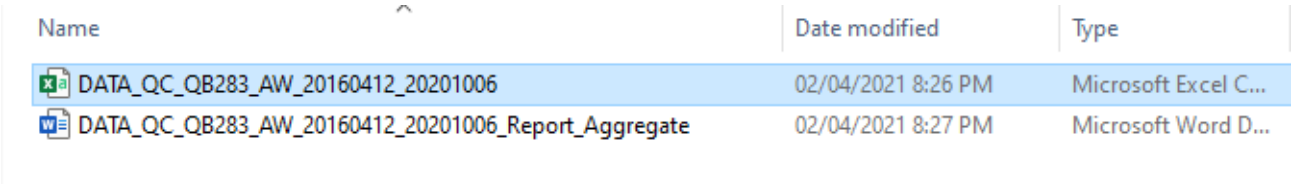
Evaluating QC test thresholds with Excel pivot tables and charts

For an actual example, download the file called
'PIVOTCHART_DATA_QC_Hunting_AW_20140422_20190425'
(sorry, it's large!)

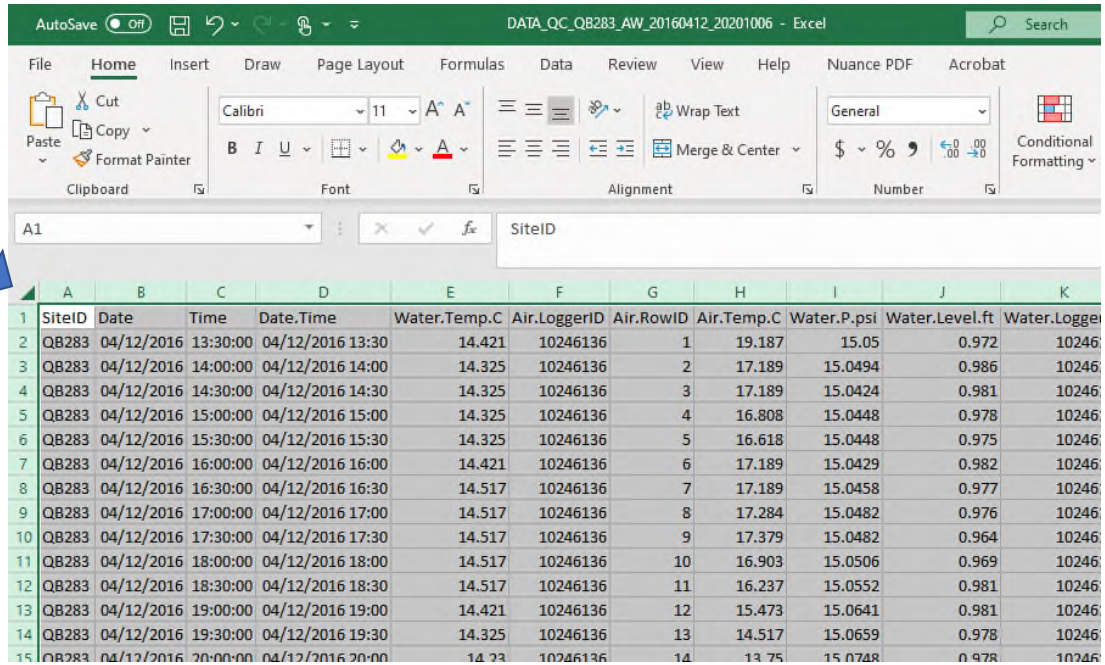
Open the aggregated csv file. Save it as an Excel file.



Evaluate the Unrealistic Values ('Gross range') thresholds with time series plots in Excel

Click in the upper left corner of the spreadsheet

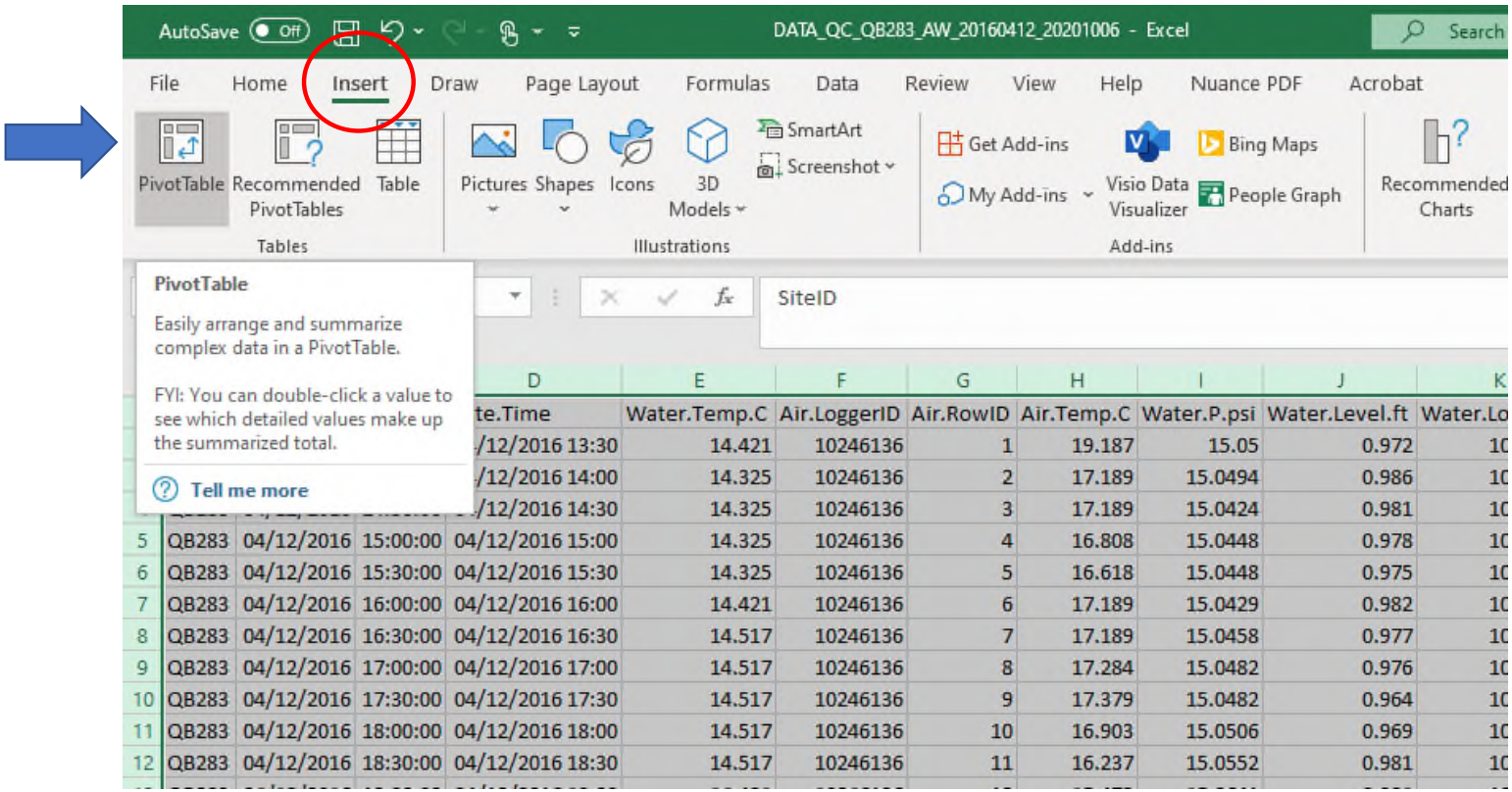
All the cells should become highlighted (in gray)



	A	B	C	D	E	F	G	H	I	J	K
1	SiteID	Date	Time	Date.Time	Water.Temp.C	Air.LoggerID	Air.RowID	Air.Temp.C	Water.P.psi	Water.Level.ft	Water.Logge
2	QB283	04/12/2016	13:30:00	04/12/2016 13:30	14.421	10246136	1	19.187	15.05	0.972	10246
3	QB283	04/12/2016	14:00:00	04/12/2016 14:00	14.325	10246136	2	17.189	15.0494	0.986	10246
4	QB283	04/12/2016	14:30:00	04/12/2016 14:30	14.325	10246136	3	17.189	15.0424	0.981	10246
5	QB283	04/12/2016	15:00:00	04/12/2016 15:00	14.325	10246136	4	16.808	15.0448	0.978	10246
6	QB283	04/12/2016	15:30:00	04/12/2016 15:30	14.325	10246136	5	16.618	15.0448	0.975	10246
7	QB283	04/12/2016	16:00:00	04/12/2016 16:00	14.421	10246136	6	17.189	15.0429	0.982	10246
8	QB283	04/12/2016	16:30:00	04/12/2016 16:30	14.517	10246136	7	17.189	15.0458	0.977	10246
9	QB283	04/12/2016	17:00:00	04/12/2016 17:00	14.517	10246136	8	17.284	15.0482	0.976	10246
10	QB283	04/12/2016	17:30:00	04/12/2016 17:30	14.517	10246136	9	17.379	15.0482	0.964	10246
11	QB283	04/12/2016	18:00:00	04/12/2016 18:00	14.517	10246136	10	16.903	15.0506	0.969	10246
12	QB283	04/12/2016	18:30:00	04/12/2016 18:30	14.517	10246136	11	16.237	15.0552	0.981	10246
13	QB283	04/12/2016	19:00:00	04/12/2016 19:00	14.421	10246136	12	15.473	15.0641	0.981	10246
14	QB283	04/12/2016	19:30:00	04/12/2016 19:30	14.325	10246136	13	14.517	15.0659	0.978	10246
15	QB283	04/12/2016	20:00:00	04/12/2016 20:00	14.23	10246136	14	13.75	15.0748	0.978	10246

Evaluate the Unrealistic Values ('Gross range') thresholds with time series plots in Excel

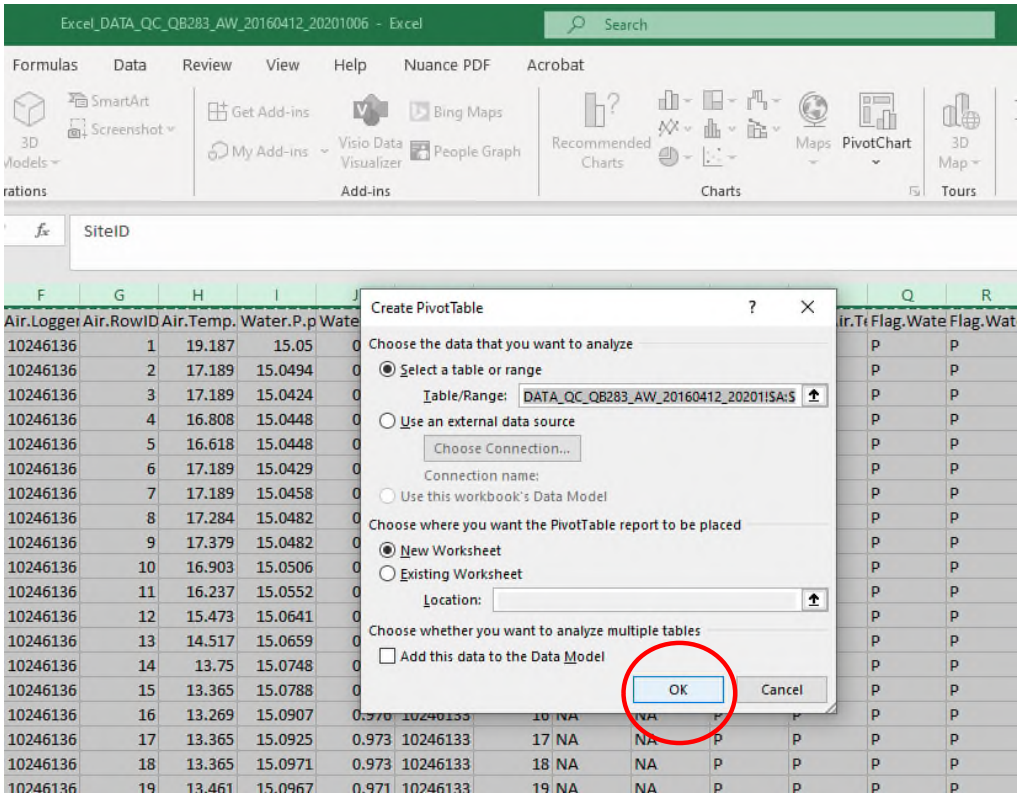
Insert
Pivot table



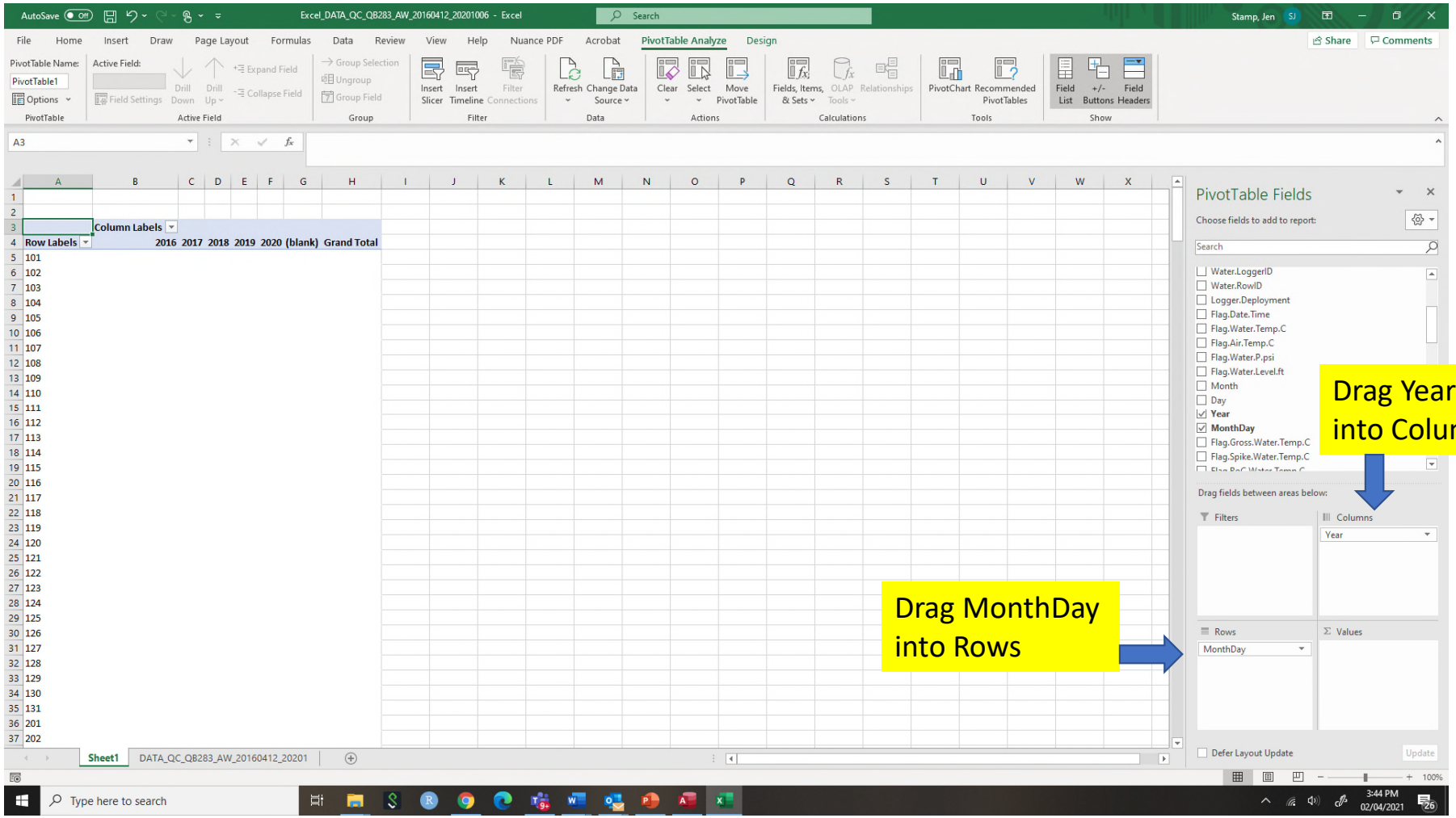
	D	E	F	G	H	I	J	K
	te.Time	Water.Temp.C	Air.LoggerID	Air.RowID	Air.Temp.C	Water.P.psi	Water.Level.ft	Water.Lo
	/12/2016 13:30	14.421	10246136	1	19.187	15.05	0.972	10
	/12/2016 14:00	14.325	10246136	2	17.189	15.0494	0.986	10
	/12/2016 14:30	14.325	10246136	3	17.189	15.0424	0.981	10
5	04/12/2016 15:00	14.325	10246136	4	16.808	15.0448	0.978	10
6	04/12/2016 15:30	14.325	10246136	5	16.618	15.0448	0.975	10
7	04/12/2016 16:00	14.421	10246136	6	17.189	15.0429	0.982	10
8	04/12/2016 16:30	14.517	10246136	7	17.189	15.0458	0.977	10
9	04/12/2016 17:00	14.517	10246136	8	17.284	15.0482	0.976	10
10	04/12/2016 17:30	14.517	10246136	9	17.379	15.0482	0.964	10
11	04/12/2016 18:00	14.517	10246136	10	16.903	15.0506	0.969	10
12	04/12/2016 18:30	14.517	10246136	11	16.237	15.0552	0.981	10

Evaluate the Unrealistic Values (‘Gross range’) thresholds with time series plots in Excel

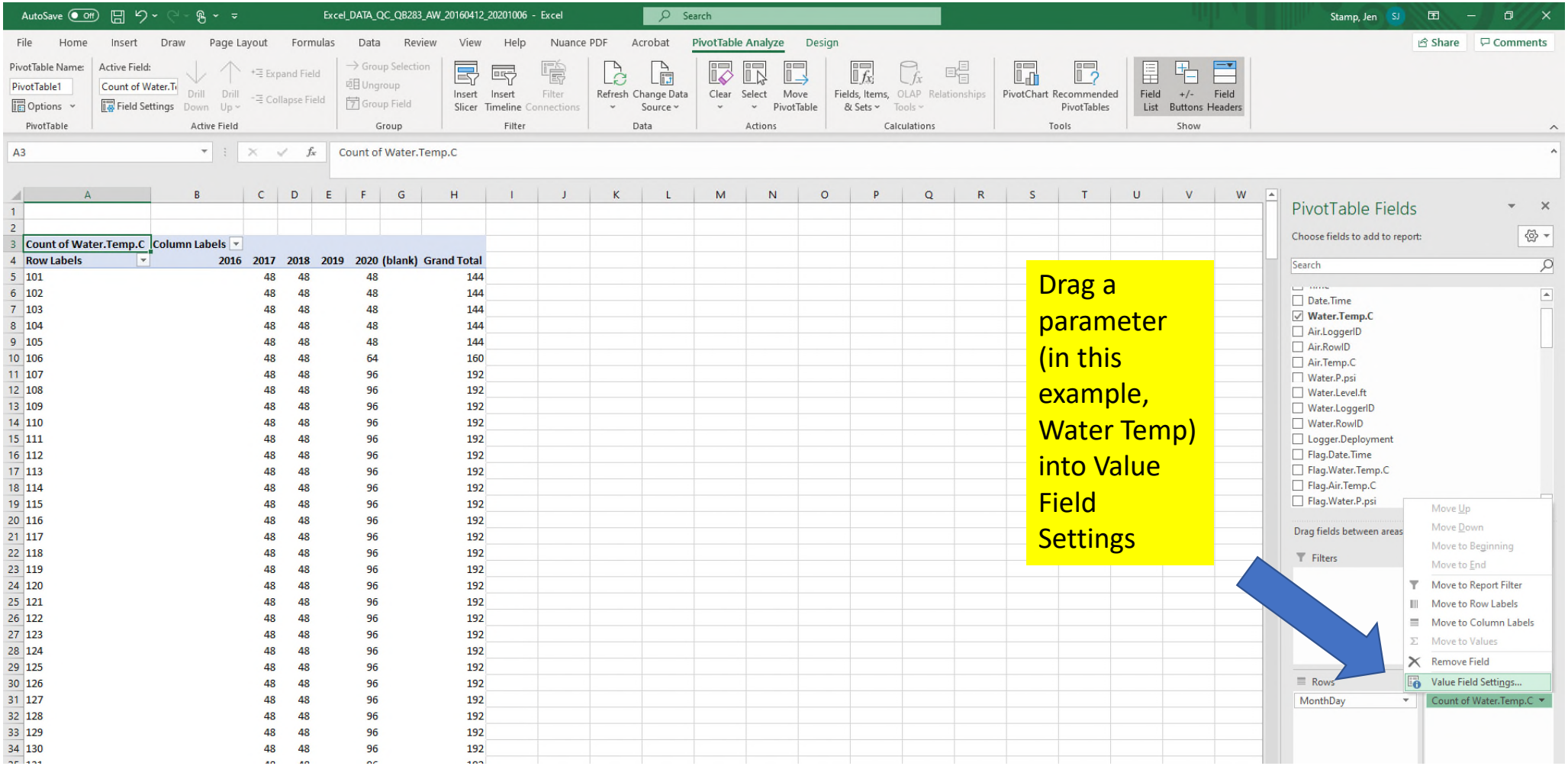
Click ‘ok’



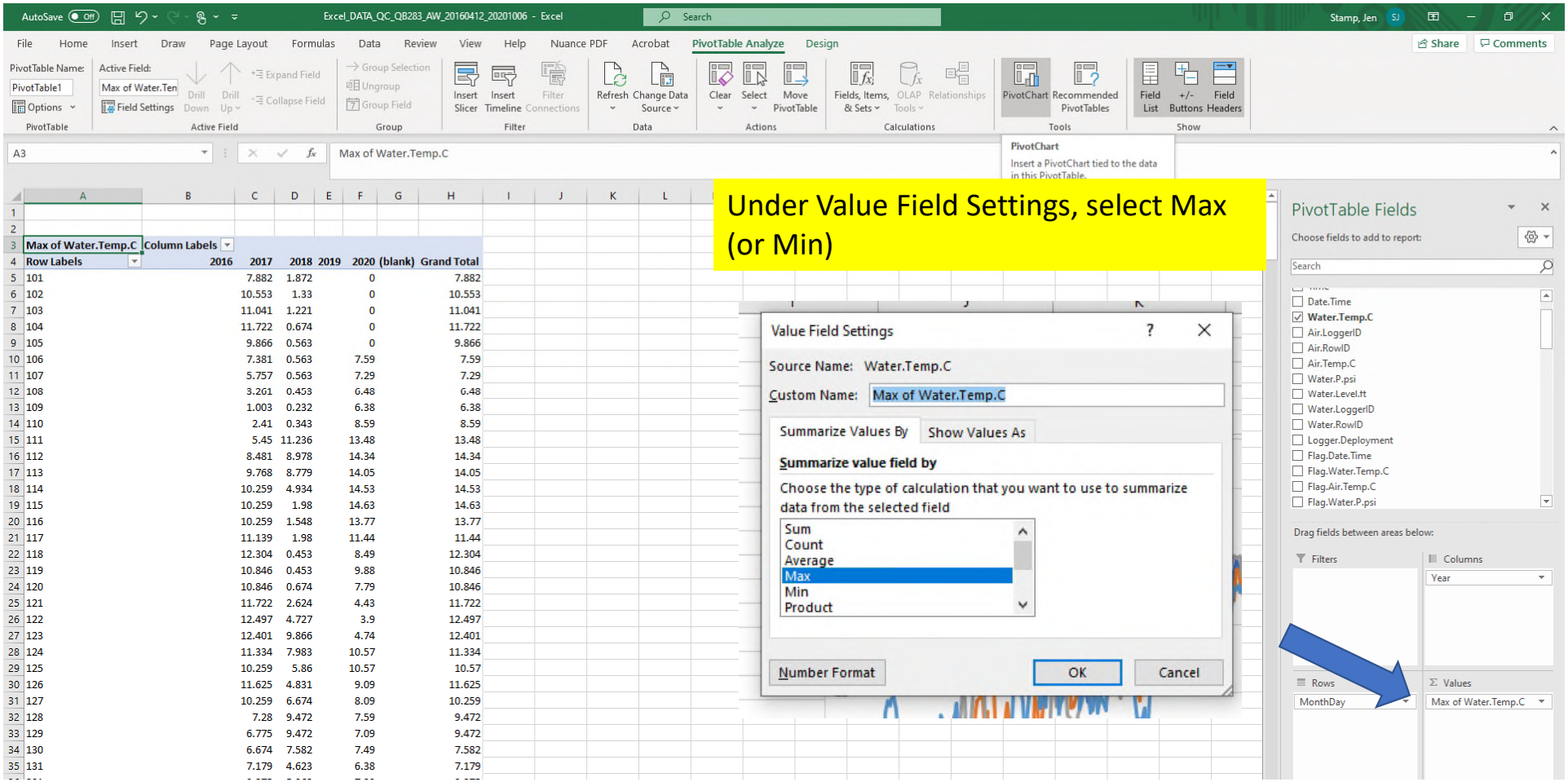
Evaluate the Unrealistic Values ('Gross range') thresholds with time series plots in Excel



Evaluate the Unrealistic Values ('Gross range') thresholds with time series plots in Excel

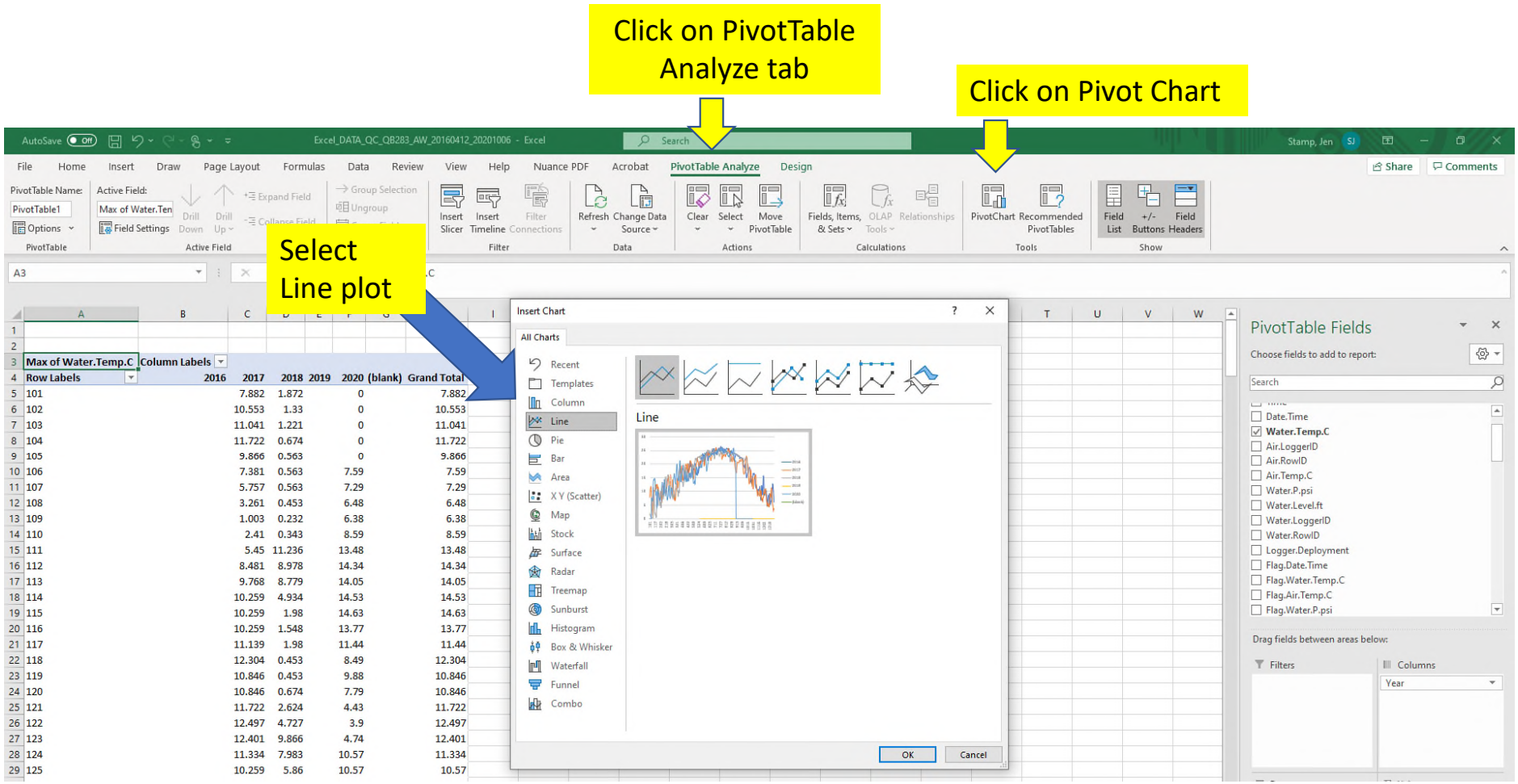


Evaluate the Unrealistic Values ('Gross range') thresholds with time series plots in Excel

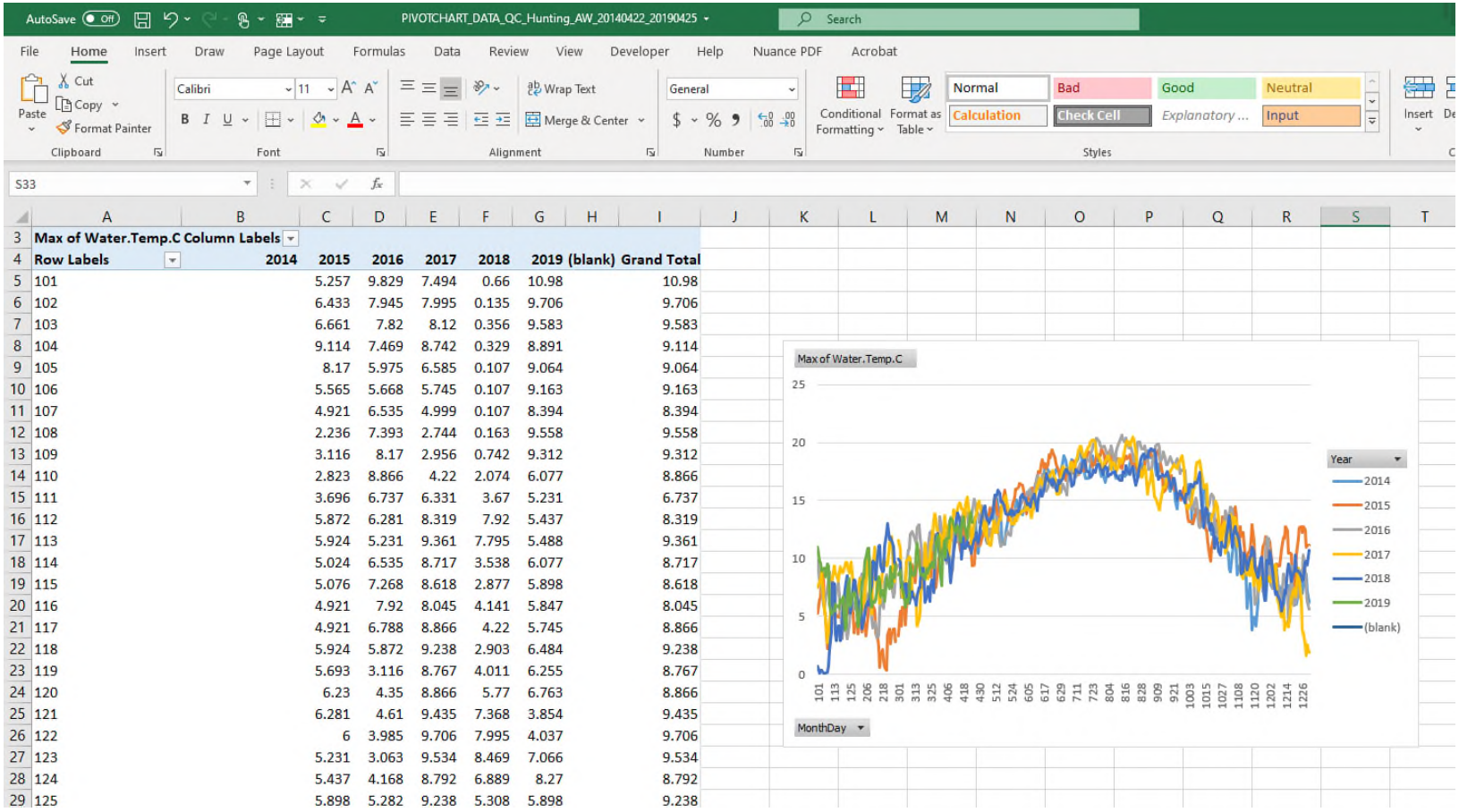


Max of Water.Temp.C	Column Labels						
Row Labels	2016	2017	2018	2019	2020	(blank)	Grand Total
101		7.882	1.872		0		7.882
102		10.553	1.33		0		10.553
103		11.041	1.221		0		11.041
104		11.722	0.674		0		11.722
105		9.866	0.563		0		9.866
106		7.381	0.563		7.59		7.59
107		5.757	0.563		7.29		7.29
108		3.261	0.453		6.48		6.48
109		1.003	0.232		6.38		6.38
110		2.41	0.343		8.59		8.59
111		5.45	11.236		13.48		13.48
112		8.481	8.978		14.34		14.34
113		9.768	8.779		14.05		14.05
114		10.259	4.934		14.53		14.53
115		10.259	1.98		14.63		14.63
116		10.259	1.548		13.77		13.77
117		11.139	1.98		11.44		11.44
118		12.304	0.453		8.49		12.304
119		10.846	0.453		9.88		10.846
120		10.846	0.674		7.79		10.846
121		11.722	2.624		4.43		11.722
122		12.497	4.727		3.9		12.497
123		12.401	9.866		4.74		12.401
124		11.334	7.983		10.57		11.334
125		10.259	5.86		10.57		10.57
126		11.625	4.831		9.09		11.625
127		10.259	6.674		8.09		10.259
128		7.28	9.472		7.59		9.472
129		6.775	9.472		7.09		9.472
130		6.674	7.582		7.49		7.582
131		7.179	4.623		6.38		7.179

Evaluate the Unrealistic Values (‘Gross range’) thresholds with time series plots in Excel



Evaluate the Unrealistic Values ('Gross range') thresholds with time series plots in Excel

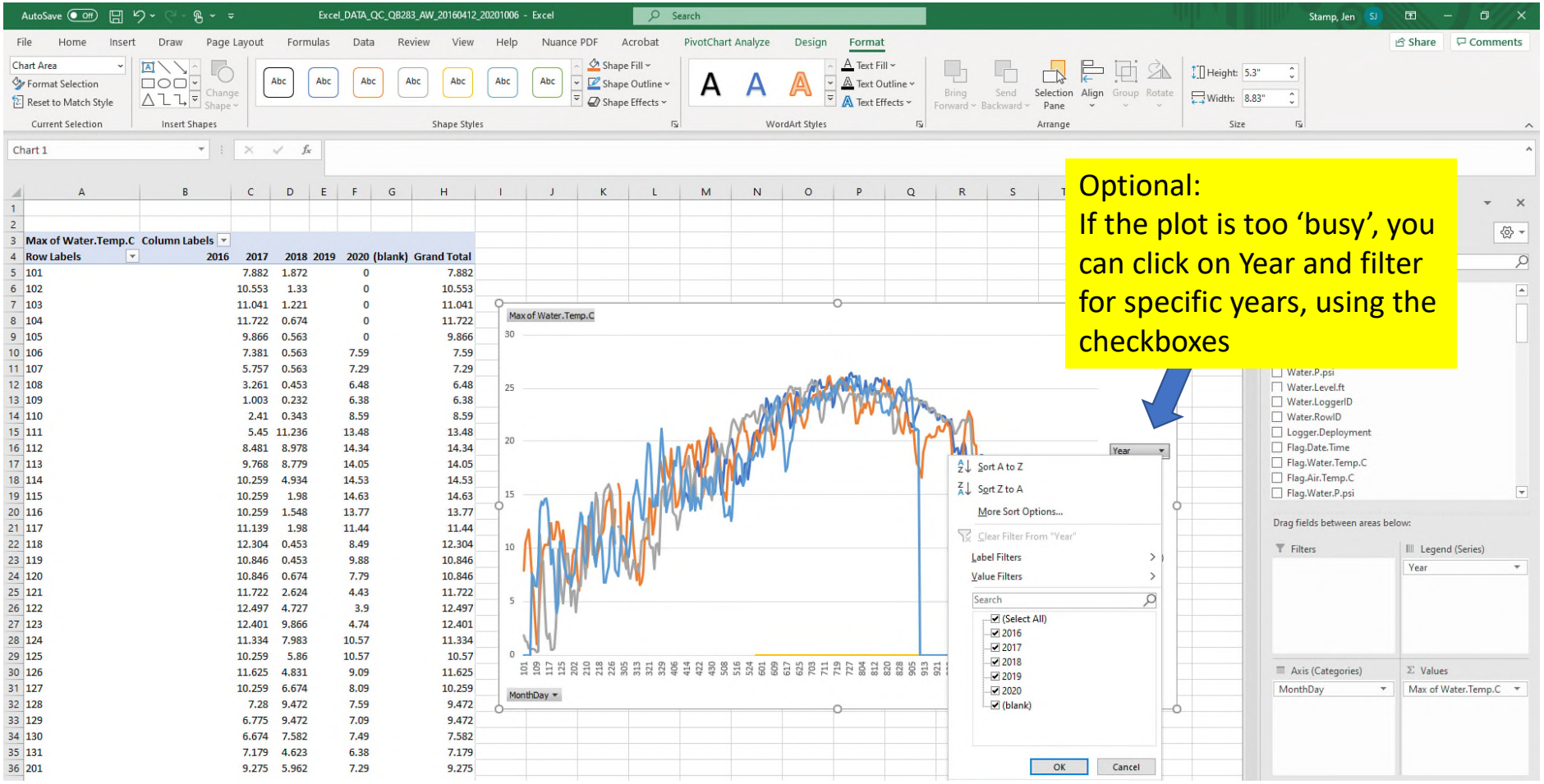


Max of Water.Temp.C	Column Labels						
Row Labels	2014	2015	2016	2017	2018	2019	(blank) Grand Total
101		5.257	9.829	7.494	0.66	10.98	10.98
102		6.433	7.945	7.995	0.135	9.706	9.706
103		6.661	7.82	8.12	0.356	9.583	9.583
104		9.114	7.469	8.742	0.329	8.891	9.114
105		8.17	5.975	6.585	0.107	9.064	9.064
106		5.565	5.668	5.745	0.107	9.163	9.163
107		4.921	6.535	4.999	0.107	8.394	8.394
108		2.236	7.393	2.744	0.163	9.558	9.558
109		3.116	8.17	2.956	0.742	9.312	9.312
110		2.823	8.866	4.22	2.074	6.077	8.866
111		3.696	6.737	6.331	3.67	5.231	6.737
112		5.872	6.281	8.319	7.92	5.437	8.319
113		5.924	5.231	9.361	7.795	5.488	9.361
114		5.024	6.535	8.717	3.538	6.077	8.717
115		5.076	7.268	8.618	2.877	5.898	8.618
116		4.921	7.92	8.045	4.141	5.847	8.045
117		4.921	6.788	8.866	4.22	5.745	8.866
118		5.924	5.872	9.238	2.903	6.484	9.238
119		5.693	3.116	8.767	4.011	6.255	8.767
120		6.23	4.35	8.866	5.77	6.763	8.866
121		6.281	4.61	9.435	7.368	3.854	9.435
122		6	3.985	9.706	7.995	4.037	9.706
123		5.231	3.063	9.534	8.469	7.066	9.534
124		5.437	4.168	8.792	6.889	8.27	8.792
125		5.898	5.282	9.238	5.308	5.898	9.238

Evaluate the maximum and minimum values (in this example, maximum value for water temperature).

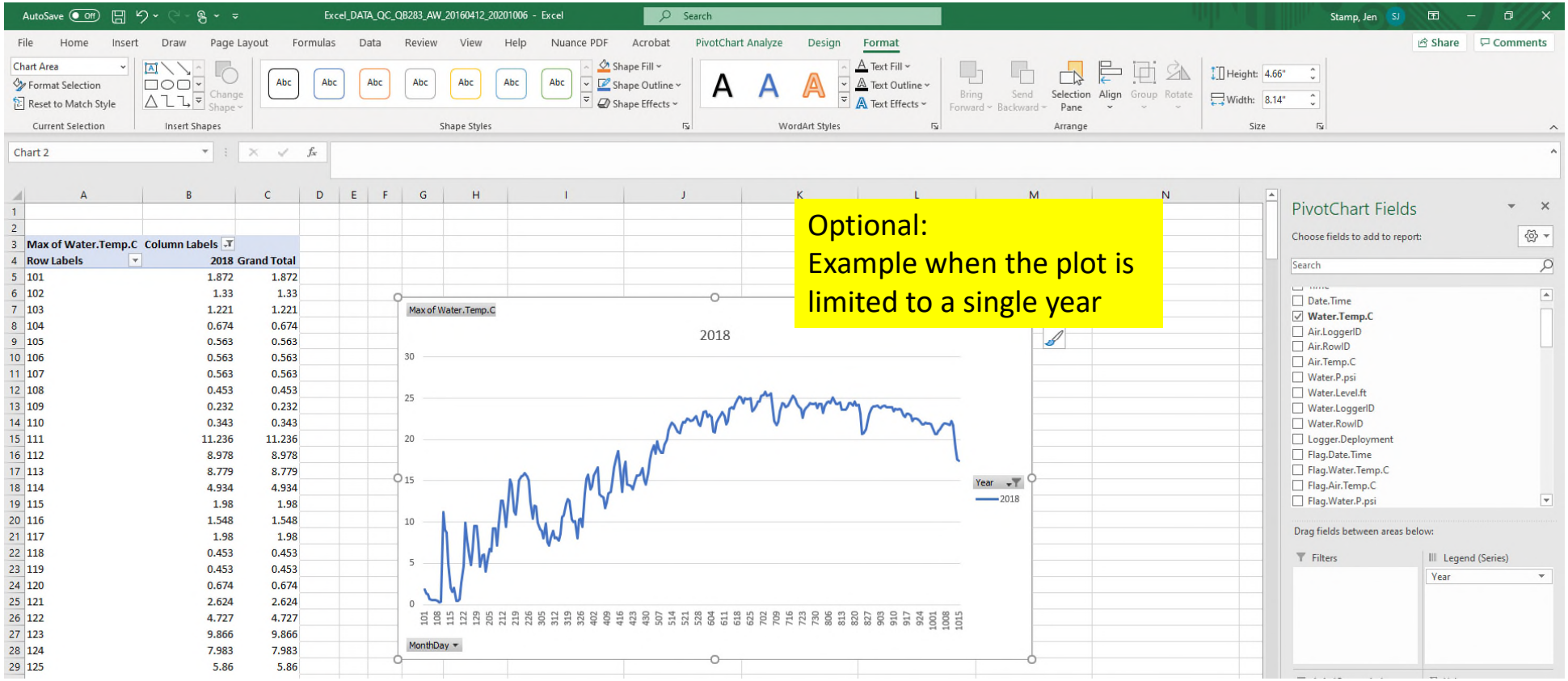
Do the default thresholds look appropriate for your site? If not, adjust them.

Evaluate the Unrealistic Values (‘Gross range’) thresholds with time series plots in Excel



Max of Water.Temp.C	Column Labels						
Row Labels	2016	2017	2018	2019	2020	(blank)	Grand Total
101		7.882	1.872		0		7.882
102		10.553	1.33		0		10.553
103		11.041	1.221		0		11.041
104		11.722	0.674		0		11.722
105		9.866	0.563		0		9.866
106		7.381	0.563		7.59		7.59
107		5.757	0.563		7.29		7.29
108		3.261	0.453		6.48		6.48
109		1.003	0.232		6.38		6.38
110		2.41	0.343		8.59		8.59
111		5.45	11.236		13.48		13.48
112		8.481	8.978		14.34		14.34
113		9.768	8.779		14.05		14.05
114		10.259	4.934		14.53		14.53
115		10.259	1.98		14.63		14.63
116		10.259	1.548		13.77		13.77
117		11.139	1.98		11.44		11.44
118		12.304	0.453		8.49		12.304
119		10.846	0.453		9.88		10.846
120		10.846	0.674		7.79		10.846
121		11.722	2.624		4.43		11.722
122		12.497	4.727		3.9		12.497
123		12.401	9.866		4.74		12.401
124		11.334	7.983		10.57		11.334
125		10.259	5.86		10.57		10.57
126		11.625	4.831		9.09		11.625
127		10.259	6.674		8.09		10.259
128		7.28	9.472		7.59		9.472
129		6.775	9.472		7.09		9.472
130		6.674	7.582		7.49		7.582
131		7.179	4.623		6.38		7.179
201		9.275	5.962		7.29		9.275

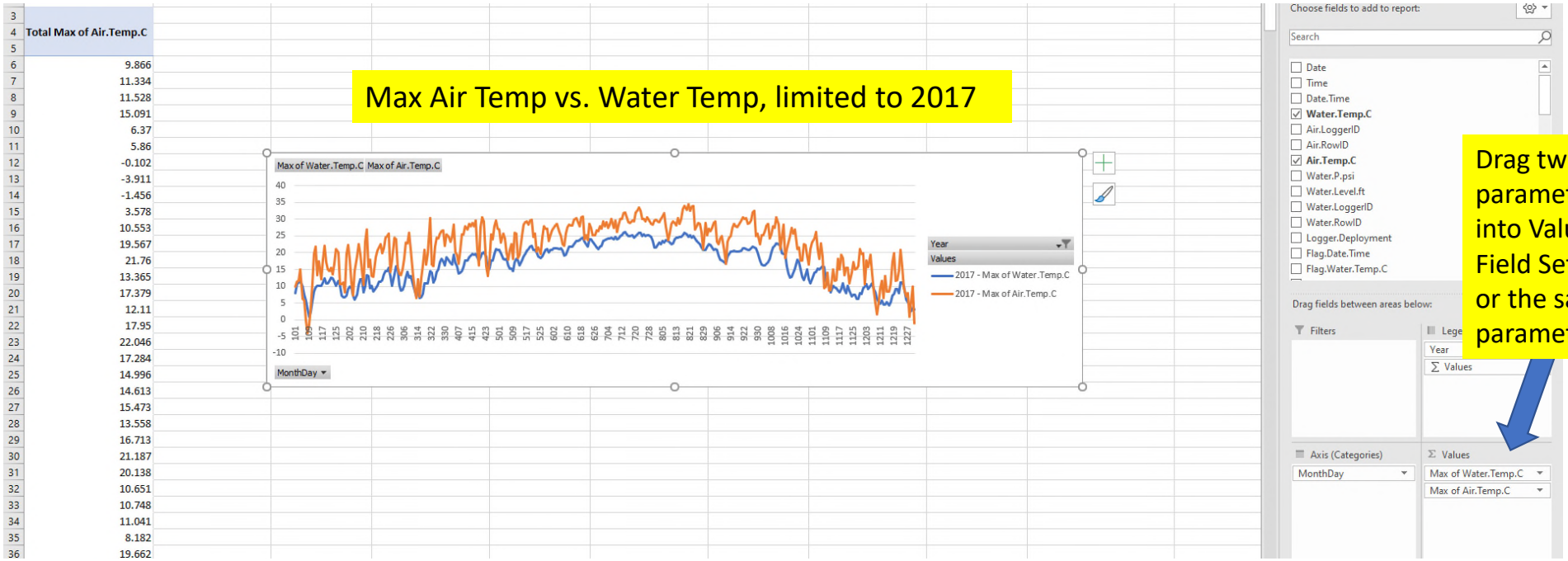
Evaluate the Unrealistic Values (‘Gross range’) thresholds with time series plots in Excel



Max of Water.Temp.C	Column Labels	
Row Labels	2018	Grand Total
101	1.872	1.872
102	1.33	1.33
103	1.221	1.221
104	0.674	0.674
105	0.563	0.563
106	0.563	0.563
107	0.563	0.563
108	0.453	0.453
109	0.232	0.232
110	0.343	0.343
111	11.236	11.236
112	8.978	8.978
113	8.779	8.779
114	4.934	4.934
115	1.98	1.98
116	1.548	1.548
117	1.98	1.98
118	0.453	0.453
119	0.453	0.453
120	0.674	0.674
121	2.624	2.624
122	4.727	4.727
123	9.866	9.866
124	7.983	7.983
125	5.86	5.86

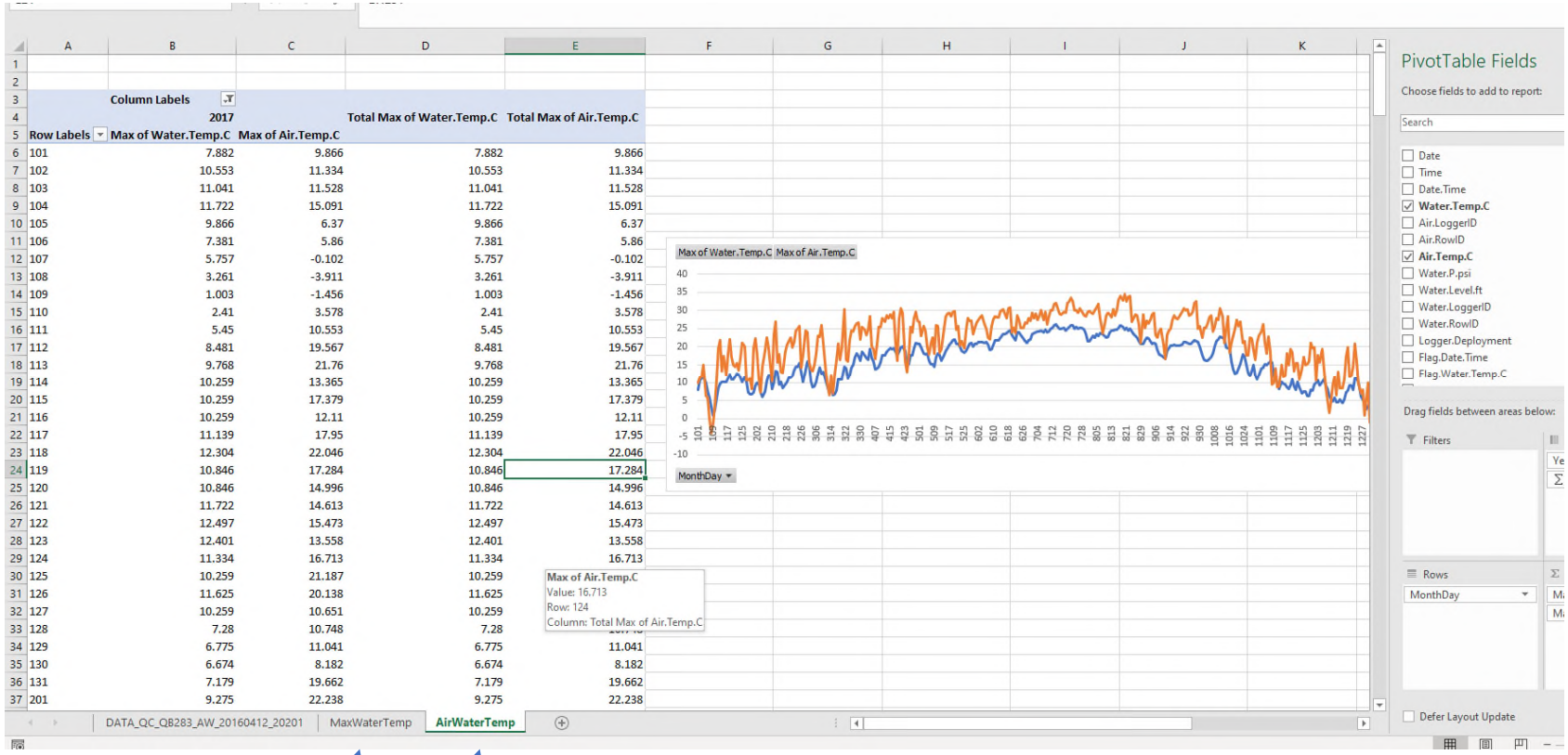
Evaluate the Unrealistic Values (‘Gross range’) thresholds with time series plots in Excel

Optional:
You can also put two parameters in the Values box at once, or put the same parameter in twice (e.g., water temp 2x) and select max value for one and min for the other, and both will appear in the plot.



Evaluate the Unrealistic Values ('Gross range') thresholds with time series plots in Excel

As you create new pivot tables/charts, rename the worksheets (e.g., MaxWaterTemp)

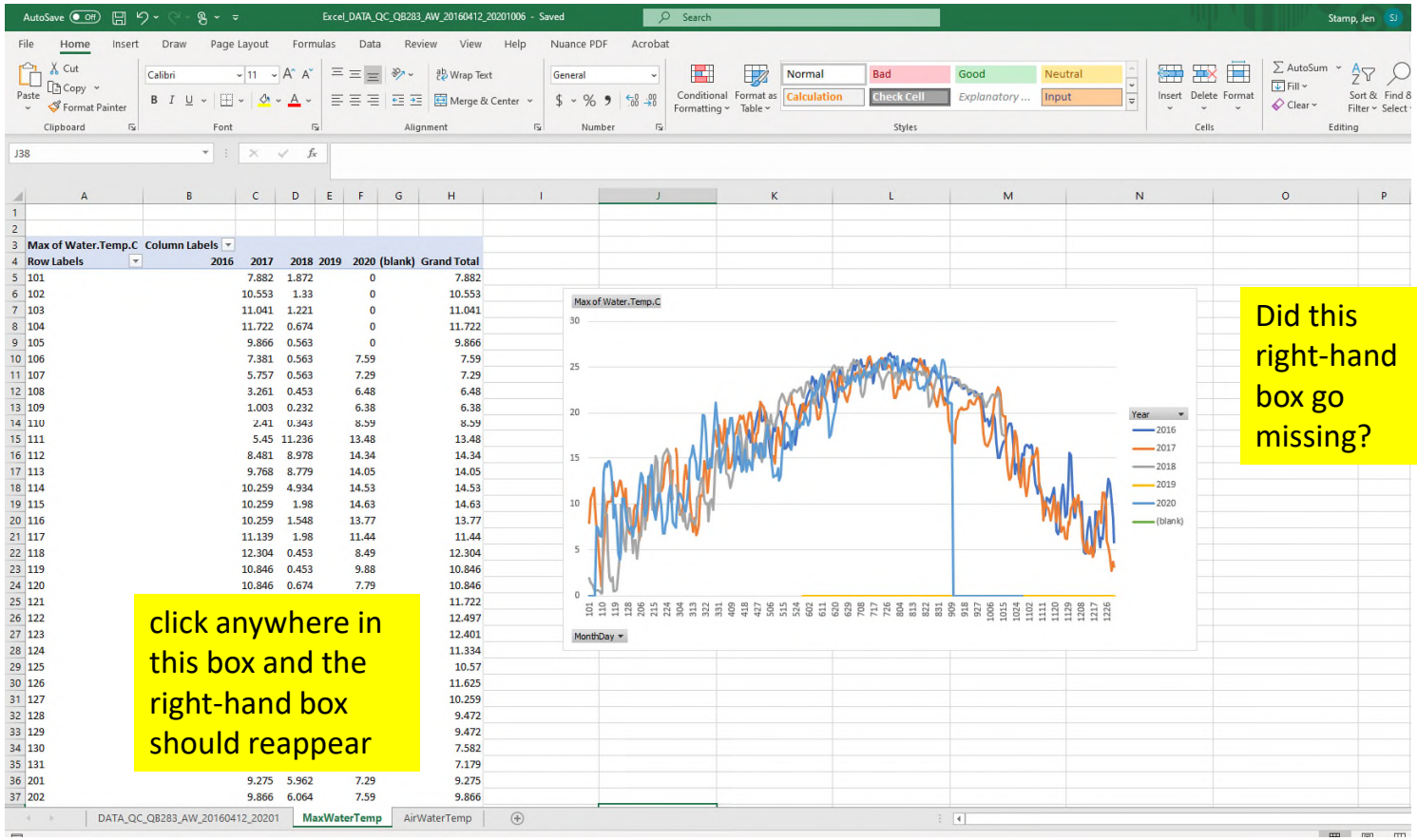


rename the worksheets (e.g., MaxWaterTemp)
For an example, see the Excel file 'PIVOTCHART_DATA_QC_Hunting_AW_20140422_20190425'

Evaluate the Unrealistic Values ('Gross range') thresholds with time series plots in Excel

Troubleshooting tip

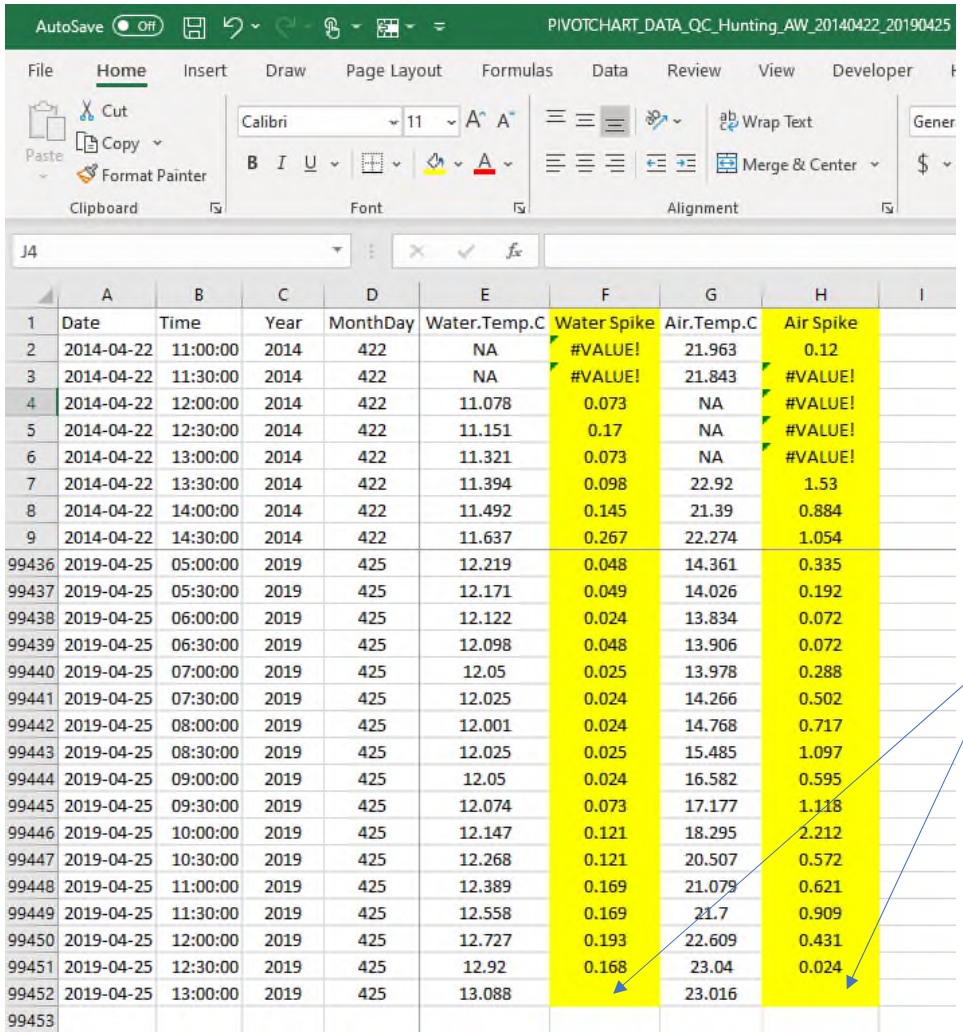
If the box on the right-hand side disappears, click on the columns on the left-hand side and the right-hand box should reappear



Max of Water.Temp.C	Column Labels					
Row Labels	2016	2017	2018	2019	2020	(blank)	Grand Total
101		7.882	1.872		0		7.882
102		10.553	1.33		0		10.553
103		11.041	1.221		0		11.041
104		11.722	0.674		0		11.722
105		9.866	0.563		0		9.866
106		7.381	0.563		7.59		7.59
107		5.757	0.563		7.29		7.29
108		3.261	0.453		6.48		6.48
109		1.003	0.232		6.38		6.38
110		2.41	0.343		8.59		8.59
111		5.45	11.236		13.48		13.48
112		8.481	8.978		14.34		14.34
113		9.768	8.779		14.05		14.05
114		10.259	4.934		14.53		14.53
115		10.259	1.98		14.63		14.63
116		10.259	1.548		13.77		13.77
117		11.139	1.98		11.44		11.44
118		12.304	0.453		8.49		12.304
119		10.846	0.453		9.88		10.846
120		10.846	0.674		7.79		10.846
121							11.722
122							12.497
123							12.401
124							11.334
125							10.57
126							11.625
127							10.259
128							9.472
129							9.472
130							7.582
131							7.179
201		9.275	5.962		7.29		9.275
202		9.866	6.064		7.59		9.866

Evaluating the Spike Test thresholds in Excel

Spike test evaluation



	A	B	C	D	E	F	G	H	I
1	Date	Time	Year	MonthDay	Water.Temp.C	Water Spike	Air.Temp.C	Air Spike	
2	2014-04-22	11:00:00	2014	422	NA	#VALUE!	21.963	0.12	
3	2014-04-22	11:30:00	2014	422	NA	#VALUE!	21.843	#VALUE!	
4	2014-04-22	12:00:00	2014	422	11.078	0.073	NA	#VALUE!	
5	2014-04-22	12:30:00	2014	422	11.151	0.17	NA	#VALUE!	
6	2014-04-22	13:00:00	2014	422	11.321	0.073	NA	#VALUE!	
7	2014-04-22	13:30:00	2014	422	11.394	0.098	22.92	1.53	
8	2014-04-22	14:00:00	2014	422	11.492	0.145	21.39	0.884	
9	2014-04-22	14:30:00	2014	422	11.637	0.267	22.274	1.054	
99436	2019-04-25	05:00:00	2019	425	12.219	0.048	14.361	0.335	
99437	2019-04-25	05:30:00	2019	425	12.171	0.049	14.026	0.192	
99438	2019-04-25	06:00:00	2019	425	12.122	0.024	13.834	0.072	
99439	2019-04-25	06:30:00	2019	425	12.098	0.048	13.906	0.072	
99440	2019-04-25	07:00:00	2019	425	12.05	0.025	13.978	0.288	
99441	2019-04-25	07:30:00	2019	425	12.025	0.024	14.266	0.502	
99442	2019-04-25	08:00:00	2019	425	12.001	0.024	14.768	0.717	
99443	2019-04-25	08:30:00	2019	425	12.025	0.025	15.485	1.097	
99444	2019-04-25	09:00:00	2019	425	12.05	0.024	16.582	0.595	
99445	2019-04-25	09:30:00	2019	425	12.074	0.073	17.177	1.118	
99446	2019-04-25	10:00:00	2019	425	12.147	0.121	18.295	2.212	
99447	2019-04-25	10:30:00	2019	425	12.268	0.121	20.507	0.572	
99448	2019-04-25	11:00:00	2019	425	12.389	0.169	21.079	0.621	
99449	2019-04-25	11:30:00	2019	425	12.558	0.169	21.7	0.909	
99450	2019-04-25	12:00:00	2019	425	12.727	0.193	22.609	0.431	
99451	2019-04-25	12:30:00	2019	425	12.92	0.168	23.04	0.024	
99452	2019-04-25	13:00:00	2019	425	13.088		23.016		
99453									

Create a new worksheet

Copy and paste Date, Time, Year, MonthDay, and the desired parameters into the worksheet (in this example, Water.Temp.C and Air.Temp.C)

Create a new column for each parameter (in this example, WaterSpike and Air Spike, highlighted in yellow). Enter the absolute difference formula (cell above – cell below). In this example, where the water temperature data is in Col E, you start with this formula =ABS(E2-E3) and carry it to the bottom (the next cell should read ABS(E3-E4) and so on…

Delete the value in the last row since it doesn't have another value to compare to.

Create a pivot table and column plot – see next slide

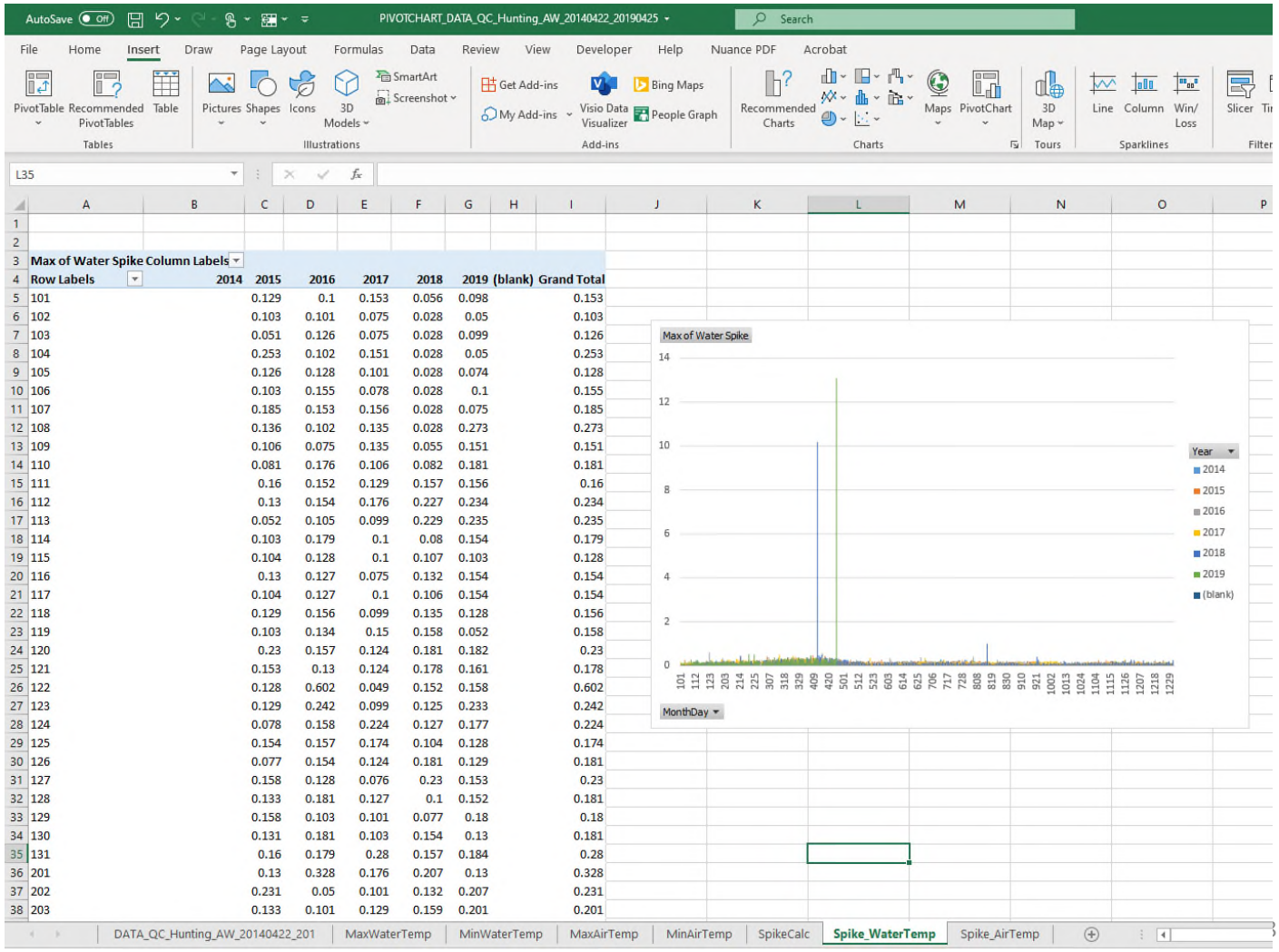
Spike test evaluation

To create the pivot table, follow the same instructions as above (see slides 3-9) except select ‘Column plot’ instead of ‘Line plot’.

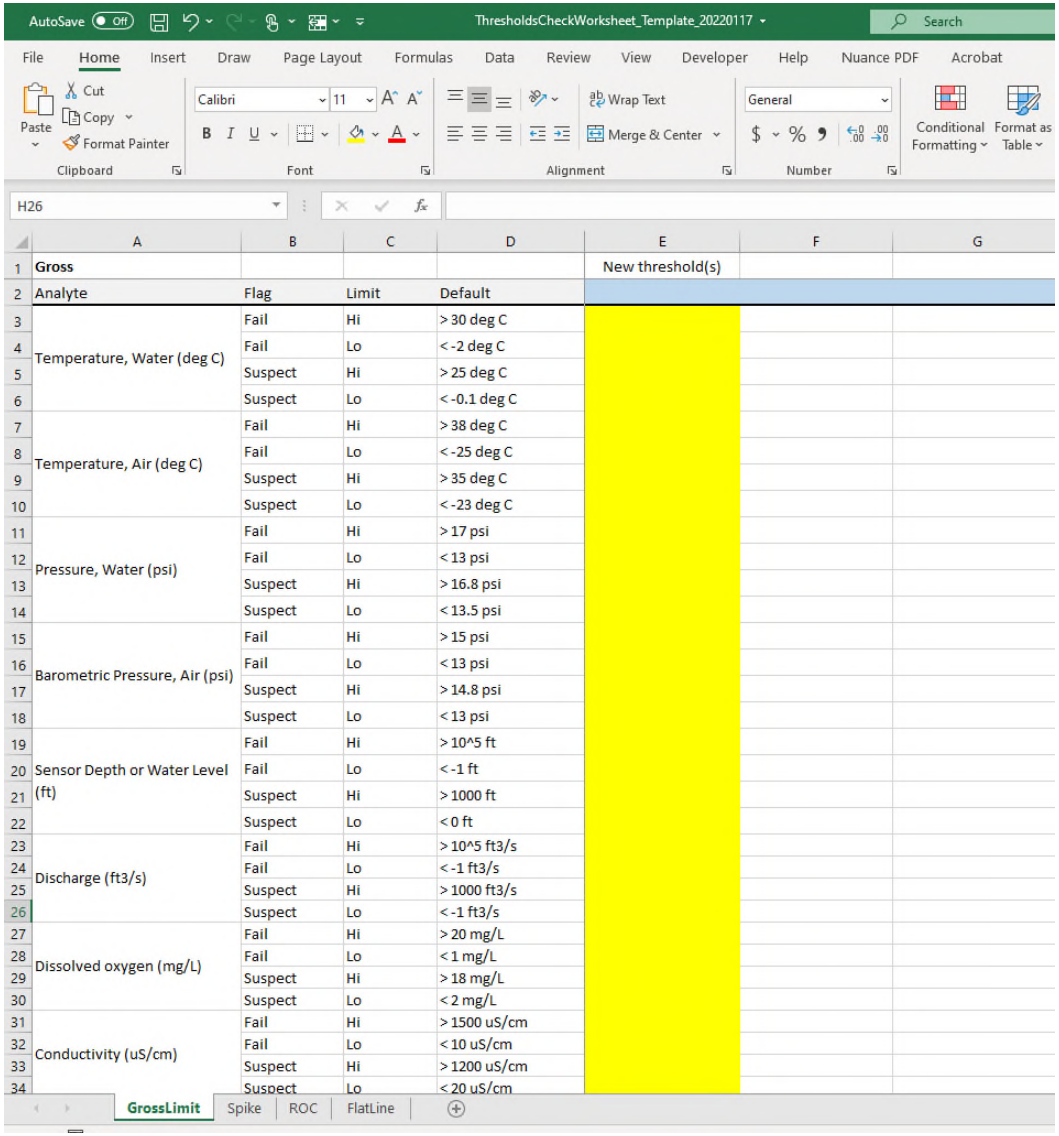
Evaluate the maximum values.

Do the default thresholds look appropriate for your site? If not, adjust them.

Sorry – these plots get to be slow and clunky because the Excel file is usually very large. But I find them helpful enough to be worth the time, at least currently.



Documentation



	A	B	C	D	E	F	G
1	Gross				New threshold(s)		
2	Analyte	Flag	Limit	Default			
3	Temperature, Water (deg C)	Fail	Hi	> 30 deg C			
4		Fail	Lo	< -2 deg C			
5		Suspect	Hi	> 25 deg C			
6		Suspect	Lo	< -0.1 deg C			
7	Temperature, Air (deg C)	Fail	Hi	> 38 deg C			
8		Fail	Lo	< -25 deg C			
9		Suspect	Hi	> 35 deg C			
10		Suspect	Lo	< -23 deg C			
11	Pressure, Water (psi)	Fail	Hi	> 17 psi			
12		Fail	Lo	< 13 psi			
13		Suspect	Hi	> 16.8 psi			
14		Suspect	Lo	< 13.5 psi			
15	Barometric Pressure, Air (psi)	Fail	Hi	> 15 psi			
16		Fail	Lo	< 13 psi			
17		Suspect	Hi	> 14.8 psi			
18		Suspect	Lo	< 13 psi			
19	Sensor Depth or Water Level (ft)	Fail	Hi	> 10^5 ft			
20		Fail	Lo	< -1 ft			
21		Suspect	Hi	> 1000 ft			
22		Suspect	Lo	< 0 ft			
23	Discharge (ft3/s)	Fail	Hi	> 10^5 ft3/s			
24		Fail	Lo	< -1 ft3/s			
25		Suspect	Hi	> 1000 ft3/s			
26		Suspect	Lo	< -1 ft3/s			
27	Dissolved oxygen (mg/L)	Fail	Hi	> 20 mg/L			
28		Fail	Lo	< 1 mg/L			
29		Suspect	Hi	> 18 mg/L			
30		Suspect	Lo	< 2 mg/L			
31	Conductivity (uS/cm)	Fail	Hi	> 1500 uS/cm			
32		Fail	Lo	< 10 uS/cm			
33		Suspect	Hi	> 1200 uS/cm			
34		Suspect	Lo	< 20 uS/cm			

Documentation

We provide a ‘threshold check’ worksheet that you can use to document threshold changes and the basis for those changes.

Download the Excel file ‘ThresholdsCheckWorksheet_Template_20220117’

Reminder –
Units are important! If you change from feet to meters or °C to °F, you will need to adjust the default QC test thresholds accordingly. The user can also modify the units in the Config file.