Non-binding Arbitrations Before
Martha O. Pagel, Arbitrator

Initiated Pursuant to Final Settlement Stipulation
Kansas v. Nebraska & Colorado
No. 126, Orig., U.S. Supreme Court
Decree of May 29, 2003, 538 U.S. 720

Colorado's Compact Compliance Pipeline Proposal
(Arbitration Initiated May 2, 2013)

and

Colorado's Bonny Reservoir Accounting Proposal
(Arbitration Initiated May 2, 2013)

PRE-FILED TESTIMONY OF KANSAS EXPERT STEVEN P. LARSON

September 18, 2013

Section 1 – Qualifications

Q: Please state your name and business address for the record.

A: My name is Steven P. Larson. My business address is 7944 Wisconsin Avenue, Bethesda, Maryland.

Q: Please describe your educational background.

A: I hold a bachelors degree in civil engineering from the University of Minnesota that I received in 1969 and I also hold a masters degree in civil engineering from the University of Minnesota that I received in 1971.

Q: Please describe your employment history after you received those degrees.

A: After obtaining my masters degree in 1971, I was hired by the Water Resources Division of the United States Geological Survey as a hydrologist. My first assignment with the United States Geological Survey, or USGS as it is often referred to, was to attend a 6-month training program in Denver, Colorado to learn about the various activities, projects and work products of the Water Resources Division. Following that training I was assigned to the district office of the Water Resources Division in St. Paul, Minnesota. From 1971 to 1975 I conducted various water resource related projects within the State of Minnesota including several projects that involved the development, calibration and application of groundwater models. In 1975, I was transferred to the National Headquarters of the USGS in Reston, Virginia to work in a research capacity within the Northeast Region of the Water Resources Division. My duties in that position were basically threefold. One was to conduct research into the

development and use of computer models for simulating various groundwater flow processes. Second, I conducted training courses for other hydrologists within and outside the USGS in the use and application of various groundwater flow models. Third, I provided consulting support to hydrologists in other offices of the Water Resources Division to assist them in using and applying groundwater flow models.

In 1980, I left the USGS and joined S. S. Papadopulos and Associates, Inc. At S. S. Papadopulos and Associates, Inc. we provide consulting services regarding environmental and water resource problems. I have been with S. S. Papadopulos and Associates, Inc. for more than 30 years. During that time, I have worked on a variety of water resource and environmental problems for clients in both the public and private sector. As part of my work, I have also provided expert testimony in a number of forums ranging from administrative hearings to original actions before the U. S. Supreme Court.

Q: Please give us some examples of projects that you have worked on that would be relevant to your work in this matter.

A: I worked for the State of Kansas in the case of Kansas versus Colorado dealing with the Arkansas River Compact. My role in that case was to evaluate impacts to stream flows associated with groundwater use and other water projects that occurred historically along the river. I served as an expert in the areas of hydrology, water rights engineering and modeling analysis and provided expert testimony before the special master in the case. I have worked for the State of Nebraska in the case of Nebraska versus Wyoming regarding development and

water use along the Platte River. My role in that case was to review groundwater and surface water models of the river system and nearby areas and to evaluate stream flow data and changes in stream flow that occurred over time. I prepared an expert report in the case describing my evaluations and conclusions but the case was settled before going to trial. I have worked for the State of South Carolina in the case of South Carolina versus North Carolina regarding development and water use along the Catawba River. My role in that case was to review and evaluate stream flow data and a reservoir operations model called CHEOPS that was developed to simulate river flows and power production from several hydroelectric plants located along the river system. I have also worked for the State of New Mexico regarding groundwater development along the Pecos River and efforts by New Mexico to maintain compliance with the Pecos River Compact. My role in that case has been to update and recalibrate the Roswell Artesian Basin Groundwater Model and to evaluate impacts from new well fields designed to provide augmentation water for purposes of compact compliance. I am currently working for the State of Montana in the case of Montana versus Wyoming. My role in that case is to provide expert analysis and testimony regarding groundwater related issues.

Perhaps most relevant is my prior work in this case. I have worked for the State of Kansas in the case of Kansas versus Nebraska since its inception. I have served as Kansas' principal modeling expert in the development of the RRCA Groundwater Model as part of the Final Settlement Stipulation. I was a member of the Modeling Committee on behalf of Kansas and actively participated in the

development and calibration of the RRCA Groundwater Model. As a result of this work, I am intimately familiar with the structure and application of the RRCA Groundwater Model for purposes of quantifying impacts to stream flows along the Republican River stream system.

Q: Did you give expert testimony in the prior arbitration before Arbitrator Pagel in 2010?

A: Yes, I provided testimony related to the application of the RRCA Groundwater Model for computing the augmentation credit associated with Colorado's previous augmentation proposal.

Q: Has the work that you have done in connection with this arbitration changed any of the conclusions that you reached in the prior arbitration?

A: No, the work that I have completed for the current arbitration has provided further confirmation of conclusions that I had reached in the prior arbitration.

Q: I have marked as Exhibit CCP/BR K1, a copy of your curriculum vitae. Is Exhibit CCP/BR K1 a copy of your curriculum vitae?

A: Yes it is.

To the arbitrator: The State of Kansas offers Mr. Larson as an expert in the areas of hydrology and hydrologic modeling analysis

<u>Section 2 – Expert Report and Exhibits</u>

Q: Have you prepared any expert reports in this matter?

A: Yes, I have prepared two expert reports, one in response to Colorado's Compact Compliance Pipeline Proposal and one in response to Colorado's Bonny Reservoir Accounting Proposal.

Q: I have marked as Exhibit CCP/BR-K2 your report responding to Colorado's Compact Compliance Pipeline Proposal and as Exhibit CCP/BR-K3 your report responding to Colorado's Bonny Reservoir Accounting Proposal. Are these exhibits CCP/BR-K2 and CCP/BR-K3 copies of your reports in this proceeding?

A: Yes, they are.

Q: With respect to Exhibit CCP/BR-K2, your response to Colorado's Compact Compliance Pipeline Proposal, would you please summarize the work that you conducted for this report?

A: I worked with Dr. Sam Perkins from the Kansas Department of Agriculture, Division of Water Resources to evaluate the impact of adding augmentation water to the Republican River stream system. Specifically, our work focused on demonstrating how the RRCA Groundwater Model should be applied in accordance with Section IV-H of the FSS to compute the appropriate amount of credit associated with the addition of augmentation water to the Republican River stream system.

Q: Could you briefly describe how you applied the RRCA Groundwater Model to compute the augmentation credit pursuant to Section IV-H of the FSS?

A: We used data provided by Colorado regarding a 40-year future study period to demonstrate how the RRCA Groundwater Model is applied to compute appropriate credit associated with addition of augmentation water. Colorado had developed a future scenario that included estimates of the amount of augmentation water that might be added during each year of the 40-year study

period. The estimated amounts of augmentation water needed over the 40-year study period ranged from 4,000 acre feet per year initially to as much as 13,400 acre feet per year during the latter years of the study period. In the Colorado scenario, the augmentation water was assumed to be added during the fall and winter months of October through March. The average annual amount of augmentation water added over the 40-year study period was 8,185 acre feet. Using the Colorado scenario, we computed the impact of adding the augmentation water by comparing results from two runs of the RRCA Groundwater Model over the 40-year study period. In one model run, the augmentation water was included and in the other run, the augmentation water was not included.

Q: Specifically, what model results did you compare and what was the result of that comparison?

A: We compiled the results of the model calculations of base flow at the various accounting points throughout the Republican River stream network for each of the runs and then computed the change in the base flow at each of these accounting points associated with the addition of augmentation water to the Republican River stream system. The computed changes in base flows are the appropriate credit associated with augmentation water pursuant to Section IV-H of the FSS. We compiled the annual augmentation credit computed using the RRCA Groundwater Model on Table 1 of Exhibit CCP/BR-K2. These results demonstrate the amount of credit that would be computed over the 40-year study period under the assumptions made by Colorado regarding the amount of

augmentation water that would be added over the study period. On average, the annual computed augmentation credit as shown on Table 1 is about 7,200 acre feet or about 88 to 89 percent of the average amount of augmentation water that was assumed to be added over the study period.

Q: Does the Colorado proposal use the RRCA Groundwater Model to compute the augmentation credit?

A: No, the Colorado proposal presumes that the credit is 100% of the amount of water added to the Republican River stream system.

Q: Does the Colorado proposal include augmentation water in runs of the RRCA Groundwater Model?

A: The Colorado proposal includes augmentation water in all runs of the model used to determine the amounts of groundwater computed beneficial consumptive use or CBCUg and the computed credit associated with Imported Water seepage in the mound area or mound credit. The Colorado proposal does not use the RRCA Groundwater model to compute the augmentation credit,

Q: What is the effect of Colorado's proposal to include the augmentation water in these runs of the RRCA Groundwater Model?

A: It increases the amount of CBCUg for each State but has essentially no impact on the computed mound credit.

Q: Did you prepare tables that illustrate the effects of Colorado's proposed inclusion of augmentation water in these runs of the RRCA Groundwater Model?

A: Yes. Based on model runs provided by Colorado over the same 40-year study period that I mentioned earlier, we presented four tables that compare amounts of CBCUg and mound credit with and without augmentation water included. The first three tables, Tables 2, 3 and 4 in our report, compare CBCUg for each State and the last table, Table 5, compares the mound credit.

Q: Can you summarize what the tables show as the effect of including the augmentation water in these runs of the RRCA Groundwater Model?

A: On average, Colorado's CBCUg is computed to increase by about 400 acre per year over the study period, Kansas' CBCUg is computed to increase by an average of about 90 acre feet per year, and Nebraska's CBCUg is computed to increase by an average of about 490 acre feet per year over the study period. The computed mound credit is essentially unaffected by the inclusion of augmentation water in the model runs.

Q: In the model runs used to compute CBCUg for each State, pumping by one of the States is turned off, correct?

A: Yes. Results from a model run with one of the State's pumping turned off is compared to results from a model run with all of the State's pumping on to determine the amount of CBCUg for that State.

Q: What does the Colorado proposal assume for the amount of augmentation water when there is no pumping in Colorado?

A: The Colorado proposal includes augmentation water even in the model run where pumping in Colorado is turned off.

Q: If there was no pumping in Colorado, where would the augmentation water come from?

A: With no pumping in Colorado, the source of augmentation water is not apparent. This represents a significant conceptual problem with the Colorado proposal.

Q: Does the inclusion of augmentation water in the model run without Colorado pumping have any impact on the results from the model?

A: Yes, in net effect, including the augmentation water in the model run without Colorado pumping reduces Colorado's CBCUg from what it would be if augmentation water were not included in the model run without Colorado pumping.

Q: How does the procedure of including the augmentation water in the model run without Colorado pumping reduce Colorado's CBCUg?

A: In effect, the procedure maintains losses in the reach from the Colorado State line to Swanson Reservoir that would not occur if augmentation water were not included. In the run without Colorado pumping, stream base flows are typically higher than they are with Colorado pumping. Increased losses in this reach without Colorado pumping are the origin of a credit that Colorado receives in the accounting process. This credit serves to reduce Colorado's CBCUg and this credit would be smaller if augmentation water was not included in the model run without Colorado pumping.

Q: Is measuring the amount of augmentation water discharged into the stream the same as using the RRCA Groundwater Model to calculate the augmentation credit?

A: No. One would assume that the amount of augmentation water to be added to the stream system would be measured rather than simply estimated. But the measured discharge of augmentation water into the stream would only be the starting point for the calculations one would make using the RRCA Groundwater Model. The model calculations would provide an estimate of how that additional water would be affected as it moves through the stream network from the point where the augmentation water is added.

Q: And is the RRCA Groundwater Model is capable of making these calculations?

A: Yes. The RRCA Groundwater model is a tool that was designed to compute stream base flows and changes in stream base flows that occur within the model's stream network. And so the calculation of gains and losses and changes in gains and losses to these stream flows within the modeled stream network are one of the fundamental components of the RRCA Groundwater Model.

Q: Table 2 in your report, Exhibit CCR/BR-K2 indicates that the Colorado proposal would increase the Colorado CBCUg by an average of 403 acre feet per year over the study period used by Colorado, correct?

A: Yes.

Q: How does that increase in CBCUg compare with the augmentation credit calculations that are shown on Table 1 of Exhibit CCR/BR-K2?

A: As shown on Table 1, the augmentation credit calculated using the RRCA Groundwater Model would average 7,244 acre feet per year over the same study

period. The average augmentation discharge over the study period as shown on the table is 8,185 acre feet per year, which means that the augmentation credit is 941 acre feet per year less, on average over the study period, than the augmentation discharge. This reduction represents about 11 percent of the augmentation discharge. The increase in CBCUg for Colorado shown on Table 2 represents about 5 percent of the augmentation discharge.

Q: So, in effect, the Colorado proposal would decrease the reduction in its augmentation credit from 11 percent as calculated using the RRCA Groundwater Model to about 5 percent under the Colorado method, correct?

A: Yes.

Q: Turning now to the other expert report that you prepared with Dr. Perkins, Exhibit CCP/BR-K3. Is this a copy of that report?

A: Yes, Exhibit CCP/BR-K3 is the report by me and Dr. Perkins regarding Colorado's Bonny Reservoir Accounting Proposal.

Q: Can you summarize the work that you and Dr. Perkins conducted that is reflected in your expert report, Exhibit CCP/BR-K3?

A: The Colorado proposal represents a significant change in physical conditions within the South Fork Sub-basin of the Republican River. Furthermore, the change is complicated by the fact that conditions associated with Bonny Reservoir and its operation in the future will likely vary in an unpredictable way owing to the continued existence of the dam and outlet structure of the reservoir. We have presented a series of tables from model runs provided by Colorado to

illustrate the range in conditions and impacts that might be experienced going forward under the Colorado proposal. These tables, Tables 1, 2 and 3, compare the calculations of CBCUg for each of the States over the same 40-year study period that was discussed earlier for two different conditions. The two conditions represent two end points associated with the Colorado proposal, a "full Bonny" condition on the one hand and a "no Bonny" condition on the other hand.

Q: What do the results of your comparisons on these tables, Tables 1, 2 and 3, of Exhibit CCR/BR-K3, show?

A: The structure of the tables is explained in my report. In summary, there are three columns for each accounting point shown on the tables. The first column labeled WB tabulates CBCUg for the "Full Bonny" condition. The second column labeled NB tabulates CBCUg for the "Dry Bonny" condition. The label WB refers to a "with Bonny" condition where Bonny Reservoir is represented in the RRCA Groundwater Model in the same way it is currently represented. The label NB refers to a "no Bonny" condition where the stream network for the South Fork is represented in the RRCA Groundwater Model in the same way it was before Bonny Reservoir was constructed. The Colorado proposal also includes a third representation for Bonny Reservoir that is referred to as a "small Bonny" condition. This condition would vary the representation of the reservoir in the RRCA Groundwater Model according to the reservoir water elevation reported by the U. S. Bureau of Reclamation. A varying representation of reservoir conditions in the RRCA Groundwater Model apart from varying reservoir water elevations has not been done previously and Colorado has not provided

modeling calculations of this condition analogous to the WB and NB conditions shown on the tables. Thus the tables do not include a column representing this condition. The third column in the tables, labeled Del, tabulates the difference between the result in the NB column and the WB column. In other words, the Del column shows the difference in CBCUg that the Colorado proposal would create without Bonny Reservoir versus with Bonny Reservoir. With respect to Colorado's CBCUg, the Colorado proposal would reduce CBCUg by an average of about 8,500 acre feet per year over the study period without Bonny Reservoir versus with Bonny Reservoir. Similarly, Kansas' CBCUg would be reduced by an average of about 2,400 acre feet per year over the study period without Bonny Reservoir versus with Bonny Reservoir. Nebraska's CBCUg would be reduced by an average of about 250 acre feet per year over the study period without Bonny Reservoir versus with Bonny Reservoir.

Q: What is the cause of the significant difference in CBCUg under the Colorado proposal without Bonny Reservoir versus with Bonny Reservoir?

A: There are principally two reasons for the significant difference. First, not including a reservoir condition in the RRCA Groundwater Model eliminates the potential for depletions from the reservoir water body. As shown on Table 1 of our report under the column header "Bonny", the difference in CBCUg between a without Bonny condition versus a with Bonny condition averages 3,091 acre feet per year over the study period as shown at the bottom of the "Del" column in the Bonny heading. In fact, the CBCUg in the Bonny Reservoir reach flips from a positive value which is a depletion to a negative value which represents a credit.

In other words, when Bonny Reservoir is included there are depletions from the reservoir water body. When Bonny Reservoir is eliminated, increased losses in the stream reach without Colorado pumping create a credit that is analogous to the credit Colorado receives in the reach from the State line to Swanson Reservoir on the main stem of the Republican River. As shown on Table 1, this "credit" averages about 1,400 acre feet per year over the study period. The remaining reduction in Colorado's CBCUg, which averages about 5,600 acre feet per year over the study period, is related to other losses or "credits" in other parts of the South Fork stream network downstream from the reservoir. This average difference of about 5,600 acre feet per year on average can be seen under the Del column for the South Fork heading on Table 1.

Q: With regard to the losses or "credits" that you refer to, does your report describe those in more detail?

A: Yes. We compiled a table, Table 4 in our report, that tabulates Colorado's CBCUg under the condition without Bonny Reservoir at various points along the South Fork stream network from above the Bonny Reservoir stream reach down to the confluence with the Republican River near Benkelman, Nebraska. Details of Table 4 are described in our report. In summary, we used the values of CBCUg at the different points along the stream system to compute the change or difference in CBCUg from one point to the next to illustrate how the CBCUg changes as one moves downstream through the South Fork stream system. As shown on Table 4, most of these differences are negative values and indicate that the reductions or "credits" in CBCUg progressively accumulate as one

moves downstream from the Bonny Reservoir stream reach to the confluence with the Republican River near Benkelman.

Q: What does Table 4 in Exhibit CCR/BR-K3 show as to where these reductions in CBCUg or "credits" are occurring?

A: Some of the reductions in CBCUg or "credits" occur above the Kansas-Colorado State Line. Reaches 1, 2, 3 and 4 on Table 4 represent segments of the stream system that are above the State Line. The accumulated reduction in CBCUg over those reaches totals about 2,700 acre feet per year on average over the study period. Reach 5 on Table 4 represents the segment of the stream system from the State Line to the confluence with the Republican River near Benkelman. Reductions in CBCUg over that reach average about 3,200 acre feet per year over the study period.

Q: You indicated that these reductions in CBCUg are related to losses that occur within the stream network, correct?

A: Yes, at various times under certain conditions, groundwater levels fall below the level of the water in the stream system and the stream loses water to the groundwater. At times, these losses can deplete the entire base flow in the stream. Under those conditions the stream becomes dry, at least in places and at times.

Q: Does the dry stream condition have any impact on the determination of CBCUg?

A: Yes. Dry stream conditions can create a situation where the sum of the CBCUg for the individual States does not equal to the total CBCUg that would be

calculated by the RRCA Groundwater Model if pumping for all of the States were considered simultaneously.

Q: Can you explain that in more detail?

A: Yes. CBCUg is calculated for each State by making a model run with the pumping for that State alone turned off and comparing results from that run with a run where pumping for all of the States was on. The comparisons for each State provide a difference in model results that determine the values of CBCUg for each State. An alternative run can be made where pumping for all the States is turned off together. If results from this run are compared to a run where pumping for all of the States was on, the difference would represent a total CBCUg for all the States. This total CBCUg, however, cannot be attributed to any one State, but it can be compared the sum of values of CBCUg that are calculated for each State.

Q: Will the sum of the values of CBCUg for each State equal the total CBCUg result that you described?

A: Not always. If the RRCA Groundwater Model was mathematically linear, it would. However, the model is not always linear and so the sum will not always equal the total CBCUg. Dry stream conditions are representative of one form of non-linear behavior in the model and can contribute to a lack of equality between the sum of the CBCUg values and the total CBCUg.

Q: Does this lack of equality occur within the South Fork stream system of the RRCA Groundwater Model?

A: Yes, it does. At various times and places in the model calculations, dry stream conditions will occur and create a difference between the sum of the CBCUg values for the States and the total CBCUg that would be calculated from a run with all pumping on compared to a run with all pumping off.

Q: How large is the inequality within the South Fork stream system of the RRCA Groundwater Model?

A: It will vary over time but in the analyses that we have been discussing for example, the average difference over the 40-year study for the condition where Bonny Reservoir is included in the model is about 700 acre feet per year.

Q: If Bonny Reservoir is not included in the model, is the difference the same?

A: No. Without Bonny Reservoir, the average difference over the 40-year study period increases to about 3,800 acre feet per year.

Q: Why is the difference larger when Bonny Reservoir is not included?

A: There are more losses from the stream system under the scenario without Bonny Reservoir in the model and these higher losses contribute to an increase in the departure of the sum of the CBCUg values for each State from the total CBCUg.

Q: What do these differences or departures in the sum of the CBCUg values for each State from the total CBCUg represent?

A: These differences represent residual depletions or residual CBCUg that is not allocated to any of the States.

Q: So what does your analysis show regarding these unallocated depletions or unallocated CBCUg under the Colorado proposal when Bonny Reservoir is not included?

A: Our analysis shows that these residual depletions or residual CBCUg is likely to be much larger under the Colorado proposal when Bonny Reservoir is not included.

Q: How does the Colorado proposal plan to represent Bonny Reservoir in the RRCA Groundwater Model?

A: The representation will vary depending on conditions reported by the U. S. Bureau of Reclamation.

Q: How does Colorado propose to vary the representation of Bonny Reservoir?

A: As we understand, there will be three primary representations, a “Full Bonny” representation that considers Bonny Reservoir as it is currently represented in the model; a “Dry Bonny” representation that presumes conditions as if the dam, reservoir and outlet works are not present; and a “Small Bonny” representation that varies the size of the reservoir and its connection to groundwater based on reservoir stage data from the U. S. Bureau of Reclamation.

Q: Do any of the other reservoirs in the RRCA Groundwater Model have varying sizes and connection to groundwater that are determined by the reservoir stage?

A: No. The reservoir stage for the other reservoirs does vary over time according to measured data but the size of the reservoirs and their connection to groundwater is not adjusted.

Q: So the Colorado proposal under the "Small Bonny" representation would depart from the method used to represent the other reservoirs in the RRCA Groundwater Model, correct?

A: Yes, it would.

Q: Does the size of the other reservoirs vary over time?

A: Yes, depending on their individual area-capacity relationships, the surface area and storage volume for the reservoir will vary as the reservoir stage goes up and down.

Q: Do we know how when or how often the different reservoir representations described in the Colorado proposal will occur?

A: No. The Colorado plan specifies what representation will be assumed based on the reservoir stage data from the U. S. Bureau of Reclamation but actual reservoir stages are unpredictable.

Q: When the RRCA Groundwater Model is run without pumping in Colorado, what happens to the computed stream flow in the South Fork stream system?

A: Those computed stream flows will increase.

Q: So there will be more stream flow into the Bonny Reservoir stream reach when the model is run without Colorado pumping?

A: Yes, stream flow into the reach from upstream increases without Colorado pumping and, as result, losses in the Bonny Reservoir reach are greater without Colorado pumping than with Colorado pumping which reduces Colorado's CBCUg. This effect is reflected as a credit to Colorado's CBCUg as shown by

the value of -1,428 acre feet per year at the bottom of the NB (no Bonny) column under the Bonny heading in Table 1 of my report.

Q: What is the representation of Bonny Reservoir in the RRCA Groundwater Model assumed to be under those conditions?

A: As we understand, it would be assumed to be the same representation that was used in the model run that included the Colorado pumping.

Q: Under what circumstances does the Colorado proposal presume that Bonny Reservoir does not exist?

A: According to the Colorado plan, whenever the reported reservoir stage is below an elevation of 3638.5 feet, a “Dry Bonny” representation is used which is, in effect, eliminating the reservoir from the model.

Q: What about any water storage that might occur under this condition?

A: As I understand, the Colorado plan would presume that there was, in effect, no water storage even if there were storage as long as the reservoir stage was below an elevation of 3638.5 feet. In other words, the reservoir would be presumed to have no dead storage, or any storage whatsoever, if the reservoir stage was at an elevation of 3638.5 feet or lower.

Q: Does water storage have any impact on the flow of water through the reservoir?

A: Yes, stream flows through the reservoir would be re-regulated to some degree by the storage conditions in the reservoir.

Q: Earlier in your testimony, we discussed the reduction in Colorado's CBCUg or a credit that Colorado would get in the Bonny Reservoir reach or segment of the South Fork under the "no Bonny" condition, correct?

A: Yes, as we discussed, that credit would average 1,428 acre feet as shown on Table 1 of my report.

Q: Does this reduction in CBCUg or creation of a credit occur in other segments of the South Fork above Benkelman?

A: Yes, as shown on Table 4 of my report, there is a reduction in CBCUg or a credit in all of the stream reaches or segments from above Bonny Reservoir to the confluence of the South Fork with the Republican River at Benkelman. The average values of CBCUg reduction or credit for each reach or segment over the study period are at the bottom of the right most set of columns on Table 4 beginning with the column labeled "Difference Reach 1". The average values for all of the reaches or stream segments are negative indicating a reduction in CBCUg or a credit in all of the reaches. The total average reduction in CBCUg or credit is shown at the bottom of the right most column as 5,892 acre feet per year.

Q: Does this total reduction in CBCUg or credit show up on Table 1 of your report?

A: This reduction in CBCUg or credit is the primary part of the 8,515 acre foot per year average difference shown at the bottom of the "Del" column under the "Total" heading at the right side of Table 1. In other words, most of the difference between the CBCUg with and without Bonny Reservoir is related to reductions in

CBCUg or the credit associated with increased losses in the South Fork stream reaches from Bonny Reservoir down to the confluence of the Republican River at Benkelman.

Pursuant to 28 U.S.C. §1746, I declare under penalty of perjury that the foregoing is true and correct.

Executed on September 18, 2013.