

SITE NUMBER— 07144100

SITE NAME—Little Arkansas River near Sedgwick

DATE CREATED— 3/4/2013

MODEL DEVELOPMENT DATA PERIOD— 3/23/2005 – 9/22/2011

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 66 concurrent measurements of turbidity and total suspended solids samples collected from 03-23-2005 through 09-22-2011. Samples were collected throughout the range of continuously observed hydrologic conditions. Summary statistics and complete model-calibration dataset are provided. No total suspended solids values were deemed outliers.

MODEL DEVELOPMENT— Regression analysis was done using S-PLUS, R, and a spreadsheet macro that examined turbidity and streamflow together as explanatory variables for estimating total suspended solids. Different combinations of untransformed and \log_{10} -transformed data were evaluated. Total suspended solids and turbidity 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 Mallow's 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 total suspended solids concentration at site number 07144100.

Turbidity-based model:

$$\log_{10}(TSS) = 0.962 \times \log_{10}(Turb) + 0.189$$

where

TSS = total suspended solids, in milligrams per liter; and

Turb = turbidity, in formazin nephelometric units.

The use of turbidity as an explanatory variable makes sense both physically and statistically. It makes physical sense because suspended solids scatter light in water. There is a clear correlation between total suspended solids and turbidity. Turbidity makes statistical sense as an explanatory variable because it resulted in a model with low Mallow's C_p and *PRESS* values, and high adjusted R^2 values.

TOTAL SUSPENDED SOLIDS 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. The turbidity monitor was removed during winter months because of below freezing conditions. 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).

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Reviewed: Patrick Rasmussen

Model Form

$$\log(\text{TSS}) = 0.962 * \log(\text{Turb}) + 0.189$$

Explanatory variable summary statistics

	log(Turb)	Turb
Minimum	0.5185	3.30
1st Quartile	1.332	21.5
Median	2.114	130
Mean	1.848	178
3rd Quartile	2.362	230
Maximum	3.025	1060

Notes:

Dependent variable summary statistics

	log(TSS)	TSS
Minimum	0.6021	4.00
1st Quartile	1.550	35.5
Median	2.134	136
Mean	1.967	229
3rd Quartile	2.492	311
Maximum	3.223	1670

Notes:

Model Calibration

Basic Data

Number of Measurements:	66
Standard Error:	0.1511
MSPE (Upper)	41.61
MSPE (Lower)	29.38
R ²	0.95
Adj R ²	0.95
Duan BCF:	1.06

Explanatory Variables

Variable	Value	Standard Error
Intercept	0.189	0.0531
log(Turb)	0.962	0.0269

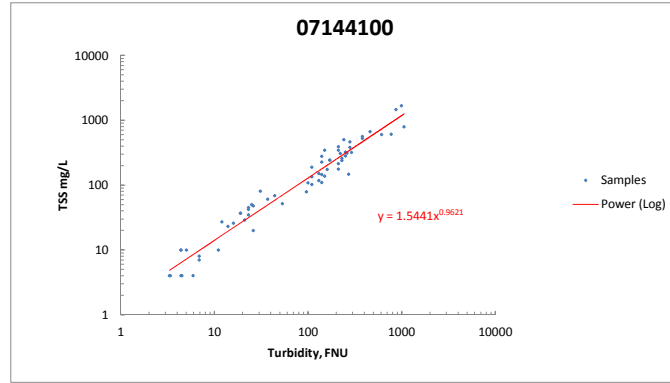
Notes:

Covariance Matrix

	Intercept	log(Turb)
Intercept	1	-0.937
log(Turb)	-0.937	1

Test Criteria

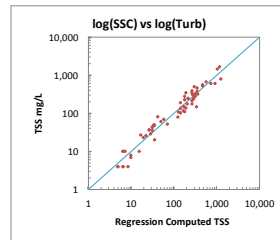
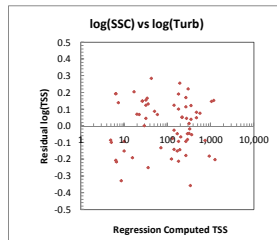
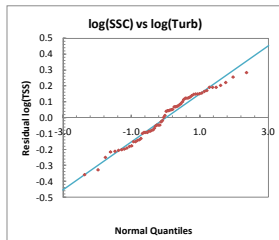
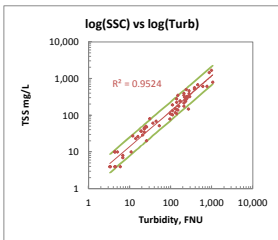
	Leverage	Cook's D	DFITS
	0.0909	0.797	0.348



Observations exceeding at least one test criterion

Observation	Observed log(TSS)	Predicted log(TSS)	Residuals	Standardized Residuals	Studentized Residuals	Leverage	Cook's D	DFITS
8	0.602	0.930	-0.328	-2.23	-2.31	0.0519	0.136	-0.539
34	0.602	0.808	-0.206	-1.40	-1.42	0.0611	0.0642	-0.361
37	0.602	0.817	-0.215	-1.47	-1.48	0.0603	0.0692	-0.375
65	2.17	2.53	-0.358	-2.40	-2.50	0.0259	0.0765	-0.407

Notes:



Water

Date	Turbidity, Temperature		TSS mg/L	log(TSS)	log(Turb)	Regression		Normal Quantiles	90% P.I.	
	FNU	°C				Computed TSS	Residual log(TSS)		Lower	Upper
3/23/2005	260	6.50	312	2.49	2.42	325	-0.018	-0.095	182.0	581.2
5/10/2005	170	17.8	243	2.39	2.23	216	0.051	0.171	120.9	386.2
5/27/2005	1060	20.6	790	2.90	3.03	1257	-0.202	-1.28	703.3	2246.6
6/6/2005	290	21.1	320	2.51	2.46	361	-0.053	-0.288	202.2	645.7
6/9/2005	380	17.8	524	2.72	2.58	469	0.049	0.133	262.2	837.5
8/31/2005	96.0	24.4	79.0	1.90	1.98	125	-0.198	-1.20	69.8	222.9
1/10/2007	6.90	3.10	8.00	0.903	0.839	9.90	-0.093	-0.625	5.5	17.7
2/5/2007	5.90	0.200	4.00	0.602	0.771	8.52	-0.328	-1.97	4.8	15.2
3/12/2007	23.0	12.7	42.0	1.62	1.36	31.5	0.124	0.672	17.6	56.4
3/21/2007	26.0	15.3	48.0	1.68	1.42	35.5	0.131	0.720	19.9	63.4
3/27/2007	250	17.0	324	2.51	2.40	313	0.015	-0.019	175.2	559.8
4/2/2007	380	13.1	566	2.75	2.58	469	0.082	0.409	262.2	837.5
4/18/2007	130	12.9	150	2.18	2.11	167	-0.046	-0.249	93.4	298.3
7/11/2007	210	23.6	392	2.59	2.32	265	0.170	1.20	148.2	473.3
8/16/2007	26.0	27.0	20.0	1.30	1.42	35.5	-0.249	-1.76	19.9	63.4
9/6/2007	23.0	23.2	45.0	1.65	1.36	31.5	0.154	1.06	17.6	56.4
11/26/2007	4.40	4.50	10.0	1.00	0.644	6.42	0.192	1.38	3.6	11.5
12/6/2007	5.00	3.60	10.0	1.00	0.699	7.26	0.139	0.770	4.1	13.0
3/6/2008	610	3.30	605	2.78	2.79	739	-0.087	-0.493	413.4	1320.4
4/14/2008	230	9.40	240	2.38	2.36	289	-0.081	-0.409	161.7	516.5
5/29/2008	230	20.2	260	2.42	2.36	289	-0.046	-0.210	161.7	516.5
6/30/2008	210	23.8	345	2.54	2.32	265	0.115	0.536	148.2	473.3
8/5/2008	31.0	26.5	81.0	1.91	1.49	42.0	0.285	2.36	23.5	75.1
9/16/2008	170	18.2	244	2.39	2.23	216	0.053	0.210	120.9	386.2
4/6/2009	53.0	8.00	52.0	1.72	1.72	70.4	-0.132	-0.720	39.4	125.8
4/13/2009	140	9.70	226	2.35	2.15	179	0.101	0.493	100.3	320.5
4/28/2009	280	13.5	383	2.58	2.45	349	0.040	0.019	195.4	624.3
6/16/2009	870	22.6	1460	3.16	2.94	1040	0.148	0.822	581.9	1858.8
7/30/2009	210	22.1	176	2.25	2.32	265	-0.177	-0.994	148.2	473.3
9/9/2009	210	20.1	214	2.33	2.32	265	-0.093	-0.580	148.2	473.3
9/24/2009	770	16.5	610	2.79	2.89	924	-0.181	-1.06	517.2	1652.1
11/3/2009	140	9.30	110	2.04	2.15	179	-0.212	-1.48	100.3	320.5
11/19/2009	6.90	7.20	7.00	0.845	0.839	9.90	-0.151	-0.877	5.5	17.7
12/1/2009	4.40	6.40	4.00	0.602	0.644	6.42	-0.206	-1.38	3.6	11.5
12/17/2009	3.40	1.90	4.00	0.602	0.532	5.01	-0.098	-0.672	2.8	9.0
1/6/2010	3.30	1.00	4.00	0.602	0.519	4.87	-0.086	-0.450	2.7	8.7
1/19/2010	4.50	2.80	4.00	0.602	0.653	6.56	-0.215	-1.60	3.7	11.7
2/4/2010	4.40	3.00	10.0	1.00	0.644	6.42	0.192	1.48	3.6	11.5
2/23/2010	11.0	2.50	10.0	1.00	1.04	15.5	-0.191	-1.13	8.7	27.7
3/10/2010	150	9.80	345	2.54	2.18	192	0.256	1.97	107.2	342.4

3/11/2010	100	8.70	109	2.04	2.00	130	-0.076	-0.368	72.6	231.8
4/14/2010	12.0	16.4	27.0	1.43	1.08	16.9	0.204	1.60	9.4	30.2
4/23/2010	110	16.4	189	2.28	2.04	142	0.124	0.625	79.6	254.1
5/13/2010	460	15.3	670	2.83	2.66	563	0.075	0.368	315.1	1006.4
6/9/2010	990	21.8	1670	3.22	3.00	1177	0.152	0.994	658.5	2103.6
6/10/2010	160	23.8	175	2.24	2.20	204	-0.066	-0.328	114.1	364.4
6/13/2010	280	22.0	463	2.67	2.45	349	0.122	0.580	195.4	624.3
6/14/2010	150	22.9	138	2.14	2.18	192	-0.143	-0.822	107.2	342.4
6/15/2010	250	23.0	282	2.45	2.40	313	-0.046	-0.171	175.2	559.8
6/16/2010	220	23.6	307	2.49	2.34	277	0.045	0.057	154.9	494.9
7/6/2010	140	23.2	278	2.44	2.15	179	0.191	1.28	100.3	320.5
8/19/2010	37.0	24.8	61.0	1.79	1.57	49.8	0.088	0.450	27.9	89.1
8/25/2010	240	23.7	502	2.70	2.38	301	0.222	1.76	168.5	538.1
11/16/2010	140	7.00	145	2.16	2.15	179	-0.092	-0.536	100.3	320.5
1/19/2011	21.0	0.200	29.0	1.46	1.32	28.9	0.002	-0.057	16.2	51.7
3/7/2011	14.0	6.90	23.0	1.36	1.15	19.6	0.070	0.328	10.9	35.0
3/16/2011	19.0	9.10	37.0	1.57	1.28	26.2	0.149	0.877	14.7	46.9
4/6/2011	16.0	12.0	26.0	1.42	1.20	22.2	0.068	0.249	12.4	39.7
4/18/2011	19.0	16.4	37.0	1.57	1.28	26.2	0.149	0.934	14.7	46.9
5/2/2011	25.0	11.6	50.0	1.70	1.40	34.2	0.165	1.13	19.1	61.1
5/16/2011	23.0	15.0	35.0	1.54	1.36	31.5	0.045	0.095	17.6	56.4
6/7/2011	44.0	24.0	69.0	1.84	1.64	58.9	0.069	0.288	32.9	105.2
6/21/2011	110	23.4	134	2.13	2.04	142	-0.026	-0.133	79.6	254.1
6/22/2011	130	22.6	118	2.07	2.11	167	-0.151	-0.934	93.4	298.3
8/15/2011	270	24.8	148	2.17	2.43	337	-0.358	-2.36	188.7	602.8
9/22/2011	110	16.7	103	2.01	2.04	142	-0.140	-0.770	79.6	254.1