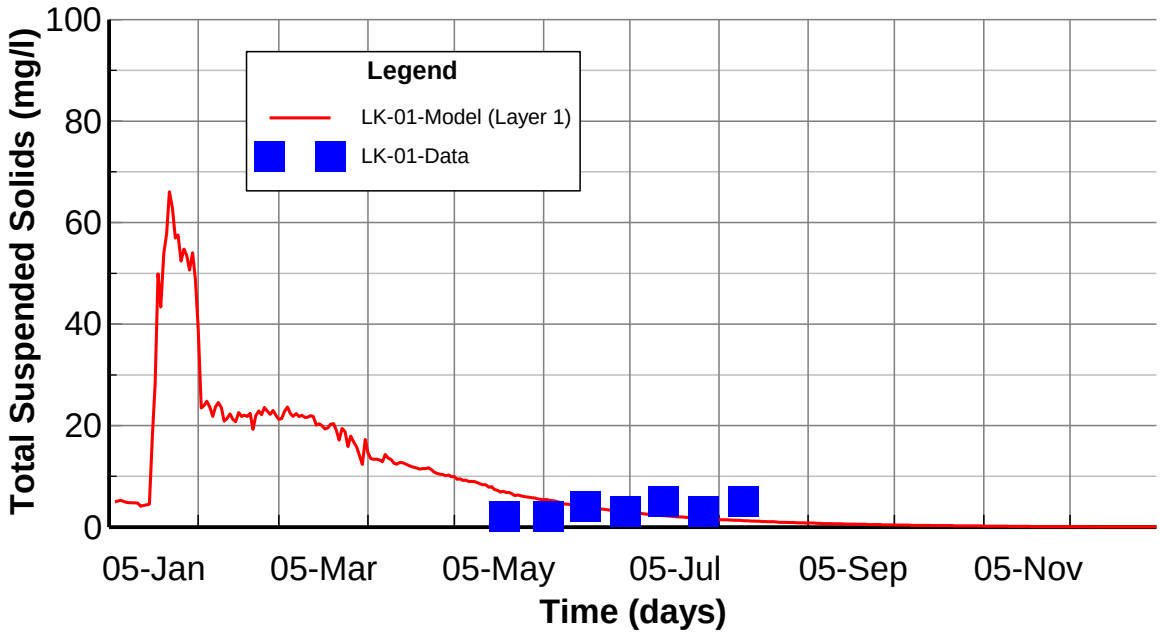


Figure **Error! No text of specified style in document.**.10. Bottom Layer TSS Validation Plot at Station LK-01

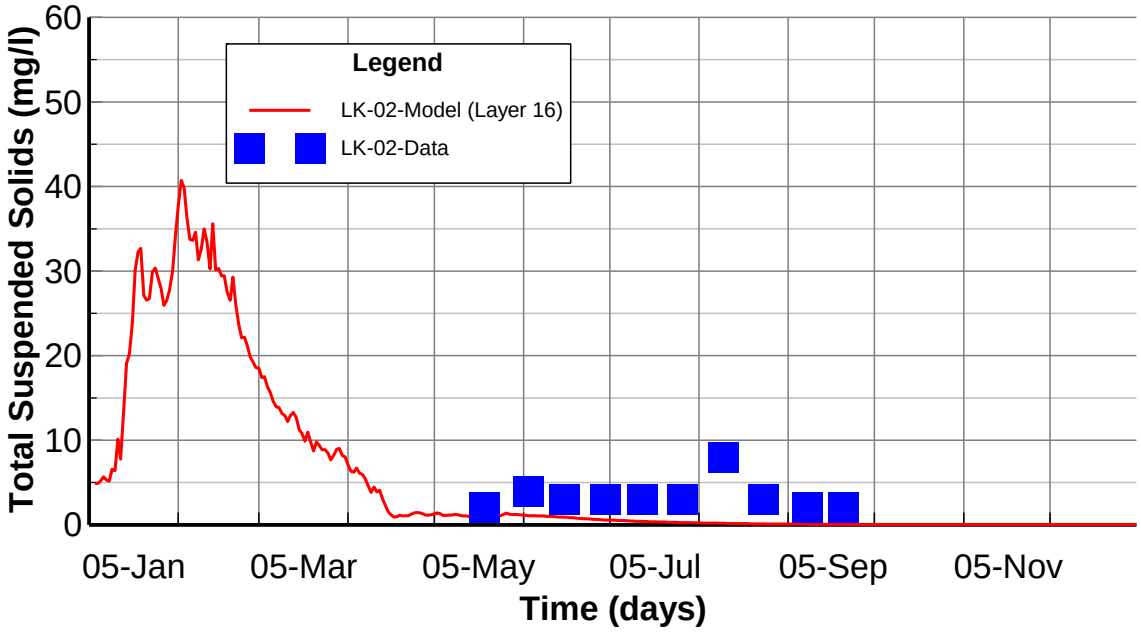


Figure **Error! No text of specified style in document.**.11. Surface Layer TSS Validation Plot at Station LK-02

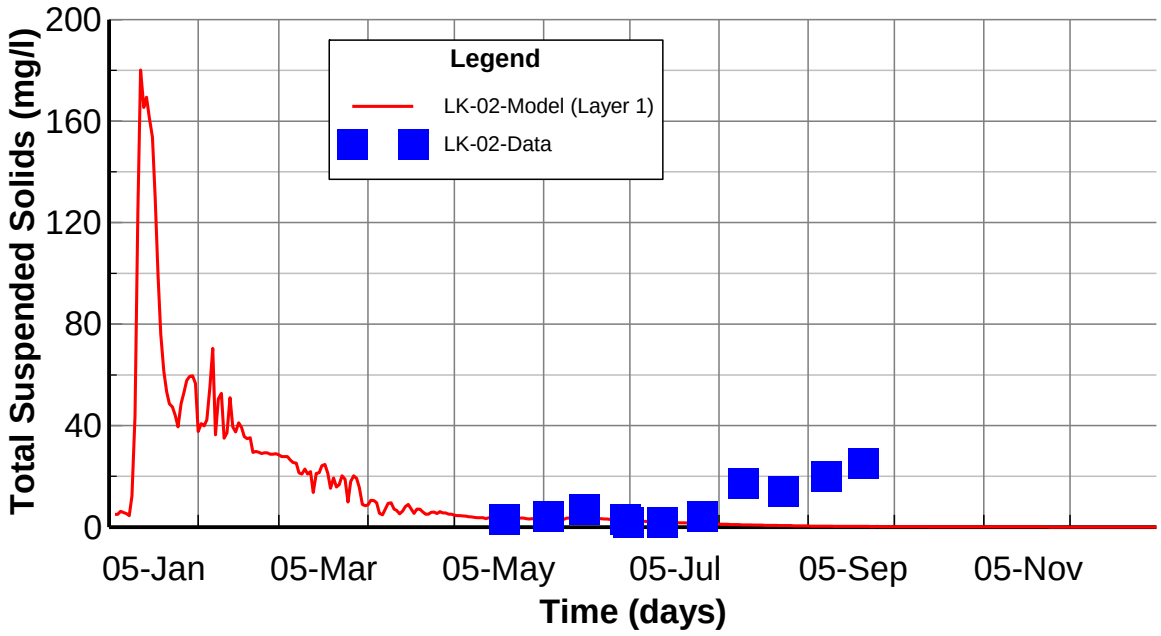


Figure **Error! No text of specified style in document.**.12. Bottom Layer TSS Validation Plot at Station LK-02

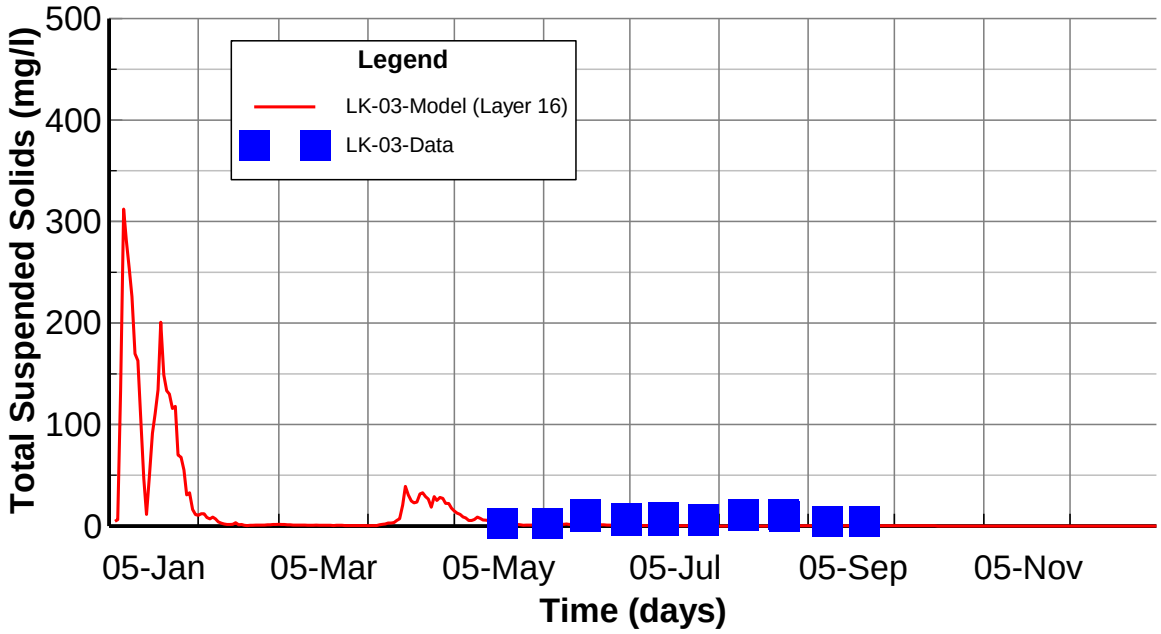


Figure **Error! No text of specified style in document.**.13. Surface Layer TSS Validation Plot at Station LK-03

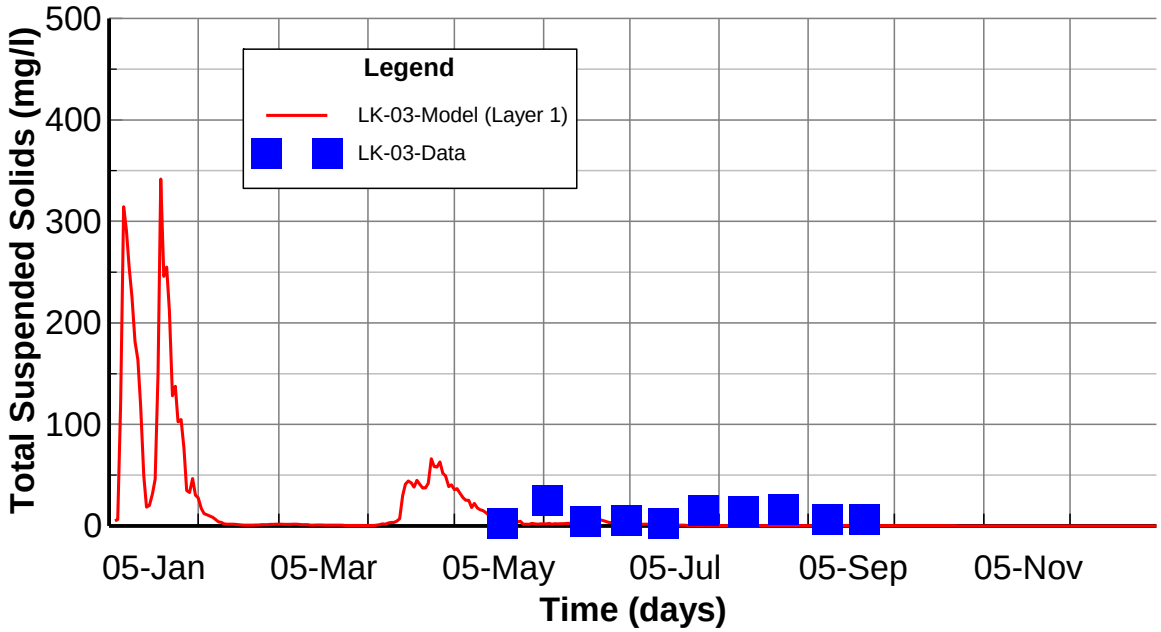


Figure **Error! No text of specified style in document.**.14. Bottom Layer TSS Validation Plot at Station LK-03

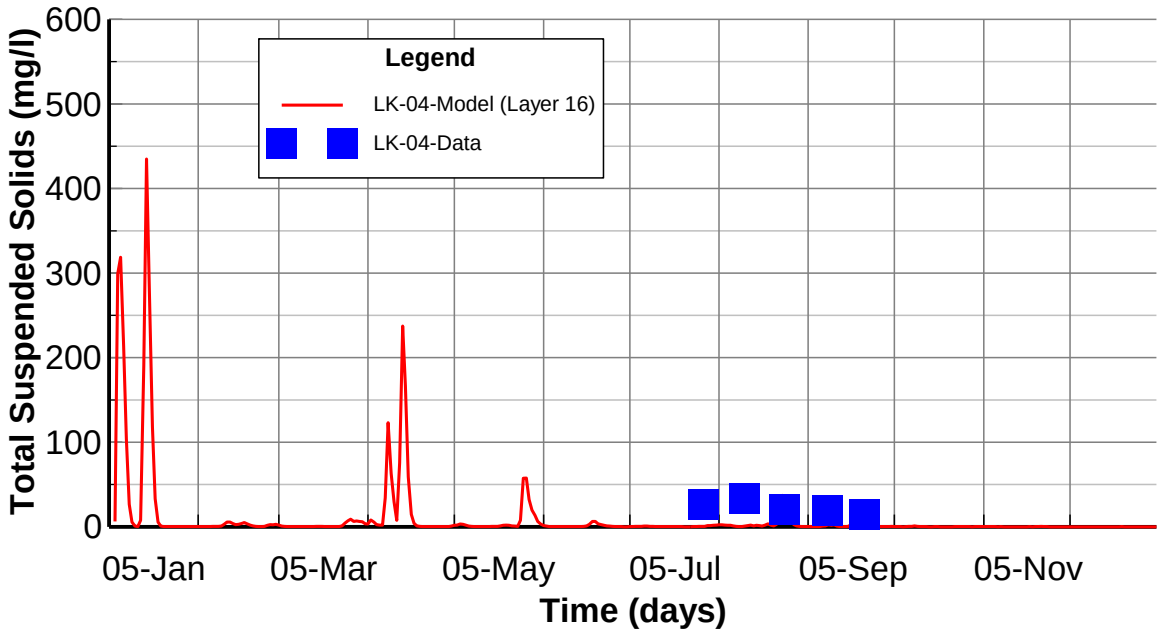


Figure **Error! No text of specified style in document.**.15. Surface Layer TSS Validation Plot at Station LK-04

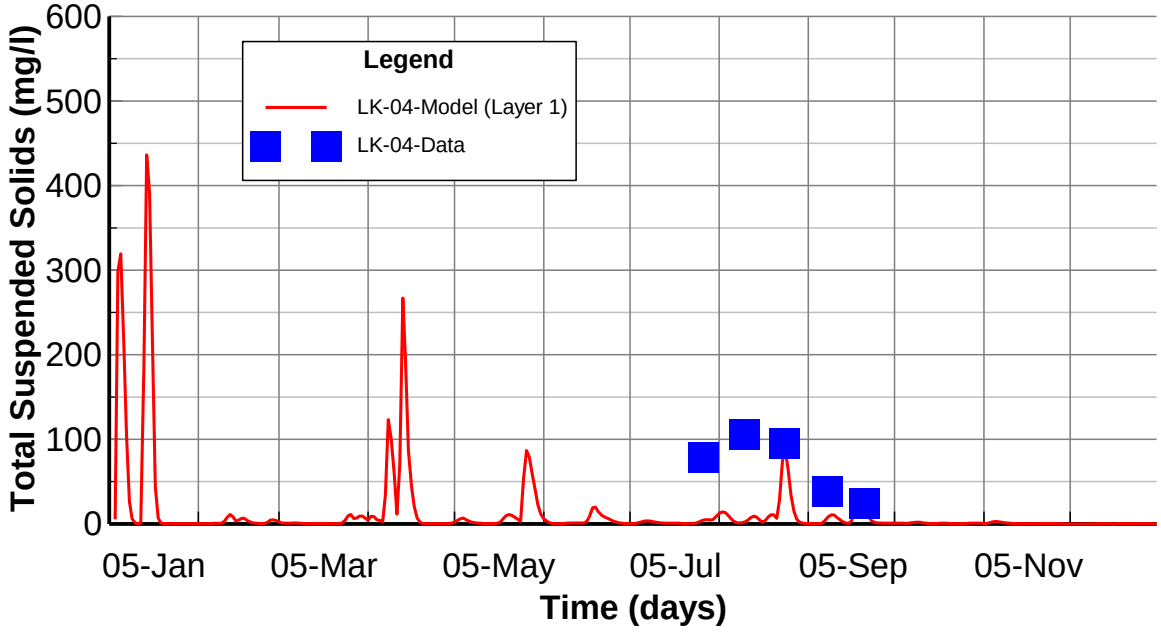


Figure **Error! No text of specified style in document.**.16. Bottom Layer TSS Validation Plot at Station LK-04

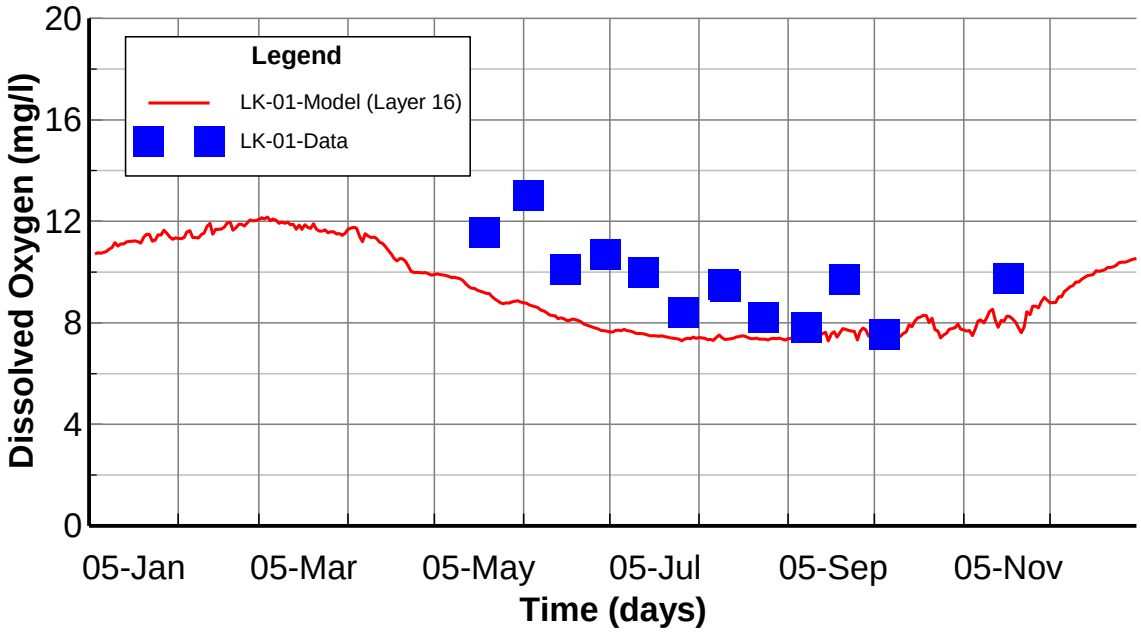


Figure **Error! No text of specified style in document.**.17. Surface Layer Dissolved Oxygen Validation Plot at Station LK-01

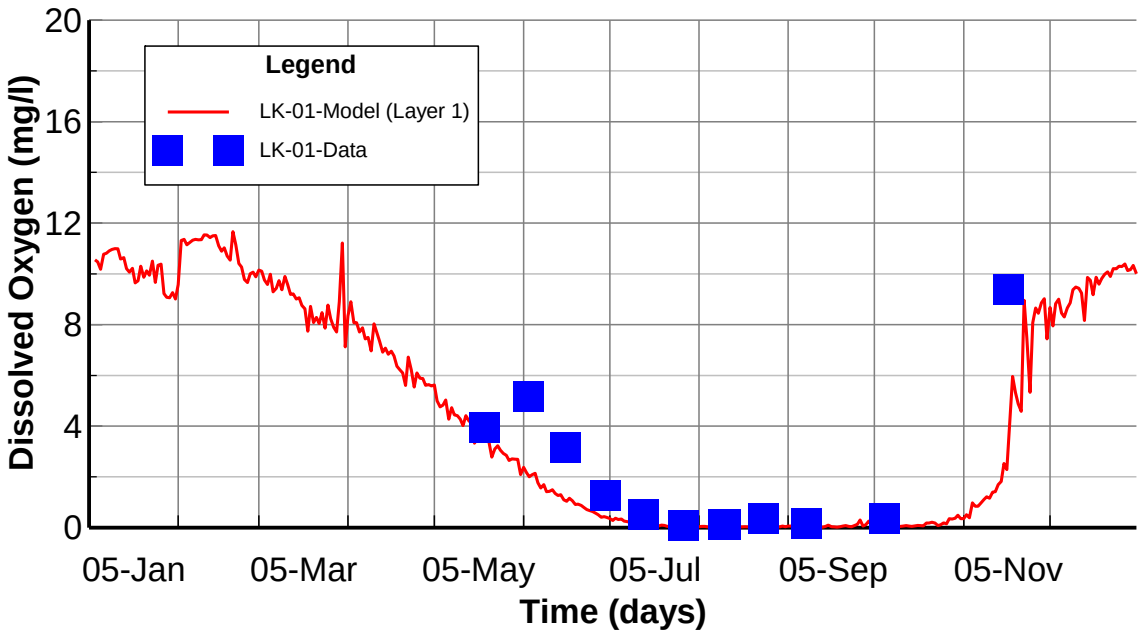


Figure **Error! No text of specified style in document.**.18. Bottom Layer Dissolved Oxygen Validation Plot at Station LK-01

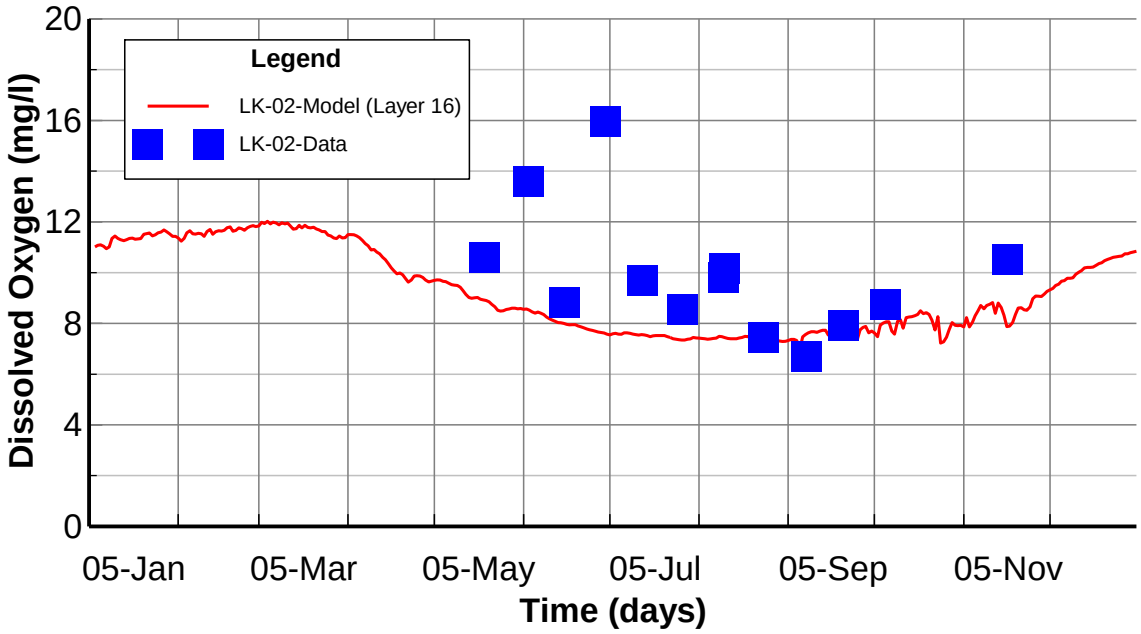


Figure **Error! No text of specified style in document.**.19. Surface Layer Dissolved Oxygen Validation Plot at Station LK-02

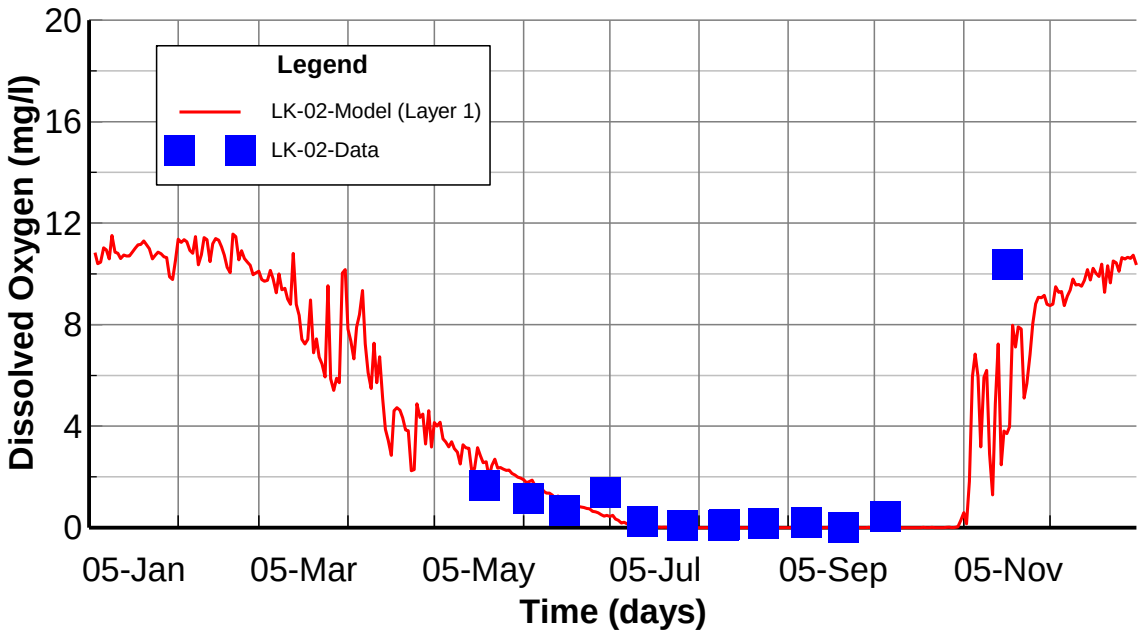


Figure **Error! No text of specified style in document.**.20. Bottom Layer Dissolved Oxygen Validation Plot at Station LK-02

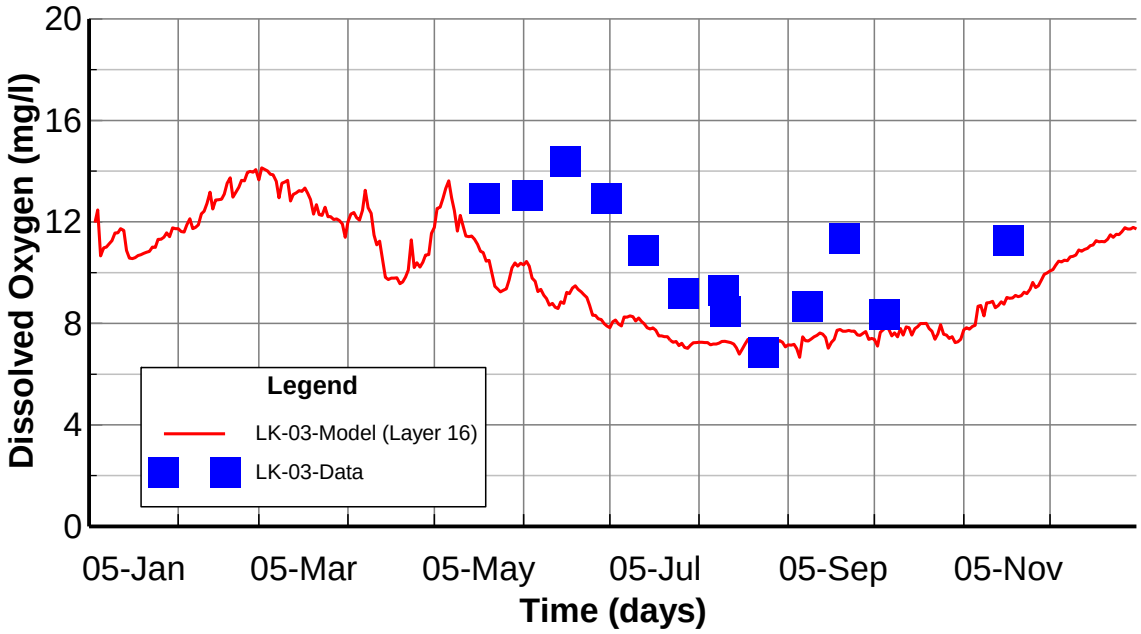


Figure **Error! No text of specified style in document.**.21. Surface Layer Dissolved Oxygen Validation Plot at Station LK-03

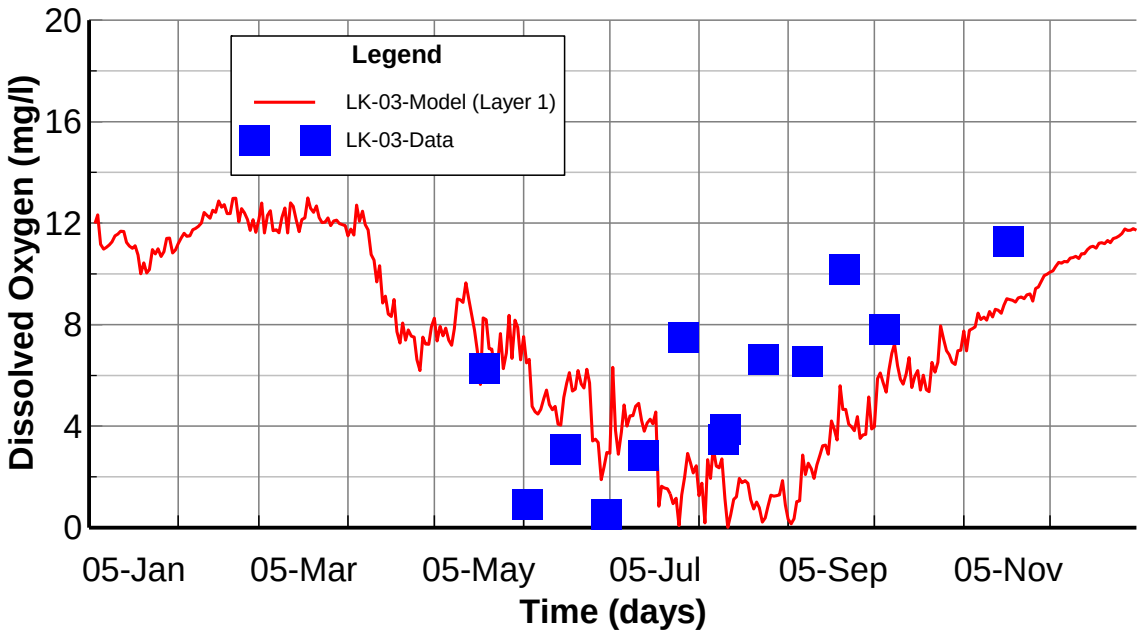


Figure **Error! No text of specified style in document.**.22. Bottom Layer Dissolved Oxygen Validation Plot at Station LK-03

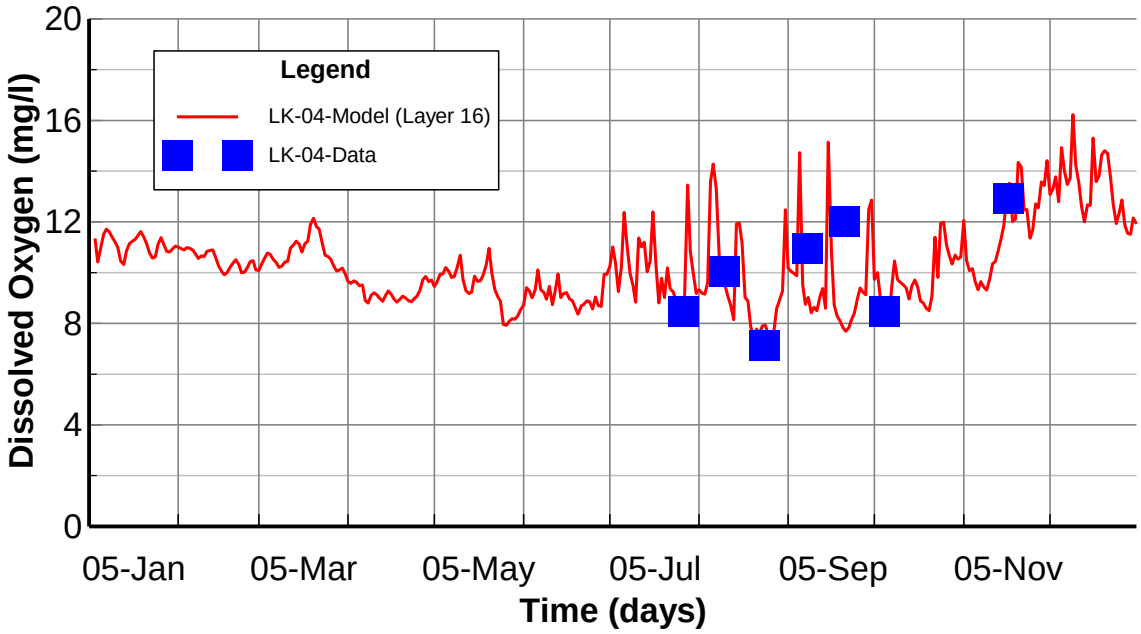


Figure **Error! No text of specified style in document.**.23. Surface Layer Dissolved Oxygen Validation Plot at Station LK-04

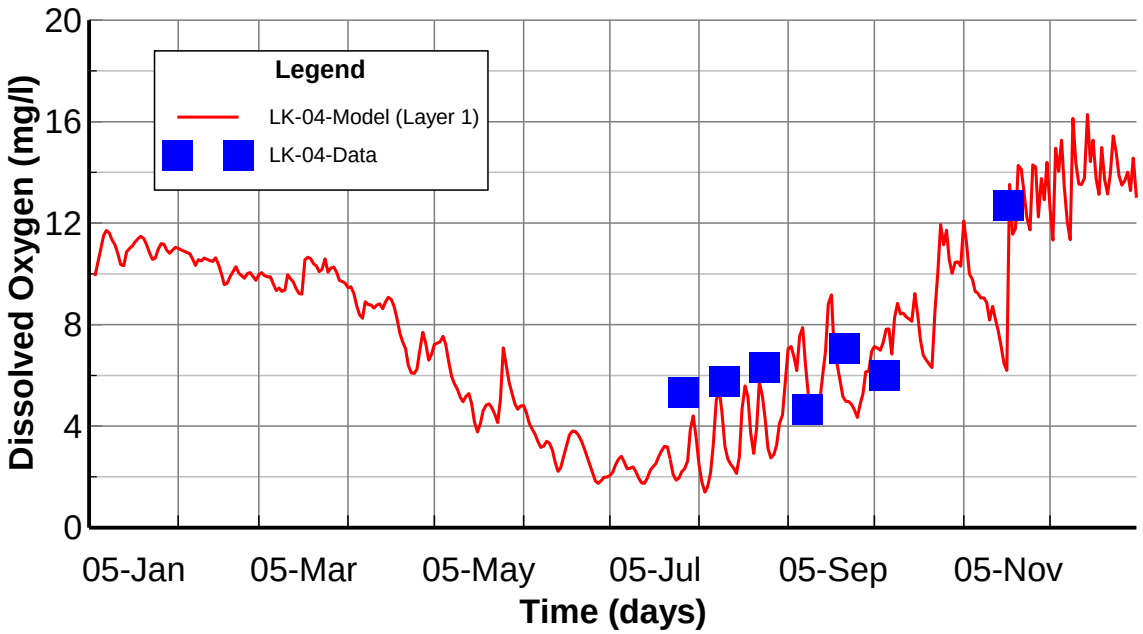


Figure **Error! No text of specified style in document.**.24. Bottom Layer Dissolved Oxygen Validation Plot at Station LK-04

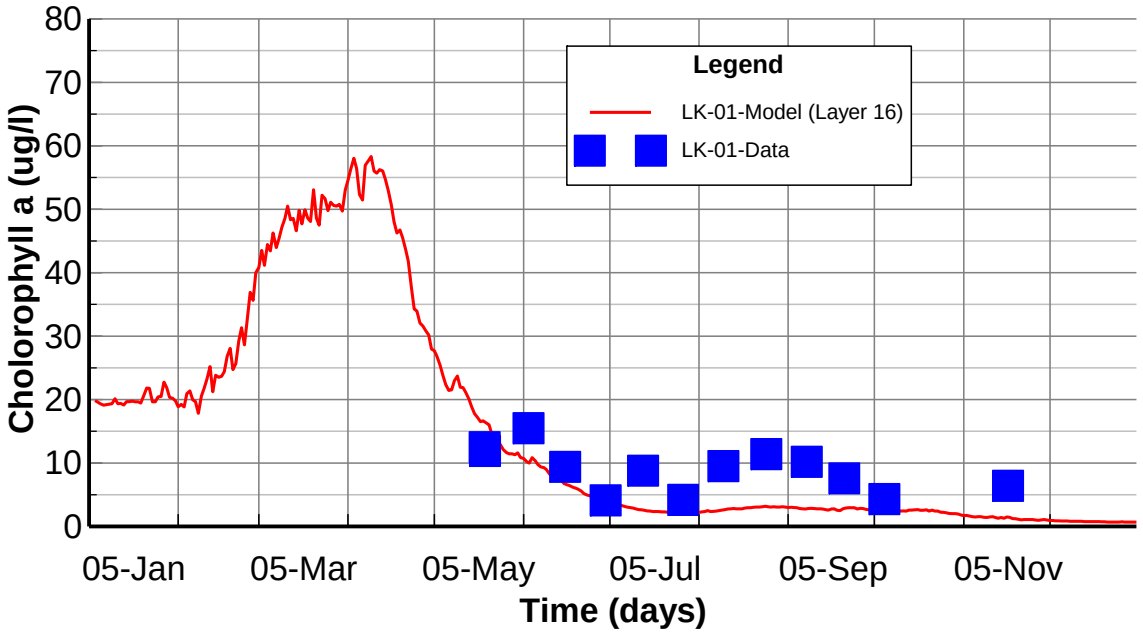


Figure **Error! No text of specified style in document.**.25. Surface Layer Chlorophyll a Validation Plot at Station LK-01

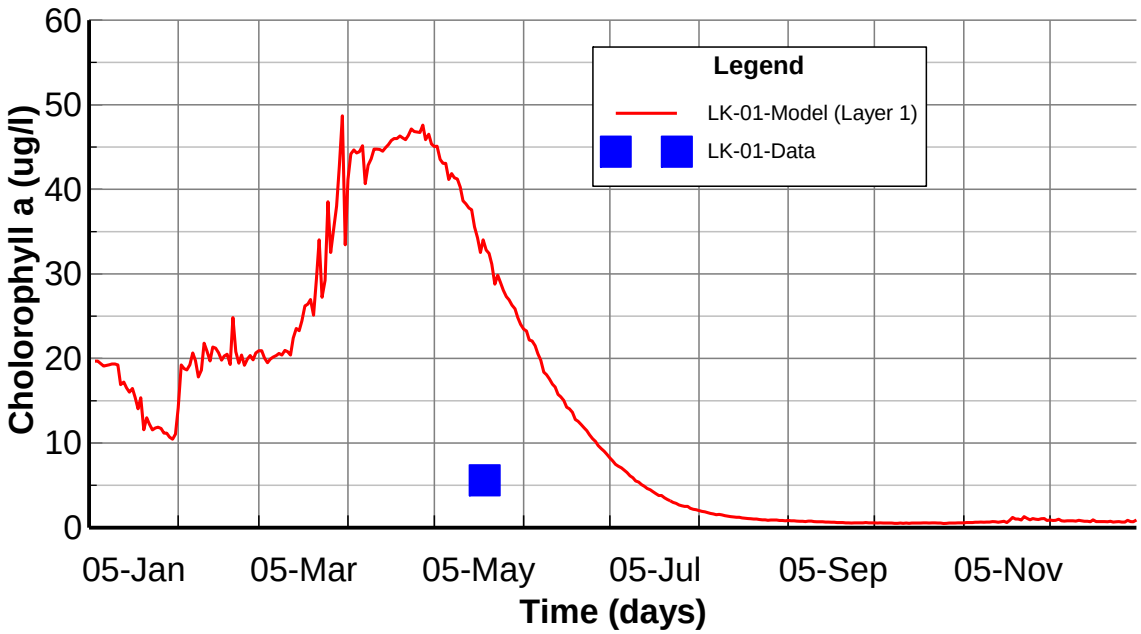


Figure **Error! No text of specified style in document.**.26. Bottom Layer Chlorophyll a Validation Plot at Station LK-01

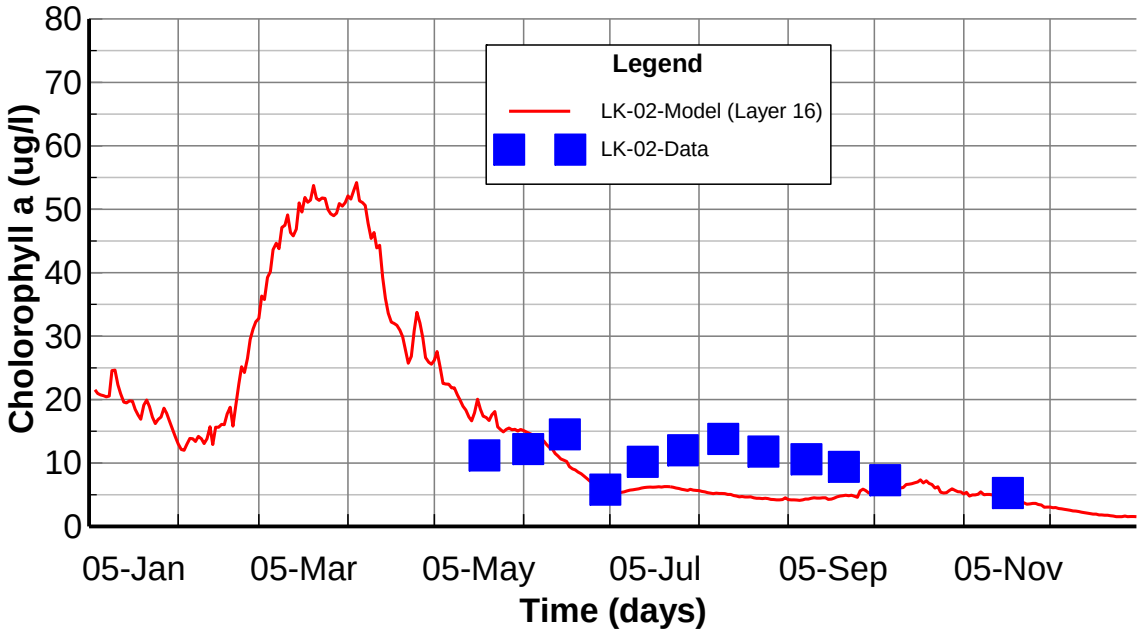


Figure **Error! No text of specified style in document.**.27. Surface Layer Chlorophyll a Validation Plot at Station LK-02

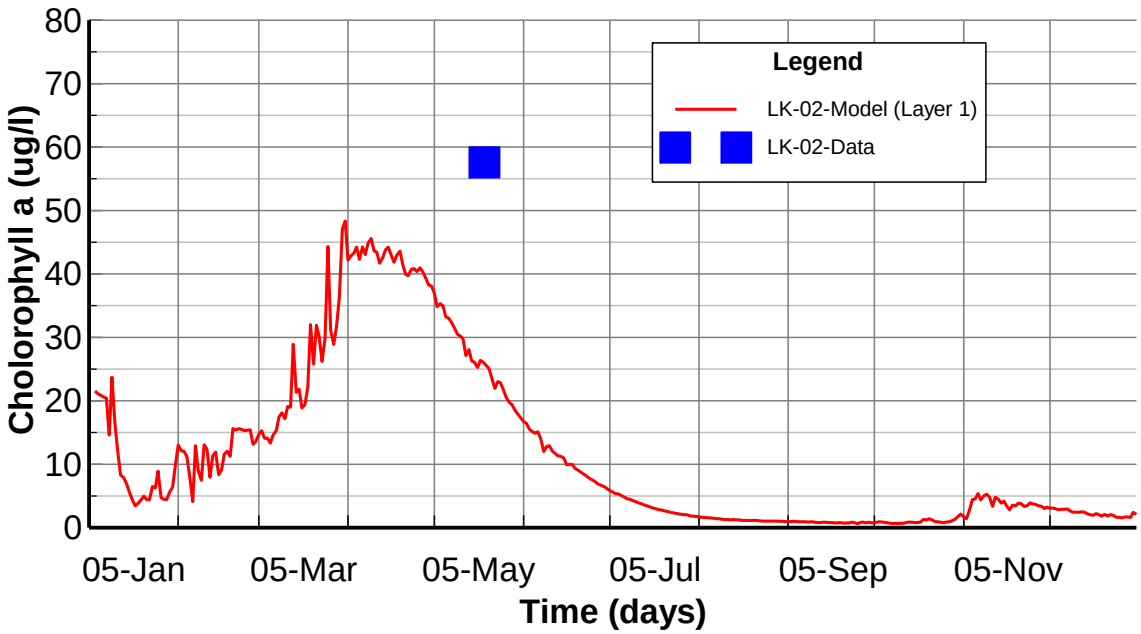


Figure **Error! No text of specified style in document.**.28. Bottom Layer Chlorophyll a Validation Plot at Station LK-02

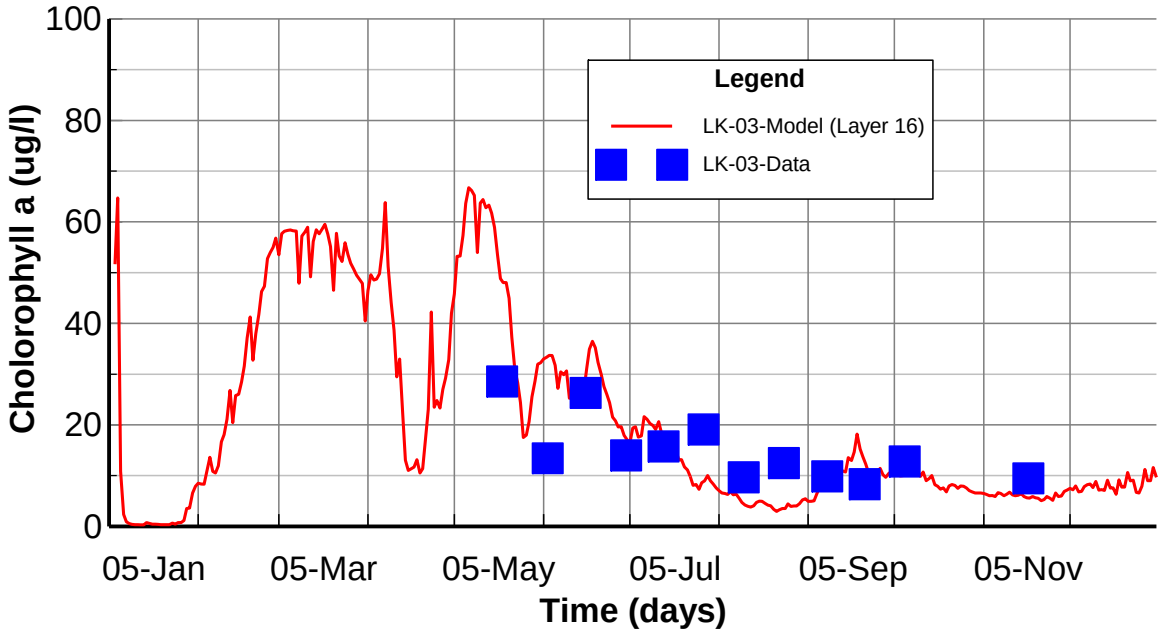


Figure **Error! No text of specified style in document.**.29. Surface Layer Chlorophyll a Validation Plot at Station LK-03

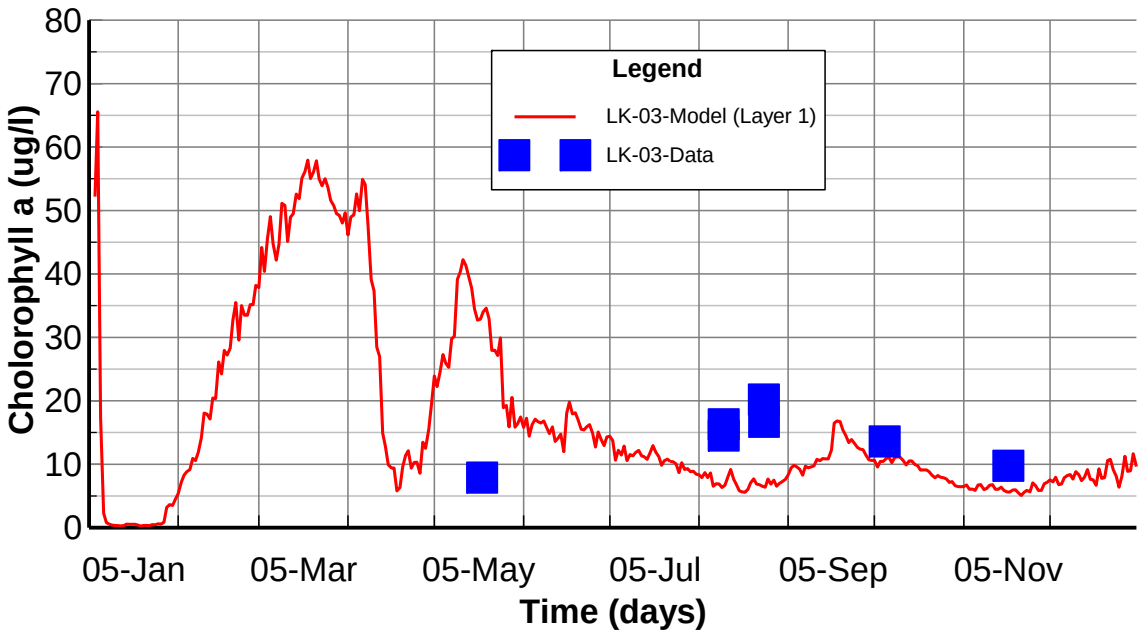


Figure **Error! No text of specified style in document.**.30. Bottom Layer Chlorophyll a Validation Plot at Station LK-03

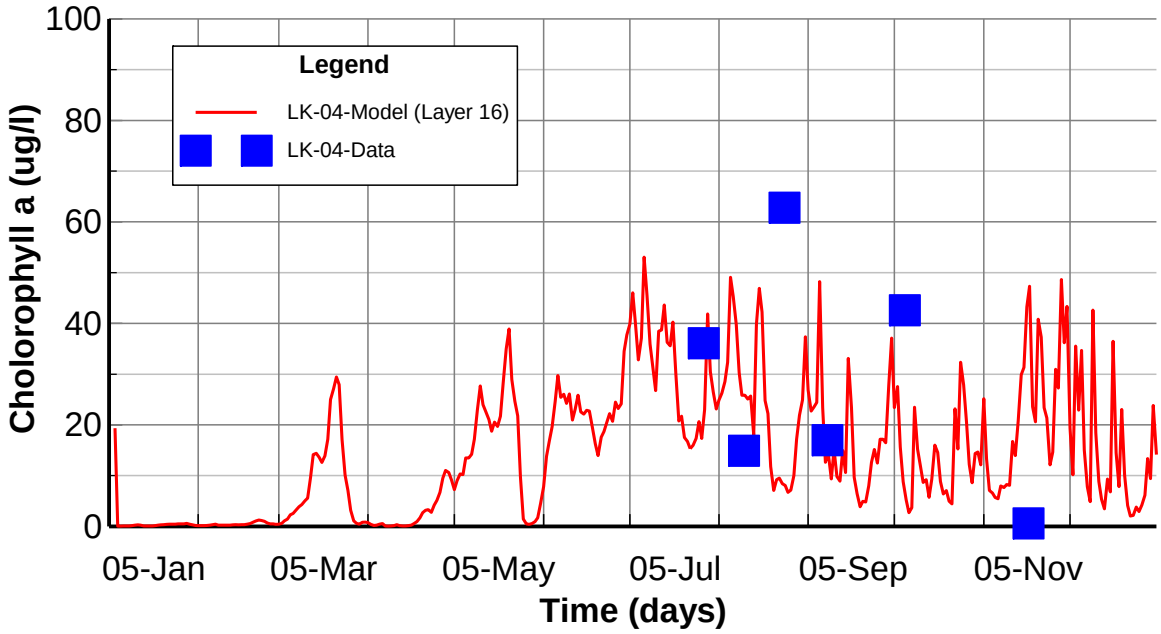


Figure **Error! No text of specified style in document.**.31. Surface Layer Chlorophyll a Validation Plot at Station LK-04

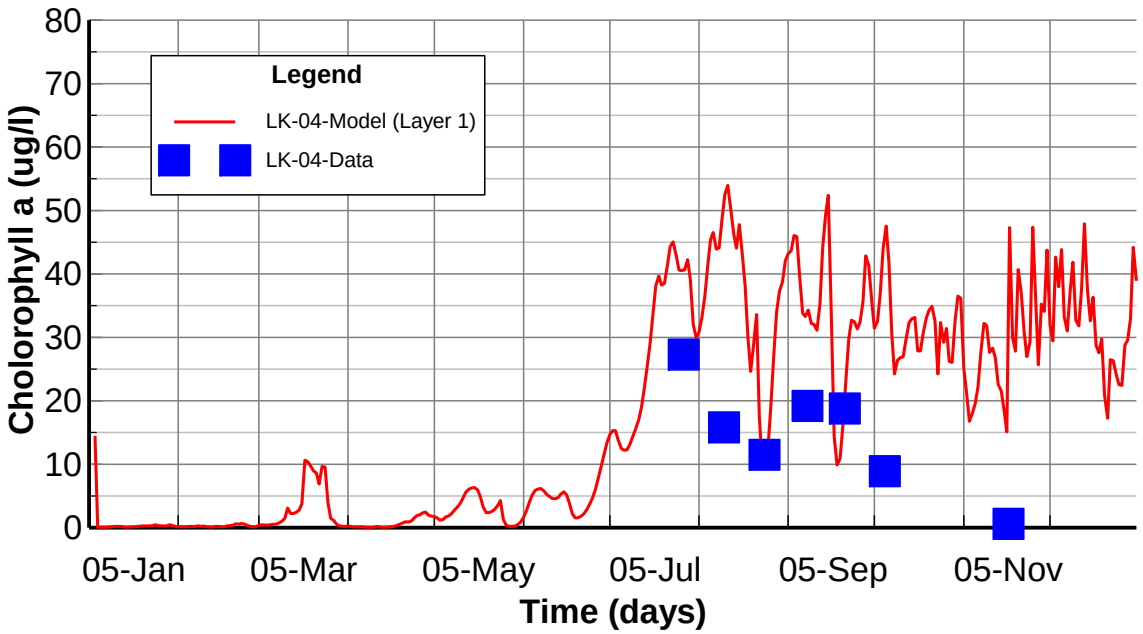


Figure **Error! No text of specified style in document.**.32. Bottom Layer Chlorophyll a Validation Plot at Station LK-04

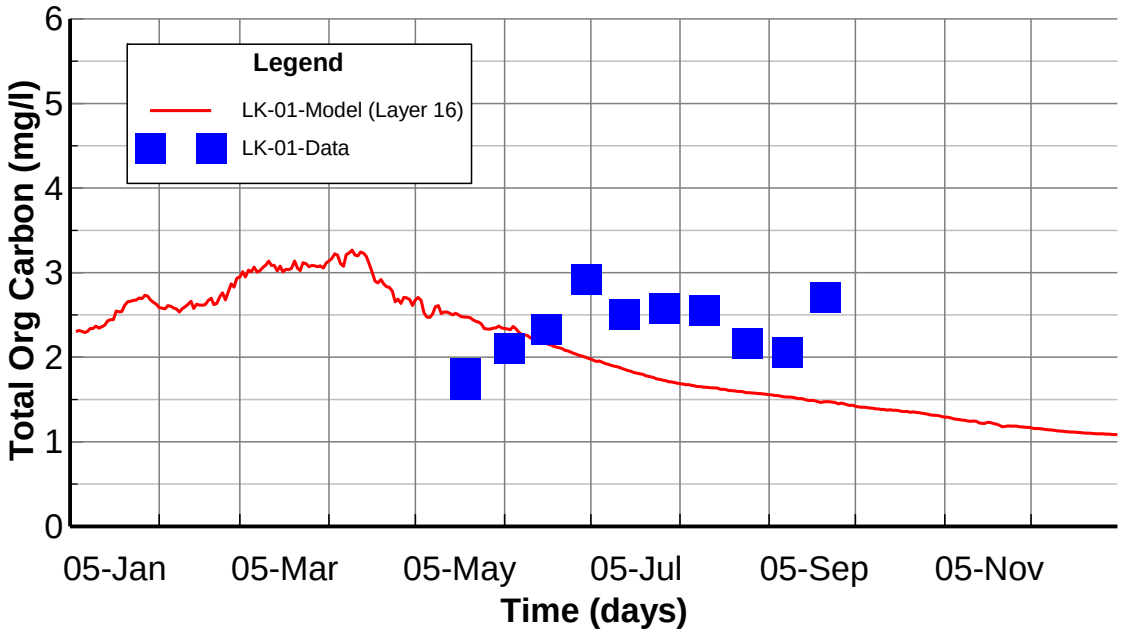


Figure **Error! No text of specified style in document.**.33. Surface Layer TOC Validation Plots at Station LK-01

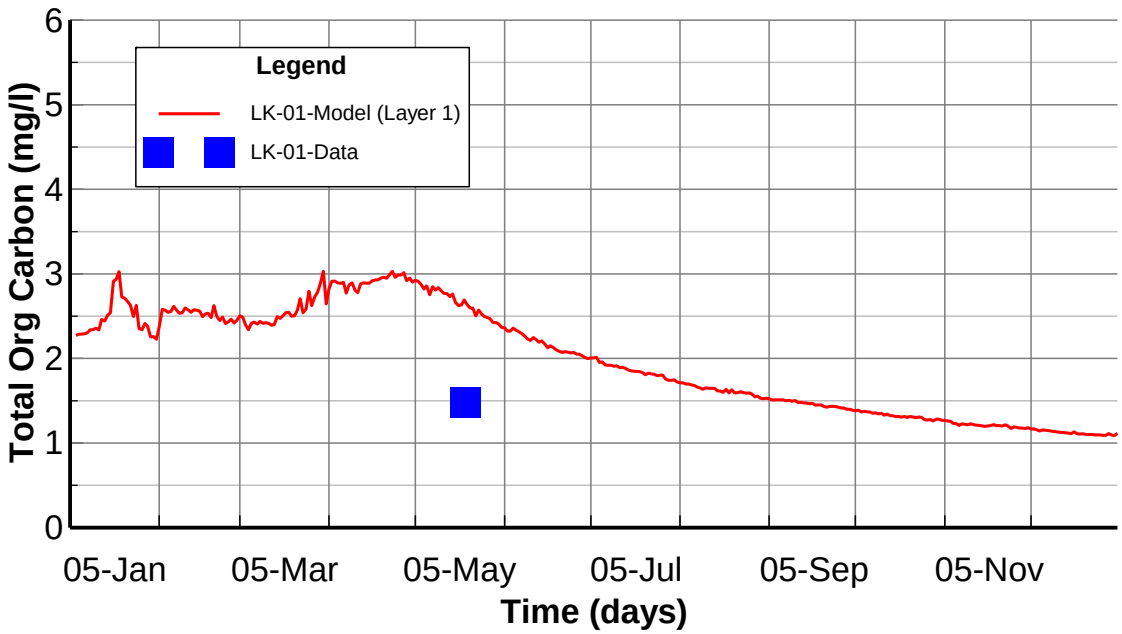


Figure **Error! No text of specified style in document.**.34. Bottom Layer TOC Validation Plots at Station LK-0

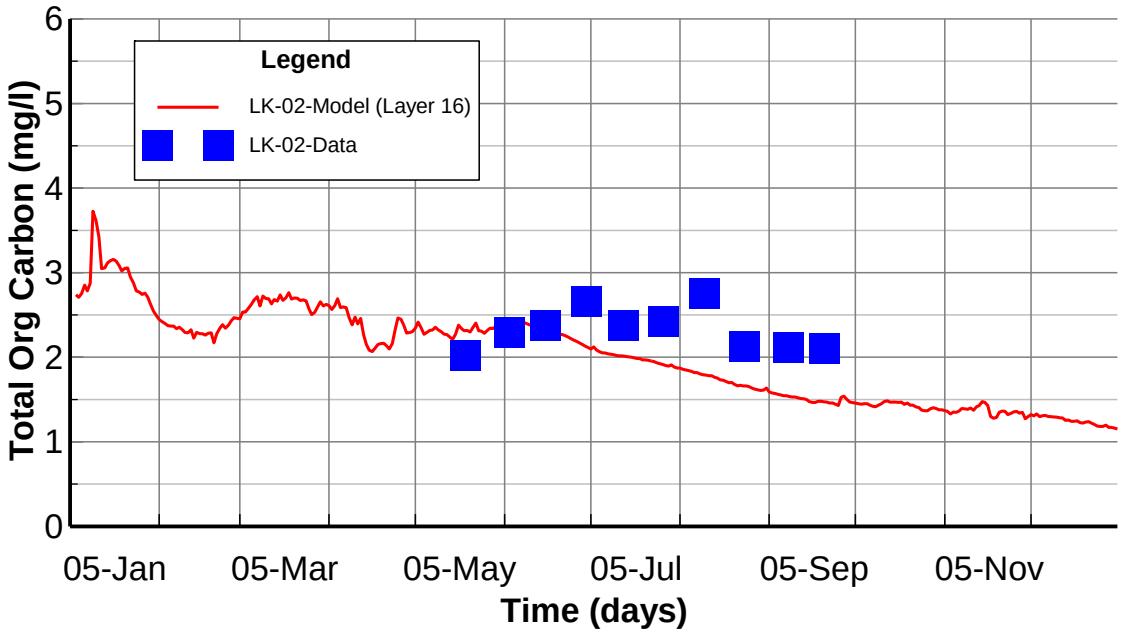


Figure **Error! No text of specified style in document.**.35. Surface Layer TOC Validation Plots at Station LK-02

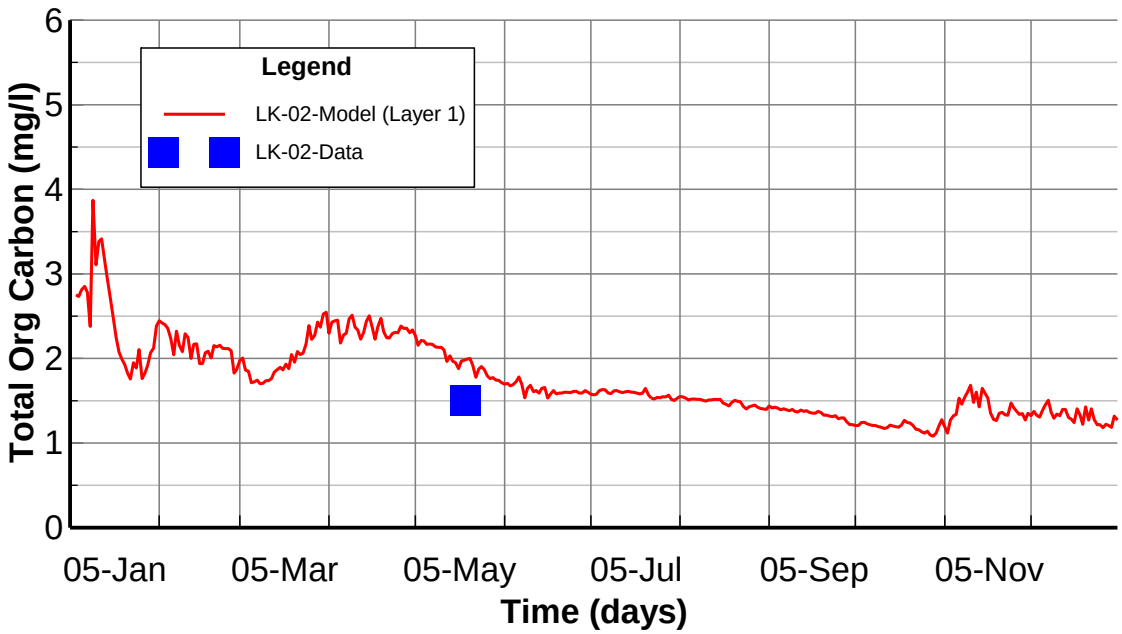


Figure **Error! No text of specified style in document.**.36. Bottom Layer TOC Validation Plots at Station LK-02

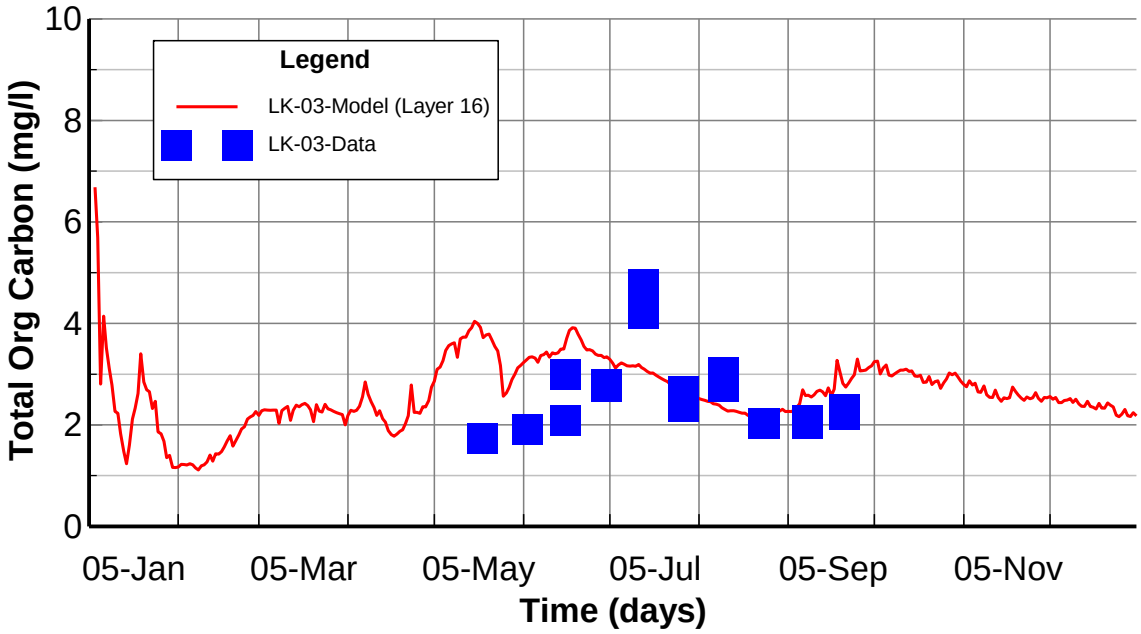


Figure **Error! No text of specified style in document.**.37. Surface Layer TOC Validation Plots at Station LK-03

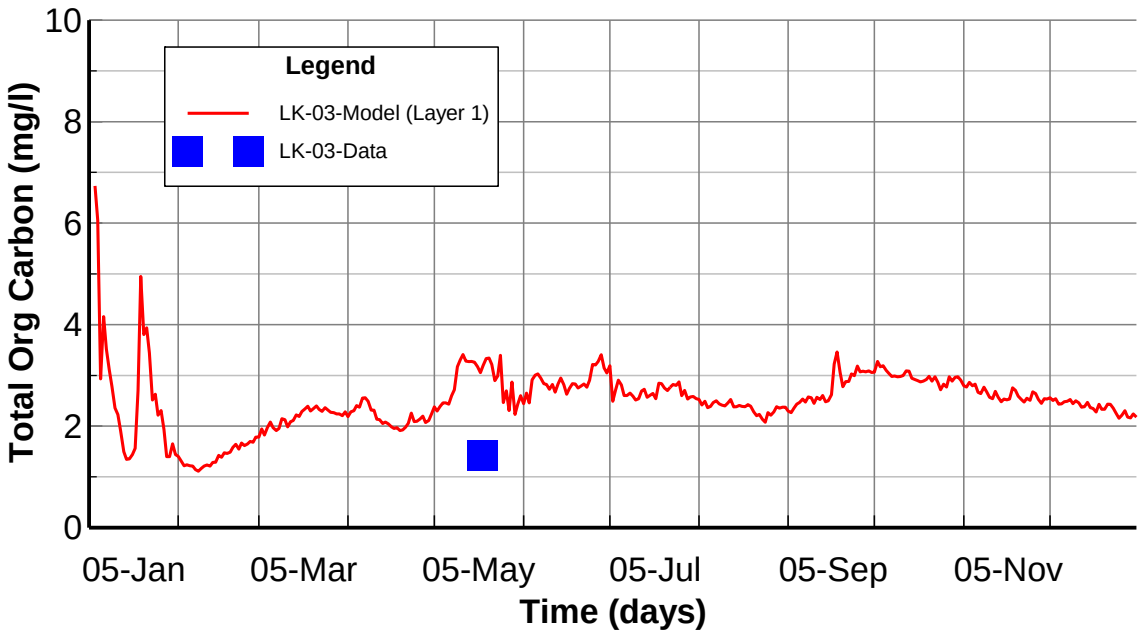


Figure **Error! No text of specified style in document.**.38. Bottom Layer TOC Validation Plots at Station LK-03

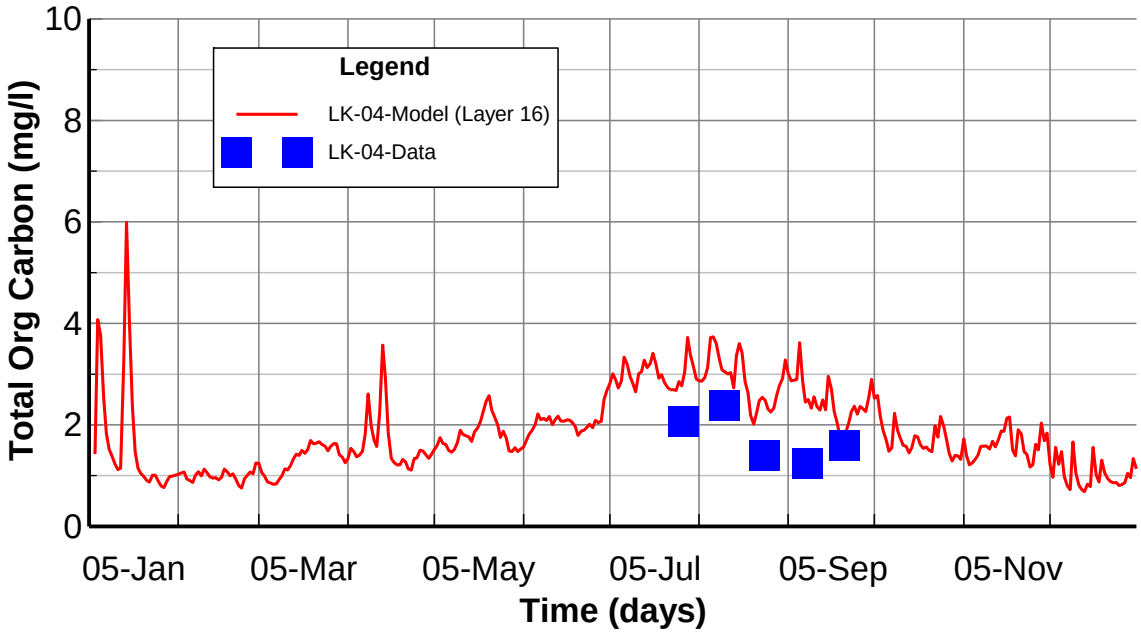


Figure **Error! No text of specified style in document.**.39. Surface Layer TOC Validation Plots at Station LK-04

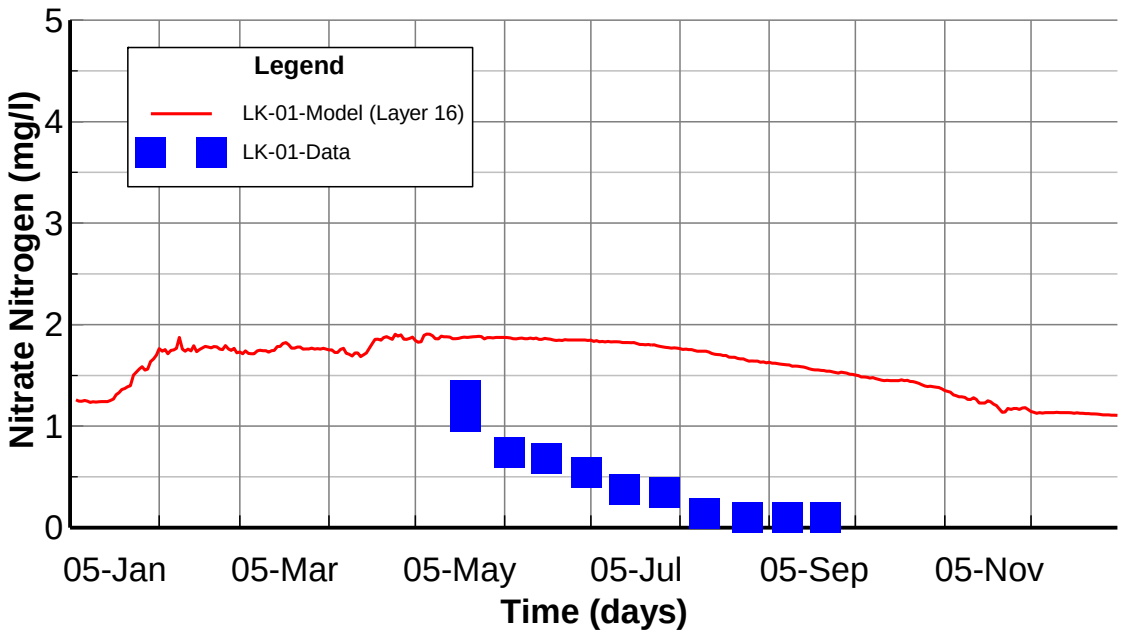


Figure **Error! No text of specified style in document.**.40. Surface Layer NO3 Validation Plots at Station LK-01

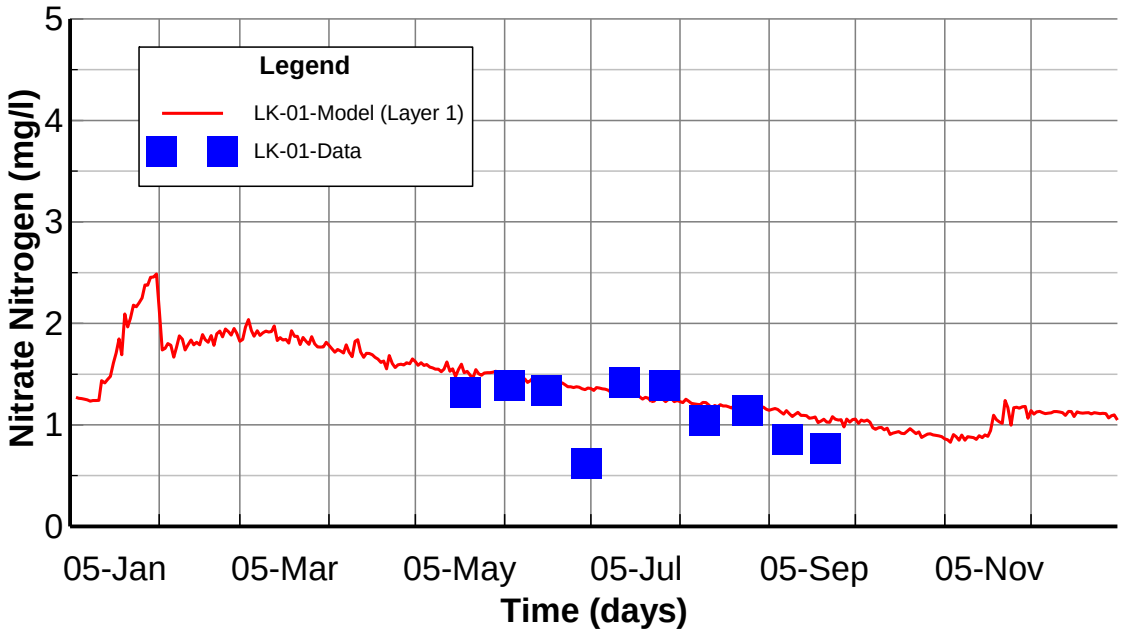


Figure **Error! No text of specified style in document.**.41. Bottom Layer NO3 Validation Plots at Station LK-01

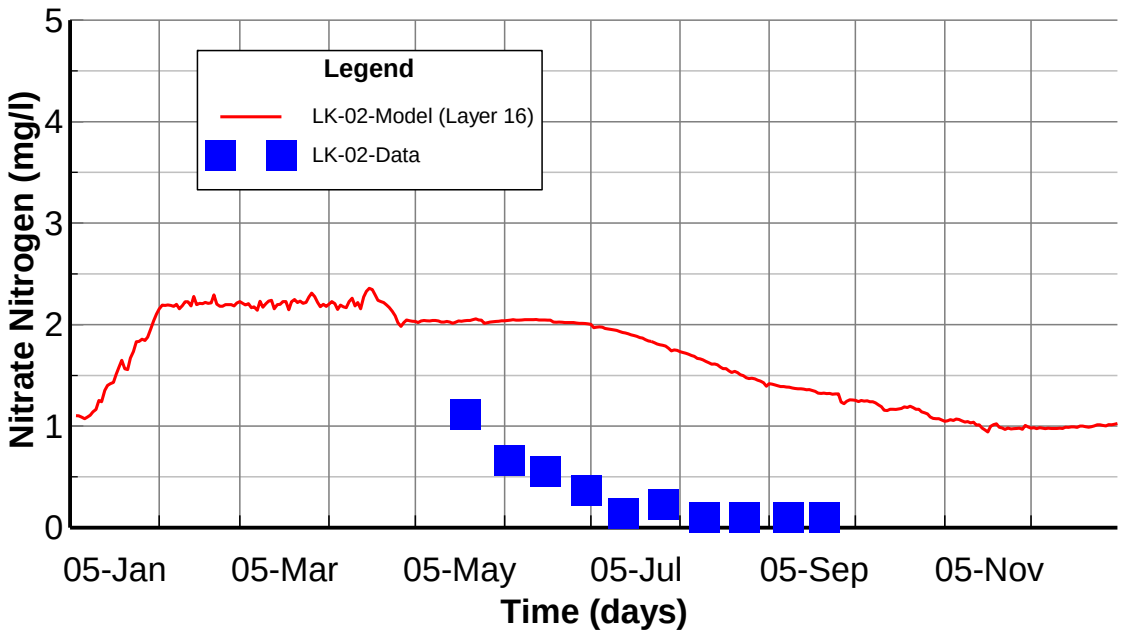


Figure **Error! No text of specified style in document.**.42. Surface Layer NO3 Validation Plots at Station LK-02

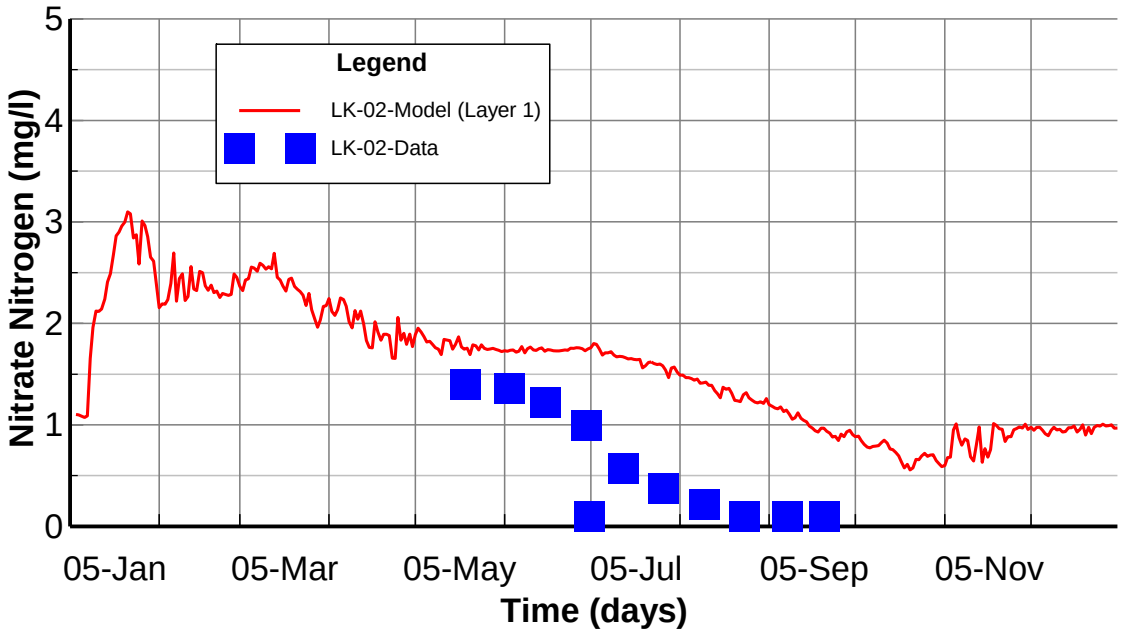


Figure **Error! No text of specified style in document.**.43. Bottom Layer NO3 Validation Plots at Station LK-02

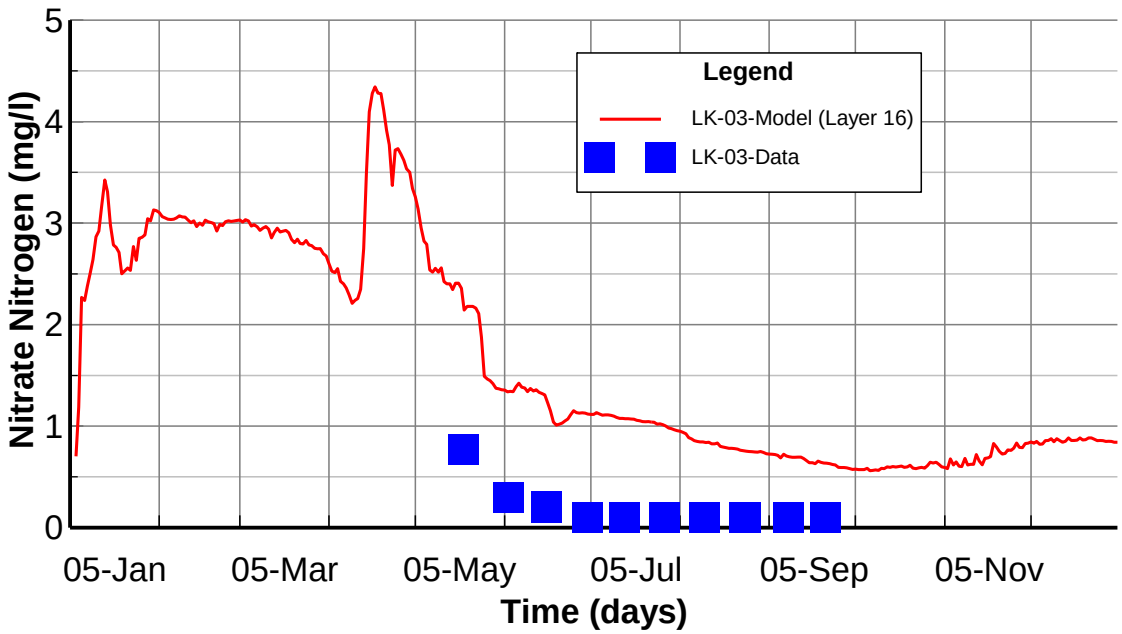


Figure **Error! No text of specified style in document.**.44. Surface Layer NO3 Validation Plots at Station LK-03

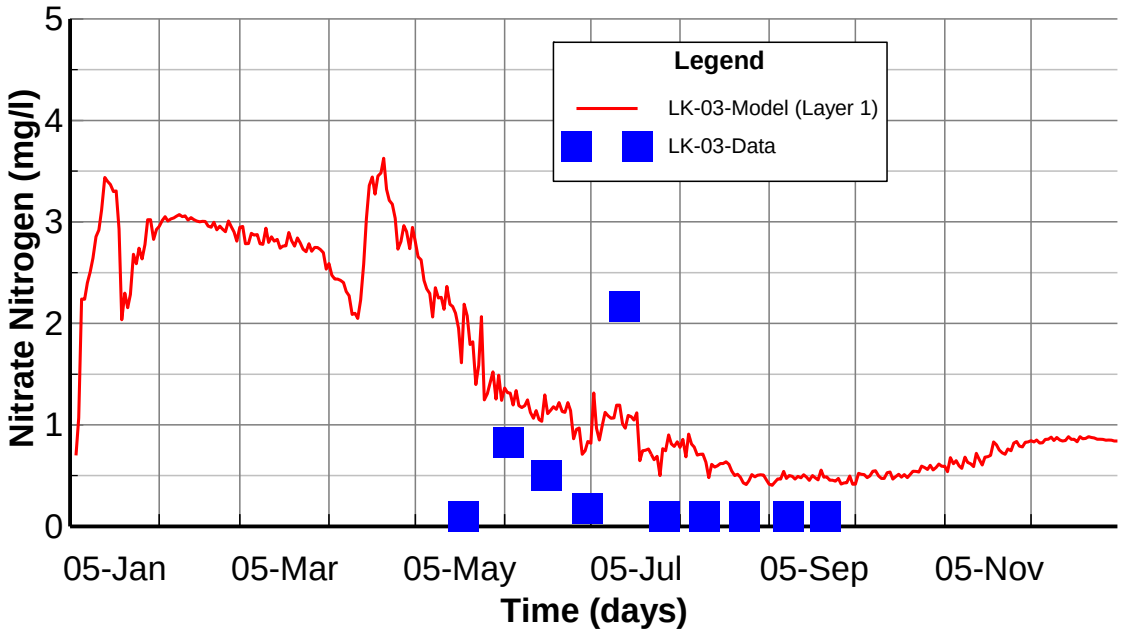


Figure **Error! No text of specified style in document.**.45. Bottom Layer NO3 Validation Plots at Station LK-03

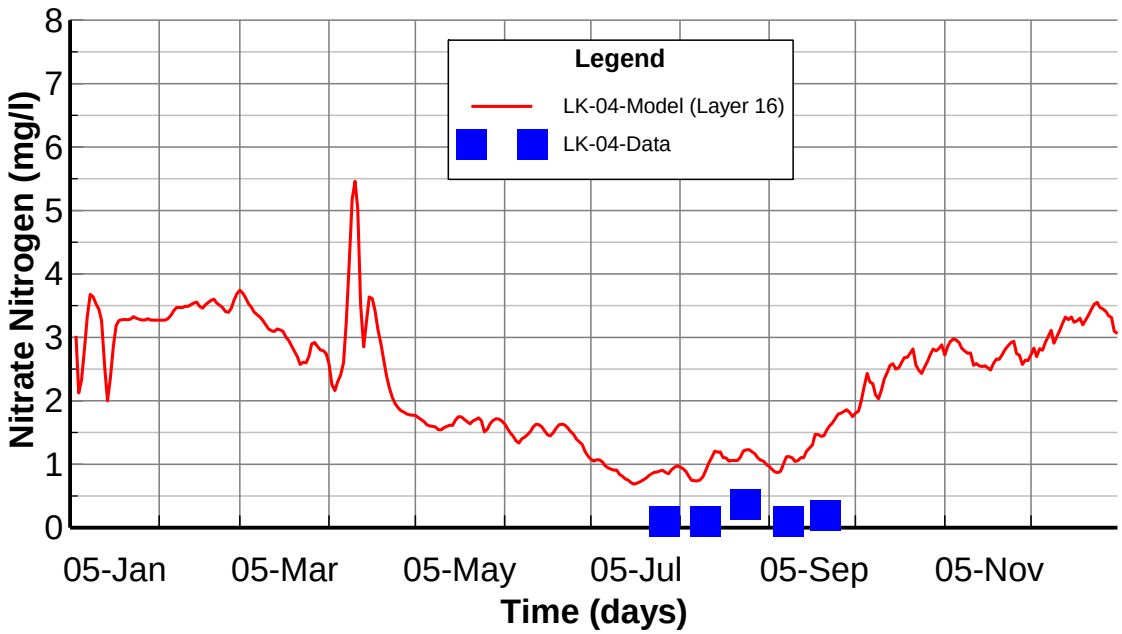


Figure **Error! No text of specified style in document.**.46. Surface Layer NO3 Validation Plots at Station LK-04

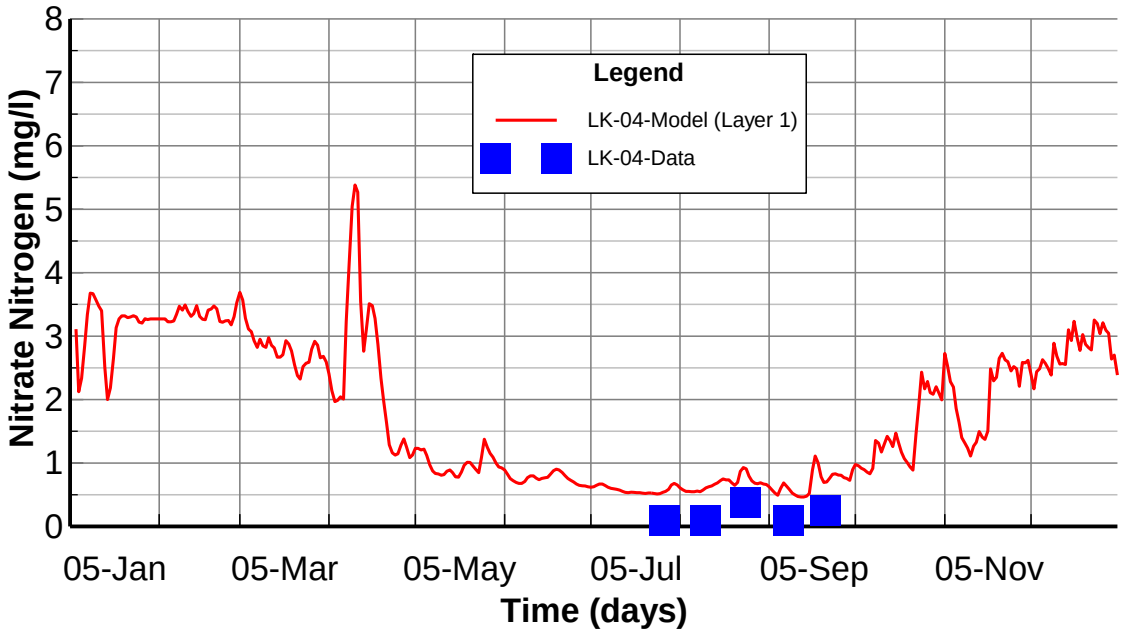


Figure **Error! No text of specified style in document.**.47. Bottom Layer NO3 Validation Plots at Station LK-04

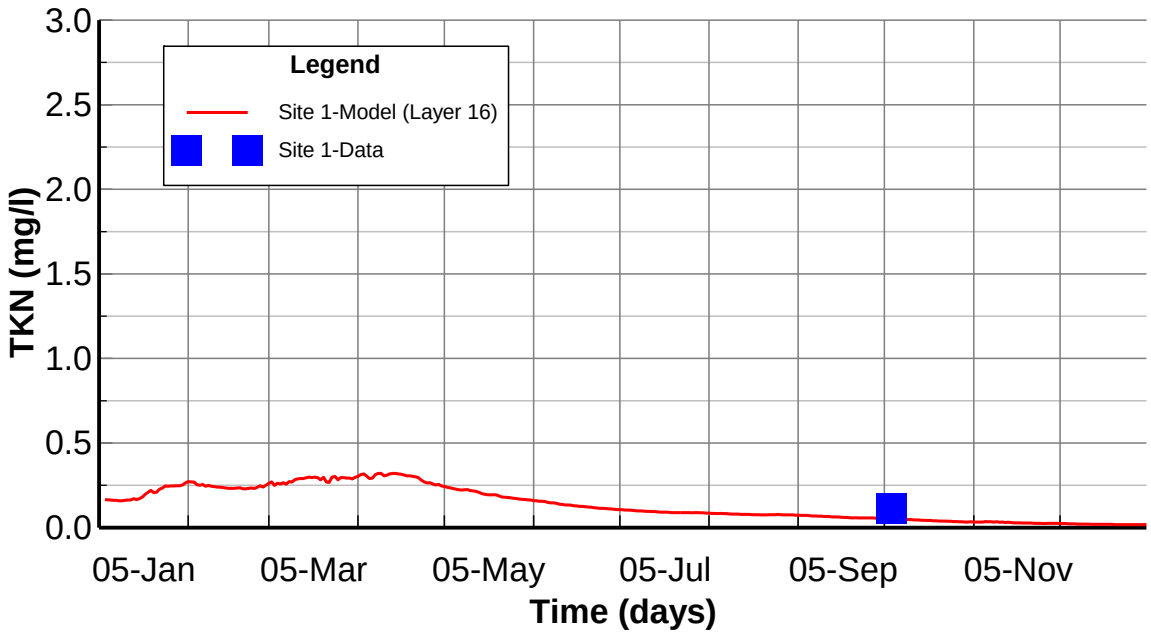


Figure **Error! No text of specified style in document.**.48. Surface Layer TKN Validation Plots at Station Site 1

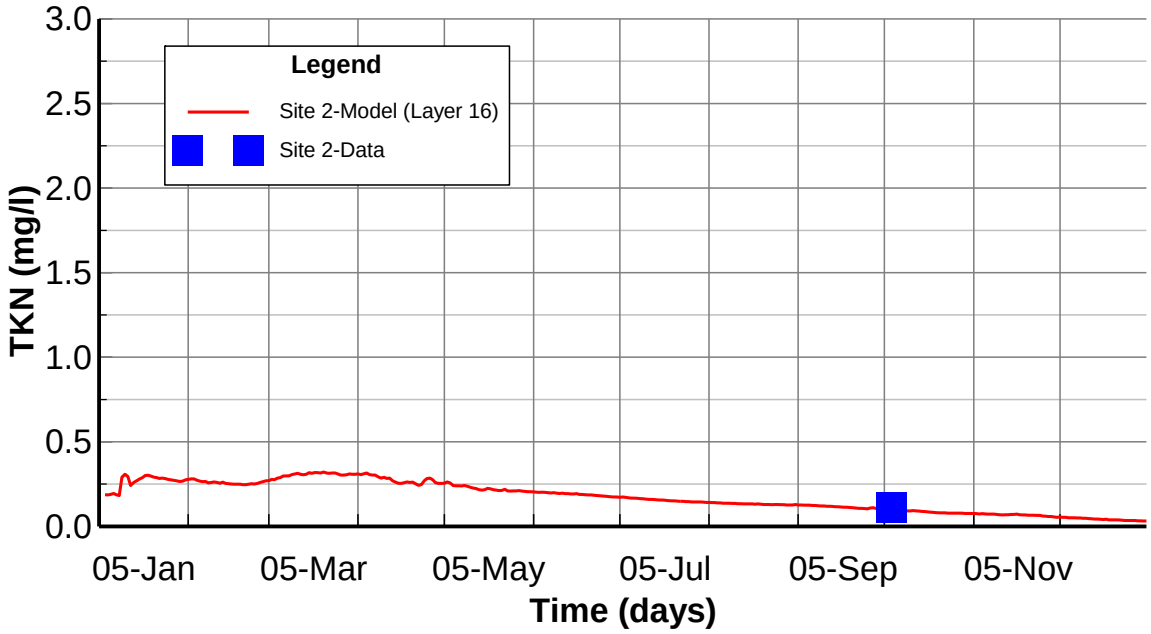


Figure **Error! No text of specified style in document.**.49. Surface Layer TKN Validation Plots at Station Site 2

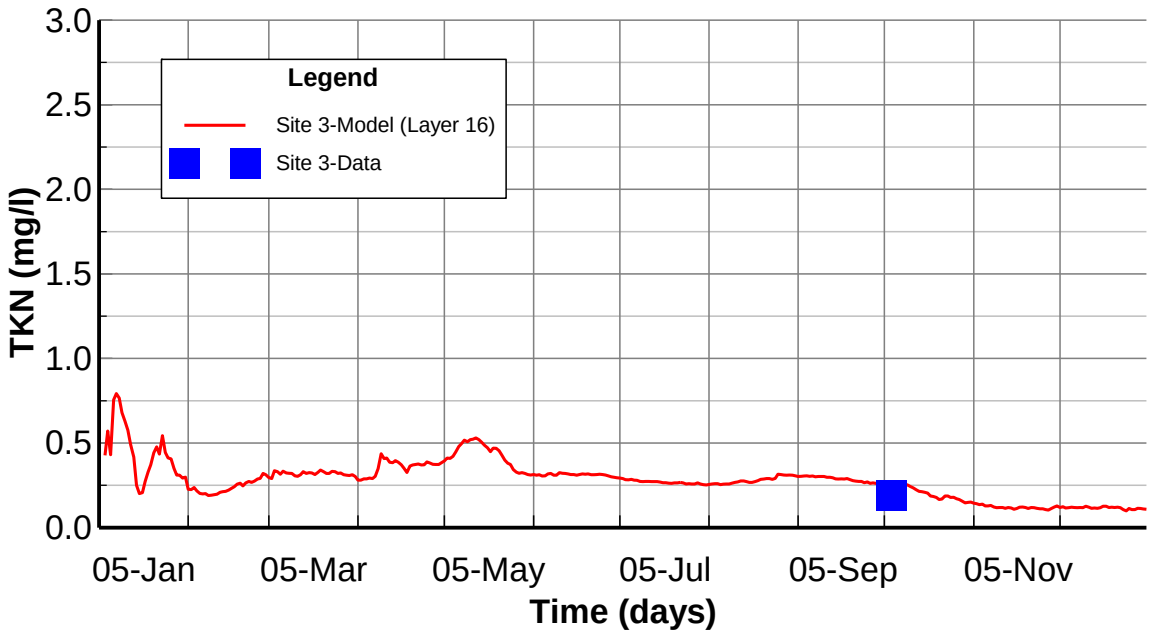


Figure **Error! No text of specified style in document.**.50. Surface Layer TKN Validation Plots at Station Site 3

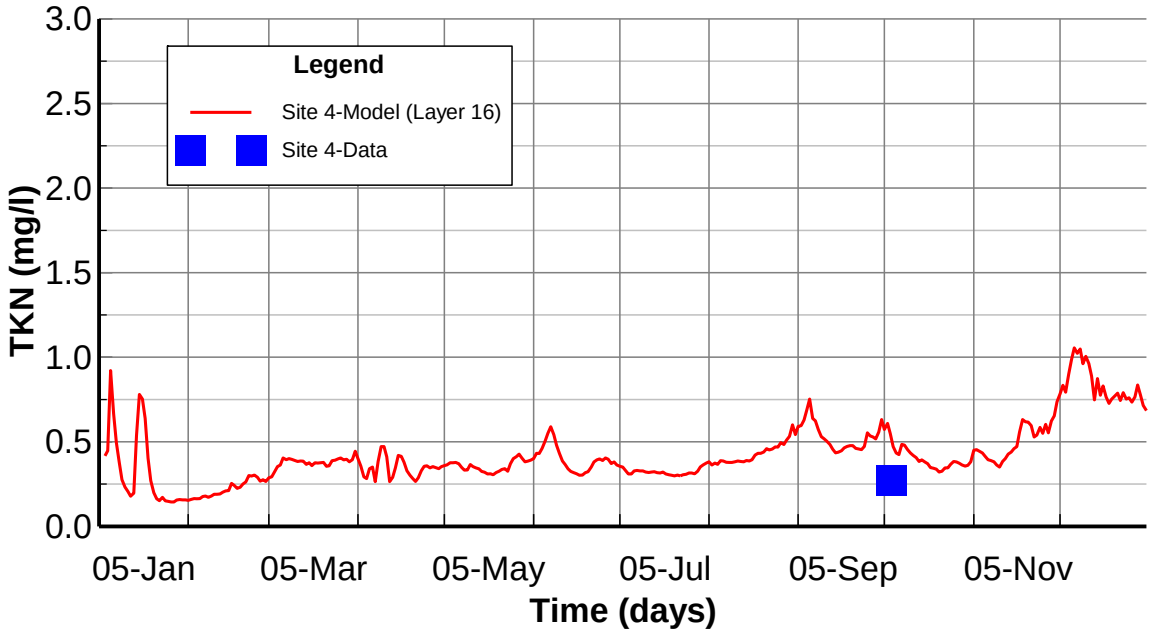


Figure **Error! No text of specified style in document.**.51. Surface Layer TKN Validation Plots at Station Site 4

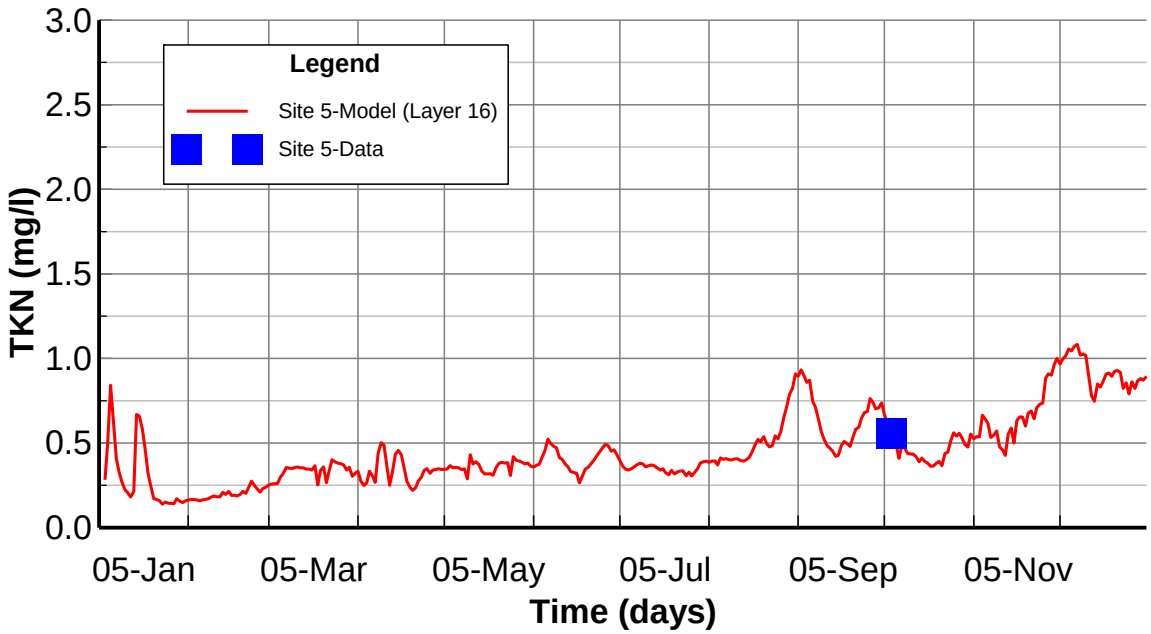


Figure **Error! No text of specified style in document.**.52. Surface Layer TKN Validation Plots at Station Site 5

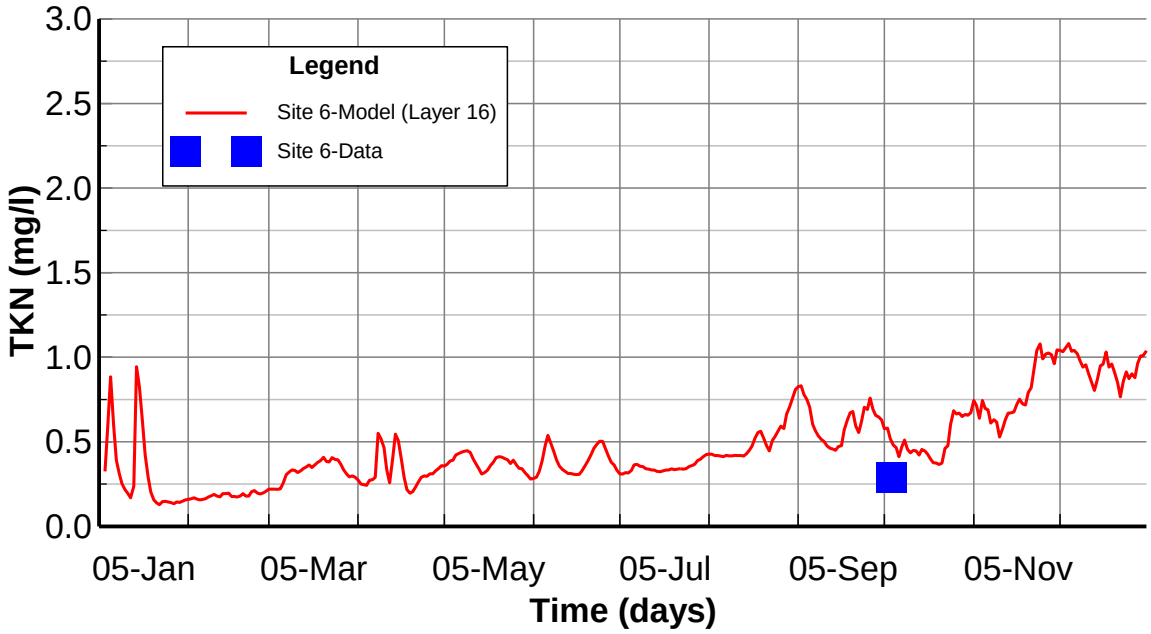


Figure **Error! No text of specified style in document.**.53. Surface Layer TKN Validation Plots at Station Site 6

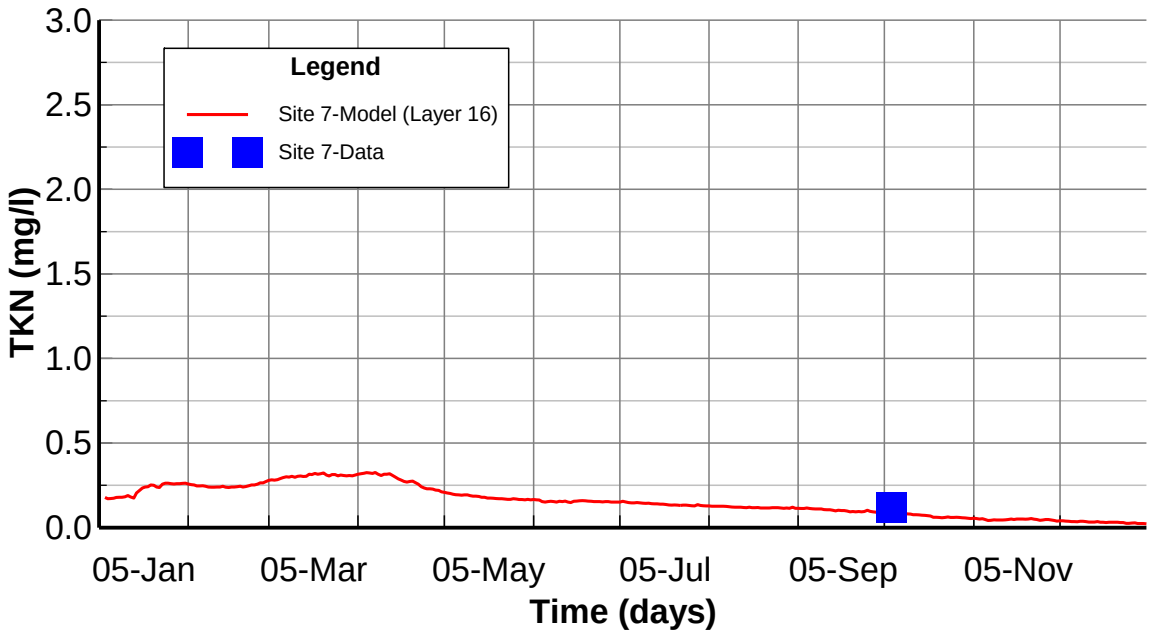


Figure **Error! No text of specified style in document.**.54. Surface Layer TKN Validation Plots at Station Site 7

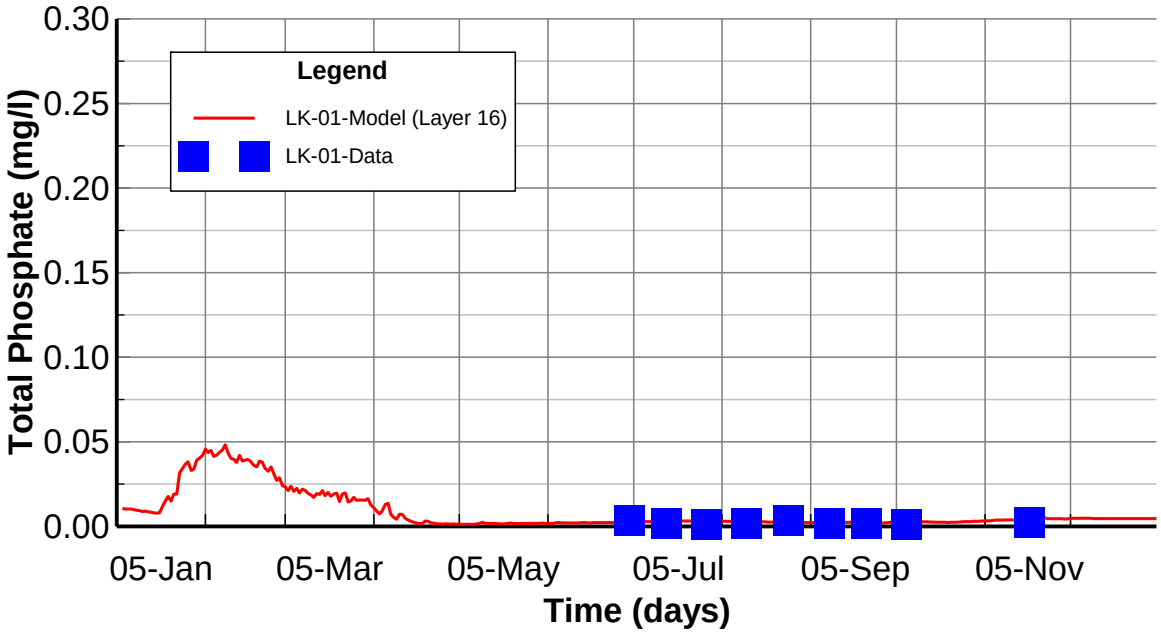


Figure **Error! No text of specified style in document.**.55. Surface Layer TPO4 Validation Plots at Station LK-01

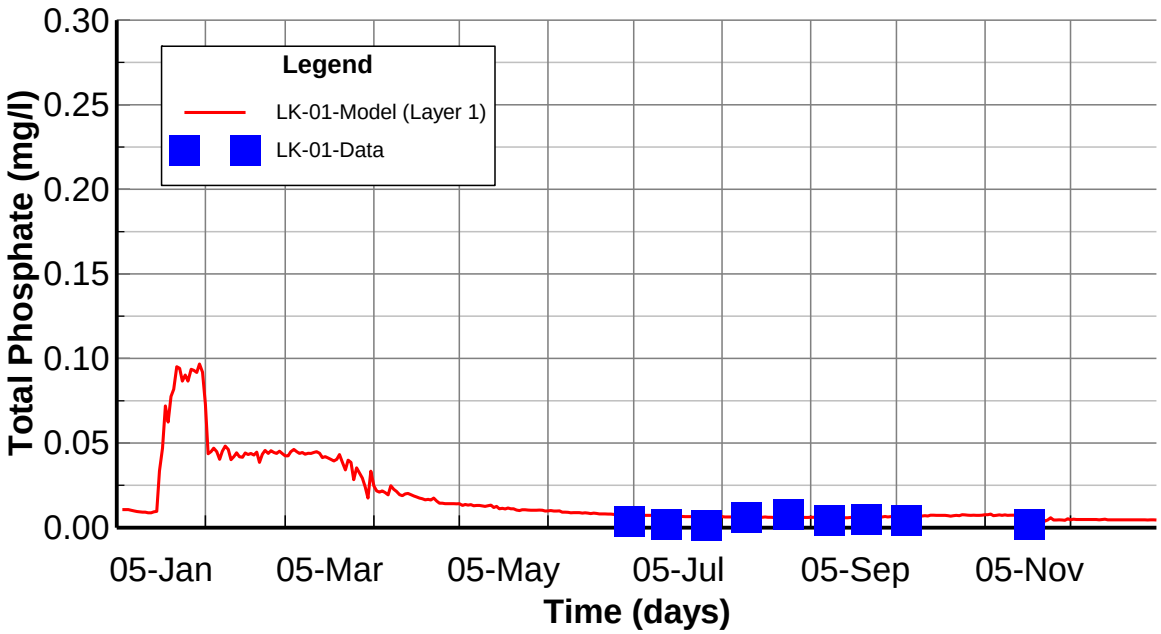


Figure **Error! No text of specified style in document.**.56. Bottom Layer TPO4 Validation Plots at Station LK-01

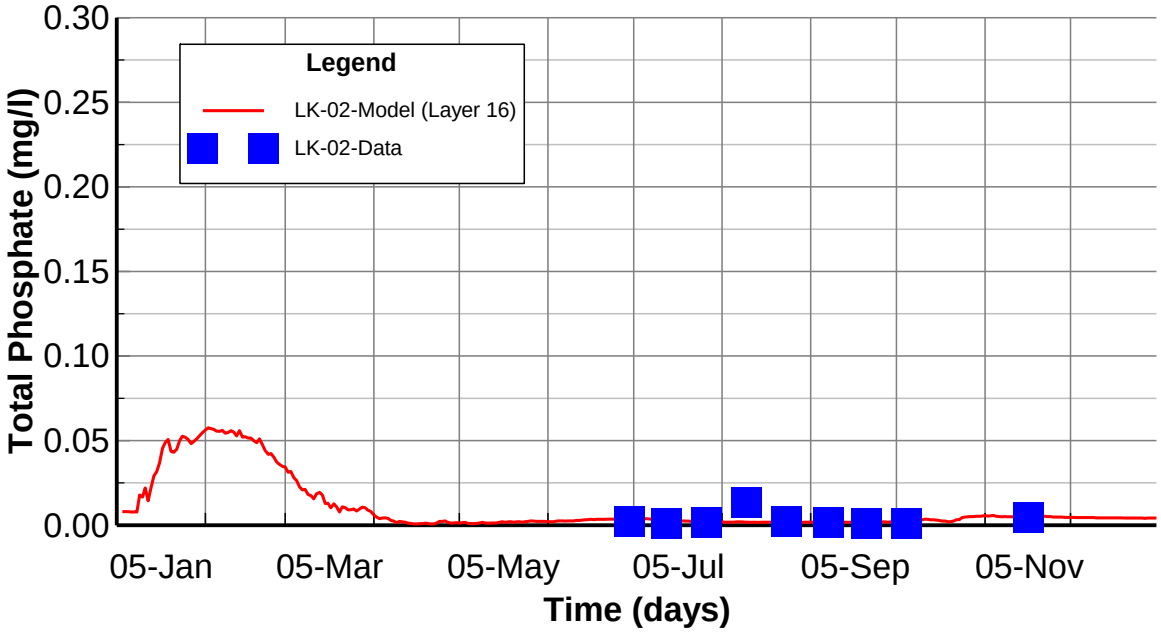


Figure **Error! No text of specified style in document.**.57. Surface Layer TPO4 Validation Plots at Station LK-02

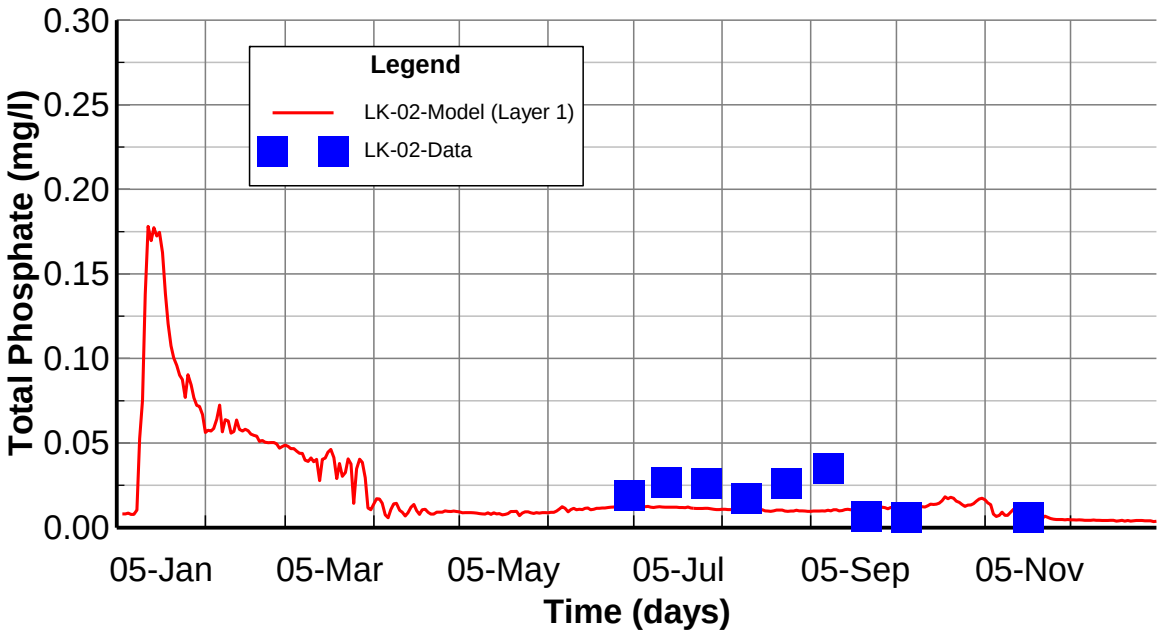


Figure **Error! No text of specified style in document.**.58. Bottom Layer TPO4 Validation Plots at Station LK-02

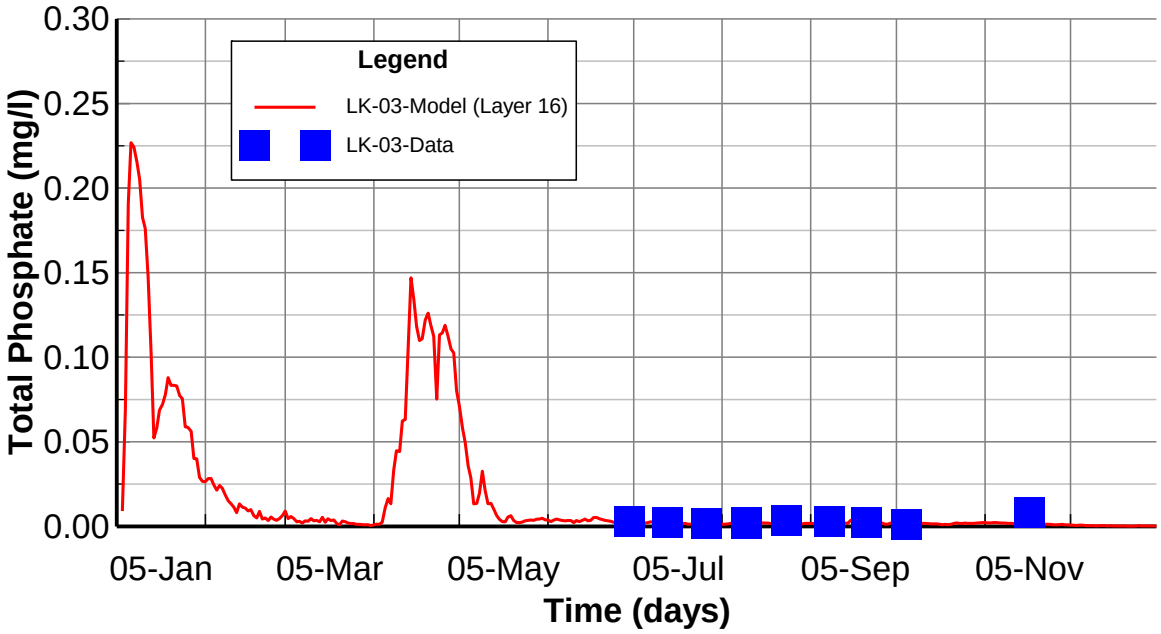


Figure **Error! No text of specified style in document.**.59. Surface Layer TPO4 Validation Plots at Station LK-03

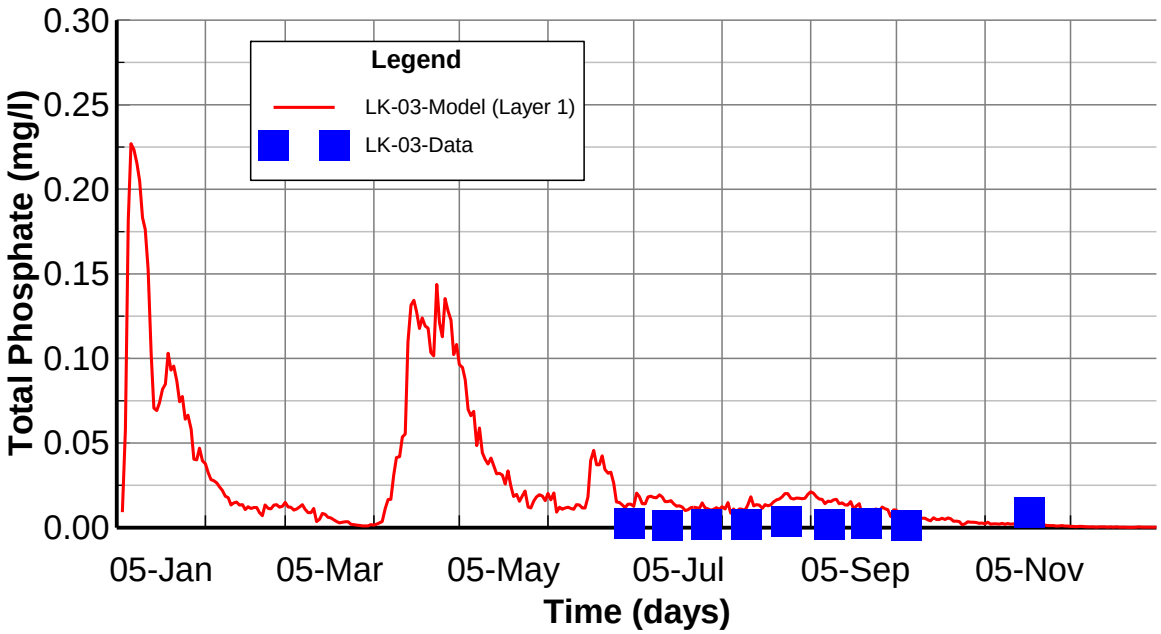


Figure **Error! No text of specified style in document.**.60. Bottom Layer TPO4 Validation Plots at Station LK-03

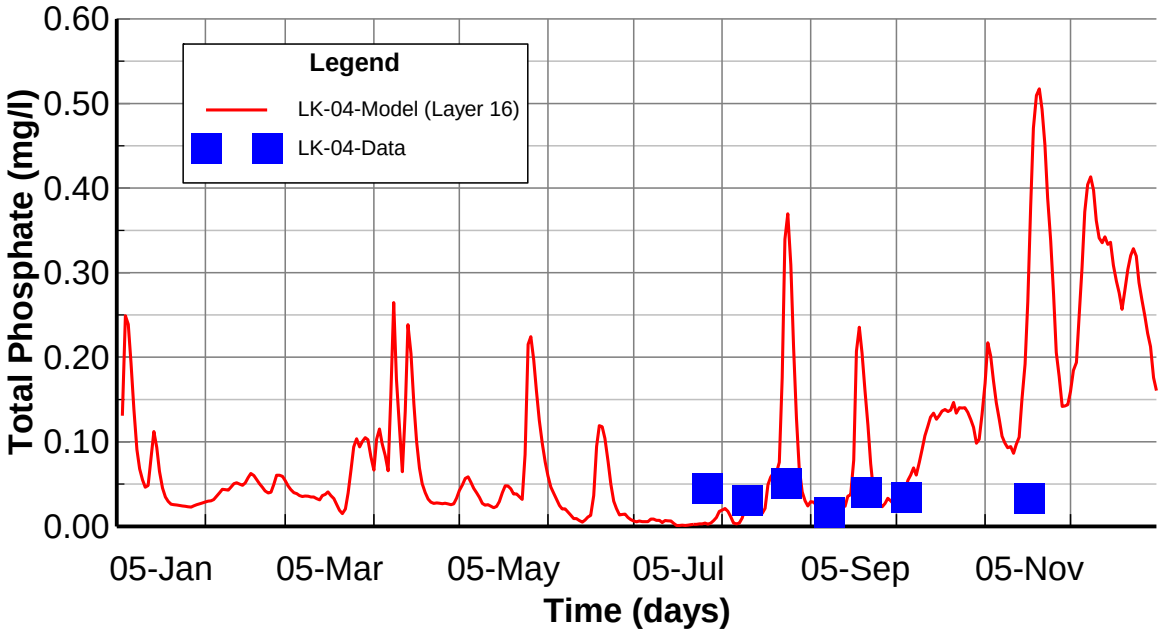


Figure **Error! No text of specified style in document.**.61. Surface Layer TPO4 Validation Plots at Station LK-04

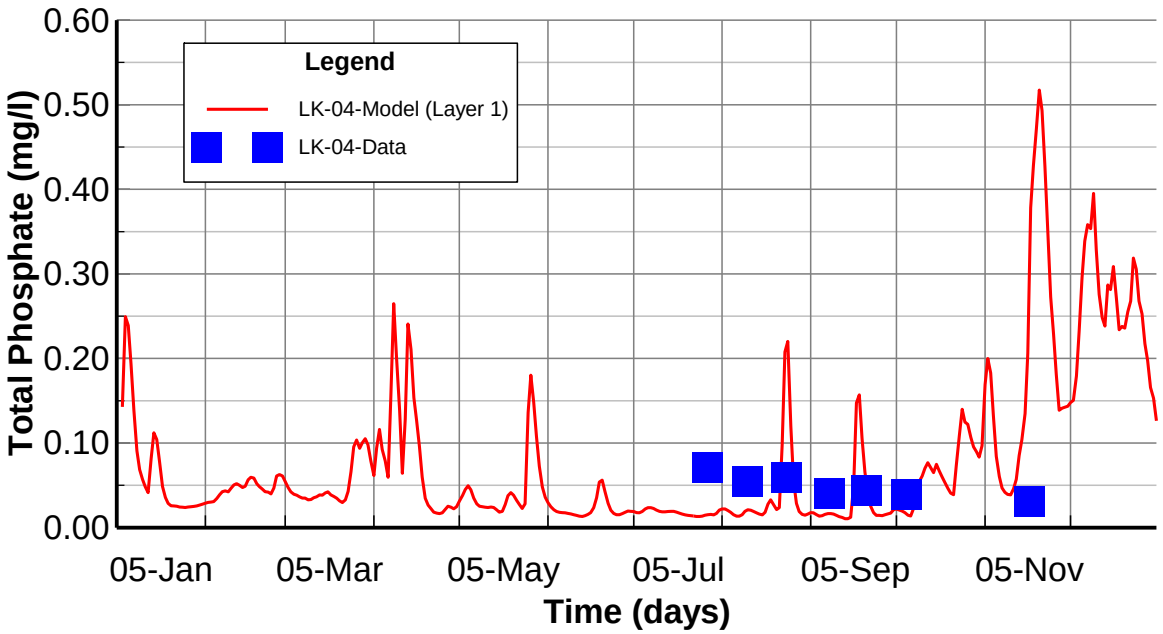


Figure **Error! No text of specified style in document.**.62. Bottom Layer TPO4 Validation Plots at Station LK-04

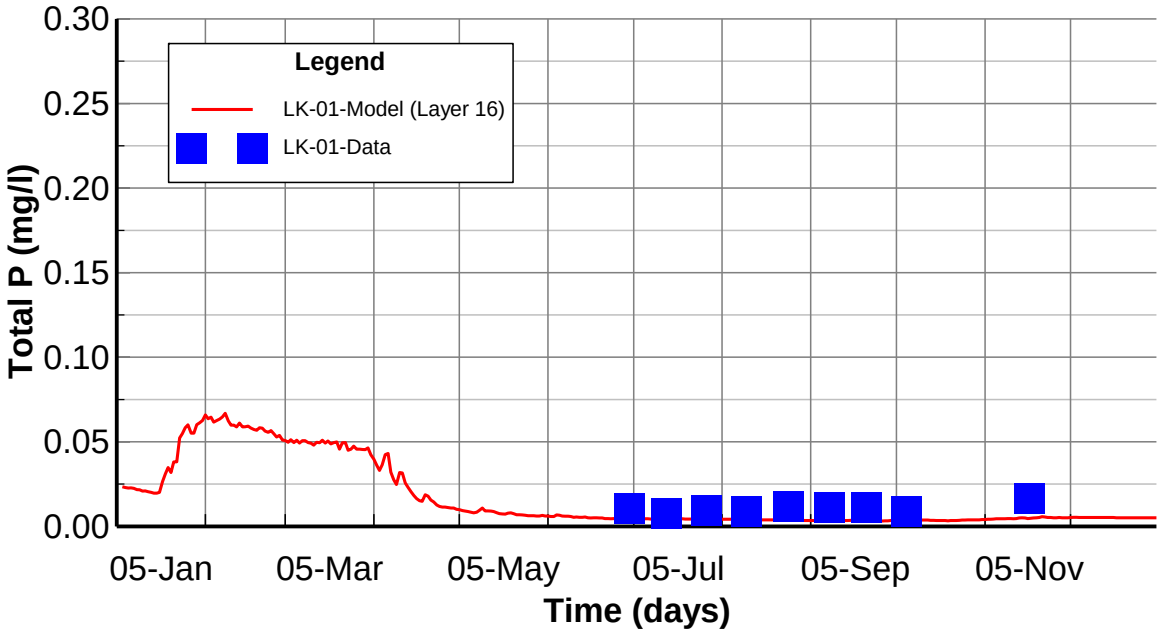


Figure **Error! No text of specified style in document.**.63. Surface Layer TP Validation Plots at Station LK-01

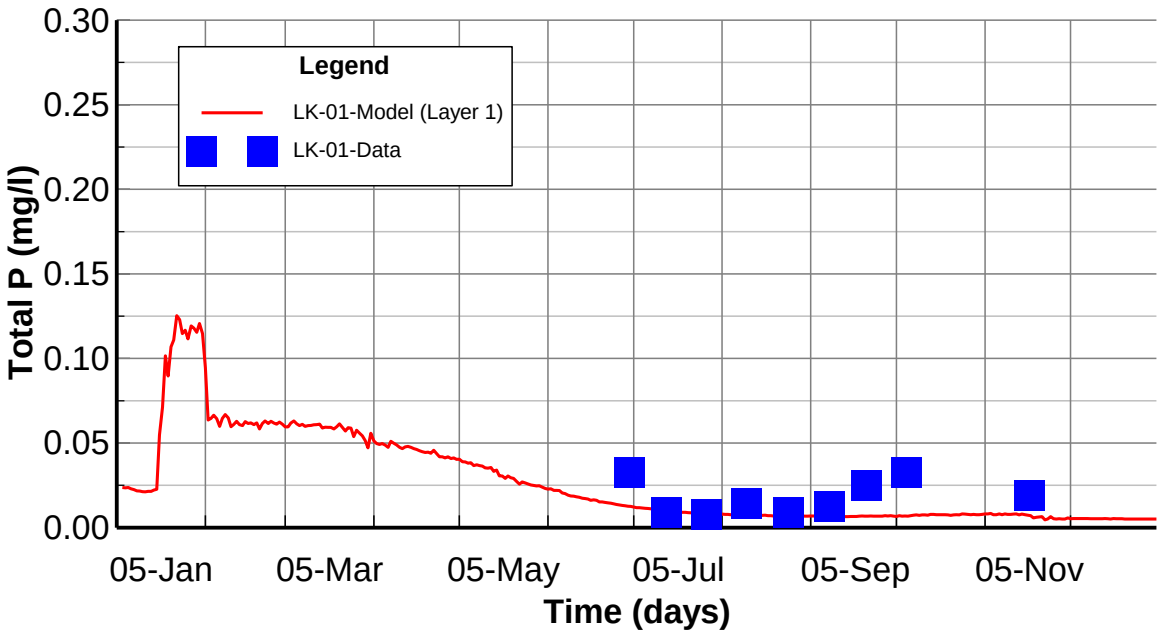


Figure **Error! No text of specified style in document.**.64. Bottom Layer TP Validation Plots at Station LK-01

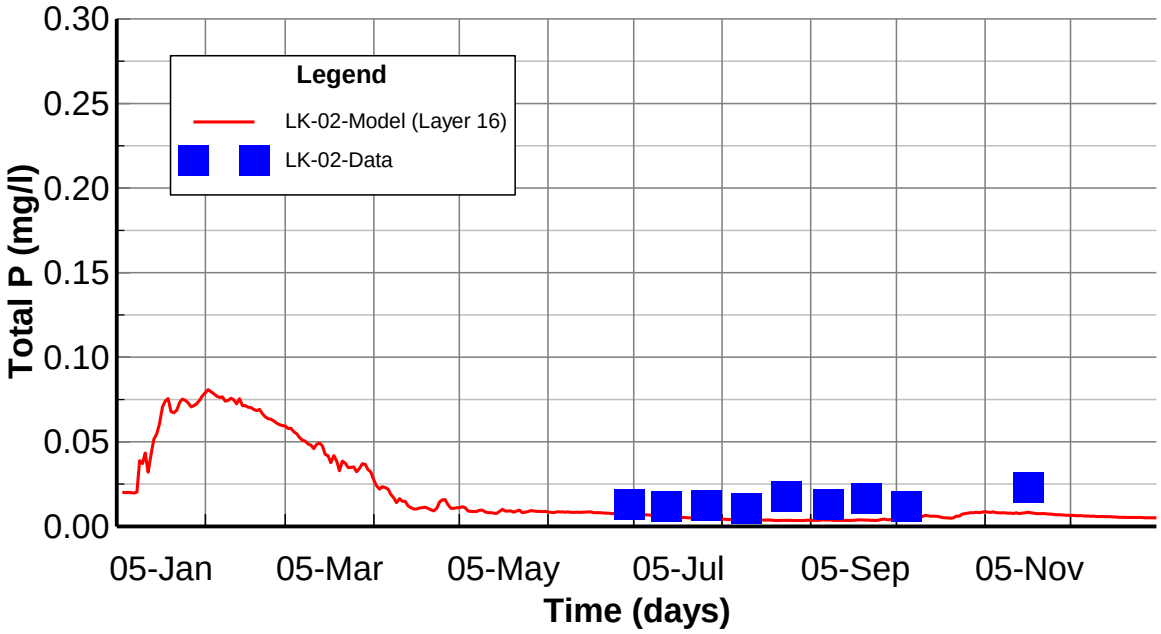


Figure **Error! No text of specified style in document.**.65. Surface Layer TP Validation Plots at Station LK-02

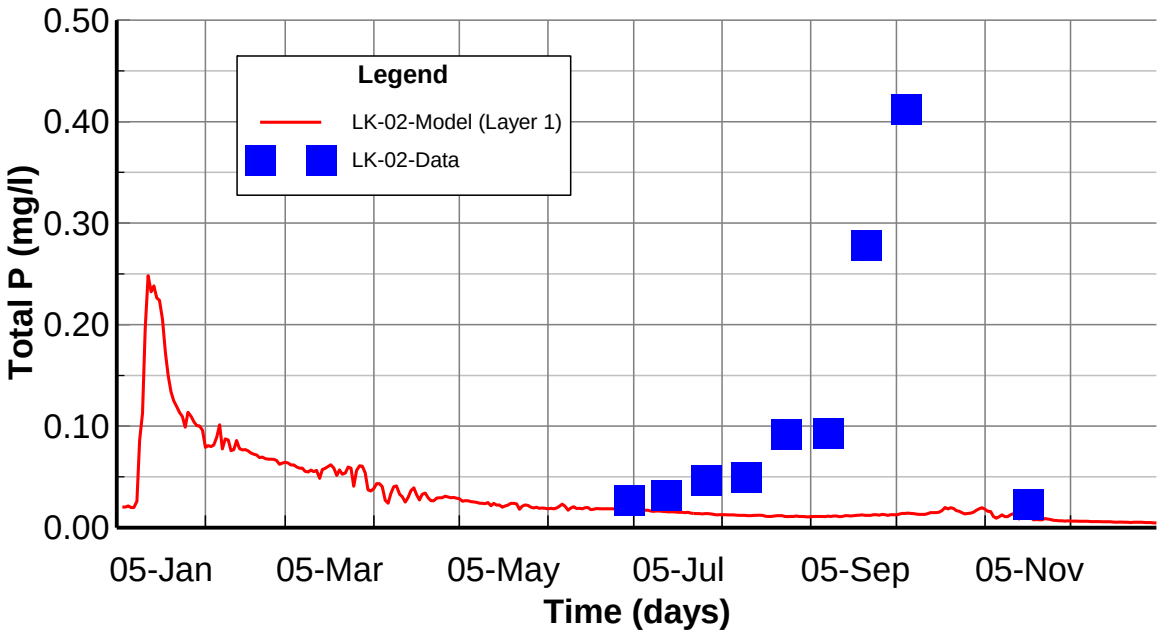


Figure **Error! No text of specified style in document.**.66. Bottom Layer TP Validation Plots at Station LK-02

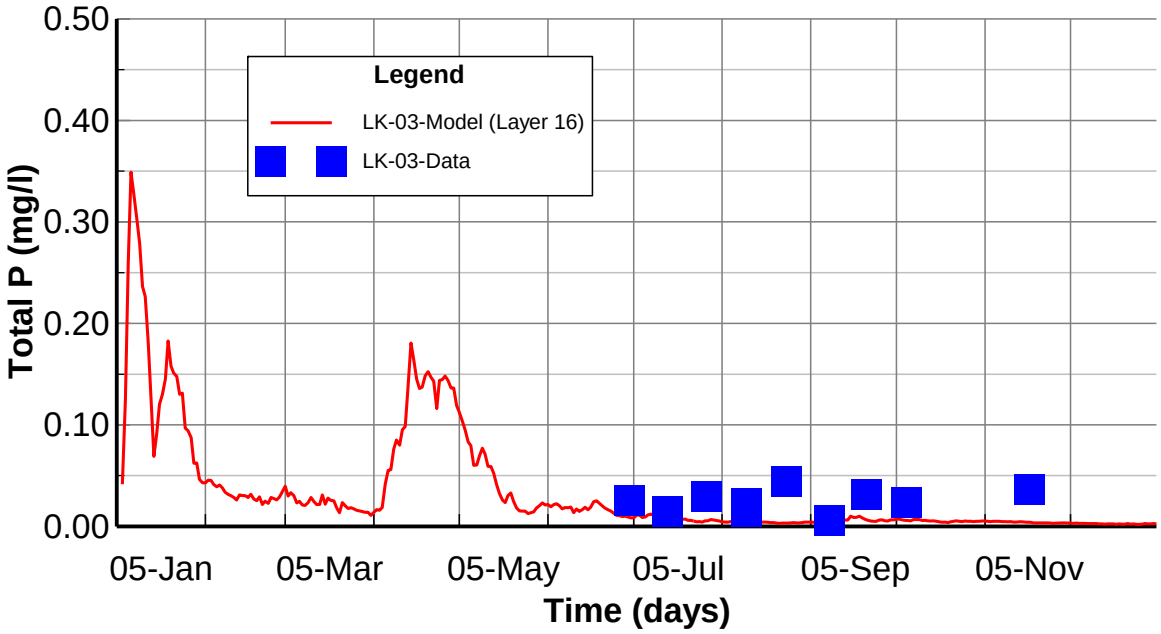


Figure **Error! No text of specified style in document.**.67. Surface Layer TP Validation Plots at Station LK-03

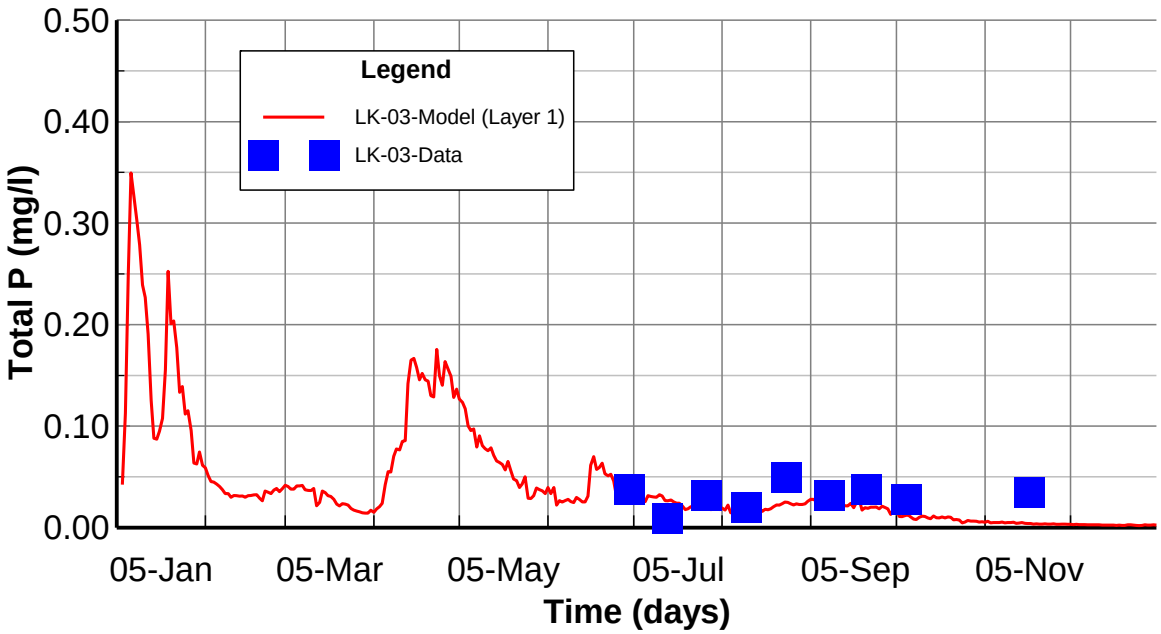


Figure **Error! No text of specified style in document.**.68. Bottom Layer TP Validation Plots at Station LK-03

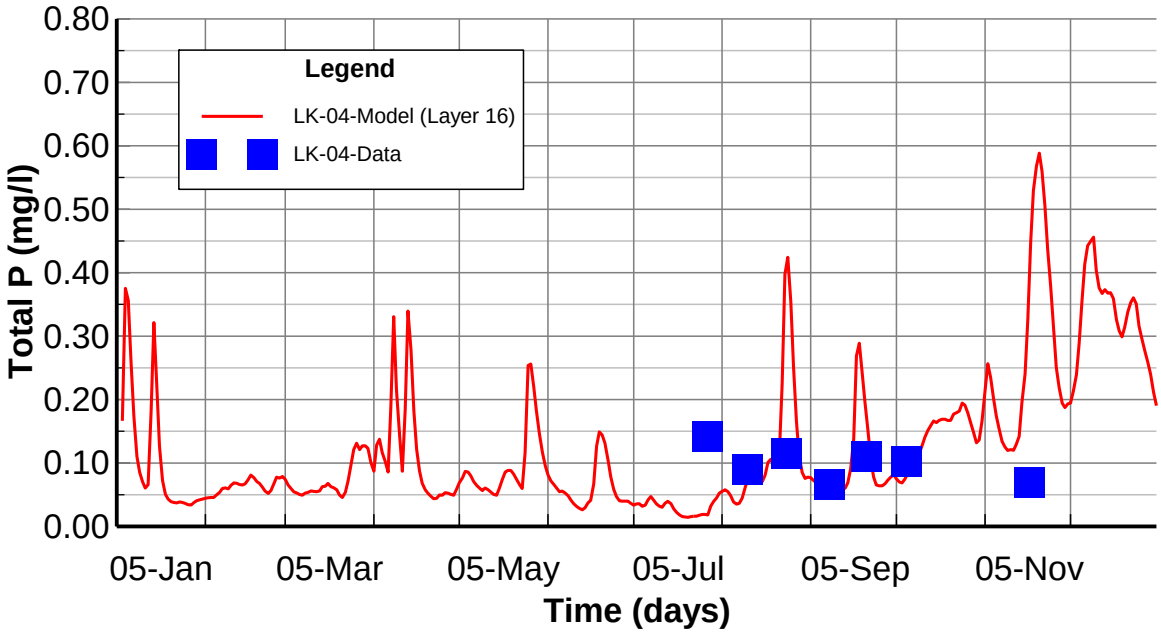


Figure **Error! No text of specified style in document.**.69. Surface Layer TP Validation Plots at Station LK-04

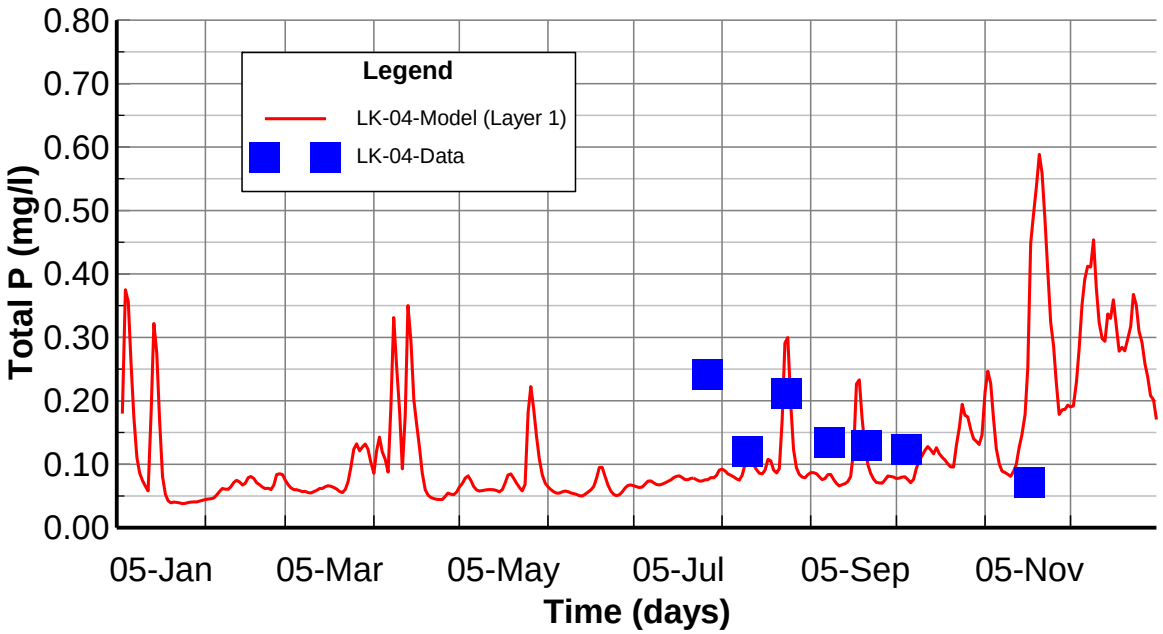


Figure **Error! No text of specified style in document.**.70. Bottom Layer TP Validation Plots at Station LK-04

APPENDIX L
VERTICAL PROFILE PLOTS FOR WATER QUALITY MODEL CALIBRATION AND VALIDATION OF WATER TEMPERATURE

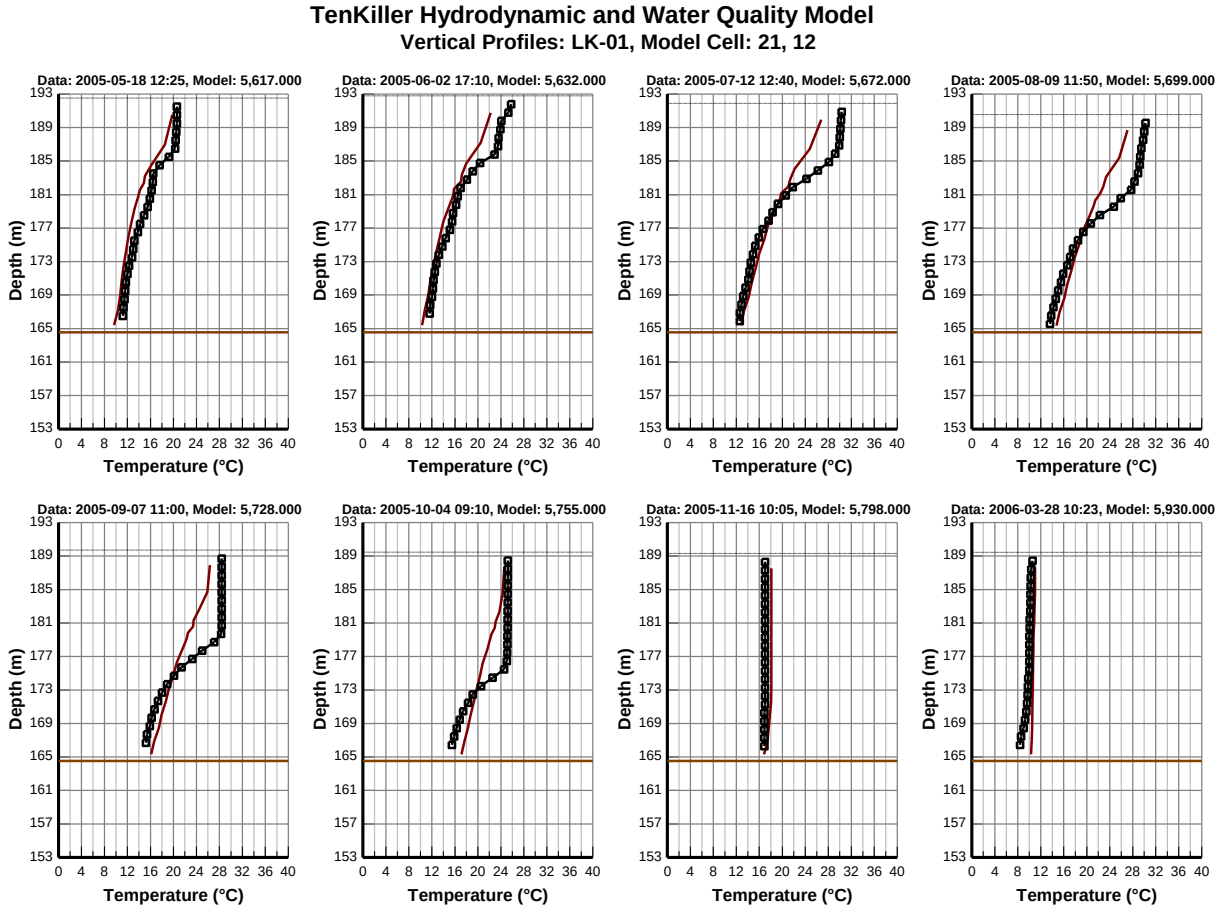


Figure **Error! No text of specified style in document.**.1. Water Temperature Vertical Profile Comparison Plot at Station LK-01 (18 May 2005 – 28 March 2006) (page 2-1)

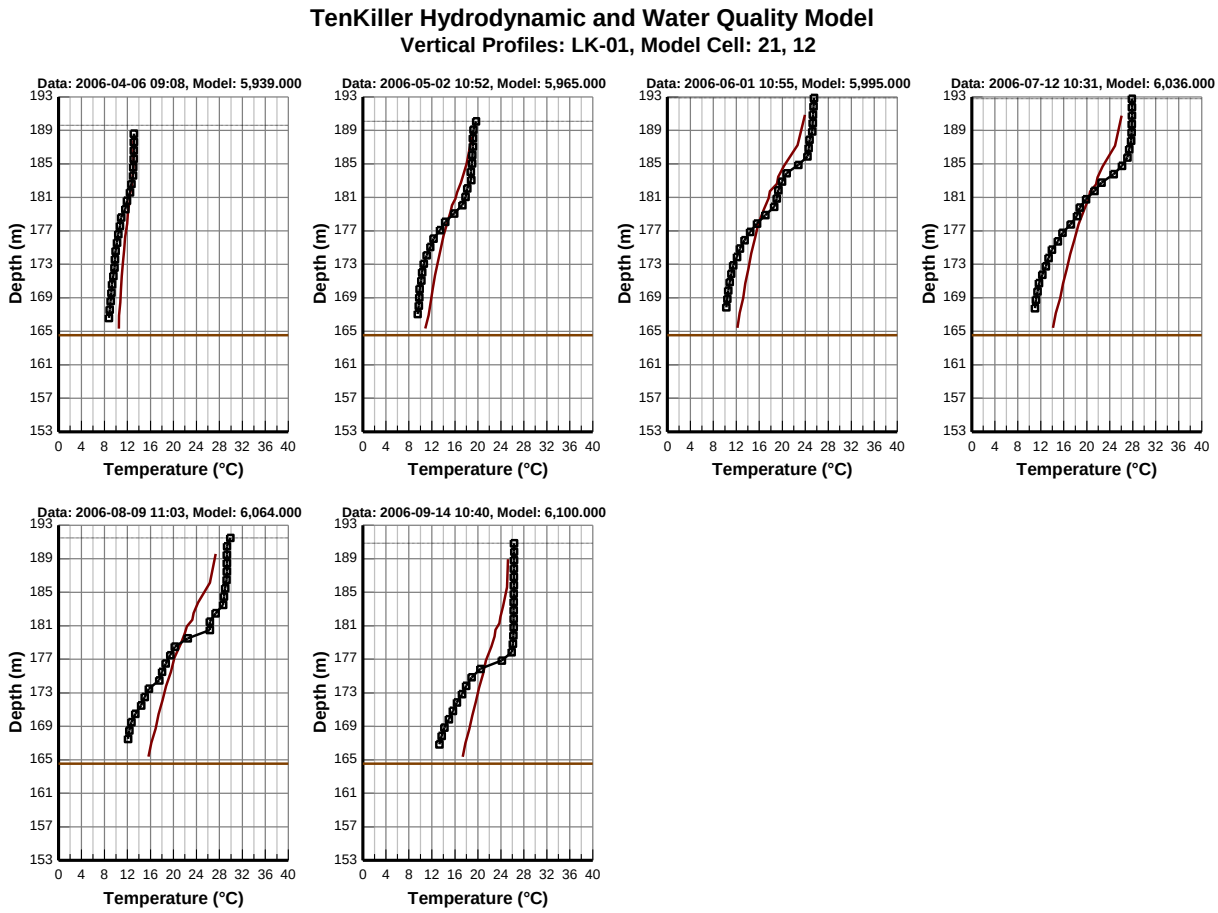


Figure **Error! No text of specified style in document.**.2. Water Temperature Vertical Profile Comparison Plot at Station LK-01 (6 April 2006 – 14 September 2006) (page 2-2)

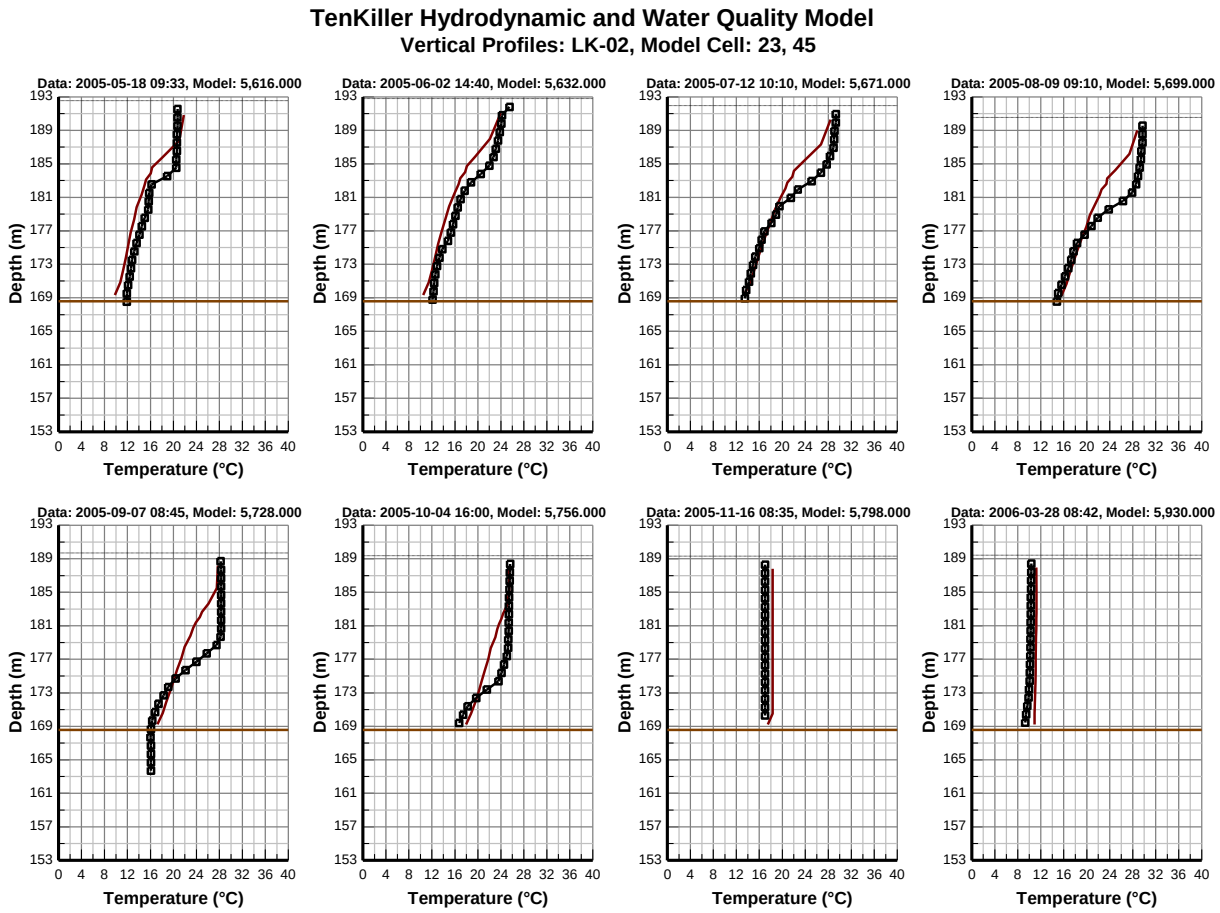


Figure **Error! No text of specified style in document.**.3. Water Temperature Vertical Profile Comparison Plot at Station LK-02 (18 May 2005 – 28 March 2006) (page 2-1)

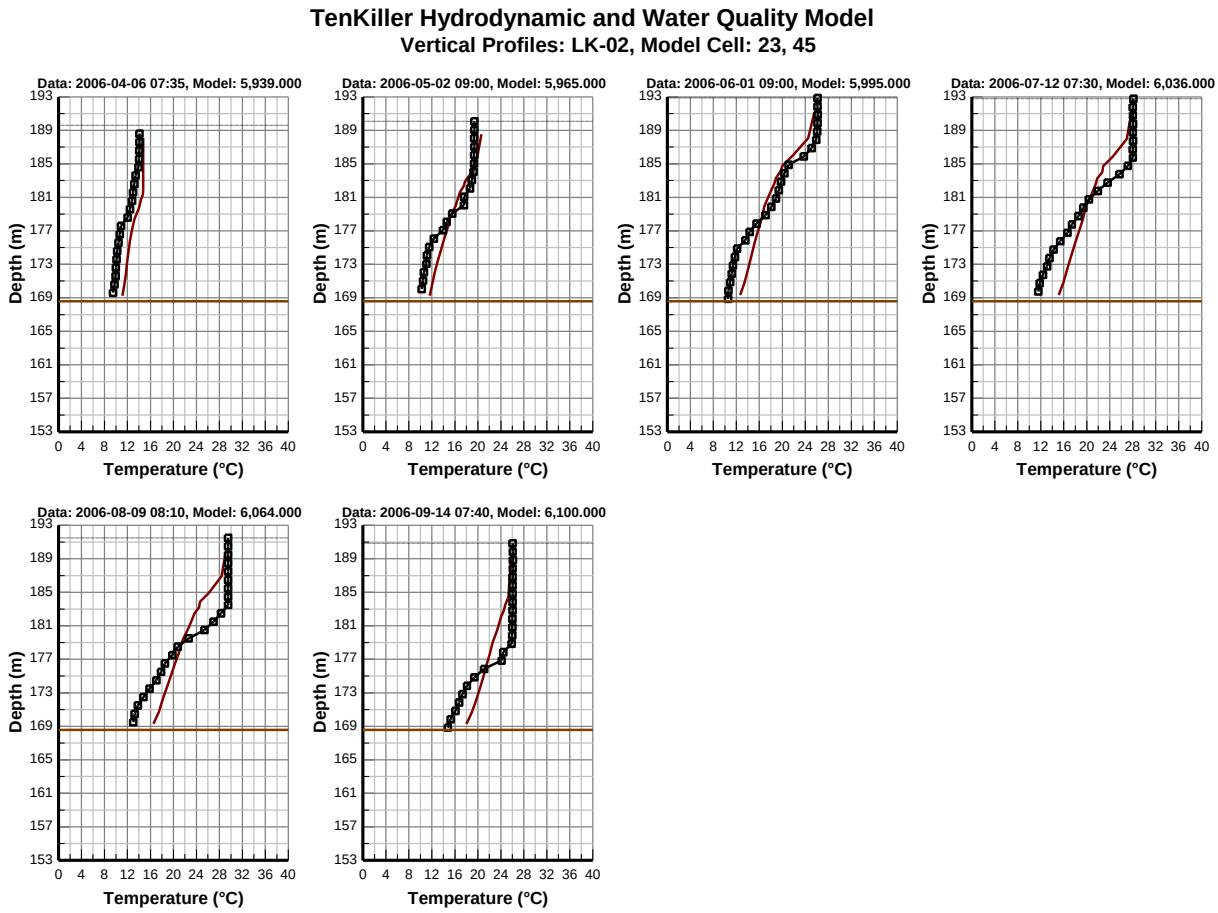


Figure **Error! No text of specified style in document.**.4. Water Temperature Vertical Profile Comparison Plot at Station LK-02 (6 April 2006 – 14 September 2006) (page 2-2)

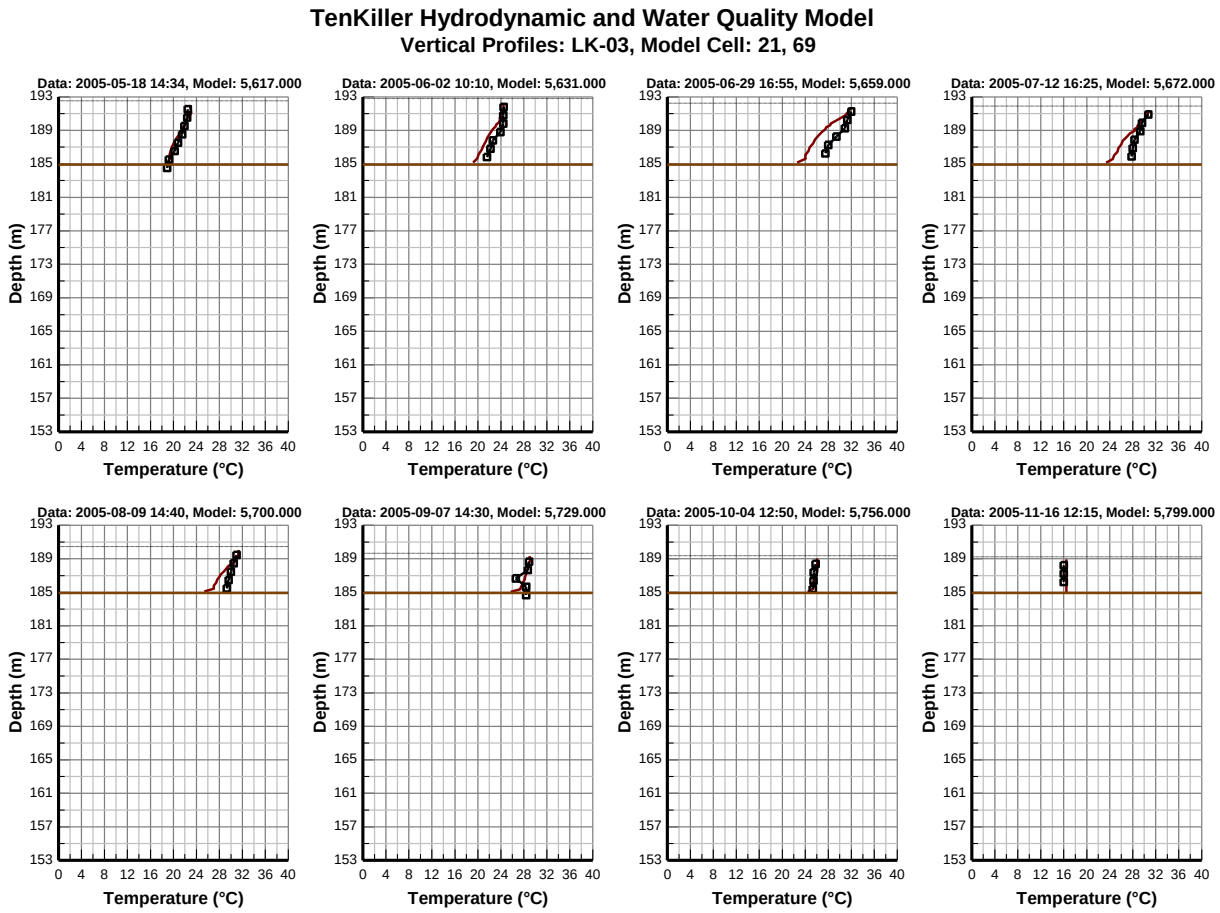


Figure **Error! No text of specified style in document.**.5. Water Temperature Vertical Profile Comparison Plot at Station LK-03 (18 May 2005 – 16 November 2005) (page 2-1)

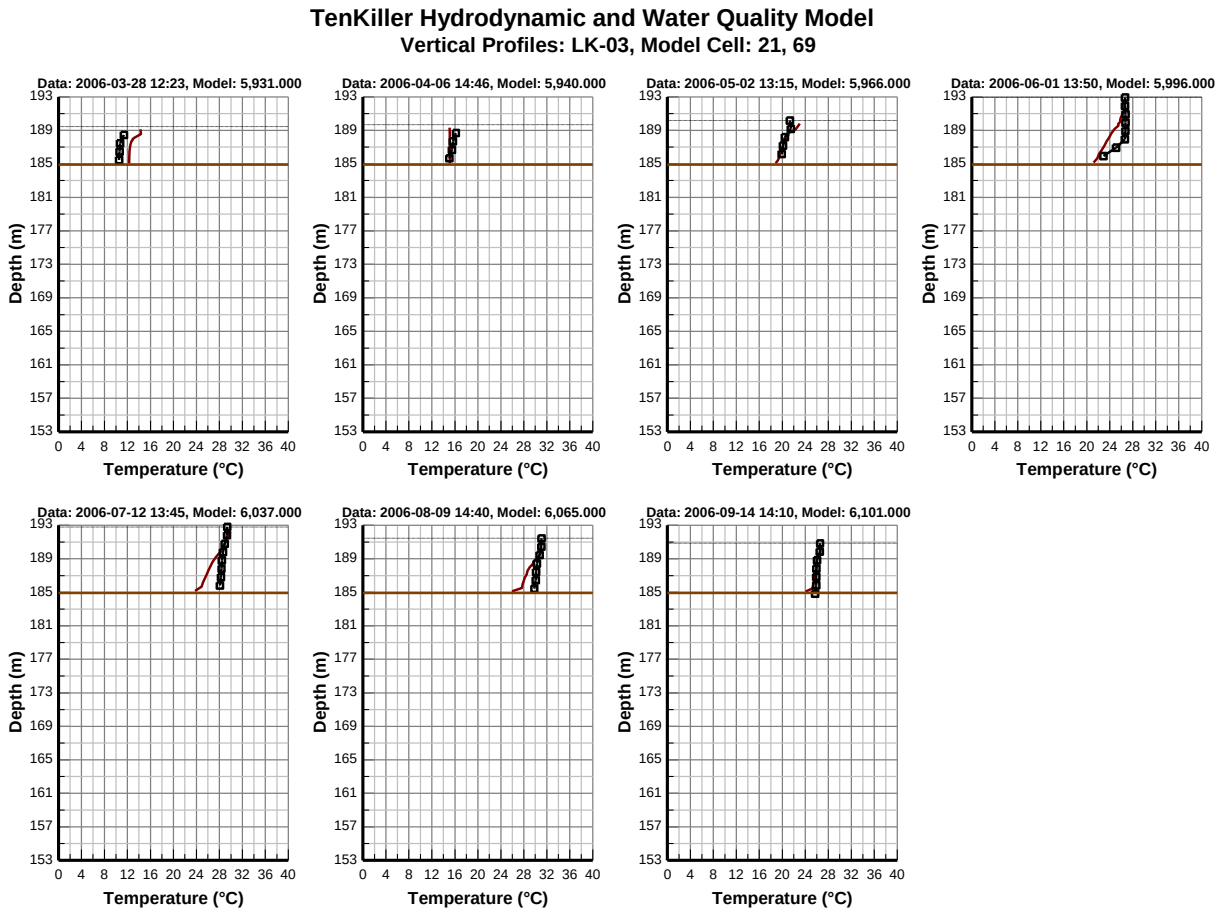


Figure **Error! No text of specified style in document.**.6. Water Temperature Vertical Profile Comparison Plot at Station LK-03 (28 March 2006 – 14 September 2006) (page 2-2)

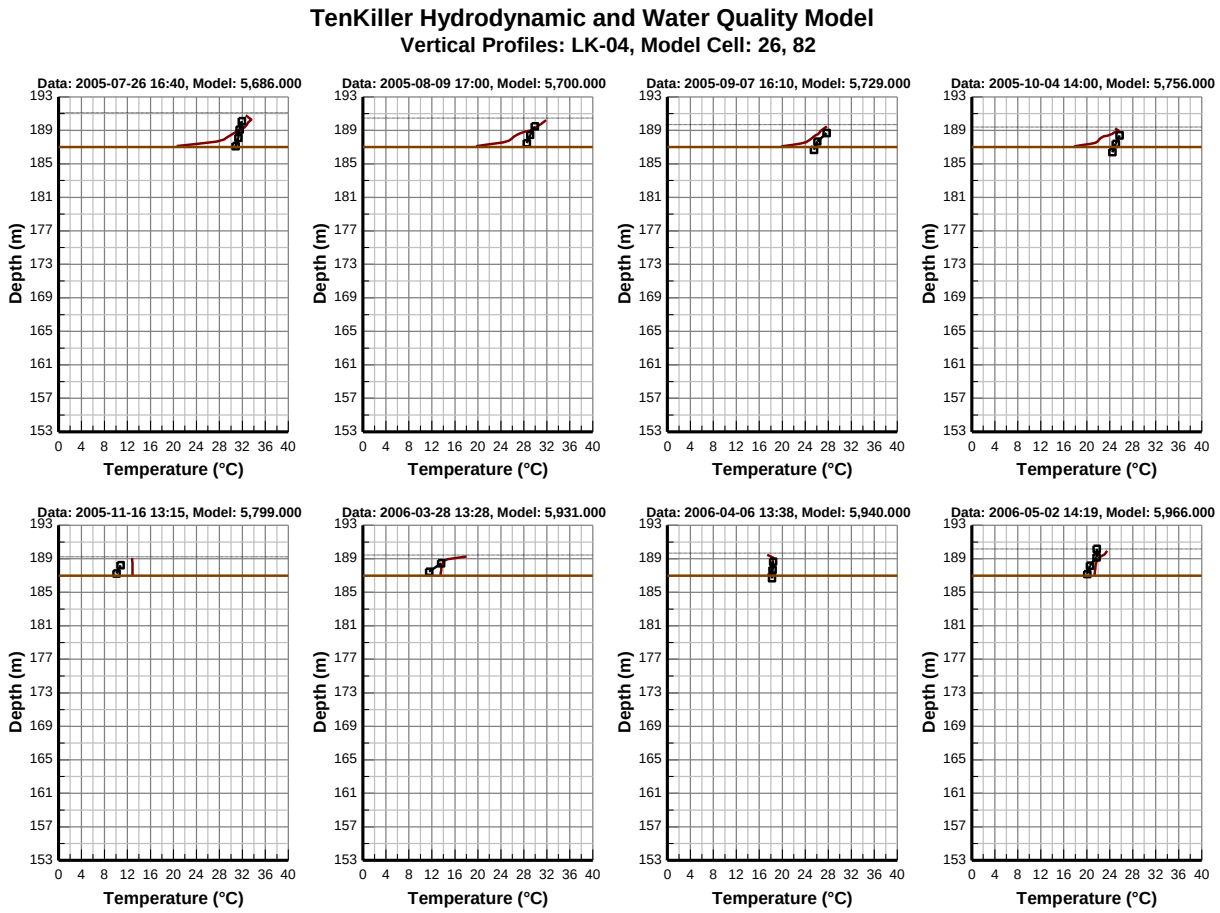


Figure **Error! No text of specified style in document.**.7. Water Temperature Vertical Profile Comparison Plot at Station LK-04 (26 July 2005 – 2 May 2006) (page 2-1)

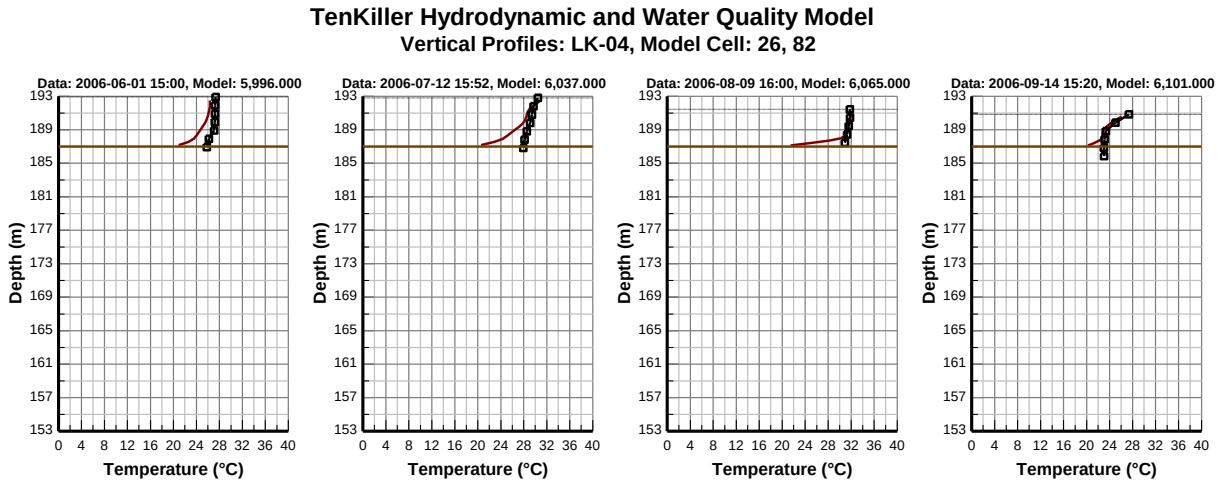


Figure **Error! No text of specified style in document.**.8. Water Temperature Vertical Profile Comparison Plot at Station LK-04 (1 June 2006 – 14 September 2006) (page 2-2)

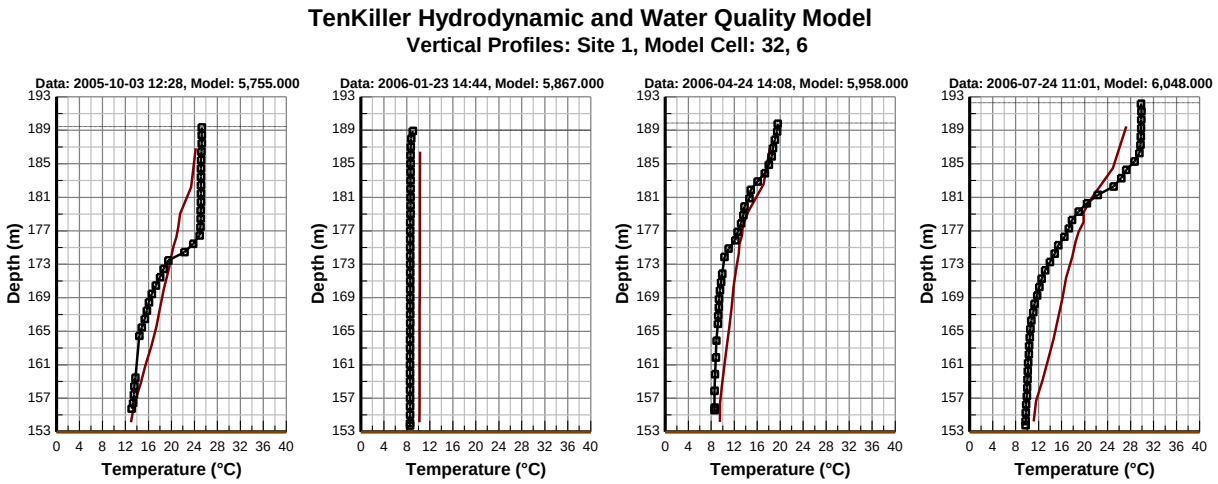


Figure **Error! No text of specified style in document.**.9. Water Temperature Vertical Profile Comparison Plot at Station Site 1 (3 October 2005 – 24 July 2006) (page 1-1)

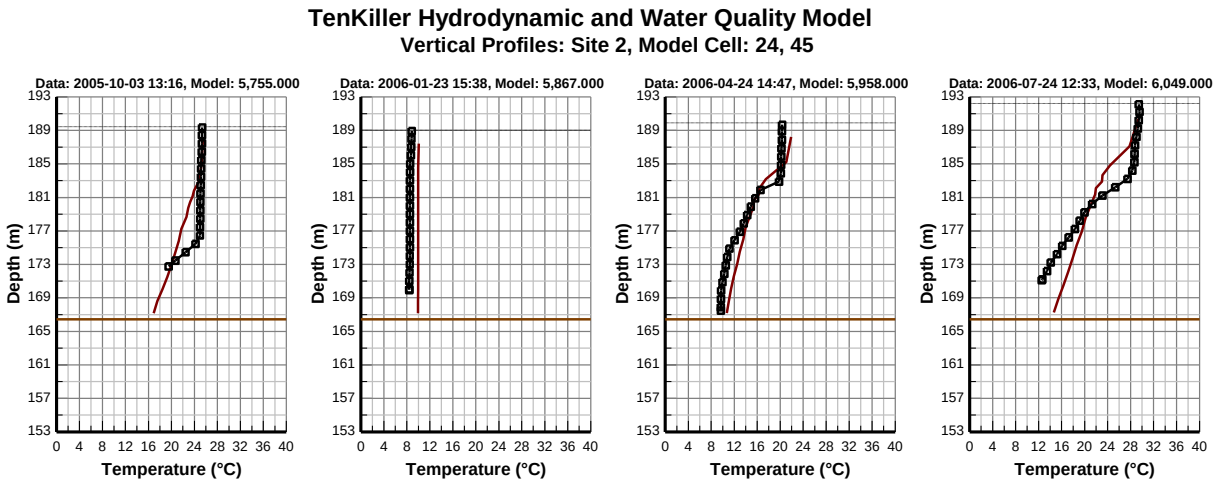


Figure **Error! No text of specified style in document.**.10. Water Temperature Vertical Profile Comparison Plot at Station Site 2 (3 October 2005 – 24 July 2006) (page 1-1)

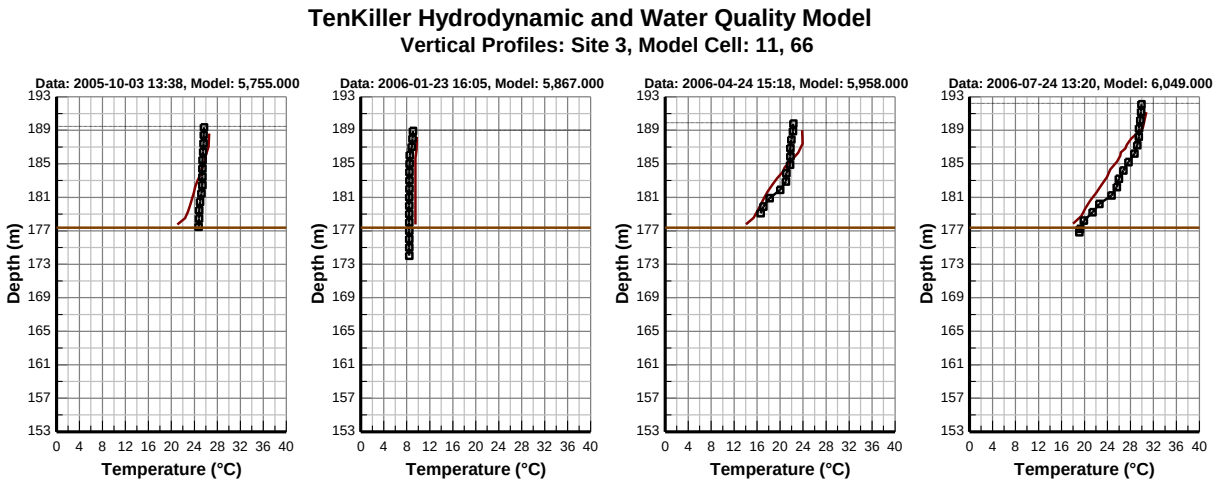


Figure **Error! No text of specified style in document.**.11. Water Temperature Vertical Profile Comparison Plot at Station Site 3 (3 October 2005 – 24 July 2006) (page 1-1)

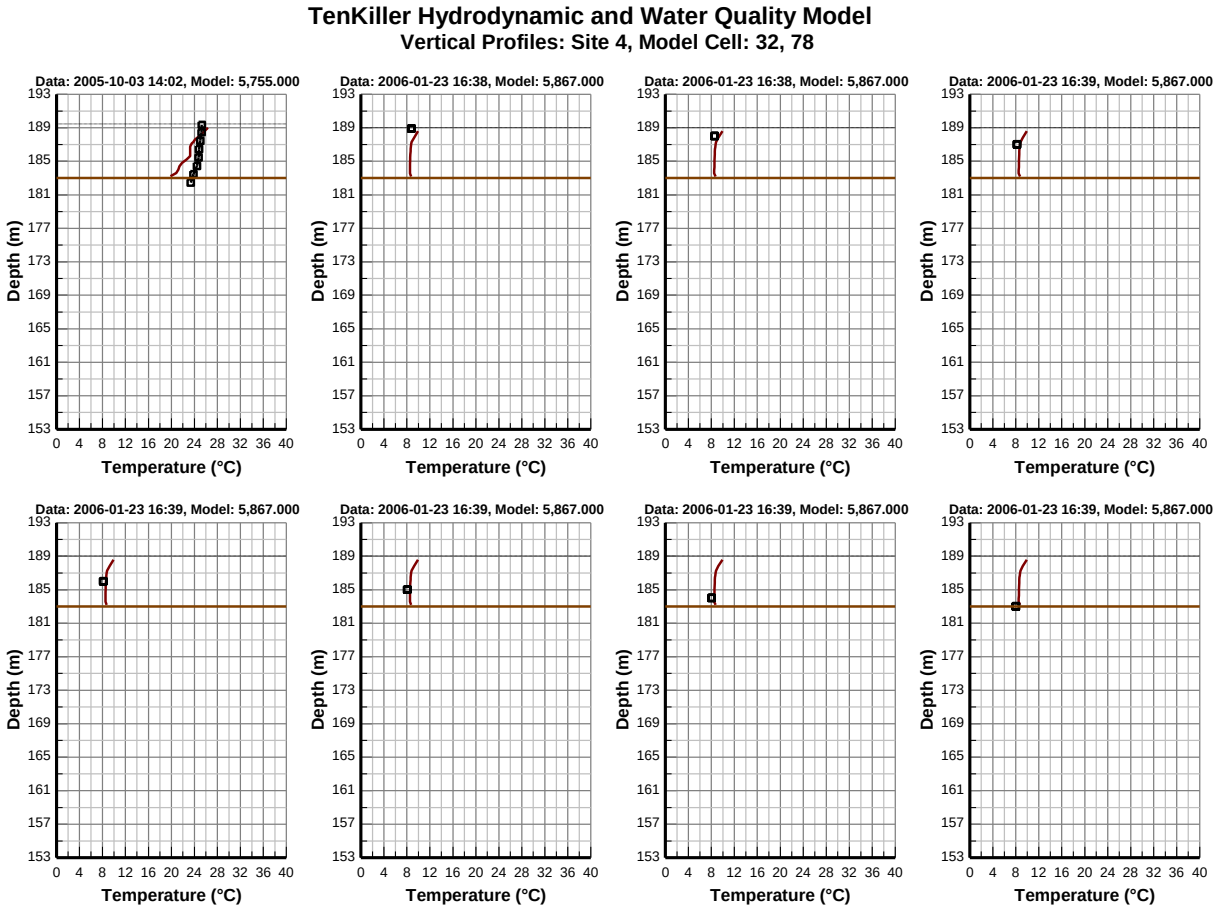


Figure **Error! No text of specified style in document.**.12. Water Temperature Vertical Profile Comparison Plot at Station Site 4 (3 October 2005 – 23 January 2006) (page 2-1)

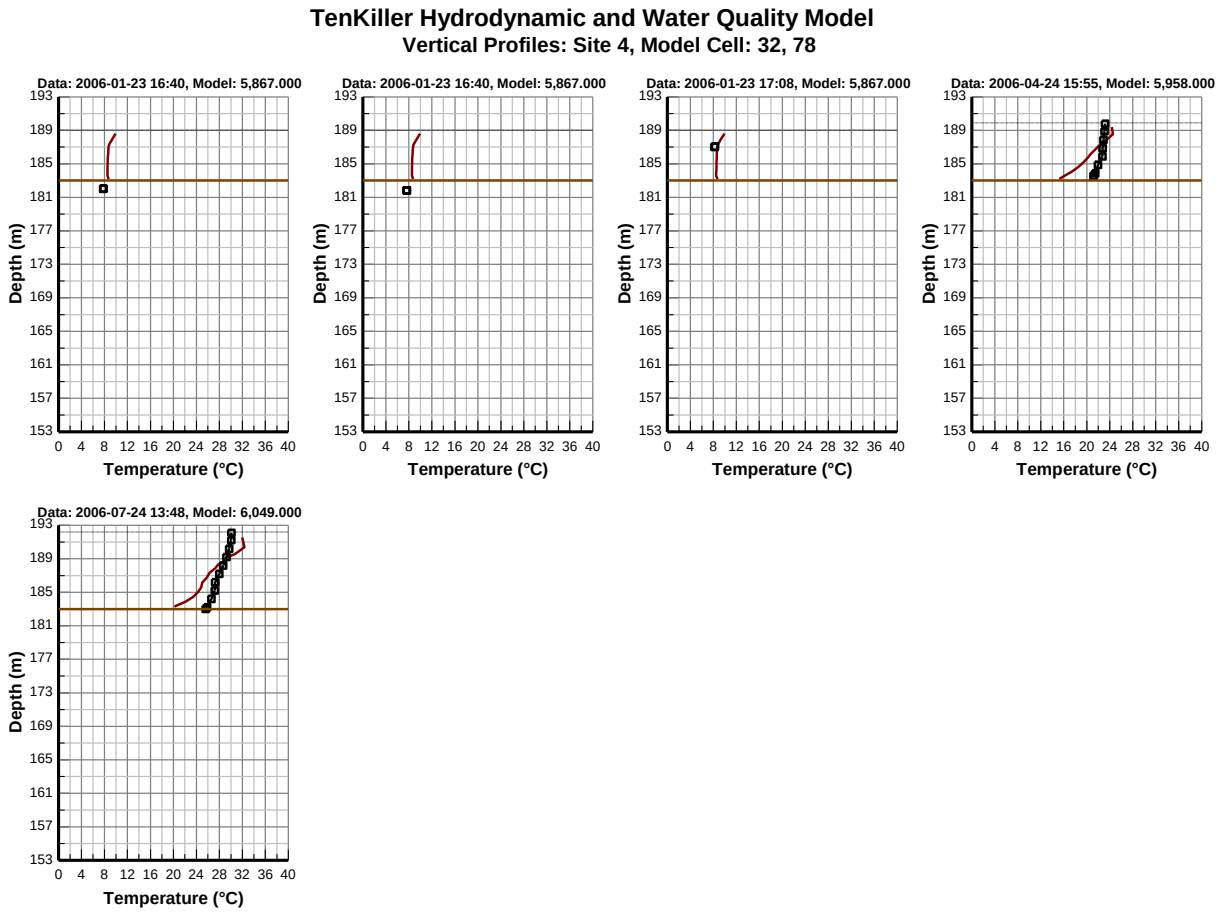


Figure **Error! No text of specified style in document.**.13. Water Temperature Vertical Profile Comparison Plot at Station Site 4 (23 January 2006 – 24 July 2006) (page 2-2)

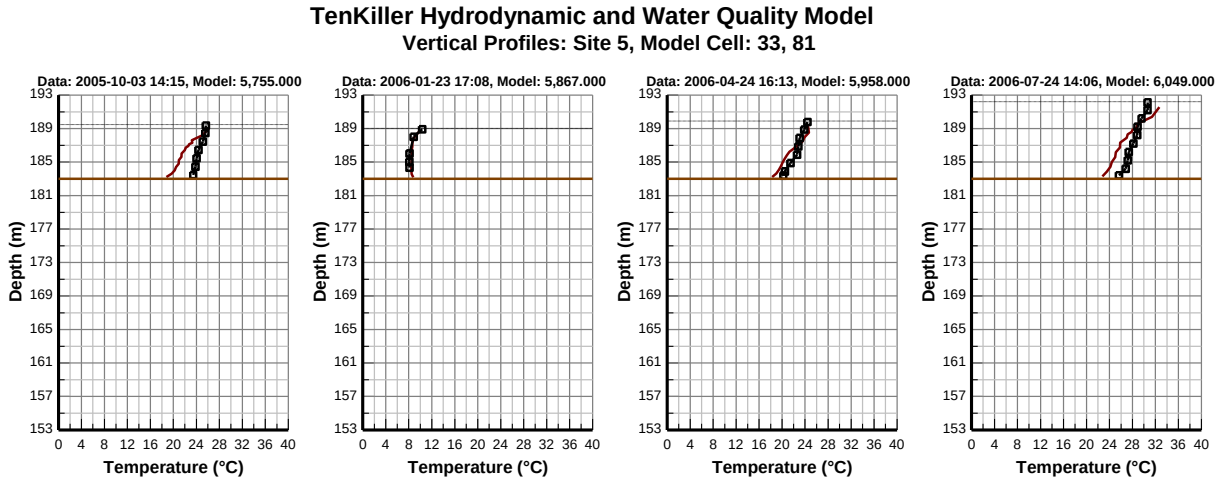


Figure **Error! No text of specified style in document.**.14. Water Temperature Vertical Profile Comparison Plot at Station Site 5 (3 October 2005 – 24 July 2006) (page 1-1)

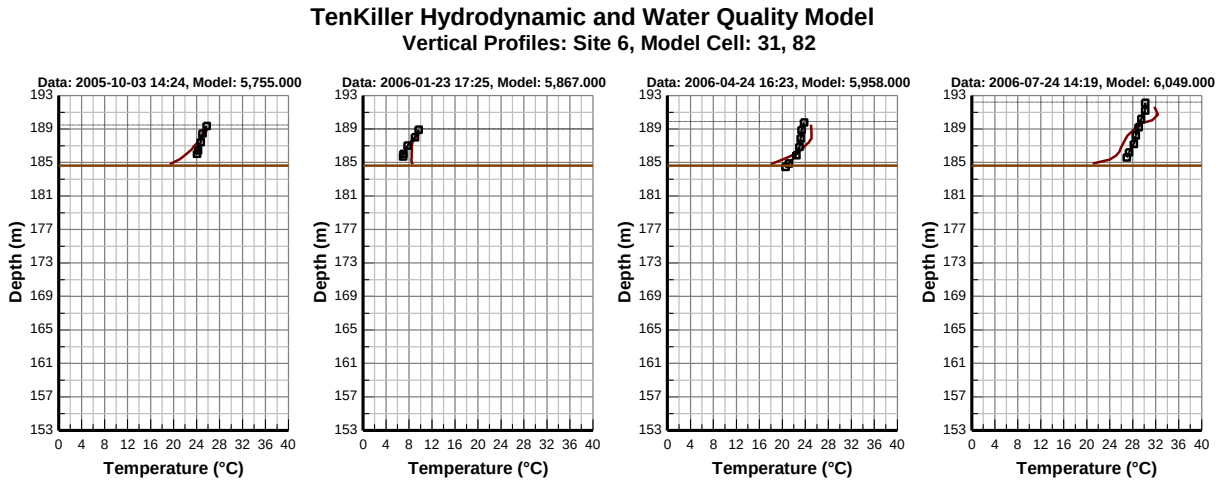


Figure **Error! No text of specified style in document.**.15. Water Temperature Vertical Profile Comparison Plot at Station Site 6 (3 October 2005 – 24 July 2006) (page 1-1)

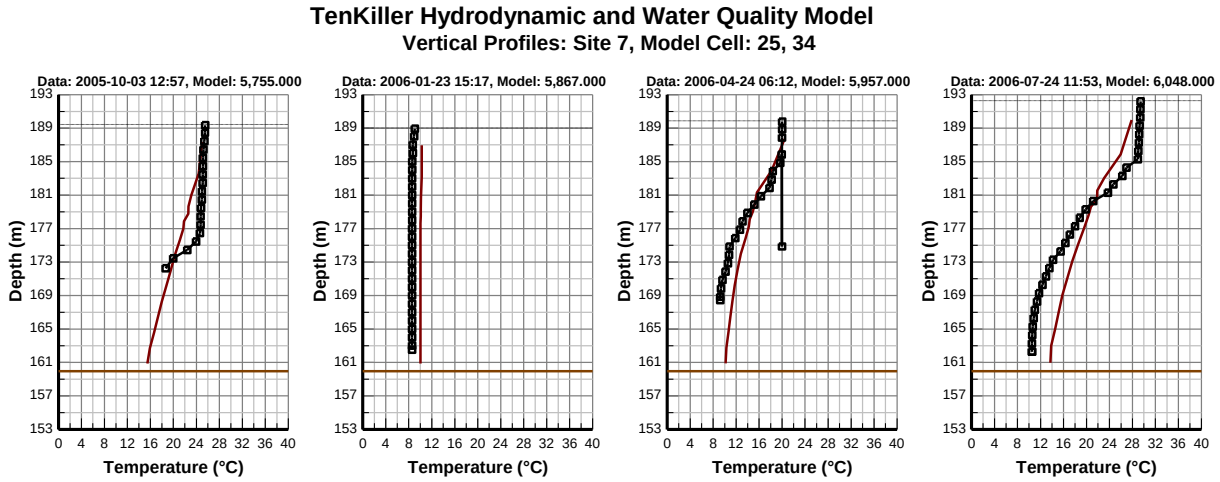


Figure **Error! No text of specified style in document.**.16. Water Temperature Vertical Profile Comparison Plot at Station Site 7 (3 October 2005 – 24 July 2006) (page 1-1)

APPENDIX M
VERTICAL PROFILE PLOTS FOR WATER QUALITY MODEL CALIBRATION AND VALIDATION OF DISSOLVED OXYGEN

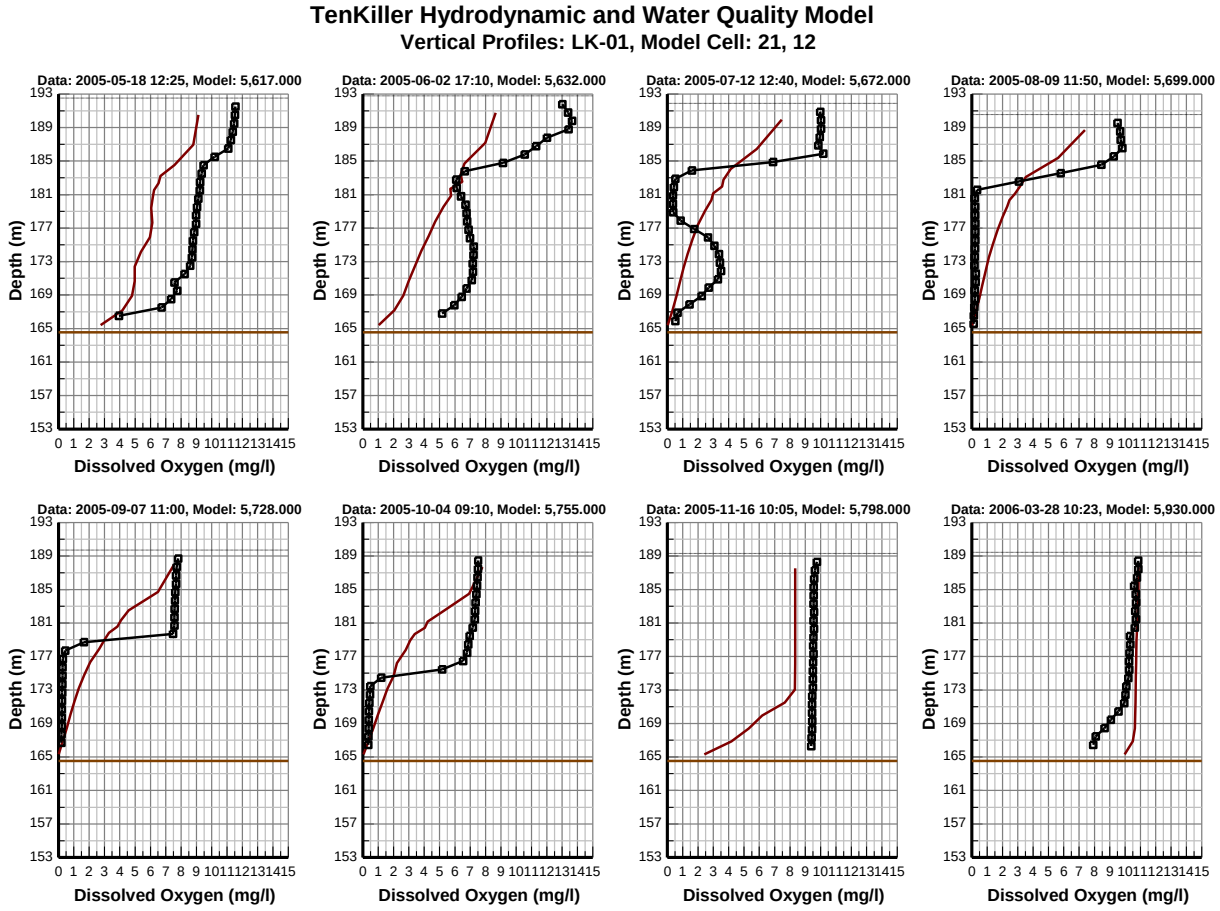


Figure **Error! No text of specified style in document.**.1. Dissolved Oxygen Vertical Profile Comparison Plot at Station LK-01 (18 May 2005 – 28 March 2006) (page 2-1)

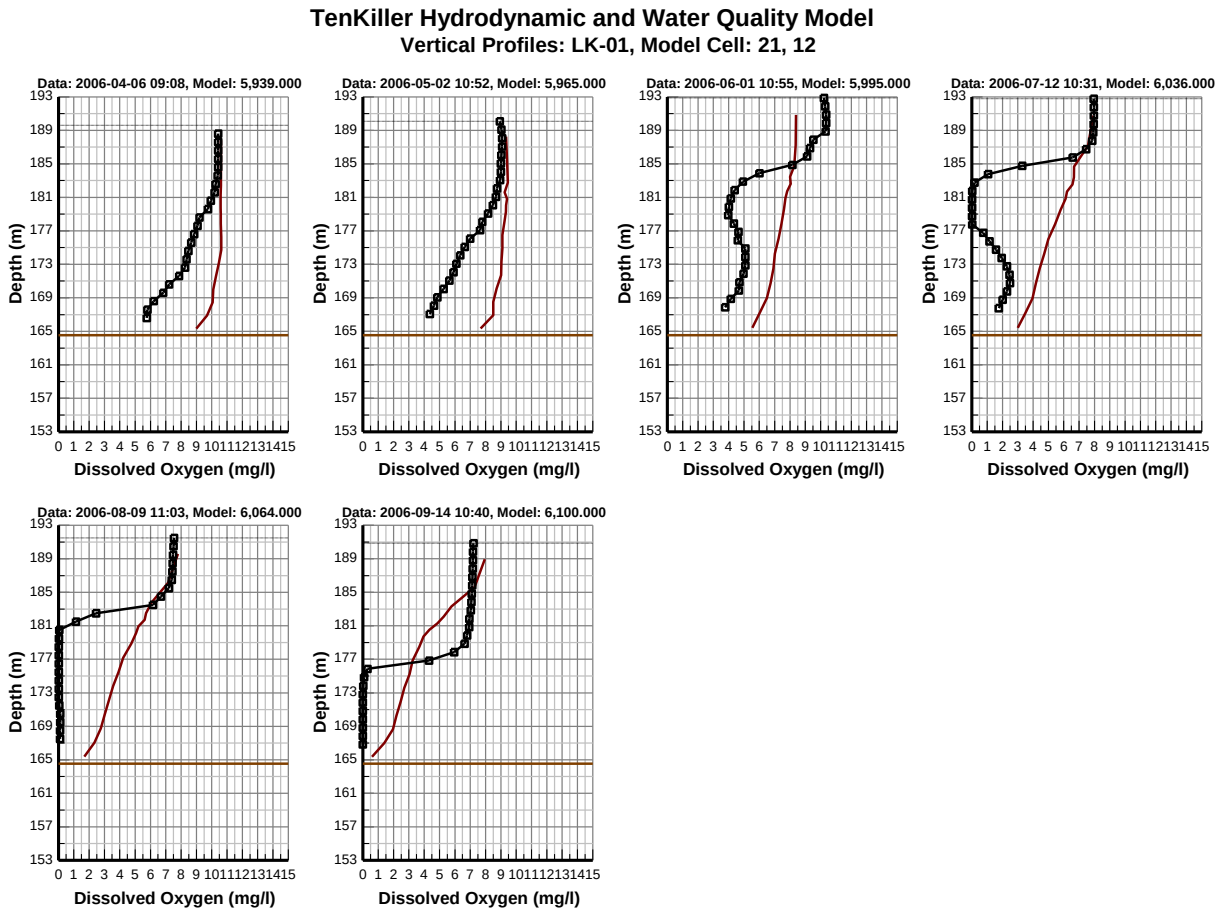


Figure **Error! No text of specified style in document.**.2. Dissolved Oxygen Vertical Profile Comparison Plot at Station LK-01 (6 April 2006 – 14 September 2006) (page 2-2)

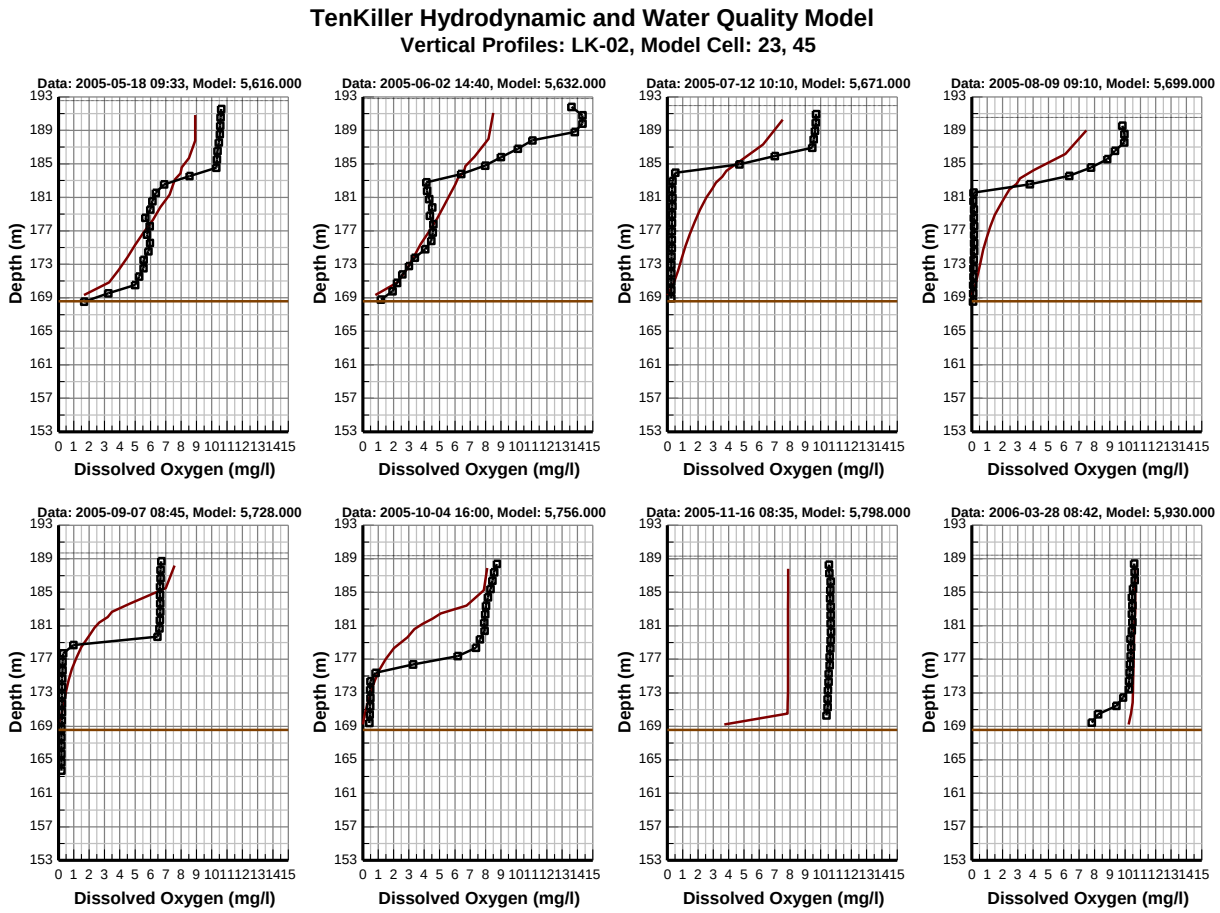


Figure **Error! No text of specified style in document.**.3. Dissolved Oxygen Vertical Profile Comparison Plot at Station LK-02 (18 May 2005 – 28 March 2006) (page 2-1)

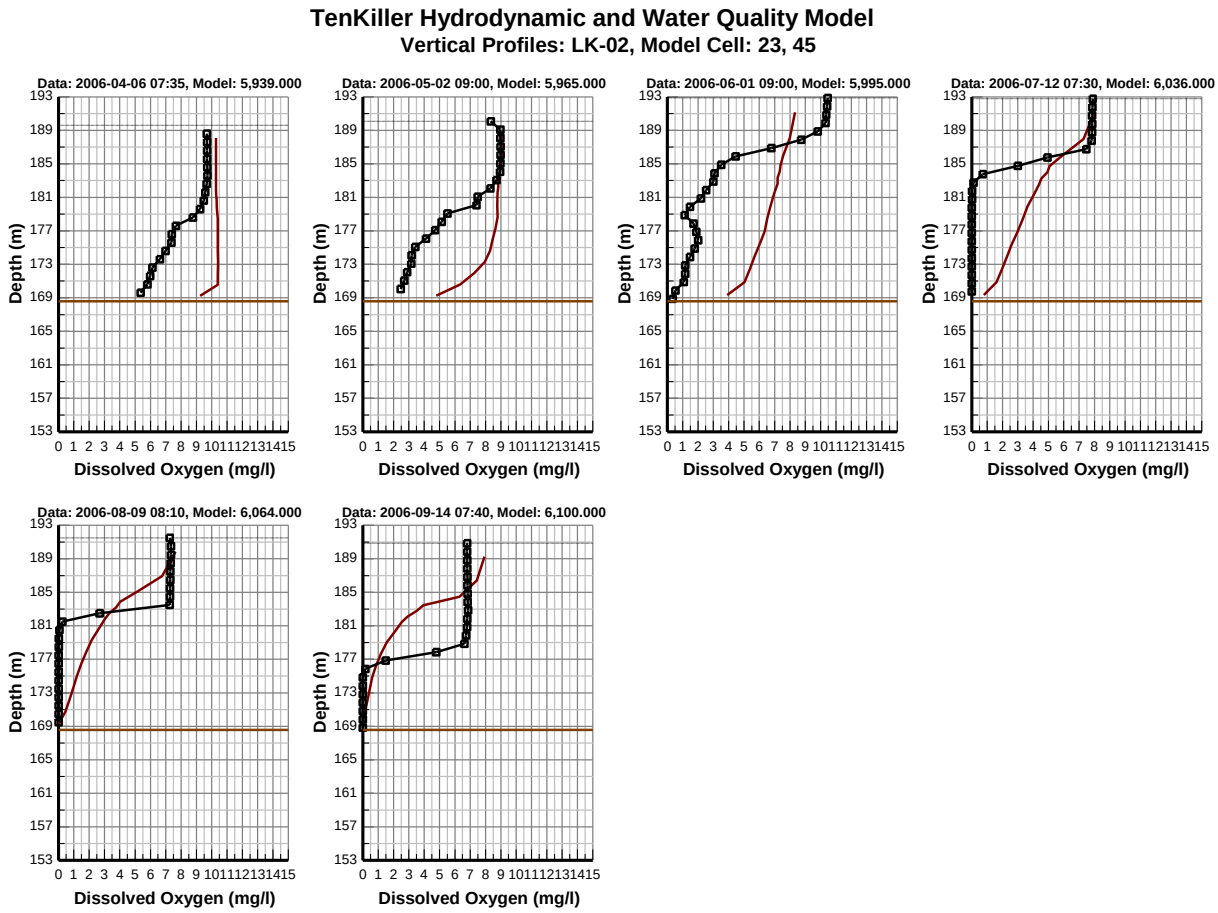


Figure **Error! No text of specified style in document.**.4. Dissolved Oxygen Vertical Profile Comparison Plot at Station LK-02 (6 April 2006 – 14 September 2006) (page 2-2)

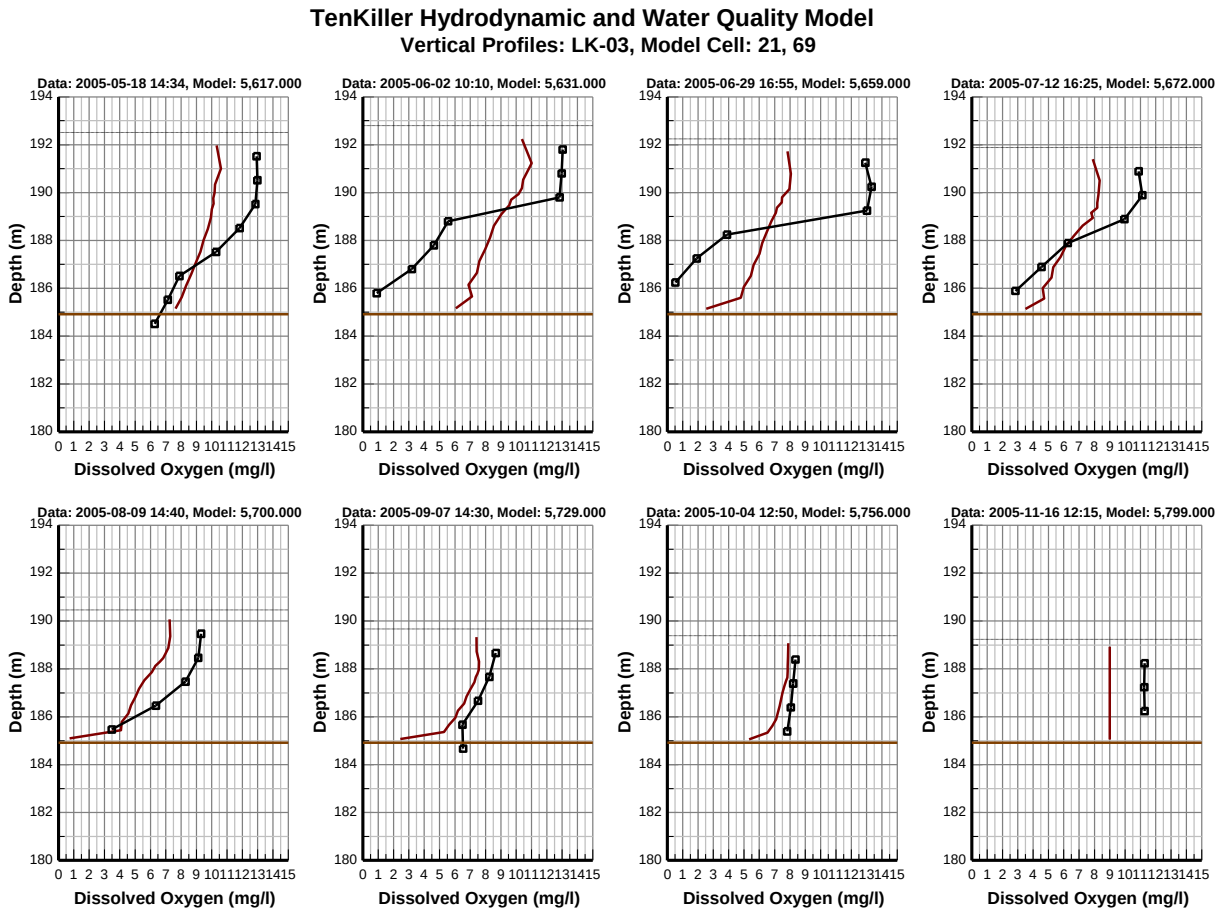


Figure **Error! No text of specified style in document.**.5. Dissolved Oxygen Vertical Profile Comparison Plot at Station LK-03 (18 May 2005 – 16 November 2005) (page 2-1)

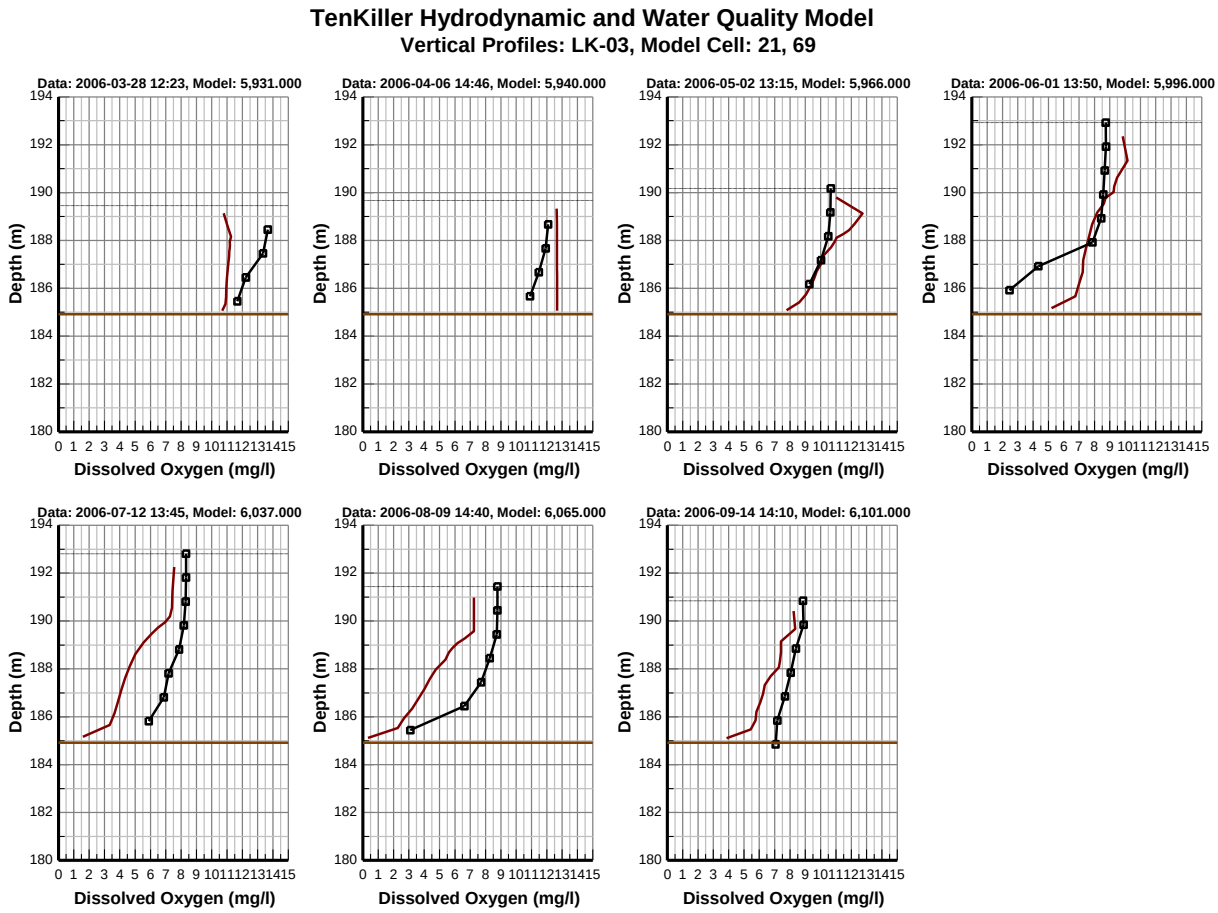


Figure **Error! No text of specified style in document.**.6. Dissolved Oxygen Vertical Profile Comparison Plot at Station LK-03 28 March 2006 – 14 September 2006) (page 2-2)

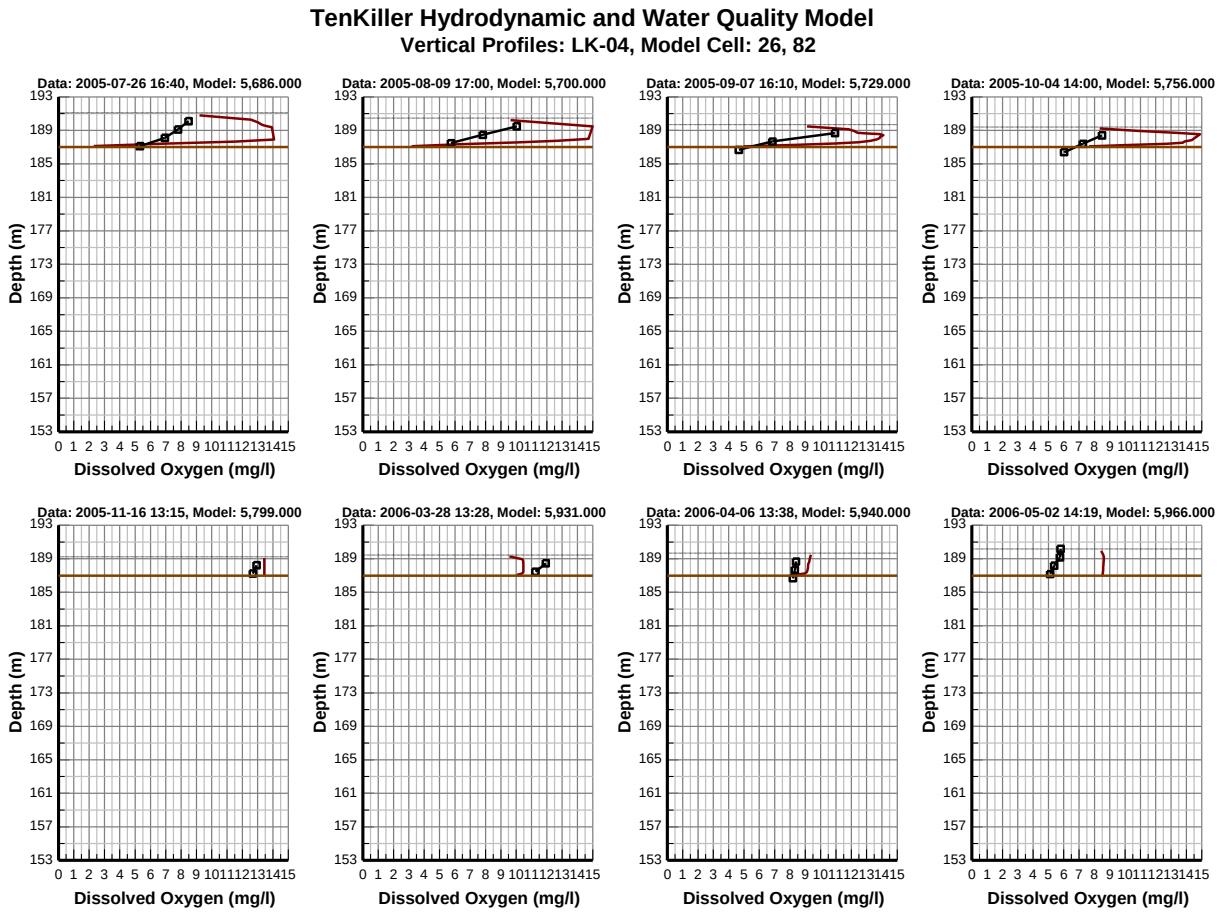


Figure **Error! No text of specified style in document.**.7. Dissolved Oxygen Vertical Profile Comparison Plot at Station LK-04 (26 July 2005 – 2 May 2006) (page 2-1)

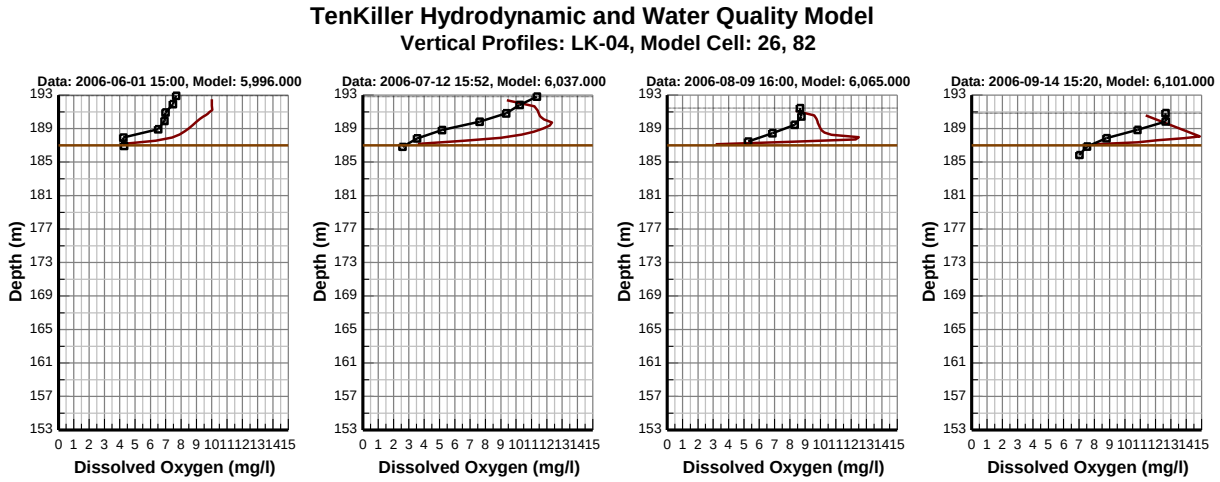


Figure **Error! No text of specified style in document.**.8. Dissolved Oxygen Vertical Profile Comparison Plot at Station LK-04 (1 June 2006 – 14 September 2006) (page 2-2)

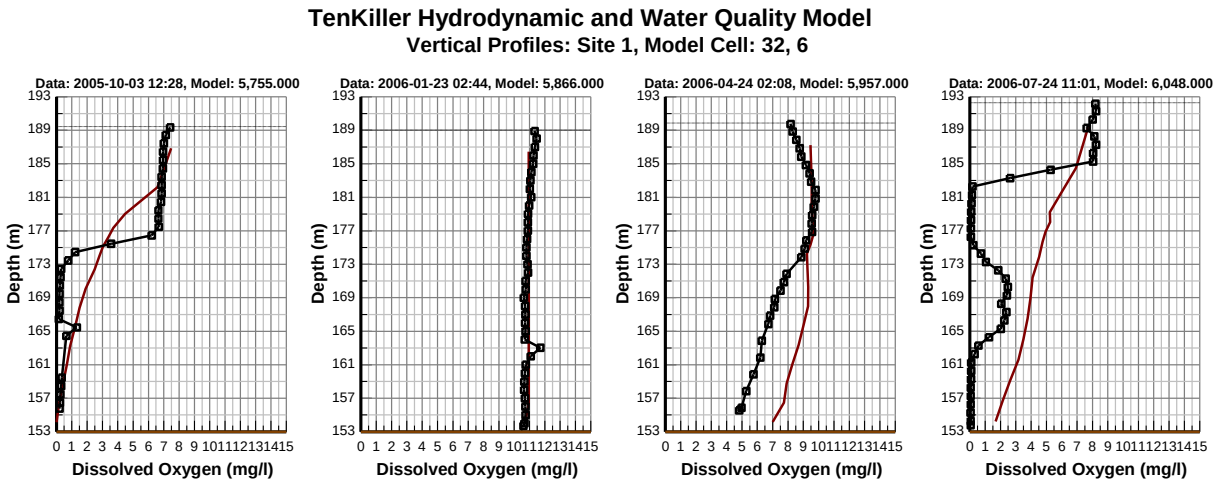


Figure **Error! No text of specified style in document.**.9. Dissolved Oxygen Vertical Profile Comparison Plot at Station Site 1 (3 October 2005 – 24 July 2006) (page 1-1)

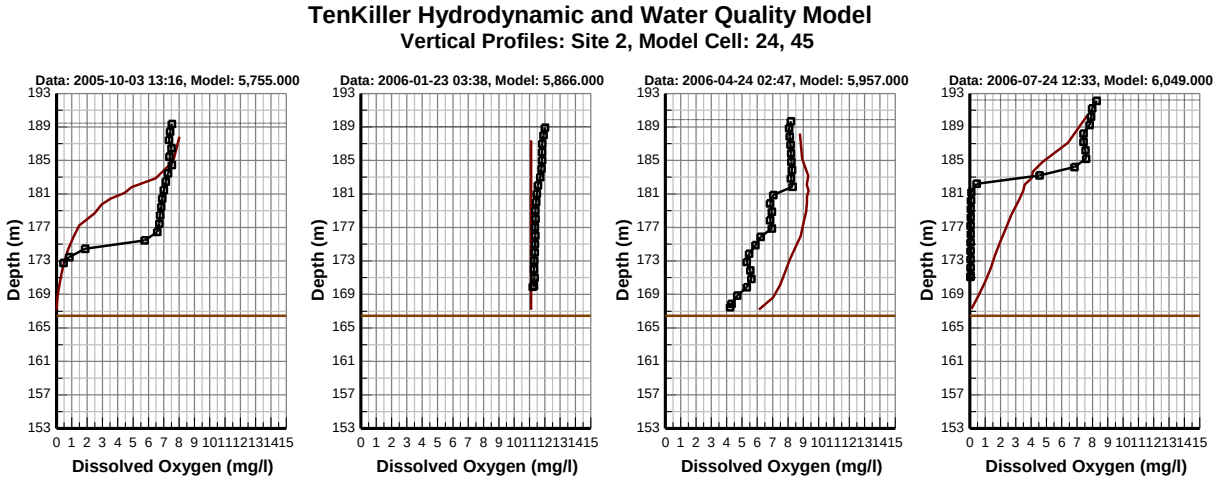


Figure **Error! No text of specified style in document.**.10. Dissolved Oxygen Vertical Profile Comparison Plot at Station Site 2 (3 October 2005 – 24 July 2006) (page 1-1)

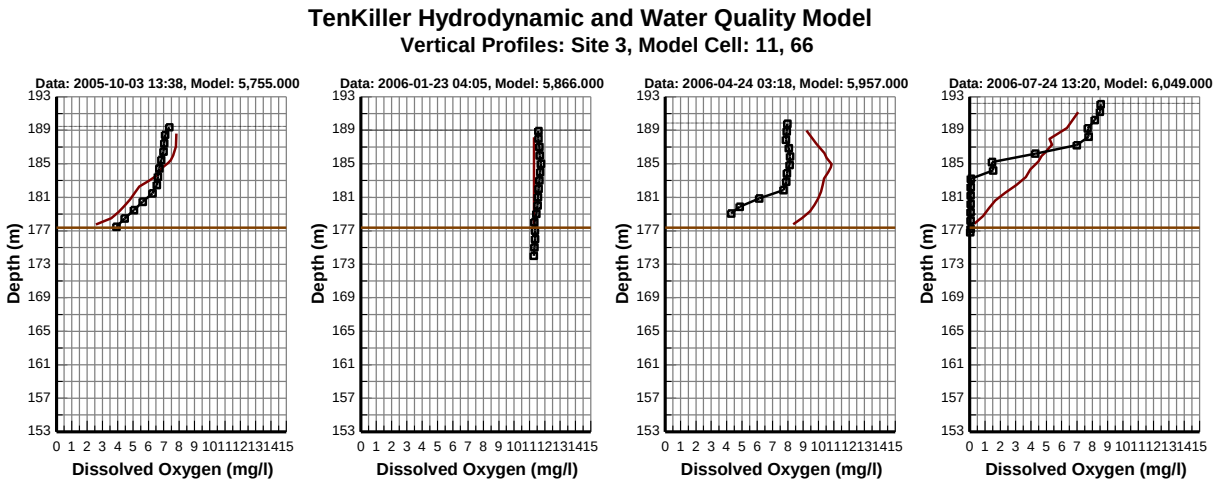


Figure **Error! No text of specified style in document.**.11. Dissolved Oxygen Vertical Profile Comparison Plot at Station Site 3 (3 October 2005 – 24 July 2006) (page 1-1)

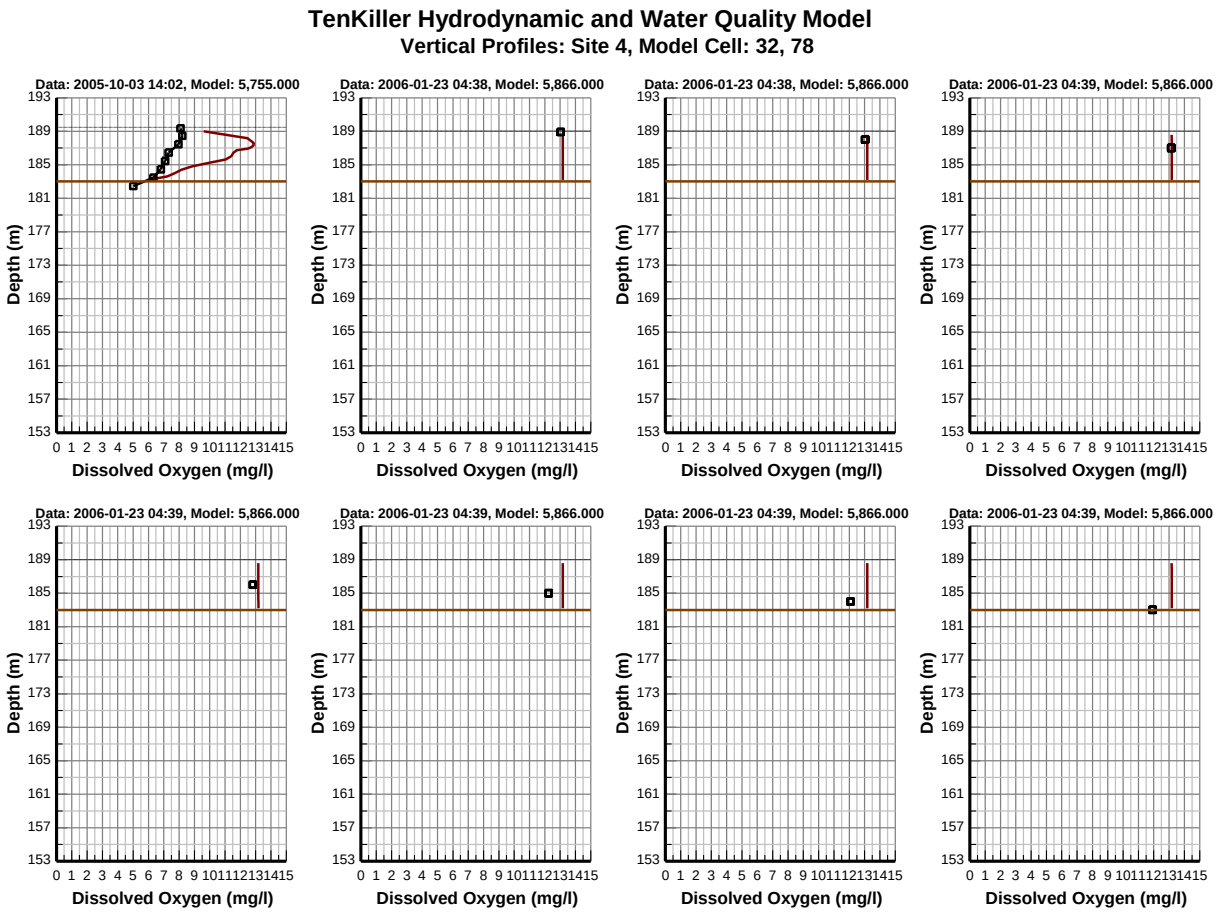


Figure **Error! No text of specified style in document.**.12. Dissolved Oxygen Vertical Profile Comparison Plot at Station Site 4 (3 October 2005 – 23 January 2006) (page 2-1) (page 2-1)

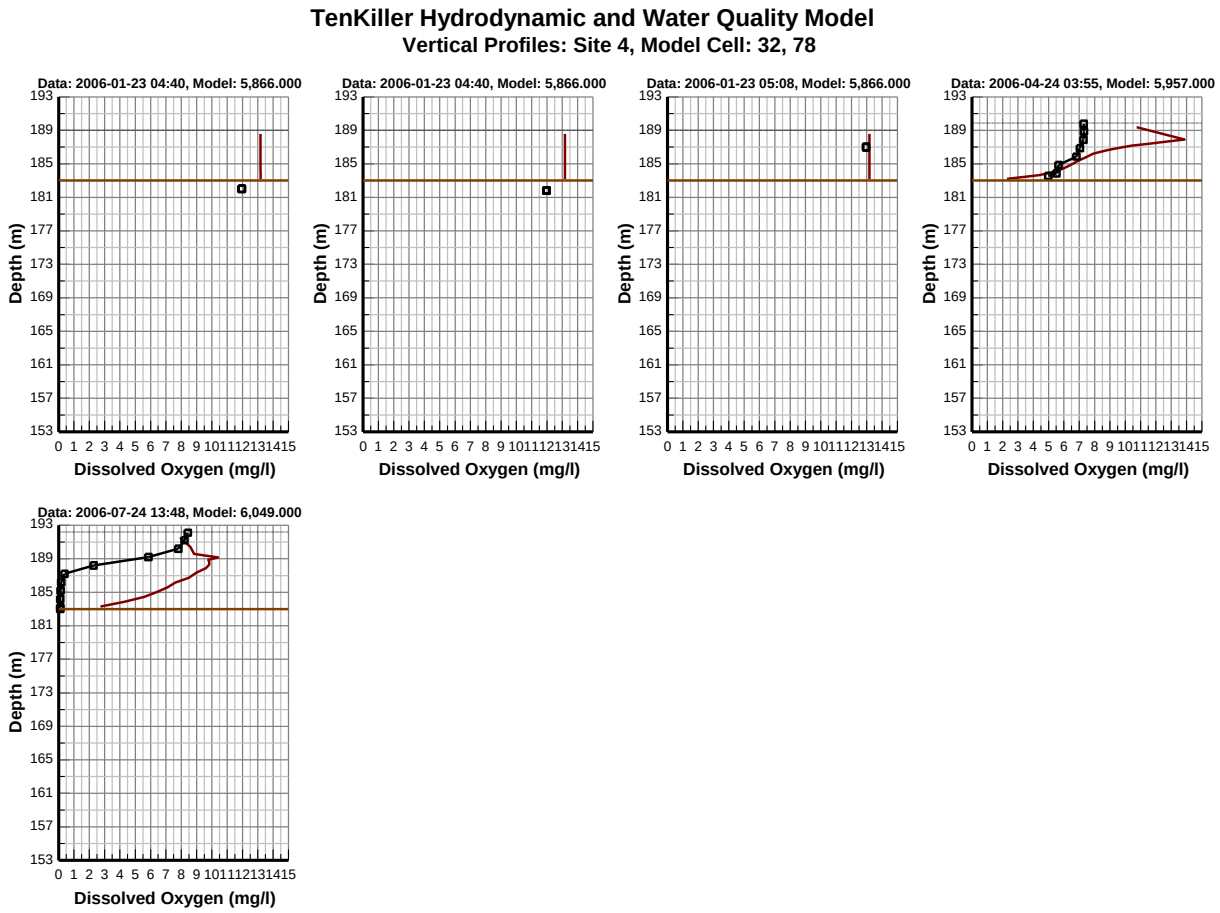


Figure **Error! No text of specified style in document.**.13. Dissolved Oxygen Vertical Profile Comparison Plot at Station Site 4 (23 January 2006 – 24 July 2006) (page 2-2)

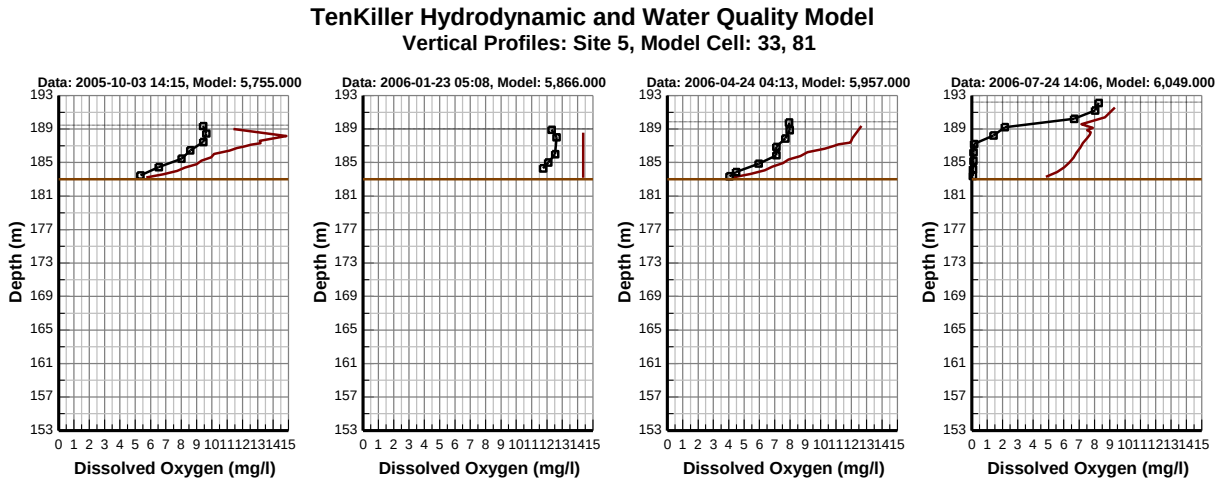


Figure **Error! No text of specified style in document.**.14. Dissolved Oxygen Vertical Profile Comparison Plot at Station Site 5 (3 October 2005 – 24 July 2006) (page 1-1)

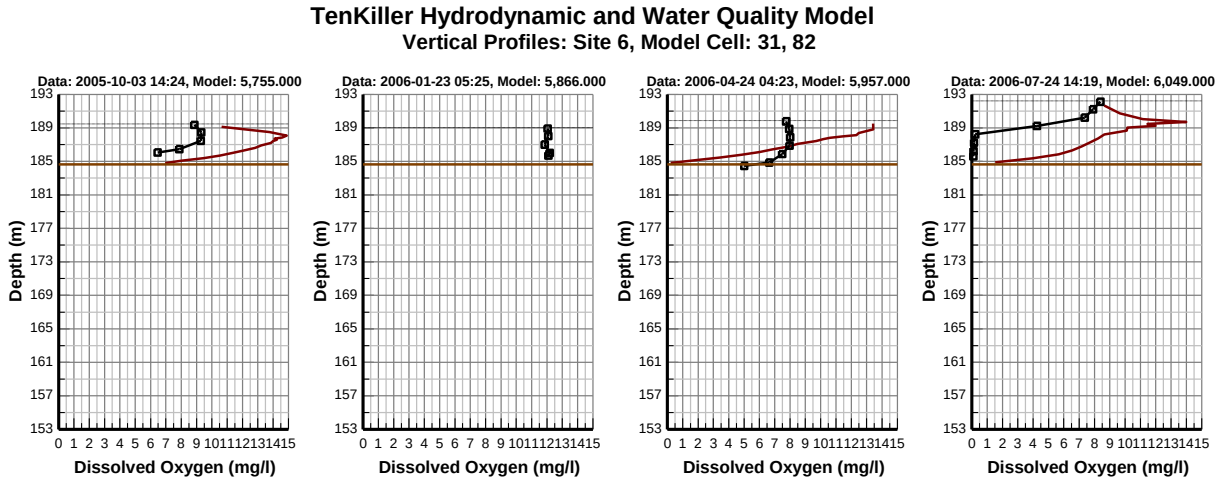


Figure **Error! No text of specified style in document.**.15. Dissolved Oxygen Vertical Profile Comparison Plot at Station Site 6 (3 October 2005 – 24 July 2006) (page 1-1)

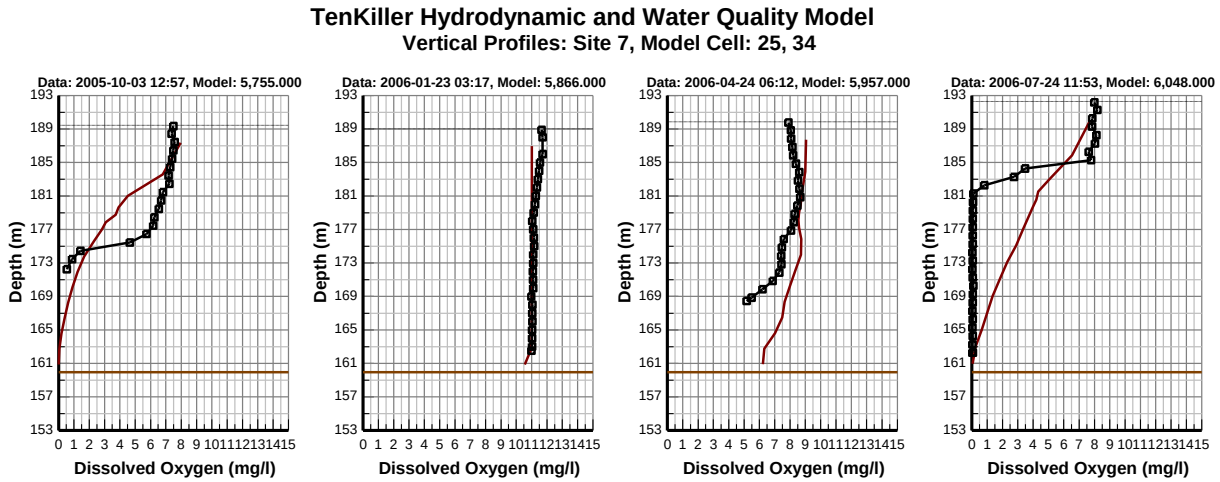


Figure **Error! No text of specified style in document.**.16. Dissolved Oxygen Vertical Profile Comparison Plot at Station Site 7 (3 October 2005 – 24 July 2006) (page 1-1)

APPENDIX N
MODEL PERFORMANCE STATISTICS FOR CALIBRATION AND VALIDATION

Table **Error! No text of specified style in document.**-1. Summary Model Performance Statistics for Hydrodynamic Model of the Tenkiller Ferry Lake for Calibration and Validation Periods

Station ID	Parameter	Layer	Starting	Ending	# Pairs	RMS (m)	Rel RMS (%)	Data Average (m)	Model Average (m)
TENO2	Stage (m)	Surface	1/1/2006 0:00	12/31/2006 0:00	365	0.029	0.643	190.989	190.985
TENO2	Stage (m)	Surface	1/3/2005 0:00	12/31/2005 0:00	363	0.022	0.309	191.455	191.456

Table **Error! No text of specified style in document.**-2. Summary Statistics of Water Temperature

Station ID	Layer	Starting	Ending	# Pairs	RMS (°C)	Rel RMS (%)	Data Average (°C)	Model Average (°C)
LK-01	Layer 1	5/18/2005 12:25	9/26/2006 11:30	27	2.061	24.222	12.322	13.702
LK-01	Layer 16	5/18/2005 12:25	9/26/2006 11:30	27	1.987	10.06	25.199	23.731
LK-02	Layer 1	5/18/2005 9:33	9/26/2006 7:30	27	2.071	26.891	13.044	14.361
LK-02	Layer 16	5/18/2005 9:33	9/26/2006 7:30	27	0.95	4.715	25.131	25.185
LK-03	Layer 1	5/18/2005 14:34	9/26/2006 14:25	27	3.019	14.976	24.4	22.03
LK-03	Layer 16	5/18/2005 14:34	9/26/2006 14:25	27	0.937	4.545	26.191	26.543
LK-04	Layer 1	7/26/2005 16:40	9/26/2006 15:45	21	5.636	27.085	23.8	19.642
LK-04	Layer 16	7/26/2005 16:40	9/26/2006 15:45	21	1.088	5.155	25.812	26.191

Table **Error! No text of specified style in document.**-3. Summary Statistics of TSS

Station ID	Layer	Starting	Ending	# Pairs	RMS (mg/l)	Rel RMS (%)	Data Average (mg/l)	Model Average (mg/l)
LK-01	Layer 1	5/18/2005 12:58	9/26/2006 12:00	21	2.801	70.024	3.048	1.491
LK-01	Layer 16	5/18/2005 12:05	9/26/2006 12:00	25	2.68	38.286	2.7	0.526
LK-02	Layer 1	5/18/2005 10:19	9/26/2006 8:00	25	11.707	50.898	7.64	5.338
LK-02	Layer 16	5/18/2005 9:01	9/26/2006 8:00	24	3.701	61.679	3.048	2.19
LK-03	Layer 1	5/17/2005 15:22	8/9/2006 14:50	22	17.944	78.016	7.636	7.963
LK-03	Layer 16	5/17/2005 14:05	9/26/2006 14:40	34	16.477	183.081	5.382	5.078
LK-04	Layer 1	7/26/2005 16:40	9/26/2006 16:00	19	78.635	51.061	52.816	23.31
LK-04	Layer 16	7/26/2005 16:40	9/26/2006 16:00	20	30.003	90.917	17.1	9.911

Table **Error! No text of specified style in document.**-4. Summary Statistics of DO

Station ID	Layer	Starting	Ending	# Pairs	RMS (ug/l)	Rel RMS (%)	Data Average (ug/l)	Model Average (ug/l)
LK-01	Layer 16	5/18/2005 12:05	9/26/2006 12:00	27	4.24	28.454	5.733	4.266
LK-02	Layer 16	5/18/2005 9:01	9/26/2006 8:00	26	9.267	56.85	7.881	11.728
LK-03	Layer 1	5/17/2005 15:22	9/14/2006 14:30	20	16.228	45.204	14.433	15.603
LK-03	Layer 16	5/17/2005 14:05	9/26/2006 14:40	28	19.256	47.082	14.137	22.225
LK-04	Layer 1	7/26/2005 16:40	9/26/2006 16:00	21	17.886	66.988	11.655	20.744
LK-04	Layer 16	7/26/2005 16:40	9/26/2006 16:00	22	33.51	25.234	25.418	15.463

Table **Error! No text of specified style in document.**-5. Summary Statistics of Chlorophyll a

Station ID	Layer	Starting	Ending	# Pairs	RMS (ug/l)	Rel RMS (%)	Data Average (ug/l)	Model Average (ug/l)
LK-01	Layer 16	5/18/2005 12:05	9/26/2006 12:00	27	4.24	28.454	5.733	4.266
LK-02	Layer 16	5/18/2005 9:01	9/26/2006 8:00	26	9.267	56.85	7.881	11.728
LK-03	Layer 1	5/17/2005 15:22	9/14/2006 14:30	20	16.228	45.204	14.433	15.603
LK-03	Layer 16	5/17/2005 14:05	9/26/2006 14:40	28	19.256	47.082	14.137	22.225
LK-04	Layer 1	7/26/2005 16:40	9/26/2006 16:00	21	17.886	66.988	11.655	20.744
LK-04	Layer 16	7/26/2005 16:40	9/26/2006 16:00	22	33.51	25.234	25.418	15.463

Table **Error! No text of specified style in document.**-6. Summary Statistics of TOC

Station ID	Layer	Starting	Ending	# Pairs	RMS (mg/l)	Rel RMS (%)	Data Average (mg/l)	Model Average (mg/l)
LK-01	Layer 1	5/18/2005 12:58	9/26/2006 12:00	15	1.04	100.008	1.813	0.978
LK-01	Layer 16	5/18/2005 12:05	9/26/2006 12:00	25	1.117	74.944	2.3	1.412
LK-02	Layer 1	5/18/2005 10:19	9/26/2006 8:00	15	0.848	68.388	1.92	1.185
LK-02	Layer 16	5/18/2005 9:01	9/26/2006 8:00	24	0.791	21.74	2.497	2.122
LK-03	Layer 1	5/17/2005 15:22	8/9/2006 14:50	13	0.742	63.445	2.182	2.423
LK-03	Layer 16	5/17/2005 14:05	9/26/2006 14:40	34	0.905	29.864	2.556	2.877
LK-04	Layer 1	3/28/2006 13:40	9/26/2006 16:00	14	1.154	40.358	1.969	2.815
LK-04	Layer 16	7/26/2005 16:40	9/26/2006 16:00	20	0.68	44.134	2.042	2.377

Table **Error! No text of specified style in document.**-7. Summary Statistics of NO3

Station ID	Layer	Starting	Ending	# Pairs	RMS (mg/l)	Rel RMS (%)	Data Average (mg/l)	Model Average (mg/l)
LK-01	Layer 1	5/18/2005 12:58	9/26/2006 12:00	24	0.5	38.072	0.616	1.026
LK-01	Layer 16	5/18/2005 12:05	9/26/2006 12:00	25	1.071	88.798	0.286	1.314
LK-02	Layer 1	5/18/2005 10:19	9/26/2006 8:00	25	0.899	69.394	0.38	1.214
LK-02	Layer 16	5/18/2005 9:01	9/26/2006 8:00	24	1.24	121.7	0.203	1.414
LK-03	Layer 1	5/17/2005 15:22	8/9/2006 14:50	22	1.084	52.501	0.362	1.221
LK-03	Layer 16	5/17/2005 14:05	9/14/2006 14:30	33	1.191	116.779	0.176	1.285
LK-04	Layer 1	7/26/2005 16:40	9/14/2006 15:40	18	1.037	78.536	0.347	1.153
LK-04	Layer 16	7/26/2005 16:40	9/14/2006 15:40	19	1.709	134.6	0.312	1.829

Table **Error! No text of specified style in document.**-8. Summary Statistics of TPO4

Station ID	Layer	Starting	Ending	# Pairs	RMS (mg/l)	Rel RMS (%)	Data Average (mg/l)	Model Average (mg/l)
LK-01	Layer 1	6/29/2005 13:40	9/26/2006 12:00	22	0.003	34.9	0.003	0.005
LK-01	Layer 16	6/29/2005 13:40	9/26/2006 12:00	23	0.001	44.985	0.001	0.002
LK-02	Layer 1	6/29/2005 10:30	9/26/2006 8:00	23	0.02	57.599	0.013	0.019
LK-02	Layer 16	6/29/2005 10:30	9/26/2006 8:00	23	0.01	77.973	0.002	0.006
LK-03	Layer 1	6/29/2005 16:55	8/9/2006 14:50	22	0.043	533.893	0.003	0.029
LK-03	Layer 16	6/29/2005 16:55	9/26/2006 14:40	26	0.041	571.903	0.002	0.018
LK-04	Layer 1	7/26/2005 16:40	9/26/2006 0:00	21	0.079	73.217	0.051	0.066
LK-04	Layer 16	7/26/2005 16:40	9/26/2006 16:00	21	0.104	113.759	0.033	0.074

Table **Error! No text of specified style in document.**-9. Summary Statistics of TP

Station ID	Layer	Starting	Ending	# Pairs	RMS (mg/l)	Rel RMS (%)	Data Average (mg/l)	Model Average (mg/l)
LK-01	Layer 1	6/29/2005 13:40	9/26/2006 12:00	22	0.012	38.709	0.015	0.006
LK-01	Layer 16	6/29/2005 13:40	9/26/2006 12:00	23	0.008	87.118	0.011	0.003
LK-02	Layer 1	6/29/2005 10:30	9/26/2006 8:00	23	0.116	29.251	0.082	0.022
LK-02	Layer 16	6/29/2005 10:30	9/26/2006 8:00	23	0.012	60.329	0.015	0.013
LK-03	Layer 1	6/29/2005 16:55	8/9/2006 14:50	22	0.038	78.32	0.032	0.043
LK-03	Layer 16	6/29/2005 16:55	9/26/2006 14:40	26	0.044	75.757	0.028	0.032
LK-04	Layer 1	7/26/2005 16:40	9/26/2006 0:00	21	0.141	37.225	0.158	0.126
LK-04	Layer 16	7/26/2005 16:40	9/26/2006 16:00	21	0.116	116.933	0.098	0.107