

Update on 2008 Experimental High Flow Test and Observations

**Technical Workgroup Meeting
Phoenix, AZ - April 08, 2008
[1300 – 1330]**

**Ted Melis, David Topping, John Hamill, Paul Grams,
Matthew Andersen, Helen Fairley, Glenn Bennett
And Many Others**

**Grand Canyon Monitoring and Research Center,
U.S. Geological Survey, 2255 North Gemini Dr.
Flagstaff, AZ 86001**



Part I – Review of Science Tasks, Relevant Questions & Reporting

- Strategic Science Questions [Table 1]
- Projects & Budgets [Table 2]
- Strategy for Evaluating Test Results [Figure 4]
- Review of Completion Timeline [FY08-09]
- Synthesis of High Flow Testing [FY10]

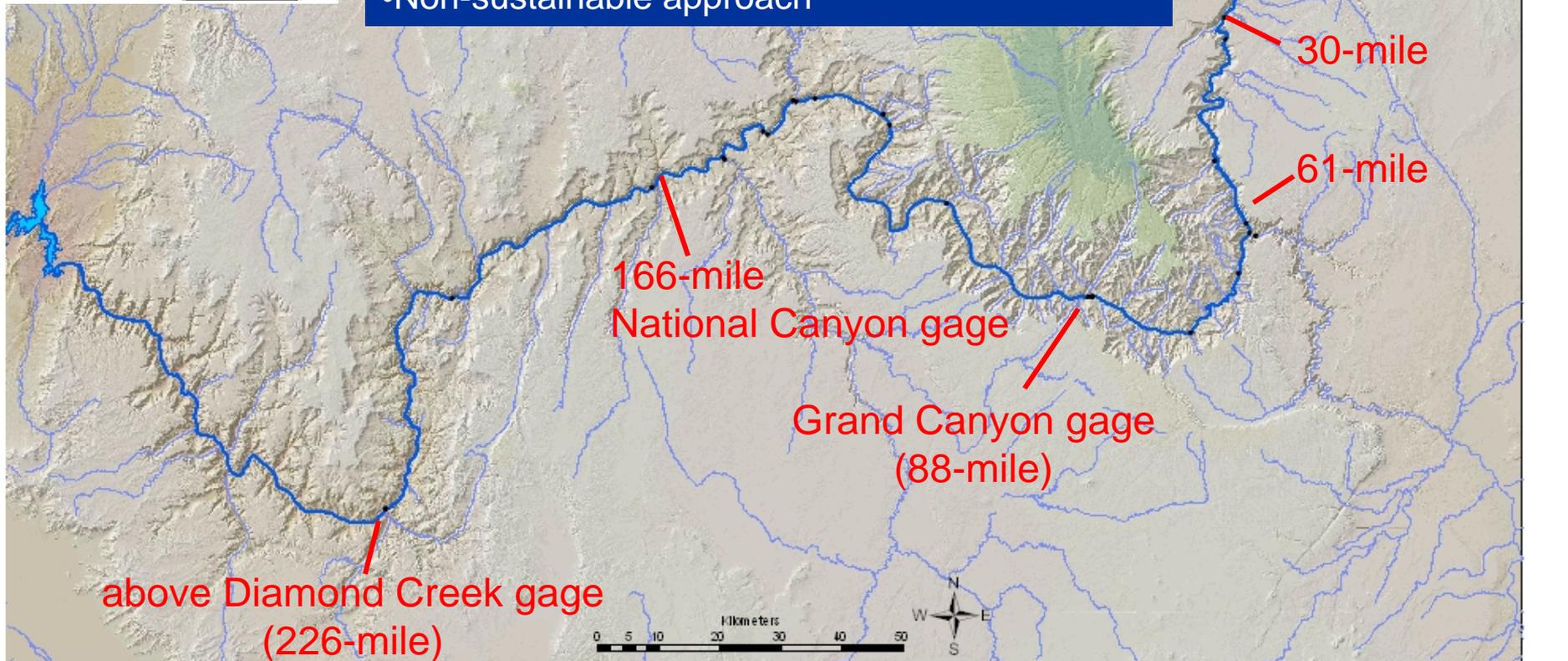
Part II – Early results from 2008 HFE



*All Observations and Results are Preliminary – Subject to Review
And Revision*

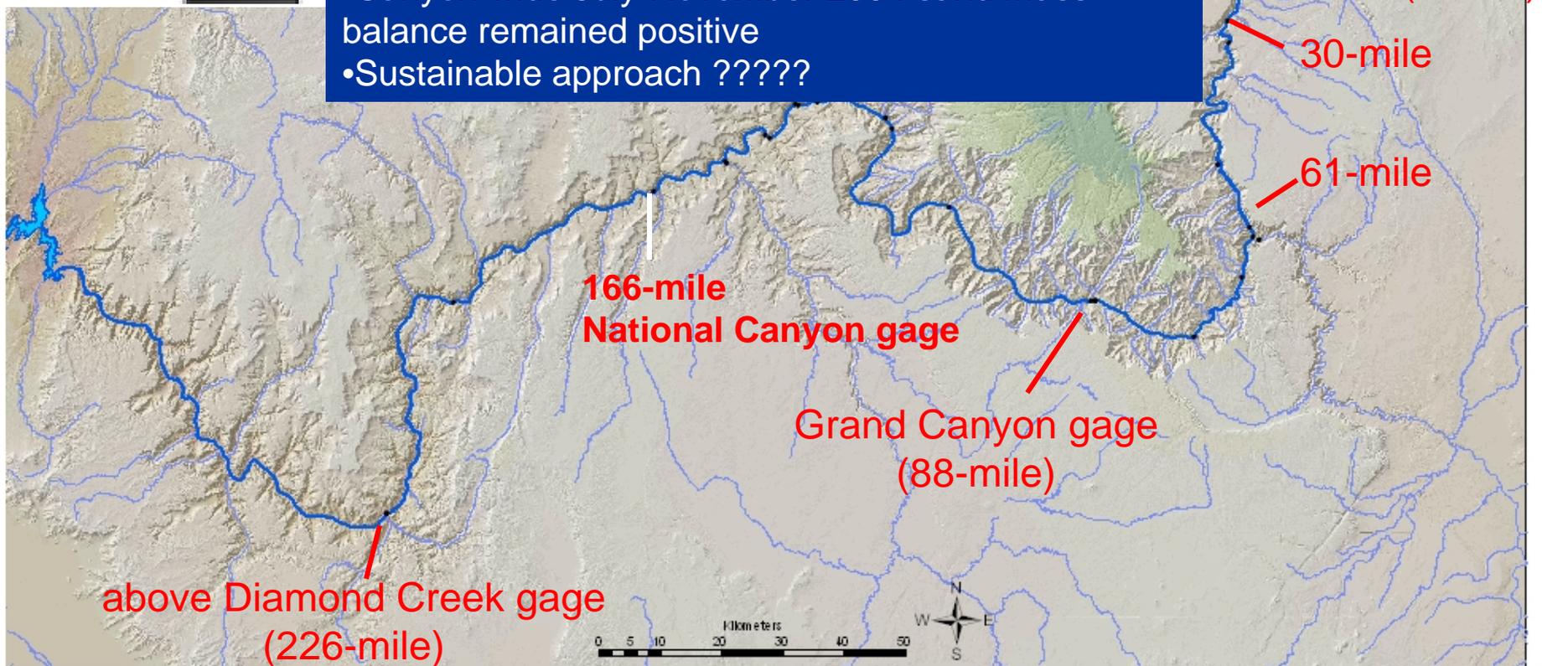
1996 synopsis

- No recent tributary sand enrichment prior to flood
- Erosion of upstream sandbars led to high-elevation sand deposition downstream
- Upstream sandbars did not rebuild during subsequent years
- Non-sustainable approach



2004 synopsis

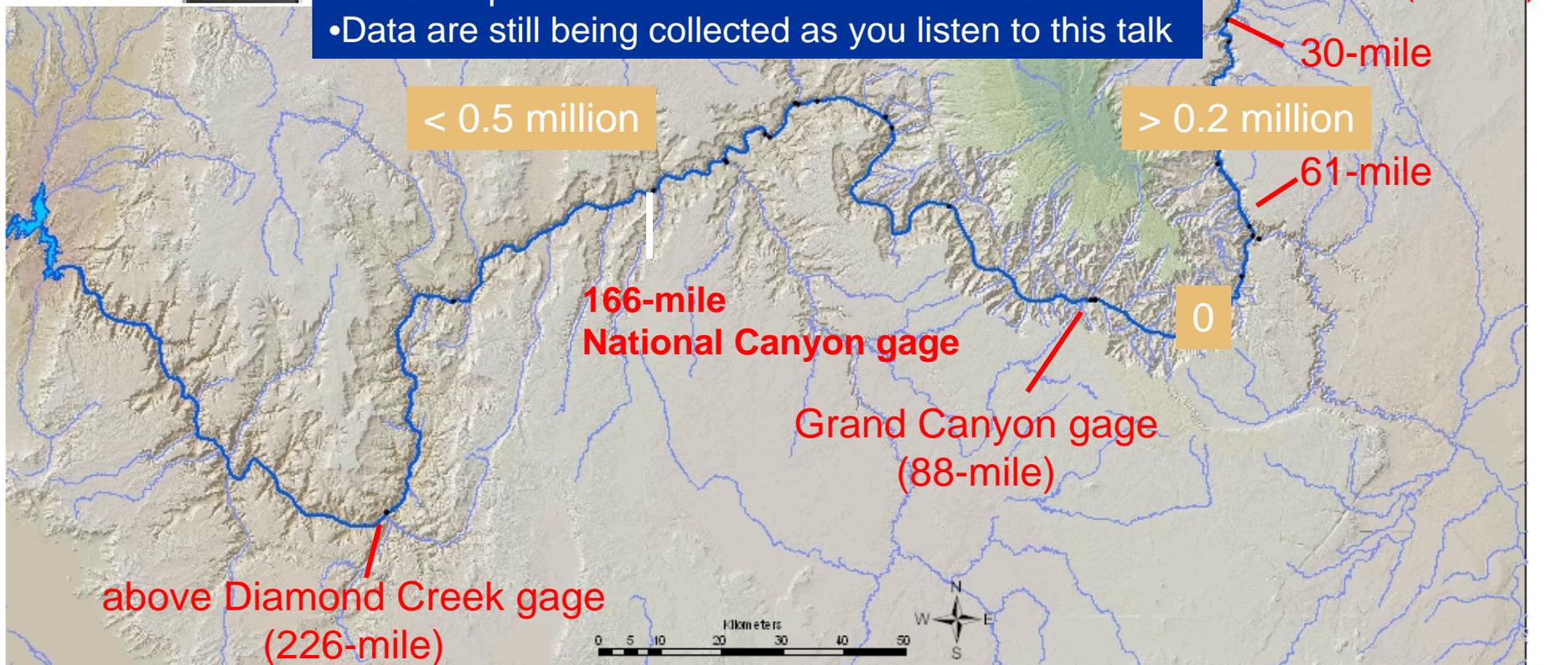
- > 800,000 metric tons of sand retained above river-mile 30 prior to flood (mostly above river-mile 8)
- Sandbars built between river-miles 1 & 40
- Downstream from river-mile 40, erosion of upstream sandbars led to high-elevation sand deposition downstream
- Canyon-wide July-November 2004 sand mass balance remained positive
- Sustainable approach ?????



2008 synopsis



- Demonstrable sand enrichment prior to flood in all reaches **except between river-miles 61 and 88**
- Sandbars eroded in uppermost Marble Canyon
- Impressive sandbar deposition in parts of lower Marble Canyon and eastern Grand Canyon
- October 2006-March 2008 sand mass balance remained positive between river-miles 1 and 88
- Data are still being collected as you listen to this talk

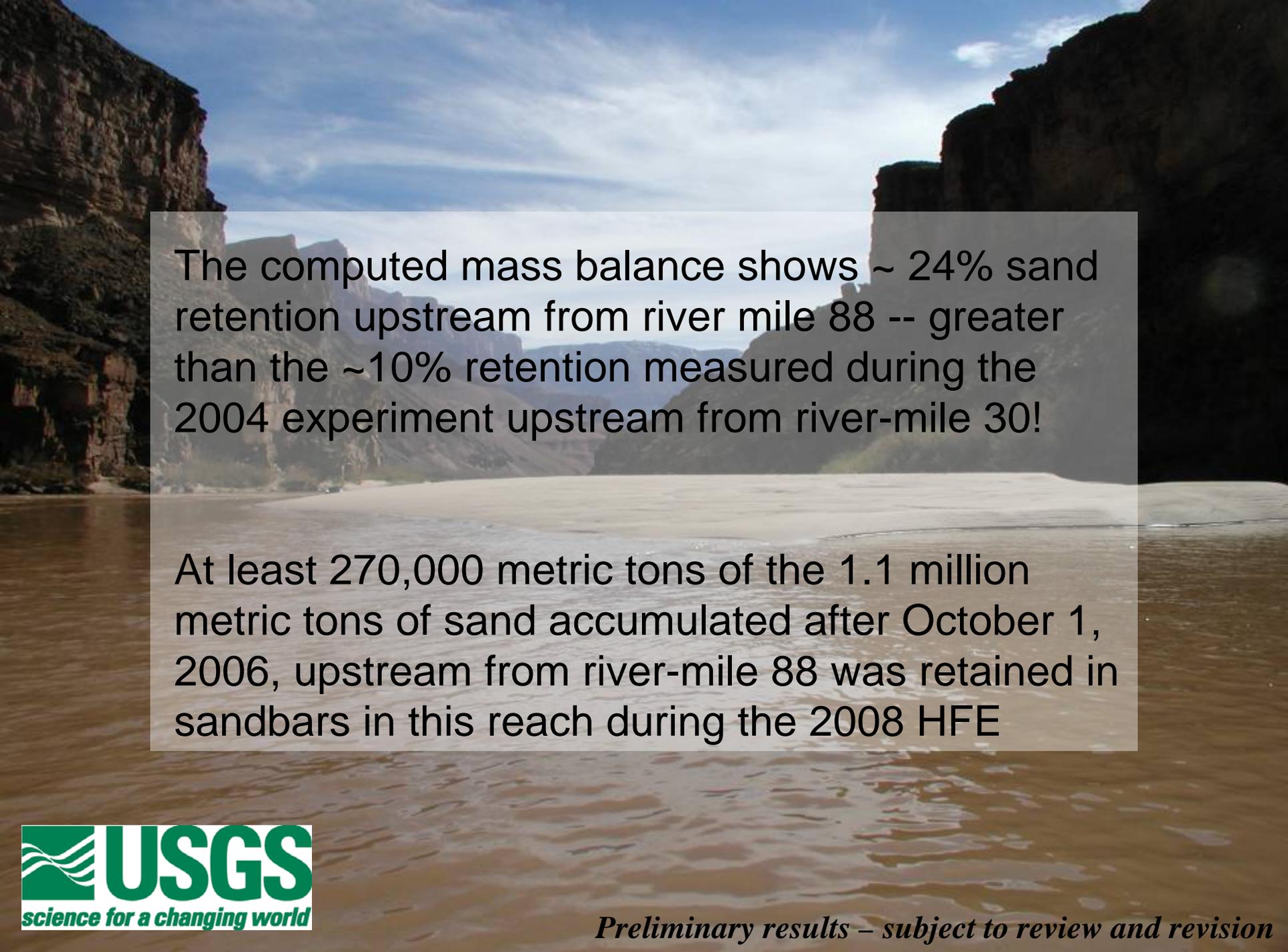


Part III – Sand Transport Monitoring During 2008 Test at Phantom Ranch

2008 Test Hydrograph vs. 2004 or 1996 Tests?

What Does Suspended Sand Data Tell Us?

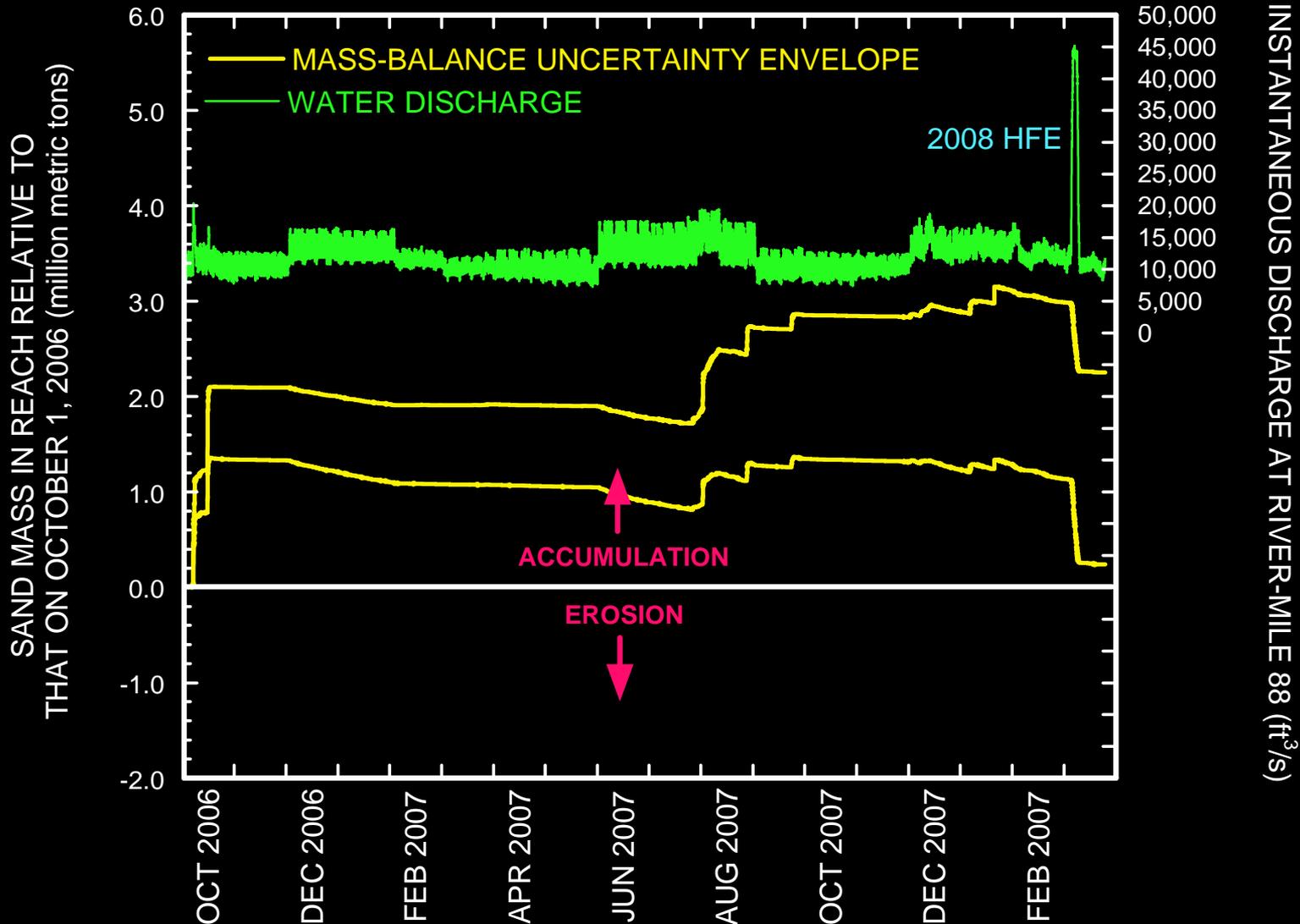
How Was Sand Transport Different in 2008 Test?



The computed mass balance shows ~ 24% sand retention upstream from river mile 88 -- greater than the ~10% retention measured during the 2004 experiment upstream from river-mile 30!

At least 270,000 metric tons of the 1.1 million metric tons of sand accumulated after October 1, 2006, upstream from river-mile 88 was retained in sandbars in this reach during the 2008 HFE

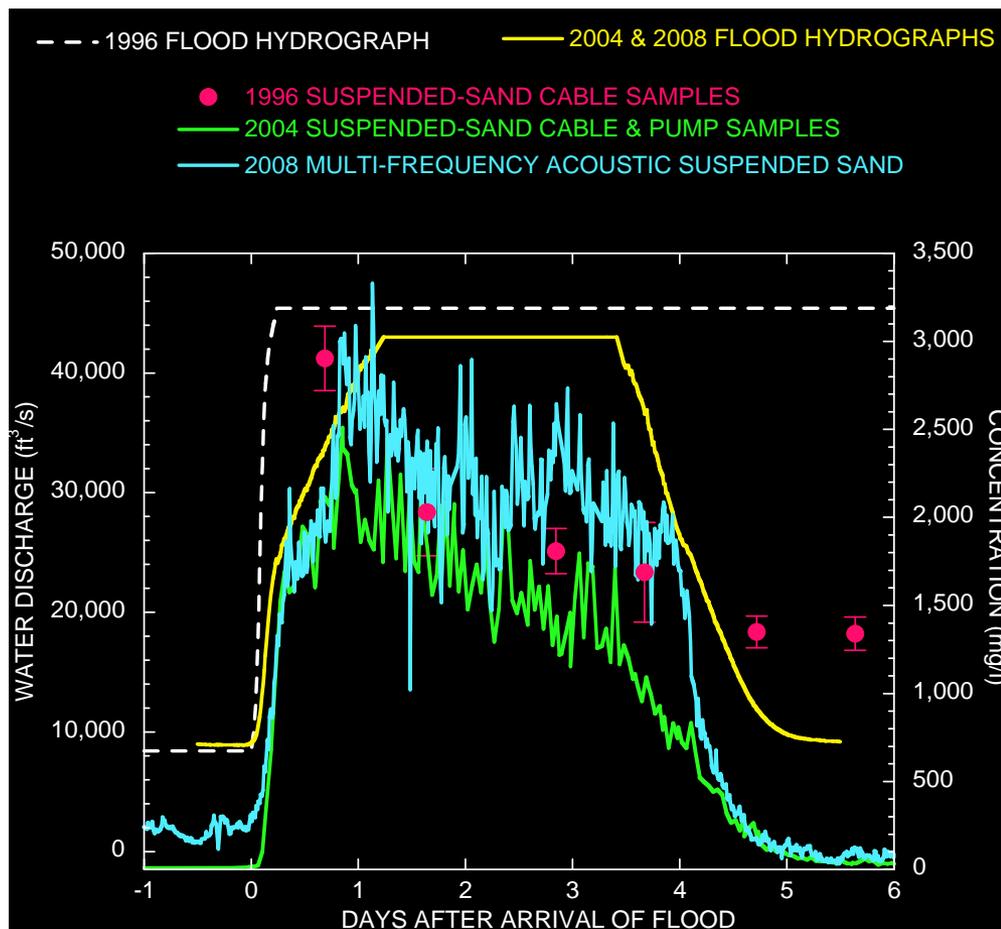
OCT 2006 - MAR 2008 MASS-BALANCE SAND BUDGET FOR MARBLE CANYON AND EASTERN GRAND CANYON (river-miles 1-88)



Demonstrable > 270,000 metric tons sand retention!

Preliminary results – subject to review and revision

- Concentrations at beginning of 2008 HFE were similar to during initial parts of 1996 and 2004 controlled-flood experiments
- But concentrations decreased more slowly during the 2008 HFE than either the 1996 or 2004 controlled-flood experiments
- Thus, the river was most sand enriched at this site during the 2008 HFE, likely as a result of the downstream export of sand stored in lower Marble Canyon prior to the 2008 HFE.



Part IV – Initial Photographic Data

“A Tale of Winners & Losers”

Long Term (Cathedral Wash) Site in Upper Marble?

Backwater Study Site in Upper Marble?

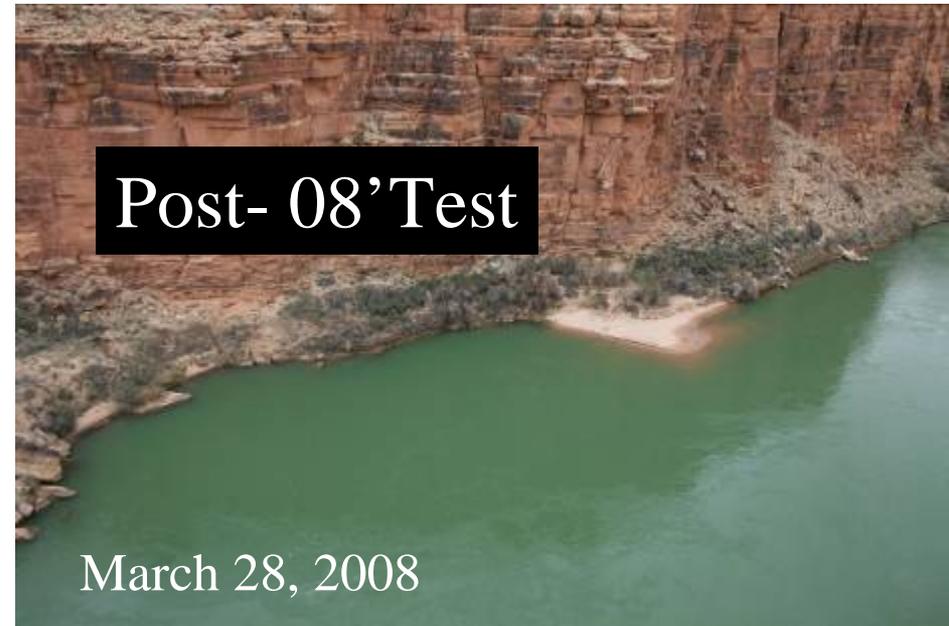
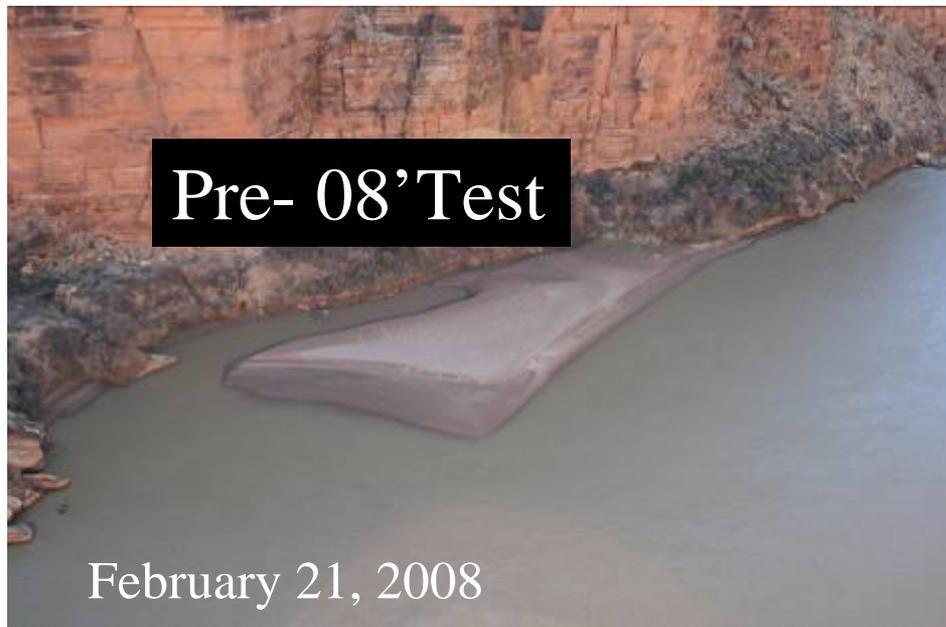
Sandbars in Lower Marble Canyon?

A Few Sandbars Between LCR and Phantom?

Photographic Data – RM 2

LOSERS WHERE WE NEEDED WINNERS MOST?

Matched Photos – Above Cathedral Wash - River Left
A Clear “Backwater” Loser in 2008 Test



Photographic Data – RM 3

Matched Photos – Above Cathedral Wash - River Left

Professor Emmett Laursen Predicted Net Erosion in 1976!



October 1987



March 29, 2008

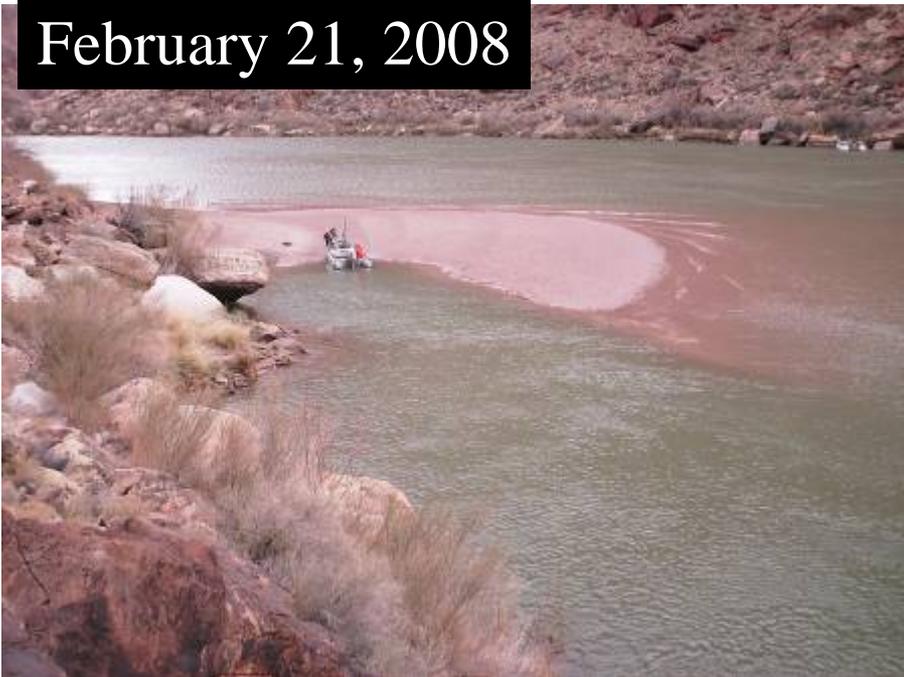


This Isn't What Was There After 83'

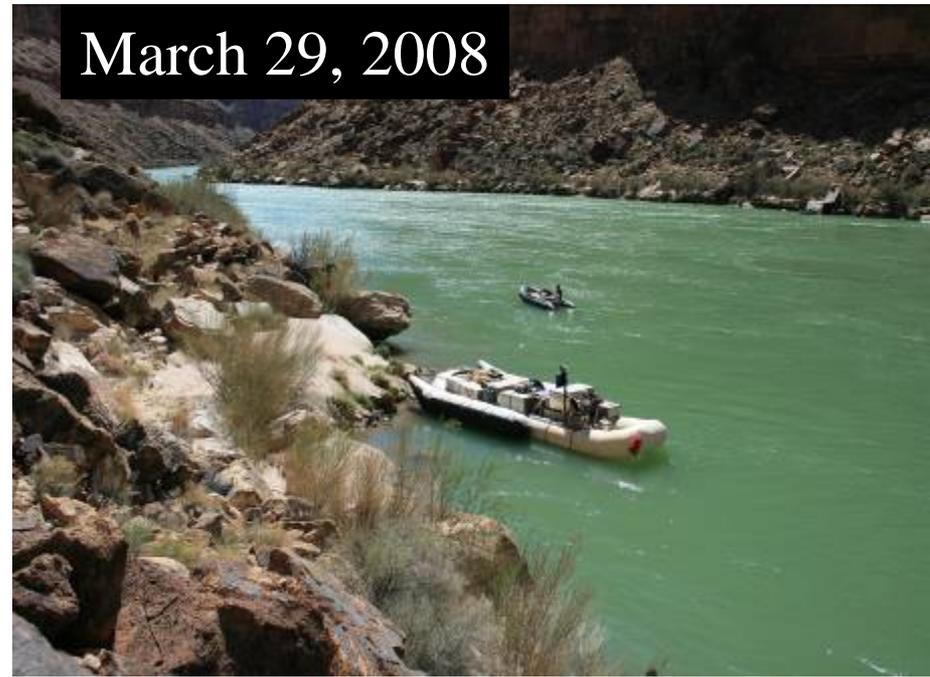
Photographic Data – RM 6

Matched Photos – Below Six Mile Wash on River Left
Another Backwater Habitat Gone

February 21, 2008



March 29, 2008



Despite the Fact that there were approximately
1 Million Metric tons of Sand was Above 30-Mile?

Photographic Data – RM 16

Matched Photos – Hot Na Na Camp on River Left

Pre-HFE 2008



Post-HFE 2008



Photographic Data – RM 22

Matched Photos – 22-Mile on River Right
A Backwater Habitat Gain

Pre-HFE 2008



Post-HFE 2008



Photographic Data – RM 23

Matched Photos – “Harry McDonald” Camp on River Left

Pre-HFE 2008



Post-HFE 2008



Photographic Data – RM 30

Matched Photos – 30-Mile on River Right
Another Backwater Habitat & Campsite Gain

Pre-HFE 2008



Post-HFE 2008



Photographic Data – RM 30R

Matched Photos – “Fence Fault” Camp -River Right
A Gain Similar to the 2004 Response

Pre-HFE 2008



Post-HFE 2008



Photographic Data – RM 31R

Matched Photos – South Canyon Camp

Higher & Wider!

Pre-HFE 2008



Post-HFE 2008



Photographic Data – RM 34L

Matched Photos – on River Left “Nautaloid Camp”

Pre-HFE 2008



Post-HFE 2008



Photographic Data – RM 41L

Matched Photos – on River Right “Buck Farm Camp”

Pre-HFE 2008



Post-HFE 2008



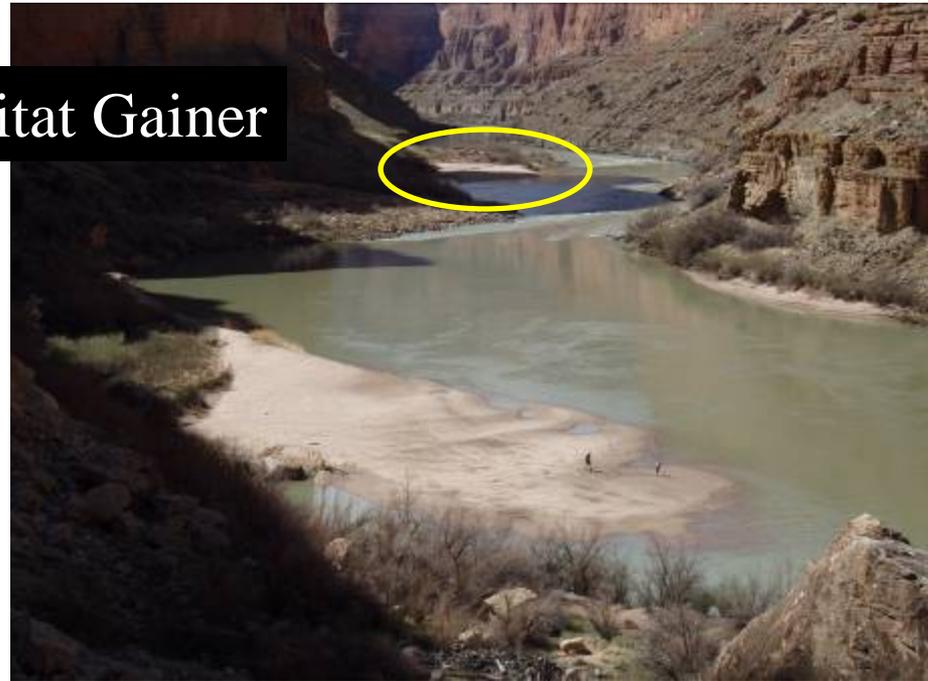
Photographic Data - RM 45L

Matched Photos – Eminence Break Eddy – Long-Term Study Site



Backwater Habitat Gainer

Pre- 08' Test



Post- 08' Test

Photographic Data – RM 45.3L

Matched Photos – 45-Mile on River Left
Starved Reattachment Bar?

Pre-HFE 2008

Post-HFE 2008



Photographic Data – RM 45L

Matched Photos – “Willie Taylor Site” on River Left
Another Backwater Gain Here

Pre-HFE 2008



Post-HFE 2008



Photographic Data – RM 51L

Matched Photos – on River Left Above Nankoweap
What Happened Here?

Pre-HFE 2008



Post-HFE 2008



Photographic Data – RM 55R

Matched Photos – Kwagunt Marsh

Pre-HFE 2008



Post-HFE 2008



Photographic Data – RM 65L

Matched Photos – on River Left Above Lava-Chuar
Higher, Not Wider?

Pre-HFE 2008



Post-HFE 2008



Photographic Data – RM 81L

Matched Photos – Grapevine Camp
Higher & Wider!

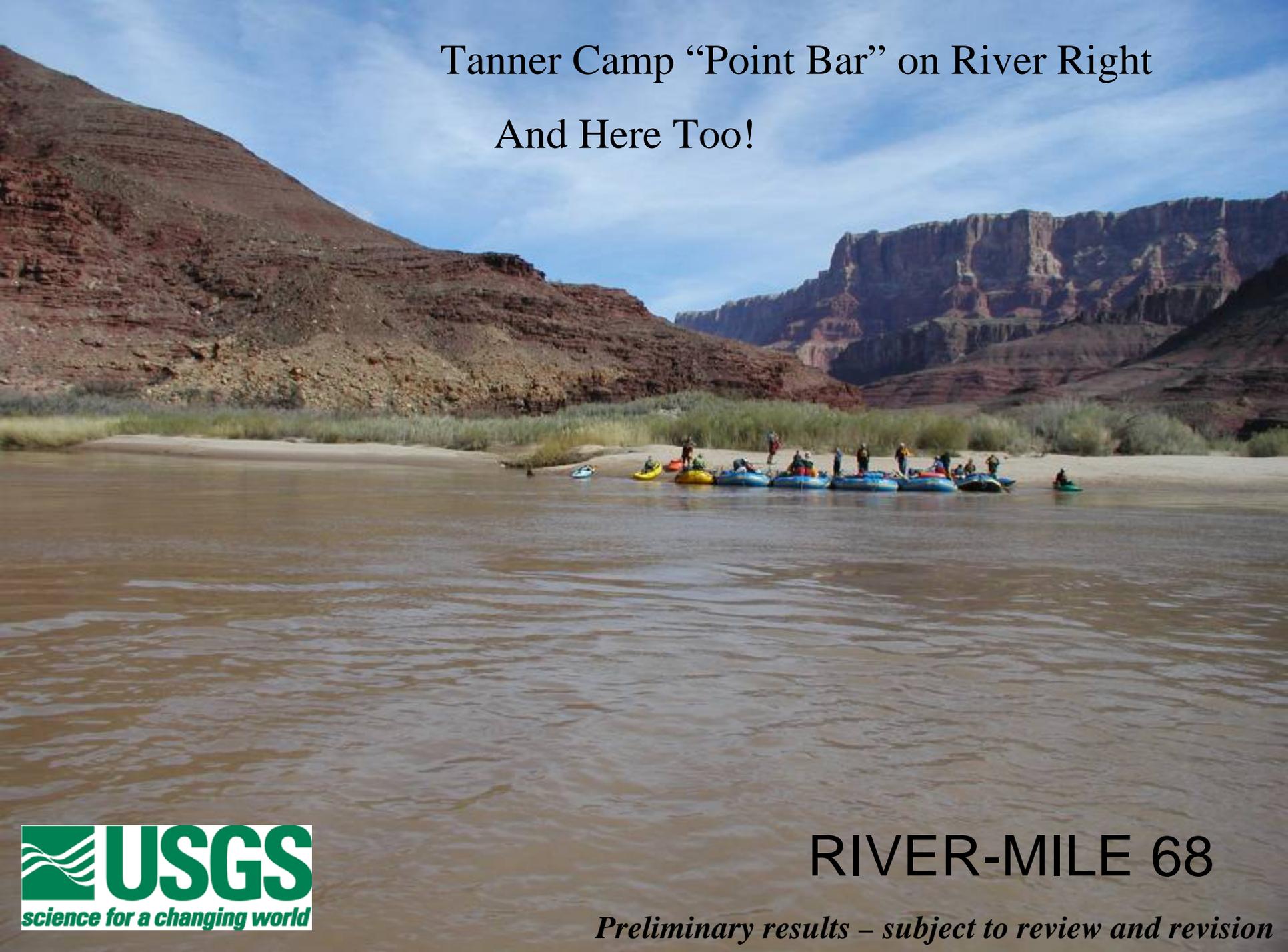
Pre-HFE 2008



Post-HFE 2008



Tanner Camp “Point Bar” on River Right
And Here Too!



Zoroaster Camp
Below Clear Creek - River Left

**Especially Good Results in Critical
Camping Site Reaches!**



RIVER-MILE 84

Preliminary results – subject to review and revision

When Will Results Be Finalized?

WELL, WE HAVE OVER 1,000
SUSPENDED-SEDIMENT SAMPLES TO
PROCESS....STAYED TUNED FOR
UPDATES in 2008-09'



Thanks for Your Attention!