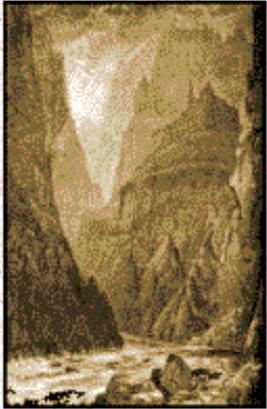


Grand Canyon Monitoring and Research Center  
**Revisiting Experimental Flow Designs For  
Sediment and Fishery Resources  
WY 2005 and Beyond**

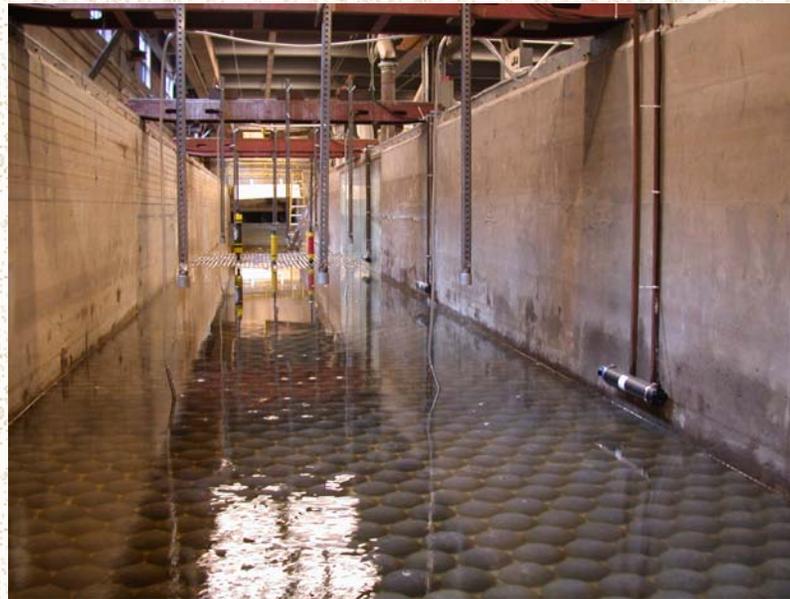




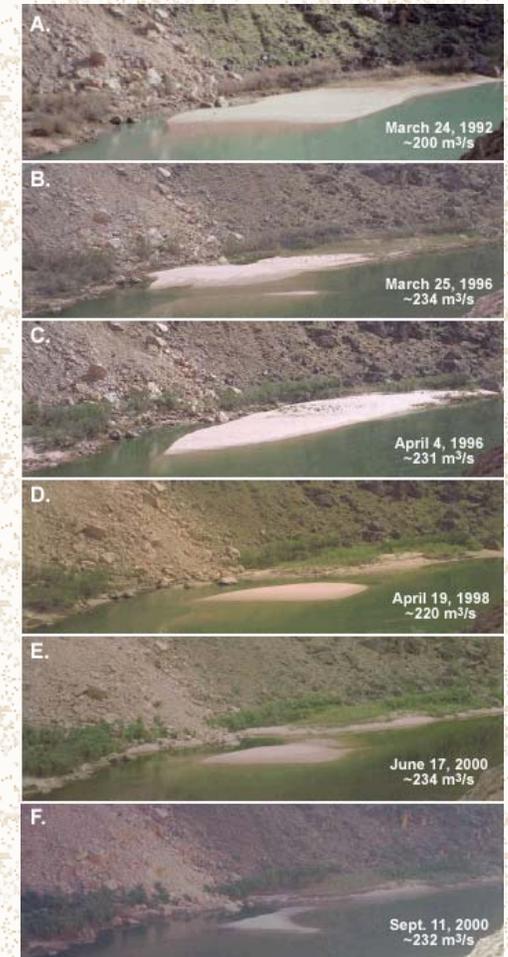
## Southwest Biological Science Center - GCMRC

### Experimenting with Sand

**Sand Export and Conservation** *For any monthly volume, a steady flow should transport less sand than any diurnal fluctuating flow regime (true for a flume, but perhaps not for the CRE owing to the confounding issue of hundreds of eddies that act as both “sinks” & “sources.”)*



**Main Channel Flume at St. Anthony Falls Laboratory  
Minneapolis, MN on the Mississippi River**





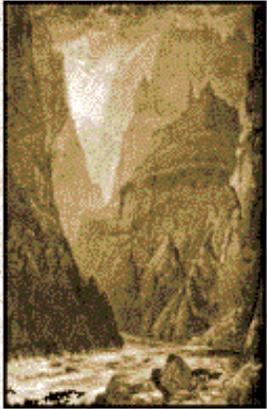
## Southwest Biological Science Center - GCMRC Experimenting with Sand Scenario #2

**Sand Bars within Eddies** *Might increase in size during brief periods of fluctuating flows following sand inputs from the Paria River (temporarily increasing sand availability prior to controlled floods that occur shortly thereafter)*



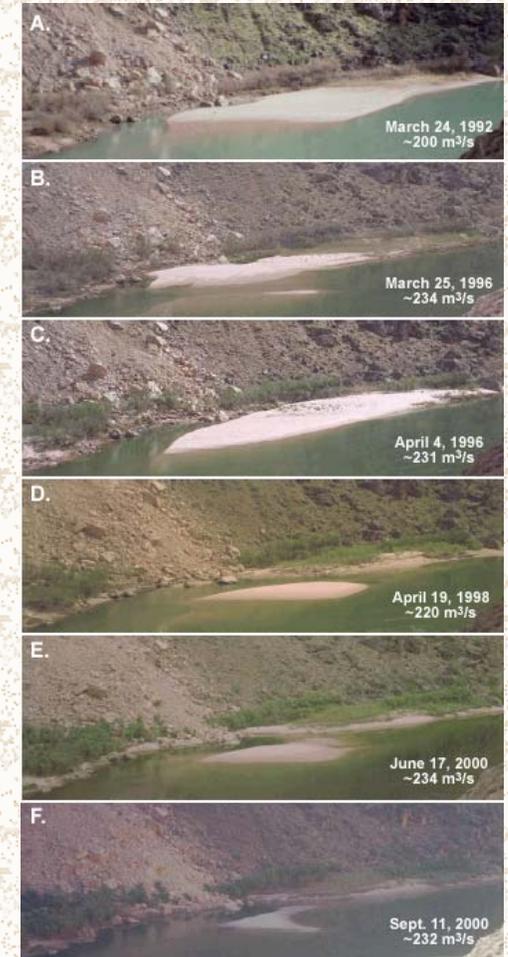
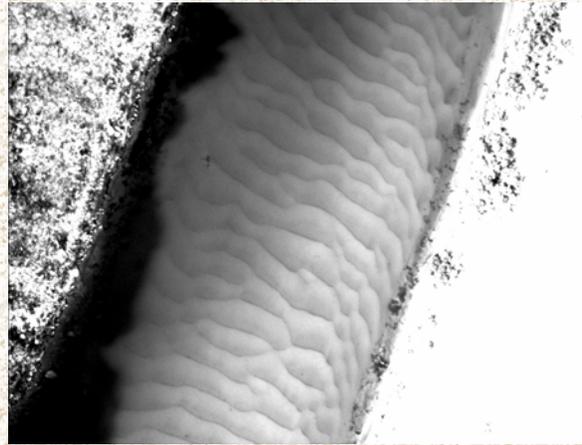
**Eminence Reattachment Bar – April 23, 2004**

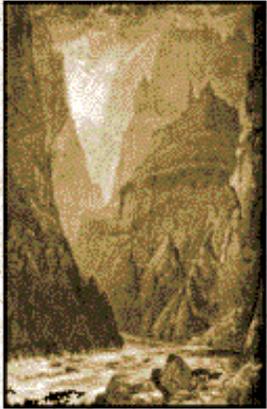




## Southwest Biological Science Center - GCMRC Experimenting with Sand Scenarios 1 & 3

**Sand Storage in the Main Channel** in scenario #1 is optimized throughout the system by flows that equate to the pre-dam mean, daily discharge (scenario #3 may have limited potential owing to the fact that large Winter sand inputs from the Paria River are relatively rare)

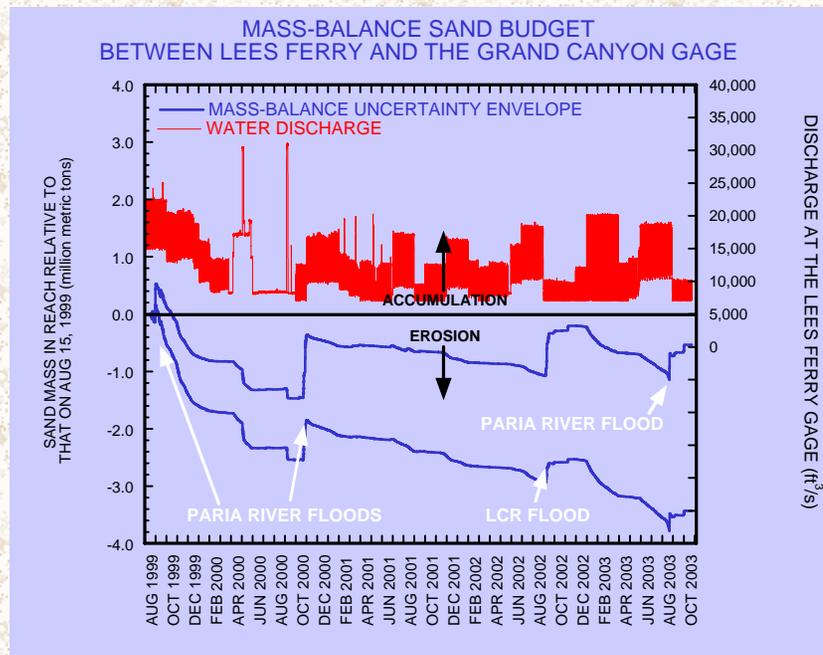


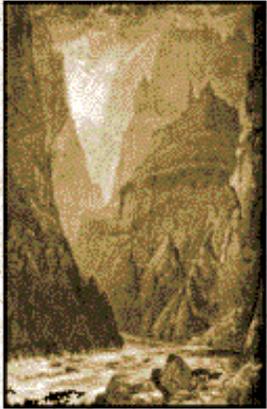


# Southwest Biological Science Center - GCMRC

## Why Pursue the “Blocked” Approach for Fish?

**Sorting Out Sand Options** is relatively easier with respect to establishing cause & effect compared with answering fishery questions (the current sediment experiments build on the knowledge gained from the 1996 test and the monitoring since 1999)



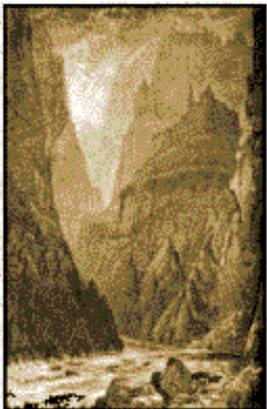


## Southwest Biological Science Center - GCMRC

### Why Pursue the “Blocked” Approach?

**Long-Term Implementation** *is focused on Flow and Non-Flow treatments that are related to Reasonable and Prudent Alternatives, as well as Non-RPA ideas about elements of ecosystem changes in the post-dam era, such as introduced non-native fish and reduced turbidity*





# Southwest Biological Science Center - GCMRC

## The Original “Blocked” Approach of 2002, with Five Treatments

	Increased Fluctuations In Daily Flows	Mechanical Removal of Rainbow Trout in GC	Stable-Low Flows in Fall	TCD (Future)	Beach Habitat Building Flow
WY2002-03	Green	Green	Green	Red	Green
WY2003-04	Green	Green	Red	Red	Red
WY2004-05	Red	Green	Green	Red	Red
WY2005-06	Red	Green	Red	Red	Red
WY2006-07	Red	Red	Green	Red	Green
WY2007-08	Red	Red	Red	Red	Red
WY2008-09	Green	Red	Green	Red	Red
WY2009-10	Green	Red	Red	Red	Red
WY2010-11	Green	Green	Red	Green	Green
WY2011-12	Green	Green	Red	Green	Red
WY2012-13	Red	Green	Green	Green	Red
WY2013-14	Red	Green	Red	Green	Red
WY2014-15	Red	Red	Green	Green	Green
WY2015-16	Red	Red	Red	Green	Red
WY2016-17	Green	Red	Green	Green	Red
WY2017-18	Green	Red	Red	Green	Red



# Southwest Biological Science Center - GCMRC

## The Revised “Blocked” Strategy with Two Controlled and Two Randomized Treatments

Water Year	Flow Treatment (Jan – Apr, Aug– Dec)	Mechanical Removal of Rainbow Trout in GC (Jan-Mar, Jul - Dec)	Temperature Control Device/Low Reservoir Releases	Beach Habitat Building Flow (Jan – Jul)
WY2002-03	Fluctuating	Remove Fish	Random	Event Driven
WY2003-04	Fluctuating	Remove Fish	Random	Event Driven
WY2004-05	Stable	Remove Fish	Random	Event Driven
WY2005-06	Stable	Remove Fish	Random	Event Driven
WY2006-07	Fluctuating	Do Not Remove Fish	Random	Event Driven
WY2007-08	Fluctuating	Do Not Remove Fish	Random	Event Driven
WY2008-09	Stable	Do Not Remove Fish	Random	Event Driven
WY2009-10	Stable	Do Not Remove Fish	Random	Event Driven
WY2010-11	Fluctuating	Remove Fish	Random	Event Driven
WY2011-12	Fluctuating	Remove Fish	Random	Event Driven
WY2012-13	Stable	Remove Fish	Random	Event Driven
WY2013-14	Stable	Remove Fish	Random	Event Driven
WY2014-15	Fluctuating	Do Not Remove Fish	Random	Event Driven
WY2015-16	Fluctuating	Do Not Remove Fish	Random	Event Driven
WY2016-17	Stable	Do Not Remove Fish	Random	Event Driven
WY2017-18	Stable	Do Not Remove Fish	Random	Event Driven