Storm Water Influenced Stream Sampling – Is it worth the hassle?

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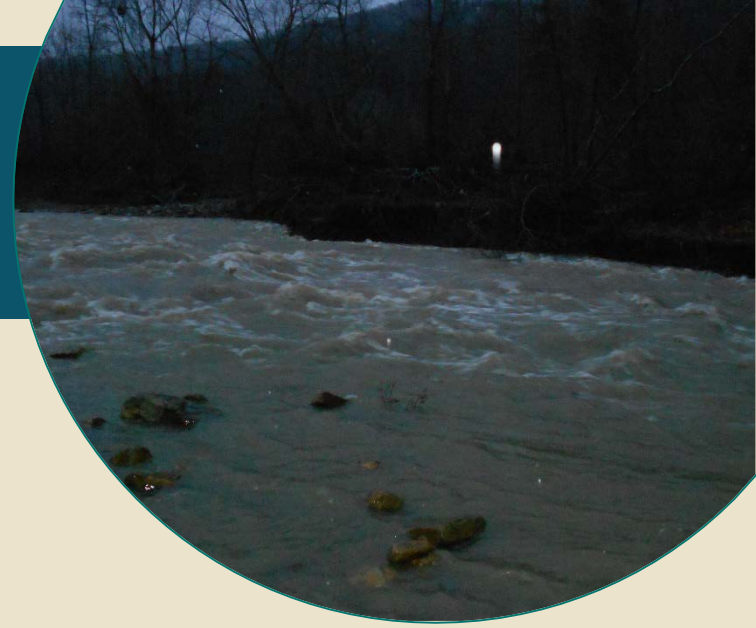
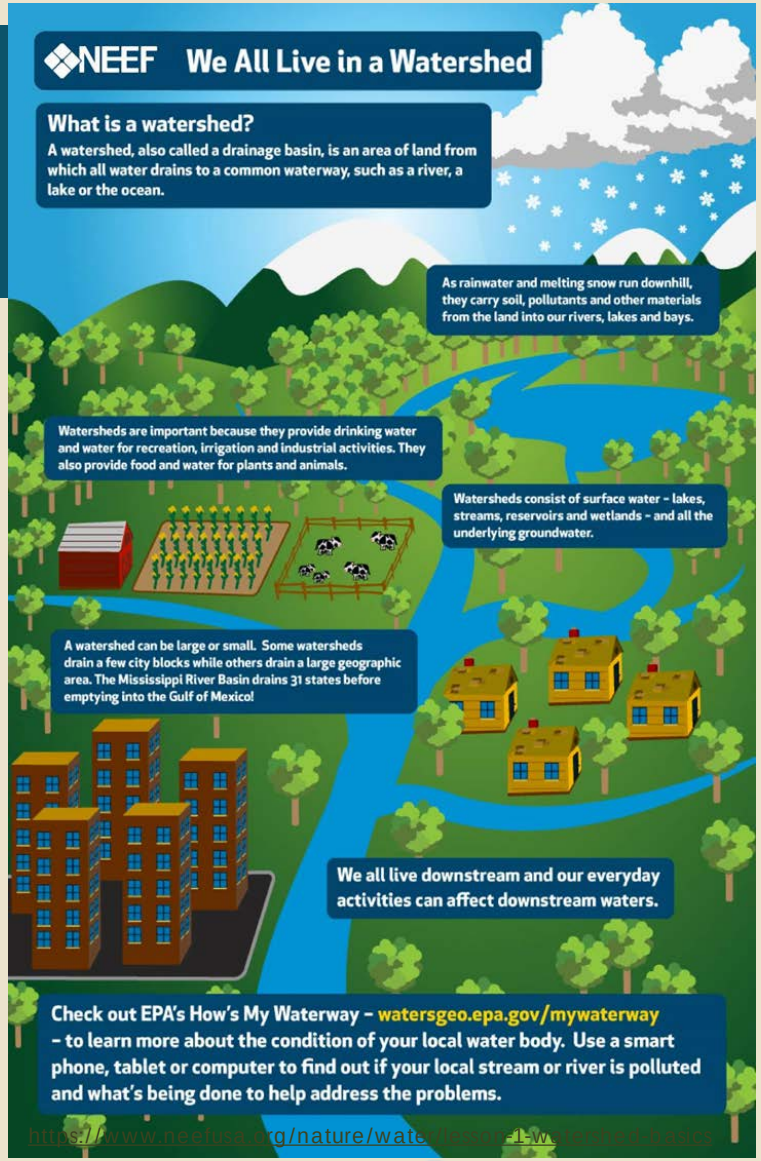
Why is it a hassle?

- Rain doesn't happen between 8-5
- Watching weather all through the night
- We sample for both watershed studies and industrial clients
  - Have to drive as far as 5 hours
  - Have lots of storm water collection



Why do we do watershed studies?

- Determine contributing sources of pollutants
  - In tributaries
  - Drinking water sources
- Revision of TMDLs
- Evaluate pollutant loading and reduction recommendations
- Improve watershed hydrology



https://www.neefusa.org/nature/water/lesson-1-watershed-basics

What are we trying to gain by sampling during storm events?

- Identify non-point sources contributing
- Changing landscape can elevated streamflow for 30-40 years Swift and Swank 1981- Coweeta Hydrologic Laboratory
- Changing landscape can affect nutrient concentrations for 10-20 years Swank and Douglas 1975 Coweeta Hydrologic Laboratory
- Soil disturbance can increase erosion and sediment loading in streams Paustian and Beschta, 1979
- It is how non-point source pollution enters steams

Undisturbed VS Disturbed Stream Concentrations

- Streams in ‘disturbed’ watersheds have higher suspended solids and nutrient concentrations
- See how as the stream rises so do the concentrations?

Monitored flow using level loggers

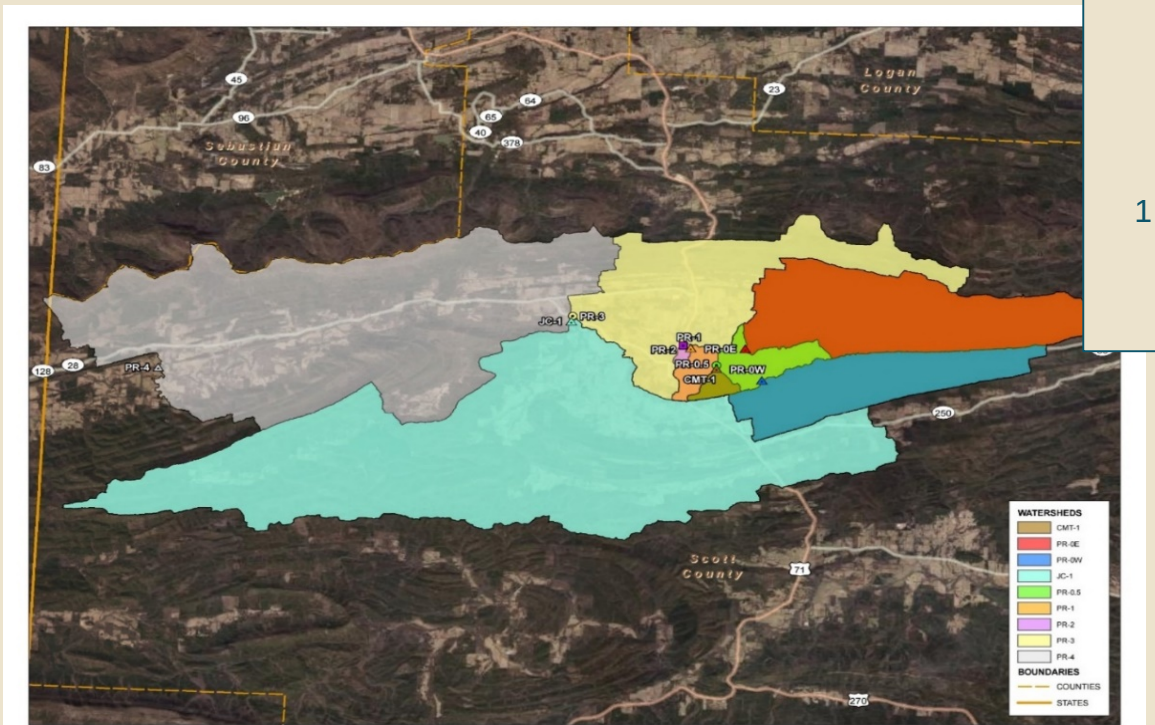
- Level loggers were installed at all sampling locations
- Stage and flow measurements taken during each site visit
- Data used to predict flow for study period
- Once we know flow then loading can be predicted

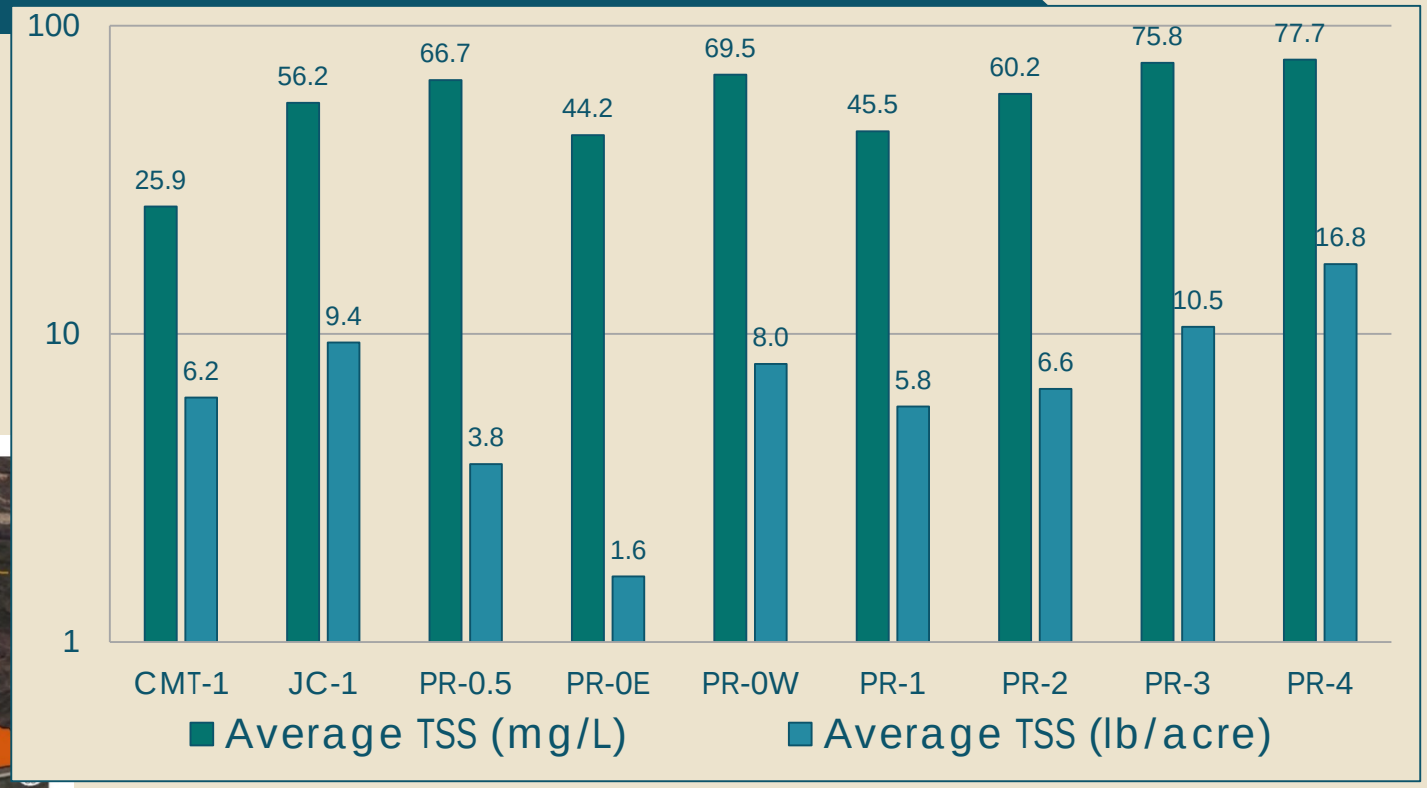
How are loads calculated?

$$\text{Load}\left(\frac{\text{lb}}{\text{day}}\right) = \text{Concentration}\left(\frac{\text{mg}}{\text{L}}\right) * \text{Flow (MGD)} * 8.34\left(\frac{\text{lbs}}{\text{gal}}\right)$$

- Normalized using watershed area

$$\text{Load}\left(\frac{\text{lb}}{\text{acre-day}}\right) = \frac{\text{load}\left(\frac{\text{lb}}{\text{day}}\right)}{\text{watershed area (acre)}}$$

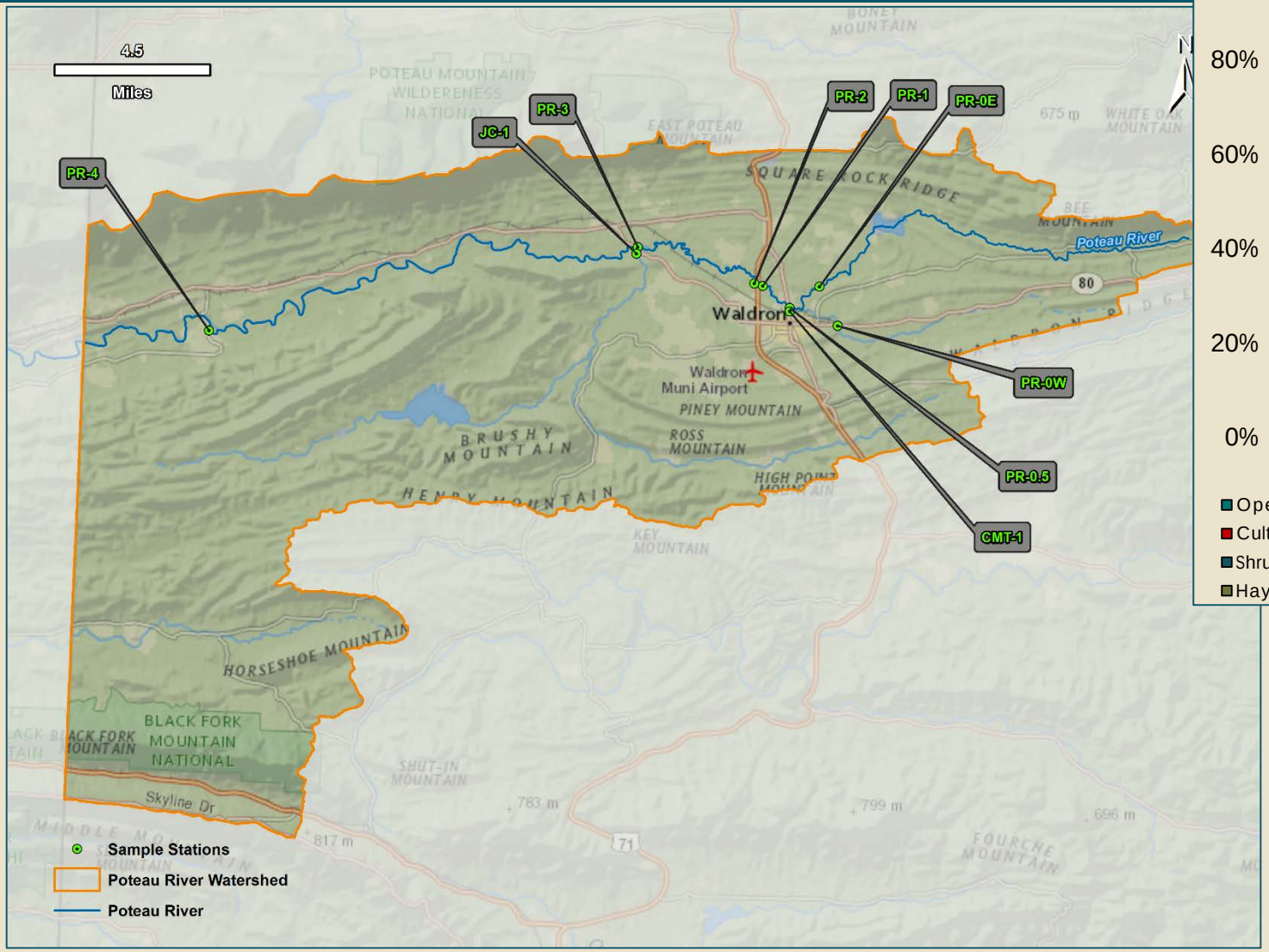


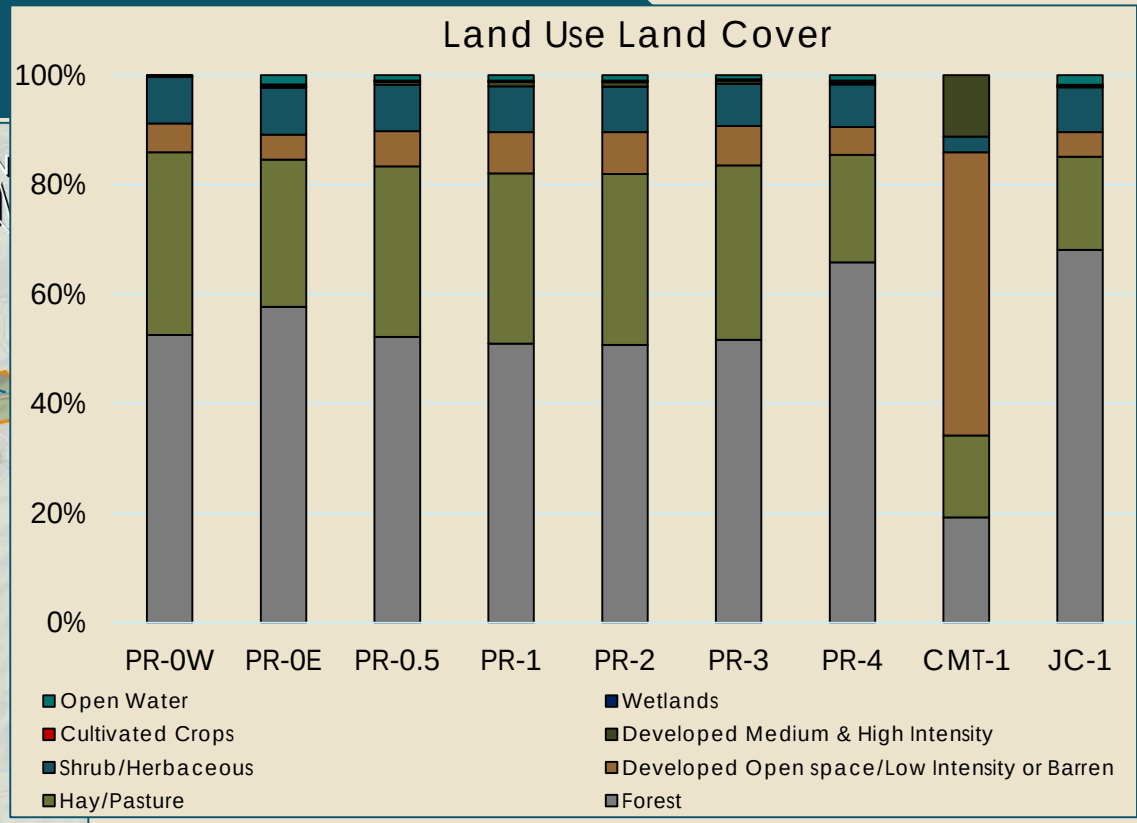


Projects demonstrating it may be worth the hassle

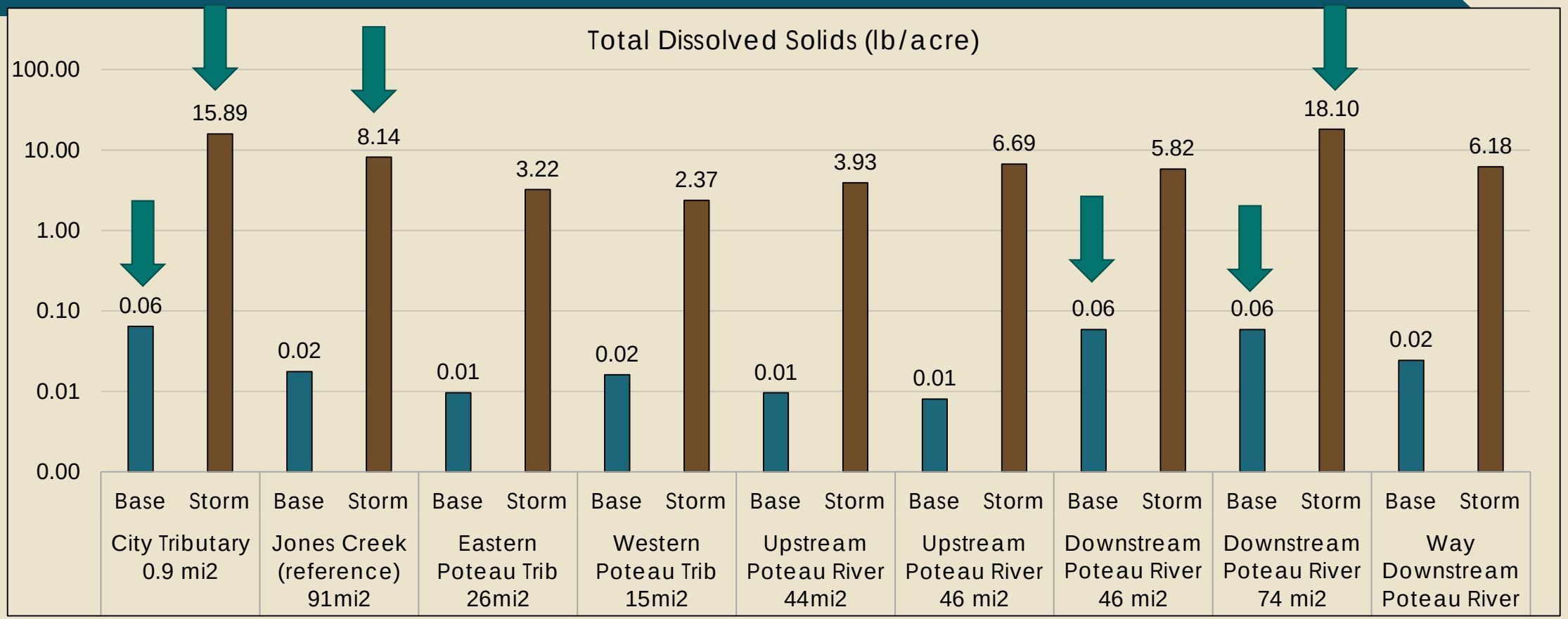
- City of Waldron – Section 319 Nonpoint Source Management
- Fort Smith Utility - Section 319 Nonpoint Source Management
- A TMDL revision in south Arkansas
- Lake Conway Point Remove Watershed – Section 319

City of Waldron – identify large non-point contributors





Base Flow VS Storm Flow



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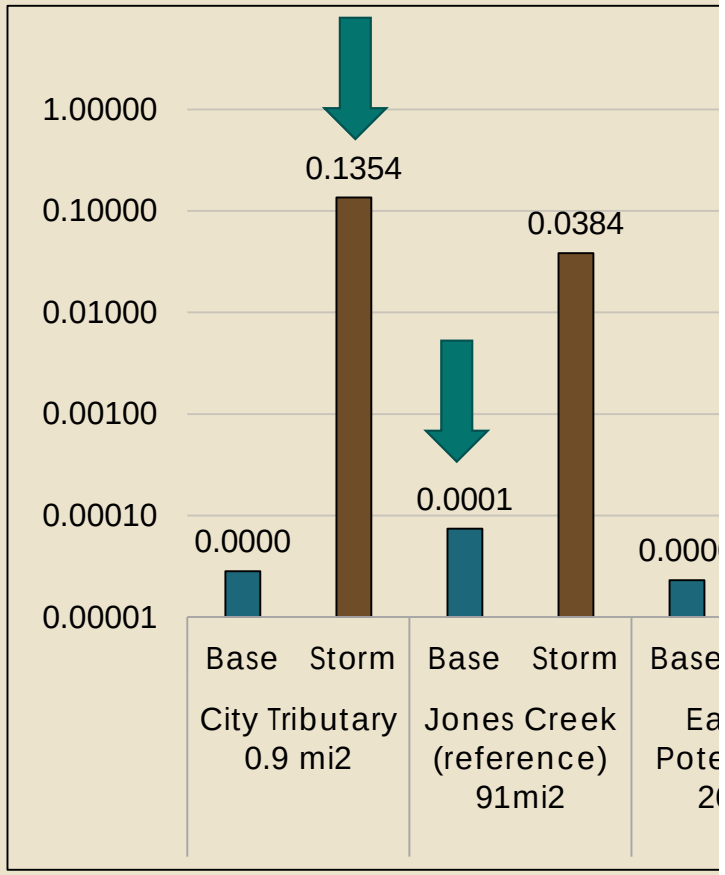
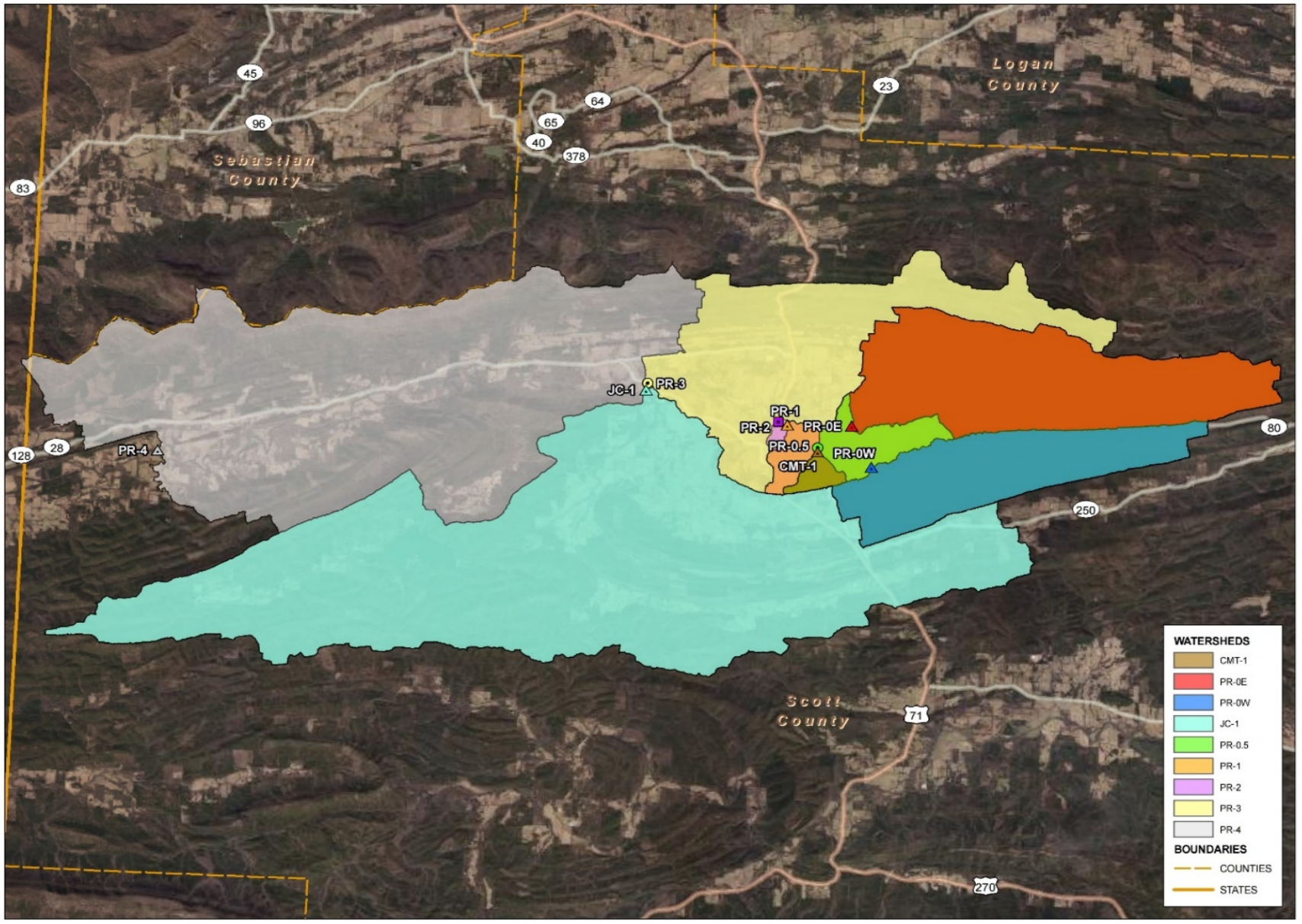




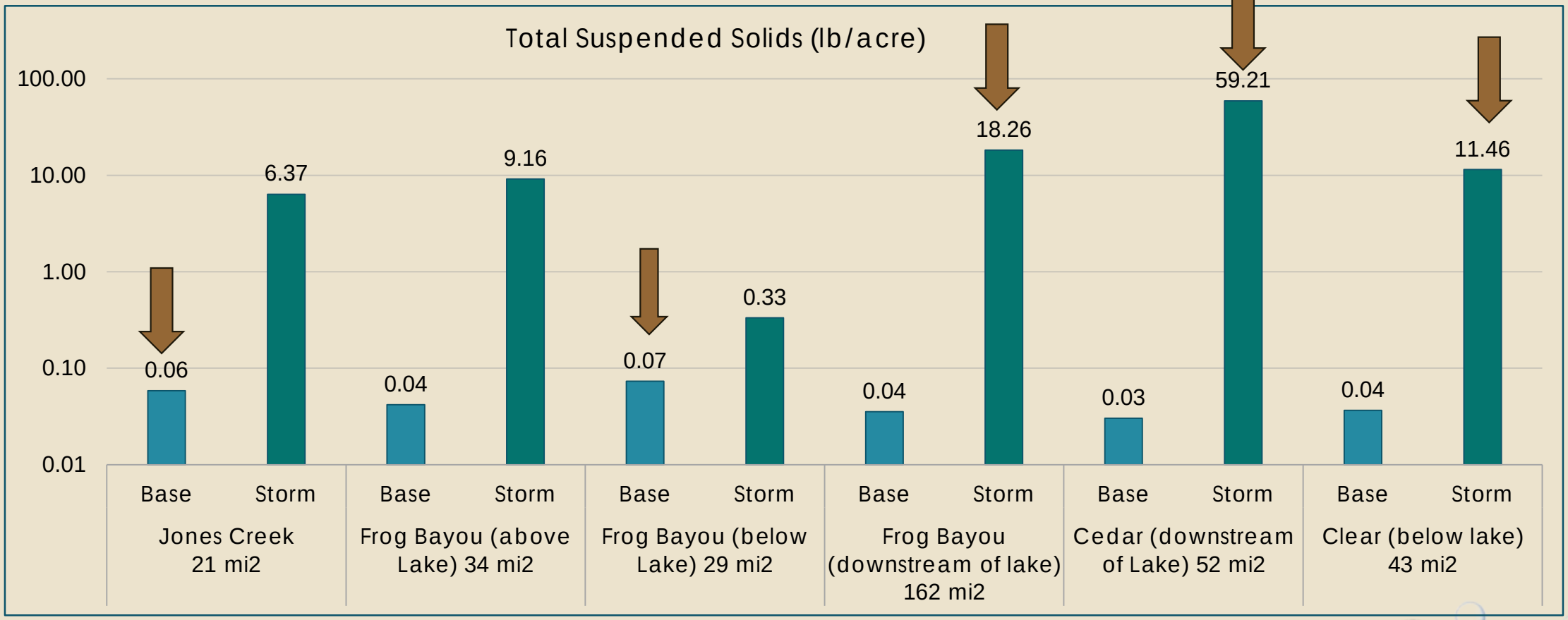
Conclusions

Jones Creek	City Tributary	Eastern Poteau Trib	Western Poteau Trib	Upstream Poteau River PR-0.5	Upstream Poteau River PR-1	Downstream Poteau River PR-2	Downstream Poteau River PR-3	Downstream Poteau River PR-4
Mining site runoff	Impacted riparian buffer	Impacted riparian buffer	Impacted riparian buffer	Cattle runoff	Cattle runoff	Cattle runoff	Cattle runoff	Cattle runoff
Cattle runoff	Carwash runoff	Stream bank erosion	Cattle runoff	Impacted riparian buffer	Impacted riparian buffer	Poultry runoff	Stream bank erosion	Impacted riparian buffer
	Stream bank erosion	Cattle runoff	Poultry runoff	Stream bank erosion	Poutry runoff			
	Urban runoff from Waldron	Poutlry runoff	Stream bank erosion	Poultry runoff				

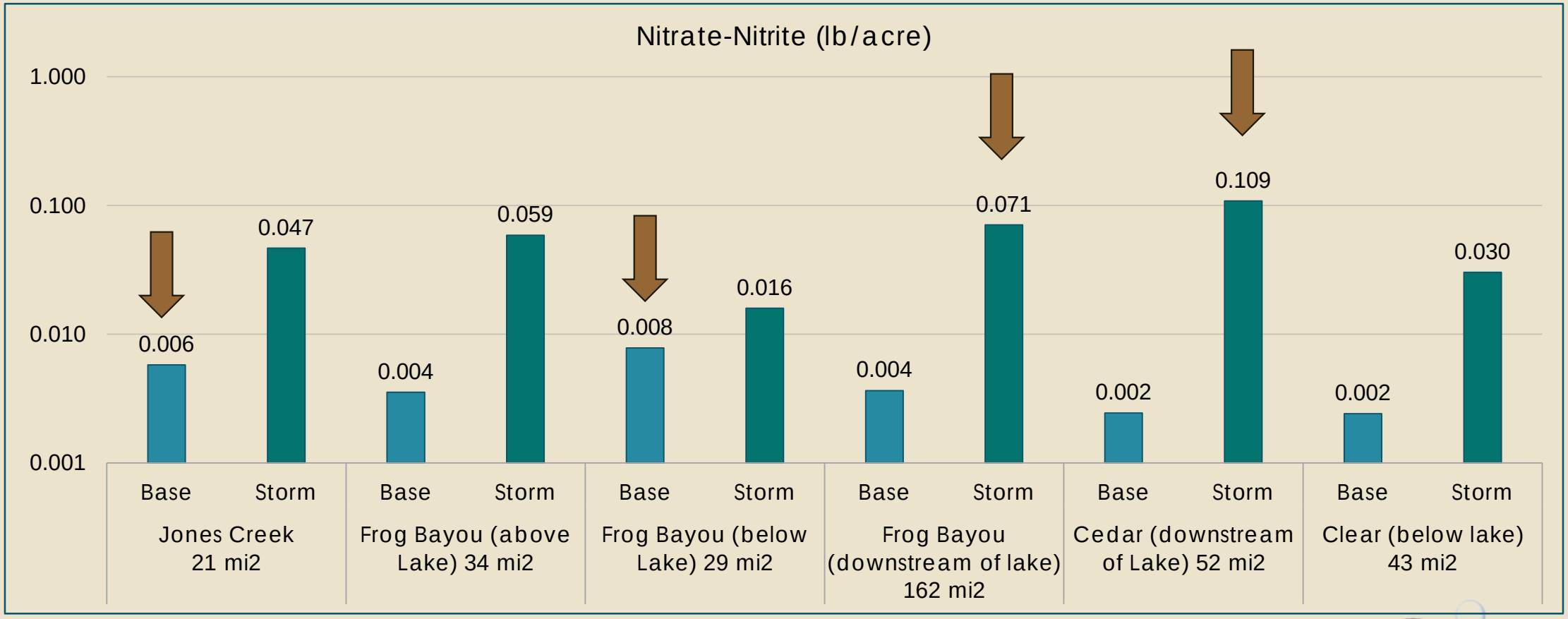
Fort Smith Utility

- Started off as Frog Bayou watershed study
- Identify large contributors to the drinking water source
- See what the lake was capturing/retaining

Base Flow VS Storm Flow



Let's Look at Nitrate



Made recommendations in WMP

Rank	Sub-watershed	Management Type	Management Action (Practice)
1	FB-1	Restoration	Stream bank stabilization
2	Jones-1	Restoration	Stream bank stabilization
3	Lake (FB-2)	Restoration	Stream bank stabilization
4	FB-1	BMP	Pasture management BMPs
5	Jones-1	BMP	Pasture management BMPs
6	Jones-1	BMP	Unpaved roads maintenance/upgrade
7	FB-1	BMP	Unpaved roads maintenance/upgrade
8	Lake (FB-2)	BMP	Unpaved roads maintenance/upgrade
9	Lake (FB-2)	BMP	Urban (developed areas) storm water BMPs
10	FB-1/Jones-1	Restoration	Restoration of riparian buffers on rural and urban land

TMDL Revision in South Arkansas

- EPA contracted company to write a TMDL
- The TMDL was written with little to no actual data used
- Still in process but overall the watershed has improved dramatically since the TMDL was written

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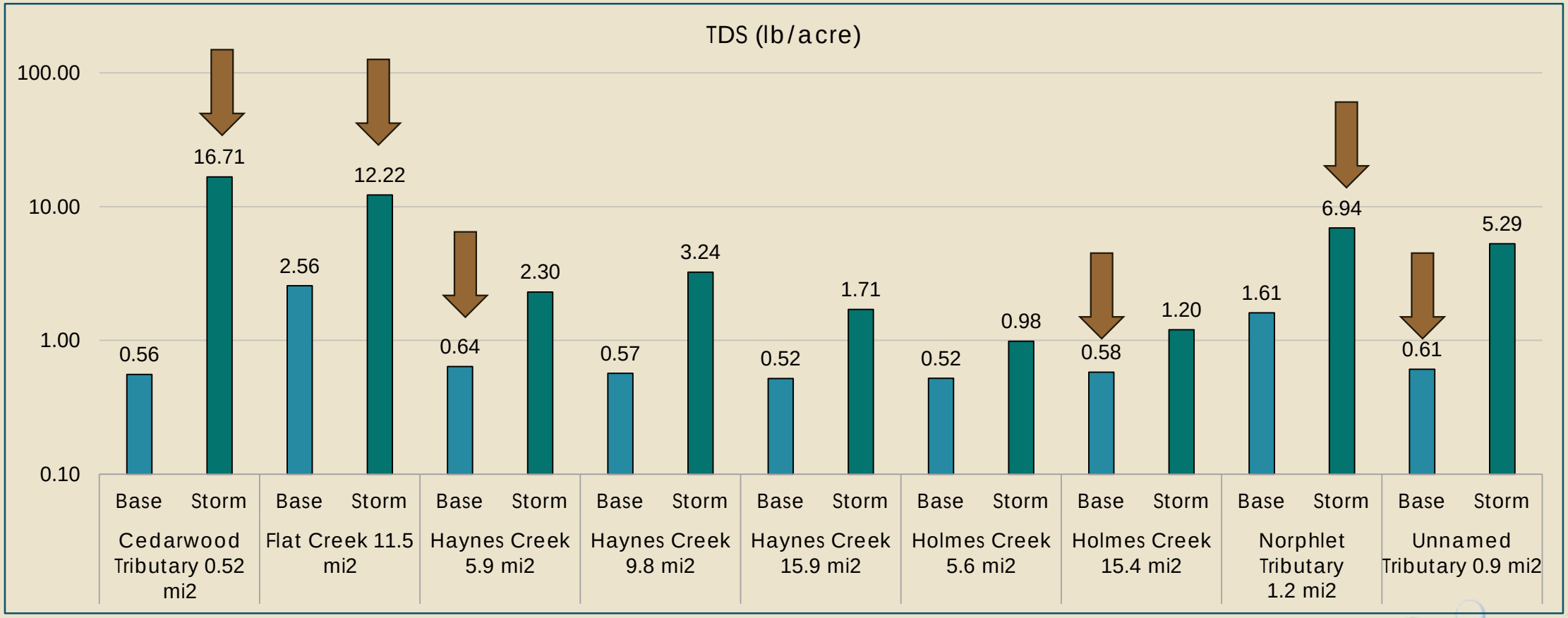
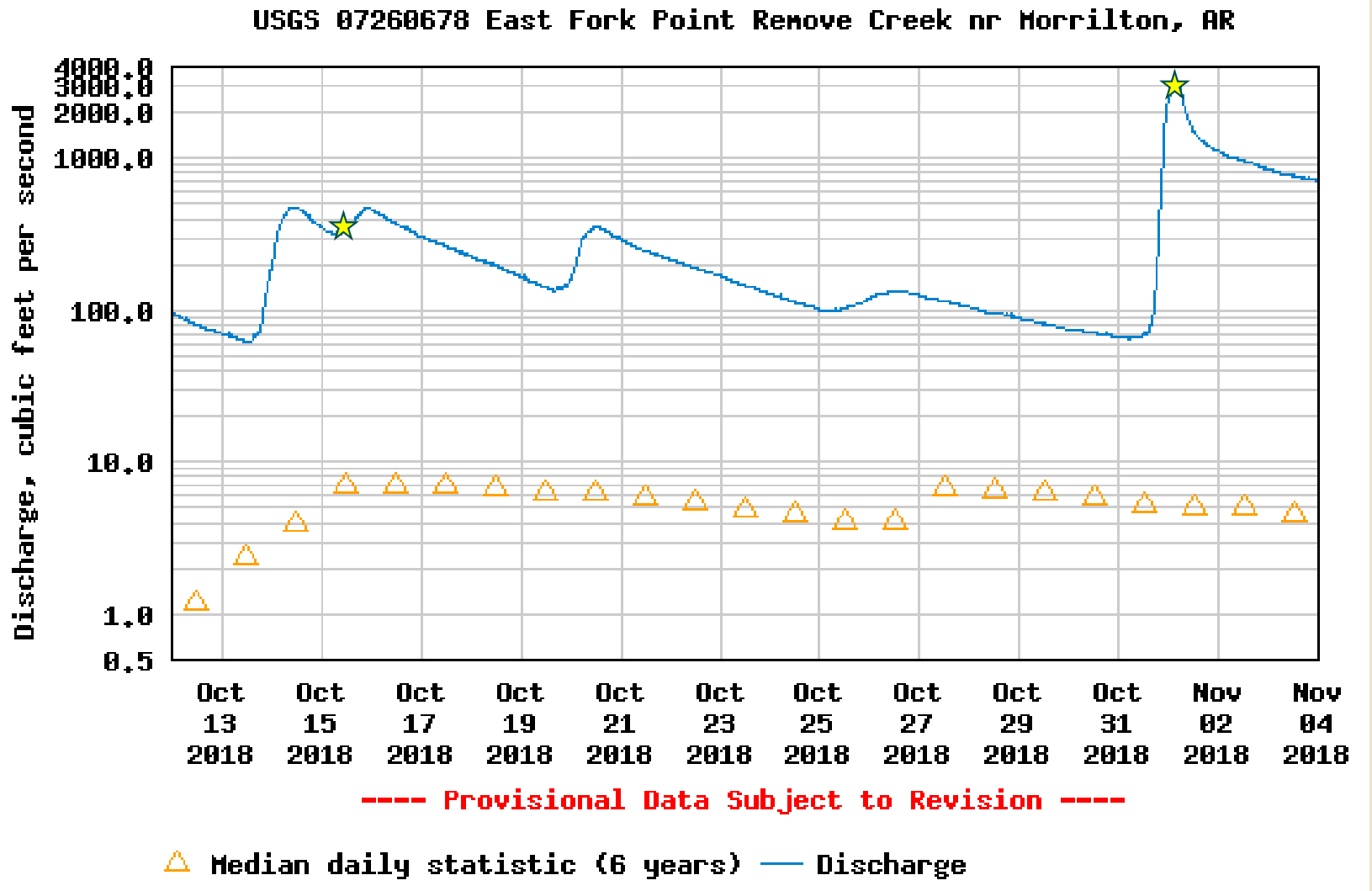
Base Flow VS Storm Flow

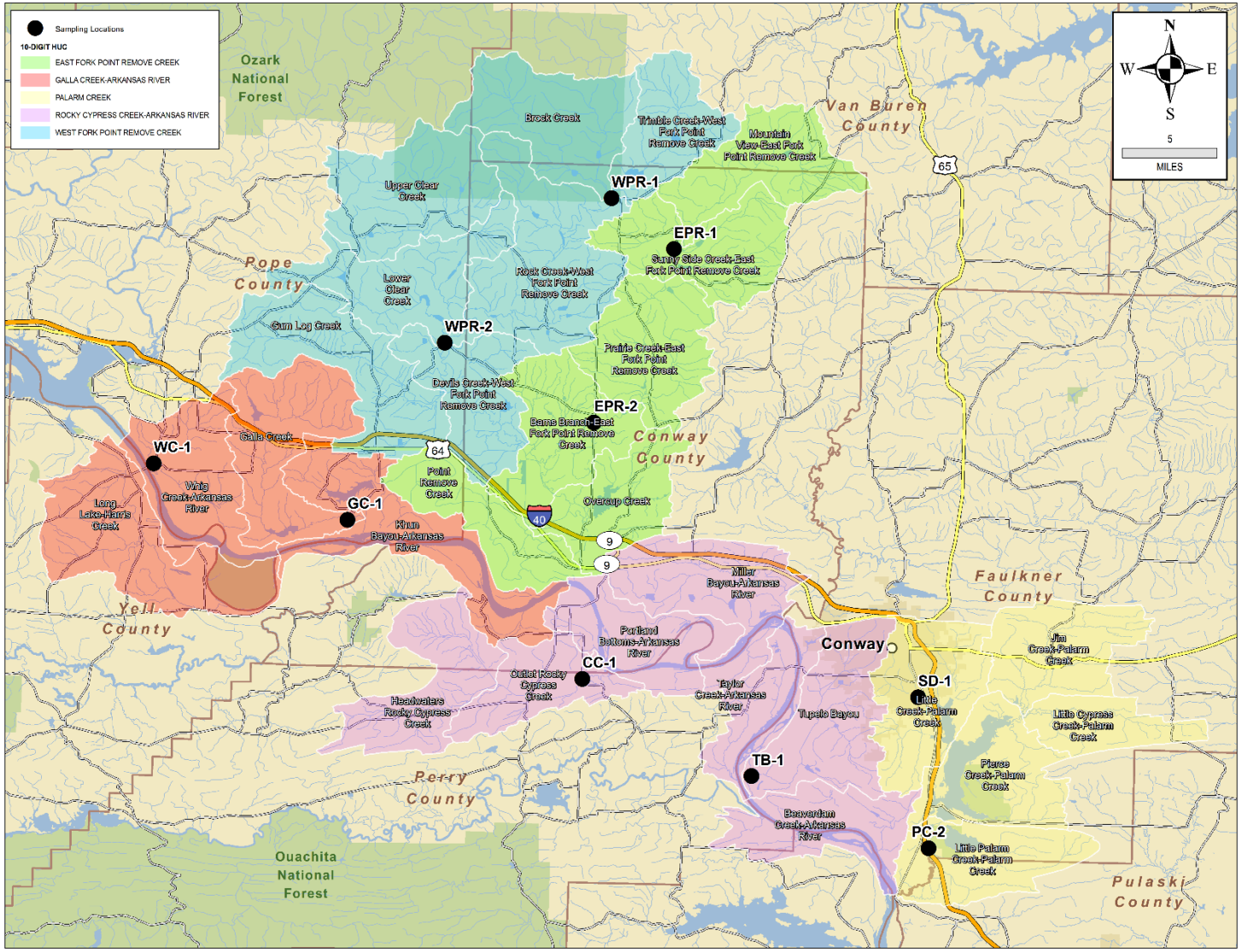


Timing Matters



- 10/15/18 1505 – 17.8
- 11/1/18 – 1040 – 59.7

Ongoing LCPR Project – 319 Nonpoint Source Grant



- Timing is important but a challenge

Such a large study area needs we felt 2 teams were needed

Team 1

- Total work time Team 1 : About 7.25 hour day
- Google Earth drive time is 3 hr 34 min
- Work time I project to be 3 hours 45 minutes

Order	Team 1	Watershed size (mi2)	Take flow?
1	LC-1	5	Yes
2	SD-1	8.1	Yes
3	TB-1	42	Yes
4	CC-1	59	Yes
5	GC-1	45	Yes

Team 2

- Total work time Team 2 : About 7 hour day
- Google Earth drive time is 4 hrs 11 min
- Work time I project to be 2 hours 45 minutes

Order	Team 2	Watershed size (mi2)	Take flow?
1	WC-1	13.5	Yes
2	WPR-1	74	Yes
3	EPR-1	57	Yes
4	WPR-2	222	No
5	EPR-2	100	No

Autosamplers are an alternative

- Come with their own challenges
- Did they trigger? Can we get to all of them within holding time?

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Conclusions

- Paints a different picture than base flow sampling
- Storm sampling comes with its challenges
- Storm sampling is very valuable information and where possible should be included in watershed studies

Questions?

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