>>> "John Weisheit" <john@livingrivers.org> 04/30/07 3:15 PM >>>
Hello Nan,

Comments on Draft Environmental Impact Statement for Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead.

Two attachments:

1) pdf file
2) Microsoft Word file (Word for MacIntosh)

Please do not hesitate to contact me should you have any questions.

Sincerely,

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April 30, 2007

Regional Director, Lower Colorado Region
Bureau of Reclamation, Attn: BCOO-1000
P.O. Box 61470
Boulder City, NV 89006-1470

Sent via email: strategies@lc.usbr.gov

Re: Comments on Draft Environmental Impact Statement for Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead

Dear Regional Director,

Living Rivers/Colorado Riverkeeper and the Center for Biological Diversity submit the following as comments on the Draft Environmental Impact Statement for Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead (DEIS).

With this DEIS, it was hoped that the seven basin states and the Bureau of Reclamation (Reclamation) would take an important step in articulating the need for, and response to, the increasing likelihood that Colorado River water users will experience shortages. It was assumed that in this era of uncertainty surrounding Colorado River hydrology that Reclamation would hold true to its mission to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public. Unfortunately, the DEIS fell well short in meeting these expectations.

When the public hears the word "shortages," the term most commonly associated with this initiative, it wants to know how much, and the appropriate actions necessary to respond. While the DEIS has provided answers, the response leaves the public with little confidence that the principle agency responsible for managing the Colorado River water supplies has a full grasp of the problems now before it, nor a commitment to charting a path to overcome them.

- Baseline Conditions Not Properly Defined

  The potential for shortages on the Colorado River have been mounting long before the emergence of the current drought. The over-allocation of water due to improper assumptions as to the Colorado River's mean inflow has reached the point where shortages, which never occurred in the past, will shortly be inevitable. Reclamation is

repeating the same mistake by using a 15.0 million acre-feet (maf) mean inflow projection well above the paleo-climate reconstruction estimates of 13.0-14.7 maf. If the observed flows of 14.2 maf of the past 50 years were to be used as a guide, the Basin States proposal would be of little value, and Upper Basin water users would be destined to restrict their consumption to meet their delivery requirements to the Lower Basin.

- Climate Change Does Not Exist?

  Reclamation's modeling excluded any analysis of the potential for the region's rising temperatures to further impact future streamflow. Study after study from the nation's leading research centers now point to reduced flows on the Colorado River in the years ahead: ranging from 10 percent over the next century to upwards of 50 percent by 2050. As the National Research Council reported in February, while there may be uncertainty as to the magnitude of change, flows on the Colorado River are expected to reduce. Even the most modest reduction in flows, five percent over the 53-year forecast period, would create shortages far in excess of what the DEIS has contemplated.

- Conservation Measures Undefined

  While a program for banking conserved water in Lake Mead is contained in the Basin States proposal, this program appears speculative as to the level of participation, or how it assures a decreasing reliance on Colorado River water commensurate with the level of shortages Nature may impose.

We fully recognize the dilemma faced by Reclamation in developing this DEIS. Had it undertaken a thorough evaluation, addressing the range of uncertainty regarding mean streamflow and climate, the Basin States initiative would have looked far too meager a response to warrant much consideration. However, Reclamation's principle mission, especially during these uncertain hydrologic times, should be to present as unbiased and as clear picture of what the future might be, not what a select group of politicians and/or special interests want it to look like.

**1. Baseline Conditions Not Properly Defined**

Reclamation must present a clear picture to the public of the real challenge facing Colorado River water users. The system's over-allocation is now creating an imbalance that requires shortages to become the norm, not rare events that may result from extended dry periods. These are not problems necessitating detailed study to understand nor sophisticated computer models to simulate, yet Reclamation neglects to offer such critical background information to the pubic.

As illustrated in Table 1, employing Reclamation's own assumptions, in 2008 it is projected that the Colorado River will provide an operating surplus of just 2.7% (400,000 af), shifting to an annual net shortage of 3.3% (-490,000 af) by 2060. This latter figure is little different from the extensive results offered by Reclamation's own model discussed in Chapter 4, Section 4 of the DEIS.

**Table 1**
**Colorado River Water Balance**

| | 2008 | 2060 |
|---|---|---|
| Inflows | | |
| Mean Inflows at Lees Ferry | 15.03 | 15.03 |
| Gains between Glen Canyon Dam and Hoover Dam | 0.77 | 0.77 |
| Gains below Hoover Dam | 0.50 | 0.50 |
| Total System Inflows | 16.30 | 16.30 |
| Outflows | | |
| Upper Basin depletions | **(4.54)** | **(5.43)** |
| Lake Powell evaporation | (0.56) | (0.56) |
| Lake Mead evaporation | (0.80) | (0.80) |
| Lower Basin & Mexico consumption | (9.00) | (9.00) |
| Evaporation and operational losses below Hoover Dam | (1.0) | (1.0) |
| Net System Balance | 0.40 | (0.49) |

Although this imbalance is what is now driving the Basin States to develop a plan for shortages, nowhere in the DEIS are such basic issues and mathematics surrounding the system's over-allocation addressed. It is not the drought that is forcing this EIS. Nor is it the potential intervention by the Secretary of Interior should Lake Mead fall below 1,025 msl as stated in the Purpose and Need. These are all secondary to the main issue: the Colorado River has reached its limit, yet plans are underway to take more water.

It's vital that Reclamation ensures the public is fully aware of this dynamic, since it illustrates how sensitive the system has now become to changes in inflow, and thus how critically important inflow assumption are for Colorado River planning purposes.

Reclamation, however, has avoided any frank discussion on the likelihood of, or impacts resulting from, a reduction in the forecasted mean inflow of 15.0 maf used in its modeling. Reclamation offers the public only this, "However, 99-year record period is a relatively short time frame, and it is possible that future flows may include periods of wet or dry conditions that are outside of all the possible sequences seen in the historical record."

This is an amazingly cavalier attitude since Reclamation knows better than most how foolhardy reliance on merely observed streamflow records can be. History has already proven that mistakes in forecasting future mean streamflow on the Colorado can lead to major problems down the road. It is precisely such a misadventure that is behind the imbalance the system now experiences. This DEIS is underway now because those who signed-off on the Colorado River Compact of 1922 mistakenly believed in their mean Lees Ferry streamflow calculations of 16.4 maf. In allocating just 15 maf, they assumed a nearly ten percent buffer. A buffer we've longtime known is not there. Scientists concur that the period used by Compact drafters was the wettest in the past 1,200 years, and have also concluded the 20$^{th}$ century to be one of the wettest overall. Knowing this, it

seems imprudent to assume future flows will necessarily be so benevolent.

As the National Research Council (NRC) stated in its recent report, "Colorado River Basin Water Management: Evaluating and Adjusting to Hydroclimatic Variability," relying on gage data alone is a somewhat antiquated practice.

> *"For many years, scientific understanding of Colorado River flows was based primarily on gaged streamflow records that covered several decades. Recent studies based on tree-ring data, covering hundreds of years, have transformed the paradigm governing understanding of the river's long-term behavior and mean flows. These studies affirm year-to-year variations in the gaged records. They also demonstrate that the river's mean annual flow—over multi-decadal and centennial time scales, as shown in multiple and independent reconstructions of Colorado River flows—is itself subject to fluctuations."*

The studies the NRC authors refer to all estimate a long-term mean streamflow at Lees Ferry below the 15.0 maf mean uses by Reclamation in the DEIS.

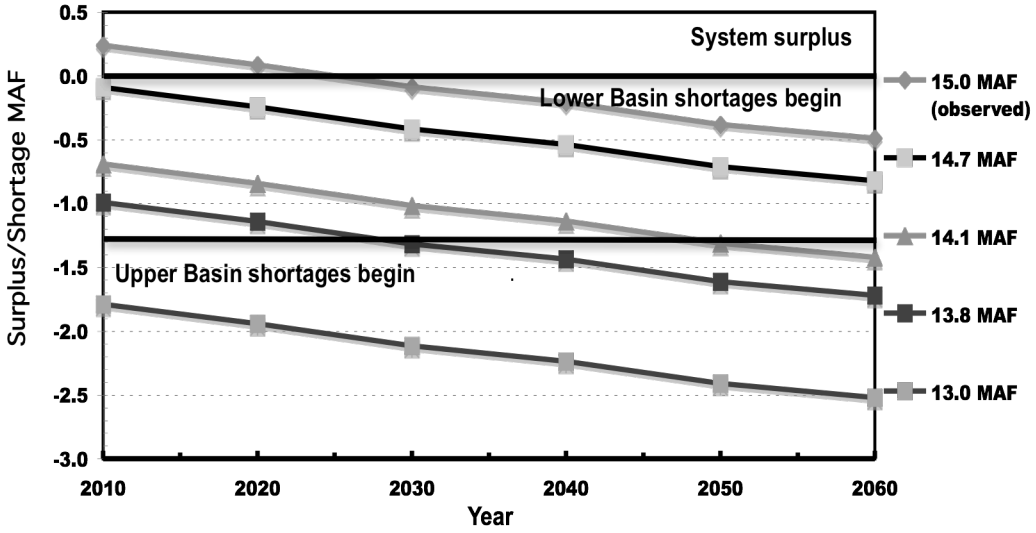
**Table 2**
**Reconstructions of Colorado River**
**Mean Flows at Lees Ferry**

| Author (year) | Reconstruction Period | MAF |
|---|---|---|
| Stockton and Jacoby (1976) | 1511/12/20-1961 | 13.0 – 14.15 |
| Michaelsen et al. (1990) | 1568-1962 | 13.8 |
| Hidalgo et al. (2000) | 1493-1962 | 13.0 |
| Woodhouse et al. (2006) | 1490-1997/98 | 14.1 – 14.7 |

These paleoclimatic reconstructions illustrate that it is not only possible, but growing evidence suggests that the observed mean streamflow being used by Reclamation is too high. Surprisingly, nowhere in the DEIS is this fundamental assumption addressed, merely the disclaimer that the model may misrepresent the future because of its reliance on the observed record.

Here again, a sophisticated model is not necessary to illustrate the significant impacts changes in mean streamflow would have on the imbalance growing in the system. Figure 1 uses the information from Tables 1 and 2 to estimate the net annual shortages Colorado River water users will experience should the mean inflow be less than 15.0 maf Reclamation projects. Figure 1 also illustrates how, should future flows drop to 14.1 maf annually, shortages will likely occur in both the Upper and Lower Basins—not just the Lower Basin as forecasted in the DEIS. Furthermore, this 6.2 percent reduction in the mean streamflow is sufficient to generate average annual shortages right now in excess of the 400,000 – 600,000 af shortage policy at the heart of the Basin States alternative. Evaluating a reduction of this magnitude is hardly inappropriate as it is very close to the observed mean of 14.2 maf from 1950 to the present.

**Figure 1**
**Anticipated Average Annual Colorado River Surplus/Shortages**
**Under Observed Record and Selected Reconstructed Mean Inflows**




To its credit, Reclamation does provided some alternative flow sequences summarized in Appendix N. However, no analysis was performed on the potential impacts should the observed mean streamflow prove inaccurate in projecting future Colorado River flows. Two of the three scenarios used relied on the observed record to simulate flows with greater variability, but not significant reductions in mean flow volumes. The third alternative sequence, Direct Paleo, used Woodhouse data with a mean of 14.6 maf. This offered a glimpse into the type of sensitivity analysis that should be undertaken on the full range of reconstructed streamflow estimates. The likelihood of shortages rose from 70 to 80 percent in 2060, with shortages in excess of 2 maf five percent of the time—shortages not forecasted using the observed mean of 15.0 maf. To these changes Reclamation offers just the following commentary on the Direct Paleo results.

> *"The Direct Paleo scenario underestimates the observed mean, as expected, because this paleo reconstruction has a lower mean (14.6 million acre-feet [maf]) than the observed period (15.0 maf). …The Direct Paleo is able to generate much lower flows that observed, approximately 3.7 maf lower five percent of the time. It was expected the Direct Paleo would generate lower flows than observed as these are characteristic of Lees Ferry streamflow reconstructions." Pages N-4/5)*

To limit such an important discussion to known statistical differences without any background as to why these differences exist, and that surrounding them is a whole body of work that suggests that Reclamation is over-estimating the mean annual flow, is not only misleading, but wholly inappropriate given the issues at stake should Reclamation's assumptions be wrong.

As Table 2 illustrates, Reclamation's choice of reconstruction data with an annual mean of 14.6 maf is at the top end of the mean flow estimates by paleo-reconstruction

researchers. While the data used for its Direct Paleo scenario is among the most recent, the National Research Council further notes there is not yet consensus on which reconstruction may be most appropriate for planning purposes. Therefore, Reclamation must not limit its discussion of alternative hydrologic sequencing to merely a brief analysis of one reconstruction data set. It must fully analyze the full range of variability advanced by researchers so that both Reclamation and the public can be sufficiently informed to evaluate the alternatives for the proposed action.

**2. Climate Change Does Not Exist?**

Even more alarming than Reclamation's unwillingness to objectively address what constitutes an appropriate historical mean streamflow, is the agency's policy to wholly ignore the recommendations of climate scientists who are warning with increasing regularity of the inevitability of reduced Colorado River flows in the decades ahead.

The most recent alert arrived this month in the April edition of *Science Magazine*. The Lamont Doherty Earth Observatory of Columbia University forecasts that drier climatic conditions are already taking hold in the Southwest. Droughts similar to what the region is now experiencing will become more common, and the respites in between will generate less precipitation than in the past.

> *" Here we show that there is a broad consensus amongst climate models that this region will dry significantly in the 21st Century and that the transition to a more arid climate should already be underway. If these models are correct, the levels of aridity of the recent multiyear drought, or the Dust Bowl and 1950s droughts, will, within the coming years to decades, become the new climatology of the American Southwest."*

In the National Research Council's report released six weeks earlier it was emphasized that the trend toward rising temperatures in the Colorado River basin will continue, thus further stressing water supplies.

> *"Any future decreases in Colorado River streamflow, driven primarily by increasing temperatures, would be especially troubling because the quantity of water allocations under the Law of the River already exceeds the amount of mean annual Colorado River flows. This situation will become even more serious if there are sustained decreases in mean Colorado River flows. Results from these numerous hydroclimatic studies are not unanimous, and all projections of future conditions contain some degree of uncertainty. Nevertheless, the body of climate and hydrologic modeling exercises for the Colorado River basin points to a warmer future with reductions in streamflow and runoff."*

To illustrate this range of forecasts one need look no further than the two most recent papers released that address the Colorado River specifically. Both used models contained in the Intergovernmental Panel on Climate Change (IPCC), 4th Assessment released in February.

In Christensen, et al. 2007, University of Washington, it was found that mean results from eleven models generated reductions of annual streamflow at Lees Ferry from eight to eleven percent toward the end of the century: "Although our results show somewhat

smaller (ensemble mean) reductions in runoff over the next century than in previous studies (Christensen et al, 2004 in particular), the reservoir system simulations show nonetheless that supply may be reduced below current demand which in turn will cause considerable degradation of system performance."

In Hoerling, et al., 2006, NOAA Earth System Research Laboratory, where 12 models were employed, a much more dramatic changes to the mean flow at Lees Ferry was forecasted: "Relative to the 1990-2005 mean flow of 13 maf, the 42-run average projects a 25 percent decline in streamflow during 2006-2030, and a 45 percent decline during 2035-2060."

In 2005, Milly, et al., NOAA Geophysical Fluid Dynamics Laboratory, 12 models contained in the IPCC 4th Assessment were also used to assess future Colorado River flows. The results projected reductions in the Colorado River flows from 10 to 30 percent by 2050.

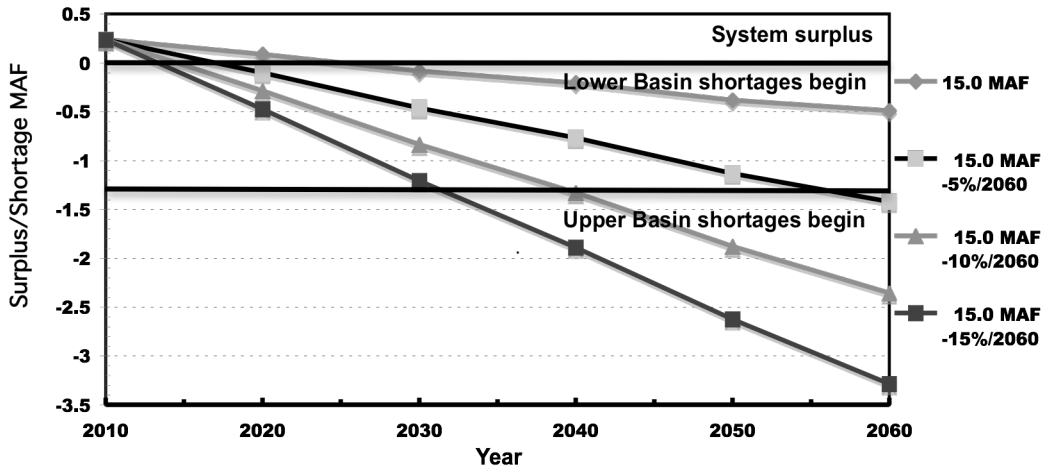
In the face of such mounting evidence, Reclamation remains steadfast in using its 15.0 maf observed mean streamflow to evaluate proposed alternatives designed to address shortage conditions. However, if the projections contained in the findings of any of the above researchers prove accurate, such conditions would dramatically, if not entirely eliminate, the viability of the proposed alternatives to cope with the scale of shortages Nature may deliver during Reclamation's forecast period.

As illustrated in Table 3 and Figure 2 below, assuming the most modest projections of just a 5 percent increase over the next 50 years, the Colorado River system will begin to force shortages in both the Upper and Lower Basins by 2060. Albeit crude, the results of such calculations are not inconsistent with past research. As Nash et.al, reported in 1993, a 5 percent reduction on Colorado River flows would indeed begin to stress the Upper Basin's ability to meet its Colorado River Compact obligations.

**Table 3**
**Estimated Impact of Inflow Reductions**
**On Colorado River Water Balances in 2060**
**Using 15.03 maf Observed Mean Streamflow**

| | Reduction | | | |
|---|---|---|---|---|
| | 0% | -5% | -10% | -15% |
| Inflows | | | | |
| Mean Inflows at Lees Ferry | 15.03 | 14.28 | 13.53 | 12.78 |
| Gains between Glen Canyon Dam and Hoover Dam. | 0.77 | 0.73 | 0.69 | 0.65 |
| Gains below Hoover Dam | 0.50 | 0.48 | 0.45 | 0.43 |
| Total System Inflows | 16.30 | 15.49 | 14.67 | 13.86 |
| Outflows | | | | |
| Upper Basin depletions | (4.54) | (5.43) | (5.43) | (5.43) |
| Lake Powell evaporation | (0.56) | (0.59) | (0.62) | (0.64) |
| Lake Mead evaporation | (0.80) | (0.84) | (0.88) | (0.92) |
| Lower Basin & Mexico consumption | (9.00) | (9.00) | (9.00) | (9.00) |
| Evaporation and operational losses below Hoover Dam | (1.00) | (1.05) | (1.10) | (1.15) |
| Total System Losses | (15.90) | (16.91) | (17.03) | (17.14) |
| Net System Balance | (0.40) | (1.42) | (2.36) | (3.29) |

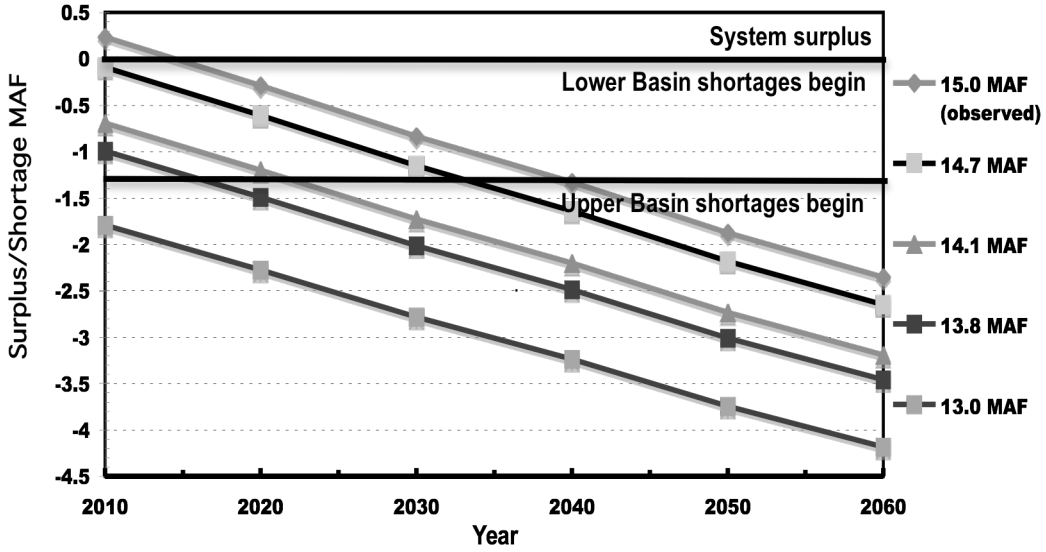
**Figure 2**
**Estimated Impact of Inflow Reductions on Colorado River Shortages 2010- 2060**
**Using 15.03 maf Observed Mean Streamflow**




These estimated shortages are all calculated assuming Reclamation's 15.0 maf streamflow. As noted above, there is significant evidence that suggest that reliance on the observed record my significantly over-estimate the system's ability to avoid shortages. Moreover, as the Hoering analysis illustrated, models themselves rely on

different mean streamflows when making their forecasts. As such, it's instructive to also examine how shortage conditions may change depending on the mean streamflow the climate change reduction factor are applied to. Figure 3 illustrates how a 10% reduction in flows attributed to climate change would impact the same reconstructed streamflow estimates from Figure 1.

**Figure 3**
**Estimated Impact on Colorado River Shortages 2010- 2060**
**Assuming a 10% Inflow Reduction to Observed, and Selected Reconstructed Mean Inflows**




While nobody yet knows if any of the scenarios outlined in Figures 2 and 3 above will pass by Lees Ferry in the coming decades, all estimates are well within the range of projections that have been made by climate researchers to date. Needless to say, all forecast shortages well beyond the range contemplated by the DEIS.

For Reclamation to project future Colorado River shortages while ignoring such overwhelming evidence is of an error of magnitude far greater than mistakes made by those who framed the Compact 85 years ago. Then, just a few people were asking that caution be exercised given the limited data at hand. Now society is faced with the reverse. Most people recognize the need for caution given the volumes of data available encouraging it, yet Reclamation alone chooses to embark on a path of risk, blind to the flashing lights along the way.

**3. The Conservation Unknown**

The majority of the DEIS evaluates plans for when and how to reduce flows from Lake Mead should certain shortage conditions exist. What is virtually ignored are the steps the Lower Basin should be taking to reduce its reliance on this water as these shortages gradually become a permanent condition due to increased Upper Basin consumption and the potential continuation of the downward trend in overall system inflows.

Admittedly, given the limited level of initial shortages forecasted by Reclamation for the interim period, the DEIS likely assumes that such shortages are of a magnitude well within the abilities of the Lower Basin states to absorb without creating additional noise in the system. However, even under Reclamation's rather optimistic predictions of inflows, shortages of more than .5 MAF will become commonplace. Arizona in particular will be facing reductions nearly every year.

More importantly, should Colorado River inflows continue to reflect the kind of downturn many researchers are predicting, a nearly persistent state for Lower Basin reductions would quickly materialize. Furthermore, should those forecasts suggesting more severe reductions in streamflow prove accurate, the Upper Basin too may be forced to permanently adjust its consumption.

The DEIS's only attention to the water conservation issues pertaining to the Basin States Alternative, is through a mechanism allowing the Basin States to bank water in Lake Mead for release at a later date. However, as the DEIS notes, the actual use of this program is vague to say the least.

> *"At this time, it is unknown which entities might participate in a Lake Mead mechanism that allows the storage and delivery of conserved system and non-system water. Furthermore, the timing and magnitude of the storage and delivery of conserved water is unknown." (Page M-1.)*

Furthermore, as is illustrated in the specimen worksheet reproduced in Table M-3, it is unclear if the kinks of the program have been ironed out. The worksheet shows California accumulating over 3 maf of water in Lake Mead, whereas the assumptions state California's maximum allowable accumulation is 1.5 maf.

While a potentially valuable concept, the lack of any discussion as to how this, or any other program, will cause those Lower Basin water users most exposed to shortage situation to reduce their reliance on Colorado River water, illustrates an ongoing lack of foresight by the Lower Basin states. As summarized in Section 1 above, these shortages have been a known problem resulting from the river's over-allocation. The Lower Basin's reluctance to address this problem is evidence by the political background spawning the Basin States proposal, and ultimately this DEIS. Moreover, the Lower Basin's unwillingness to advance a more far-reaching alternative, which recognizes the scale of potential shortages discussed above, further reveals its resistance to planning for what it has known for decades would be coming.

Therefore, the Department of Interior must require from the Basin States, as a pre-condition to any changes in dam operations, a detailed action plan outlining how they will reduce their consumption of Colorado River should shortages of the range discussed above materialize. It's not enough to assume that junior water rights holders will happily accept such cuts on a regular basis. Colorado River water users must resolve disputes in advance of shortages occurring, so that federal resources, including the courts, are not forced to do it for them.

In developing their plans, the Basin States and Reclamation should examine the

tremendous water losses evaporating off the surfaces of Lakes Powell and Mead, averaging 1.36 maf annually. Much of the water in both these reservoirs could be stored underground in aquifers already plumbed into the Colorado River system.

It's ironic that as the climate heats up, and evaporation rates increase, the states of Arizona and California, which have extensive capacity in their Colorado River groundwater recharge facilities, would advocate storing "conserved" water in Lake Mead where more losses will undoubtedly occur. The DEIS should therefore examine how the proposed "Lake Mead storage and delivery of conserved system and non-system water" program can be shifted to more efficient storage reservoirs underground. Such storage would also avoid the potential loss associated with Mead banking should Reclamation be forced to spill excess water for flood control purposes through Hoover Dam

**Conclusion**

Thirty million people now rely on Colorado River water to be delivered to their homes, a number which is increasing despite the fact river flows are decreasing. Much of the Southwest economy relies on this water, therefore will experience serious repercussions should shortages materialize that are beyond the magnitude forecasted in this DEIS.

The men who met at Bishops Lodge in 1922 created this problem by allocating more water than the Colorado River had historically provided. Reclamation now appears destined to perpetuate this error by again assuming there is more water in the river than paleo-reconstruction experts now advise. Moreover, Nature is in the process of imposing major changes on the Colorado River that no amount of computer modeling can hide.

We therefore urge Reclamation and the Basin States to take a step back and revisit the assumptions that went into this process so they better reflect the changing world around them. Only then can some *real* alternatives for dealing with the *real* shortages problems be developed, analyzed and presented to the public. The longer Reclamation and the Basin States delay attending to all this, the fewer the options, the more contentions the atmosphere, and the more costly the solutions become.

Lastly, recognizing the importance of this issue, Living Rivers/Colorado Riverkeeper would appreciate the opportunity to offer additional comments to Reclamation and this DEIS process. We understand that other interveners intend to submit comments beyond today's published deadline and that Reclamation has agreed to incorporate them in the Final EIS. Please notify us as to the final deadline after which no additional comments will be accepted on this DEIS.

Sincerely,

John Weisheit, Living Rivers, Conservation Director
Michelle Harrington, Center for Biological Diversity, Rivers Program Director