DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION

BRIAN SCHWEITZER, GOVERNOR

1625 ELEVENTH AVENUE

STATE OF MONTANA

DIRECTOR'S OFFICE (406) 444-2074
FAX: (406) 444-2684

PO BOX201601
HELENA, MONTANA 59620-1601

January 28, 2011

Mr. Dan Jewell, Area Manager
U.S. Department of Interior
Bureau of Reclamation, Great Plains Region
Montana Area Office
P.O. Box 3017
Billings, Montana 59107-0137

Dear Mr. Jewell:

Please find attached comments on the "Draft Bighorn Lake Operating Criteria Evaluation Study and Report" you provided November 16, 2010. Recent studies by the Bureau of Reclamation (BOR) have provided useful information on Bighorn Reservoir operations and the many uses that compete for water--especially in low-water years: power generation, irrigation water supply, and recreational uses above, within, and below the reservoir. In addition, the recent study by the U.S. Army Corps of Engineers (Yellowtail Dam Reallocation Study, USACE Omaha District, April 1, 2010) examines the merit and risk in reducing the flood control pool to provide for more carry-over storage – especially in a series of low-water years. This option has potential to improve water levels in the reservoir for recreation and allow reservoir releases that would help maintain the excellent fishery downstream from the dam, while meeting hydropower and irrigation demands.

Trial implementation of proposed revised operating criteria in 2010 indicates that fine-tuning is necessary to meet downstream recreational goals. Water year 2010 was a challenging year for Bighorn reservoir management. The March forecast for spring runoff was 50% of normal, but as the season progressed, forecasts were revised upwards on a monthly basis due to late season precipitation—with the actual runoff amounting to 135% of normal. Consequently, implementation of the revised operating criteria resulted in an extended period of high flows (~10,000 cfs), in late May through early July, that interfered with spawning and recreational use of the river below the dam. We suggest modifications need to be considered that will improve BOR's ability to meet downstream fishery goals when unusual conditions occur.

The Bighorn River has three large BOR storage projects. Releases from Boysen (892,000 af) and Buffalo Bill Reservoirs (646,000 af) in Wyoming control about 70% of the runoff into Bighorn Reservoir (1,100,000 af). Accordingly, there needs to be effective system-wide coordination and communication in reservoir operations to effectively implement revised operating criteria proposed in the draft BOR report. This is a daunting task given the size of the projects and hydrologic complexity of the Bighorn basin, the challenge of forecasting snowmelt runoff (and the possibility of unusual weather events), and the need to balance competing uses on each reservoir and between reservoirs. The BOR Montana Area Office has made a sincere and significant effort to make the process of Bighorn Reservoir operations a transparent and understandable process.

We suggest that Bighorn Reservoir operations could benefit from increased transparency, regarding how Boysen and Buffalo Bill reservoir operations affect Bighorn Reservoir inflow, outflow and reservoir levels. The primary coordination which takes place between the three reservoirs relies on the sharing of operating plans which give estimated outflows from the Wyoming projects. There appears to be little actual system-wide integration of operations. We suggest that all aspects of reservoir operations - flood control, recreation, power generation, and priority of water rights - be coordinated between the three reservoirs.

The Department appreciates the sincere effort BOR has made in developing revised operating criteria that attempt to balance competing uses during water-short conditions. Please contact me (406-444-1948) or my staff (Chuck Dalby: 406-444-6644 or Jim Robinson 406-444-4247) if you have questions or wish to discuss the comments.

Sincerely,

Mary Sexton, Director
Montana Department of Natural Resources and Conservation
1625 11th Avenue
P.O. Box 201601
Helena, Montana 59620-1601

cc. attachment

Joe Maurier, Director
Montana Fish, Wildlife, and Parks
Helena, Montana

Tim Davis, Division Administrator
Water Resources Division
Montana Department of Natural Resources and Conservation
Helena, Montana

Chuck Dalby, Hydrologist
Water Resources Division
Montana Department of Natural Resources and Conservation
Helena, Montana

Jim Robinson, Planner
Water Resources Division
Montana Department of Natural Resources and Conservation
Helena, Montana

Kim Overcast, Regional Office Manager,
Water Resources Division
Montana Department of Natural Resources and Conservation
Billings, Montana

Jennifer Anders, Assistant Attorney General
Montana Department of Justice
Helena, Montana

Montana Department of Natural Resources and Conservation
Comments on U.S. Bureau of Reclamation
Draft Bighorn Lake Operating Criteria
Evaluation Study and Report
September 12, 2010

Page 3

Improved levels of flood control will be provided by utilizing reservoir operation rule curves during the April-July runoff season to draft the reservoir sufficiently to handle higher runoff during years with above-normal mountain snowpack.

This statement suggests that the ability to provide flood control will be improved under draft criteria. How is this possible when the flood-pool storage will be reduced? Further, relying on reservoir drawdown during the April-July runoff season to handle runoff during years with above normal snowpack will likely generate elevated runoff in the Bighorn River that interferes with downstream recreational uses. We suggest modifications need to be considered that will improve BOR's ability to meet downstream fishery goals when unusual conditions occur.

Page 15

November through March Gain Forecast: Before evaluating methods for forecasting the gain, a correction was needed to the formula for calculating the gain. In the past, the gain was calculated as the Bighorn Lake inflow less the release from Boysen Dam and the release to the river from Buffalo Bill Dam. This method of determining the gain did not include the water released directly from Buffalo Bill Dam to the Heart Mountain Canal. This method of calculating the gain was initiated shortly after Yellowtail Dam was constructed and it is unclear why only the river release was used rather than the total release. Although the Heart Mountain Canal diverts directly from Buffalo Bill Dam rather than from the river below the dam, its impact on the downstream river flow is essentially the same as other canals that divert directly from the river. Water diverted for irrigation is only partially consumed as nearly 50 percent of these diversions return to the river as return flow. ***The method used to calculate the gain should consistently treat all of the canals the same. Either all of the canals diversion should be subtracted from the reservoir releases or none of them should be subtracted. The least complicated and consistent method to account for the gain is to calculate it as the inflow to Bighorn Lake less the total releases from Boysen and Buffalo Bill Dams.***

It is not clear from this statement, which method was used? Are the "total" releases referred to, the dam outflows plus canal flows or returns from canal flows? Canal diversions from the Bighorn River downstream from Boysen and Buffalo Bill Dams, represent losses (to Bighorn Reservoir inflow) and the only gain is the estimated return flow.

Page 15 (continued)

The first evaluation made was to determine if there has been any change over time to the November through March gain. The November through March gain was plotted for each water year from 1968 through 2007. Since water year 1967 was a record high year and 2001-2007 were extreme drought years these years were excluded from the plot so that these extreme events would not overly influence the trend line.

The following graph (Figure 2) shows the gains from 1968 through 2000 along with the calculated trend line. The trend line was statistically determined by an Excel spreadsheet routine. As shown on the graph, there is a strong downward trend to this data even with the late 1990s being higher runoff years. It is not totally clear why the gains have significantly declined but some of the factors that have likely contributed to this are as follows: (1) changes in irrigation practices from gravity systems to sprinkler: (2) a major rehabilitation betterment program on the Shoshone Irrigation Project during the 1980s that 16 replaced many of the open lateral irrigation delivery canals with closed pipelines reducing groundwater recharge; (2) and increased groundwater use in the basin.

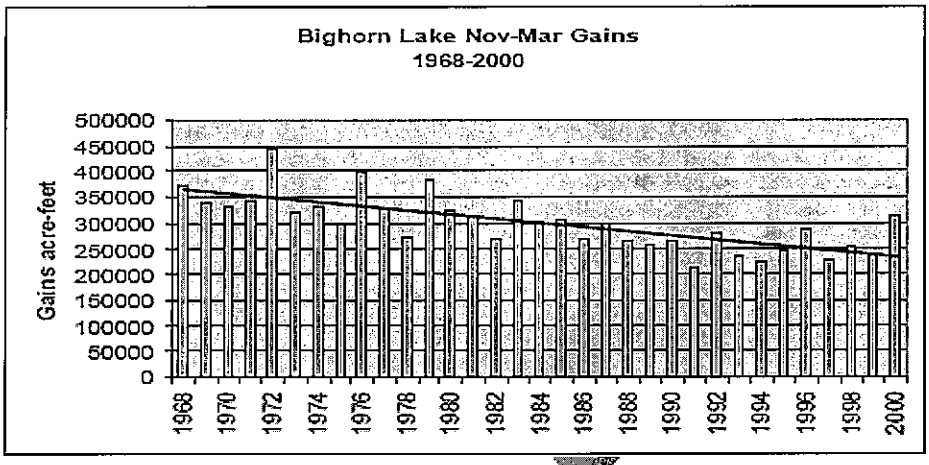

Figure 2

Figure 2 shows that estimated gains range from 450,000 af to ~220,000 af over the years 1968 to 2000 and the trendline suggests a decline of about 130,000 af between 1968 and 2000. It is interesting to note that beginning in 1990 the trend appears to level off.

Years that were excluded from Figure 2, should be included on the graph for comparison. A trend line for just the years 1968 to 2000 can be calculated, and a separate trend line can be calculated for the years 2001 to 2007. Excluding these latter drought years seems problematic, since it is the water-supply conditions of the 2000's that have prompted revision of operating criteria. For example, during the period 2001 to 2007, do the gains in inflow to the reservoir, decline at a much steeper rate? If so what is the cause?

USACE Reallocation Analysis

The report does not adequately address conclusions of the Yellowtail Dam Reallocation Study by the U.S. Army Corps of Engineers (USACE). The USACE concluded that:

1. For the inflow design flood, the reallocated condition reaches a peak pool elevation that is only 1.1 ft from the top of Yellowtail Dam.

2. For the project design flood, the reservoir outflow is 1,150 cfs over the capacity of the Yellowtail Afterbay Dam.

3. For the 1923 event, the reservoir outflow is 8,050 cfs over the capacity of the Yellowtail Afterbay Dam.

How do the above conditions, under the proposed revised operating criteria, affect dam safety and potential downstream flood damage?

The USACE study concludes that maintaining the Bighorn Reservoir pool elevation five to eight feet higher, going into the spring runoff season, will have a very modest effect on downstream (Dam to N.Dak. border) flood damages. Channel Reaches for assessing flood damages were defined in the USACE report: Reach 1-Miles City; Reach 2-Miles City (??); Reach 3-Sidney; Reach 5- Hardin; Reach 6-Bighorn. The USACE concludes:

> *Reach 5 and reach 6 did not show any change in flood damages as a result of the reallocation. Reach 3 did have some modest changes in flood damages. However, the reaches displaying the most impact from the reallocation were reaches 1 and 2—with reach 1 being the most affected overall. Studying the period of record, reaches 1 and 2 yielded decreases in flood damages while reach 3 had an increase in flood damages.*
> *(USACE Reallocation Study, page 76.)*

Reductions and increases referred to above are based on the average of 1967 to 2006 annual differences between the baseline (existing operating criteria) and reallocation operating criteria. USACE estimates are as follows: Reach 1-1.8% reduction; Reach 2-0.3% reduction; Reach 3-0.3% increase; (is there a Reach 4?); Reach 5-no change; Reach 6-no change. How is it that a reduction in flood storage can result in a reduction in downstream flood damages in any of the channel reaches?

The USACE analysis uses discharge/damage curves that were developed in 1974 and then adjusted for inflation. However, adjustment for inflation does not compensate for the amount of increased development that has occurred along the Bighorn and Yellowstone River over the past 37 years. A more accurate estimate of potential flood damage costs requires updating of the discharge/cost curves to reflect current conditions.

Need for BOR and Inter-Agency Coordination

The Bighorn River has three large BOR storage projects. Releases from Boysen (892,000 af) and Buffalo Bill Reservoirs (646,000 af) in Wyoming control about 70% of the runoff into Bighorn Reservoir (1,100,000 af). Accordingly, there needs to be effective system-wide coordination and communication in reservoir operations to effectively implement revised operating criteria proposed in the draft BOR report. This is a daunting task given the size of the projects and hydrologic complexity of the Bighorn basin, the challenge of forecasting snowmelt runoff (and the possibility of unusual weather events), and the need to balance competing uses on each reservoir and between reservoirs. The BOR Montana Area Office has made a sincere and significant effort to make the process of Bighorn Reservoir operations a transparent and understandable process.

We suggest that Bighorn Reservoir operations could benefit from increased transparency, regarding how Boysen and Buffalo Bill reservoir operations affect Bighorn Reservoir inflow, outflow and reservoir levels. The primary coordination which takes place between the three reservoirs relies on the sharing of operating plans which give estimated outflows from the Wyoming projects. There appears too little actual system-wide integration of operations. We suggest that all aspects of reservoir operations - flood control, recreation, power generation, and priority of water rights - be coordinated between the three reservoirs.