

SITE NUMBER—07144100

SITE NAME—Little Arkansas River near Sedgwick

DATE CREATED—3/11/2013

MODEL DEVELOPMENT DATA PERIOD—7/27/2004 – 5/16/2011

MODEL-CALIBRATION DATASET—All data were collected using U.S. Geological Survey (USGS) protocols and are stored in National Water Information System (NWIS) database. The regression model is based on 67 concurrent measurements of suspended sediment concentration, streamflow, and turbidity samples collected from 07-27-2004 through 05-16-2011. Samples were collected throughout the range of continuously observed hydrologic and turbidity conditions. Summary statistics and complete model-calibration dataset are provided. Two suspended sediment values were deemed outliers.

Outliers removed from the dataset.

Date	Suspended sediment concentration, in milligrams per liter	Turbidity, in formazin nephelometric units
12/1/2009	85	3.9
12/17/2009	174	1.4

The documentation to review the SSC analysis was unavailable. However, the suspended sediment concentration values were either 10 times more than the maximum or less than the minimum suspended sediment concentration value at similar turbidity values. For this reason, the samples were removed from the dataset.

MODEL DEVELOPMENT— Regression analysis was done using S-PLUS, R, and a spreadsheet macro that examined specific conductance as an explanatory variable for estimating suspended sediment concentration. Different combinations of untransformed and log₁₀-transformed data were evaluated. Suspended sediment concentration, turbidity, and streamflow were selected as the best model based on residual plots, model standard percentage error (*MSPE*), adjusted R^2 , prediction error sum of squares (*PRESS*), and Mallows' C_p . Model spreadsheet is archived and can be found at <http://nrtwq.usgs.gov/ks> for review, and contains all relevant sample data and more in-depth statistical information.

MODEL SUMMARY—Summary of final regression analysis for suspended sediment concentration at site number 07144100.

Suspended sediment concentration-based model:

$$\log_{10}(SSC) = 0.98 \times \log_{10}(Turb) + 0.294 ,$$

where

SSC = suspended sediment concentration, in milligrams per liter; and

Turb = turbidity, in formazin nephelometric units.

The use of turbidity and streamflow as explanatory variables makes sense both physically and statistically. Physically because suspended sediment is composed of particles that scatter light in water. There is a clear correlation between streamflow and particles in water. Turbidity and streamflow makes statistical sense as an explanatory variable because they resulted in a model with low Mallows' C_p and PRESS values, and high adjusted R^2 values.

SUSPENDED SEDIMENT CONCENTRATION RECORD— The record is computed using the regression model in the National Real-Time Water Quality (NRTWQ) website. Data are computed at hourly intervals. The record is complete for the year except as noted. A more in-depth description of the water quality record can be found at –

<http://nrtwq.usgs.gov/ks>

REMARKS—

- Site location, equipment, and other stream-gaging station information can be found in the Site Information Management System (SIMS).

Computed: Aaron King

Reviewed: Patrick Rasmussen

Model Form

$$\log(\text{SSC}) = 0.98 * \log(\text{Turb}) + 0.294$$

Explanatory variable summary statistics

	log(Turb)	Turb
Minimum	0.519	3.30
1st Quartile	1.36	23.0
Median	2.15	140
Mean	1.89	176
3rd Quartile	2.36	230
Maximum	3.03	1060
Notes:		

Dependent variable summary statistics

	log(SSC)	SSC
Minimum	0.778	6.00
1st Quartile	1.60	40.0
Median	2.36	230
Mean	2.17	314
3rd Quartile	2.67	467
Maximum	3.19	1560
Notes:		

Model Calibration

Basic Data

Number of Measurements:	63
Standard Error:	0.089
MSPE (Upper)	22.73
MSPE (Lower)	18.52
R ²	0.980
Adj R ²	0.980
Duan BCF:	1.02

Explanatory Variables

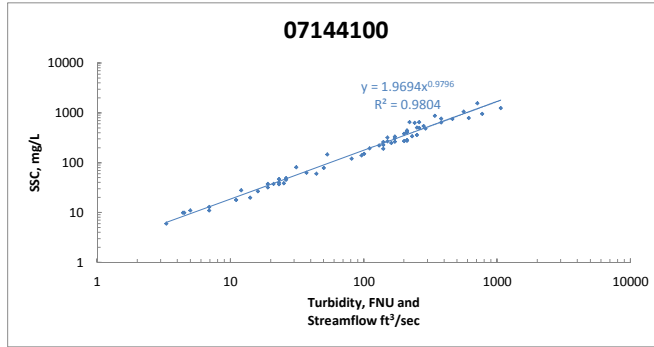
Variable	Value	Standard Error
Intercept	0.294	0.0359
log(Turb)	0.980	0.0177
Notes:		

Covariance Matrix

	Intercept	log(Turb)
Intercept	1	-0.950
log(Turb)	-0.950	1

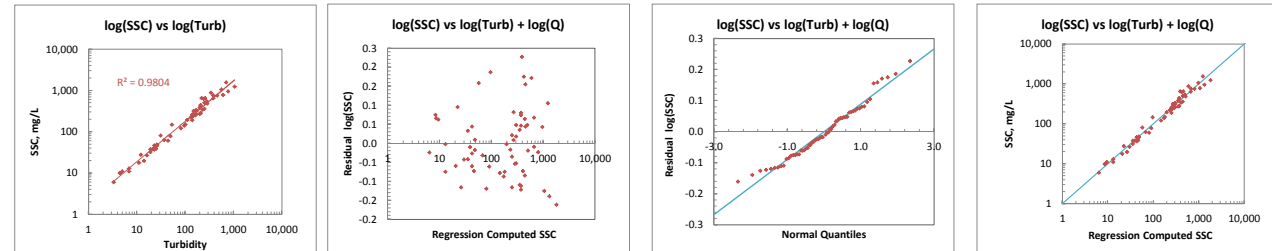
Test Criteria

Leverage	Cook's D	DFITS
0.134	0.848	0.423



Observations exceeding at least one test criterion

Observation	Observed log(SSC)	Predicted log(SSC)	Residuals	Standardized Residuals	Studentized Residuals	Leverage	Cook's D	DFITS
27	1.60	2.61	-1.01	-4.79	-5.92	0.0274	0.215	-0.994
40	1.56	1.10	0.461	2.24	2.32	0.0767	0.139	0.668
41	1.94	1.01	0.935	4.59	5.56	0.0932	0.722	1.78
56	2.85	2.50	0.352	1.72	1.75	0.0813	0.0870	0.519
Notes:								



Date	Turbidity		Streamflow		SSC, mg/L	log(Turb)	log(SSC)	Regression		
	FNU	ft³/sec	ft³/sec	ft³/sec				Computed SSC	Residual log(SSC)	Normal Quantiles
7/27/2004 0:00	200	5855.211			384	2.301	2.584	353.5	0.03591	0.3649
1/27/2005 0:00	81	171.9977			122	1.908	2.086	145.8	-0.07752	-0.9019
3/23/2005 0:00	260	5855.211			506	2.415	2.704	457.1	0.04411	0.4955
3/31/2005 0:00	50	155.0416			79	1.699	1.898	90.92	-0.06102	-0.6352
5/10/2005 0:00	170	202.7993			314	2.23	2.497	301.5	0.01765	0.2403
5/27/2005 0:00	1060	742.6377			1250	3.025	3.097	1811	-0.161	-2.346
6/6/2005 0:00	290	1957.205			487	2.462	2.688	508.7	-0.01897	-1.19E-01
6/9/2005 0:00	380	11797.21			649	2.58	2.812	663	-0.00924	0.03967
8/31/2005 0:00	96	112.4541			141	1.982	2.149	172.3	-0.08695	-1.028
1/10/2007 0:00	6.9	13.75113			11	0.8388	1.041	13.06	-0.07468	-0.8439
3/12/2007 0:00	23	19.1356			40	1.362	1.602	42.49	-0.02622	-0.2403
3/21/2007 0:00	26	50.95942			49	1.415	1.69	47.91	0.009754	0.1996
3/27/2007 0:00	250	163.7947			362	2.398	2.559	439.9	-0.08464	-0.9632
4/2/2007 0:00	380	2885.551			775	2.58	2.889	663	0.06782	0.8439
4/18/07 12:00 AM	130	860.577			223	2.114	2.348	231.8	-0.01685	-0.03967
5/8/07 12:00 AM	200	9275.776			275	2.301	2.439	353.5	-0.1091	-1.098
5/10/07 12:00 AM	170	5192.087			267	2.23	2.427	301.5	-0.05277	-0.4511
5/24/07 12:00 AM	560	5252.818			1070	2.748	3.029	969.3	0.04293	0.4076
5/25/07 12:00 AM	210	10926.19			280	2.322	2.447	370.8	-0.122	-1.581
7/11/07 12:00 AM	210	1927.15			446	2.322	2.649	370.8	0.08016	1.028
8/16/07 12:00 AM	26	59.26939			46	1.415	1.663	47.91	-0.01768	-0.07941
9/6/07 12:00 AM	23	25.52442			47	1.362	1.672	42.49	0.04381	0.4511
12/6/07 12:00 AM	5	29.5492			11	0.699	1.041	9.529	0.06234	0.6845
12/13/07 12:00 AM	260	2740.146			654	2.415	2.816	457.1	0.1555	1.349
3/6/08 12:00 AM	610	978.7307			790	2.785	2.898	1054	-0.1252	-1.738
4/14/08 12:00 AM	230	483.9471			343	2.362	2.535	405.4	-0.07258	-0.6845
6/30/08 12:00 AM	210	877.0272			440	2.322	2.643	370.8	0.07428	0.9019
8/5/08 12:00 AM	31	24.88007			82	1.491	1.914	56.92	0.1585	1.455
9/16/08 12:00 AM	170	1716.205			337	2.23	2.528	301.5	0.04835	0.6352
4/6/09 12:00 AM	53	187.4148			148	1.724	2.17	96.26	0.1868	1.955
4/13/09 12:00 AM	140	851.2272			262	2.146	2.418	249.3	0.02162	0.2813
4/28/09 12:00 AM	280	9190.134			549	2.447	2.74	491.5	0.04801	0.5874
5/8/09 12:00 AM	710	3253.52			1560	2.851	3.193	1223	0.1057	1.257
7/30/09 12:00 AM	210	523.1419			287	2.322	2.458	370.8	-0.1113	-1.174

9/9/09 12:00 AM	210	3141.001	413	2.322	2.616	370.8	0.04677	0.5409
9/24/09 12:00 AM	770	332.7602	961	2.886	2.983	1324	-0.1392	-1.955
11/3/09 12:00 AM	140	328.0811	230	2.146	2.362	249.3	-0.03495	-0.3228
11/19/09 12:00 AM	6.9	64.97855	13	0.8388	1.114	13.06	-0.00213	0.07941
1/6/10 12:00 AM	3.3	94.51012	6	0.5185	0.7782	6.343	-0.02412	-0.1996
1/19/10 12:00 AM	4.5	79.68536	10	0.6532	1	8.595	0.06578	0.7885
2/4/10 12:00 AM	4.4	63.90931	10	0.6435	1	8.407	0.07534	0.9632
2/23/10 12:00 AM	11	69.34409	18	1.041	1.255	20.63	-0.05921	-0.5409
3/10/10 12:00 AM	150	546.7842	322	2.176	2.508	266.7	0.08183	1.098
3/11/10 12:00 AM	100	11111	151	2	2.179	179.3	-0.07455	-0.7885
4/14/10 12:00 AM	12	52.73309	28	1.079	1.447	22.46	0.09566	1.174
4/23/10 12:00 AM	110	227.6153	196	2.041	2.292	196.8	-0.001824	0.1193
5/13/10 12:00 AM	460	543.8144	758	2.663	2.88	799.4	-0.0231	-0.1593
6/10/10 12:00 AM	160	3344.643	251	2.204	2.4	284.1	-0.05381	-0.4955
6/13/10 12:00 AM	340	7904.956	883	2.531	2.946	594.5	0.1718	1.581
6/14/10 12:00 AM	150	15161.67	272	2.176	2.435	266.7	0.008539	0.1593
6/15/10 12:00 AM	250	6480.41	510	2.398	2.708	439.9	0.06422	0.7355
6/16/10 12:00 AM	220	4805.951	656	2.342	2.817	388.1	0.2279	2.346
8/19/10 12:00 AM	37	60.75484	63	1.568	1.799	67.69	-0.0312	-0.2813
8/25/10 12:00 AM	240	769.9608	633	2.38	2.801	422.7	0.1754	1.738
11/16/10 12:00 AM	140	261.8506	191	2.146	2.281	249.3	-0.1156	-1.257
1/19/11 12:00 AM	21	83.29205	38	1.322	1.58	38.87	-0.009797	
3/7/11 12:00 AM	14	50.81632	20	1.146	1.301	26.13	-0.1161	-1.349
3/16/11 12:00 AM	19	48.00769	38	1.279	1.58	35.24	0.03278	0.3228
4/6/11 12:00 AM	16	37.57128	27	1.204	1.431	29.78	-0.04253	-0.4076
4/18/11 12:00 AM	19	32.832	32	1.279	1.505	35.24	-0.04185	-0.3649
5/2/11 12:00 AM	25	28.80818	39	1.398	1.591	46.11	-0.07269	-0.7355
5/16/11 12:00 AM	23	26.82455	37	1.362	1.568	42.49	-0.06008	-0.5874
6/7/11 12:00 AM	44	21.85781	61	1.643	1.785	80.22	-0.1189	-1.455