Appendix 2.15. Model Archive Summary for Chloride Concentration at U.S. Geological Survey site 07144100; Little Arkansas River near Sedgwick, Kansas, during May 1998 through December 2019

This model archive summary summarizes the chloride model developed to compute hourly or daily chloride. Model development methods follow U.S. Geological Survey (USGS) guidance from Office of Surface Water/Office of Water Quality Technical Memoranda and USGS Techniques and Methods, book 3, chap. C4 (Rasmussen and others, 2009).

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Site and Model Information

Site Number: 07144100

Site Name: Little Arkansas River near Sedgwick, Kansas

Location: Latitude 37°52'59", longitude 97°25'27" referenced to North American Datum of 1927, in NE 1/4 NW 1/4 NW 1/4 sec.15, T.25 S., R.1 W., Sedgwick County, Kansas; hydrologic unit 11030012.

Equipment: A Sutron Satlink II High Data Rate Collection Platform and a Design Analysis Water Log H350/355 nonsubmersible pressure transducer transfers real-time stage and water-quality data via satellite. The primary reference gage is a Type-A wire-weight gage located on the downstream bridge handrail. Check-bar elevation is 33.614 feet. The orifice is enclosed in a well-screen and attached to a concrete pier on the left downstream side of the bridge. Gage height was measured during May 1998 through December 2019. A YSI 6600 water-quality monitor equipped with water temperature, specific conductance, pH, dissolved oxygen, and turbidity (a YSI Model 6026 [September 1998 through December 2006] and YSI Model 6136 [July 2004 through March 2015]) sensors collected data during April 1998 through March 2015. A YSI EXO2 water-quality monitor equipped with water temperature, specific conductance, pH, dissolved oxygen, turbidity, and fluorescent dissolved organic matter sensors collected data during September 2014 through December 2019. A Hach Nitratax monitor collected nitrate data during March 2012 through December 2019.

Date model was developed: June 1, 2020

Model calibration data period: May 1, 1998 through December 11, 2019

Model Data

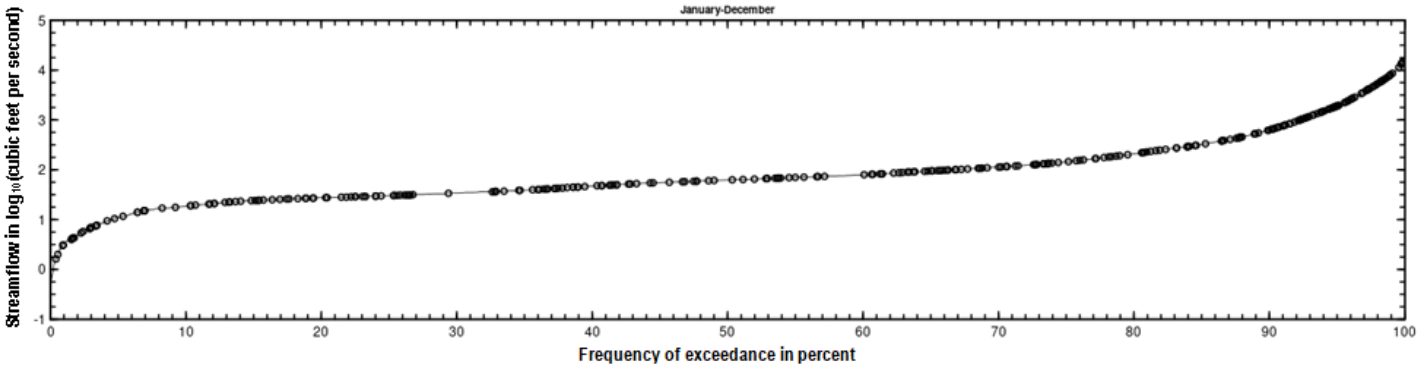
All data were collected using USGS protocols (U.S. Geological Survey, variously dated; Wagner and others, 2006; Sauer and Turnipseed, 2010; Turnipseed and Sauer, 2010) and are stored in the National Water Information System (NWIS) database (U.S. Geological Survey, 2021). Explanatory variables were evaluated individually and in combination. Potential explanatory variables included streamflow, water temperature, specific conductance, pH, dissolved oxygen, YSI EXO2 turbidity, nitrate, and fluorescent dissolved organic matter. Seasonal components (sine and cosine variables) also were evaluated as explanatory variables.

The regression model is based on 329 concomitant values of discretely collected chloride and continuously measured specific conductance during May 1998 through December 2019. Discrete samples were collected over a range of streamflow and specific conductance conditions. Six samples had concentrations that were below the minimum reporting level (<5 mg/L) and a Tobit regression model was developed to compute estimates of TSS using the absolute maximum likelihood estimation approach (Hald, 1949; Cohen, 1950; Tobin, 1958; Helsel and others, 2020). Summary statistics and the complete model-calibration dataset are provided below. Outliers and influential points were identified using methods described in Rasmussen and others (2009), including leverage and Cook's distance (Cook's D; Cook, 1977) values. Outliers in previously published versions of this model (Christensen and others, 2003; Rasmussen and others, 2016) were examined and retained in the dataset if there were no clear issues, explanations, or conditions that would cause a result to be invalid for model calibration. All samples were retained in the dataset.

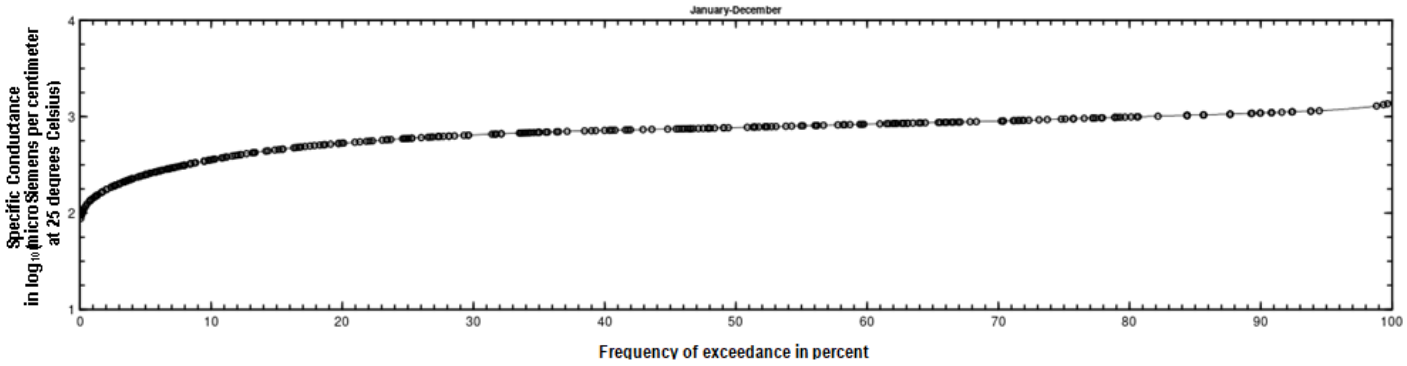
Chloride

Discrete samples were collected from the downstream side of the bridge or instream within 50 feet of the bridge using equal-width-increment, multi-vertical, single vertical or grab-dip methods following U.S. Geological Survey (variously dated) and Rasmussen and others (2014). Discrete samples were collected on a semifixed to event-based schedule ranging from 4 to 25 samples per year with a FISP US DH–95 or D–95 with a Teflon bottle, cap, and nozzle depth-integrating sampler, a DH–81 with a Teflon bottle, cap, and nozzle hand sampler or a grab sample with a Teflon bottle depending on sample location. Samples were analyzed for chloride by the Wichita Municipal Water and Wastewater Laboratory in Wichita, Kansas, or the USGS National Water Quality Laboratory according to standard methods (American Public Health Association and others, 1995).

Chloride Samples Plotted on Streamflow Duration Curve



Chloride Samples Plotted on Specific Conductance Duration Curve



Continuous Data

Concomitant specific conductance values were time interpolated. If no concomitant continuous data were available within two hours of sample collection, the sample was not included in the dataset.

Model Development

Tobit regression models were developed using absolute maximum likelihood estimation methods using the *smwrQW* (v.0.7.9) package in R (version 4.0.0) programming language (R Core Team, 2020).

Specific conductance was selected as the best predictor of chloride based on residual plots, a larger pseudo coefficient of determination (pseudo R^2) and a relatively low estimated residual standard error (*RSE*). Specific conductance was positively related to total chloride because it measures water's capacity to conduct an electrical current and is related to the concentration of ionized substances in water (Hem, 1992).

Model Summary

Summary of final chloride regression analysis at site number 07144100:

Chloride-based model:

$$\log_{10}(CL) = 1.316 \times \log_{10}(SC) - 1.903$$

where,

$\log_{10}$ = logarithm base 10;
CL = chloride, in milligrams per liter (mg/L); and
SC = specific conductance, in microsiemens per centimeter at 25 degrees Celsius (µS/cm)

The log-transformed model may be retransformed to original units so that CL can be calculated directly. The retransformation introduces a bias in the calculated constituent. This bias may be corrected using Duan's bias correction factor (BCF; Duan, 1983). Extracted model residuals used for BCF computation included censored residuals that were replaced by their expected values. For this model, the calculated BCF is 1.05. The retransformed model, accounting for BCF is:

$$CL = 0.0131 \times SC^{1.316}$$

Model Statistics, Data, and Plots

Model

LOGCL = + 1.316 * LOGSC – 1.903

Variable Summary Statistics

	CL	SC
Minimum	<5	90.17
1st Quartile	27.994	316
Median	56.223	658.17
Mean	63.61	609.94
3rd Quartile	88.815	852.81
Maximum	315	1383.33

Explanatory Variables

Coefficients:

	Estimate	Std. Error	z-score	p-value
(Intercept)	-1.903	0.07440	-25.58	0
logSC	1.316	0.02727	48.25	0

Basic Model Statistics

```
Estimated residual standard error (Unbiased) = 0.1359
Distribution: normal
Number of observations = 329, number censored = 6 (1.8 percent)

Loglik(model) = 182.6 Loglik(intercept only) = -164.8
  Chi-square = 694.8, degrees of freedom = 1, p-value = <0.0001

Computation method: AMLE

Pseudo R-squared: 0.8793

  AIC: -359.2
  BIC: -347.9
```

Outlier Test Criteria

```
Test criteria
leverage   cooksD
0.009119 0.694614
```

Flagged Observations

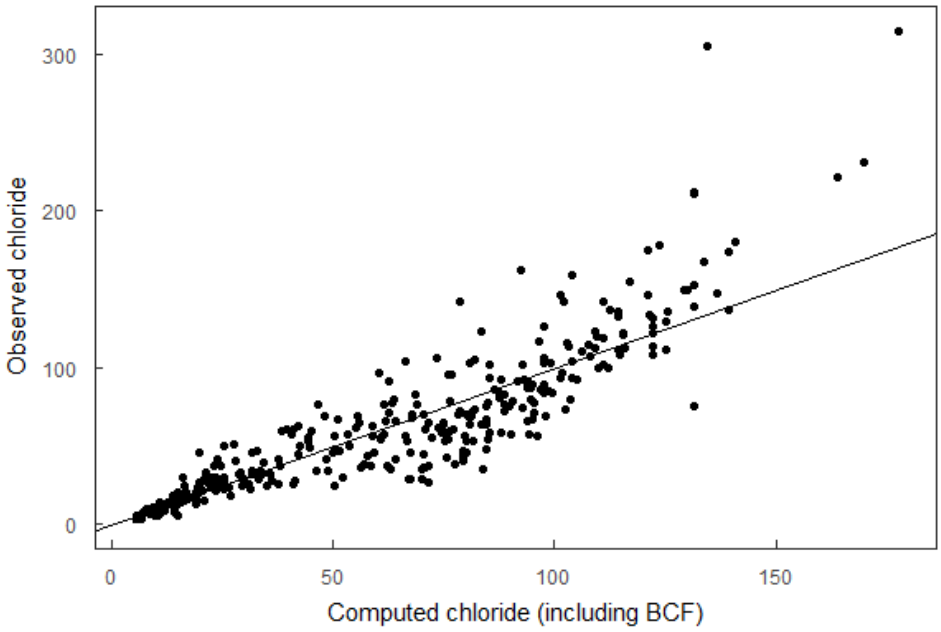
	logCL	ycen	yhat	resids	leverage	cooksD
9	1.2304	FALSE	1.1307	0.099764	0.009533	2.62E-03
15	0.699	TRUE	0.6691	-0.090133	0.025596	5.93E-03
16	0.7275	FALSE	0.7358	-0.008262	0.022675	4.39E-05
18	0.9031	FALSE	1.1356	-0.232518	0.009414	1.41E-02
23	2.3636	FALSE	2.2101	0.15347	0.009793	6.37E-03
27	1.2041	FALSE	1.1335	0.070617	0.009465	1.30E-03
34	1.0792	FALSE	1.0569	0.022278	0.01145	1.58E-04
35	1.0414	FALSE	0.9484	0.093022	0.01472	3.55E-03
49	1.301	FALSE	1.148	0.153031	0.009119	5.89E-03
57	0.699	TRUE	0.6999	-0.109022	0.02422	8.19E-03
58	1.1461	FALSE	1.0204	0.125726	0.01249	5.48E-03
62	0.8451	FALSE	0.9259	-0.08081	0.015463	2.82E-03
75	2.3464	FALSE	2.1938	0.152531	0.009395	6.03E-03
85	1.1761	FALSE	1.1069	0.069202	0.010125	1.34E-03
93	0.9542	FALSE	0.8987	0.055589	0.016396	1.42E-03
110	0.9494	FALSE	1.0515	-0.102131	0.0116	3.35E-03
112	0.9823	FALSE	0.9914	-0.009138	0.013359	3.10E-05
124	1.2577	FALSE	1.12	0.137687	0.009796	5.13E-03
127	0.716	FALSE	0.9968	-0.280788	0.013195	2.89E-02
142	0.8633	FALSE	0.9326	-0.069284	0.015239	2.04E-03
143	0.699	TRUE	0.747	-0.140704	0.022206	1.25E-02
144	0.699	TRUE	0.7543	-0.145914	0.021901	1.32E-02
145	0.699	TRUE	0.781	-0.165438	0.020813	1.61E-02
146	1.1004	FALSE	1.09	0.01042	0.010561	3.17E-05
147	1.0755	FALSE	1.1421	-0.066559	0.009259	1.13E-03
148	0.699	TRUE	0.7396	-0.135497	0.022517	1.17E-02
195	2.4983	FALSE	2.2293	0.268947	0.010277	2.06E-02
197	0.9201	FALSE	0.9346	-0.014478	0.015173	8.88E-05
198	0.7664	FALSE	0.7602	0.006232	0.021659	2.38E-05
199	0.7998	FALSE	0.9081	-0.108361	0.016069	5.28E-03
216	0.8904	FALSE	0.9712	-0.080808	0.013987	2.54E-03
223	0.9479	FALSE	0.9561	-0.008169	0.014469	2.69E-05

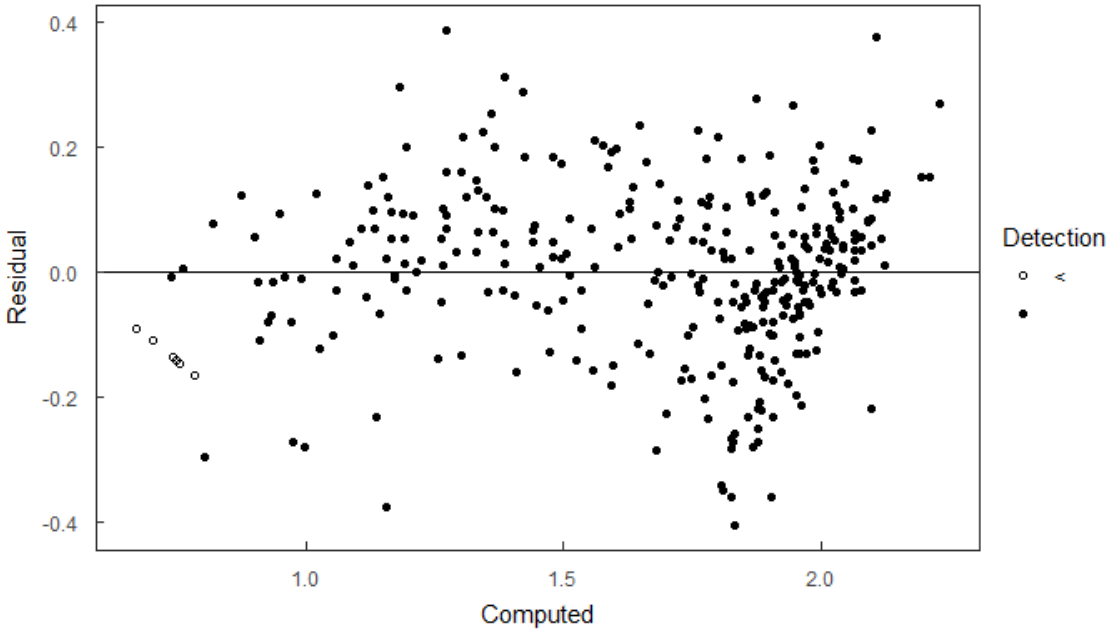
253	1.0294	FALSE	1.0593	-0.029926	0.011384	2.83E-04
256	0.8904	FALSE	0.905	-0.014558	0.016177	9.59E-05
261	1.0768	FALSE	1.1171	-0.040283	0.009868	4.42E-04
299	0.7025	FALSE	0.9731	-0.270577	0.013928	2.84E-02
300	0.9041	FALSE	1.0264	-0.122247	0.012316	5.11E-03
303	0.5084	FALSE	0.8031	-0.294709	0.019934	4.88E-02
317	0.8962	FALSE	0.8196	0.076624	0.019295	3.19E-03
320	0.9961	FALSE	0.8737	0.122338	0.017279	7.25E-03
324	1.1312	FALSE	1.0842	0.047026	0.010713	6.56E-04

95% Confidence Intervals

```
                2.5 %    97.5 %
(Intercept) -2.048929 -1.757296
logSC        1.262232  1.369116
```

Plots

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0.0
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1.0
1.5
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Computed
Detection
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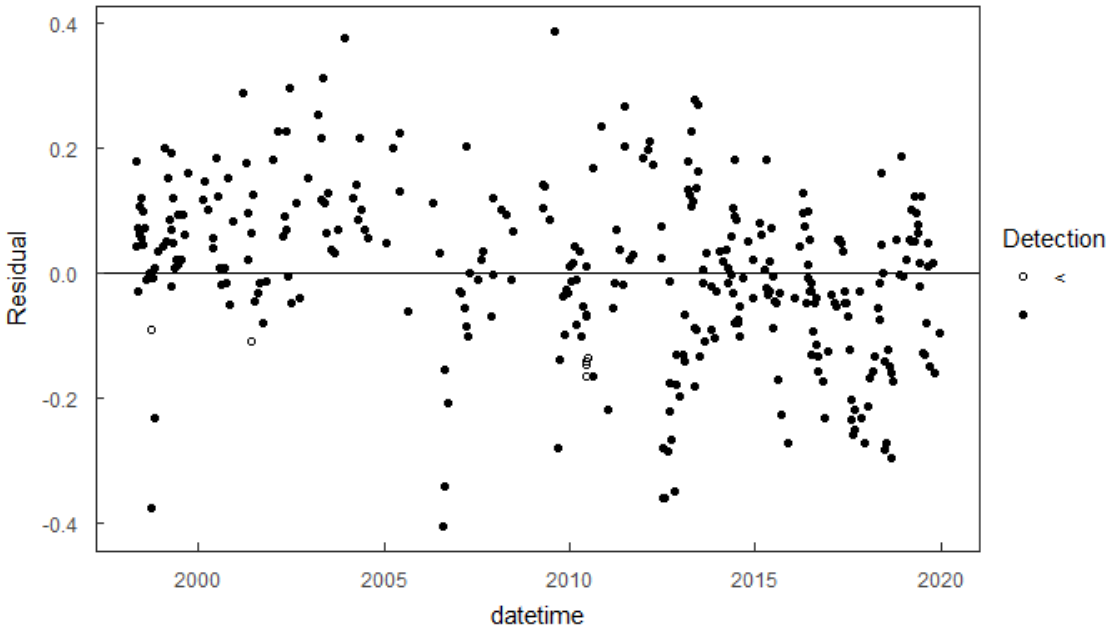
Residual
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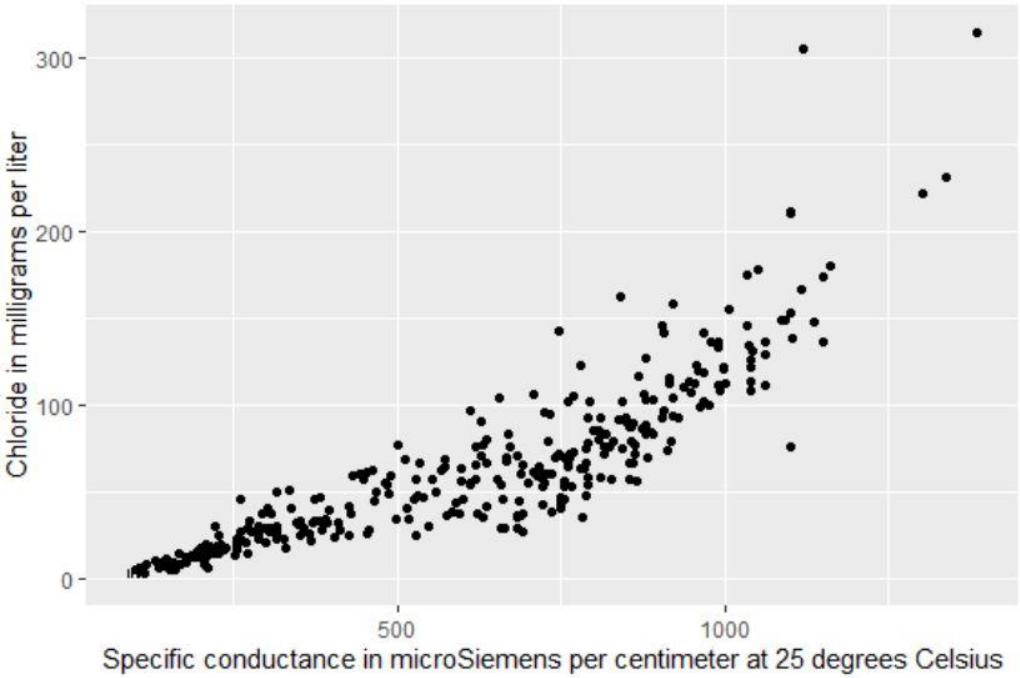
0.0
-0.2
-0.4
2000
2005
2010
2015
2020
datetime
Detection
<



Model-Calibration Dataset

	datetime	logCL	logSC	CL	SC	Computed logCL	Computed CL
1	5/1/1998 13:05	2.16	2.96	146	902.5	1.986	101.59
2	5/6/1998 12:10	1.97	2.91	92.8	810.8	1.925	88.23
3	5/11/1998 10:30	2.06	2.96	116	913.5	1.993	103.22
4	5/14/1998 9:25	1.35	2.5	22.5	314.2	1.383	25.34
5	5/27/1998 14:25	2.01	2.93	102	842.8	1.947	92.83
6	6/2/1998 14:20	2.14	2.99	137	977.3	2.032	112.81
7	6/16/1998 11:20	2.03	2.94	106	877	1.97	97.83
8	6/24/1998 11:05	1.9	2.8	80	634.5	1.785	63.9
9	7/10/1998 10:45	1.23	2.31	17	202.2	1.132	14.19
10	7/13/1998 14:00	1.43	2.5	27	316	1.387	25.53
11	7/20/1998 12:40	1.79	2.75	62	567.7	1.721	55.19
12	8/6/1998 9:40	1.92	2.91	83	816.7	1.929	89.07
13	9/15/1998 9:50	1.95	2.93	90	853.2	1.954	94.34
14	9/22/1998 10:15	0.778	2.32	6	210.5	1.154	14.96
15	9/25/1998 10:10	<0.699	1.96	<5	90.2	0.67	4.9
16	10/5/1998 10:20	0.728	2.01	5.34	101.3	0.737	5.72
17	10/22/1998 11:25	1.57	2.63	37	427.8	1.56	38.04
18	11/5/1998 13:40	0.903	2.31	8	204	1.136	14.35
19	12/4/1998 10:40	1.9	2.86	79	728.3	1.864	76.61
20	1/12/1999 10:30	2.14	3.04	139	1101.5	2.1	132.04
21	2/1/1999 11:00	1.57	2.49	37	306	1.368	24.47
22	2/19/1999 12:20	2.12	3.02	131	1041.3	2.068	122.64
23	3/16/1999 13:40	2.36	3.13	231	1337.7	2.211	170.51
24	3/23/1999 13:55	2.18	3.04	153	1099.6	2.099	131.74
25	4/7/1999 13:55	1.79	2.66	61	454.2	1.594	41.15
26	4/14/1999 13:50	1.67	2.73	47	540.3	1.693	51.72
27	4/16/1999 11:15	1.2	2.31	16	203.2	1.134	14.28
28	4/21/1999 14:25	1.82	2.79	66	619.7	1.771	61.94
29	4/28/1999 13:50	1.43	2.44	27	277.7	1.313	21.53
30	5/5/1999 14:00	1.93	2.91	85	806	1.922	87.54
31	5/24/1999 13:05	1.18	2.32	15	211.1	1.156	15.01
32	6/18/1999 11:00	1.4	2.5	25	316	1.387	25.53

33	6/21/1999 13:40	1.28	2.35	19	223	1.187	16.14
34	7/20/1999 10:45	1.08	2.25	12	177.8	1.058	11.97
35	8/3/1999 11:45	1.04	2.17	11	147	0.949	9.33
36	8/19/1999 10:15	2.05	2.96	113	914	1.994	103.29
37	9/28/1999 10:50	1.43	2.41	27.1	259.5	1.274	19.7
38	2/9/2000 10:45	2.22	3.05	167	1115.2	2.107	134.22
39	3/7/2000 10:20	1.48	2.46	30.1	287.3	1.332	22.53
40	3/28/2000 12:45	1.37	2.41	23.2	255.5	1.265	19.3
41	5/19/2000 9:45	2.13	3.03	136	1062.2	2.08	125.89
42	5/31/2000 11:30	1.65	2.67	44.2	464	1.606	42.33
43	6/28/2000 10:05	1.66	2.57	46	372.4	1.48	31.69
44	7/20/2000 10:40	1.98	2.86	96	725	1.861	76.15
45	7/28/2000 10:45	1.46	2.55	29	356.5	1.455	29.92
46	8/16/2000 10:40	1.86	2.87	72	745	1.877	78.93
47	9/8/2000 9:50	1.96	2.93	91	849.3	1.952	93.79
48	9/25/2000 11:25	1.94	2.93	87	857	1.957	94.9
49	10/26/2000 11:35	1.3	2.32	20	208.5	1.149	14.77
50	11/8/2000 9:35	1.61	2.71	41	514.6	1.665	48.5
51	12/4/2000 10:10	2.17	3.04	149	1085.8	2.092	129.58
52	3/14/2001 10:40	1.71	2.53	51	335.3	1.421	27.61
53	4/13/2001 9:55	1.84	2.71	69	512.5	1.663	48.24
54	4/26/2001 12:45	2.13	3	136	988.7	2.039	114.55
55	5/8/2001 9:50	1.83	2.82	68	666.3	1.813	68.15
56	6/4/2001 10:00	1.4	2.46	25	288	1.334	22.6
57	6/6/2001 10:10	<0.699	1.98	<5	95.2	0.701	5.26
58	6/23/2001 11:15	1.15	2.22	14	166.8	1.021	11.01
59	7/11/2001 10:00	1.88	2.91	76	815	1.928	88.83
60	8/2/2001 8:45	1.86	2.89	73	769.5	1.895	82.36
61	8/28/2001 9:50	1.89	2.9	78	789.7	1.91	85.21
62	9/20/2001 10:20	0.845	2.15	7	141.3	0.927	8.86
63	10/31/2001 9:40	1.94	2.93	87	853	1.954	94.32
64	1/10/2002 10:45	2.24	3.01	175	1032.5	2.063	121.27
65	2/21/2002 9:50	2.33	3.04	212	1100	2.099	131.81
66	4/9/2002 10:05	2.08	2.98	120	957.9	2.02	109.87
67	4/22/2002 11:00	1.36	2.41	23	259	1.273	19.65
68	5/13/2002 11:15	1.99	2.78	97	609.5	1.762	60.6
69	5/22/2002 11:00	1.62	2.63	42	425	1.556	37.71
70	6/6/2002 9:00	1.51	2.59	32	393	1.511	34.02
71	6/13/2002 9:30	1.48	2.34	30	220.5	1.181	15.9
72	7/9/2002 11:50	1.81	2.86	64	716.7	1.855	75
73	8/15/2002 10:00	1.88	2.79	76	618.1	1.77	61.73
74	9/19/2002 10:10	1.81	2.86	65	716.5	1.854	74.98
75	12/18/2002 10:30	2.35	3.11	222	1300	2.195	164.22
76	3/20/2003 10:20	1.61	2.48	41	301.3	1.359	23.98
77	4/17/2003 10:15	2.24	3.06	174	1150	2.125	139.75
78	4/23/2003 9:50	2.02	2.82	104	653.6	1.802	66.44
79	5/14/2003 10:00	1.7	2.5	50	316	1.387	25.53
80	5/29/2003 10:00	1.74	2.68	55	482	1.628	44.5
81	6/11/2003 10:25	1.88	2.83	76	672.9	1.819	69.03
82	6/24/2003 10:55	2.15	2.99	142	967.2	2.026	111.28
83	7/30/2003 12:20	2.01	2.95	103	888.7	1.978	99.54
84	9/3/2003 10:25	1.32	2.43	21	267.4	1.291	20.49
85	10/14/2003 11:00	1.18	2.29	15	194	1.108	13.43
86	12/11/2003 11:30	2.48	3.05	305	1120	2.11	134.97
87	3/9/2004 9:50	1.28	2.33	19	212.8	1.161	15.18
88	3/30/2004 9:50	2.19	3	155	1006.3	2.049	117.24

89	4/26/2004 12:00	2.12	3	133	989	2.039	114.59
90	5/13/2004 12:40	1.52	2.44	33	273.7	1.304	21.13
91	5/26/2004 11:45	2.16	3.01	146	1032.5	2.063	121.27
92	6/22/2004 9:10	1.34	2.41	22	259.3	1.274	19.68
93	7/27/2004 9:45	0.954	2.13	9	134.8	0.899	8.32
94	1/27/2005 11:20	1.49	2.54	31	348.7	1.443	29.06
95	3/23/2005 10:20	1.39	2.35	24.8	226.3	1.196	16.46
96	5/27/2005 9:40	1.47	2.46	29.2	288.3	1.334	22.63
97	6/6/2005 10:15	1.57	2.47	36.9	292.8	1.343	23.09
98	8/31/2005 11:30	1.41	2.56	25.6	366	1.471	30.97
99	5/2/2006 13:05	1.98	2.86	95.3	731.8	1.867	77.1
100	6/26/2006 12:40	1.36	2.46	23.1	287	1.332	22.49
101	7/27/2006 11:15	1.43	2.84	26.8	692.2	1.835	71.66
102	8/15/2006 9:10	1.46	2.82	29.1	658.2	1.806	67.05
103	8/23/2006 13:25	1.58	2.77	38.1	582.2	1.736	57.06
104	9/27/2006 11:00	1.67	2.88	47	750	1.881	79.62
105	1/10/2007 11:25	1.94	2.94	86.4	872.6	1.967	97.18
106	2/5/2007 9:30	2	2.99	99.5	974	2.03	112.31
107	3/12/2007 12:05	1.79	2.85	61.6	707.9	1.848	73.79
108	3/21/2007 12:05	1.78	2.86	59.9	728.1	1.864	76.57
109	3/27/2007 11:40	1.78	2.65	60.4	441.7	1.578	39.67
110	4/2/2007 11:50	0.949	2.25	8.9	176.1	1.052	11.83
111	4/18/2007 12:00	1.21	2.37	16.4	233.9	1.215	17.19
112	7/11/2007 12:10	0.982	2.2	9.6	158.5	0.992	10.3
113	8/16/2007 9:25	1.85	2.83	70.5	683.6	1.828	70.48
114	9/6/2007 9:35	2.05	2.98	113	954.1	2.018	109.3
115	11/26/2007 10:40	1.86	2.91	72	814.7	1.928	88.79
116	12/6/2007 11:45	1.99	2.96	96.7	905.5	1.988	102.04
117	12/13/2007 10:15	1.47	2.47	29.5	296.3	1.35	23.45
118	3/6/2008 10:30	1.47	2.48	29.3	305	1.366	24.37
119	4/14/2008 12:10	1.7	2.67	50.2	466.7	1.609	42.65
120	5/29/2008 11:45	1.16	2.34	14.5	217.8	1.174	15.64
121	6/30/2008 12:05	1.51	2.54	32	347.1	1.44	28.89
122	4/6/2009 13:00	1.92	2.83	83.3	670	1.816	68.64
123	4/13/2009 11:40	1.83	2.73	67.1	534.7	1.687	51.01
124	4/28/2009 10:05	1.26	2.3	18.1	198.5	1.121	13.85
125	6/16/2009 12:50	1.6	2.6	39.6	395	1.514	34.24
126	7/30/2009 10:35	1.66	2.41	45.8	259.5	1.274	19.7
127	9/9/2009 12:00	0.716	2.2	5.2	160	0.998	10.43
128	9/24/2009 11:15	1.12	2.4	13.1	251.5	1.256	18.9
129	11/3/2009 9:20	1.37	2.51	23.3	326.7	1.406	26.67
130	11/19/2009 11:40	1.8	2.89	63.7	780	1.903	83.84
131	12/1/2009 12:40	1.97	2.96	93.6	920.7	1.998	104.29
132	12/17/2009 12:00	2.03	3.02	108	1040	2.067	122.43
133	1/6/2010 11:50	2.14	3.06	136	1150	2.125	139.75
134	1/19/2010 10:00	2.05	3.02	113	1040	2.067	122.43
135	2/4/2010 10:40	2.03	2.98	107	948.7	2.015	108.48
136	2/23/2010 12:50	2.09	3	122	997	2.043	115.81
137	3/10/2010 9:10	1.77	2.85	58.8	713.3	1.852	74.54
138	3/11/2010 9:20	1.76	2.79	57.4	618.7	1.771	61.81
139	4/14/2010 9:05	2.1	3.02	126	1040	2.067	122.43
140	4/23/2010 10:00	1.64	2.77	43.9	590	1.743	58.06
141	5/13/2010 10:15	1.39	2.55	24.8	351.5	1.447	29.37
142	6/9/2010 9:45	0.863	2.16	7.3	143	0.933	8.99
143	6/13/2010 15:20	<0.699	2.01	<5	103.3	0.748	5.86
144	6/13/2010 19:20	<0.699	2.02	<5	104.7	0.755	5.96

145	6/14/2010 9:40	<0.699	2.04	<5	109.7	0.782	6.34
146	6/15/2010 9:20	1.1	2.27	12.6	188.3	1.091	12.92
147	6/16/2010 9:10	1.08	2.31	11.9	206.3	1.143	14.57
148	7/6/2010 9:00	<0.699	2.01	<5	102	0.74	5.76
149	8/19/2010 12:15	1.62	2.8	41.7	636.8	1.787	64.19
150	8/25/2010 11:00	1.76	2.65	56.9	449	1.587	40.53
151	11/16/2010 12:25	1.88	2.7	76.7	500.7	1.65	46.78
152	1/19/2011 11:40	1.88	3.04	75.7	1100	2.099	131.81
153	3/7/2011 11:40	1.83	2.88	67.7	759	1.887	80.88
154	3/16/2011 9:05	1.91	2.91	80.5	808	1.923	87.83
155	4/6/2011 9:30	2.09	2.98	123	956	2.019	109.58
156	5/2/2011 9:05	2.04	2.97	111	935.9	2.007	106.56
157	6/7/2011 8:30	1.81	2.84	65.3	692	1.835	71.62
158	6/21/2011 10:00	2.2	2.96	158	920	1.997	104.19
159	6/22/2011 10:20	2.21	2.92	162	840.7	1.946	92.53
160	8/15/2011 10:45	1.52	2.58	32.8	382	1.495	32.77
161	9/22/2011 9:45	1.54	2.59	34.3	390	1.507	33.68
162	12/20/2011 11:15	1.61	2.53	40.7	338.5	1.426	27.95
163	2/6/2012 10:15	1.8	2.66	62.9	461.5	1.603	42.03
164	3/1/2012 12:00	1.77	2.63	59.3	430	1.563	38.29
165	4/7/2012 10:25	1.67	2.58	46.5	382.4	1.496	32.82
166	6/18/2012 12:15	1.5	2.57	31.8	371.8	1.479	31.62
167	6/19/2012 9:00	1.75	2.72	56.8	529	1.681	50.3
168	7/5/2012 12:35	1.59	2.87	38.8	735.6	1.869	77.62
169	7/12/2012 10:15	1.54	2.89	35	781.5	1.904	84.05
170	7/19/2012 10:15	1.47	2.83	29.2	683	1.827	70.4
171	8/30/2012 8:15	1.4	2.72	24.9	529	1.681	50.3
172	9/6/2012 13:15	1.66	2.72	46.1	526.5	1.678	49.98
173	9/11/2012 10:15	1.65	2.84	45	685.5	1.829	70.74
174	9/18/2012 11:20	1.66	2.88	45.9	755.3	1.885	80.37
175	9/26/2012 9:20	1.56	2.83	36.2	683.3	1.827	70.44
176	10/24/2012 9:30	1.46	2.82	28.8	662.5	1.81	67.63
177	11/7/2012 11:10	1.76	2.92	57.2	825.8	1.936	90.39
178	11/14/2012 9:20	1.83	2.93	67.1	859.7	1.959	95.29
179	12/12/2012 10:00	1.76	2.93	57.1	854	1.955	94.46
180	1/16/2013 9:30	1.84	2.94	69.4	880.5	1.972	98.34
181	1/29/2013 10:05	1.77	2.9	58.7	791	1.911	85.4
182	2/13/2013 9:30	1.89	2.93	78.1	860	1.959	95.34
183	3/12/2013 11:00	2.1	2.94	127	878	1.971	97.97
184	3/13/2013 9:15	2.25	3.02	178	1050	2.073	123.98
185	3/27/2013 11:35	2.26	3.06	180	1160	2.13	141.35
186	4/11/2013 10:15	1.89	2.8	77.4	630.8	1.782	63.4
187	4/15/2013 9:00	2.32	3.04	211	1100	2.099	131.81
188	4/24/2013 9:30	1.84	2.76	68.8	571	1.725	55.62
189	5/6/2013 11:00	2.15	2.87	142	745	1.877	78.93
190	5/15/2013 9:10	1.66	2.78	46	599.2	1.752	59.25
191	5/21/2013 9:00	1.41	2.66	25.7	453	1.592	41.01
192	5/28/2013 10:50	1.77	2.86	58.2	718.2	1.856	75.21
193	6/5/2013 9:00	1.77	2.69	59	489	1.636	45.35
194	6/13/2013 9:20	2.15	2.96	142	906.7	1.989	102.2
195	6/24/2013 9:40	2.5	3.14	315	1383.3	2.23	178.21
196	7/9/2013 9:30	1.72	2.86	53	721	1.858	75.6
197	7/29/2013 10:30	0.92	2.16	8.32	143.5	0.935	9.03
198	8/7/2013 9:45	0.766	2.02	5.84	105.8	0.761	6.05
199	8/15/2013 9:10	0.8	2.14	6.31	137	0.909	8.5
200	8/29/2013 8:20	1.84	2.82	69.8	665.3	1.812	68.01

201	10/24/2013 9:20	1.95	2.94	88.8	877.7	1.97	97.92
202	10/30/2013 10:20	1.45	2.61	27.9	410.8	1.537	36.06
203	11/25/2013 9:10	1.85	2.94	71.6	863	1.961	95.78
204	12/11/2013 11:10	2.05	3.03	111	1060	2.078	125.54
205	1/14/2014 10:20	2.11	3.03	129	1060	2.078	125.54
206	2/20/2014 10:10	2.08	3.02	122	1040	2.067	122.43
207	3/17/2014 9:00	2.08	3	120	998	2.044	115.96
208	4/9/2014 12:30	2.05	2.99	111	988.5	2.038	114.51
209	4/14/2014 11:20	2.01	2.99	102	967	2.026	111.25
210	5/14/2014 13:20	1.75	2.78	55.8	597	1.75	58.97
211	5/15/2014 10:30	1.97	2.9	93.1	791	1.911	85.4
212	5/29/2014 10:20	2.07	2.94	117	868.7	1.965	96.6
213	6/3/2014 10:10	1.73	2.79	53.8	611.7	1.764	60.89
214	6/5/2014 10:40	2.03	2.85	106	707	1.847	73.67
215	6/9/2014 13:30	1.3	2.36	19.8	230.5	1.206	16.86
216	6/12/2014 11:40	0.89	2.18	7.77	153	0.972	9.83
217	6/24/2014 10:00	1.81	2.76	64.9	573	1.727	55.87
218	7/10/2014 9:40	1.73	2.82	53.6	657	1.805	66.89
219	7/15/2014 13:40	1.81	2.88	64.1	760	1.888	81.02
220	7/24/2014 9:10	1.8	2.89	63.5	783.2	1.905	84.29
221	8/4/2014 9:15	1.88	2.92	75.7	823	1.934	89.98
222	8/7/2014 9:10	1.8	2.9	63.7	785.8	1.907	84.67
223	9/3/2014 12:00	0.948	2.17	8.87	149	0.957	9.49
224	10/16/2014 10:10	1.8	2.78	63.1	598	1.751	59.1
225	12/9/2014 10:45	1.9	2.92	79	828.8	1.938	90.81
226	12/15/2014 9:40	2.02	2.96	104	921	1.998	104.34
227	2/11/2015 9:20	2.17	3.04	149	1090	2.094	130.23
228	2/25/2015 11:20	2.13	3.02	134	1036.7	2.066	121.91
229	4/6/2015 12:35	2.05	3	112	999	2.044	116.12
230	4/16/2015 9:50	2	2.98	99.4	960.3	2.022	110.24
231	4/22/2015 14:30	1.96	2.8	90.9	627	1.778	62.9
232	5/5/2015 9:50	1.85	2.88	71.4	762.8	1.89	81.42
233	5/20/2015 13:15	1.16	2.35	14.6	226.2	1.196	16.45
234	5/27/2015 11:50	1.24	2.38	17.5	238	1.225	17.58
235	6/10/2015 9:00	1.85	2.8	70.6	627	1.778	62.9
236	6/17/2015 10:40	1.17	2.34	14.7	217.3	1.173	15.6
237	6/29/2015 8:50	1.78	2.87	60.4	734.7	1.869	77.49
238	7/13/2015 12:30	1.45	2.59	28.5	385.5	1.5	33.16
239	8/3/2015 8:30	1.84	2.88	69.5	763.5	1.891	81.52
240	8/17/2015 9:30	1.58	2.77	37.7	595.5	1.749	58.78
241	8/27/2015 10:40	1.32	2.47	20.9	298.3	1.354	23.67
242	9/8/2015 10:00	1.47	2.74	29.6	546	1.699	52.43
243	11/17/2015 10:10	1.56	2.84	36.2	687.3	1.831	70.99
244	1/19/2016 11:10	1.84	2.88	69.8	755	1.884	80.32
245	3/16/2016 10:10	2.01	2.94	103	878	1.971	97.97
246	4/20/2016 10:40	2.01	2.9	102	792.7	1.912	85.64
247	4/21/2016 11:30	2.02	2.88	105	767	1.893	82.01
248	5/3/2016 13:20	1.52	2.54	33	350	1.445	29.21
249	5/18/2016 9:50	1.75	2.82	56.7	653.5	1.802	66.42
250	5/26/2016 12:10	1.48	2.5	30.2	314.2	1.383	25.34
251	5/31/2016 12:00	1.2	2.35	16	225	1.192	16.33
252	6/7/2016 10:30	1.7	2.75	50.4	557.5	1.711	53.89
253	6/17/2016 12:10	1.03	2.25	10.7	178.5	1.06	12.04
254	6/21/2016 10:20	1.31	2.41	20.6	254.3	1.263	19.19
255	6/28/2016 9:40	1.54	2.71	34.4	517.7	1.669	48.88
256	7/6/2016 11:15	0.89	2.13	7.77	136.2	0.906	8.44

257	7/13/2016 10:00	1.5	2.61	31.9	409	1.534	35.85
258	7/25/2016 10:30	1.74	2.84	55.5	698	1.84	72.44
259	8/11/2016 11:35	1.21	2.41	16.4	254.8	1.263	19.23
260	8/16/2016 9:30	1.53	2.7	33.8	496.5	1.645	46.27
261	8/29/2016 9:10	1.08	2.3	11.9	197.5	1.118	13.75
262	9/7/2016 9:20	1.4	2.63	25.1	425.7	1.557	37.79
263	9/13/2016 11:15	1.17	2.43	14.7	271.8	1.3	20.93
264	10/24/2016 10:10	1.74	2.9	54.5	789	1.91	85.12
265	11/15/2016 9:50	1.68	2.9	47.4	787	1.908	84.83
266	12/14/2016 10:20	1.87	2.96	73.6	911	1.992	102.85
267	1/10/2017 9:40	1.97	2.97	92.5	928	2.002	105.38
268	2/14/2017 11:10	1.92	2.94	83.7	877.7	1.97	97.92
269	3/14/2017 9:50	1.92	2.95	83.8	890.2	1.979	99.76
270	3/30/2017 13:45	1.25	2.35	17.6	225	1.192	16.33
271	4/11/2017 10:50	1.68	2.69	48.4	485.3	1.632	44.91
272	5/1/2017 11:00	1.53	2.57	33.7	373	1.481	31.76
273	5/15/2017 9:50	1.82	2.8	66.2	636.8	1.787	64.2
274	5/31/2017 10:50	1.88	2.9	75.4	786.3	1.908	84.74
275	6/5/2017 10:00	1.78	2.84	60.4	687	1.83	70.94
276	6/13/2017 9:50	1.93	2.95	84.7	886.2	1.976	99.17
277	6/28/2017 10:00	1.89	2.94	77.4	861.8	1.96	95.6
278	7/13/2017 9:40	1.74	2.86	54.7	725.3	1.861	76.2
279	7/31/2017 9:30	1.57	2.79	37.2	623	1.775	62.38
280	8/2/2017 9:50	1.55	2.8	35.1	630	1.781	63.3
281	8/16/2017 11:00	1.57	2.84	37.6	692	1.835	71.62
282	8/30/2017 9:10	1.63	2.87	42.4	748.3	1.879	79.39
283	9/6/2017 10:10	1.66	2.87	45.9	749.2	1.88	79.51
284	10/17/2017 10:10	1.84	2.87	69.6	740.3	1.873	78.28
285	11/15/2017 10:50	1.63	2.86	42.3	722.2	1.859	75.76
286	12/12/2017 9:40	1.61	2.87	40.4	749.3	1.88	79.53
287	1/18/2018 10:00	1.75	2.94	56.1	866	1.963	96.21
288	1/31/2018 10:10	1.72	2.88	52.9	765.3	1.892	81.77
289	3/6/2018 9:40	1.73	2.88	53.1	754.3	1.884	80.23
290	3/22/2018 10:50	1.75	2.88	56.2	753.3	1.883	80.09
291	4/18/2018 10:30	1.9	2.93	79.5	856	1.956	94.76
292	5/2/2018 10:00	1.87	2.93	74.5	844	1.948	93.01
293	5/9/2018 10:30	1.97	2.96	93.2	903.5	1.987	101.73
294	5/23/2018 10:40	2.06	2.98	114	945.3	2.013	107.98
295	6/1/2018 10:50	1.46	2.43	28.9	272.2	1.301	20.98
296	6/6/2018 10:00	1.68	2.73	48	531	1.683	50.55
297	6/20/2018 9:30	1.54	2.83	34.8	681.5	1.826	70.2
298	6/26/2018 9:40	1.38	2.61	24.2	404	1.527	35.27
299	7/19/2018 11:30	0.703	2.19	5.04	153.5	0.974	9.87
300	7/31/2018 10:30	0.904	2.23	8.02	168.5	1.027	11.16
301	8/16/2018 9:40	1.45	2.66	28	457.3	1.598	41.53
302	8/28/2018 10:40	1.25	2.52	17.7	328.7	1.409	26.89
303	9/6/2018 12:00	0.508	2.06	3.22	114	0.804	6.67
304	9/18/2018 9:50	1.56	2.76	36	576	1.73	56.26
305	10/16/2018 10:30	1.22	2.33	16.5	214.5	1.165	15.33
306	11/19/2018 11:00	2.04	3	109	991	2.04	114.89
307	12/4/2018 11:25	2.09	2.89	123	779.1	1.902	83.71
308	12/17/2018 10:30	1.95	2.93	89.4	859.5	1.958	95.27
309	1/29/2019 10:00	1.96	2.92	91.8	837	1.943	92
310	2/19/2019 10:30	2.17	3.05	148	1134.5	2.117	137.27
311	3/14/2019 13:30	1.73	2.68	53.7	482.5	1.628	44.56
312	3/19/2019 10:00	1.76	2.74	57.3	554	1.707	53.45

313	4/11/2019 10:50	2.01	2.88	103	760.2	1.888	81.05
314	4/16/2019 11:40	2.08	2.99	119	968.3	2.027	111.45
315	5/1/2019 13:10	1.26	2.33	18.3	214.3	1.165	15.32
316	5/15/2019 12:30	1.43	2.48	26.8	304	1.364	24.26
317	5/23/2019 12:20	0.896	2.07	7.87	117.3	0.82	6.93
318	6/5/2019 11:30	1.74	2.79	54.9	610.5	1.763	60.73
319	6/12/2019 10:50	1.93	2.9	85.5	798.8	1.917	86.52
320	6/24/2019 10:40	0.996	2.11	9.91	129	0.875	7.85
321	7/10/2019 10:40	1.34	2.57	22.1	368	1.474	31.2
322	7/30/2019 10:20	1.82	2.93	66.3	852.8	1.954	94.29
323	8/7/2019 9:40	1.83	2.9	67.1	787.2	1.908	84.86
324	8/20/2019 11:40	1.13	2.27	13.5	186.4	1.085	12.75
325	8/26/2019 10:50	1.28	2.41	18.9	255.4	1.265	19.29
326	9/11/2019 10:30	1.66	2.82	45.5	661.5	1.809	67.5
327	10/9/2019 11:50	1.97	2.93	92.5	847.5	1.95	93.52
328	11/6/2019 9:50	1.76	2.91	58.2	810	1.925	88.11
329	12/11/2019 11:10	1.9	2.96	79.2	918.7	1.997	103.99

Definitions

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CL: Chloride in mg/L (00940)
SC: Specific conductance in µS/cm @25C (00095)
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