Model Data for Suspended-Sediment Regression at 07048550, West Fork White River East of Fayetteville, AR

This model archive summarizes an ordinary least-squared (OLS) regression model developed to estimate Suspended Sediment concentration (SSC) from instantaneous turbidity data (TURB) collected during the period from October 10, 2014, to April 30, 2021. The methods used follow USGS guidance as referenced in relevant Office of Surface Water/Office of Water Quality Technical Memoranda and USGS Techniques and Methods, book 3, chap. C4 (Rasmussen and others, 2009).

SITE AND MODEL INFORMATION

USGS station Number: 07048550

USGS station Name: West Fork White River East of Fayetteville, AR

Location: Lat 36°03'14", long 94°04'59" referenced to North American Datum of 1983, in NE 1/4 NW 1/4 sec.20, T.16 N., R.29 W., Washington County, AR, Hydrologic Unit 11010001.

Drainage Area: 123 mi^2

Model number: 07048550.SSCC.WY14

Date model was created: October 27, 2021

Model calibration data period: October 10, 2014– April 30, 2021

Model application date: October 10, 2014, onward

Computed by: Sarah Banks, Lower Mississippi Gulf (LMG) WSC, October 27, 2021

STATION DETAILS

EQUIPMENT - A Sutron Satlink II Data Collection Platform (DCP) and transmitter are coupled with a Sutron Bubbler inside a metal "gun safe" style shelter that was installed on the left upstream wingwall of the superstructure bridge. A staff gage is located about 75 ft upstream on the limestone bedrock outcrop on the left bank to measure gage height (GH) data. During high water when the staff is submerged, the outside gage is a is a Type "A" wire-weight gage mounted on the upstream side of the bridge guardrail over mid-channel. Average gage height for the calibration period was 3.60 ft, and the maximum gage height was 24.61 ft. Since October 10, 2014, a YSI 6920 V2 water-quality sonde, equipped with sensors for water temperature, specific conductance (SpC), and turbidity (TURB), is located ~75 ft. upstream of the bridge at the staff gage. Stage, water temperature, SpC, and TURB are recorded every 15 minutes and transmitted hourly by a geostationary operational environmental satellite.

REMARKS –

- Channel is straight for about 150 ft upstream and about 1,000 ft downstream with wooded banks on both sides.
- The streambed at this site is Hindsville limestone covered with gravel, and silt from the Fayetteville shale and other lesser shale units further up-section. The left bank upstream of the bridge is comprised of a limestone shelf that is exposed at low to medium-flow conditions. It is thought that this shelf may have a slight impact on the SpC readings during localized rain events. There is a stable mud/sediment bank in the middle of the stream just upstream of the bridge that is covered in reeds and grasses. The right bank upstream of the bridge is scoured out as it is comprised of mostly sand/dirt/clay.
- Channel control prevails at stages of approximately 5-12.0 ft. The river begins to go into overbank on river right (south side of river) between 12 and 13 ft. Access the gage from the north if the river is rising above a stage of 12 ft.
- Overbank control on river right is a steep slope on the south side of Molly Wagnon Road. Overbank control on river left is a gently sloping open field. The left overbank is only inundated in very high flows (above stages of about 18 ft).
- There may be some regulation at very low flows by small dams located at 1) an abandoned pumping station in the Fayetteville Industrial Park (approximately 3.0 miles upstream), and 2) the West Fork City Park.
- Station is operated in cooperation with Arkansas Natural Resources Commission, Arkansas Department of Environmental Quality, and Beaver Water District.
- Sediment model is a project completed in cooperation with Beaver Water District, which contributes yearly funds to monitoring, data collection, and model development.
- Station classified as current purpose and included in network as a principal stream for planning and design.

MODEL DATA

A total of 64 sediment samples were collected from November 2014 – May 2021 (USGS, 2016). During calibration dataset development, there were 10 samples where turbidity data were not available in the computed time-series record. There was an additional observation that was removed where the corresponding turbidity value was negative. Thus, the dataset was reduced to 53 observations of paired SSC and TURB data. This dataset was evaluated by looking at any flagged observations based on model diagnostic statistics such as leverage, Cook's D, and the difference in fit (DFFITS). The final regression model is based on 50 concurrent measurements from the fixed TURB sensor and SSC samples collected from November 2014 through April 2021. Samples were collected throughout the range of continuously observed hydrologic and turbidity conditions (Samples range 1.1 – 832 Formazin Nephelometric Units (FNU) and an observed TURB range 1-1480 FNU). Summary statistics and the complete model-calibration data are provided in the dataset. TURB values are time-averaged approved unit values corresponding with the duration of sample collection. Studentized residuals from the final model were inspected for values greater than 3 or less than negative 3. Values outside of the 3 to -3 range are considered potential outliers and were investigated. DFFITS was also used for identifying influence based on the change in predicted value for a point when that point is left out of the regression. In addition to removed samples from table 1, data from 11/21/2014 at 08:30, 01/19/2016 at 12:45, 02/07/2019 at 10:30, 01/11/2020 at 08:30, and 04/30/2021 at 13:30 were flagged in the statistical analysis and reviewed. Table 1 presents any removed data with comments, data were removed based on a visual analysis of data scatter, residual analysis, and higher studentized residuals followed up by a review of the time series, sample paperwork, and expert opinions.

Table 1. Table of removed data with comments

Date/Time	TURB	SSC	Comments
2/17/2016 8:00	NA	5	Turbidity data not available due to gap in record
7/27/2017 10:15	NA	5	Turbidity data not available due to gap in record
1/9/2018 12:30	14.1	3	flagged by DFFITs and large Studentized Residual values, field notes indicate sediment fouling on monitor
5/8/2018 15:00	NA	20	Turbidity data not available due to gap in record
1/30/2019 10:15	NA	4	Turbidity data not available due to gap in record
2/21/2019 11:15	NA	12	Turbidity data not available due to gap in record
5/14/2019 15:00	NA	31	Turbidity data not available due to gap in record
7/25/2019 10:30	NA	11	Turbidity data not available due to gap in record
9/30/2019 14:00	16.2	19	Fluctuating turbidity during sampling – sample collected after monitor cleaning and redeployment.
2/18/2020 13:30	NA	7	Turbidity data not available due to gap in record
9/23/2020 13:15	NA	13	Turbidity data not available due to gap in record
10/15/2020 11:30	NA	8	Turbidity data not available due to gap in record
11/12/2020 10:45	-2.6	7	Negative turbidity – monitor error
5/11/2021 12:00	33.8	13	Flagged observation with large negative studentized residual and DFFITS, erroneous turbidity data – sample collected after monitor cleaning and redeployment.

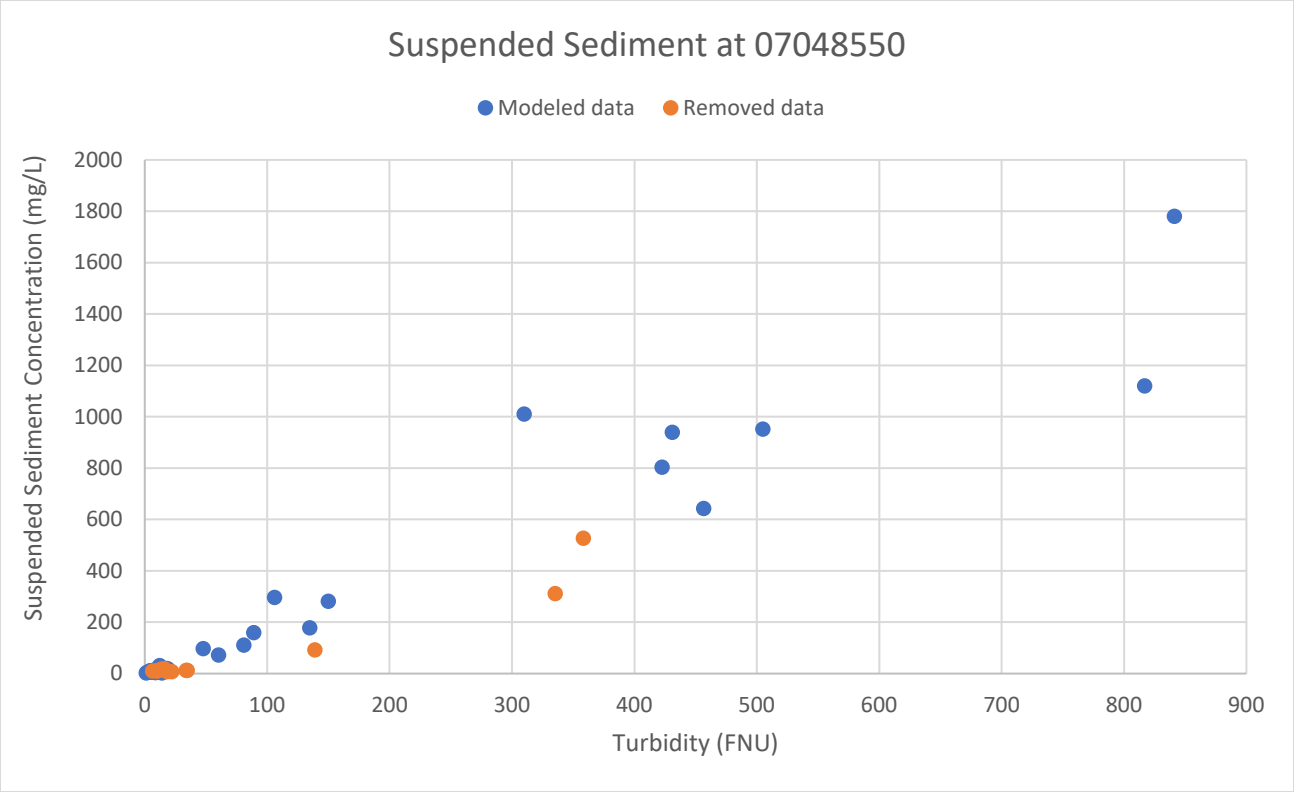


Figure 1. Plot of all suspended sediment concentrations from discreet samples and concomitant time-averaged turbidity data.

PHYSICAL SAMPLING AND SEDIMENT DATA - Six or more SSC samples are collected per year by hydrologic technicians in the Fayetteville and Little Rock offices of the USGS LMG Water Science Center following established USGS procedures (Edwards and others, 1999). A Federal Interagency Sediment Project US DH-95 (plastic bottle, cap, and nozzle) depth-integrating sampler was used from the bridge to collect sediment samples during high water (stages 4.0 to ~ 12.0 ft) using the equal-width-increment method (EWI) where a total of 10 depth integrated samples were collected along the cross section during each site visit with a sampling time of approximately 30 minutes on average. Wading grab samples were collected when the stream was less than 4 feet deep, a plastic bottle is implemented in wading grab samples. Samples are analyzed for SSC by filtration method at the USGS Sediment Laboratory in Rolla, Missouri. The samples that were collected using the EWI method were composited at the lab for analysis. All data were collected using USGS protocols and are stored in USGS NWIS databases.

SURROGATE DATA – TURB and discharge (Q) were evaluated as surrogate explanatory variables to compute time-series SSC. A YSI 6920 V2 Multi-parameter sonde logs water temperature, SpC, and TURB at the station. The sonde is mounted in a 6-inch pipe on the left bank. The Unit-value TURB collected at 15-minute intervals, is used as a surrogate for SSC. The methods used follow USGS guidance as referenced in relevant Office of Surface Water Technical Memorandum 2016.07 ,USGS Techniques and Methods reports (Rasmussen and others, 2009; Wagner and others, 2006) and the USGS National Field Manual for the Collection of Water-Quality Data (Anderson, 2005).

MODEL DEVELOPMENT

Initially, data plots of the response variable SSC and the explanatory variables TURB and Q indicated correlation to SSC. Regression analysis was done using the interface (V1.0) created by the Kansas Water Science Center, the ggplot2 package (Wickham, 2016) and base R (R Core Team, 2020). Comparison of model diagnostics (Table 2) indicated that the log base 10 transformed data were more accurate in predicting SSC, this is attributed to the right-skewed nature of the environmental data. Based on evaluation of model diagnostics (Table 2) and comparison plots of measured and modeled-estimated SSC for single and multiple linear regression models for TURB and Q, the addition of Q was not found to be significant as an explanatory variable (Table 2) and model output was limited to single linear regression (SLR) as outlined in USGS TM 3-C4 and OSW2016.07 (Rasmussen and others, 2009; Office of Surface Water, 2016.07).

Table 2. Model diagnostics for exploratory data analysis
RMSE: Root Mean Squared Error
MSPE: Mean Squared Prediction Error
R2: coefficient of determination
BCF: Bias Correction Factor

MODEL	RMSE	MSPE	R2	BCF
SSC ~ Q	279	143	0.47	NA
LogSSC ~ LogQ	0.484	136	0.632	1.77
SSC ~ TURB	112	57.4	0.914	NA
LOGSSC ~ LOGTURB	0.152	35.6	0.964	1.06
LOGSSC ~ LOGTURB + LOGQ	0.151	35.4	0.965	1.06

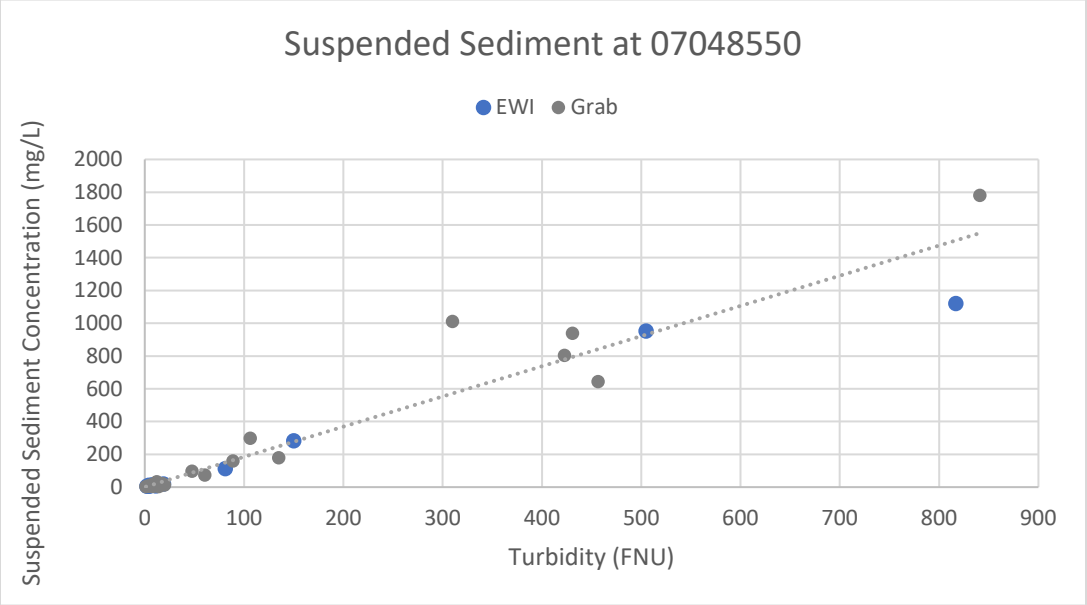


Figure 2. Plot of all suspended sediment concentrations from discreet samples and concomitant time-averaged turbidity data.

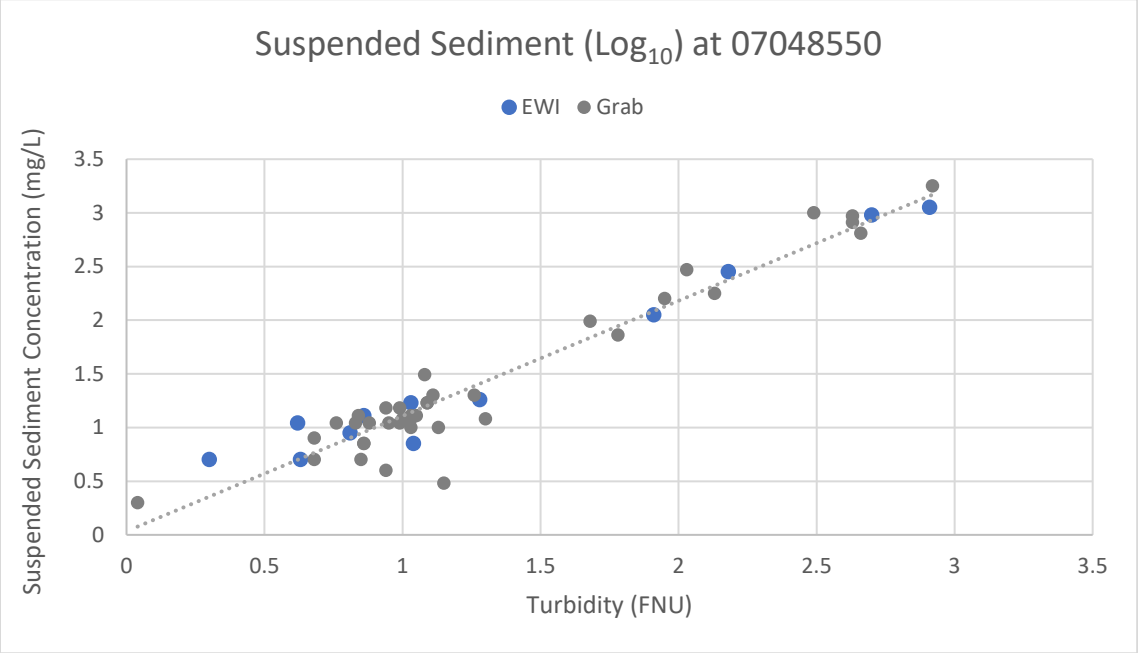


Figure 3. Plot of Log10 transformed suspended sediment concentrations from all discrete samples and concomitant Log10 transformed time-averaged turbidity data.

SSC RECORD – Unit values for SSC were computed using an Ordinary least squares (OLS) regression model relating SSC to time-averaged unit-value TURB, at 15-minute intervals for the period October 10, 2014 – April 30, 2021, Unit values for SSC were derived using the modeling interface (V1.0) furnished by the Kansas Water Science Center (Rasmussen and others, 2009), R software (R core team, 2020), and Microsoft Excel.

MODEL SUMMARY

Summary of regression analysis for suspended-sediment concentration at site 07048550, West Fork White River East of Fayetteville, AR

$\log_{10}SSC = 1.03 * \log_{10}TURB + 0.105$

where:

$\log_{10}SSC$ = base-10 logarithm of suspended-sediment concentration, in milligrams per liter; and
$\log_{10}TURB$ = base-10 logarithm of turbidity, in FNU

MODEL INFORMATION:

Number of samples = 50
Root-mean-squared-error (RMSE) = 0.152
Model standard percentage error = 35.6
Coefficient of determination (R^2) = 0.964
Bias Correction Factor (BCF) = 1.06

PREVIOUS MODELS - N/A

MODEL STATISTICS, PERFORMANCE METRICS, DATA, AND PLOTS

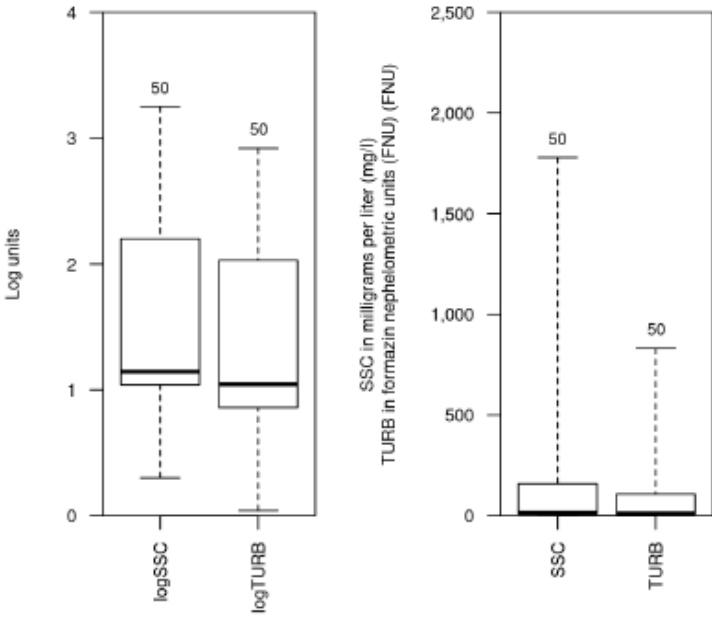
MODEL

$\log_{10}SSC = 1.03 * \log_{10}TURB + 0.105$

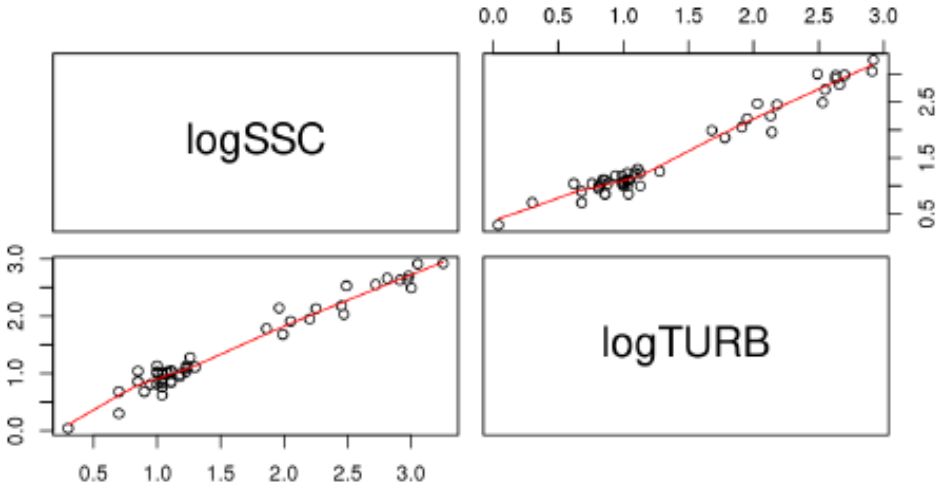
VARIABLE SUMMARY STATISTICS

	LogSSC	SSC	LogTURB	TURB
Minimum	0.30	2	0.04	1.10
1st Quartile	1.04	11	0.86	7.24
Median	1.14	14	1.04	11.10
Mean	1.55	195	1.39	111.00
3rd Quartile	2.20	158	2.03	107.00
Maximum	3.25	1780	2.92	832.00

BOX PLOTS



EXPLORATORY PLOTS



MODEL PERFORMANCE METRICS

Number of Observations: 50

Standard error (RMSE): 0.152

Average Model standard percentage error (MSPE): 35.6

Coefficient of determination (R^2): 0.964

Adjusted Coefficient of Determination (Adj. R^2): 0.963

Bias Correction Factor (BCF): 1.06

EXPLANATORY VARIABLES

	Coefficients	Standard Error	t value	Pr(>|t|)
(Intercept)	0.105	0.0456	2.31	2.52e-02
Log_{10}TURB	1.030	0.0289	35.80	2.94e-36

CORRELATION MATRIX

	Intercept	E.vars
Intercept	1.00	-0.883
E.vars	-0.883	1.00

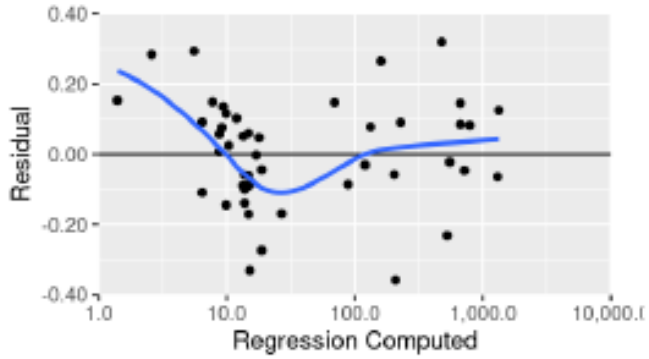
OUTLIER TEST CRITERIA

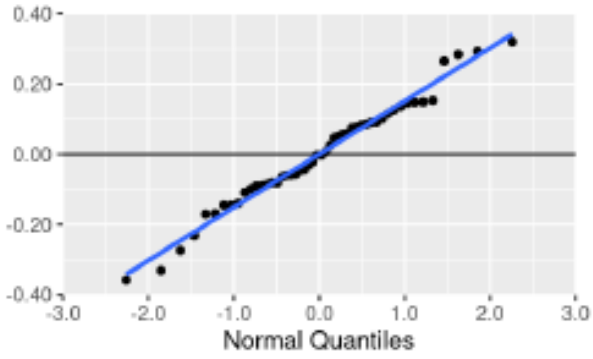
Leverage	Cook's D	DFFITS
0.120	0.194	0.400

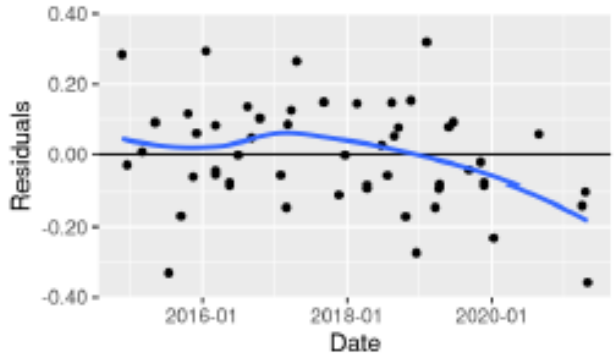
FLAGGED OBSERVATIONS

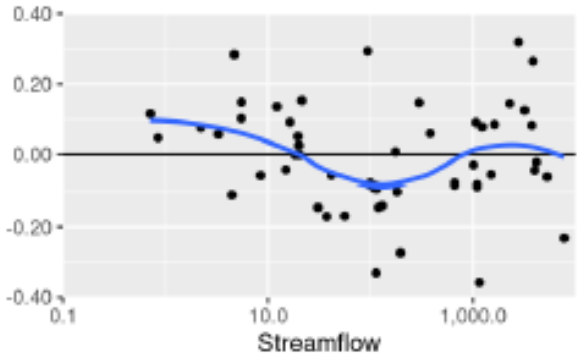
	LogSSC	Estimate	Residual	Standard Residual	Studentized Residual	Leverage	Cook's D	DFFITS
11/21/2014 08:30	0.70	0.416	0.284	1.94	2.00	0.0634	0.127	0.519
01/19/2016 12:45	1.04	0.747	0.293	1.98	2.04	0.0417	0.085	0.426
02/07/2019 10:30	3.00	2.680	0.320	2.18	2.27	0.0637	0.162	0.593
01/11/2020 08:30	2.49	2.720	-0.231	-1.58	-1.61	0.0669	0.089	-0.430
04/30/2021 13:30	1.96	2.320	-0.358	-2.41	-2.54	0.0403	0.122	-0.521

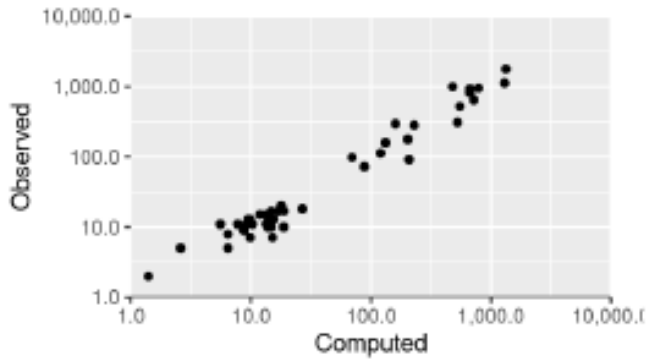
STATISTICAL PLOTS

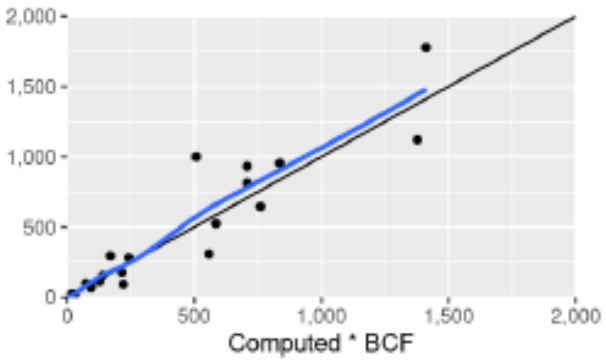


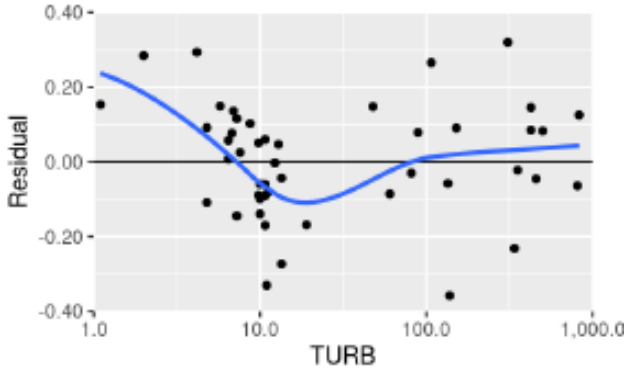


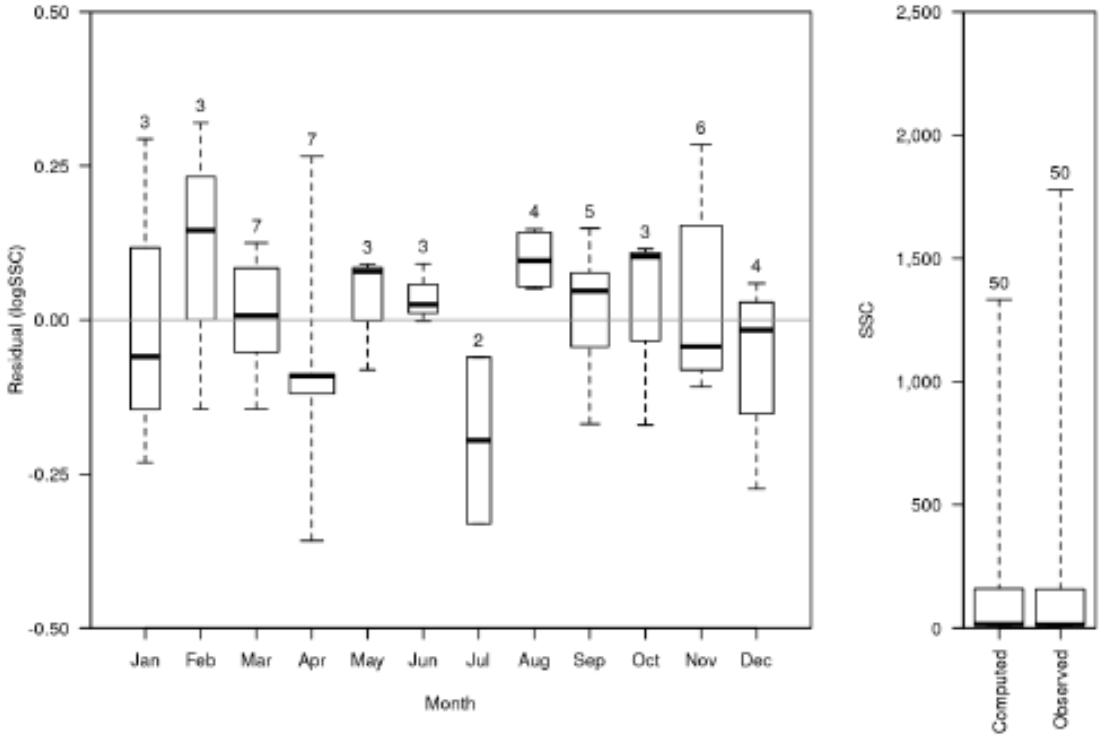


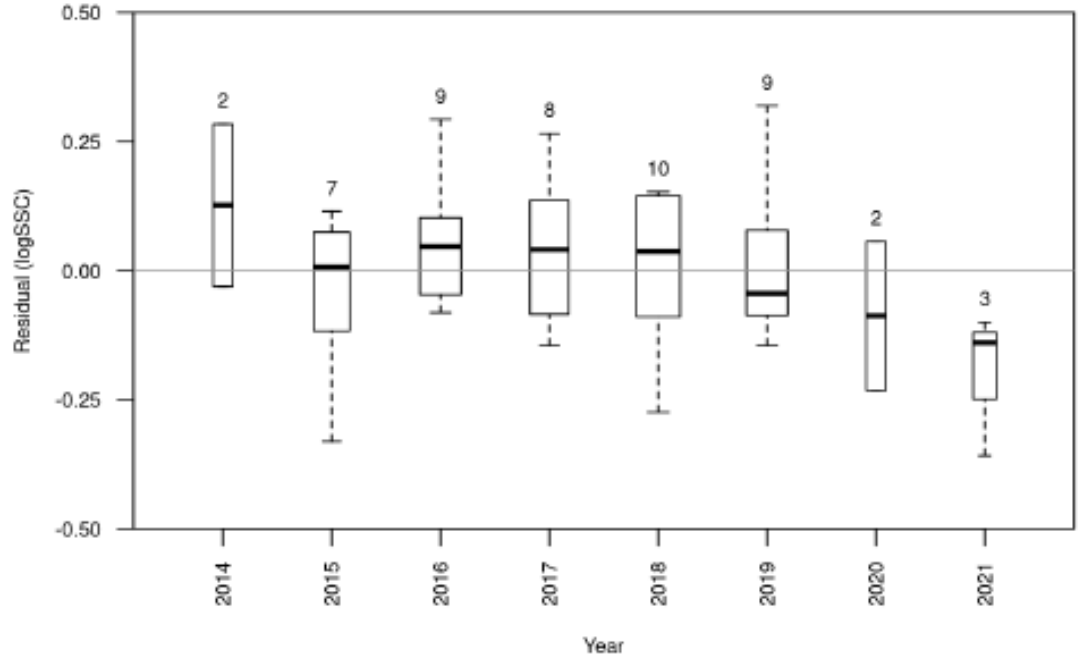




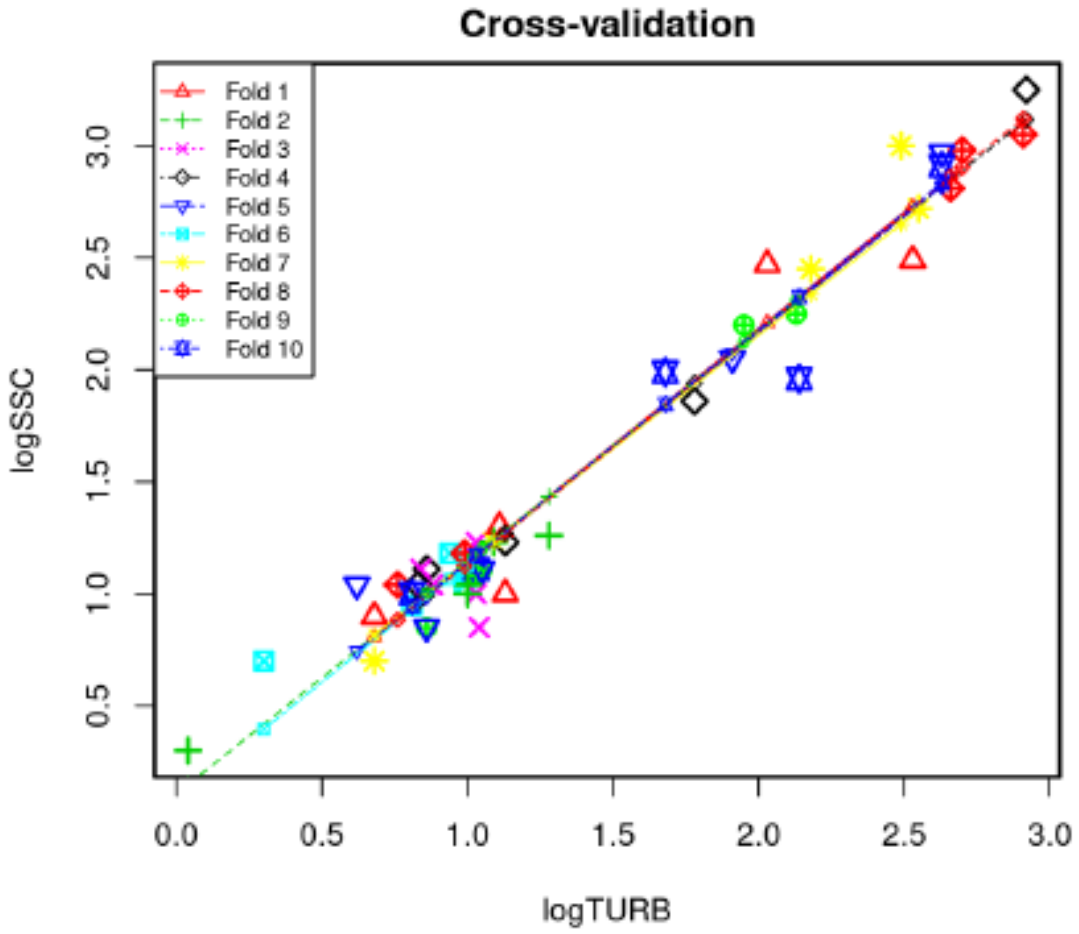





Residual (logSSC)
0.50
0.25
0.00
-0.25
-0.50
3
3
7
7
3
3
2
4
5
3
6
4
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
SSC
2,500
2,000
1,500
1,000
500
0
50
50
Computed
Observed


Residual (logSSC)
0.50
0.25
0.00
-0.25
-0.50
2
7
9
8
10
9
2
3
2014
2015
2016
2017
2018
2019
2020
2021
Year

CROSS-VALIDATION



Minimum mean squared error (MSE) of folds: 0.0083

Mean MSE of folds: 0.0233

Median MSE of folds: 0.0252

Maximum MSE of folds: 0.0422

(Mean MSE of folds) / (Model MSE): 1.0100

MODEL-CALIBRATION DATA SET

	Date	logSSC	logTURB	SSC	TURB	Computed logSSC	Computed SSC	Residual	Normal Quantiles	Censored Values
1	2014-11-21	0.7	0.3	5.01	2	0.416	2.76	0.284	1.63	--
2	2014-12-18	2.05	1.91	112	81.3	2.08	128	-0.0304	-0.125	--
3	2015-03-03	0.95	0.81	8.91	6.46	0.943	9.29	0.00703	0.075	--
4	2015-05-08	2.45	2.18	282	151	2.36	242	0.0904	0.61	--
5	2015-07-16	0.85	1.04	7.08	11	1.18	16.1	-0.331	-1.85	--
6	2015-09-16	1.26	1.28	18.2	19.1	1.43	28.5	-0.169	-1.22	--
7	2015-10-21	1.11	0.86	12.9	7.24	0.995	10.5	0.115	0.802	--
8	2015-11-17	3.05	2.91	1120	813	3.11	1380	-0.0644	-0.438	--
9	2015-12-03	1.23	1.03	17	10.7	1.17	15.7	0.0595	0.33	--
10	2016-01-19	1.04	0.62	11	4.17	0.747	5.91	0.293	1.85	--
11	2016-03-09	2.98	2.7	955	501	2.9	836	0.0828	0.494	--
12	2016-03-09	2.81	2.66	646	457	2.86	760	-0.0459	-0.227	--
13	2016-03-09	2.25	2.13	178	135	2.31	215	-0.0579	-0.278	--
14	2016-05-18	1.11	1.05	12.9	11.2	1.19	16.5	-0.0811	-0.551	--
15	2016-06-30	1.23	1.09	17	12.3	1.23	18.1	-0.00249	-0.025	--
16	2016-08-16	1.11	0.84	12.9	6.92	0.974	9.98	0.136	0.949	--
17	2016-09-06	1.3	1.11	20	12.9	1.25	19	0.0468	0.176	--
18	2016-10-18	1.18	0.94	15.1	8.71	1.08	12.7	0.103	0.735	--
19	2017-01-31	1.08	1	12	10	1.14	14.6	-0.0594	-0.33	--
20	2017-02-28	0.85	0.86	7.08	7.24	0.995	10.5	-0.145	-1.12	--
21	2017-03-07	2.91	2.63	813	427	2.82	708	0.0851	0.551	--
22	2017-03-25	3.25	2.92	1780	832	3.12	1410	0.125	0.873	--
23	2017-04-22	2.47	2.03	295	107	2.2	170	0.266	1.46	--
24	2017-09-06	1.04	0.76	11	5.75	0.891	8.25	0.149	1.22	--
25	2017-11-21	0.7	0.68	5.01	4.79	0.809	6.82	-0.109	-0.873	--
26	2017-12-22	1.23	1.09	17	12.3	1.23	18.1	-0.00249	0.025	--
27	2018-02-21	2.97	2.63	933	427	2.82	708	0.145	1.03	--
28	2018-04-12	1.04	0.99	11	9.77	1.13	14.3	-0.0891	-0.671	--
29	2018-06-25	1.04	0.88	11	7.59	1.02	11	0.0246	0.125	--
30	2018-07-24	1.11	1.03	12.9	10.7	1.17	15.7	-0.0605	-0.384	--
31	2018-08-14	1.99	1.68	97.7	47.9	1.84	73.7	0.147	1.12	--
32	2018-08-27	1.18	0.99	15.1	9.77	1.13	14.3	0.0509	0.227	--
33	2018-09-18	1.04	0.83	11	6.76	0.964	9.75	0.0763	0.384	--
34	2018-10-24	1	1.03	10	10.7	1.17	15.7	-0.17	-1.33	--
35	2018-11-19	0.3	0.04	2	1.1	0.147	1.49	0.153	1.33	--
36	2018-12-17	1	1.13	10	13.5	1.27	19.9	-0.274	-1.63	--
37	2019-02-07	3	2.49	1000	309	2.68	507	0.32	2.26	--
38	2019-03-22	0.85	0.86	7.08	7.24	0.995	10.5	-0.145	-1.03	--
39	2019-04-10	1.08	1.03	12	10.7	1.17	15.7	-0.0905	-0.735	--
40	2019-04-14	1.86	1.78	72.4	60.3	1.95	93.6	-0.086	-0.61	--
41	2019-05-30	2.2	1.95	158	89.1	2.12	140	0.0783	0.438	--
42	2019-06-21	0.9	0.68	7.94	4.79	0.809	6.82	0.0914	0.671	--
43	2019-09-09	1.23	1.13	17	13.5	1.27	19.9	-0.0439	-0.176	--
44	2019-11-07	2.72	2.55	525	355	2.74	585	-0.0221	-0.075	--
45	2019-11-25	1.11	1.05	12.9	11.2	1.19	16.5	-0.0811	-0.494	--
46	2020-01-11	2.49	2.53	309	339	2.72	558	-0.231	-1.46	--
47	2020-08-26	1	0.81	10	6.46	0.943	9.29	0.057	0.278	--
48	2021-04-02	1	1	10	10	1.14	14.6	-0.139	-0.949	--
49	2021-04-19	1.04	1	11	10	1.14	14.6	-0.0994	-0.802	--
50	2021-04-30	1.96	2.14	91.2	138	2.32	220	-0.358	-2.26	--

ORIGINAL DATA SET

datetime	Q	TURB	SSC	logQ	logTURB	logSSC	Status	Sample method	Sample method name	Hydrologic condition
11/21/2014 8:30	4.68	2	5	0.67	0.3	0.7	Accepted	70	Grab sample (dip)	Stable- normal stage
12/18/2014 10:00	1010	81	111	3	1.91	2.05	Accepted	10	Equal width increment (ewi)	Stable- high stage
3/3/2015 12:00	176	6.4	9	2.25	0.81	0.95	Accepted	70	Grab sample (dip)	Stable- normal stage
5/8/2015 9:45	1070	150	282	3.03	2.18	2.45	Accepted	10	Equal width increment (ewi)	Falling stage
7/16/2015 6:30	114	11	7	2.06	1.04	0.85	Accepted	70	Grab sample (dip)	Stable- normal stage
9/16/2015 7:45	55.9	19	18	1.75	1.28	1.26	Accepted	70	Grab sample (dip)	Stable- normal stage
10/21/2015 9:45	0.71	7.2	13	-0.15	0.86	1.11	Accepted	70	Grab sample (dip)	Stable- normal stage
11/17/2015 17:00	5290	820	1120	3.72	2.91	3.05	Accepted	10	Equal width increment (ewi)	Rising stage
12/3/2015 9:15	382	10.6	17	2.58	1.03	1.23	Accepted	70	Grab sample (dip)	Stable- normal stage
1/19/2016 12:45	93.5	4.2	11	1.97	0.62	1.04	Accepted	70	Grab sample (dip)	Stable- normal stage
2/17/2016 8:00	17.1	NA	5	1.23	0.63	0.7	Accepted	70	Grab sample (dip)	Stable- normal stage
3/8/2016 21:15	3730	505	952	3.57	2.7	2.98	Accepted	10	Equal width increment (ewi)	Rising stage
3/8/2016 23:15	3990	458	643	3.6	2.66	2.81	Accepted	10	Equal width increment (ewi)	Peak stage
3/9/2016 7:45	1500	135	178	3.18	2.13	2.25	Accepted	10	Equal width increment (ewi)	Rising stage
5/18/2016 16:00	99.4	11.3	13	2	1.05	1.11	Accepted	70	Grab sample (dip)	Stable- normal stage
6/30/2016 17:00	20.3	12.2	17	1.31	1.09	1.23	Accepted	70	Grab sample (dip)	Stable- normal stage
8/16/2016 9:15	12.2	6.9	13	1.09	0.84	1.11	Accepted	70	Grab sample (dip)	Stable- normal stage
9/6/2016 16:15	0.84	12.9	20	-0.08	1.11	1.3	Accepted	70	Grab sample (dip)	Stable- low stage
10/18/2016 13:30	5.46	8.7	15	0.74	0.94	1.18	Accepted	70	Grab sample (dip)	Stable- normal stage
1/31/2017 15:00	41.6	9.9	12	1.62	1	1.08	Accepted	70	Grab sample (dip)	Stable- normal stage
2/28/2017 11:30	30.7	7.3	7	1.49	0.86	0.85	Accepted	70	Grab sample (dip)	Stable- normal stage
3/7/2017 9:15	1620	416	804	3.21	2.63	2.91	Accepted	10	Equal width increment (ewi)	Falling stage
3/25/2017 1:00	3190	846	1780	3.5	2.92	3.25	Accepted	10	Equal width increment (ewi)	Falling stage
4/21/2017 22:45	3840	106	297	3.58	2.03	2.47	Accepted	10	Equal width increment (ewi)	Rising stage
7/27/2017 10:15	5.85	NA	5	0.77	0.85	0.7	Accepted	70	Grab sample (dip)	Stable- normal stage
9/6/2017 17:15	5.48	5.7	11	0.74	0.76	1.04	Accepted	70	Grab sample (dip)	Stable- normal stage
11/21/2017 8:15	4.44	4.8	5	0.65	0.68	0.7	Accepted	70	Grab sample (dip)	Stable- low stage
12/22/2017 9:15	18.5	12.2	17	1.27	1.09	1.23	Accepted	70	Grab sample (dip)	Stable- normal stage
1/9/2018 12:30	24.6	14.1	3	1.39	1.15	0.48	Accepted	70	Grab sample (dip)	Stable- normal stage
2/20/2018 20:15	2270	430	939	3.36	2.63	2.97	Accepted	10	Equal width increment (ewi)	Rising stage
4/12/2018 13:00	109	9.8	11	2.04	0.99	1.04	Accepted	70	Grab sample (dip)	Stable- normal stage
5/8/2018 15:00	352	NA	20	2.55	1.26	1.3	Accepted	70	Grab sample (dip)	Stable- normal stage
6/25/2018 12:45	20	7.5	11	1.3	0.88	1.04	Accepted	70	Grab sample (dip)	Stable- normal stage
7/24/2018 13:00	8.47	10.7	13	0.93	1.03	1.11	Accepted	70	Grab sample (dip)	Stable- normal stage
8/14/2018 17:45	299	47.7	97	2.48	1.68	1.99	Accepted	10	Equal width increment (ewi)	Rising stage
8/27/2018 11:00	19.6	9.8	15	1.29	0.99	1.18	Accepted	70	Grab sample (dip)	Stable- normal stage
9/18/2018 15:00	2.2	6.8	11	0.34	0.83	1.04	Accepted	70	Grab sample (dip)	Stable- normal stage
10/24/2018 10:00	37.3	10.7	10	1.57	1.03	1	Accepted	70	Grab sample (dip)	Stable- normal stage
11/19/2018 13:45	21.4	1.1	2	1.33	0.04	0.3	Accepted	70	Grab sample (dip)	Stable- normal stage
12/17/2018 13:30	196	13.6	10	2.29	1.13	1	Accepted	70	Grab sample (dip)	Stable- normal stage
1/30/2019 10:15	139	NA	4	2.14	0.94	0.6	Accepted	70	Grab sample (dip)	Stable- normal stage
2/7/2019 10:30	2790	310	1010	3.45	2.49	3	Accepted	70	Grab sample (dip)	Rising stage
2/21/2019 11:15	446	NA	12	2.65	1.3	1.08	Accepted	70	Grab sample (dip)	Stable- normal stage
3/22/2019 12:45	120	7.2	7	2.08	0.86	0.85	Accepted	70	Grab sample (dip)	Stable- normal stage
4/10/2019 10:15	116	10.8	12	2.06	1.03	1.08	Accepted	70	Grab sample (dip)	Stable- normal stage
4/14/2019 11:00	1100	60.4	72	3.04	1.78	1.86	Accepted	70	Grab sample (dip)	Falling stage
5/14/2019 15:00	234	NA	31	2.37	1.08	1.49	Accepted	70	Grab sample (dip)	Stable- normal stage
5/30/2019 1:00	1230	88.9	159	3.09	1.95	2.2	Accepted	70	Grab sample (dip)	Falling stage
6/21/2019 9:30	16.4	4.8	8	1.21	0.68	0.9	Accepted	70	Grab sample (dip)	Stable- normal stage
7/25/2019 10:30	14.9	NA	11	1.17	0.95	1.04	Accepted	70	Grab sample (dip)	Stable- normal stage
9/9/2019 12:45	14.9	13.6	17	1.17	1.13	1.23	Accepted	70	Grab sample (dip)	Stable- normal stage
9/30/2019 14:00	155	16.2	19	2.19	1.21	1.28	Accepted	70	Grab sample (dip)	Stable- normal stage
11/7/2019 9:15	4170	358	527	3.62	2.55	2.72	Accepted	10	Equal width increment (ewi)	Rising stage
11/25/2019 13:15	663	11.1	13	2.82	1.05	1.11	Accepted	70	Grab sample (dip)	Stable- normal stage
1/11/2020 8:30	7770	336	311	3.89	2.53	2.49	Accepted	10	Equal width increment (ewi)	Falling stage
2/18/2020 13:30	237	NA	7	2.37	1.34	0.85	Accepted	70	Grab sample (dip)	Stable- normal stage
8/26/2020 11:45	3.28	6.4	10	0.52	0.81	1	Accepted	70	Grab sample (dip)	Stable- normal stage
9/23/2020 13:15	14.91	NA	13	1.17	1.54	1.11	Accepted	70	Grab sample (dip)	Stable- normal stage
10/15/2020 11:30	2.48	NA	8	0.39	1.26	0.9	Accepted	70	Grab sample (dip)	Stable- normal stage
11/12/2020 10:45	44.8	-2.6	7	1.65	NA	0.85	Accepted	70	Grab sample (dip)	Stable- normal stage
4/2/2021 11:15	130	10	10	2.11	1	1	Accepted	70	Grab sample (dip)	Stable- normal stage
4/19/2021 13:00	182	10	11	2.26	1	1.04	Accepted	70	Grab sample (dip)	Stable- normal stage
4/30/2021 13:30	1160	139	92	3.06	2.14	1.96	Accepted	70	Grab sample (dip)	Falling stage
5/11/2021 12:00	116	33.8	13	2.06	1.53	1.11	Accepted	70	Grab sample (dip)	Stable- normal stage

DEFINITIONS

SSC: Suspended sediment concentration in mg/l (parameter code 80154)

TURB: time weighted turbidity in FNU (parameter code 63680)

App Version 1.0

REFERENCES CITED:

Anderson, C.W., 2005, Turbidity: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A6.7, accessed January 2022, at https://doi.org/10.3133/twri09A6.7.

Edwards, T.K., and Glysson, G.D., 1999, Field methods for measurement of fluvial sediment: U.S. Geological Survey Techniques of Water-Resources Investigations, book 3, chap. C2, 89 p, accessed January 2022, at https://pubs.er.usgs.gov/publication/twri03C2.

Office of Surface Water Technical Memorandum No. 2016.07, Policy and guidance for approval of surrogate regression models for computation of time-series suspended-sediment concentrations and loads, accessed January 2022 at https://water.usgs.gov/admin/memo/SW/sw.2016.07+wq.2016.10.pdf

R Core Team, 2020, R: A language and environment for statistical computing: R Foundation for Statistical Computing. http://www.R-project.org/

Rasmussen, P.P., Gray, J.R., Glysson, G.D., and Ziegler, A.C., 2009, Guidelines and procedures for computing time-series suspended-sediment concentrations and loads from in-stream turbidity-sensor and streamflow data: U.S. Geological Survey Techniques and Methods book 3, chap. C4, 53 p, accessed January 2022, at https://pubs.usgs.gov/tm/tm3c4/

U.S. Geological Survey, 2020, Kansas Water Science Center regression modeling interface (V1.0): U.S. Geological Survey, accessed January 2022, at http://kswsc.cr.usgs.gov:3838/peslick/regReport/

U.S. Geological Survey, 2016, National Water Information System data available on the World Wide Web (USGS Water Data for the Nation) , accessed January 2022, at http://waterdata.usgs.gov/nwis/

Wagner, R.J., Boulger, R.W.J., Oblinger, C.J., and Smith, B.A., 2006, Guidelines and standard procedures for continuous water-quality monitors: Station operation, record computation, and data reporting: United States Geological Survey Techniques and Methods 1-D3: 51 p, accessed January 2022, at https://pubs.er.usgs.gov/publication/tm1D3

Wickham, H.,2016, Ggplot2: Elegant graphics for data analysis (2nd ed.): Springer International Publishing, accessed January 2022, at https://ggplot2.tidyverse.org