Melis' – MAY 20, 2015 comments on "**Lees Ferry Recreational Trout Fishery Management Recommendations: The Voice of Lees Ferry Anglers, Guides, and Businesses"**

I defer to my fisheries colleagues on most of the content of the draft plan that is beyond my expertise, but offer the following comments/observations in response to several sections of the plan that I have had experiences with.

Lines 1-200: no comments.

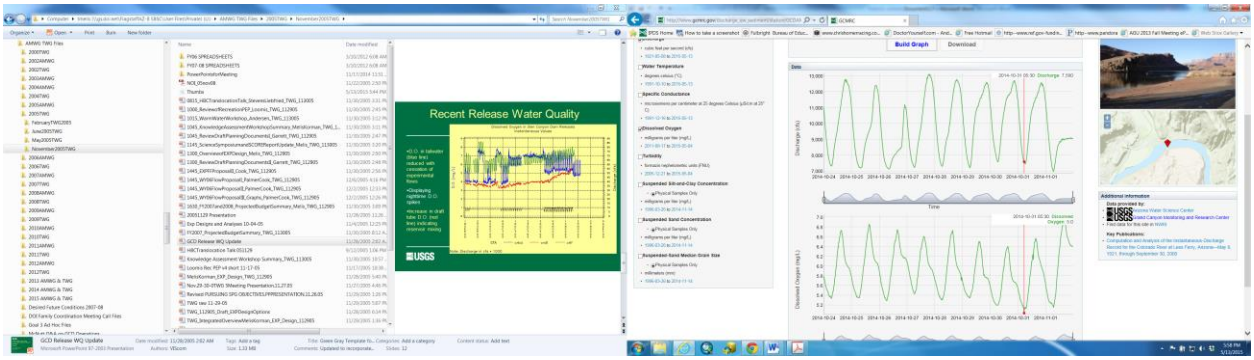
Lines 201-247: Although there have been warmer releases from the dam over the last decade, the warming seems to have been too limited to effect any significant changes in the food base below the dam, so it's reasonable I guess to suspect that fluctuations are the main reason why the tailwater segment has never supported flies – hence, more advocacy for steadier flows (they were supposed to be the cure-all in the first EIS).

It's hard though to understand how the trout fishery was able to exist at all, let alone thrive as it apparently did under the early era of unrestricted daily operations, and without EPT, no less? I would have hoped by now that some of the stakeholders might have advocated for a comprehensive synthetic analysis of the Lake Powell QW and biological data, at least in some attempt to better understand the history of the tailwater and its food base trends (including aquatic vegetation) through time… still hoping it might happen.

Lines 249-255 – Dam operations:

I find it to be a little more than ironic that historically the "best" conditions alluded to for the trout fishery below the dam, as well as periods when large prey items for fish were apparently more abundant (*gammerus*) coincide with the period of most unsteady dam releases (1960s-1980s). The available data since dam operations began to be less unsteady (1991 to now) seem to coincide with the poorer and more varied population dynamics of trout and reduced abundance of scuds (albeit, another exotic species). Extended periods of steady flows, both high (2011) and low (2000) appear to have mostly elevated RBT survival, which appears to have had a de-stabilizing influence on both the recreational fish population, economics of the area and abundance of available invertebrates for fish.

Lines 257-261 - Minimum Flows:



I think that the issue of low flows and low DO needs to be looked at a bit more carefully, and perhaps the GCMRC comments on the draft plan provide an opportunity to clarify some points.

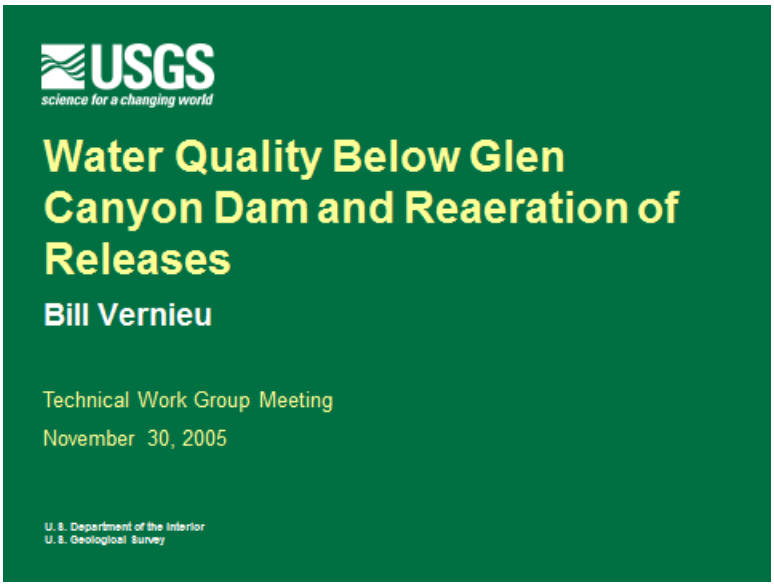
The plot on the right-above, clearly shows from data collected at Lees Ferry in late OCT 2014, that the lowest daily levels of DO in the tailwater fishery occurred at the lowest dam releases – flows that ranged down to about 7,000 cfs. So, perhaps from these data one would conclude that lower flows will always equate to lower DO, but that was the focus of the "low-turbine release" experiments conducted jointly by GCMRC and BuRec in fall 2005 (plot on left-above, and slides to follow).

By operating some of the turbines at release levels lower than would normally be scheduled, DO levels were actually observed to increase during the 2005 experiments, and this was only done at night when power plant operations were "off-peak". Also, recall that dam releases in 2005 were the warmest between 2003 and present, so trying to repeat these "experimental" releases in future periods of combined conditions of warm water and low DO releases seems like something that the group may want to actually propose for continued testing, rather than oppose?

I don't know for sure how the individual turbines were operated at night during fall 2014, but I must assume that they were not being operated in a way similar to tests conducted in fall 2005 (engineers did not want to do it, but did for the sake of science I guess).

So, I think that we need to be clear that there are different ways of releasing "low flows" from GCD and some of them might result in elevated DO levels (fall 2005), while others will result in the lowest DO conditions of a given day (fall 2014).

See PPT slides (below) presented on this topic by Bill Vernieu at TWG meeting in NOV 2005, following these "ad hoc" flow experiments (no compliance was done for these to my knowledge, as flows remained within 1996 ROD, but engineers were not keen on running the turbines like they did for any downstream environmental reasons (or any reason at all, apparently)).



Lake Powell Hydrology

- Surface elevation - 3555 ft on April 8, 2005
- Lowest elevation since May 1969
- 38 % of total capacity
- 145 ft below full pool elevation of 3700 ft
- Large amount of deltaic sediment exposed in inflow areas

USGS

2005 Inflow to Lake Powell

- Apr-Jul 2005 unregulated inflow 8.813 maf
- 111% of normal
- Surface elevation - 3608 ft on July 13, 2005
- Increase of 53 ft in 2005
- Resuspension of large amount of sediment from inflow areas
- Resulted in low dissolved oxygen levels in inflow plume as it traveled through reservoir

USGS

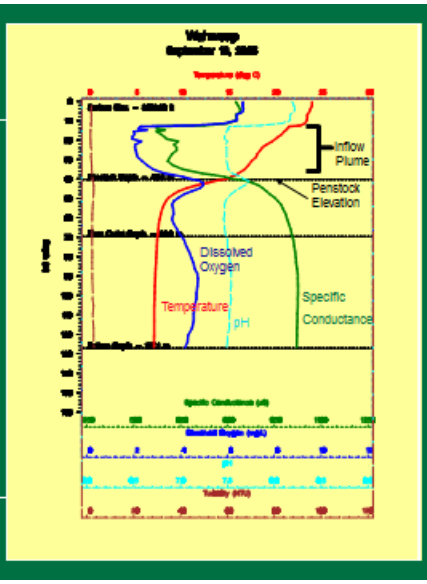
Forebay Water Quality

September 13, 2005

Inflow plume beginning to affect Glen Canyon Dam releases

- Inflow plume
  - 13m-38m
  - Minimum D.O. 1.9 mg/L
- Glen Canyon Dam Release
  - T - 14.5 °C (58 °F)
  - D.O. - 4.5 mg/L (51 %)

USGS



Forebay Water Quality

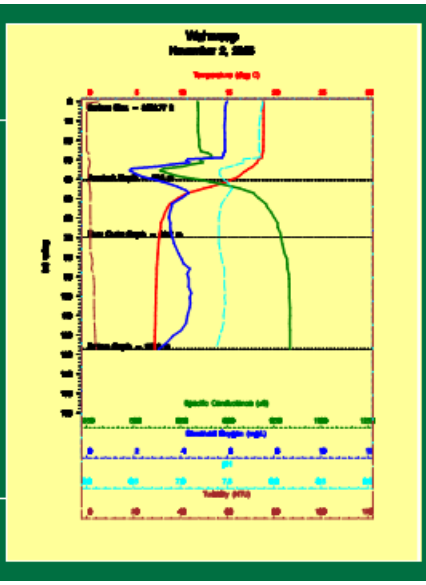
November 2, 2005

Surface of reservoir mixing

Release WQ further affected

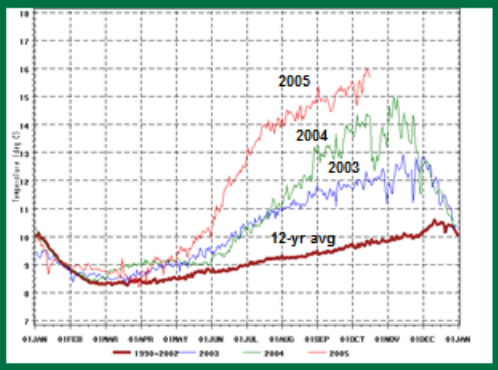
- Inflow plume
  - 28m-40m
  - Minimum D.O. 1.7 mg/L
- Glen Canyon Dam Release
  - T - 15.8 °C (58 °F)
  - D.O. - 3.6 mg/L (41 %)

USGS



Glen Canyon Dam Release Temperature

- Warmest releases since 1971
  - 16°C (61°F) on October 8, 2005
  - 6°C above 12-yr average

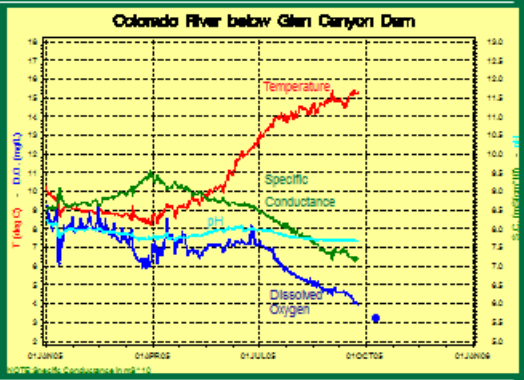


USGS

Glen Canyon Dam Releases 2005

Mean daily values

- Lowest dissolved oxygen on record (since 1990)
  - 4.0 mg/L on September 25, 2005
  - 3.3 mg/L on October 8, 2005 from draft tubes



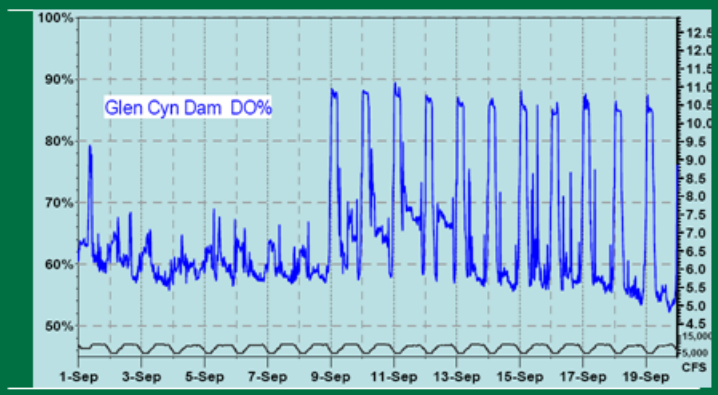
USGS

Reaeration of Dam Releases

- Past monitoring data has shown elevated dissolved oxygen levels in GCD tailwater during nighttime hours (~11 pm to ~7 am)
- These spikes appear to be associated with low discharge levels from individual turbines
- Turbine discharges resulting in maximum reaeration of releases may cause inefficient power generation and damage to turbines
- Reclamation has experimented with various operational regimes during recent experimental flow period to achieve optimal balance

USGS

Nighttime Reaeration Spikes - 2005

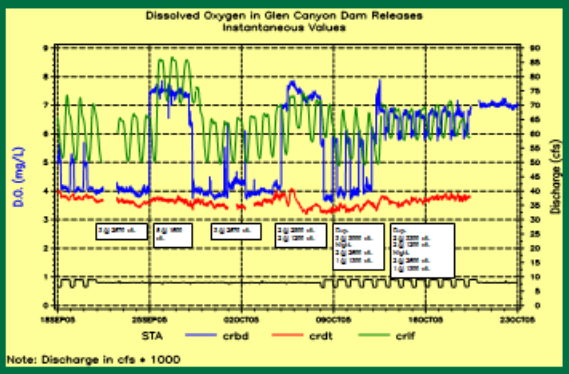


USGS

Reaeration Experiment

Long-term monitoring at three locations:

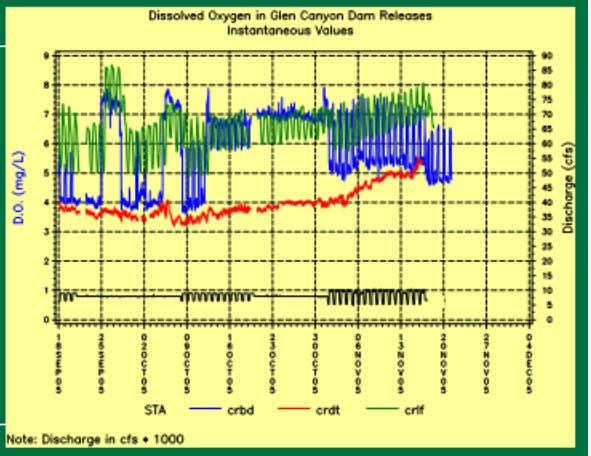
- CRDT (red) GCD Draft Tube
- CRBD (blue) GCD tailwater
- CRLF (green) Lees Ferry



USGS

Recent Release Water Quality

- D.O. in tailwater (blue line) reduced with cessation of experimental flows
- Displaying nighttime D.O. spikes
- Increase in draft tube D.O. (red line) indicating reservoir mixing



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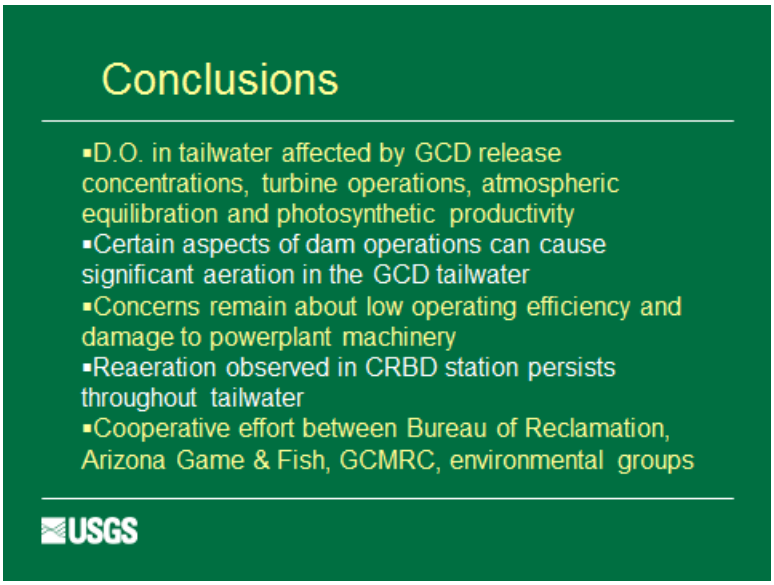

Lines 263-294: Since we have a long historical record of Paria River winter/spring sediment production, it appears that sediment-triggered spring HFEs of the type documented to have promoted trout survival and invertebrate production in 2008 will be relatively infrequent (larger sand inputs have really only occurred in DEC 1966 and JAN 2005 since the dam was closed). Testing additional future spring HFEs tied to aquatic resource conditions in the tailwater fishery seems to be scientifically warranted, though some may voice concern about doing a controlled flood without sufficiently sand enriched conditions in Marble/Grand Canyons. The 1996 Beach/Habitat-Building Flow test occurred under non-enriched sand conditions below Glen Canyon, apparently without severe or irreparable ecosystem damage being reported.

Lines 296-326: Another way to experimentally evaluate the dynamics of the trout fishery and aquatic food base resources for both native and nonnative fishes might also be to combine a March HFE with a follow-up TMF(s) in summer. This might be implemented to test whether spring floods elevate drifting prey items available to native fish below Lees Ferry through increased production following channel-bed disturbance, as a result of limiting Lees Ferry rainbow trout survival (promote more drift, while limiting "top-down" consumption of prey items by large cohort of juvenile trout in same year). By stimulating production of benthic invertebrates while also reducing juvenile trout survival, is it possible that juvenile trout that survive the TMF would grow more and faster with a locally abundant food supply?

Influence of the emergency dam releases (or lack of) in late JUN 2005 combined with poor QW in fall that year need to be understood better in the context of trout trends. Despite those combined conditions, the fishery apparently rebounded by 2007 and then really increased in 2008-9. It seems that the various elements of this plan would benefit from more formal synthesis of the available science data (fish, food base and flow/QW) for the period of 2003-2011 (warming, Fall and Spring HFEs, equalization flows, late-spring emergency drops in flow, winter TMFs, low DO, spring, summer and fall periods of steady releases, etc.).

Lines 327-339 – Dissolved Oxygen Response Protocol:

See comments above on low-flow operation of turbines. Historically, there was also a USGS streamgage operated a short distance downstream of GCD that could be re-operated to report near-real time QW conditions, but it seems that getting the data collected from the penstocks uploaded to the web as GCMRC does for its downstream gages is a much more viable solution to the plan's suggestion for more timely data access.

Lines 340-348 – Equalization Flows:

See comments above regarding HFEs in spring and TMFs in summer. It seems to me that spring time equalization rules won't be easy to revise, and that elevated dam releases in spring months through summer can be viewed experimentally (though they won't be officially) as similar to spring HFEs in terms of how they might influence food production and trout survival. If so, then why not address them with a proposed mitigation tool which is already being discussed – the summer TMFs?

Lines 349-356 – Mechanical Removal of Young Trout:

This was evaluated as part of structured decision analyses during fall 2010 (NNFC EA) and was reported on by Runge et al. (2011), particularly for the Paria River to Badger Rapids segment of Northern Marble Canyon. Since that time, fishery biologists appear to have given up on the idea that this would be a very effective use of resources to manage the LF trout resource, and have therefore promoted the idea of rigorously testing the TMF concept.

Lines 395-410 – Temperature Control Device:

Suggest that we also refer them to the GCMRC (2008) report on proceedings from expert panel on experimental designs for GCD where this topic is also dealt with extensively in a citable USGS reference. From my LTEMP interactions, this topic of thermal regime management using infrastructure seems to be quite dead from a compliance consideration perspective, yet keeps coming up and has now for three decades. Managing for a fuller Lake Powell is appealing to some, but not likely at the expense of Lake Mead storage and water supply to LCRB users. I suspect that the temperature releases from the dam will continue to be quite variable with some possibility of a repeat of conditions like were observed in 2012-13, alternating with releases like those observed in 2005, 2011 and 2014.

Lines 412-419 – Introduce Turbidity:

Runge et al. (2011) identified the strategy of a "turbidity curtain" – inputs of fine sediment at Lees Ferry, as the #1 mitigation option for limiting trout in GRCA. I suggest that there is more to be learned/gained from looking more carefully at historical trout data in Marble Canyon relative to available suspended-sediment data now abundantly available through the GCMRC monitoring program. Managing GCD to benefit downstream sandbars is already a major focus of the GCDAMP and it is possible that optimal management of Paria River fine-sediment inputs (sand primarily) for retention of annual sand inputs to Marble Canyon may also be a viable mitigation strategy for limiting rainbow trout below the Lees Ferry

trout fishery. This appears to be supported by recent correlation between sand budgets in Marble Canyon and abrupt declines in trout between the Paria and Little Colorado River confluences.

Lines 421-426 – Bypass Tube Electrical Generation:

This topic was discussed among members of the TWG's very first ad hoc group tasked with establishing triggering criteria for BHBFs (now, HFEs) in fall 1997 at meetings I attended in SLC. It has never gained any traction, but appears to be a viable solution to several potential problems, and was also advocated informally by FWS TWG representative between 2007 and 2012. The LTEMP excluded this from consideration, but the available science information suggests that having the ability to release from 35 m below the current penstock levels would be the only way to "cool" the river when warmer releases would otherwise persist, would eliminate the "spill" factor from all HFEs, would instantly mitigate low DO releases, and would be the only means of meeting downstream water delivery obligations if Lake Powell falls below powerplant operating elevations. The cost seems to be the main impediment at this point.

Lines 428-489 – Monitoring and Measurement of Trigger Parameters:

The GCDAMP and the GCMRC are on record since 1998 that use of ongoing research and monitoring findings in combination with period external Protocol Evaluation Panel reviews would be the most defendable approach to developing and maintaining long term monitoring of resources below GCD. Unfortunately, the second of the aquatic resource PEPs did not focus sufficient attention to the Lees Ferry trout fishery (for reasons that I can't understand). Hopefully, the next PEP will.

Regarding the statement:

"In addition, flows, temperature, dissolved oxygen, and nutrient levels should be monitored below Glen Canyon Dam. Channel geomorphology (mapping) and riparian habitat in the Lees Ferry reach should be monitored on a periodic basis."

I believe that GCMRC has started to conduct the types of channel mapping (aquatic and terrestrial) that is referred to here, and as mentioned previously, most of the QW monitoring is now in place, but more effort might be spent on getting suspended-sediment data during periods of high dam releases that are not scheduled as HFEs, such as the types of operations that occurred in spring through fall 2011 for transferring water from Lakes Powell to Mead. If resources were available, it would also be useful to have flood monitoring instrumentation operated in Honey Draw or Ferry Swale to document sediment inputs from those large, upstream tributaries that may periodically influence the trout fishery upstream of Lees Ferry.