

MEMORANDUM

TO: Gary Spackman, Idaho Department of Water Resources Director
FROM: Tony Olenichak, Water District #1 Program Manager
DATE: March 20, 2017
RE: Staff Memorandum Order, dated March 6, 2017

In response to the Aberdeen-Springfield Canal Company letter, dated January 18, 2017, and your order to prepare a staff memorandum, dated March 6, 2017, here is a history of how the Snake River channel losses have been applied to natural flow distributions, with emphasis on gains and losses measured in the *Below Blackfoot-to-Near Blackfoot* reach. Additional information concerning water right accounting procedures referred to in this memo is contained in the water accounting manual titled *Concepts, Practices, and Procedures Used to Distribute Water Within Water District #1* ("Accounting Manual") posted on the Water District #1 webpage <http://www.waterdistrict1.com/water%20accounting%20manual.pdf>.

Prior to 1978, a 190 cfs gain was assumed to occur in the water right accounting between the last diversion at Blackfoot (Parsons Canal) and the Snake River confluence with the Blackfoot River. The 190 cfs gain plus the discharge from the Blackfoot River comprised the natural flow in the *Below Blackfoot-to-Near Blackfoot* reach of the Snake River available to downstream diversions when only storage water was passing the Parsons Canal at Blackfoot, typically occurring towards the latter half of each irrigation season in most years when senior diversions upstream were diverting all the natural flow.

The gain arising below Blackfoot (always assumed to be positive) was added to the gain in the next downstream reach *Near Blackfoot-to-Neeley* that was calculated using a formula incorporating measurements from several springs near the American Falls Reservoir. The reach gains calculated for the *Below Blackfoot-to-Near Blackfoot* and *Near Blackfoot-to-Neeley* reaches were then summed with the reach gains calculated using the inflow-outflow equation in the next two downstream reaches between Neeley and Milner. The sum of reach gains for the four reaches below the diversions at Blackfoot (Parsons Canal) comprised the entire natural flow available to downstream diversions when only storage water in the Snake River channel was passing Blackfoot during the irrigation season.

The reach gain between *Snake River at Shelley* gage and the Parsons Canal at *Blackfoot* was calculated by subtracting the discharge at the *Snake River at Shelley* gage from the discharge at the *Snake River near Blackfoot* gage, minus the 190 cfs of Snake River gain assumed to arise between the Parsons Canal and the Blackfoot River, minus the discharge from the Blackfoot River, plus the diversions between Shelley and the Parsons Canal, plus the storage conveyance loss estimated to occur between Shelley and the Parsons Canal. This reach gain was then added to the reach gains calculated for all other reaches upstream to determine the total natural flow available to diversions above Blackfoot. The reach gain equation, *outflow minus inflow plus diversions plus storage conveyance loss*, was used to calculate reach gains in upstream reaches.

Storage conveyance loss percentages for each reach were agreed upon by resolution at the Water District #1 Annual Meeting prior to the start of the irrigation season. For example, storage conveyance losses during the 1977 irrigation season were calculated by multiplying the storage conveyed through the reaches by the following pre-determined loss percentages: 1.7% Moran to Palisades; 0.8% Palisades to Heise; 4.4% Heise to Lorenzo; 0.5% Lorenzo to Woodville; 6% Woodville to Blackfoot; 4% Henrys Lake to Island Park; 2% Island Park to Warm River; and 0.5% Warm River to Ashton.

Partly due to the approximate 100,000 acre-feet discrepancy between the actual physical reservoir system contents and calculated reservoir system carryover that occurred in the water right accounting at the end of the 1977 season, a new computerized accounting system replaced the previously used manual accounting system in an attempt to more accurately measure and distribute the actual amount of water in the system each day and to match physical reservoir system contents with reservoir carryover at the end of the irrigation season. When the computerized water right accounting was introduced in 1978, many of the assumed or estimated values previously used in the water right accounting were discontinued. A reach gain calculation based on measured USGS stream gages, diversions, reservoirs, and reservoir evaporation losses replaced the many spring measurements, pre-determined conveyance losses, and other estimated data previously used in the water right accounting to quantify reach gains.

A new river gage (*Snake River at Blackfoot*) was added in the new computerized accounting to measure the previously assumed gain between the Parsons Canal (last diversion at Blackfoot) and the *Snake River near Blackfoot* gage. However, the Parsons Canal sits on a small braid of the Snake River so the new river gage was located slightly upstream of the diversion before the Snake River split into braided channels downstream. Three new reaches were created in the water right accounting as a result of adding the new gage, splitting the one *Shelley-to-Near Blackfoot* reach into three separate reaches: 1) *Shelley-to-At Blackfoot*; 2) *At Blackfoot-to-Below Blackfoot*; and 3) *Below Blackfoot-to-Near Blackfoot*.

The *Shelley-to-At Blackfoot* reach gain is computed by subtracting the reach inflow (discharge measured at *Snake River near Shelley* gage) from the reach outflow (discharge measured at *Snake River at Blackfoot* gage) and adding the sum of all diversions within the reach. The *At Blackfoot-to-Below Blackfoot* reach, extending from the *Snake River at Blackfoot* gage down through the west braid of the Snake River to the Parsons Canal (approximately one mile in length), is assumed to have a zero reach gain. The *Below Blackfoot-to-Near Blackfoot* reach gain is computed by subtracting the reach inflow (discharge measured at the *Snake River at Blackfoot* gage) from the reach outflow (discharge measured at the *Snake River near Blackfoot* gage) and adding the sum of diversions in the *At Blackfoot-to-Below Blackfoot* and *Below Blackfoot-to-Near Blackfoot* reaches.

When the *Below Blackfoot-to-Near Blackfoot* reach gain is computed in the current water right accounting, there are three possible effects on natural flow distribution:

1. **If the *Below Blackfoot-to-Near Blackfoot* reach gain is positive**, the positive gain is added to the natural flow coming into the reach and it increases the amount of natural flow available to diversions in downstream reaches.
2. **If the *Below Blackfoot-to-Near Blackfoot* reach gain is negative and the undistributed natural flow conveyed through the reach is equal to or greater than the magnitude of loss in the reach**, the reach loss is subtracted from the natural flow coming into the reach and decreases the amount of natural flow available to diversions in downstream reaches.
3. **If the *Below Blackfoot-to-Near Blackfoot* reach gain is negative and the undistributed natural flow conveyed through the reach is less than the magnitude of loss in the reach**, the natural flow available from this reach becomes zero, and any loss in excess of the natural flow conveyed through the reach decreases the natural flow available to diversions in upstream reaches.

The situation described in *Item 3* occurs when there is zero (or very little) natural flow being conveyed through the *Below Blackfoot-to-Near Blackfoot* reach typically occurring towards the second half of most irrigation seasons when priorities above Blackfoot drop below October 11, 1900 and all the natural flow arising above Blackfoot is distributed to senior diversions above Blackfoot, i.e., only storage water is flowing through the reach. The distribution of reach losses during this period (*Item 3*) was described as being “inequitable” in the Aberdeen-Springfield Canal Company letter to Lyle Swank, dated January 18, 2017.

When a loss (negative gain) is computed for a reach in the current water right accounting that exceeds the natural flow coming into that reach, the program subtracts the loss from the natural flow available to upstream reaches, with two exceptions: 1) *To Henrys Lake* reach; and 2) *To Grassy Lake* reach. A negative reach gain in these two uppermost reaches of the watershed can't be subtracted from any reaches upstream because there are no reaches upstream from these uppermost reaches. When a loss occurs in either of these two reaches, the loss is subtracted from the natural flow available to the adjacent downstream reaches.

Subtracting a reach loss from natural flow in upstream reaches is not limited solely to the *Below Blackfoot-to-Near Blackfoot* reach. *Section 8.6* in the Accounting Manual describes the situation that commonly occurs towards the beginning of the irrigation season when there is a loss in the *Below Dry Bed-to-Lorenzo* reach while the Palisades Reservoir water right is accruing all the natural flow upstream. When there's a loss (negative gain) in the *Below Dry Bed-to-Lorenzo* reach and when there isn't any natural flow being conveyed through that reach, the water right accounting deducts the reach loss from the natural flow available to water rights in the nearest upstream reach conveying natural flow.

There may be other examples in other reaches of the water right accounting where a computed reach loss has been deducted from the natural flow in an upstream reach during the irrigation year, however, those scenarios are probably much less common and don't have the same effect on diversions as reach losses that occur in the *Below Blackfoot-to-Near Blackfoot* reach during the irrigation season because of the split in priorities that occurs above and below Blackfoot midway through the season.

Here are some **alternative methods** that could be considered for distributing reach gains and losses differently in the water right accounting if it is determined the current accounting process should be altered:

- A. In the last sentence of the Aberdeen-Springfield letter, a request was made to begin adding positive gains that occur in the *Below Blackfoot-to-Near Blackfoot* reach to upstream reaches on days when the reach gains are positive.**

This would offset some (or all) of the reductions applied to upstream natural flow from the *Below Blackfoot-to-Near Blackfoot* reach on days when the reach gains are negative. The proposed change would also reduce the net gain currently applied to downstream natural flow supplies on days when there is a positive gain in the *Below Blackfoot-to-Near Blackfoot* reach.

There isn't an instance in the water right accounting where positive reach gains arising in downstream reaches have been distributed to diversions in upstream reaches except for the *Minidoka Return Flow Credit* discussed in *Section 10.17* of the Accounting Manual whereby return flows in the *Minidoka-to-Milner* reach have been credited back to the Minidoka Canals in the upstream *Neeley-to-Minidoka* reach.

- B. Another alternative proposed in the Aberdeen-Springfield letter was to deduct losses in the *Below Blackfoot-to-Near Blackfoot* reach from natural flow arising in downstream reaches instead of deducting those losses from natural flow available to upstream reaches.**

Deducting reach losses from the natural flow available in downstream reaches isn't unprecedented in the water right accounting, however, this method has only been used for the *To Henrys Lake* and *To Grassy Lake* reaches because there aren't any reaches upstream from those two uppermost reaches to deduct losses in the water right accounting.

- C. Instead of deducting *Below Blackfoot-to-Near Blackfoot* losses from upstream or downstream natural flow when losses exceed the amount of natural flow in the *Below Blackfoot-to-Near Blackfoot* reach, losses could be deducted from storage being conveyed through the *Below Blackfoot-to-Near Blackfoot* reach.**

Section 3.7 of the Accounting Manual discusses the reasons storage conveyance losses were discontinued in the water right accounting after 1977, excepting the Willow Creek reach below Ririe Reservoir discussed in *Section 10.7* of the manual.

The water right accounting program currently does not determine which spaceholder storage allocations are flowing through the *Below Blackfoot-to-Near Blackfoot* reach when losses are occurring. Creating an equitable method to deduct losses from storage allocations in the water right accounting may prove to be as difficult as choosing between deducting losses from either upstream or downstream natural flow supplies.

The purpose of deducting losses in the *Below Blackfoot-to-Near Blackfoot* reach from either natural flow or storage supplies in the water right accounting is to maintain a balance between the surface water physically available in the system and the total amount of water distributed to surface water users. Usage of the current water right accounting method or any of the identified alternative methods to distribute *Below Blackfoot-to-Near Blackfoot* reach losses would preserve this balance.