Water Quality Characterization of Big Creek

Building a Pre-CAFO Baseline

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Dual Focus Project

- **Visitor Health and Safety**
  - *Escherichia coli* recommended by EPA as an **indicator of fecal contamination**
  - *E. coli* constitutes greater than **90%** of the bacteria found in human and animal excrement, **pathogenic to humans**
  - Arkansas Department Environmental Quality Q Reg#2 for *E. coli* during **primary contact period** (May to September)
    - **geometric mean** (5/30 days) **126 colonies per 100ml (MPN)**
    - **single-sample maximum of 298 colonies per 100ml**
  - Primary contact classification linked in early 1980's to gastrointestinal illnesses (**HCGI**) per **1,000** primary contacts, children and immunocompromised are at higher risk, **3.6%** people recreating
  - "Maximum Allowable Risk"
- **Environmental Protection**
  - Dissolved oxygen monitoring, 72-hour (more or less) periods
  - 15 minute interval samples
  - The critical season DO standard is to be met at maximum allowable water temperatures and at Q7-10 flows. However, when water temperatures **exceed 22°C, a 1 mg/l diurnal depression will be allowed below the applicable critical standard for no more than 8 hours** during any 24-hour period.
  - Boston Mountains is primary and critical limit is 6 mg/L

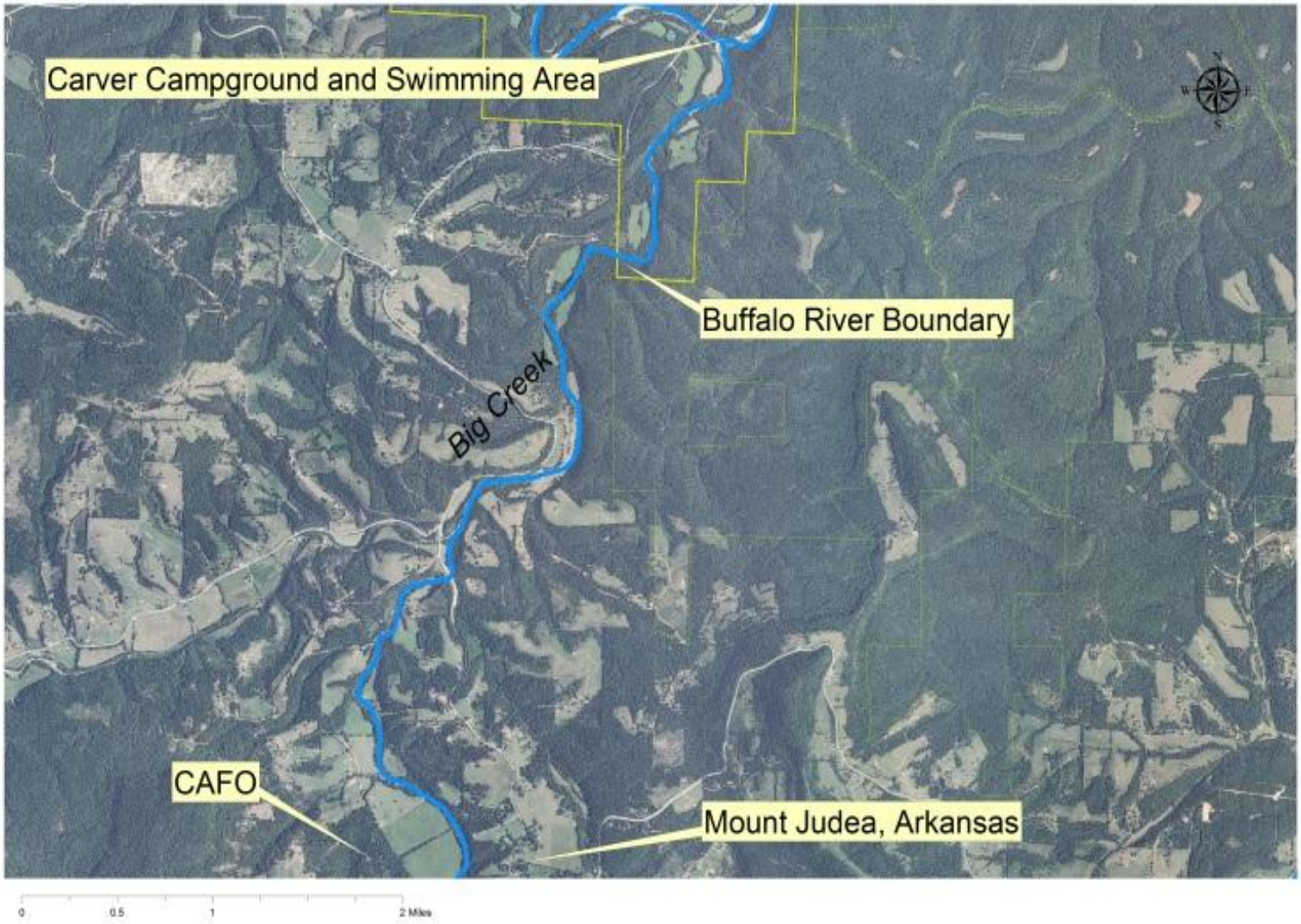
Methods

- Goal was to characterize baseline conditions for *E. coli* and physicochemical – human health and safety
- *E. coli* using the EPA approved IDEXX Method
- Grab sampling
- Sample frequency
  - Weekly collections
  - 5 samples minimum per month
  - Total of 60 samples (15 per season)
- Physicochemical
- Discharge
- Processed at BNR WQ Lab in Harrison, AR
- Period of study March 2013 through to present

Buffalo National River
Arkansas

National Park Service
U.S. Department of the Interior

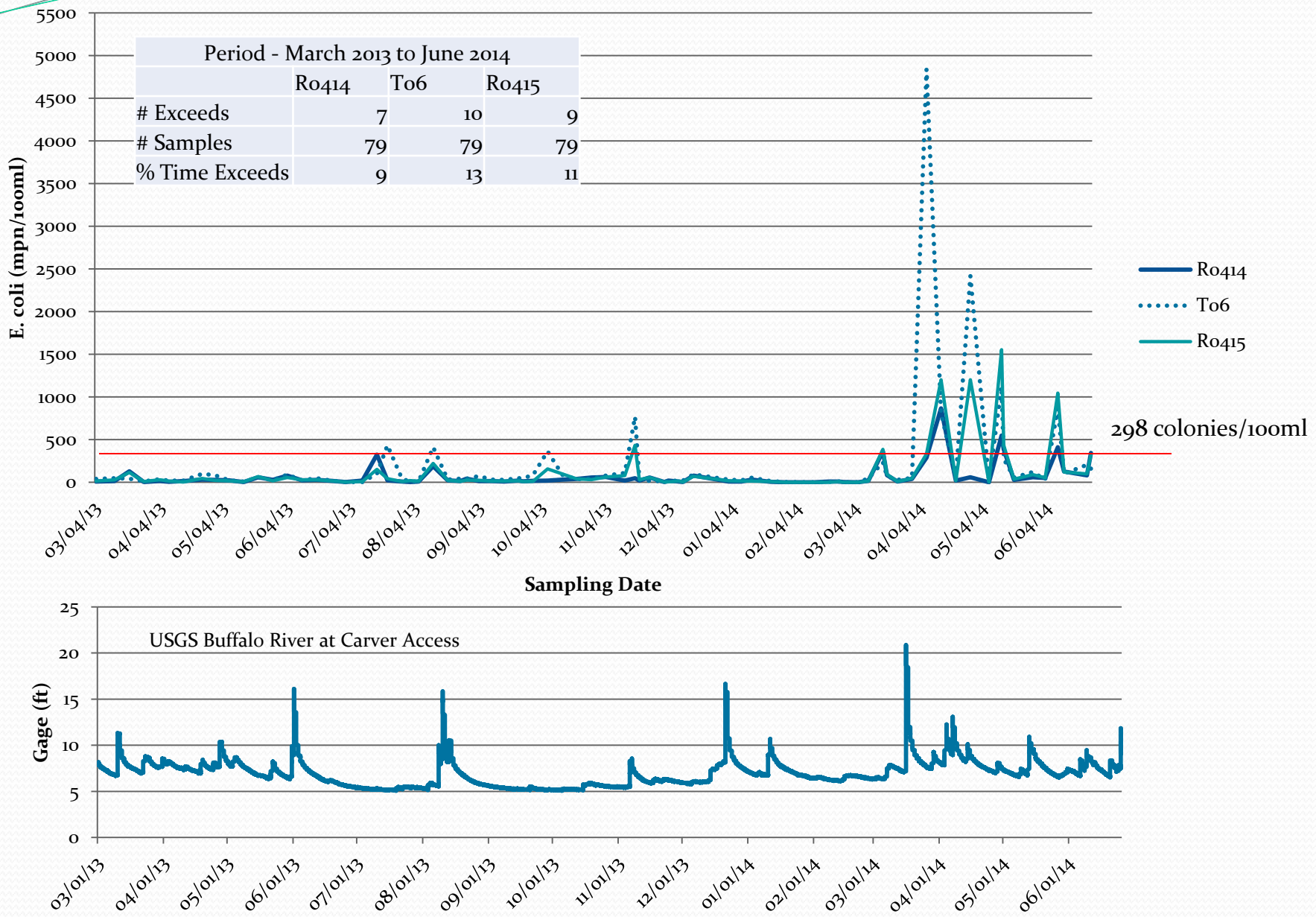
Big Creek Confluence Area



Big Creek Monitoring Sites

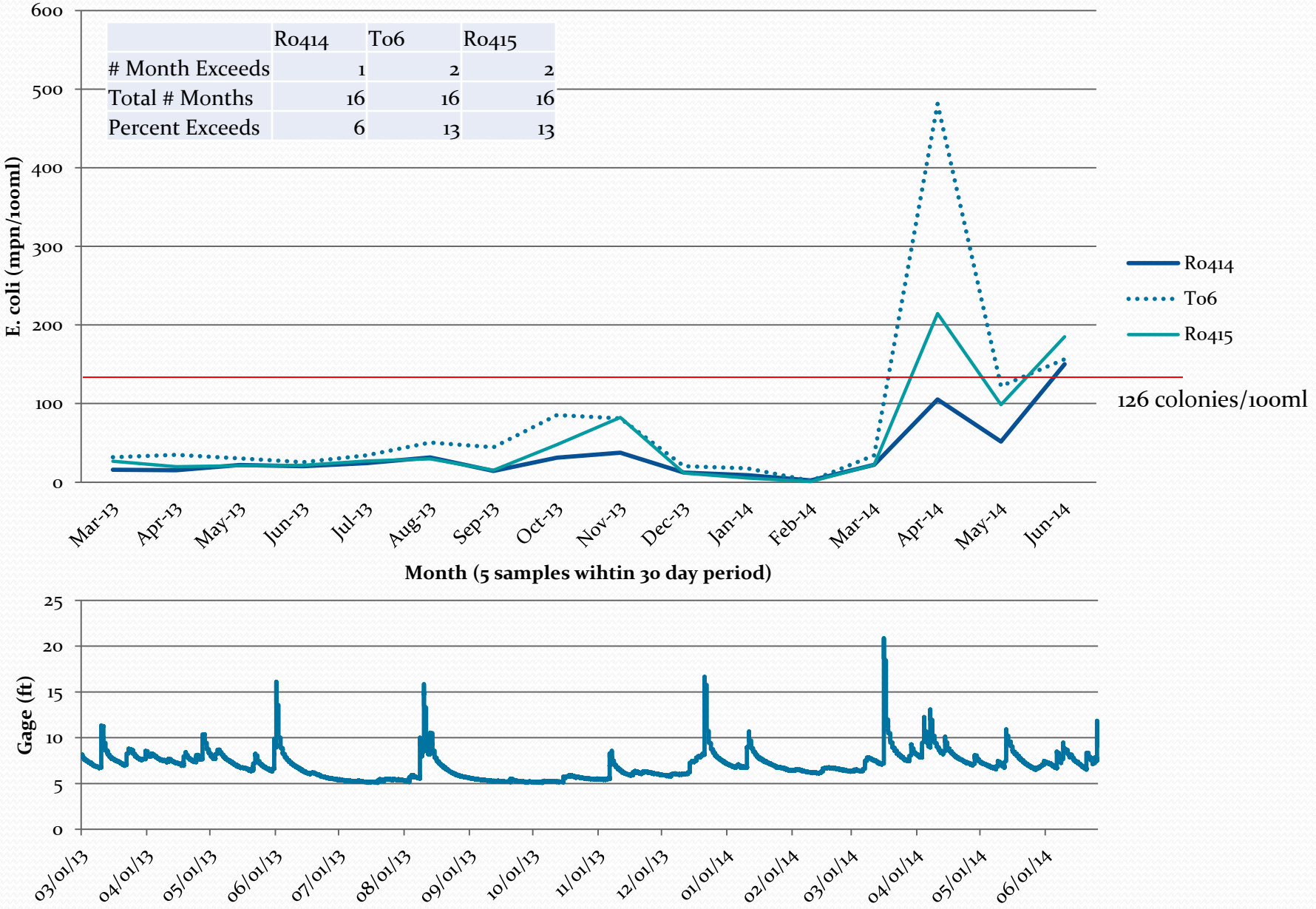
Single Sample Grab for E. coli

Period - March 2013 to June 2014			
	R0414	T06	R0415
# Exceeds	7	10	9
# Samples	79	79	79
% Time Exceeds	9	13	11

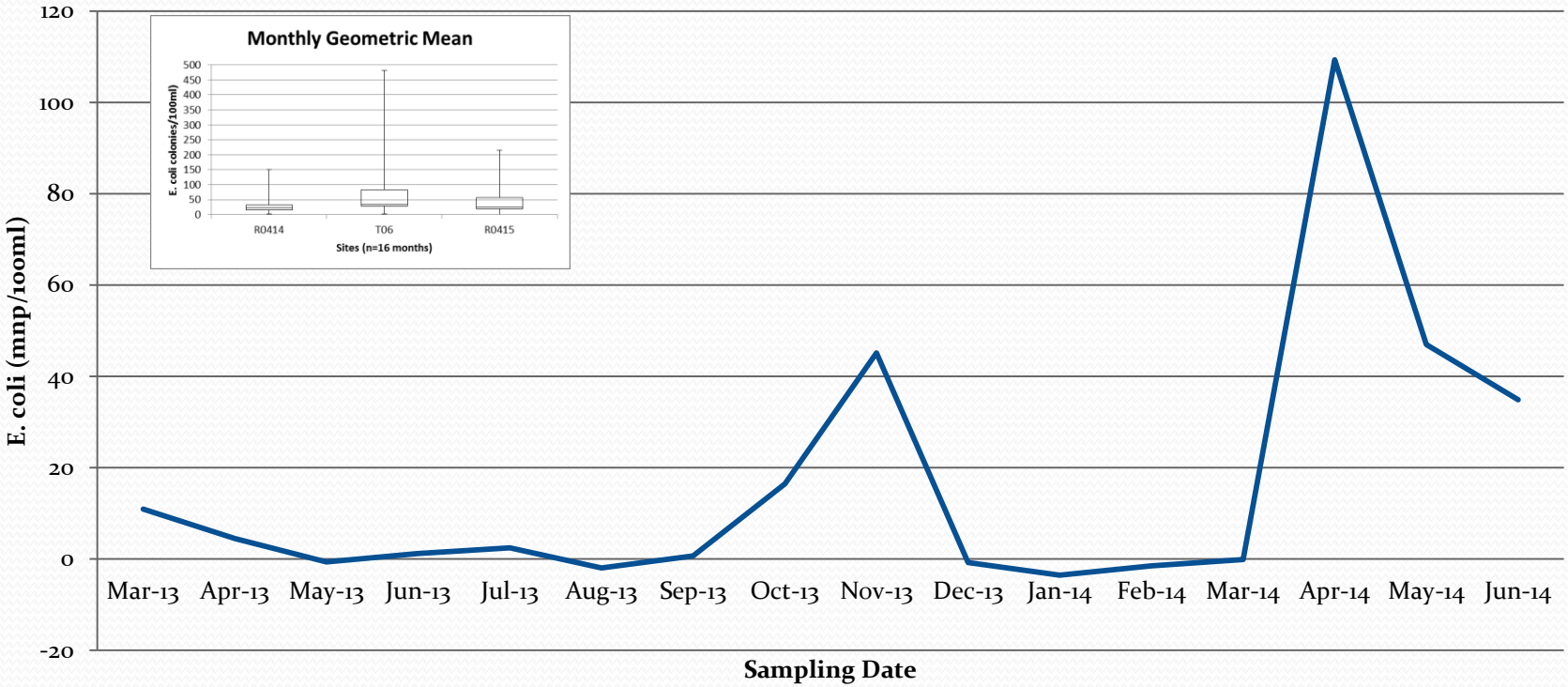


Monthly Geometric Mean of E. coli

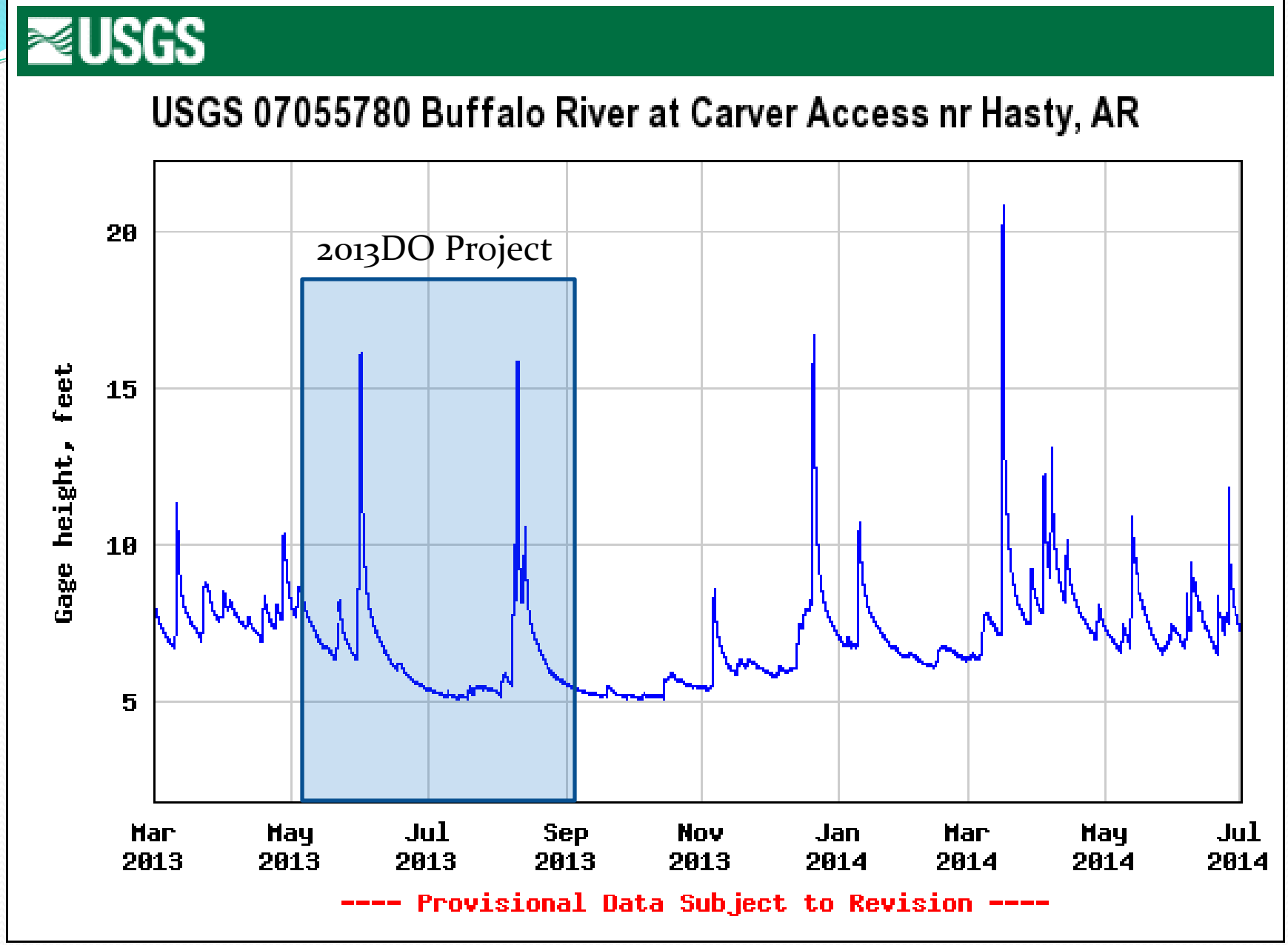
	R0414	T06	R0415
# Month Exceeds	1	2	2
Total # Months	16	16	16
Percent Exceeds	6	13	13



"Loading" Effect of Big Creek Upon Buffalo River (Geometric Mean, R0415-R0414)

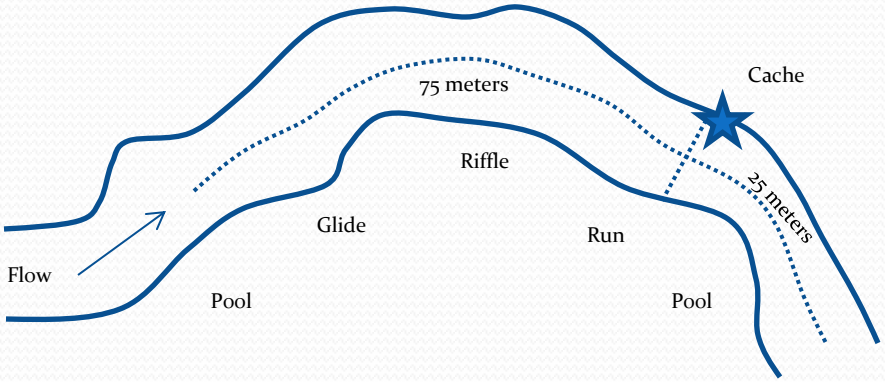


If a geometric mean of 126 colonies/100ml is the maximum allowable for recreational contact, then Big Creek in April/May of 2014 was "almost" responsible for placing the Buffalo River beyond what is assumed safe for river users.

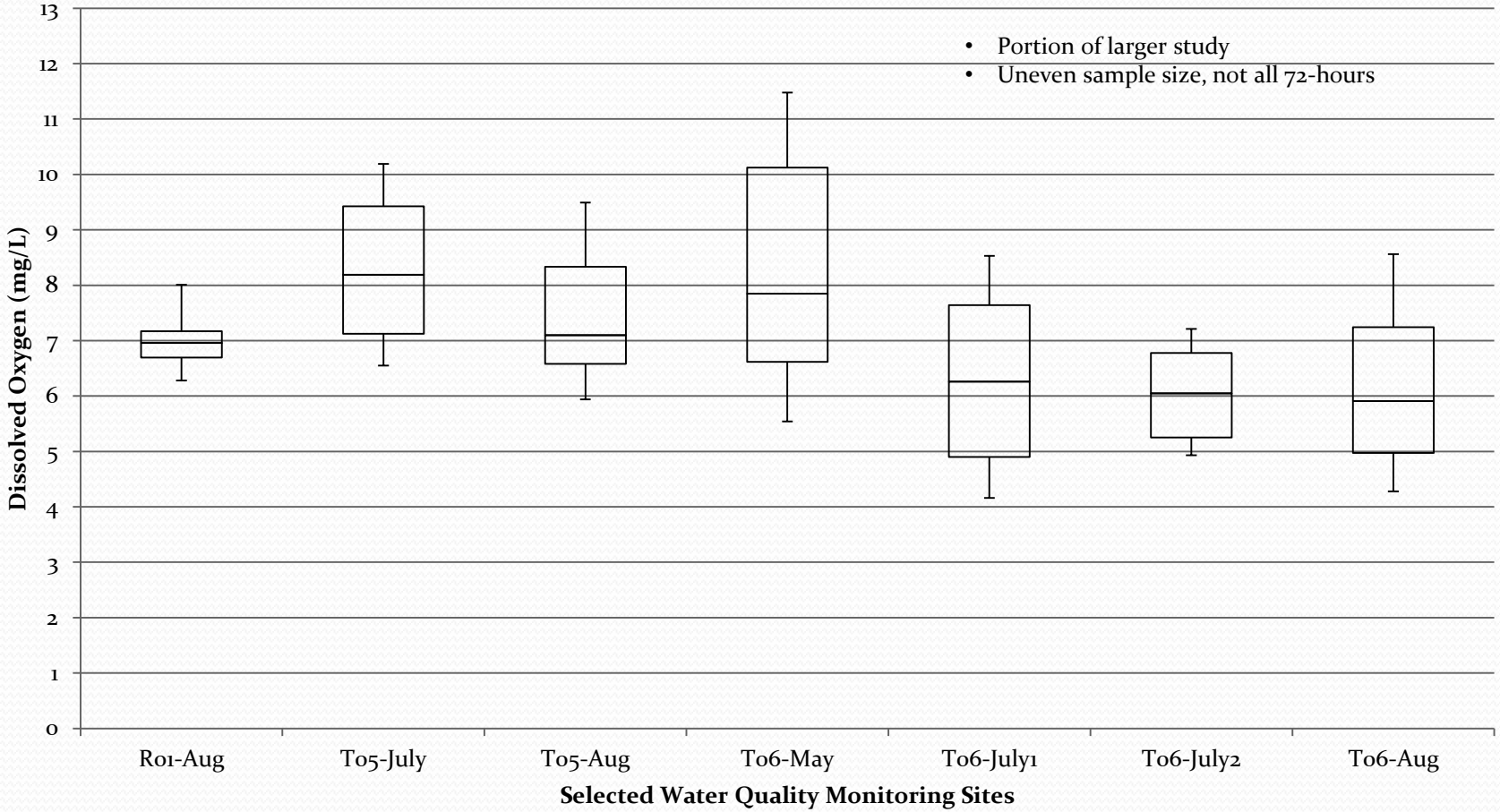

USGS
USGS 07055780 Buffalo River at Carver Access nr Hasty, AR
2013DO Project
Gage height, feet
20
15
10
5
Mar 2013
May 2013
Jul 2013
Sep 2013
Nov 2013
Jan 2014
Mar 2014
May 2014
Jul 2014
---- Provisional Data Subject to Revision ----

Reach Representativeness

- Cache selected in runs or glides
- Cross-section (velocity and DO)
- Longitudinal profile
- All sites were well under 5% difference

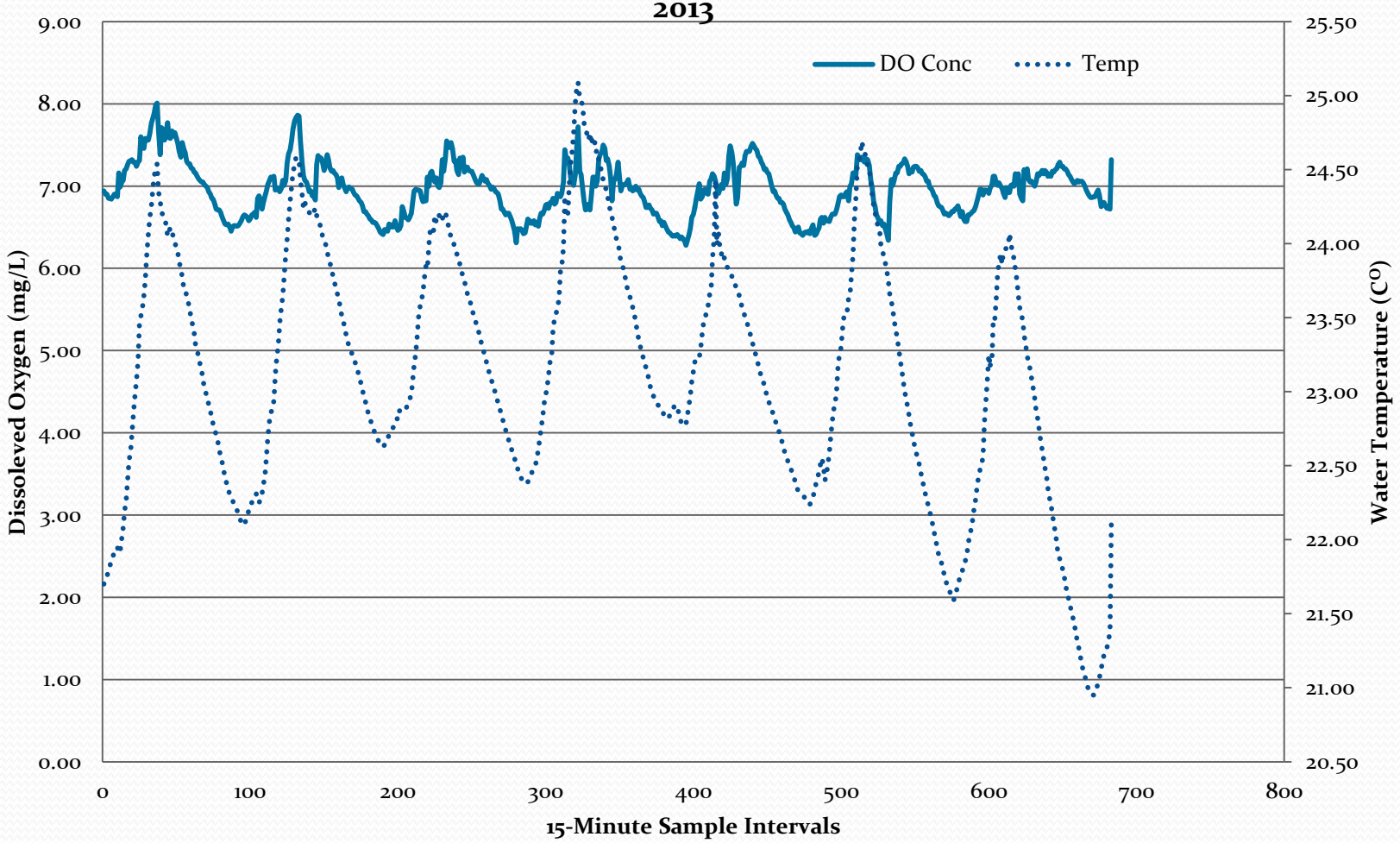


Dissolved Oxygen Monitoring - Summer 2013

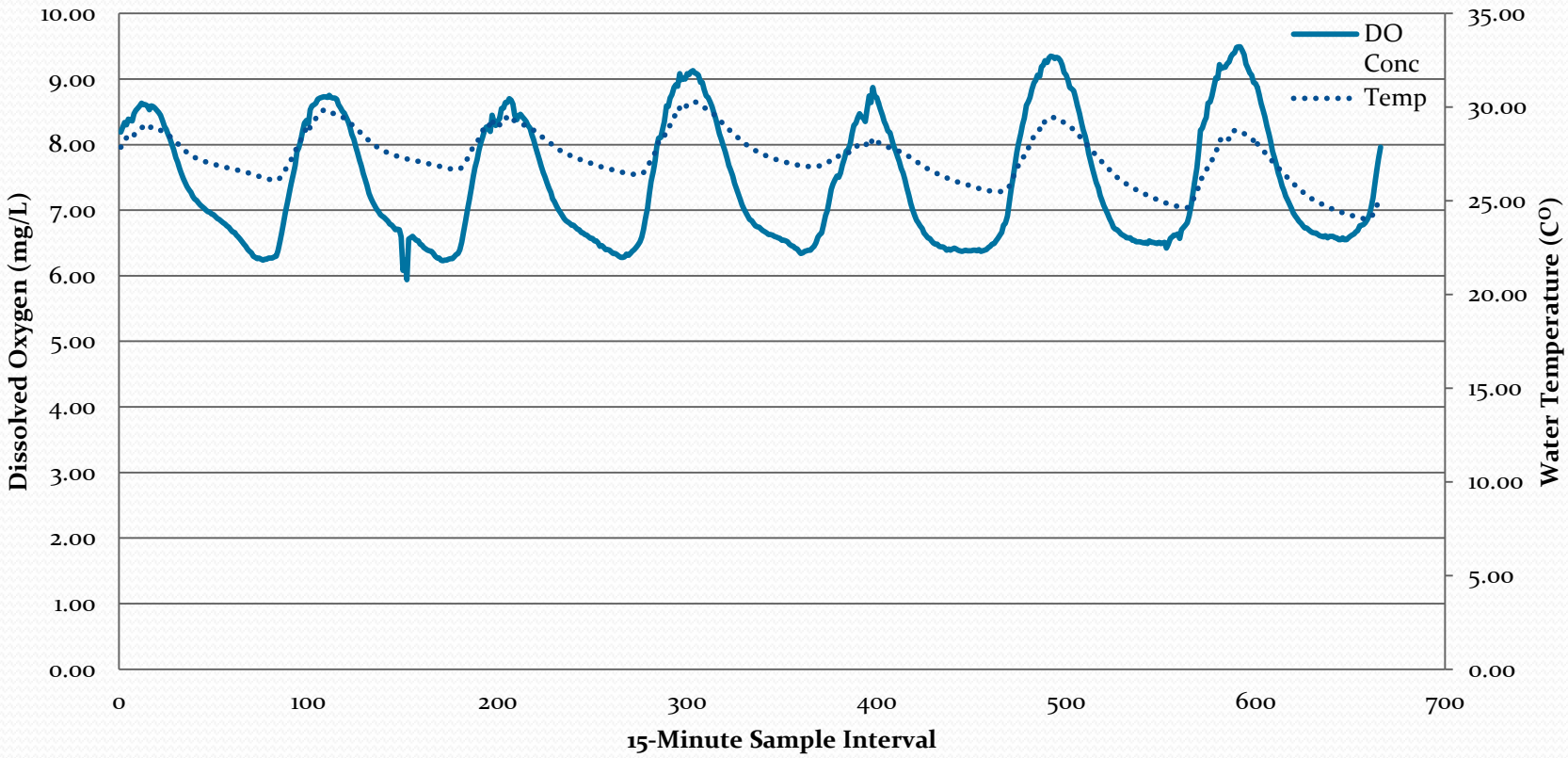


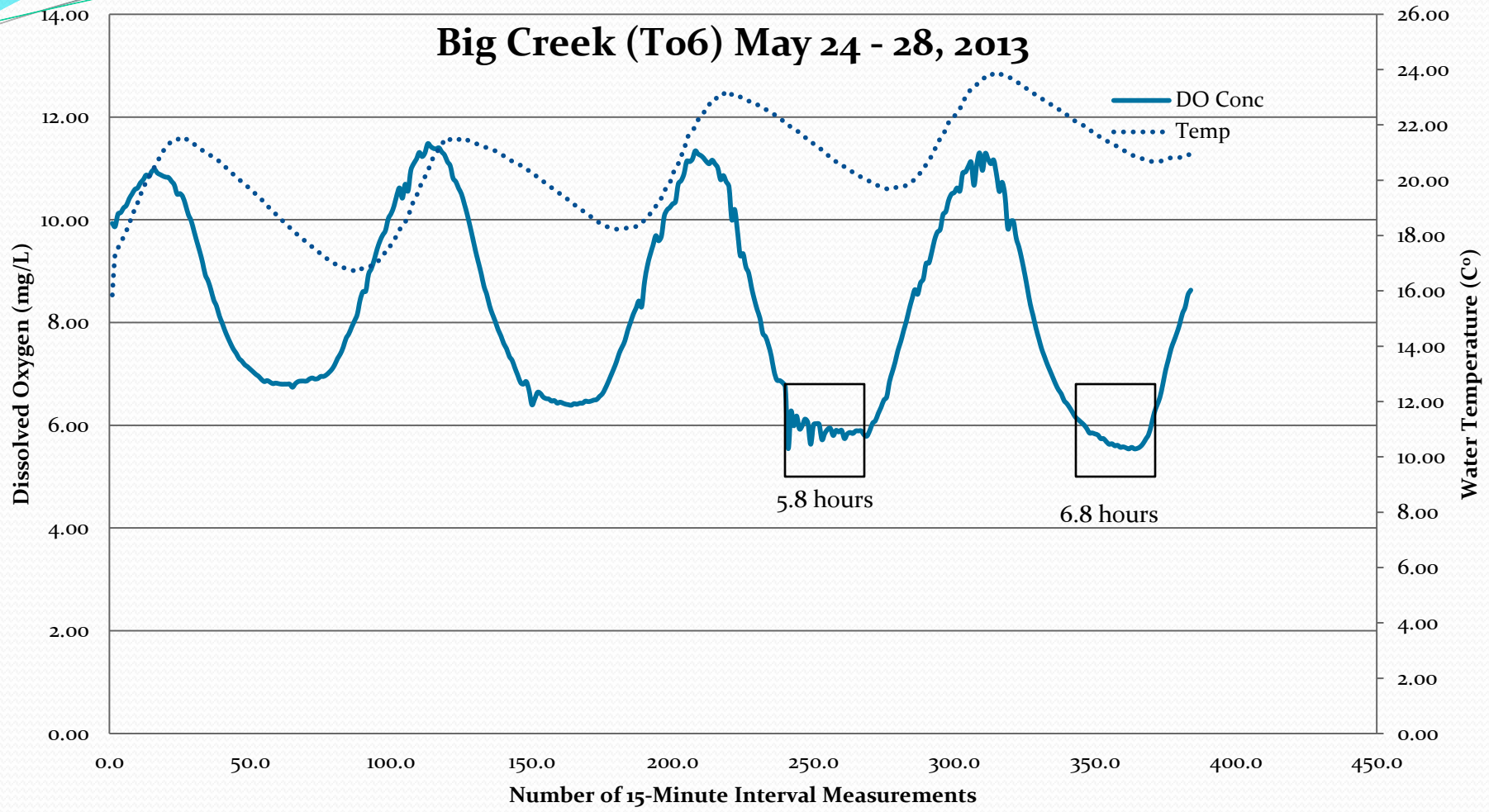
Site	Description	Drainage Area (km²)	Cleared Land Area (%)
R01	Buffalo River at Upper Wilderness Boundary	132	5
T05	Little Buffalo River	369	9
T06	Big Creek	230	13

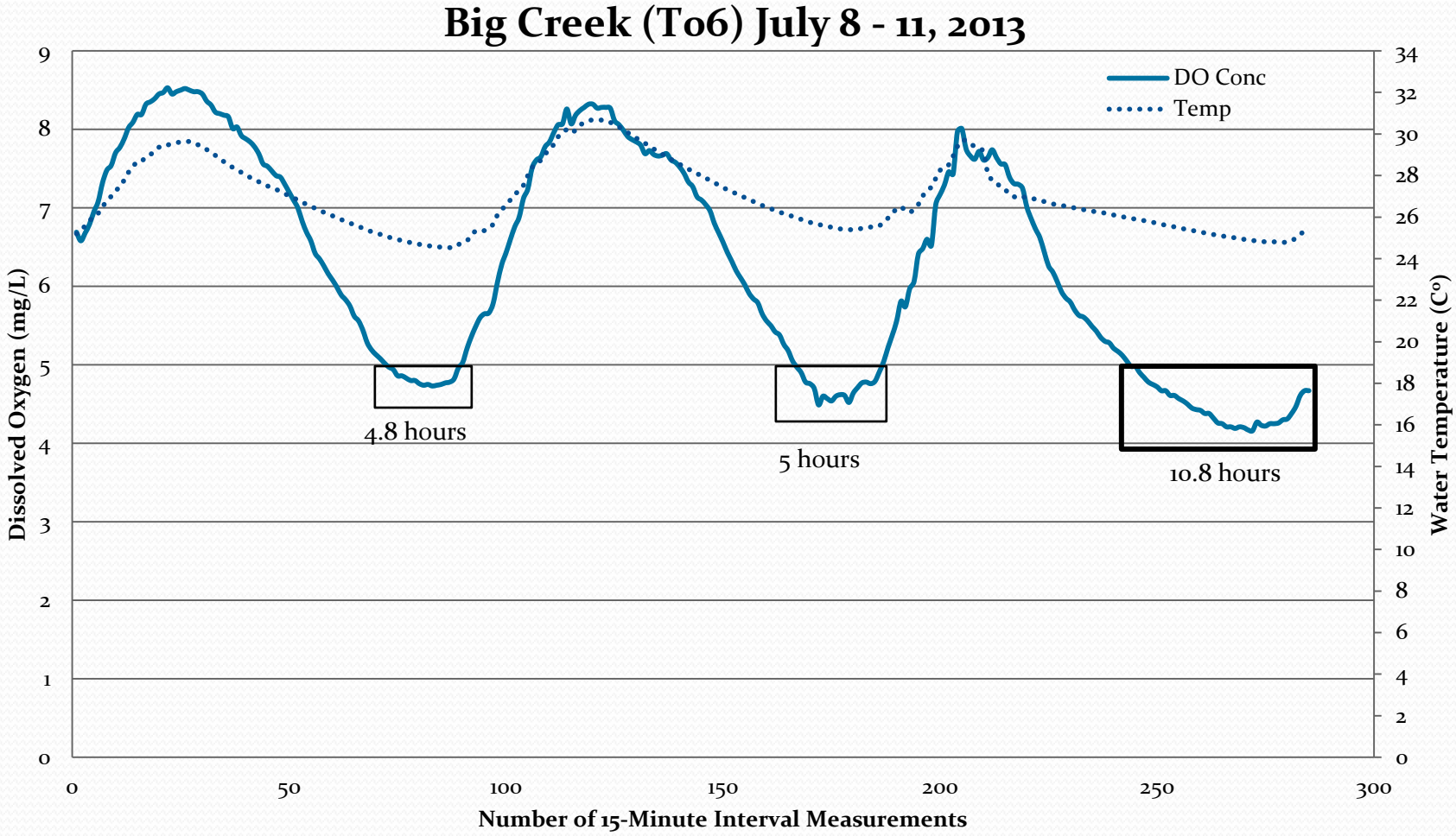
Buffalo River At Wilderness Boundary (R01) August 28 through September 4, 2013

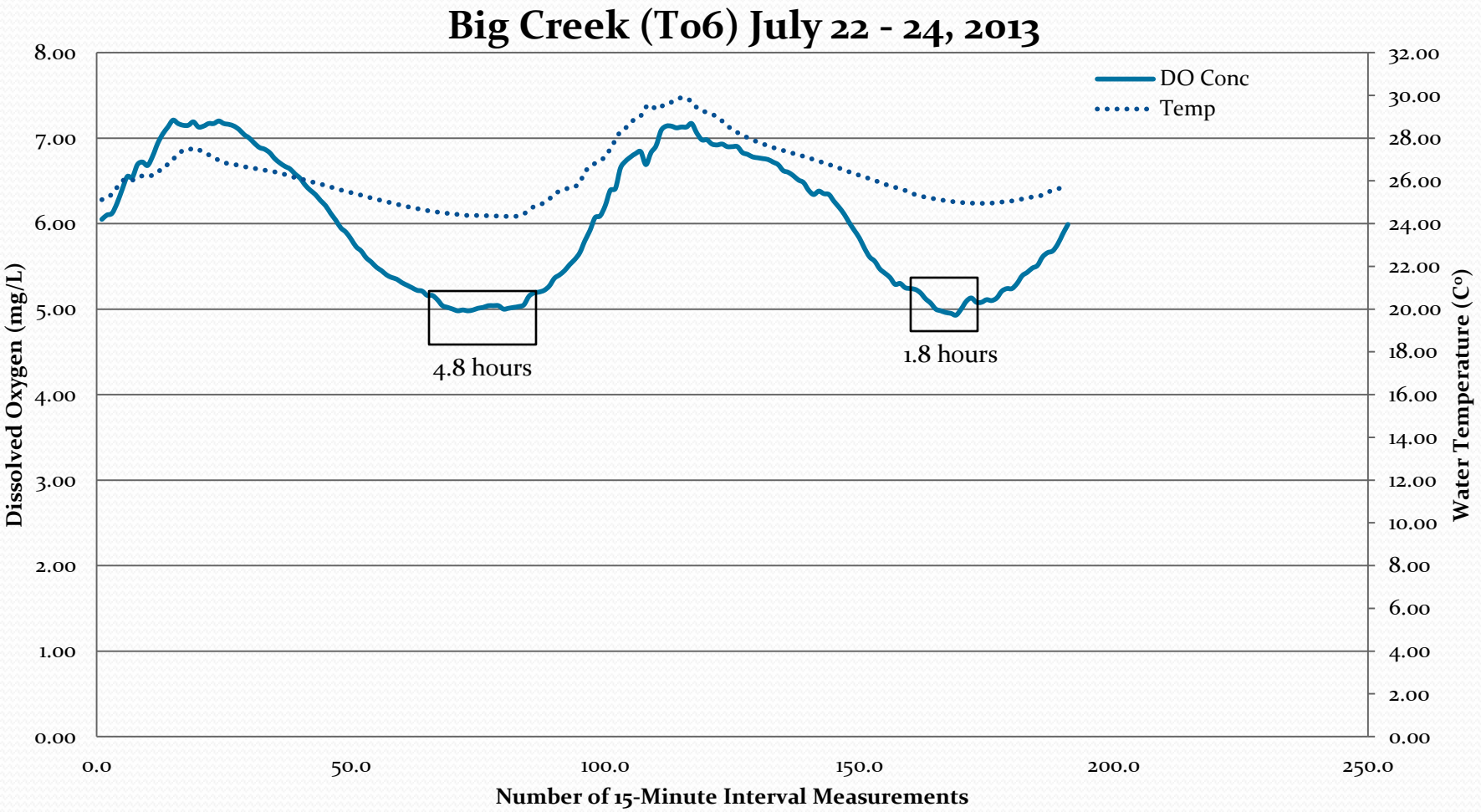


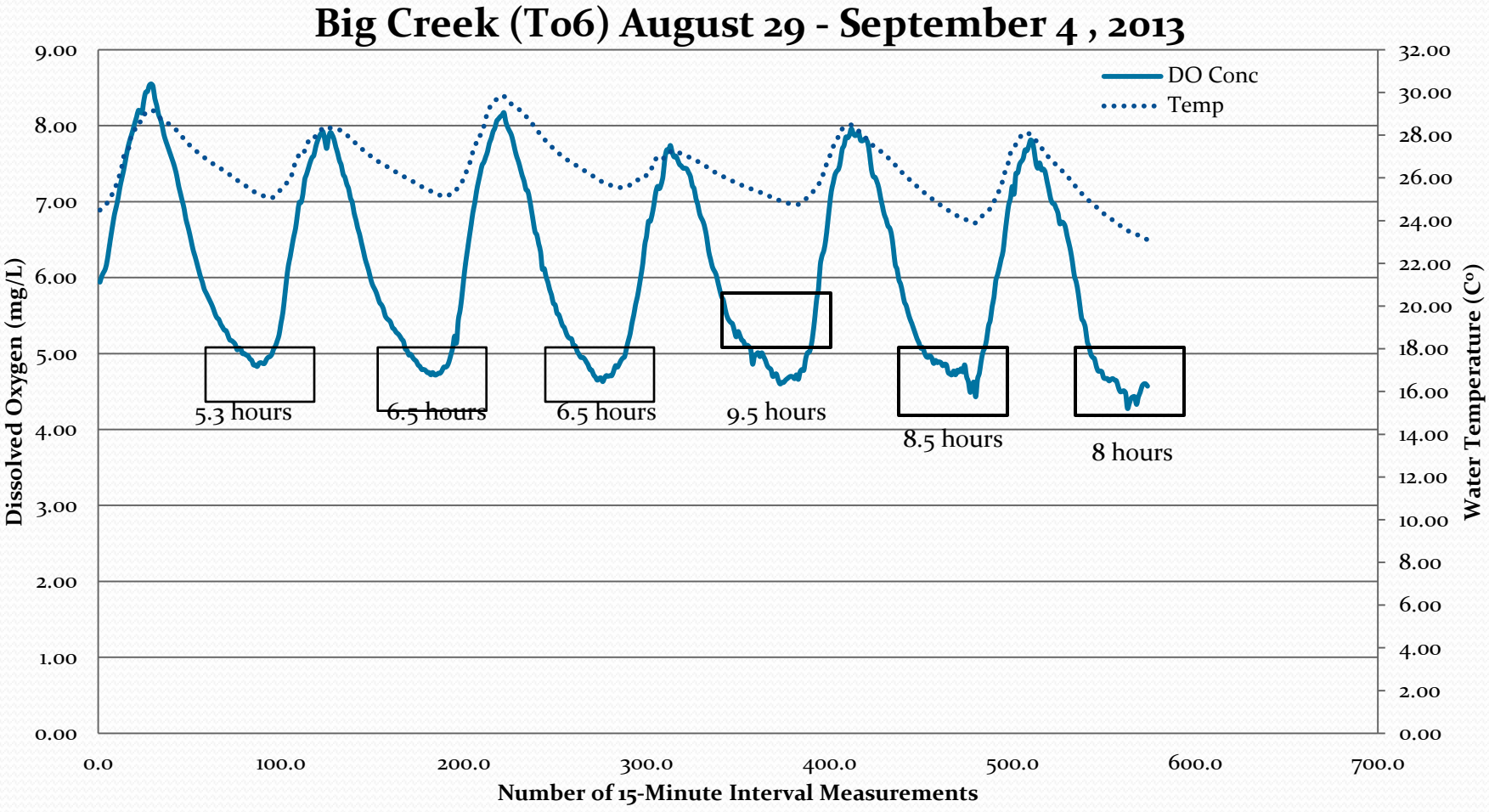
Little Buffalo River (T05) August 28 - September 4, 2013



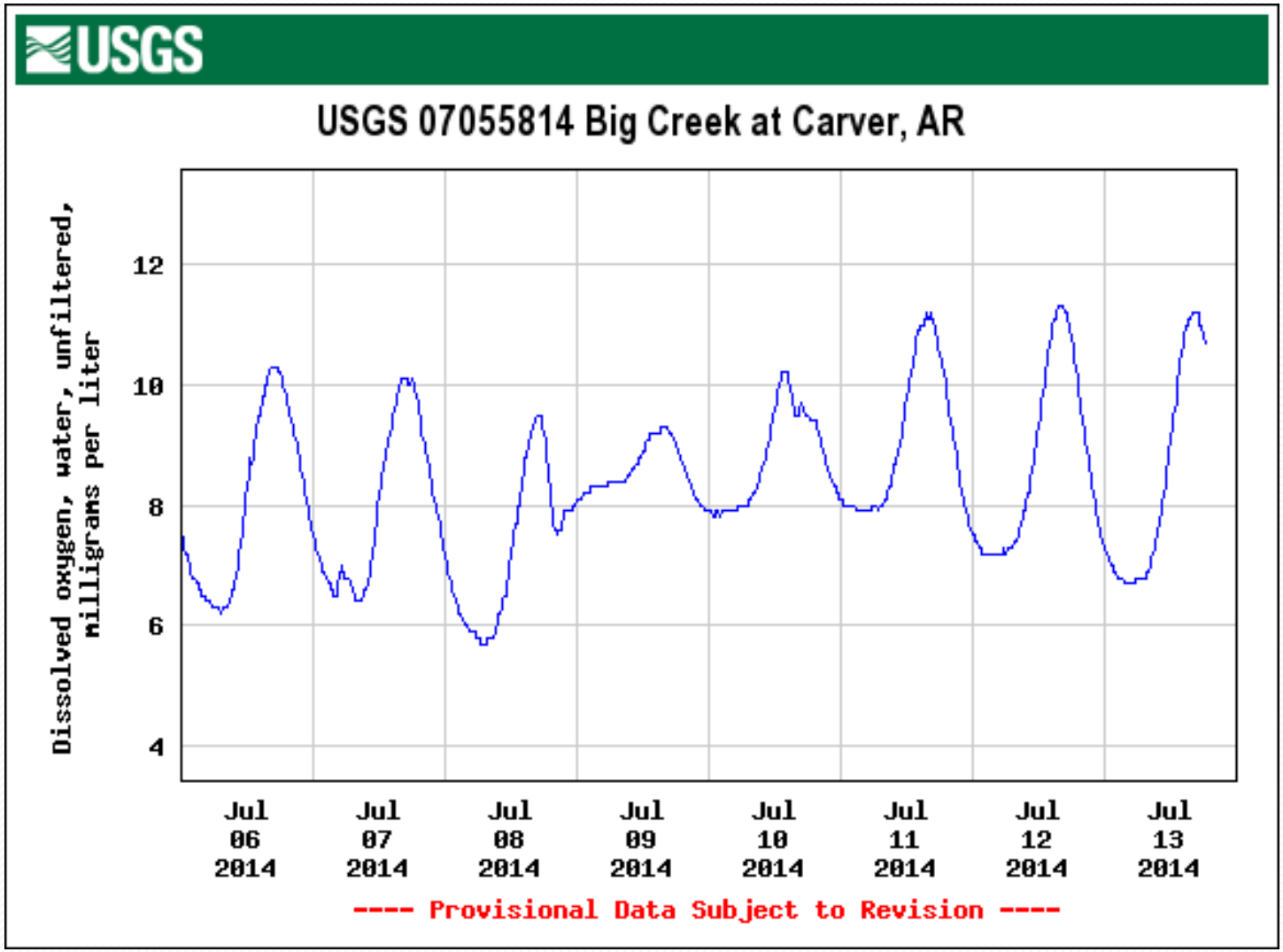

Big Creek (To6) May 24 - 28, 2013
DO Conc
Temp
Dissolved Oxygen (mg/L)
Water Temperature (C°)
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
26.00
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
5.8 hours
6.8 hours
Number of 15-Minute Interval Measurements


Big Creek (To6) July 8 - 11, 2013
DO Conc
Temp
Dissolved Oxygen (mg/L)
Water Temperature (C°)
Number of 15-Minute Interval Measurements
4.8 hours
5 hours
10.8 hours
0
1
2
3
4
5
6
7
8
9
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
0
50
100
150
200
250
300


Big Creek (To6) July 22 - 24, 2013
DO Conc
Temp
4.8 hours
1.8 hours
Dissolved Oxygen (mg/L)
Water Temperature (C°)
Number of 15-Minute Interval Measurements
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
32.00
30.00
28.00
26.00
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
0.0
50.0
100.0
150.0
200.0
250.0


Big Creek (To6) August 29 - September 4 , 2013
DO Conc
Temp
Dissolved Oxygen (mg/L)
Water Temperature (C°)
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
32.00
30.00
28.00
26.00
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
0.0
100.0
200.0
300.0
400.0
500.0
600.0
700.0
5.3 hours
6.5 hours
6.5 hours
9.5 hours
8.5 hours
8 hours
Number of 15-Minute Interval Measurements

Recent Readings from T06



Summary

- *E. coli*
  - All sites were above standard for single sample maximum and geometric mean
  - Big Creek was typically the most concentrated
  - Big Creek has a notable loading effect upon Buffalo River
  - Loading effect can put Buffalo River at Carver above recommended recreational contact limits

- Dissolved Oxygen (Summer 2013)
  - Among similar sites and times of summer, Big Creek exhibited DO concentrations that appeared stressed
  - Most of the 2013 summer, Big Creek appeared to be below critical water quality standards for DO
  - Summer of 2014 does not appear to show similar low DO patterns (USGS station) as 2103, thus far.

Conclusion

- Big Creek can have a strong influence on the recreational water quality safety for visitors within Buffalo River
- Due to the dynamic weather patterns and hydrology, characterization of the system is not complete and continued monitoring is warranted, perhaps broaden to included similar tributary systems
- BNR is developing a DO monitoring program for all WQ sites in coordination with USGS and ADEQ
- Due to potential threats to visitor safety, BNR plans to develop a health advisory system for Big Creek and other WQ sites with a focus upon recreation advisories and potential river closures

Questions?