A scenic view of a river with a large tree on the left bank and a boat in the distance. The tree has a thick, gnarled trunk and is covered in Spanish moss. The water is calm and reflects the sky. The sky is blue with some light clouds.

**Quality Assurance
Procedures for
Continuous Water Quality
Monitoring**

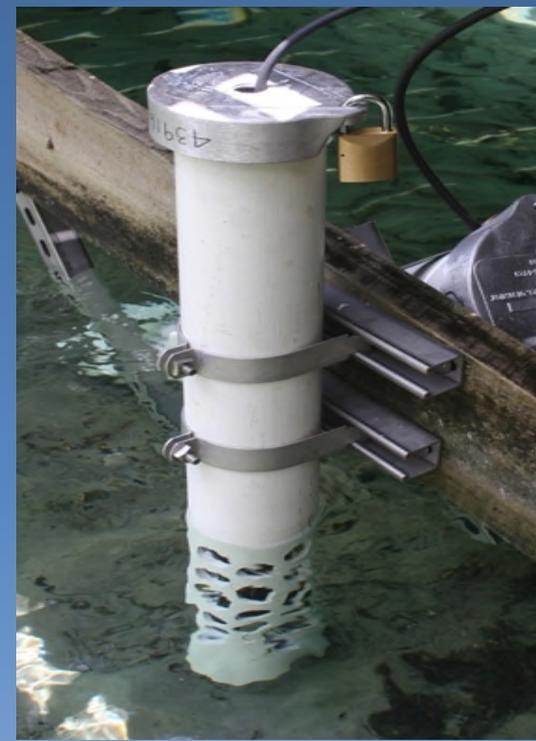
Lauren Peacock
Data Quality Assurance Specialist III
SJRWMD

Pre-Deployment

EXO2	SUNA V2	CyclePO4	EXO1
<ul style="list-style-type: none"> • Calibrate 	<ul style="list-style-type: none"> • Initial verification 	<ul style="list-style-type: none"> • Replace filters 	<ul style="list-style-type: none"> • Calibrate
<ul style="list-style-type: none"> • Initial verification 	<ul style="list-style-type: none"> • Reference update 	<ul style="list-style-type: none"> • Replace reagents 	<ul style="list-style-type: none"> • Initial verification
<ul style="list-style-type: none"> • Anti-fouling measures 	<ul style="list-style-type: none"> • Anti-fouling measures 	<ul style="list-style-type: none"> • Flushes, primes & sample runs 	<p>—</p>
<p>—</p>	<p>—</p>	<ul style="list-style-type: none"> • Anti-fouling measures 	<p>—</p>



Deployment



Field Methods



Guidelines and Standard Procedures for Continuous Water-Quality Monitors: Station Operation, Record Computation, and Data Reporting



Techniques and Methods 1-D3

U.S. Department of the Interior
U.S. Geological Survey

Retrieval Field QA

Pre-clean



Post-clean

Parameter	EXO2 Pre-clean	EXO1 Pre-clean	EXO2 Post-clean	EXO1 Post-clean
Time (hhmm)	1100	1100	1130	1130
Water Temp (°C)	22.18	22.11	22.29	22.23
pH (su)	8.03	7.81	8.04	7.87
ODO (mg/L)	7.01	7.14	7.26	7.27
ODO (%)	95.5	97.2	99.13	99.3
SpCond (µmhos/cm)	45,529	45,749	45,473	45,710
Salinity (ppt)	29.53	29.69	29.49	29.66
Col. Depth (m)	1.44	1.43	1.42	1.45
BGA (µg/L)	11.05	12.39	13.17	13.58
Rel. Chl a (µg/L)	12.80	11.09	14.20	11.37
Turbidity (FNU)	5.42	—	7.69	—
fDOM (QSU)	47.31	—	47.41	—
Wiper Postion	1.22	—	1.22	—
SUNA (mg/L)	0.163	—	0.162	—

Post-Deployment

CyclePo4	SUNA V2	EXO2	EXO1
<ul style="list-style-type: none"> Download data 	<ul style="list-style-type: none"> Download data 	<ul style="list-style-type: none"> Download data 	<ul style="list-style-type: none"> Post-cal
<ul style="list-style-type: none"> Remove and replace filters 	<ul style="list-style-type: none"> Post-cal 	<ul style="list-style-type: none"> Post-cal 	—
<ul style="list-style-type: none"> Clean instrument 	<ul style="list-style-type: none"> Clean instrument 	<ul style="list-style-type: none"> Clean instrument 	—



CM Retrieval Field Sheet

Station: <u>CUNL02</u>	Retrieval Date: <u>1/25/16</u>	Retrieval Time: <u>1030</u>
EXO2: <u>1610718</u>	SUNA: <u>456</u>	Cycle: <u>188</u>
EXO1: <u>22437</u>		
Samplers: <u>C.Akers, K.Snyder</u>	Prelogin: <u>L20160577</u>	

Parameter	EXO2 Pre	EXO1 Pre/Grab	EXO2 Post	EXO1 Post
Time (hh:mm)	1030	1030	1045	1045
Water Temp (°C)	10.85	10.85	10.91	10.91
pH	8.30	8.17	8.29	8.22
ODD (mg/L)	8.64	8.65	8.73	8.66
ODD (ft)	9.67	9.72	9.74	9.73
SpCond (µmhos/cm)	50215	50882	50596	52174
Salinity (ppt)	32.75	32.75	33.03	34.18
Col. Depth (m)	1.41	1.41	1.5	1.5
BGA (µg/L)	114.73	114.73	116.10	117.01
Chl a (µg/L)	83.9	78.1	81.9	80.5
Turbidity (NTU)	18.80	18.80	19.4	19.4
IDOM (°C)	42.858	42.858	42.97	42.97
Wiper Position	1.21	1.22		
SUNA (mg/L)	248	248	213	213

Common Data	
Tot. Depth (m)	1.9
Secchi (m)	0.25
Air Temp (°C)	11.3
Cloud Cover (%)	20
Wind Speed (mph)	4.2
Wind Dir. (deg)	330
Weather Code	20

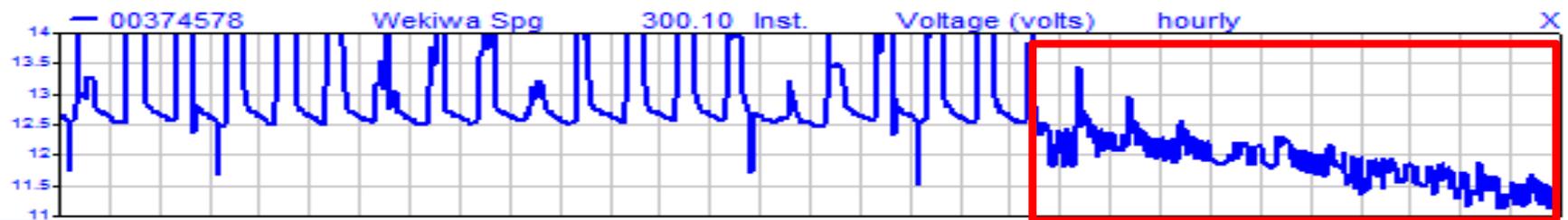
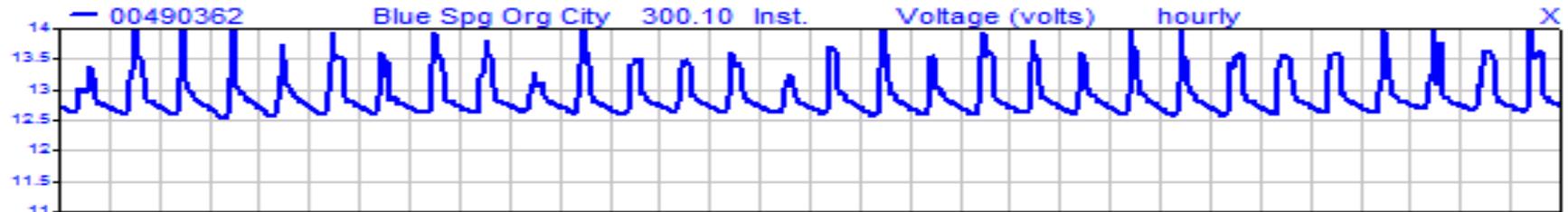
cycle #	deployment
Da	winloc <input type="checkbox"/> N
Files to H Drive	<input checked="" type="checkbox"/> N
Cycle Counts	420 <input type="checkbox"/> N
Flush, Bleach, Flush	<input checked="" type="checkbox"/> N

SUNA Post-Deployment Reality Check (CCV)						Date: <u>1/25/16</u>	Post-Deployment
Time	Buffer	Reading	P/P	F/F	OD	Data Downloaded	<input checked="" type="checkbox"/> N
8:06	Nitrate mg/L	DI	0.14	F		Files to H Drive	<input checked="" type="checkbox"/> N
8:09	Nitrate mg/L	1.00	1.01	F	C153153		

NOTES

Powered down @ 1050 - Pump not working, had to site preserve the Fe + PSC + color vial at the office @ ~1515 time

Automated Alerts & Coding

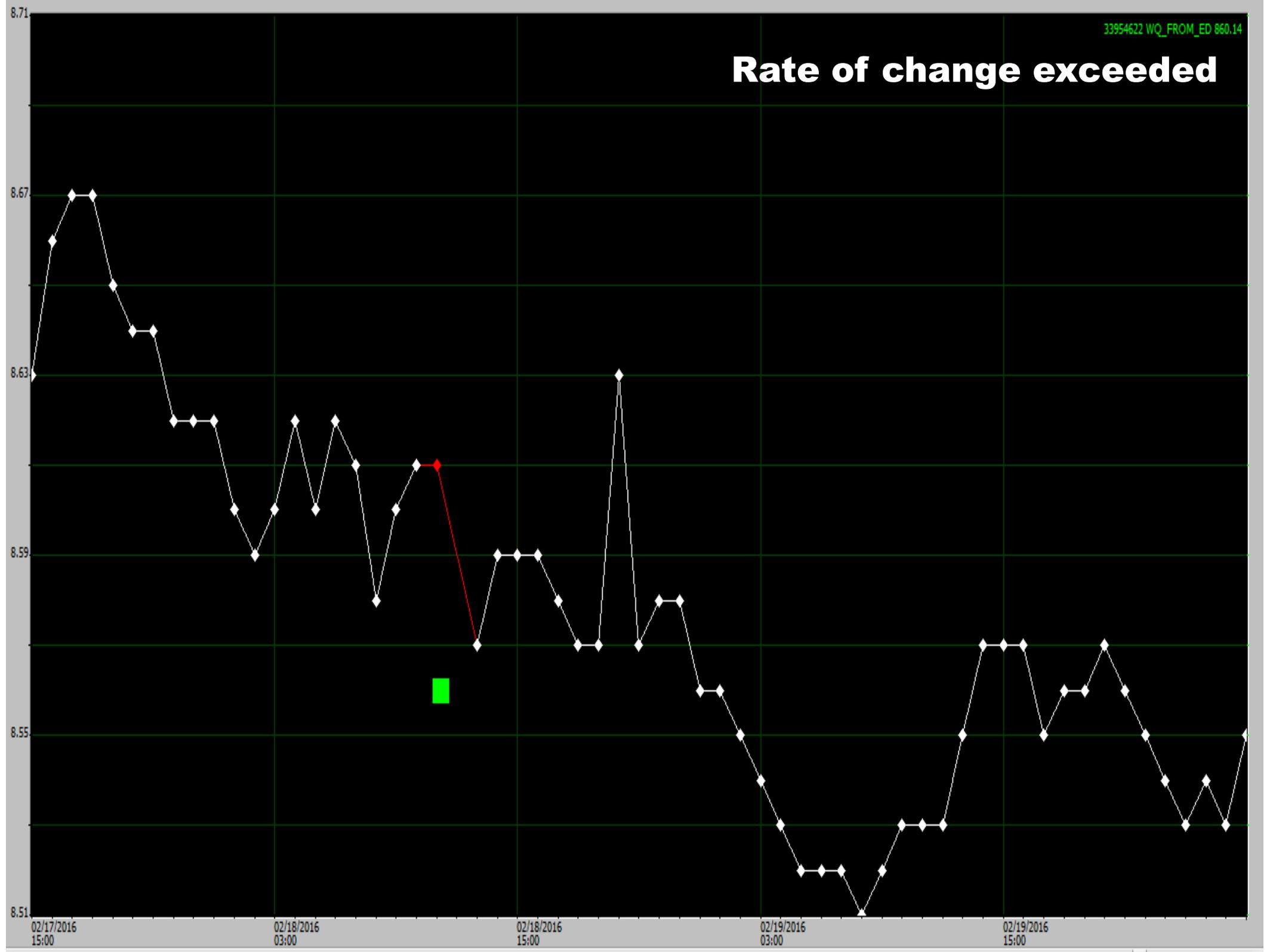


Site 33964621: CM Merritt Island Causeway at SR 520 (WQ)
 FAIL ON: DataSource X: Data 2328.10->2328 (Light Spec Avg) in range 4000.0000.. 99999.0000

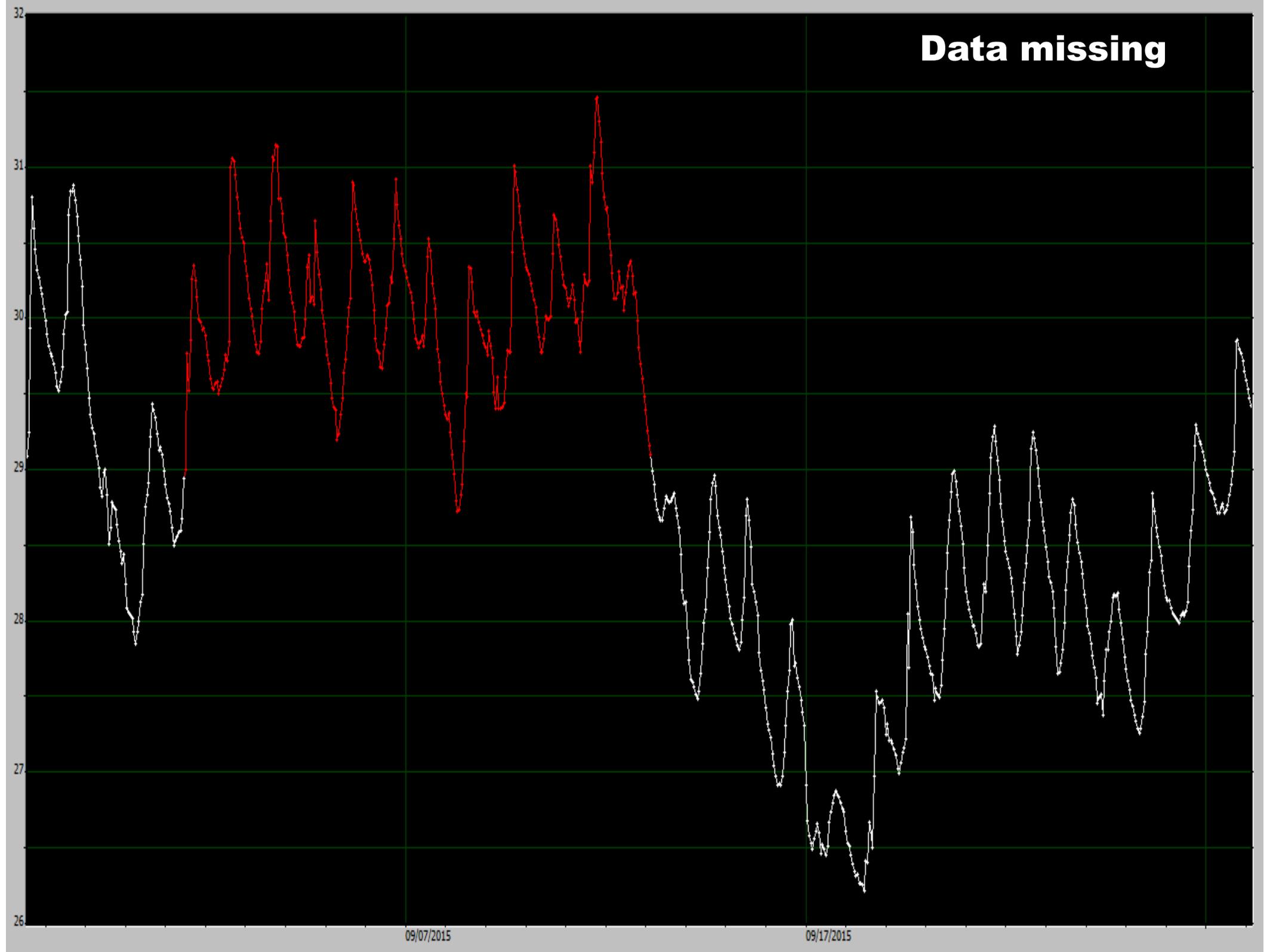
* Time 00:00_04/24/2016	value	721.00000
* Time 01:00_04/24/2016	value	720.00000
* Time 02:00_04/24/2016	value	721.00000
* Time 03:00_04/24/2016	value	721.00000
* Time 04:00_04/24/2016	value	718.00000
* Time 05:00_04/24/2016	value	719.00000
* Time 06:00_04/24/2016	value	718.00000
* Time 07:00_04/24/2016	value	716.00000
* Time 08:00_04/24/2016	value	716.00000
* Time 09:00_04/24/2016	value	718.00000
* Time 10:00_04/24/2016	value	721.00000
* Time 11:00_04/24/2016	value	727.00000
* Time 12:00_04/24/2016	value	737.00000
* Time 13:00_04/24/2016	value	741.00000

Site 33954622: CM @ Titusville Max Brewer Mem Pkwy Fishing Pier (WQ)
 FAIL ON: DataSource X: Data current, variables: 450.10,2330.10 (within 6 Hours)
 * Variable 450.10 ends at 11:00_02/18/2016 and is 6 Days out of date
 * Variable 2330.10 ends at 11:00_02/18/2016 and is 6 Days out of date
 FAIL ON: DataSource X: Data current, variable 2355.10 (within 10 Hours)
 * Variable 2355.10 ends at 07:00_02/18/2016 and is 6 Days out of date

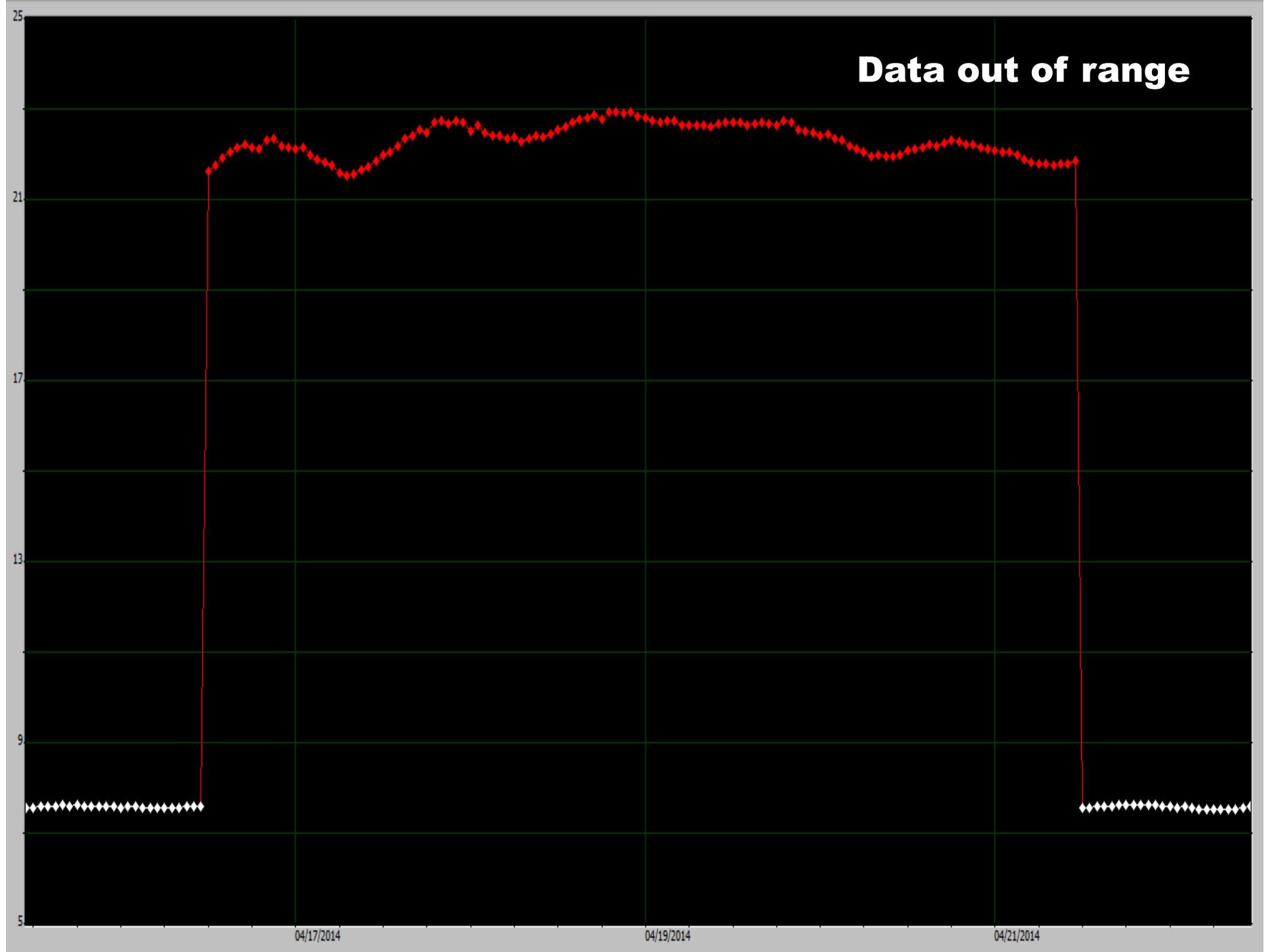
Rate of change exceeded



Data missing

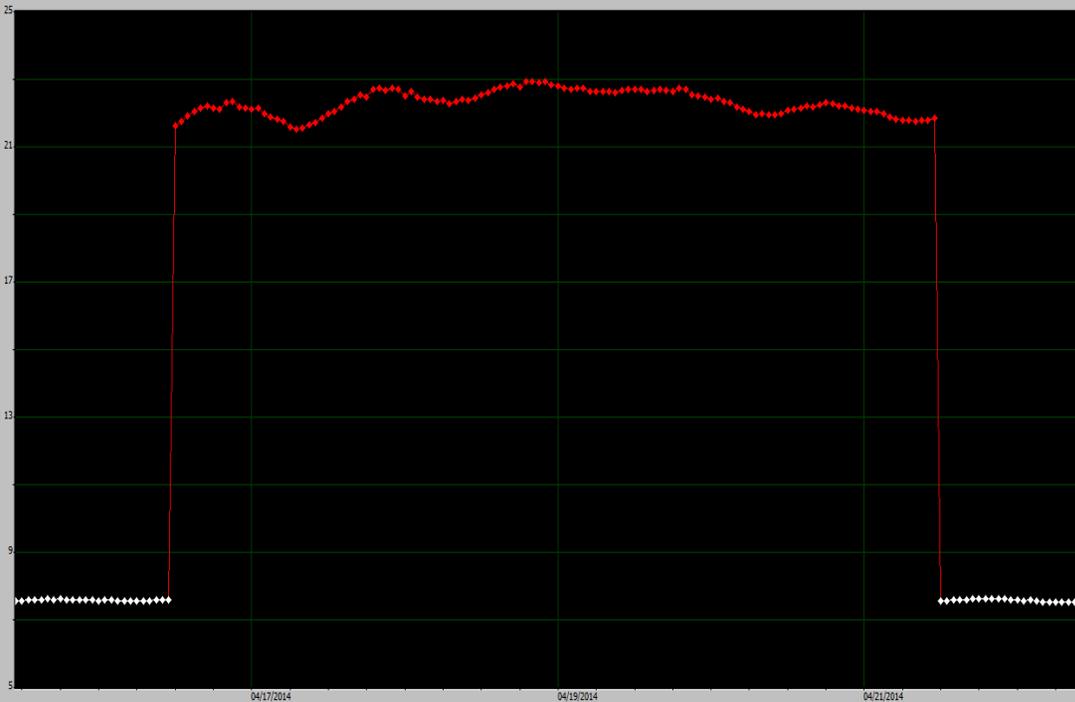


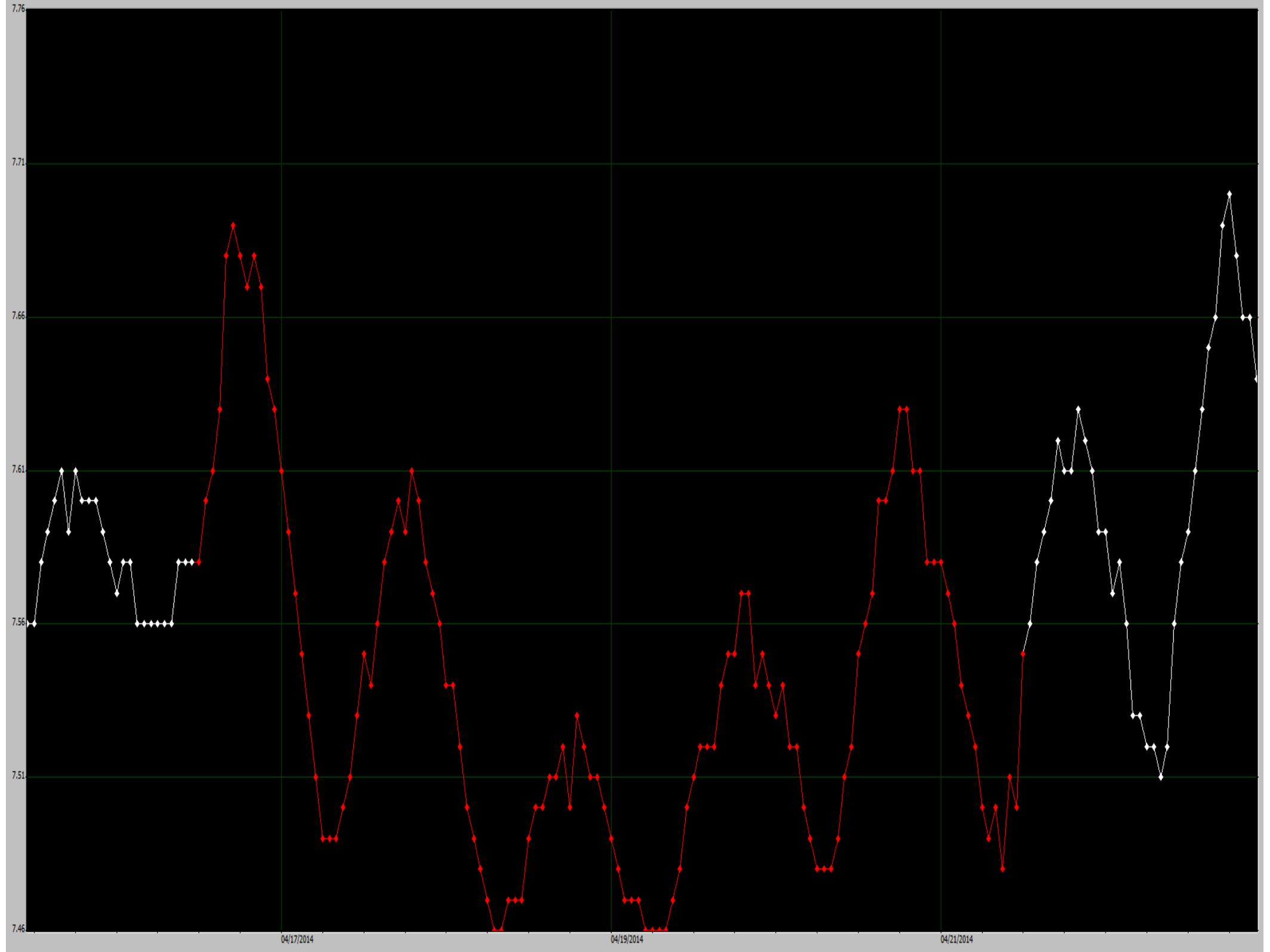
Data out of range



Program – Template Correction

4153 Silver River Near Connor			4153 Silver River Near Connor		
pH_Sensor			DO_Sensor		
Date	Time	pH	Date	Time	mg/l
04/22/2014	00:00:00	7.5900	04/22/2014	00:00:00	5.6600
04/21/2014	23:00:00	7.5900	04/21/2014	23:00:00	5.7500
04/21/2014	22:00:00	7.6100	04/21/2014	22:00:00	5.8900
04/21/2014	21:00:00	7.6200	04/21/2014	21:00:00	6.1000
04/21/2014	20:00:00	7.6300	04/21/2014	20:00:00	6.1900
04/21/2014	19:00:00	7.6100	04/21/2014	19:00:00	6.1000
04/21/2014	18:00:00	7.6100	04/21/2014	18:00:00	6.0900
04/21/2014	17:00:00	7.6200	04/21/2014	17:00:00	6.1400
04/21/2014	16:00:00	7.6000	04/21/2014	16:00:00	5.9100
04/21/2014	15:00:00	7.5900	04/21/2014	15:00:00	5.7500
04/21/2014	14:00:00	7.5800	04/21/2014	14:00:00	5.5700
04/21/2014	13:00:00	7.5600	04/21/2014	13:00:00	5.2500
04/21/2014	12:00:00	7.5500	04/21/2014	12:00:00	5.0200
04/21/2014	11:00:00	21.8400	04/21/2014	11:00:00	7.5000
04/21/2014	10:00:00	21.7800	04/21/2014	10:00:00	7.5100
04/21/2014	09:00:00	21.7800	04/21/2014	09:00:00	7.4800
04/21/2014	08:00:00	21.7500	04/21/2014	08:00:00	7.5000
04/21/2014	07:00:00	21.7900	04/21/2014	07:00:00	7.4900
04/21/2014	06:00:00	21.7800	04/21/2014	06:00:00	7.5000
04/21/2014	05:00:00	21.8300	04/21/2014	05:00:00	7.5200
04/21/2014	04:00:00	21.9000	04/21/2014	04:00:00	7.5300
04/21/2014	03:00:00	21.9900	04/21/2014	03:00:00	7.5400
04/21/2014	02:00:00	22.0400	04/21/2014	02:00:00	7.5600





Correction Criteria

Measurement	Calibration criteria	Data-correction criteria	Maximum allowable limits
Temperature °C	± 0.5	± 0.5	± 2.0
Specific conductance μS/cm	± 5 or ± 5% of the measured value, whichever is greater	± 5 or ± 5% of the measured value, whichever is greater	± 30%
Dissolved oxygen mg/L	± 0.3	± 0.3	± 2.0 or 20%, whichever is greater
pH s.u.	± 0.2	± 0.2	± 2
Turbidity FNU	± 0.5 or ± 5% of the measured value, whichever is greater	± 0.5 or ± 5% of the measured value, whichever is greater	± 3.0 or ± 30%, whichever is greater

Fouling Checks

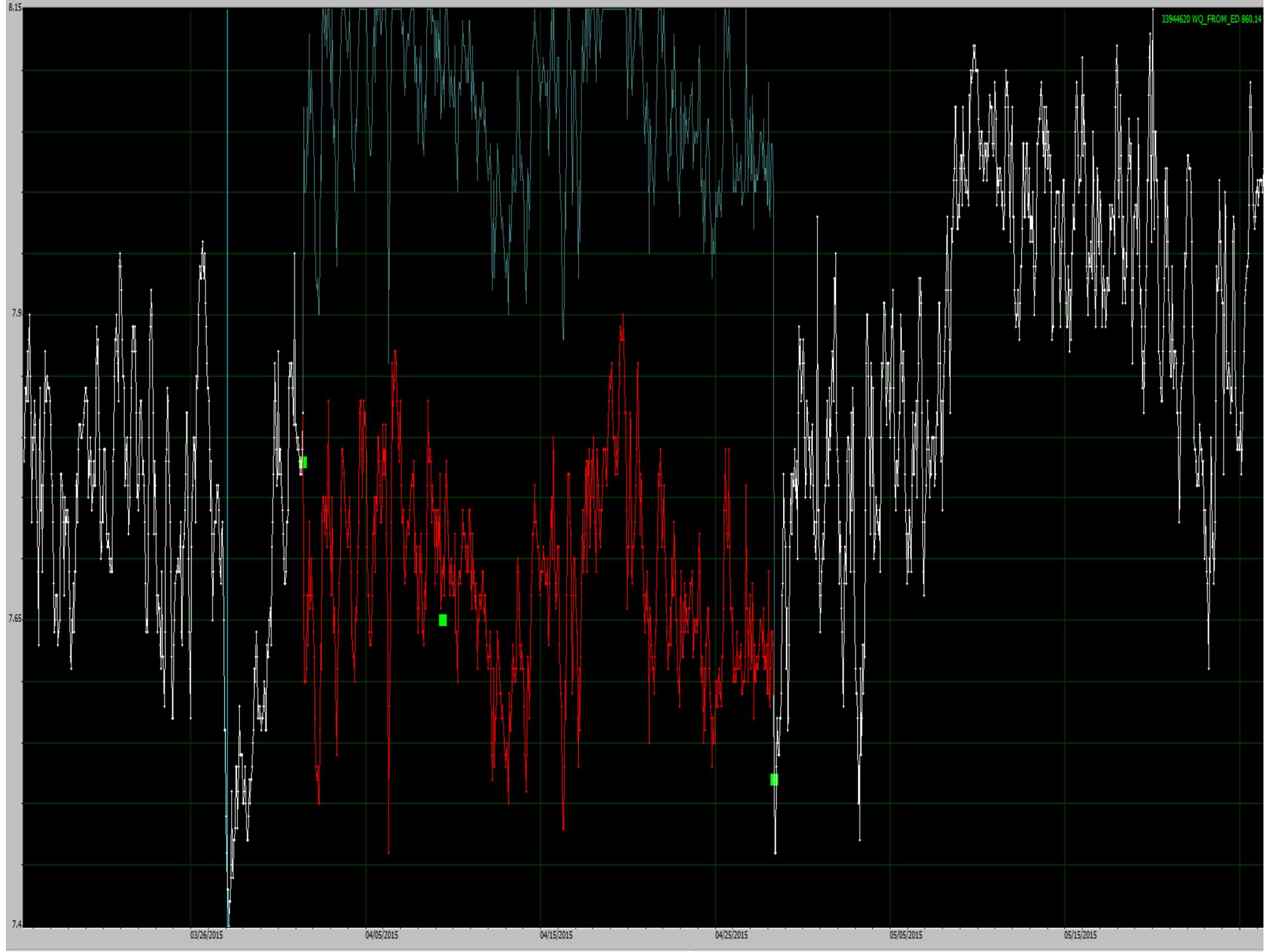
Post Calibration Checks

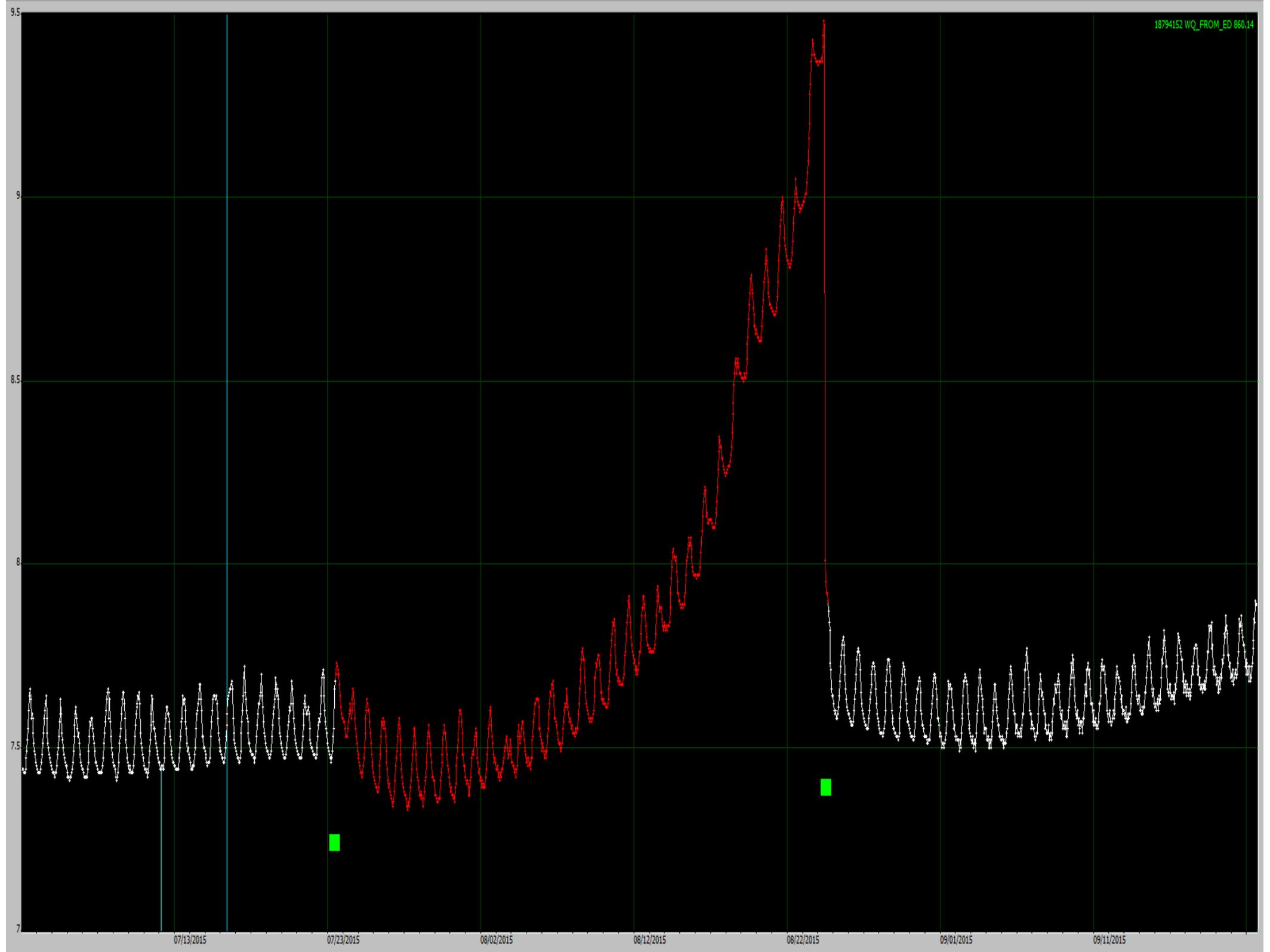
Fouling Correction

Variable Correction for Calibration Drift

version 2.29 (0

Date (MM DD YYYY)	Pre-Clean		Post-Clean		pH STD 1	EXO2 reading	pH STD 2	EXO2 reading	Correction	Average Drift Correction	Total Absolute Correction
	EXO2 reading	EXO1 field check	EXO2 reading	EXO1 field check							
4/1/2015	8.00	7.52	7.98	7.53	7.00	7.39	10.00	9.59	-0.03	0.40	0.43



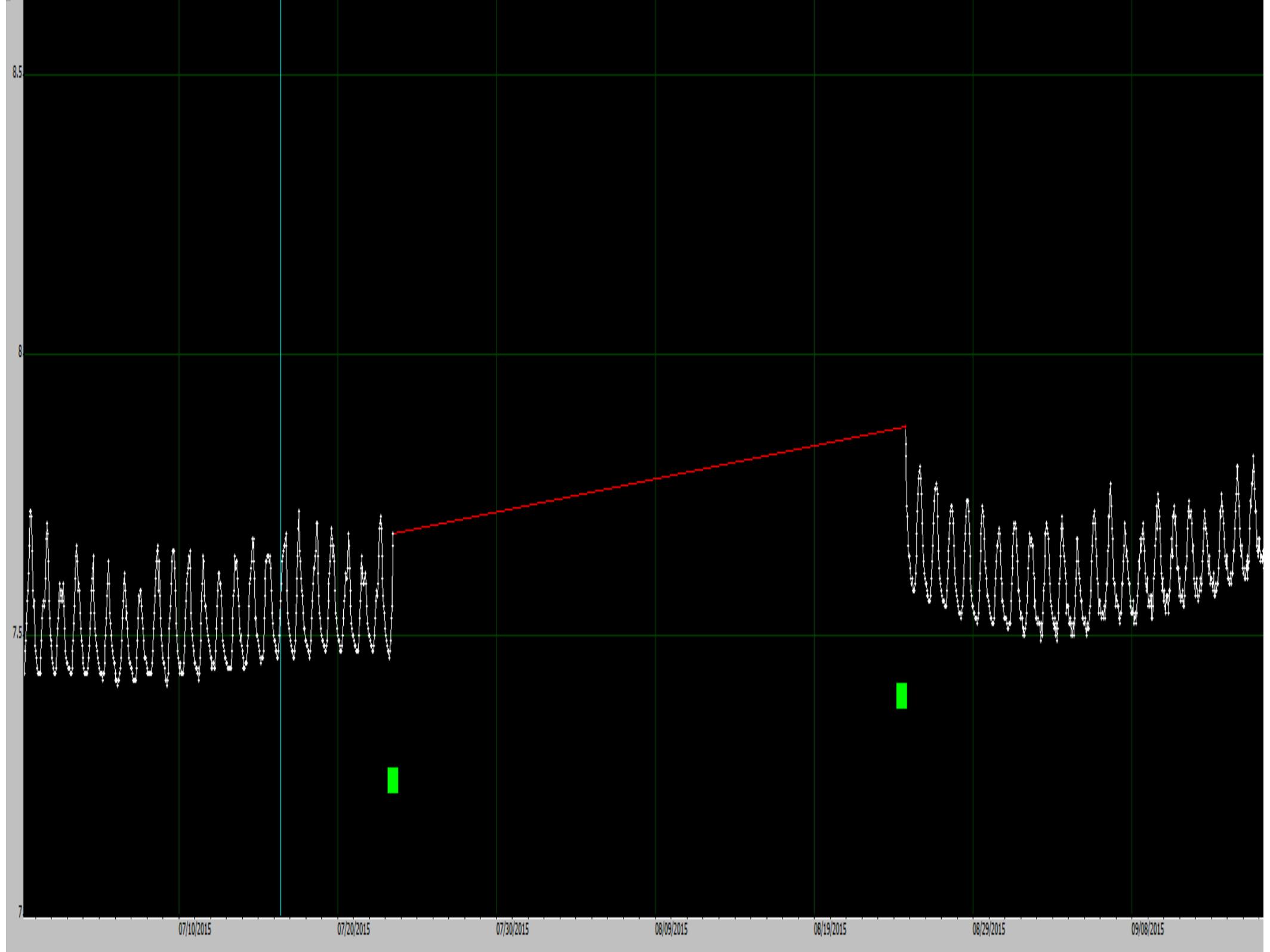


Max Allowable Correction

Measurement	Calibration criteria	Data-correction criteria	Maximum allowable limits
Temperature °C	± 0.5	± 0.5	± 2.0
Specific conductance µS/cm	± 5 or ± 5% of the measured value, whichever is greater	± 5 or ± 5% of the measured value, whichever is greater	± 30%
Dissolved oxygen mg/L	± 0.3	± 0.3	± 2.0 or 20%, whichever is greater
pH s.u.	± 0.2	± 0.2	± 2
Turbidity FNU	± 0.5 or ± 5% of the measured value, whichever is greater	± 0.5 or ± 5% of the measured value, whichever is greater	± 3.0 or ± 30%, whichever is greater

Fouling Checks		Calibration Checks				Fouling Correction	Variable Correction for Calibration Drift				
Date (MM DD YYYY)	Before Cleaning		After Cleaning		pH STD 1	station reading	pH STD 2	station reading	Correction	Average Drift Correc-tion	Total Absolute Correction
	station reading	field check	station reading	field check							
7/23/2015	9.52	7.39	9.49	7.38	7.00	12.04	10.00	14.92	-0.02	4.98	5.00

version 2.29 (0)

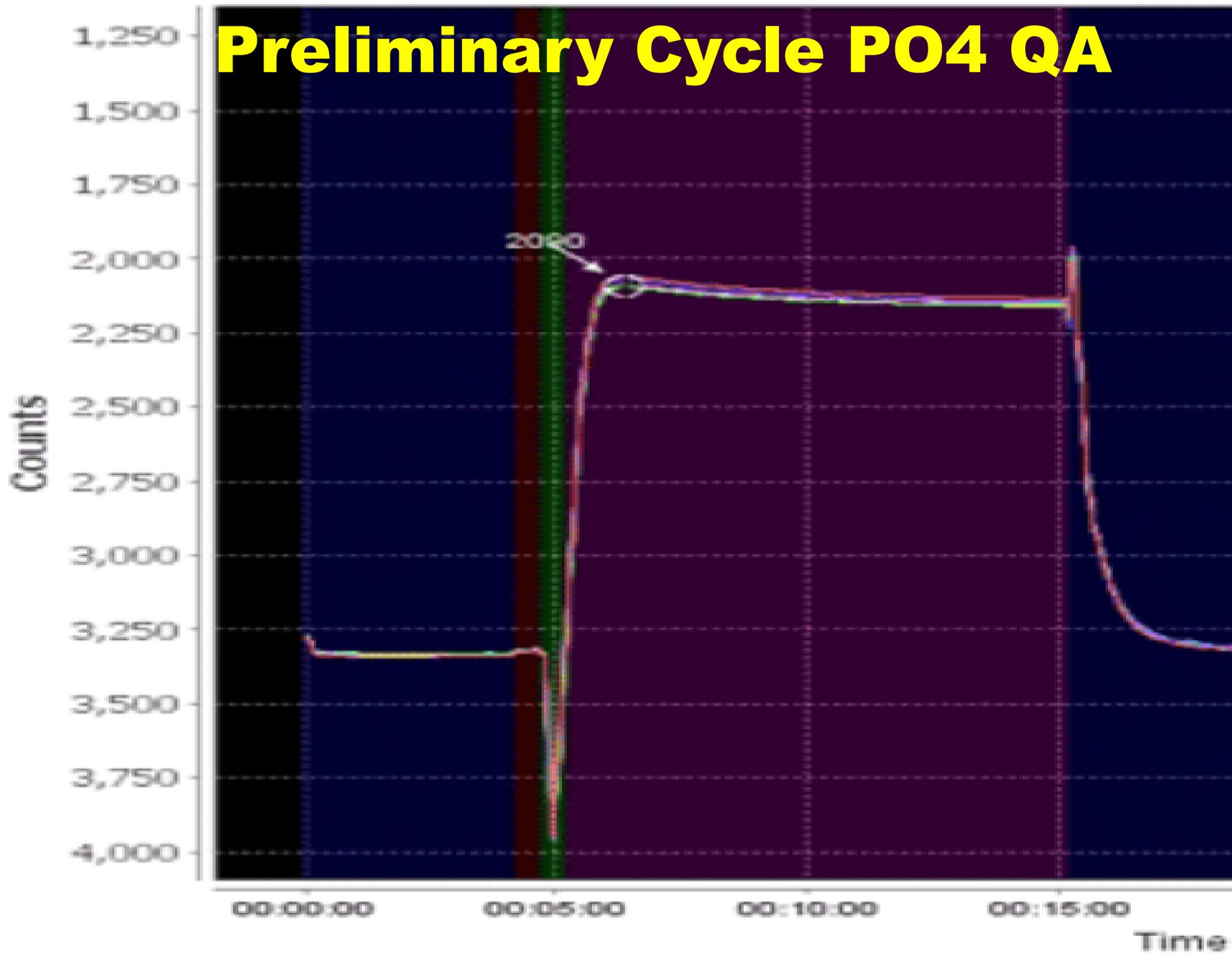


Preliminary SUNA QA

SUNA Variables	Range
Light Spectrum Average	~20,000 counts
Dark Spectrum Average	500 – 1000 counts
Relative Humidity	<50%
Absorption @ 254	<1.3
Absorption @ 350	<1.3



Preliminary Cycle P04 QA



QA Issues

- No documentation
- Swapping probes
- Programs vs. templates
- Hydro database



Improvements

Current:

- Standardization
 - Documentation
 - Field procedures
 - Programs
 - Templates

Future:

- QA SOPs
- Site audits



References

- Cycle PO4. Retrieved April 10, 2016 from <http://www.ott.com/en-us/products/water-quality/sea-bird-coastal-hydrocycle-po4-phosphate-sensor/>.
- EXO1 Sonde. Retrieved April 10, 2016 from <http://www.exowater.com/exo1>.
- EXO2 Sonde. Retrieved April 10, 2016 from <http://www.exowater.com/exo1>.
- SUNA V2. Retrieved April 10, 2016 from <http://www.ott.com/en-us/products/water-quality/sea-bird-coastal-suna-optical-nitrate-sensor/>.
- Wagner, R.J., Boulger, R.W., Jr., Oblinger, C.J., and Smith, B.A., 2006, Guidelines and standard procedures for continuous water-quality monitors—Station operation, record computation, and data reporting: U.S. Geological Survey Techniques and Methods 1–D3, 51 p. + 8 attachments; accessed April 15, 2016, at <http://pubs.water.usgs.gov/tm1d3>.



Questions?

