From: South Fork Boise Recovery Team; including US Forest Service, Trout Unlimited, University of Idaho, Idaho Department of Fish and Game, and U.S. Bureau of Reclamation

To: Jerry Gregg, Regional Director, US Bureau of Reclamation
Brian Sauer, Hydraulic Engineer, US Bureau of Reclamation
Mary Mellema, Hydrologist, US Bureau of Reclamation

Re: A recommendation for 2014 fall operational adjustments in the South Fork Boise River downstream of Anderson Ranch Reservoir

Date: August 1, 2014

The South Fork Boise River (SFBR) downstream of Anderson Ranch Reservoir is classified as critical habitat for bull trout. The critical habitat supports Foraging, Migration and Overwintering (FMO) habitat for a portion of the Arrowrock Reservoir migratory bull trout population. The SFBR also supports a regionally, if not nationally, renowned tailwater trout fishery. Rainbow trout contribute to the prey base for bull trout and rely on the same habitat for survival. A recent use and economic survey indicated that anglers took 28,602 trips to the SFBR and spent $4,620,918 in fishing-trip related expenses during 2011.

A large wildfire burned the lower portion of the SFBR drainage during August 2013. Most of the upland slopes of the SFRB downstream of Anderson Ranch Reservoir were burned as was a high proportion of the riparian vegetation in the mainstem and tributaries. During mid-September, relatively heavy rainstorms fell on exposed hill-slopes and caused extensive sediment and debris slides. Initially, five tributaries and un-named drainages contributed the most sediment to the 10 miles of the SFBR downstream of Anderson Ranch Dam. During the winter of 2013-2014, additional rains and snowmelt resulted in additional debris flows from tributaries lower in the SFBR.

Fire and the resulting sediment and debris slides are a natural and regular occurrence in southern Idaho and the Idaho Batholith. In natural systems, fires impact fish populations positively and negatively. In managed systems, impacts may be more or less severe depending on circumstances. Changes in sediment regimes may be one of the largest changes to stream networks post fire. A tremendous amount of fine sediment was added to the SFBR during these events. Fine sediments affected the quality and quantity of overwintering habitat by filling in side channels and interstitial spaces along the shoreline, these habitat features are critical for the survival of bull trout, rainbow trout, and their prey bases. Reduced quality and quantity of overwintering habitat and spawning habitat for prey fishes affect bull trout. Fisheries surveys in the fall of 2013 and spring of 2014 show reduced numbers of age-0 rainbow trout that will support the future rainbow trout fishery and serve as prey fish for bull trout. In a natural system, these sediment inputs are sorted and transported under naturally occurring high flows during spring snowmelt. In regulated systems, such as the SFBR, high flow events are attenuated to mitigate flood risk and to store water for irrigation (and other uses). The regulated flows result in lower peak flows especially in poor water years or years with low carryover storage like the

winter of 2013/2014. During these conditions, less fine sediment is transported leading to longer-term detrimental impacts to bull trout, their habitats, and other aquatic biota.

In response to substantial public concern, a multi-agency team was formed to develop recommendations to minimize the impact to trout populations and hasten recovery. This team includes staff from US Forest Service, US Bureau of Reclamation (Reclamation), University of Idaho (U of I), Trout Unlimited, and Idaho Department of Fish and Game. Meetings were held on November14, 2014, March 5, 2014, May 29, 2014, and July 18, 2014. Initially, the group developed a list of data needs in order to assess potential responses to mitigate or reduce the effects of the fires and resulting debris flows. Recent fisheries and habitat data were assembled, a sediment transport model developed, and water forecasting was reviewed. After discussing preliminary results from sediment model and recent fish surveys, the team recommended (on April 24, 2014) that the SFBR be held at 300 cfs until after Memorial Day weekend and a flushing pulse be provided in late May/early June. Maintaining lower flows served three purposes:

1) Provide as much stability as possible during the rainbow trout spawning period;
2) Provide stability for incubating rainbow trout eggs; and
3) Increase reservoir storage, in anticipation that increased storage would enable a flushing pulse that could be used to mobilize fine sediment during the 2014 spring runoff period.

The team believed this strategy would have provided benefits to the fish and macro-invertebrate communities as well as aquatic habitats while still meeting other water management obligations. The SFBR flows were maintained at 300 cfs until after Memorial Day weekend, however, storage in the Boise River system precluded a flushing event as there was little room to store the flushed water in the lower system (Arrowrock and Luck Peak reservoirs). The team believes that a pulsing flow is an important step to hasten recovery of important fish populations and habitats found within the SFBR. As such, the team reconvened after learning that a spring flush was not possible to update the sediment model and discuss options for a flushing pulse later during the 2014 water year.

Modelers from U of I's Ecohydraulics group developed a 1 dimensional (1D) coupled hydraulic and sediment transport model of SFBR (between Anderson Ranch Dam Gage and Neal Bridge) to simulate sediment transport through the system. The sediment transport model assumes all the sediments within the channel are available for transport and there is no additional sediment inputs from tributaries or hill slopes. The volume of recently deposited sediment (debris fan) was estimated by field measurements at four separate locations. A total of five debris fans were identified within 10 miles downstream of Anderson Ranch Dam. The 1D sediment model predicts that size of sediment that will move under certain flow volumes given the channel cross-sectional shape and slope. Sediment particles less than the size used by spawning fishes were considered in the model. Existing LiDAR DEM data was used to extract cross-sectional depth data to more accurately identify depth of recently deposited sediment and identify where redistribution of sediment would occur under each flow scenario. Three different discharge magnitude and duration scenarios (based on recommendations of the team) were used to investigate total volume of sediment transport from debris fans, upper canyon and canyon

sections. Discharge scenarios included a pulse of 2000 cfs for 8 days; 2400 cfs for 8 days; and 3000 cfs for three months.

Sediment transport simulations based on the 1D model showed that the 2014 irrigation flows of 1600 cfs move some sediment but do not erode the debris fans completely. Part of the mobilized sediment is deposited in lower velocity reaches like pools and the remaining sediment remains in transport. A 2000 cfs pulse (Scenario 1) does not visibly change the sediment transport in comparison to 1600cfs. A 2400 cfs or higher flow pulse (Scenario 2) causes a detectable change in slope of the cumulative sediment volume at the control cross-section. A constant 3000 cfs (Scenario 3) discharge for three months would erode the debris fans more extensively than the previous two scenarios (1 and 2), but the majority of sediments are not transported into Arrowrock Reservoir only redistributed to low velocity areas along the SFBR. Analysis of potential depositional areas shows that overwintering habitat and spawning reaches should not experience large deposits of fine sediments, improving the quality of both habitat types.

Key findings from latest modeling:

- A flow pulse of 2000 cfs for 8 days does not visibly change the sediment transport.
- A flow pulse of 2400 cfs or greater for 8 days causes a detectable change in the deposition of sediment while improving the quality of both overwintering and spawning habitat.
- Flows in excess of 3000 cfs, sustained for as long as three months will mobilize fine sediments but will not flush them out of the river corridor into Arrowrock Reservoir.

We recommend a flow pulse of at least 2400 cfs for a minimum of eight days based on the new results from U of I's sediment transport model. The recommended pulsing flows depicted in Table 1 are based on this recommendation, as well as discussions with Reclamation water managers regarding water balances/deliveries within the Boise River system, and other bull trout ESA requirements. Reclamation has requirements for maintaining critical bull trout habitat threshold storage levels in both Anderson Ranch and Arrowrock reservoirs during the same time period as the recommended pulsing flows. Neither requirement will be jeopardized as a result of the recommended flow pulse. Furthermore, water used for the flushing pulse (approximately 16,000 acre feet), if stored in Arrowrock Reservoir through November 2014, would provide an additional benefit to migratory bull trout returning to Arrowrock Reservoir. Benefits to the migration zone would be provided by minimizing the length of the MF Boise River that flows through the Arrowrock Reservoir drawdown zone during the migration period (Reclamation 2006 – Monitoring and Implementation Plan for the USFWS 2005 Biological Opinion).

We offer these recommendations as a framework for discussion with the Boise River water users.

Table 1. Estimated discharge of the South Fork Boise River downstream of Anderson Ranch Reservoir for the recommended 2014 flushing pulse to benefit bull trout and bull trout critical habitat. (Estimated summer operations may vary from 1600 to 1800 cfs.)

Date	2014 "normal" operations (cfs)	2014 conceptual pulse (cfs)	Difference (cfs)
August 1	1600	1600	0
August 2	1600	1600	0
August 3	1600	1600	0
August 4	1600	1600	0
August 5	1600	1600	0
August 6	1600	1600	0
August 7	1600	1600	0
August 8	1600	1600	0
August 9	1600	1600	0
August 10	1600	1600	0
August 11	1600	1600	0
August 12	1600	1600	0
August 13	1600	1600	0
August 14	1600	1600	0
August 15	1600	1600	0
August 16	1600	1600	0
August 17	1600	1600	0
August 18	1600	2100	500
August 19	1600	2400	800
August 20	1600	2400	800
August 21	1600	2400	800
August 22	1600	2400	800
August 23	1600	2400	800
August 24	1600	2400	800
August 25	1600	2400	800
August 26	1600	2400	800
August 27	1600	2100	500
August 28	1600	1600	0
August 29	1600	1600	0
August 30	1600	1600	0
August 31	1600	1600	0
September 1	1600	1600	0
September 2	1600	1600	0
September 3	600	600	0
September 4	600	600	0
September 5	600	600	0
September 6	600	600	0
September 15	300	300	0