

303b) Comments, 9-10-2018  
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Comments regarding the 4b listing of certain segments of the Buffalo River and Big Creek (upper), and the expectation that the Beautiful Buffalo River Action Committee (BBRAC) is the appropriate tool for ascertaining the “attainment of the water quality standard” and that degradation on these waterways can and has been reversed.

**Part I**

The Governor’s charge: “establish measureable objectives, set achievable action items, establish durable partnerships, share agency resources, and inform policymakers and the general public of relevant progress,” while lofty rhetoric, is vacuous without significant means for action.

Despite a very lengthy, generally informative but diffuse Buffalo River Watershed Management Plan [DRAFT, December 15, 2017], there is little evidence that BBRAC has money, staffing, a plan, investigating tools, or any power of implementation for investigating the above mentioned 4b) listing, much less solving the problem. Indeed the inertia of BBRAC is clear from the listing of year one priorities:

- developing a stakeholder forum
- initiating the development of a watershed management plan
- identifying early actions to “jump start” improvements
- prioritizing future research needs.

By its very nature (voluntary), BBRAC is not moving fast, if at all, in any direction, initial targets are scheduled for evaluation in 2023!

BBRAC used dubious statistical analysis to focus on 7 tributary streams for “action,” but missed the 4b) stretches now assigned to their prevue. As will be demonstrated in Part II, there is a need for future research and much better sampling design, but in this specific case, there is good data from BCRET, USGS, NPS, and ADEQ . Enough for reliable statistical analysis and conclusions if there is will power to do so.

BBRAC, by its committee structure, is inherently political – ADEQ, ANRC, Department of Health, Parks and Tourism, Arkansas Agriculture Department, Arkansas Game and fish, and Arkansas Geographic Information System. The intense focus on the C&H hog farm and the proposed 4b) action shows that political argument is likely to continue.

The watershed management plan does list the primary threats to water quality. But Stakeholders, all Arkansans really, might rightly view BBRAC as window dressing, if it does not step forward for the real challenge of preserving the water quality in the Buffalo River watershed.

**Recommendation 1** In order to avoid the appearance of “window dressing” or obfuscation via arcane agency verbiage, BBRAC should quickly establish the “management alternatives” that are purported to exist, allowing full participation by environmental stakeholders (e.g. BRWA, OS, Audubon, River Keepers, etc.)

Although further study is generally merited in any watershed, there is enough data available on Big Creek and perhaps this stretch of the Buffalo River, to identify likely sources of nutrients, and therefore to make useful management decisions on nutrients.

## **Part II**

Although the issue of swine CAFO’s on a National River is both political and emotional there is the scientific arena that can point in the right direction. My expertise is in mathematical modeling and statistics. There are areas of the data gathering and analysis of this proposed 4b) action that need careful scrutiny by outside expert evaluators (not committee members or BCRET personal), to assure quality control. Below I will present **only one area** of questionable conclusions found in the BBRAC plan – and there are other problems with BCRET analysis. A dismissal of this one, of many critiques, does not avoid the technical problems in the BBRAC and BCRET studies.

**Recommendation 2** In the design, implementation, and evaluation of “management alternatives,” BBRAC would benefit by using an outside statistician. An outside consultant with groundwater experience would help in resolving issues with karst.

### **One, of many, statistical problems with BBRAC data: yearly surface water nutrient loads.**

Yearly nutrient loads are notoriously unpredictable because they depend on highly variable stream discharge, nutrient concentration levels which can correlate to discharge rates, and human input, e.g. manure spreading schedules. This inherent problem is compounded when BBRAC tries estimating loads with the wrong formula:  $\text{Yearly load} = \text{total yearly discharge} \times \text{median}$  (loading table section 3, p. 37-38) rather than  $\text{Yearly load} = \text{total yearly discharge} \times \text{flow weighted mean}$ , which is correct.

If it becomes clear that TMLDs are required to solve the 4b) impairment problem, accurate yearly and mean daily load estimates become crucial.

In Big Creek, and possibly the main stem and other tributaries, TP concentrations are positively correlated with flow and nitrate concentrations are negatively correlated with flow. Consequently, the BBRAC method overestimates the nitrate load and underestimates the TP load, severely.

By far, the best data for any tributary stream are from BCRET and USGS (5/1/14-8/31/17) at both the upstream and downstream sample sites. For the mean yearly discharge on the BCRET sampling dates during this period (~ 100 cfs at the USGS gage at Mt. Judea), the more correct formula gives an estimate that is 465% higher than the BBRAC method, see below.

ADEQ data at Carver for this time period was not useful for loading conclusions due to small sample size and unrepresentative flow rates, sample sizes (n = 2, 8, 12, 9 for dP, TP, NI, and TN). This was a systemic problem for the entire BBRAC study, since nitrate was the only nutrient that was systematically sampled

over the 30 year period. Even for nitrate, the sampling apparently occurred during base flow, although no discharge records were published.

The best way to estimate daily or yearly loads (at least for nitrate) is to install continuous monitoring for both discharge and nitrate concentrations at the same location during the same time period, as was the case at Carver for two years.

**The Data** (5/1/14-8/31/17, BCRET, n = 137)

	<b>median</b>	<b>flow weighted mean</b>	<b>difference</b>
<b>dP, UP</b>	0.0090	0.0111	<b>23%</b>
<b>dP, DN</b>	0.011	0.025	<b>127%</b>
<b>% increase</b>	22	125	
<b>TP, UP</b>	0.0260	0.0653	<b>151%</b>
<b>TP, DN</b>	0.026	0.147	<b>465%</b>
<b>% increase</b>	0	125	
	<b>median</b>	<b>flow weighted mean</b>	
<b>Nitrate, UP</b>	0.099	0.103	<b>4%</b>
<b>Nitrate, DN</b>	0.216	0.166	<b>-23%</b>
<b>% increase</b>	118	61	
<b>TN, UP</b>	0.175	0.329 (0.241)	<b>88% (38%)</b>
<b>TN, DN</b>	0.320	0.666 (0.359)	<b>108% (12%)*</b>
<b>% increase</b>	83	102 (49)	

\* Of the 137 data points at Mt. Judea, two had very high flows (discharge > 2000 cfs) and carried high levels of TN but oddly not of nitrate.

**Recommendation 3** Mass balance modeling

Poultry litter is not allowed to be imported into the Buffalo River watershed, but since CAFOs grow none of their own food stock they essentially import waste when they use their spread fields. Only a small percentage of these excess nutrients are removed from the fields in agricultural product. What happens to the rest? The pathways for TN and TP are significantly different. The Big Creek drainage, being limited geographically, would be a good place to do a mass balance study. This has been resisted eternally since the answer is likely to be that most of the imported nutrients end up in the watersheds. But maybe not, an academic study by experts would clarify the issue.

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