



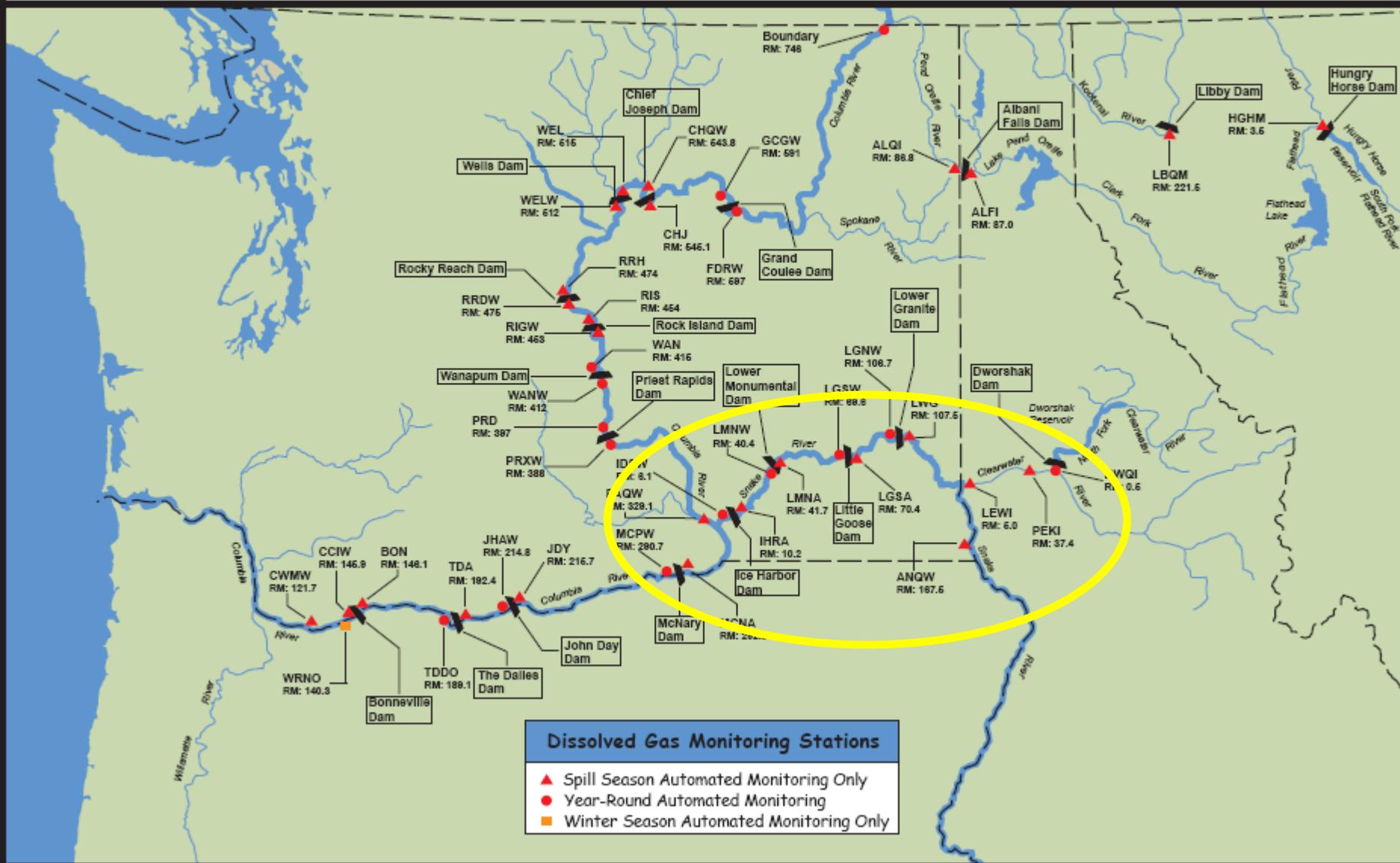
**USACE Walla Walla District
QA/QC Evaluation of 2012 FMS TDG
Monitoring Data**

**USGS Washington Water Science Center
Dwight Copeland
Kevin Wright**

Presentation Outline

- Station locations
- Instrumentation
- Data completeness
- QA/QC
 - Pre and post calibration comparisons to primary standards
 - Sensor comparisons to secondary standards
- Summary

2007 Dissolved Gas Monitoring Network - CDB-DSS Database



FMS's

- 15 sites: 6 year-round sites, 9 seasonal sites
- Total Cost for FY 2013 \$342,510
- 5 Forebay sites, 6 Tailwater sites, 4 Riverine sites
- All 15 sites visited every three weeks during spill season and 6 tailwater sites every four weeks outside spill season

Field equipment

- 37 sondes
- Hydrolab Mini 4a, and Mini 5 sondes.
- Sutron SDI-12 digital barometers
- 14 Sutron Satlink 2 HDR DCP's plus one Sutron 8210 HDR DCP with external phone modem .
- NovaLynx hand-held digital field barometers.

Field equipment for 2012

- All Sutron digital barometers at FMS's
- New Novalynx 230-M202 Handheld Digital Barometer Purchased
- Purchased 25 new TDG Membranes from Hach Environmental.

Lab equipment

- Heise calibrated digital pressure gage
- Ashcroft calibrated digital pressure gage
- Two Barnant digital thermometers
- ParoScientific digital barometric pressure Digiquartz Laboratory Standard.
Model 745.

Data Completeness

During the Spill Season April 1 to Sept. 30.

99.9% of the BP, 98.0% TDG

data and 99.9% of the WT data

were received in real-time

and passed provisional QA/QC review.

PEKI, LGSW and PAQW accounted for 90.0% of the bad TDG data.

For the whole reporting period

99.6% of the BP, 98.4% TDG and 99.6% of the WT data



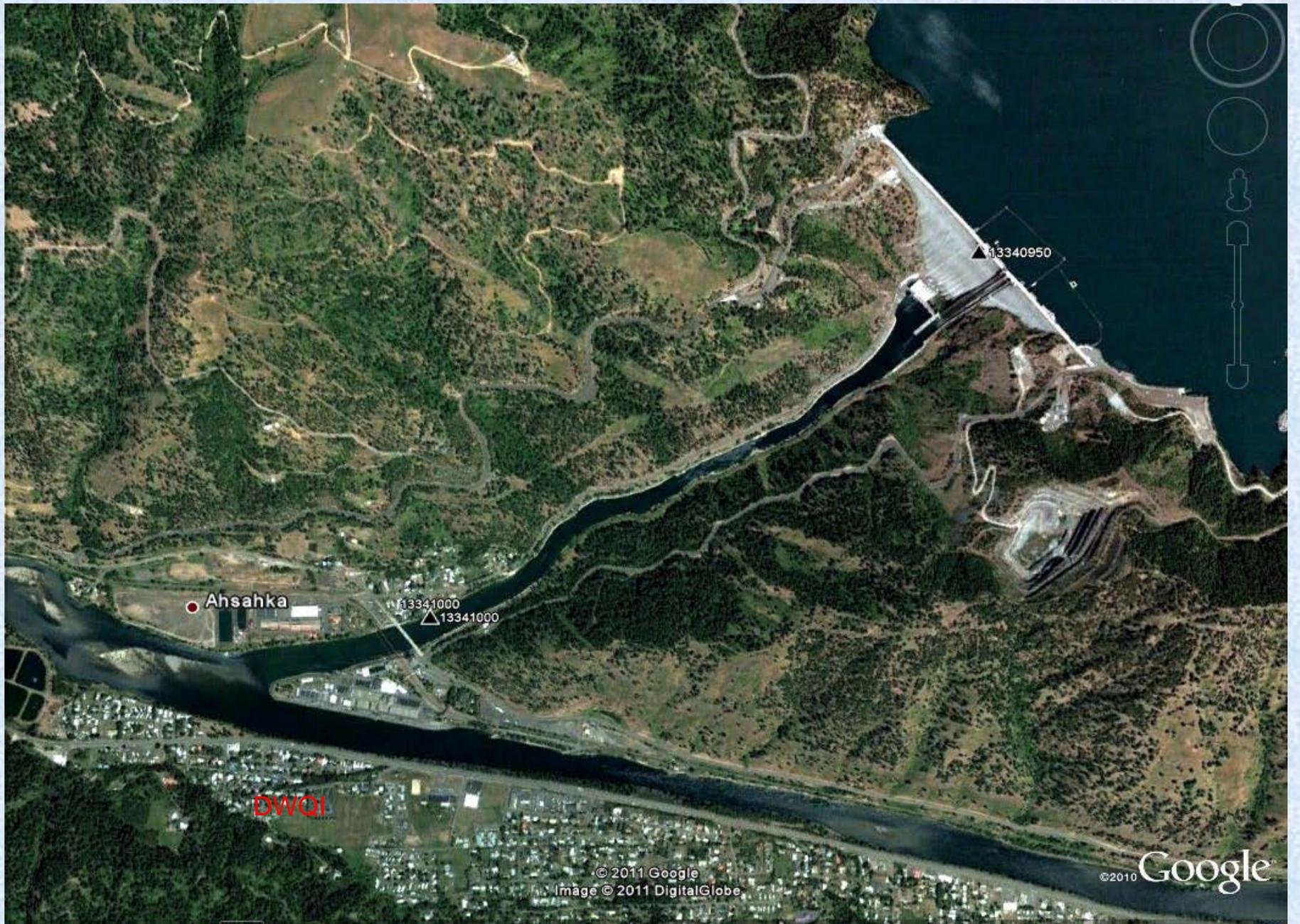
Missing/ Anomalous BP and TDG Data

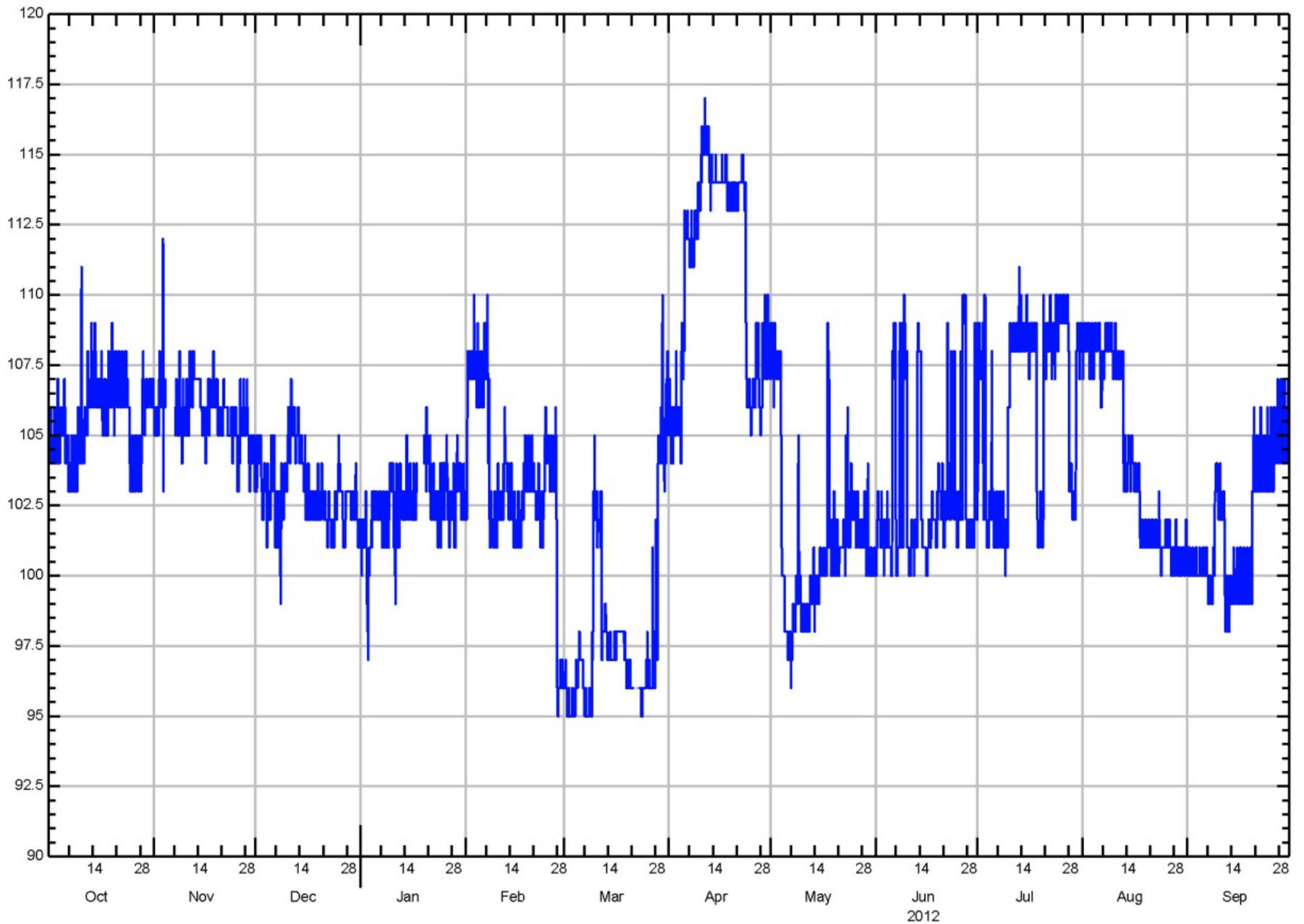
1679 Hours or 2.0% of Total for 2012

Hours	Percent	Reason
834	49.7	Too Low
240	14.3	DCP Failure
222	13.2	Spike
162	9.6	Missing
105	6.3	Bad membrane
97	5.8	Cable Failure
19	1.1	Inspection
0	0	Bad Sonde
0	0	Other

Unusable BP/TDG data

- Worst Sites: PEKI 372 hours, LEWI 318 hours, LGSW 182 hours and DWQI 178 hours where unusable
 - Mostly due to Too Low of readings, Membrane failures, DCP and cable failures.
- Best sites: ANQW, LGSA, LMNA, IHRA and MCNA : 0 hours unusable





13341000 NORTH FORK CLEARWATER RIVER AT AHSAHKA, ID (Pressure, disc gages PUBLISHED (†), COMPUTED) * 1

Dworshak





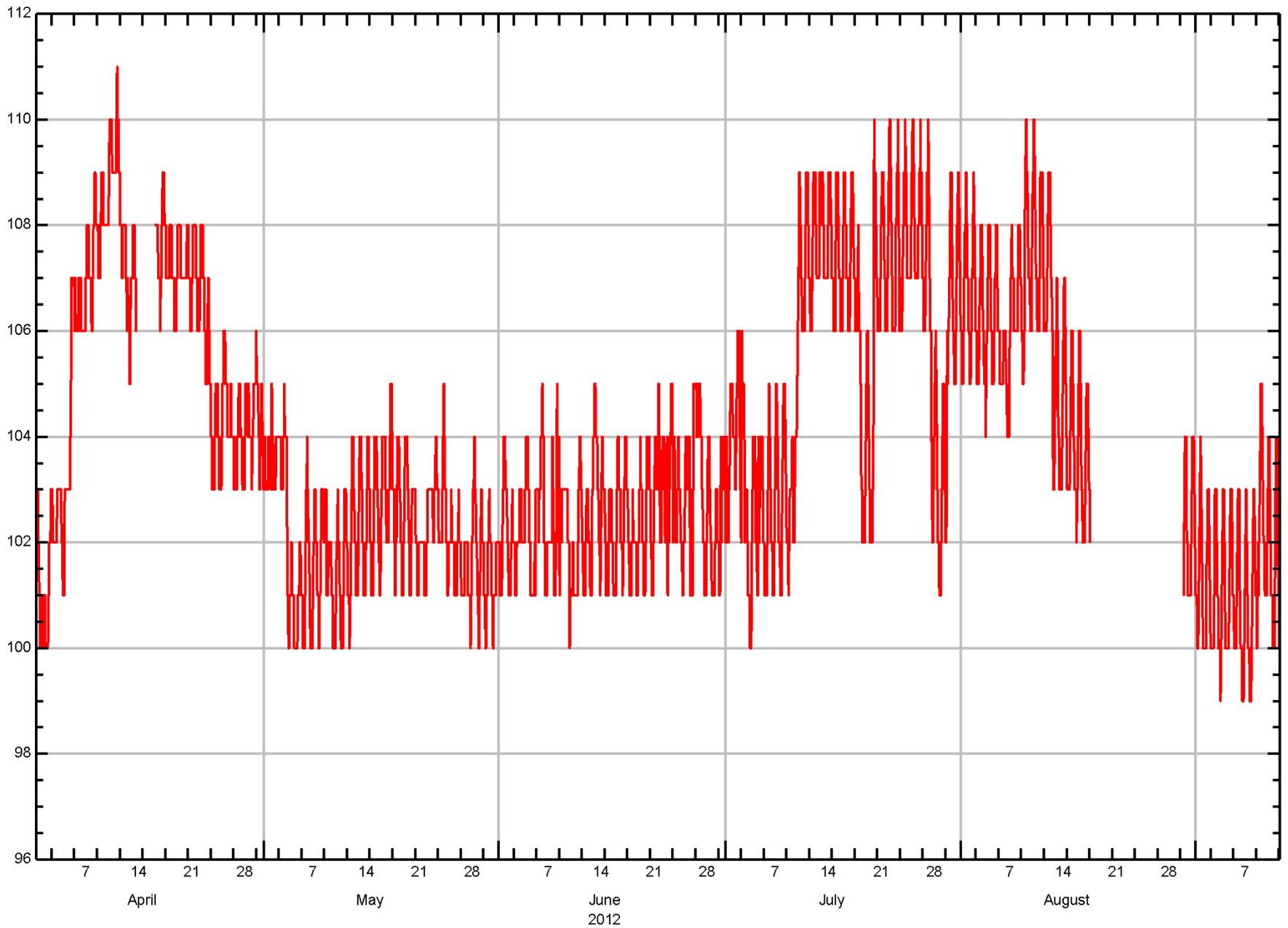
Peck

13341050 ▲ 13341050
13341050

Snells Island

Image U.S. Geological Survey
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Image USDA Farm Service Agency

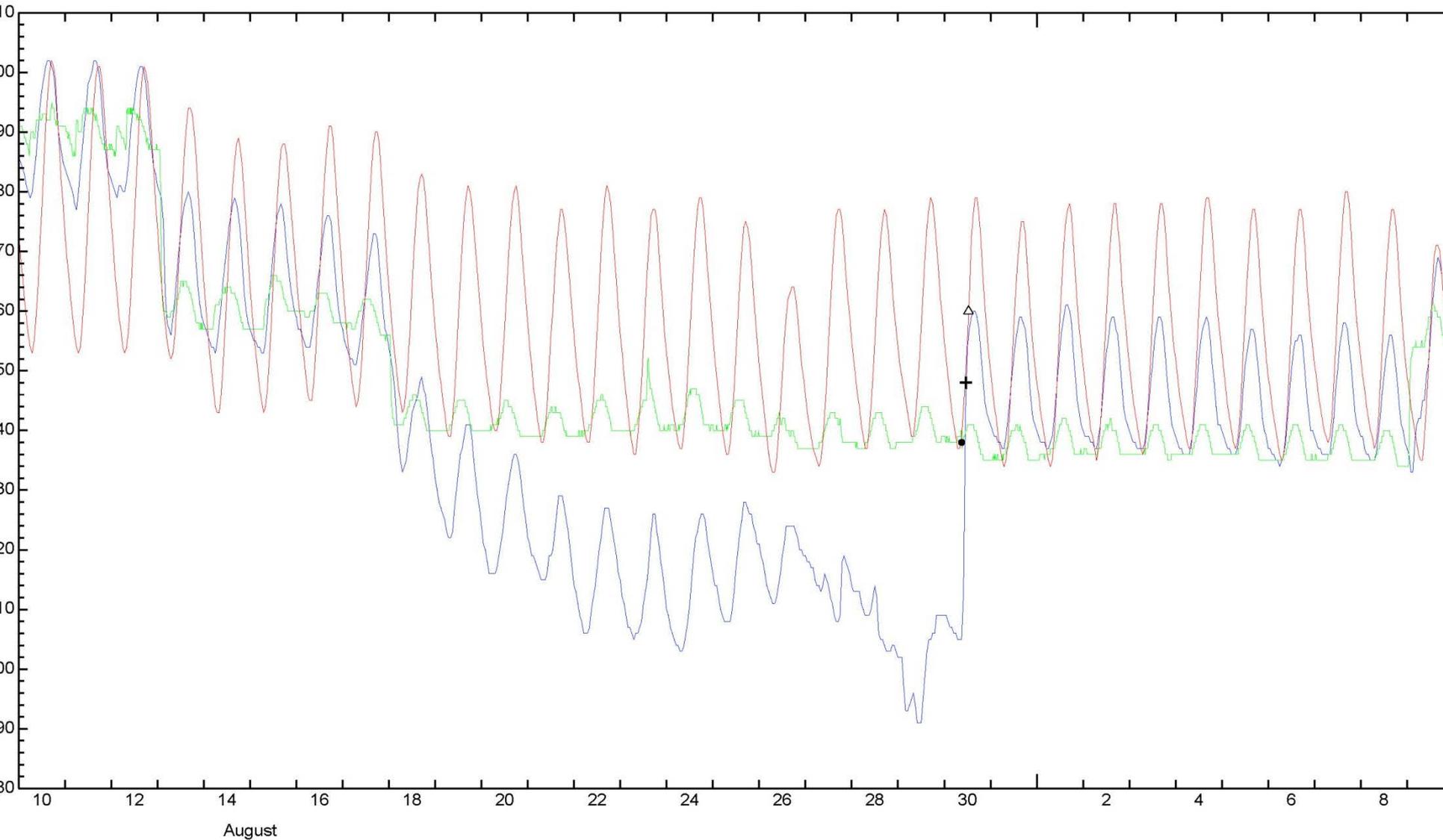
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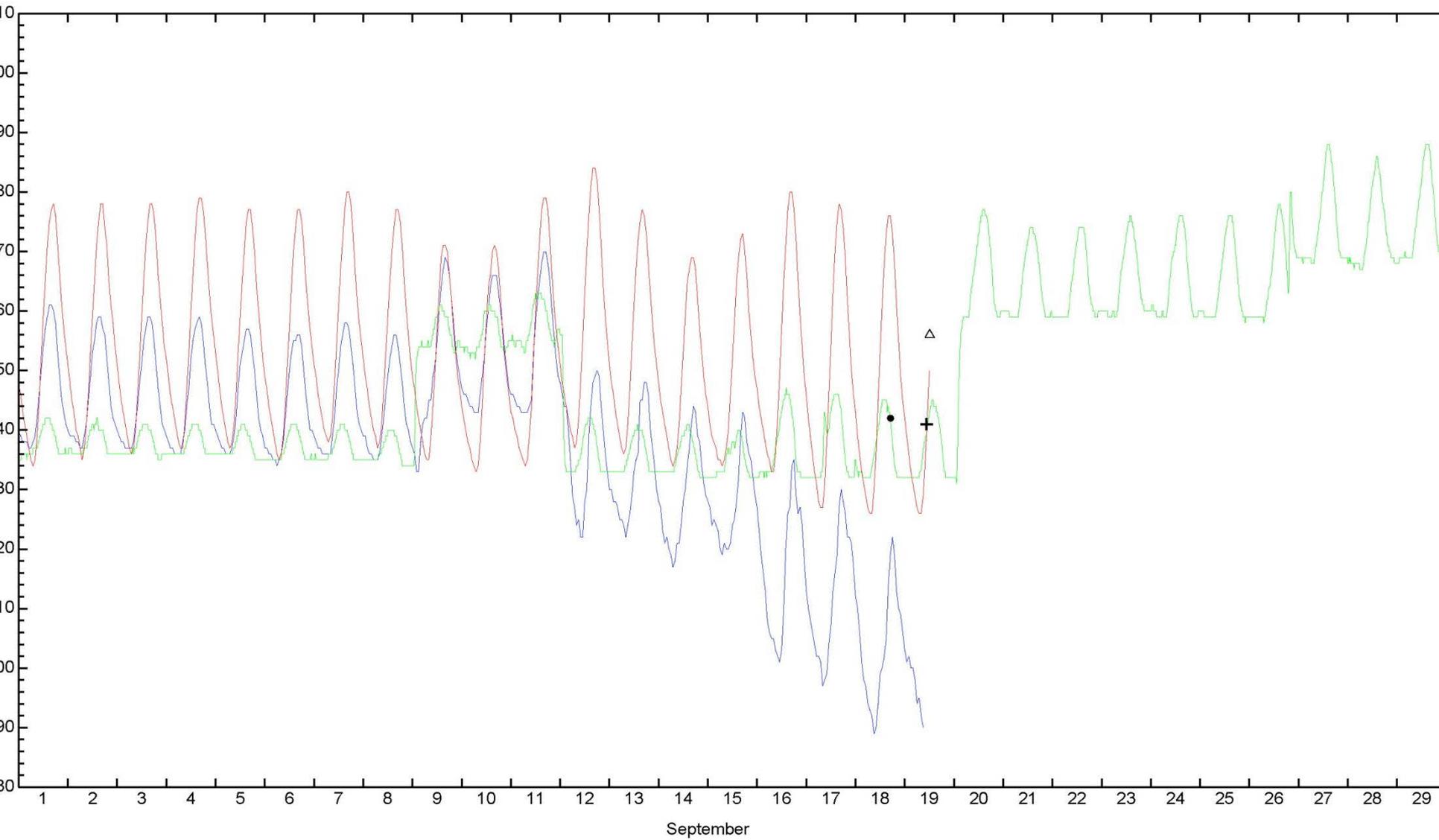
13341050 CLEARWATER RIVER NEAR PECK, ID (Pressure, diss gases PUBLISHED (%), COMPUTED) * 1

Peck





- 13341050 CLEARWATER RIVER NEAR PECK, ID (Pressure, diss gases FROM TDG DCP (mm/Hg), MEASURED METHOD) * 1
- 13341000 NORTH FORK CLEARWATER RIVER AT AHSAHKA, ID (Pressure, diss gases FROM DCP (mm/Hg), MEASURED METHOD) * 1
- 13343000 CLEARWATER RIVER NEAR LEWISTON, ID (Pressure, diss gases FROM DCP (mm/Hg), MEASURED METHOD, Trans. Code=S) * 1
- 13341050 CLEARWATER RIVER NEAR PECK, ID (All sensor readings, Pressure, diss gases)}
- 13341000 NORTH FORK CLEARWATER RIVER AT AHSAHKA, ID (All sensor readings, Pressure, diss gases)}
- △ 13343000 CLEARWATER RIVER NEAR LEWISTON, ID (All sensor readings, Pressure, diss gases)}



- 13341050 CLEARWATER RIVER NEAR PECK, ID (Pressure, diss gases FROM TDG DCP (mm/Hg), MEASURED METHOD) * 1
- 13341000 NORTH FORK CLEARWATER RIVER AT AHSAHKA, ID (Pressure, diss gases FROM DCP (mm/Hg), MEASURED METHOD) * 1
- 13343000 CLEARWATER RIVER NEAR LEWISTON, ID (Pressure, diss gases FROM DCP (mm/Hg), MEASURED METHOD, Trans. Code=S) * 1
- + 13341050 CLEARWATER RIVER NEAR PECK, ID (All sensor readings, Pressure, diss gases)}
- 13341000 NORTH FORK CLEARWATER RIVER AT AHSAHKA, ID (All sensor readings, Pressure, diss gases)}
- △ 13343000 CLEARWATER RIVER NEAR LEWISTON, ID (All sensor readings, Pressure, diss gases)}

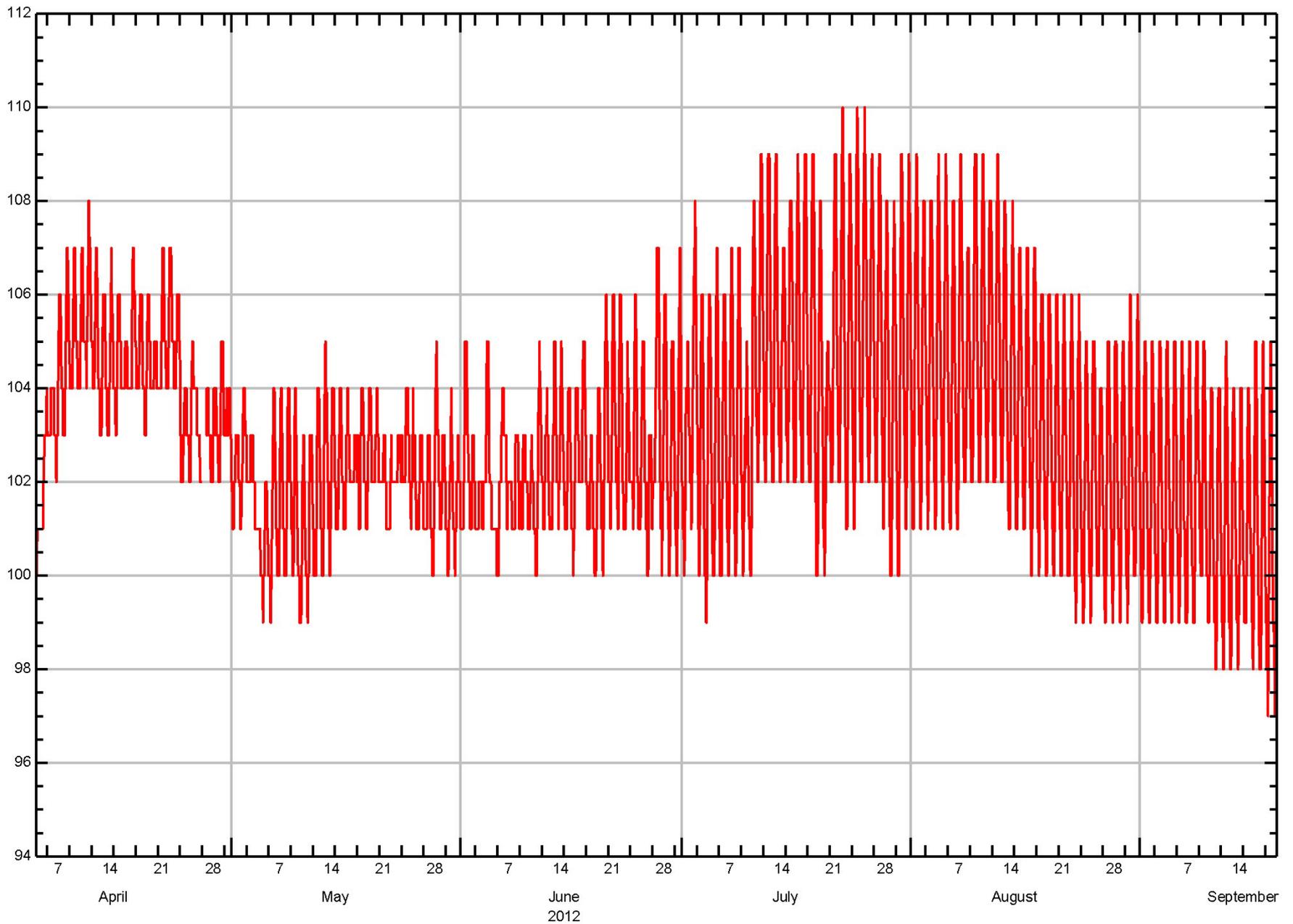


Lewiston

13343000 ▲ 13343000
13343000

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13343000 CLEARWATER RIVER NEAR LEWISTON, ID (Pressure, diss gases PUBLISHED (H), COMPUTED) * 1

Lewiston



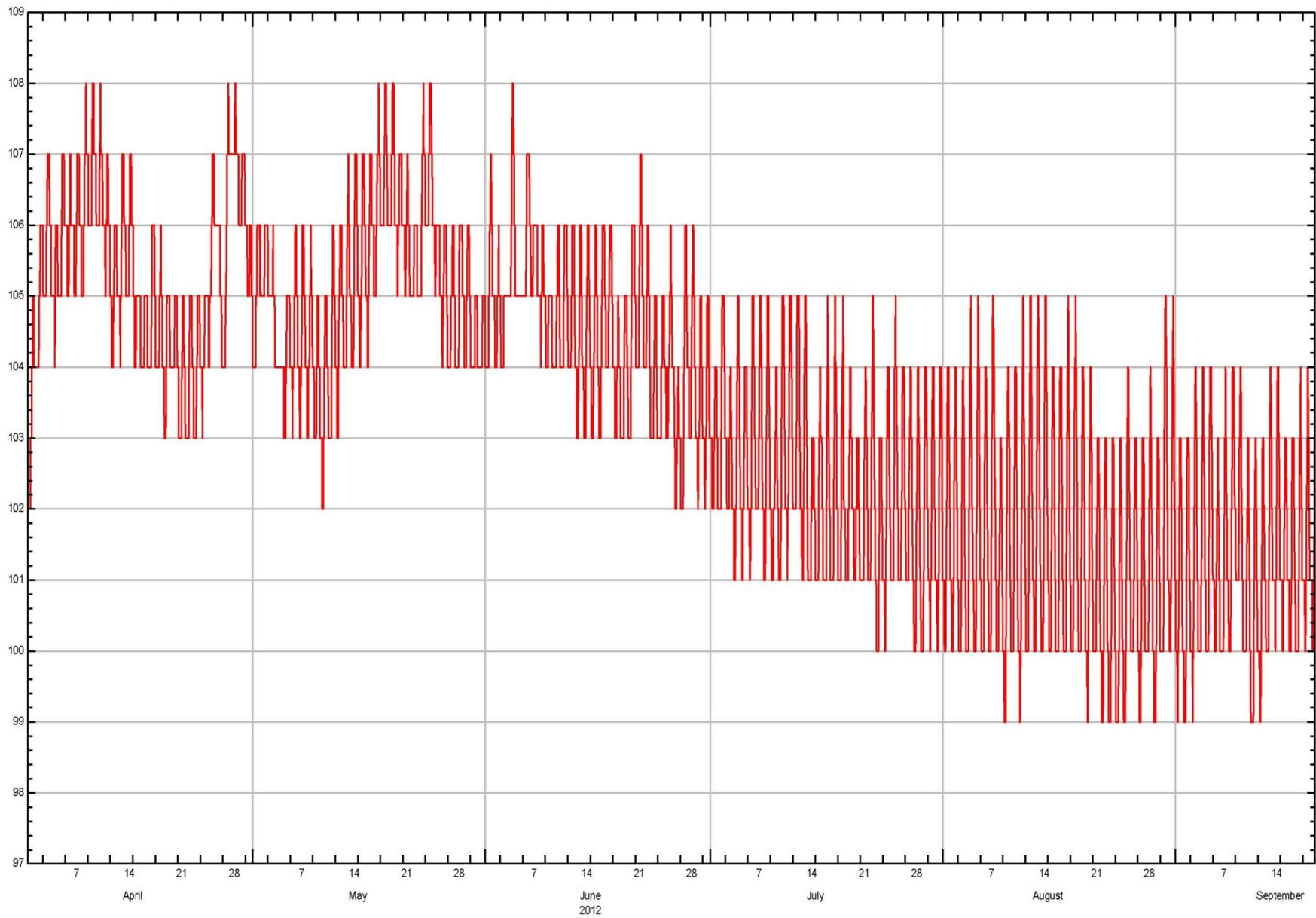


Anatone

13334300
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Image U.S. Geological Survey

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13334300 SNAYE RIVER NEAR ANATONE, MA (Pressure, diss gases PUBLISHED (%), COMPUTED) * 1



Anatone



Lower Granite

Log Cabin Island

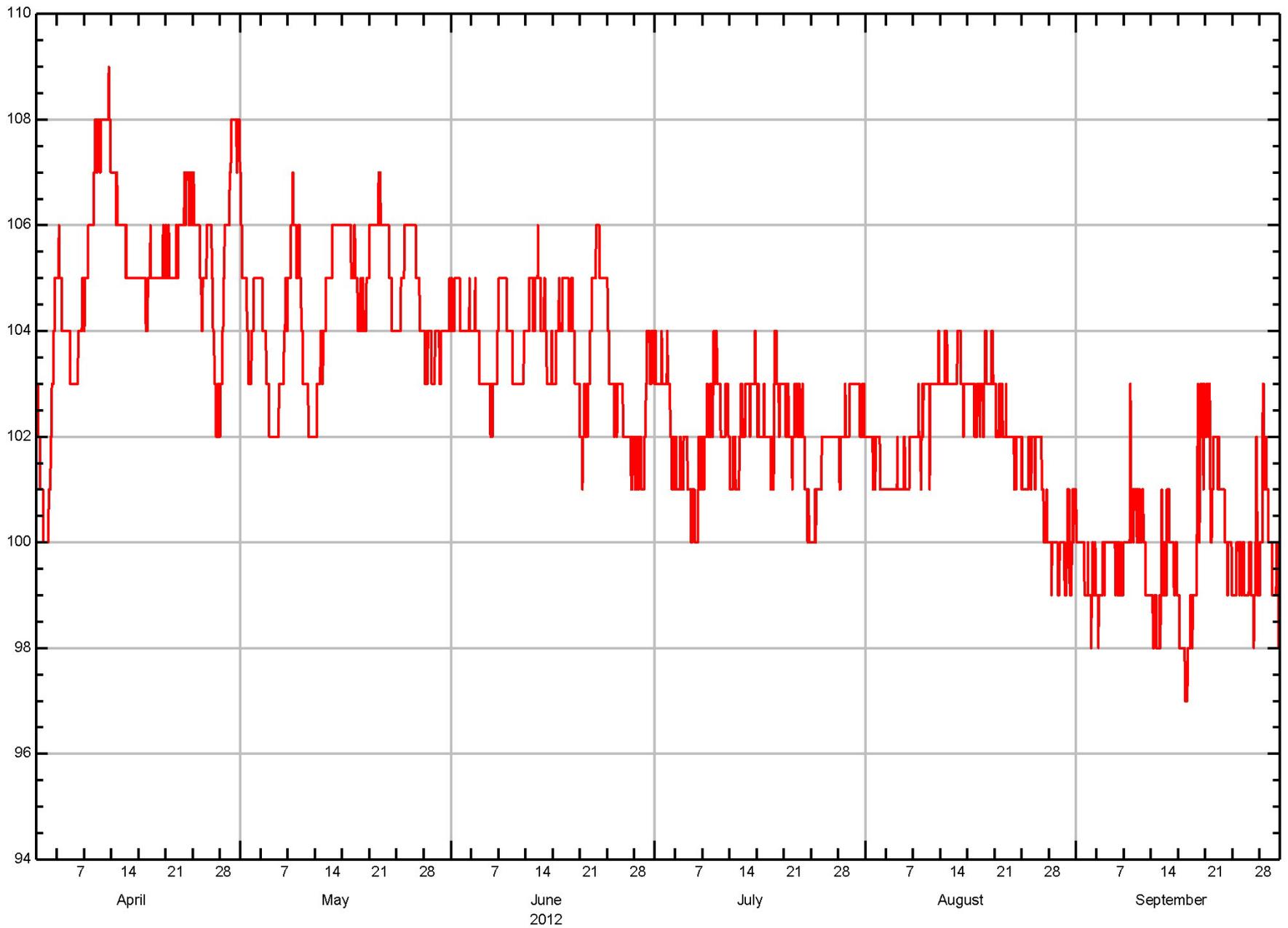
Lower Granite Lake

13343595
▲ 13343595

13343590 ▲ 13343590

Image U.S. Geological Survey
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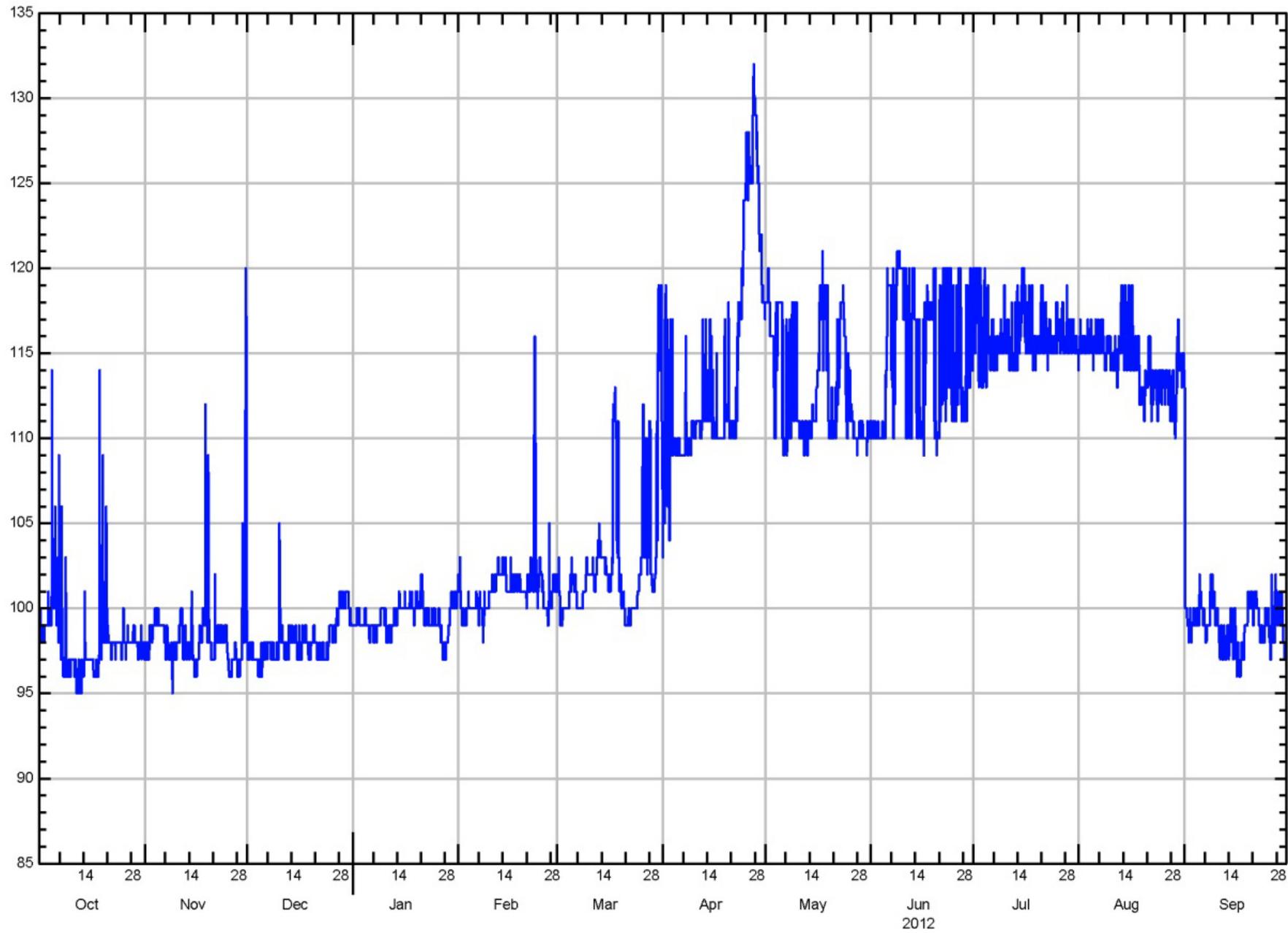
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13343590 LOWER GRANITE LK FOREBAY AT LOWER GRANITE DAM, WA (Pressure, diss gases PUBLISHED (%), COMPUTED) * 1



Lower Granite Forebay



13343595 SNAKE RIVER (RIGHT BANK) EL LOWER GRANITE DAM, WA (Pressure, diss gases PUBLISHED (%), COMPUTED) * 1

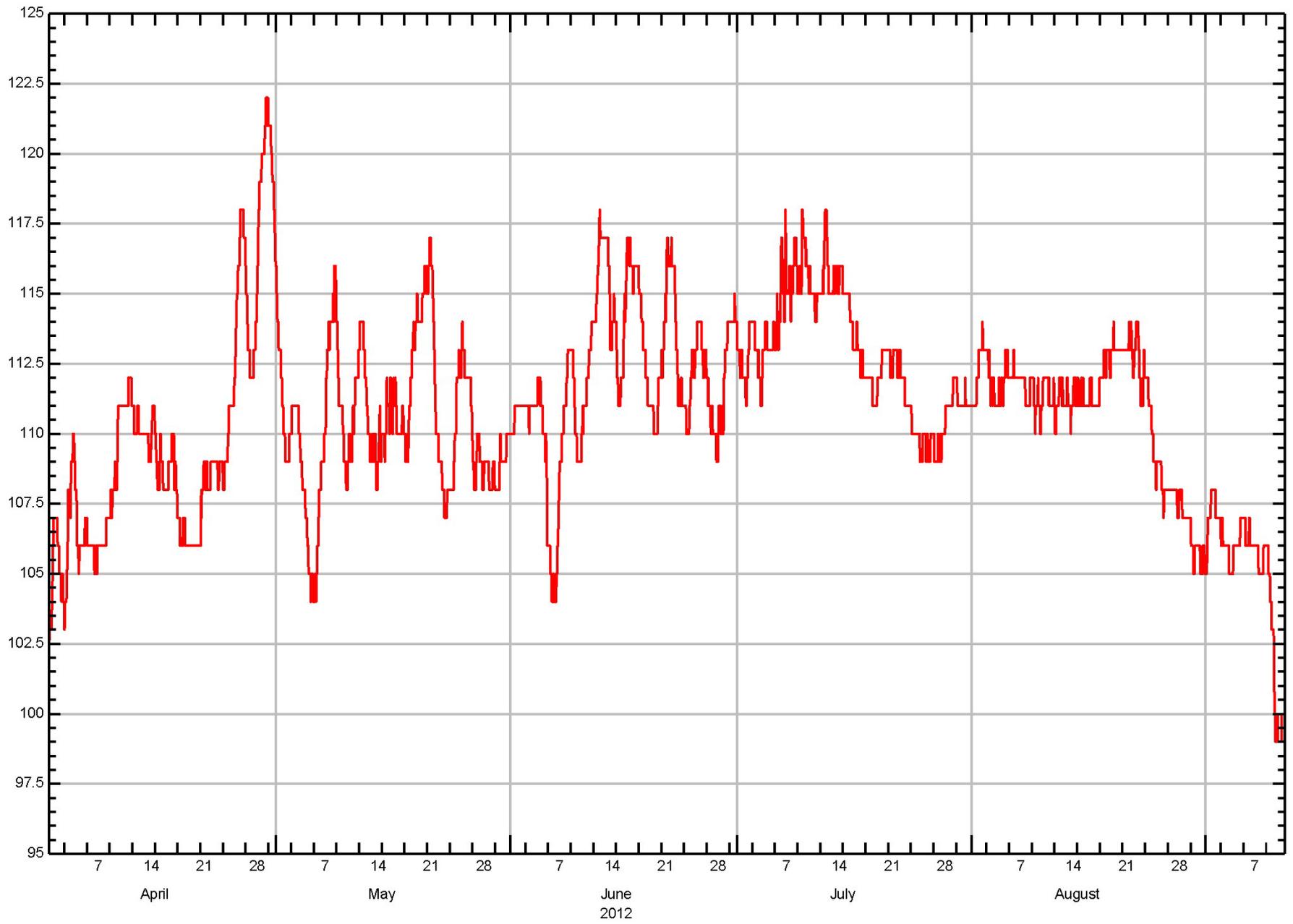
Lower Granite Tailwater





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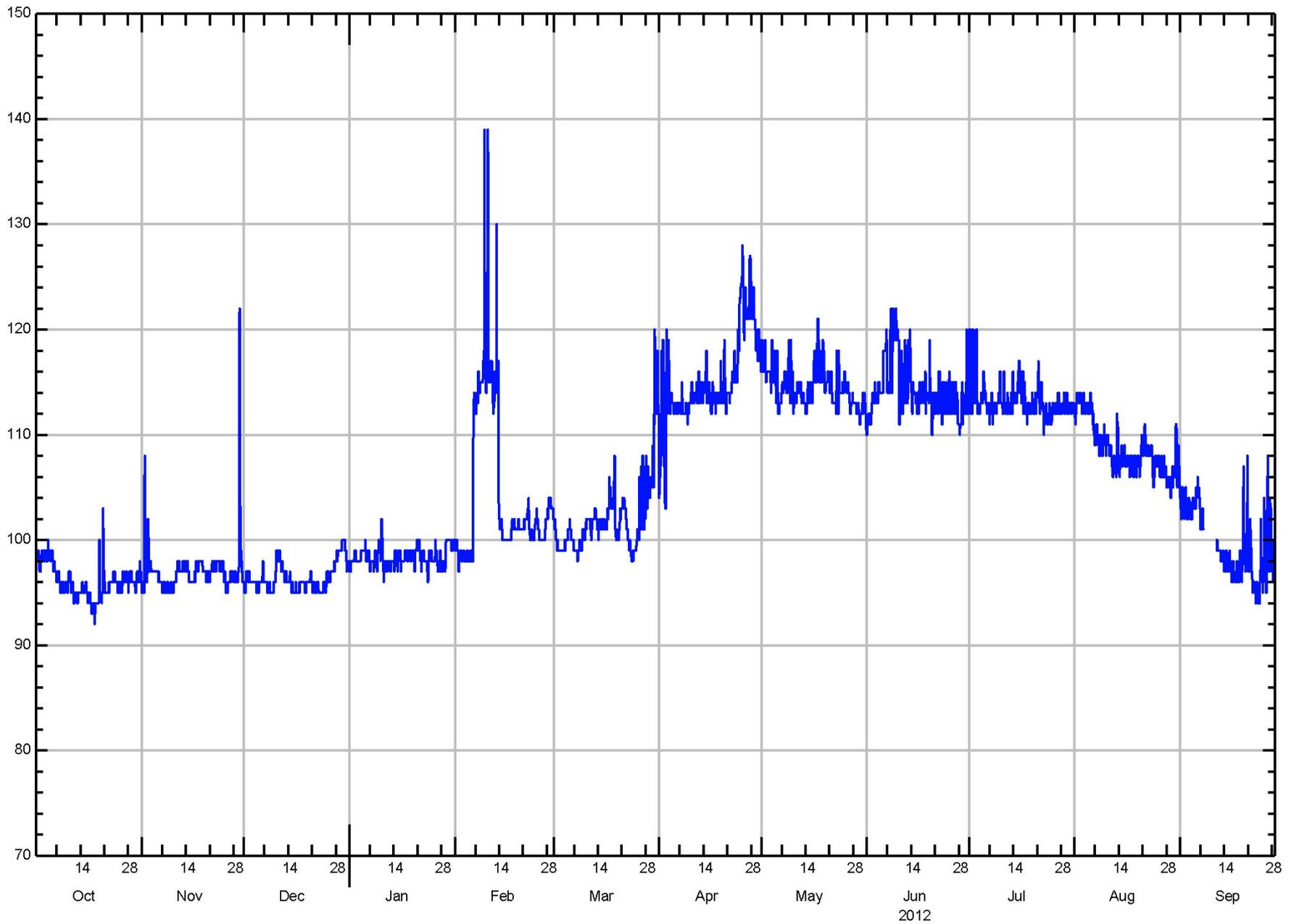
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13343955 LAKE BRYAN FOREBAY AT LITTLE GOOSE DAM, WA (Pressure, diss gases PUBLISHED (%), COMPUTED) * 1



Little Goose Forebay



13343960 SNAKE RIVER BELOW LITTLE GOOSE DAM, WA (Pressure, diss gases PUBLISHED (%), COMPUTED) * 1



Little Goose Tailwater



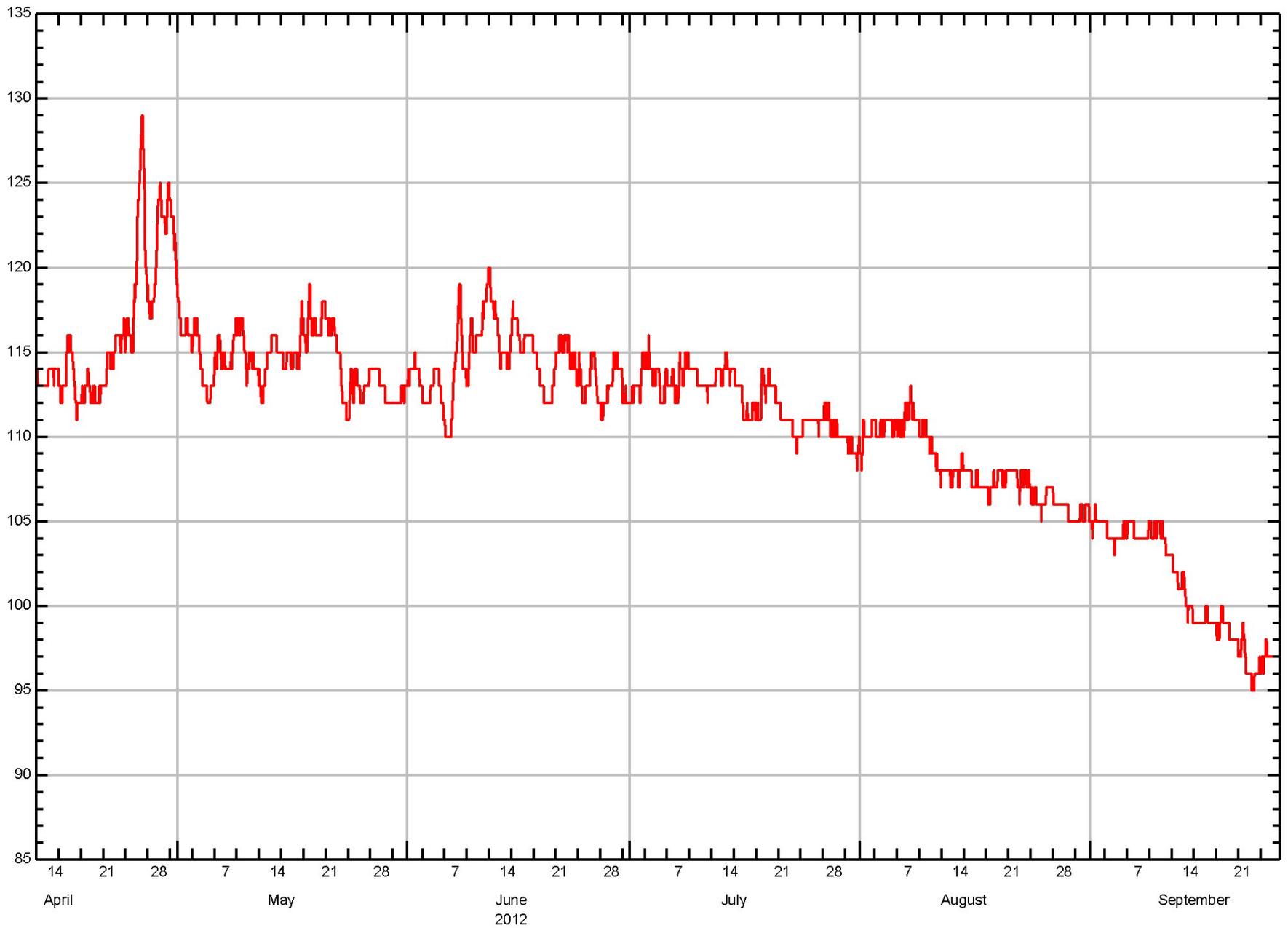
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Lower Monumental

Image U.S. Geological Survey
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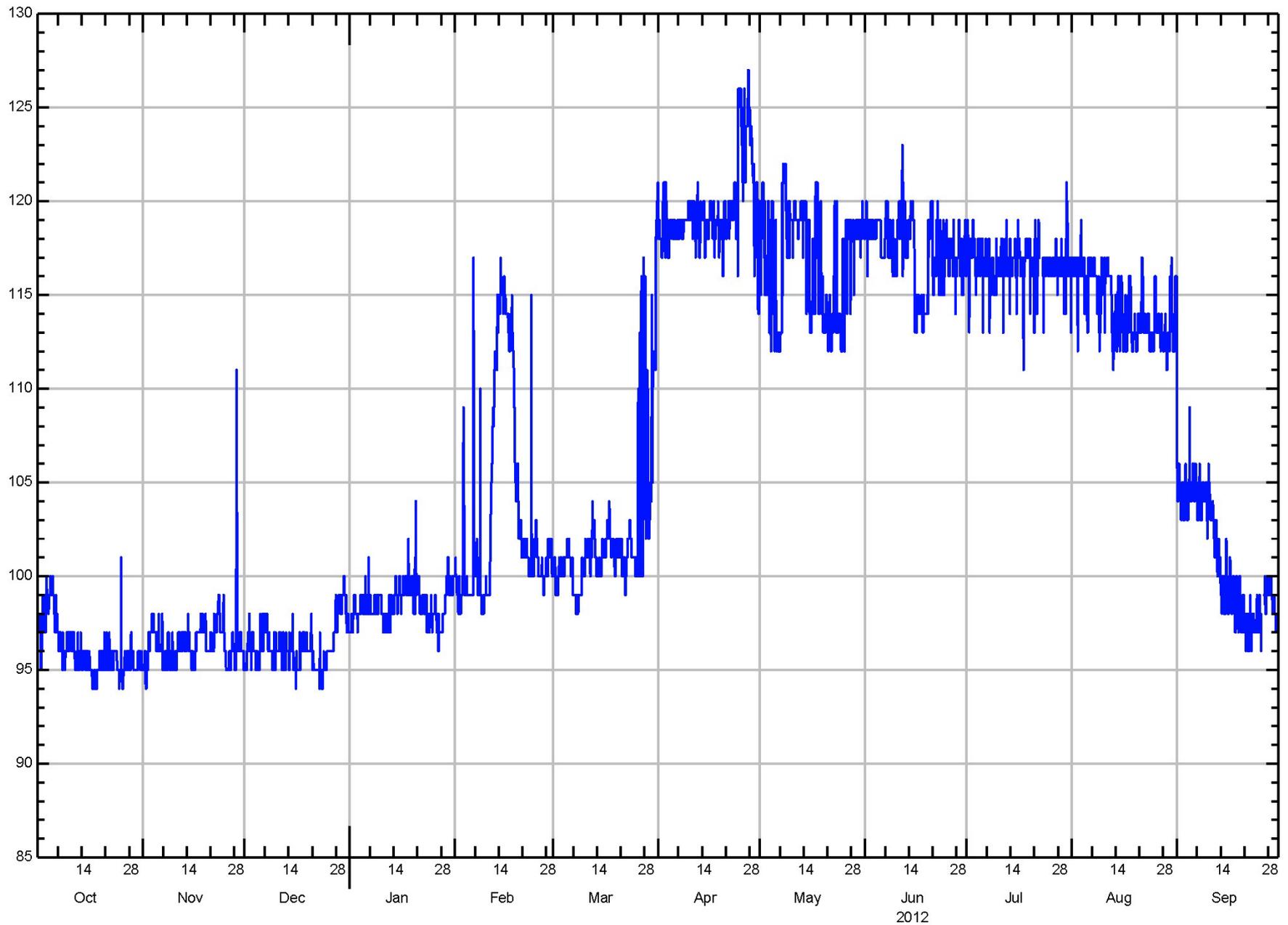
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13352595 LAKE H G WEST FOREBAY AT LOWER MONUMENTAL DAM, WA (Pressure, diss gases PUBLISHED (%), COMPUTED) * 1



Lower Monumental Forebay



13352600 SNAKE RIVER BELOW LOWER MONUMENTAL DAM, WA (Pressure, diss gases PUBLISHED (*), COMPUTED) * 1



Lower Monumental Tailwater

Ice Harbor

Goose Island

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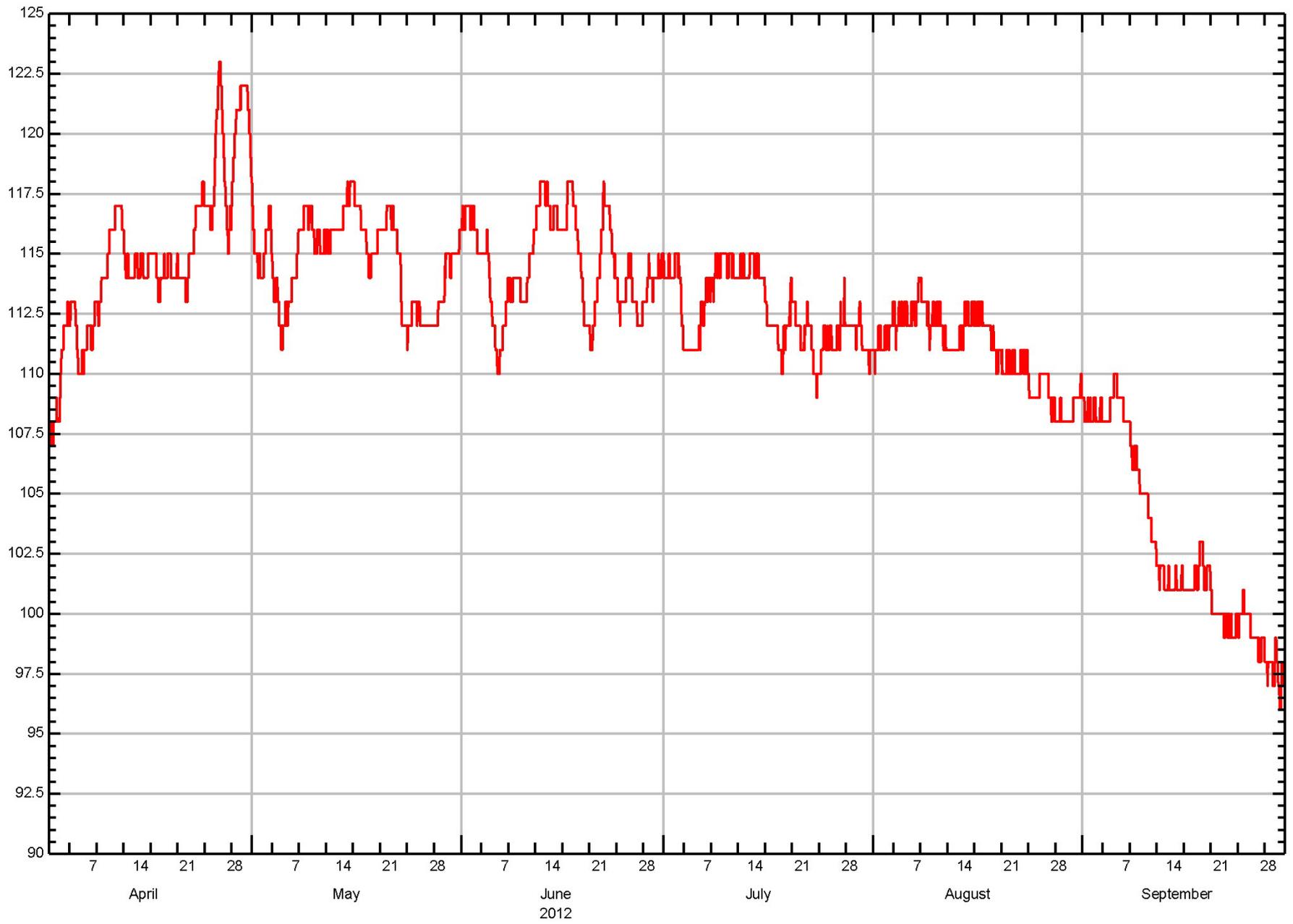
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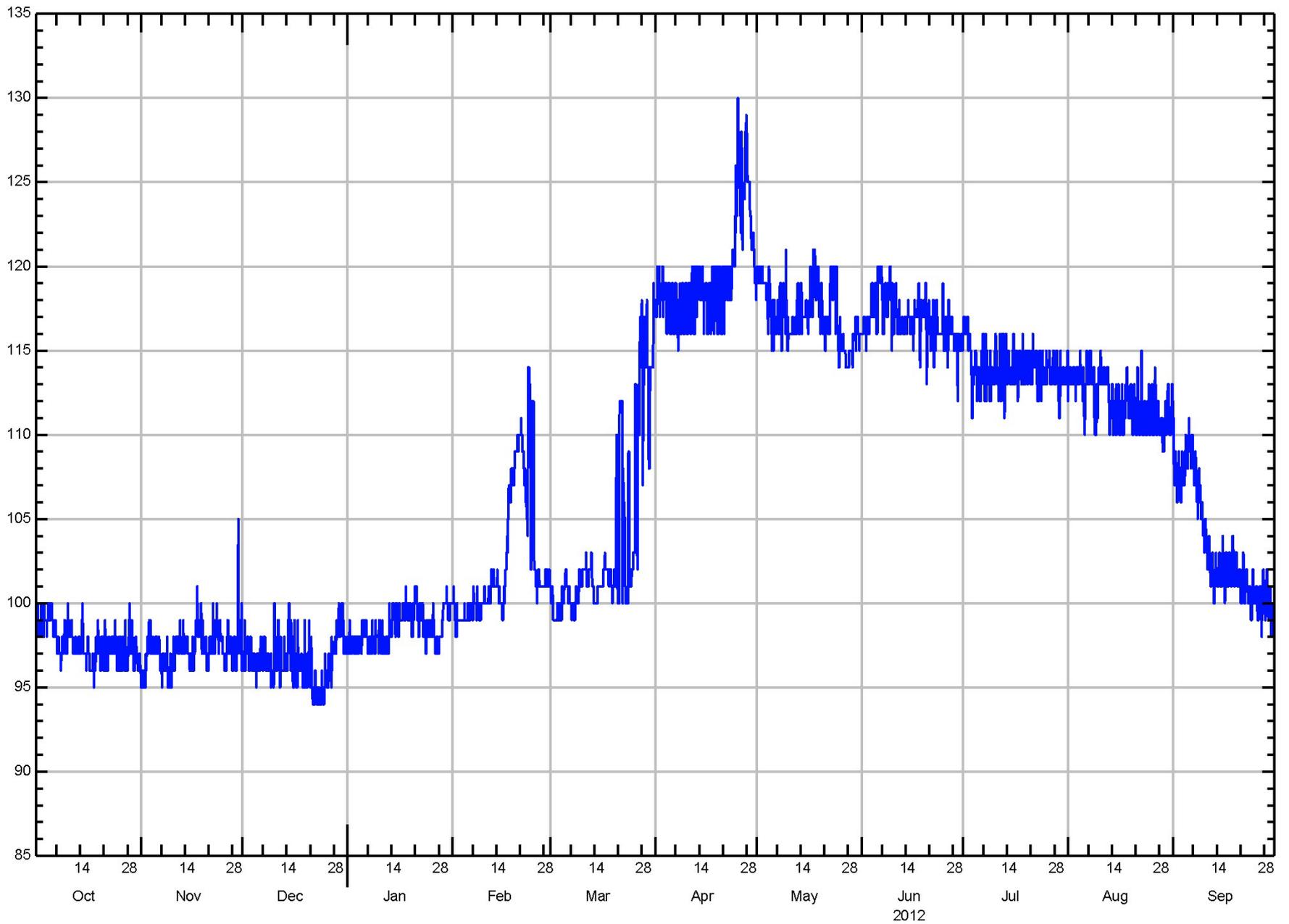




13352950 LAKE SACJAWEA FOREBAY AT ICE HARBOR DAM, WA (Pressure, diss gases PUBLISHED (%), COMPUTED) * 1



Ice Harbor Forebay



13353010

SNAKE RIVER EL GOOSE ISLAND EL ICE HARBOR DAM, WA (Pressure, diss gases PUBLISHED (%), COMPUTED) * 1



Ice Harbor Tailwater



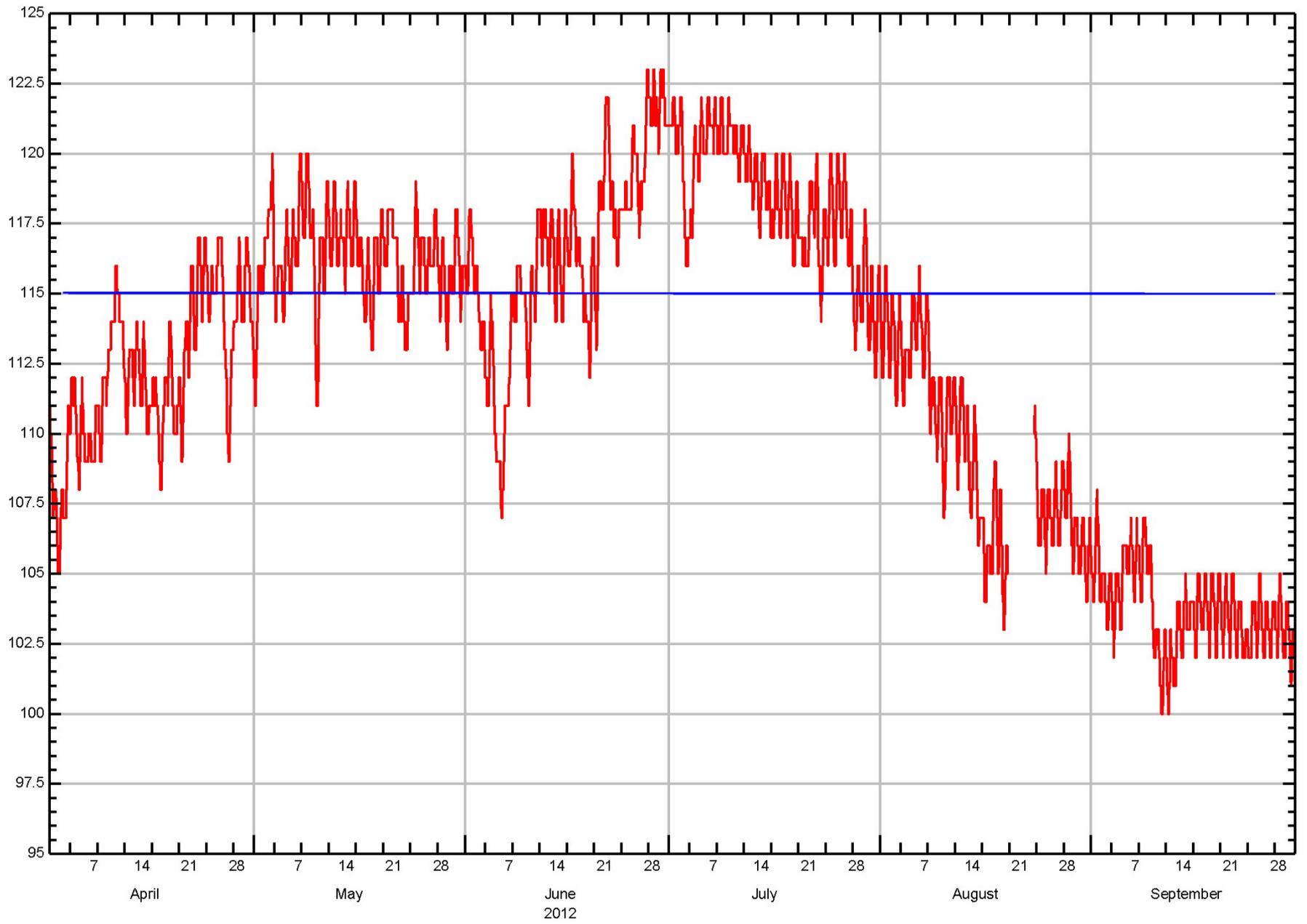
12514400
▲
12514400

Clover Island
12514500
▲
12514500

Kennewick
Pasco

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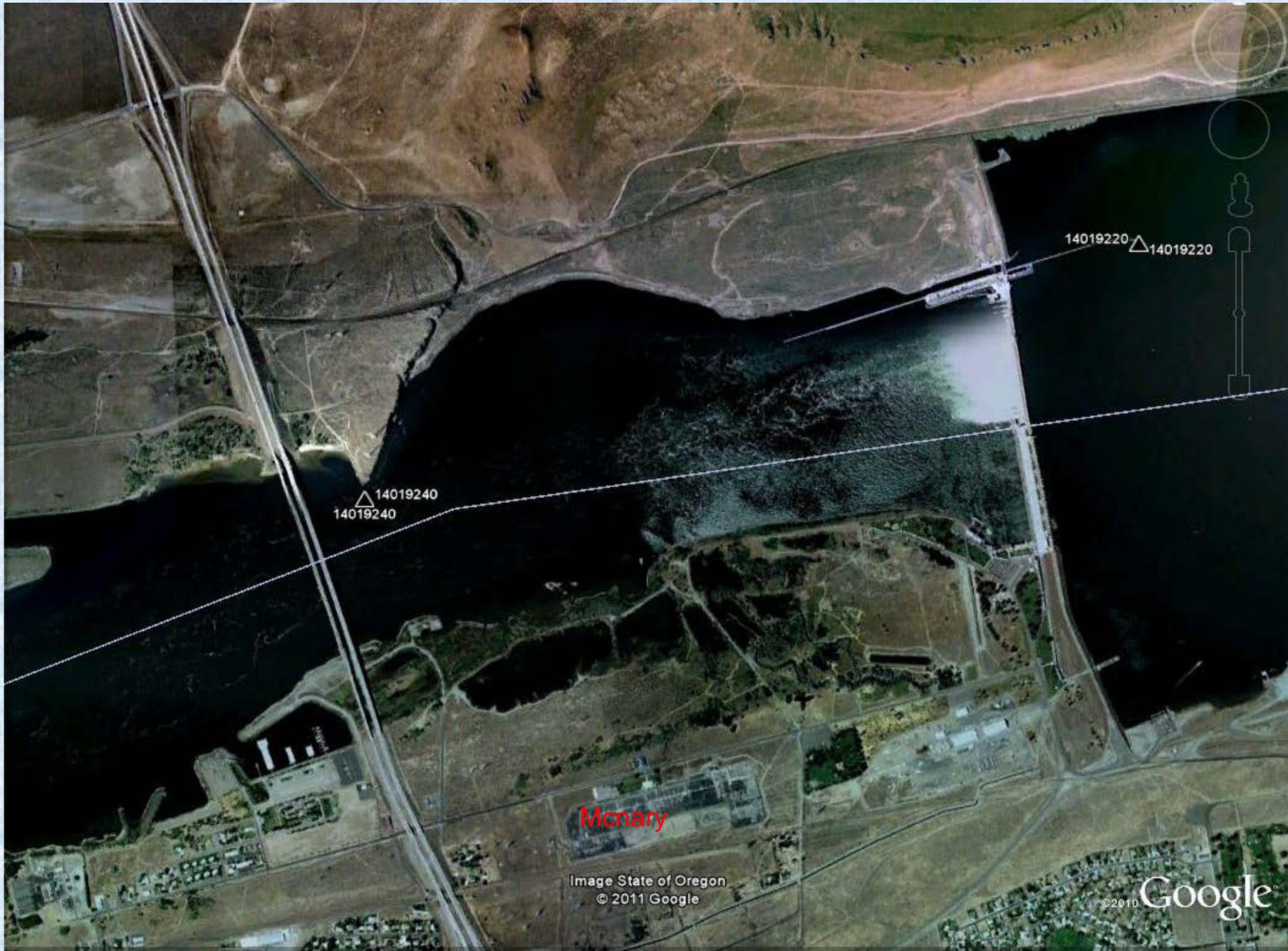
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12514400 COLUMBIA RIVER BELOW HWY 395 BRIDGE AT PASCO, WA (Pressure, diss gases PUBLISHED (%), COMPUTED) * 1

Pasco





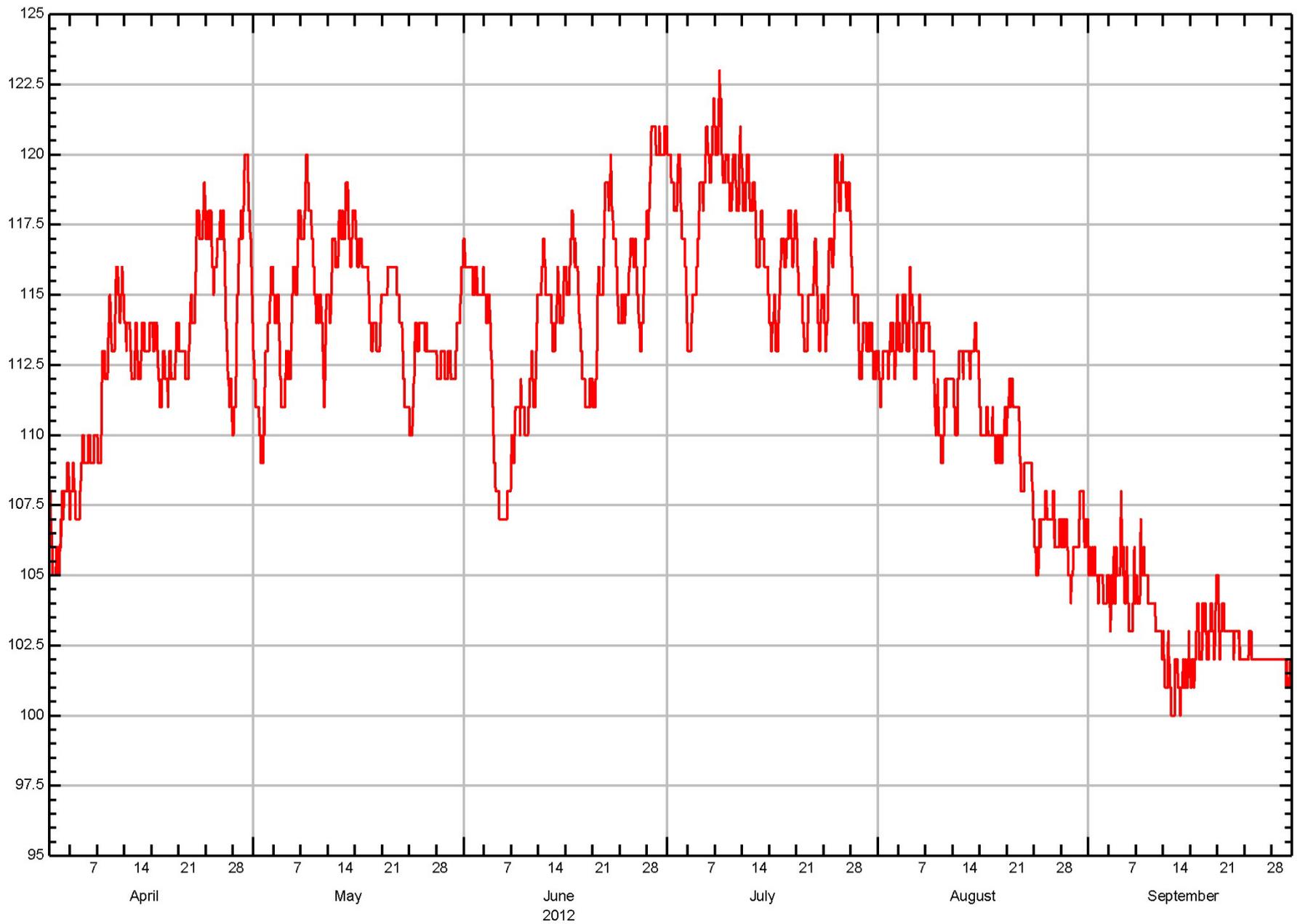
McNary

14019240
14019240

14019220
14019220

Image State of Oregon
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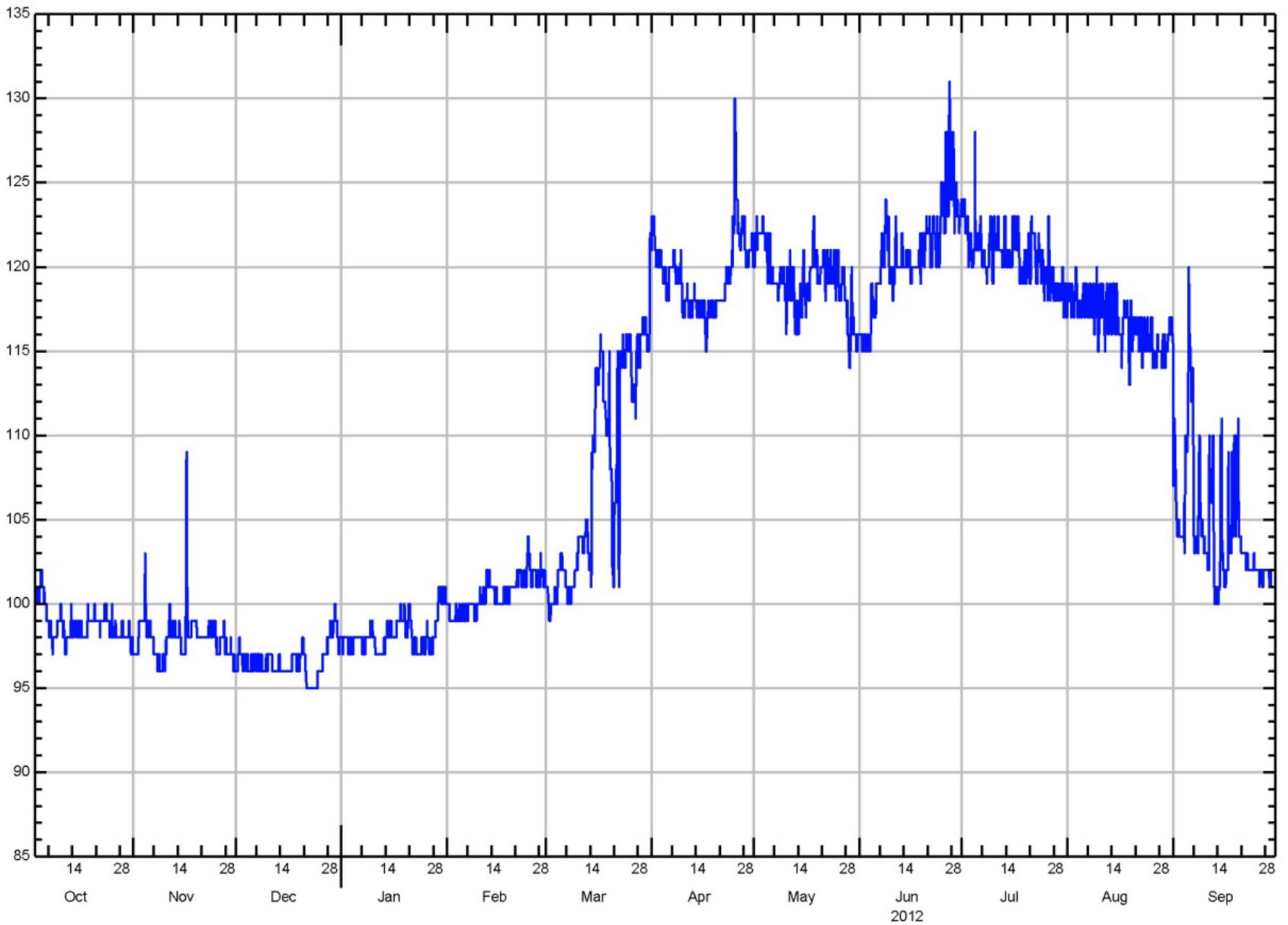
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14019220 COLUMBIA RIVER AT McNARY DAM LOCK NR UMATILLA, OR (Pressure, diss gases PUBLISHED (%), COMPUTED) * 1

McNary Forebay



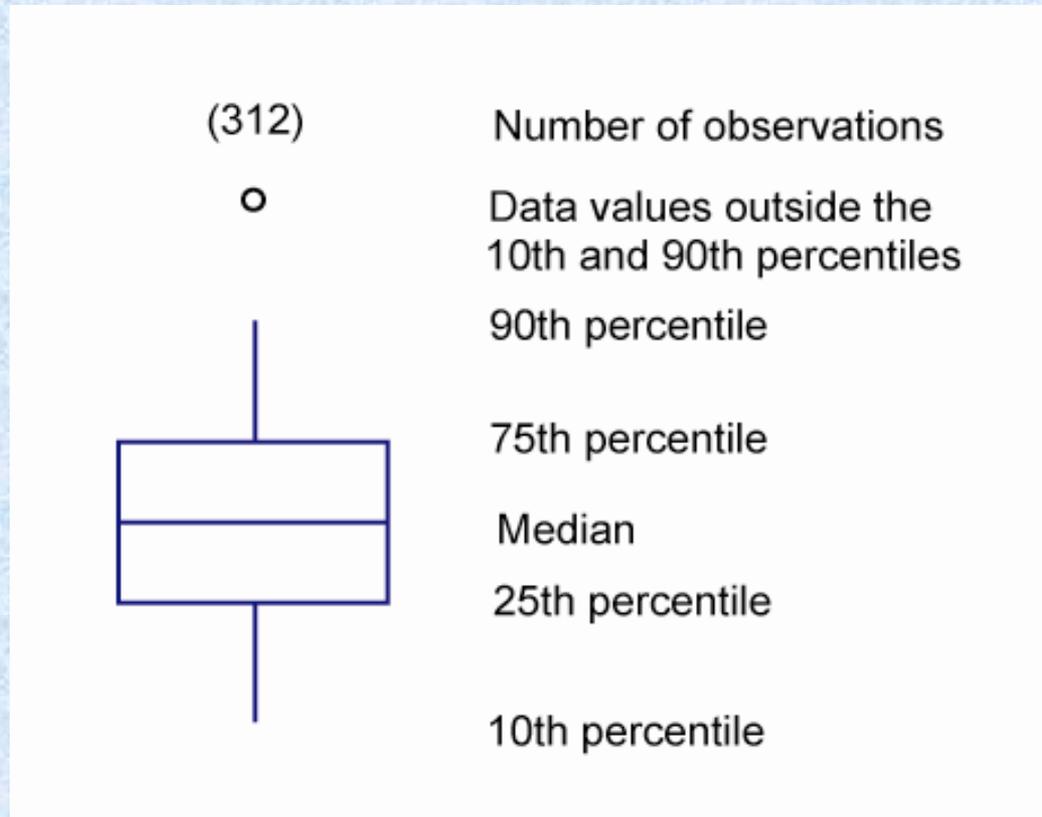


14019240 COLUMBIA RIVER BELOW McNARY DAM NEAR UMATILLA, OR (Pressure, diss gases PUBLISHED (%), COMPUTED) * 1

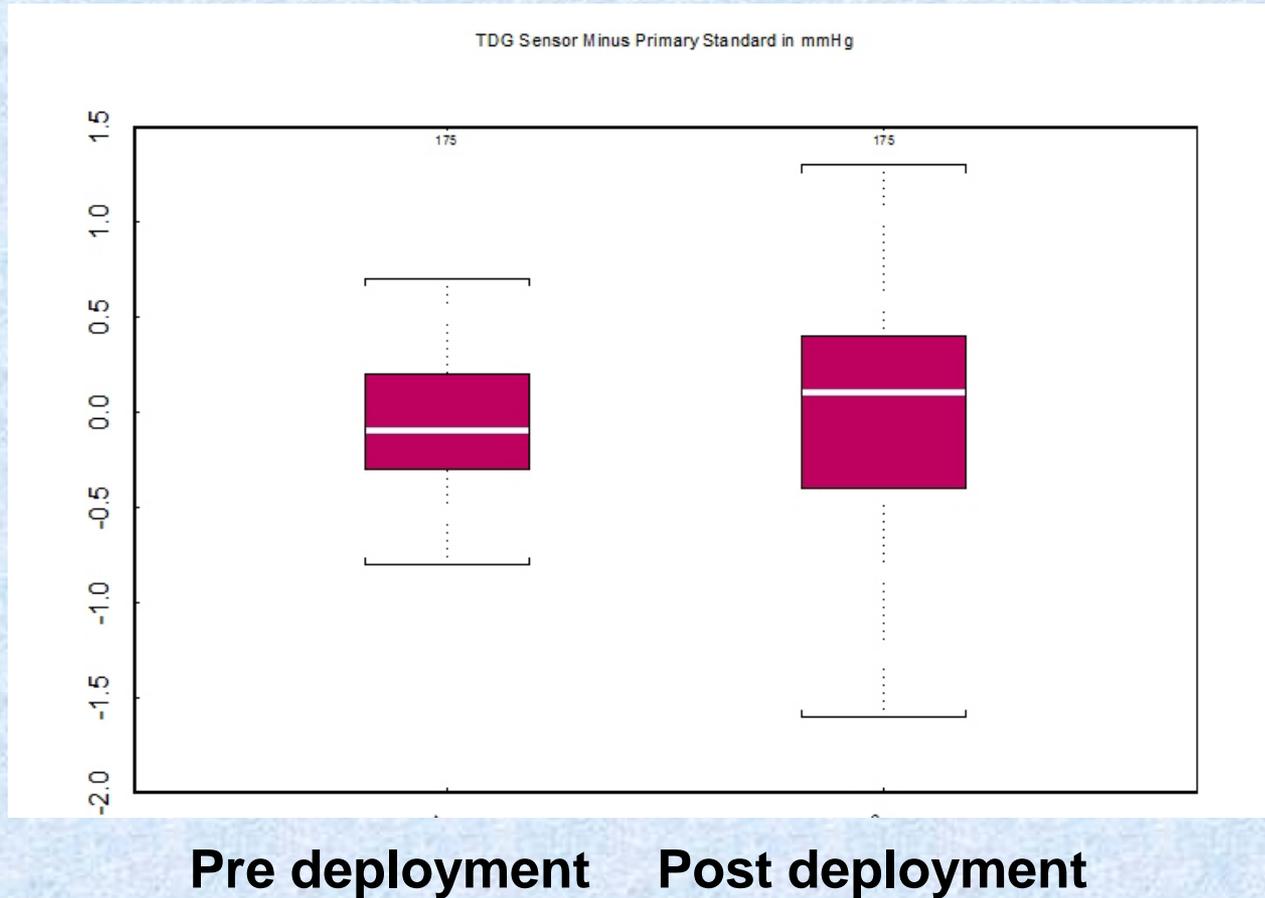
McNary Tailwater



Explanation of a Boxplot

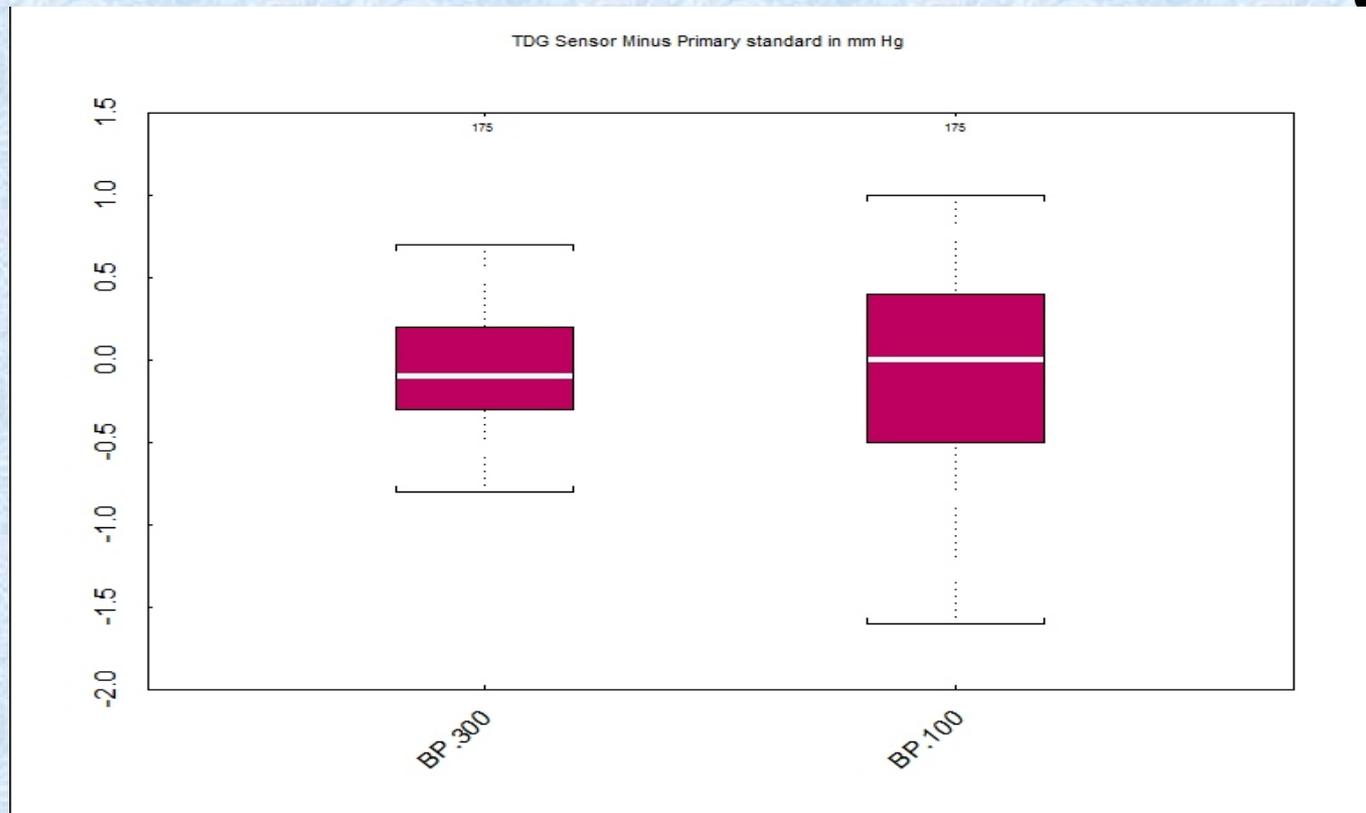


TDG Sensor vs Primary Standard Barometric Pressure



TDG Sensor vs Primary Standard

Barometric Pressure + 300 or 100 mm Hg

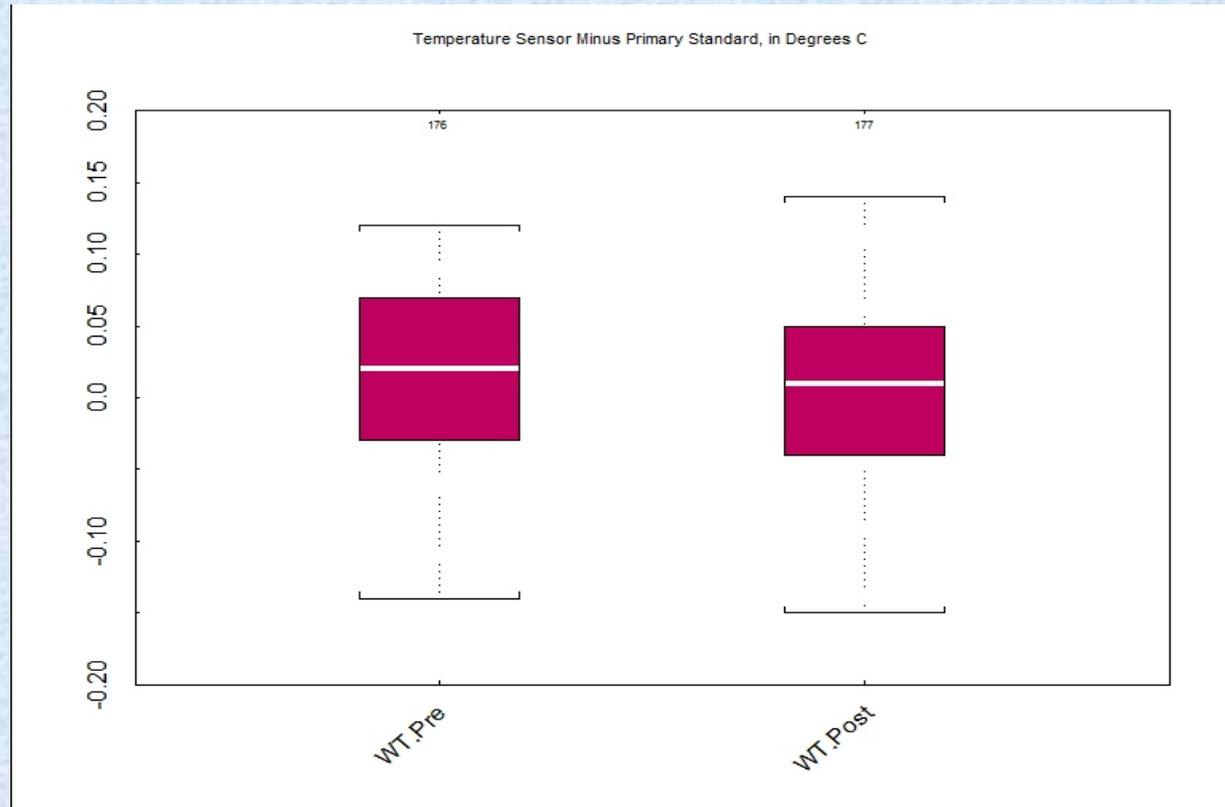


**Pre deployment
(+300 mmHg)**

**Post deployment
(+100 mg Hg)**

Temperature Sensor vs Primary Standard

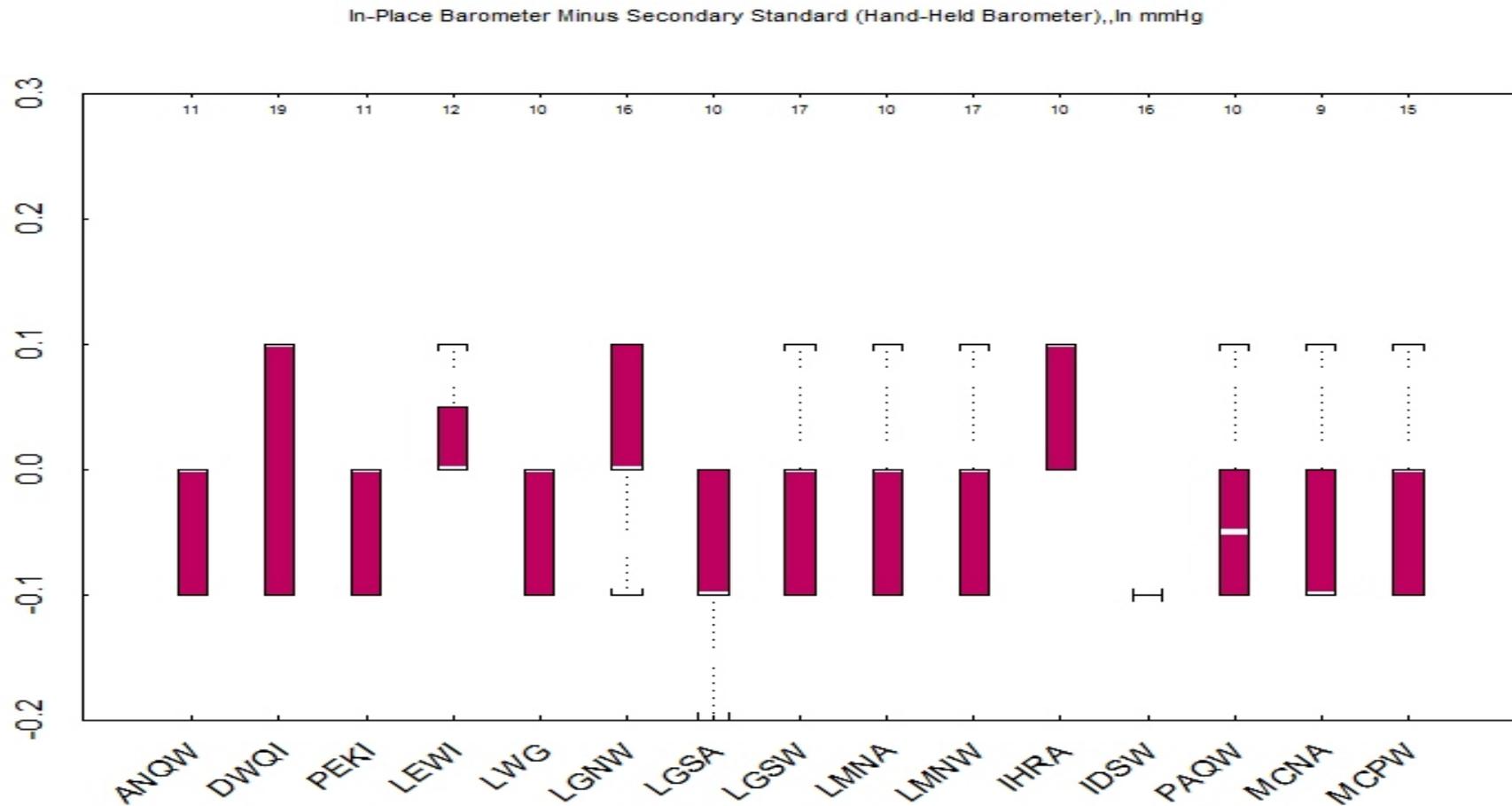
Water temperature



Pre deployment Post deployment

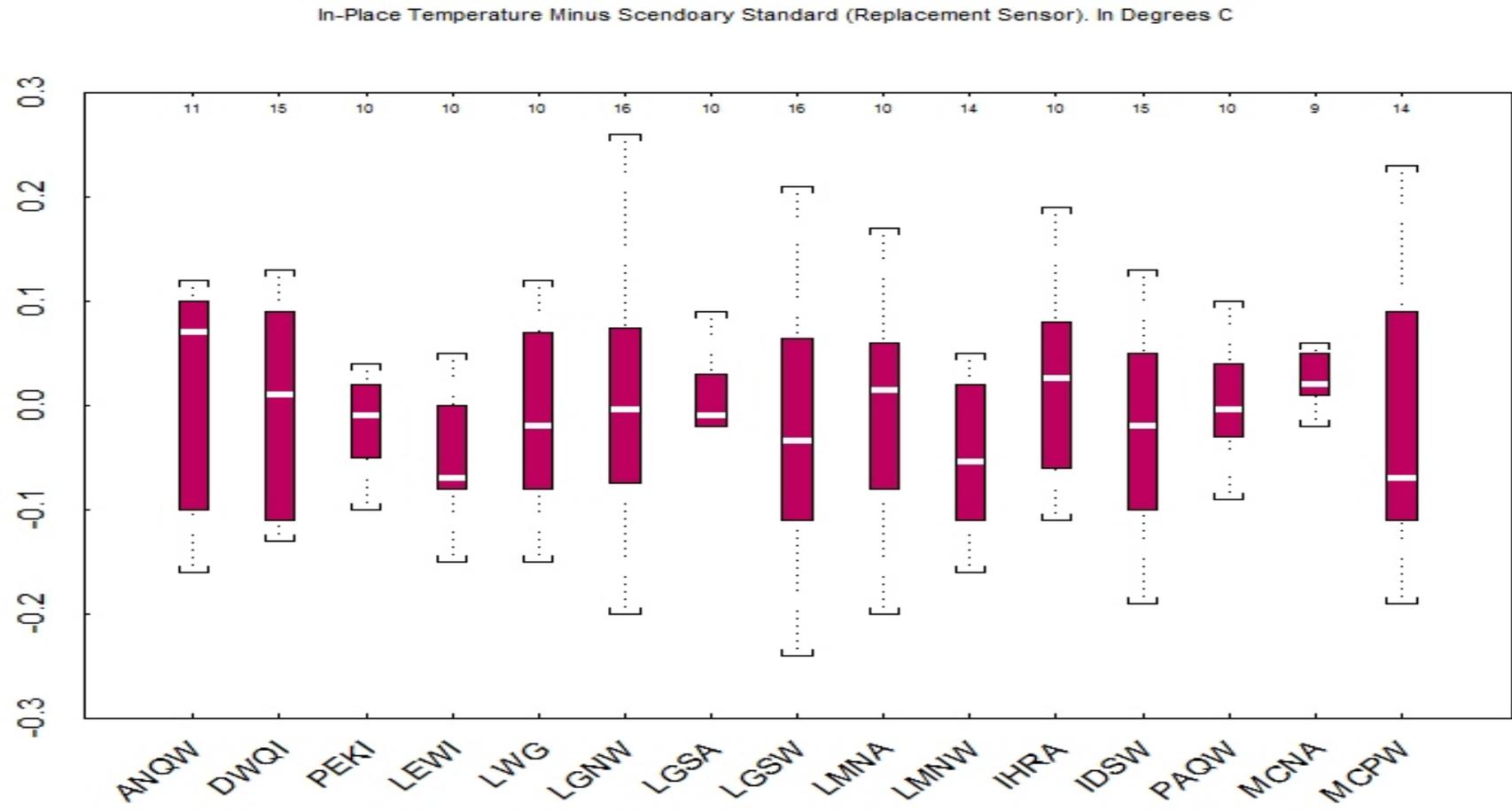
In-Place Barometer vs Secondary Standard

Barometric Pressure



Temperature Sensor vs Secondary Standard

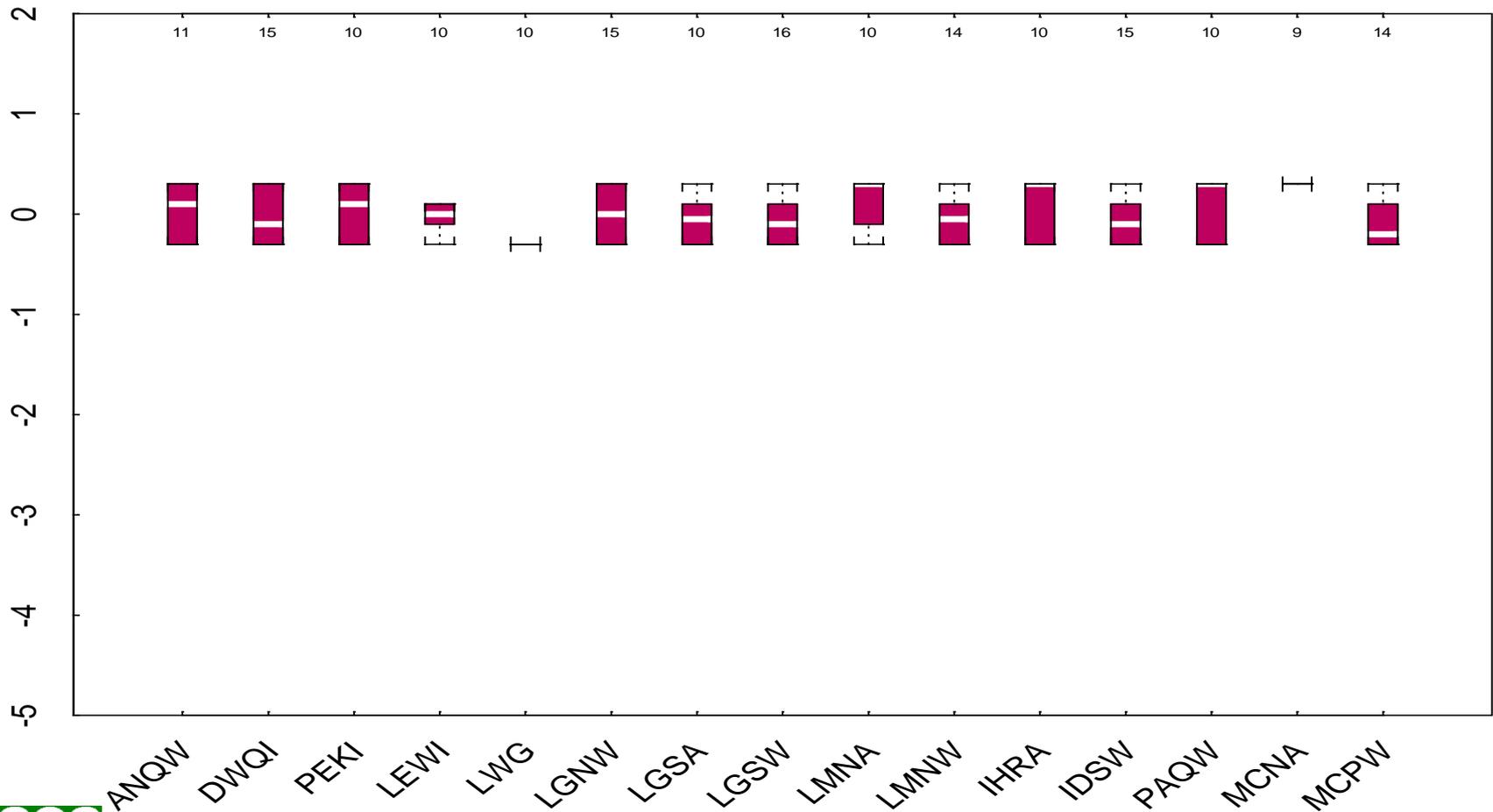
Water Temperature



TDG Sensor vs Secondary Standard

Difference in TDG (Percent Saturation)

IN-PLACE TDG SENSOR MINUS SECONDARY STANDARD (REPLACEMENT SENSOR), IN PERCENT



Summary

- 15 sites: 6 year-round and 9 seasonal stations
- 2.4% missing/ anomalous data



Summary

Median differences between TDG Sensors vs. Primary Standards (performed in lab)

- **Barometric pressure**
 - Pre deployment: -0.1 mm Hg
 - Post deployment: 0.1 mm Hg
- **Water temperature**
 - Pre deployment: 0.02 °C
 - Post deployment: 0.01 °C



Summary

**Median differences between TDG Sensors vs.
Secondary Standards (performed in field)**

Barometric pressure: 0.0 mm Hg

Water temperature: -.01 °C

TDG, in percent saturation: 0%



SUBMERGED ANCHOR ROPES
16FT. MIN. BELOW SURFACE