

Engineering Committee Report

Republican River Compact Administration

August 22, 2017

EXECUTIVE SUMMARY

The Engineering Committee (EC) met four times since last August's Republican River Compact Administration (RRCA) Annual Meeting. Over the past year, the EC completed these assignments: 1) hold quarterly meetings; 2) exchange information listed in Section V of the RRCA Accounting Procedures and Reporting Requirements, including all required data and documentation; 3) continue work and provide future updates on improving accounting tools developed by the Engineering Committee; 4) continue to explore options for sharing evaporation charges for Harlan County Lake when accounts exist separate from the project water supplies of Bostwick Irrigation District and explore potential means to adjust the compact accounting of Harlan County Lake for the mutual benefit of the States; 5) work to resolve issues preventing agreement on final accounting for 2006-2015; and 6) work to finalize 2016 accounting.

Ongoing assignments include 1) continue efforts to resolve concerns related to varying methods of estimating ground and surface water recharge and return flows and related issues; 2) discuss developing an application and approval process for future augmentation plans; 3) assign responsibility for collecting specific fields of data collected for the annual data exchange; 4) create a document memorializing when RRCA Accounting Procedures have changed over the years and incorporate it into the Accounting Procedures; and 5) work on producing a RRCA public website.

The EC recommends discussion by the RRCA on the exchange of data and documentation and the modeling runs completed by Principia Mathematica for 2016, discussion on the proposed 2016 accounting, direction from the commissioners on the RRCA draft website, and the recommended EC assignments for the following year.

Details of the various EC tasks are described further in the remainder of this report, including as attachments, the EC meeting notes.

COMMITTEE ASSIGNMENTS AND WORK ACTIVITIES RELATED TO THESE ASSIGNMENTS

1. Meet quarterly to review the tasks assigned to the committee.
 - a. Assignment completed.
 - b. The EC held four meetings since the August 2015 RRCA Annual Meeting. Notes from the four EC meetings are attached: November 21, 2016 (Attachment 1), February 3, 2017 (Attachment 2), May 11, 2017 (Attachment 3), and July 18, 2017 (Attachment 4).

- c. The EC also met informally on May 23, 2017 to prepare for the upcoming May 25, 2017 special meeting.
 2. Exchange by April 15, 2017, the information listed in Section V of the RRCA Accounting Procedures and Reporting Requirements, and other data required by that document, including all necessary documentation. By July 15, 2017, the states will exchange any updates to these data.
 - a. Assignment completed.
 - b. Kansas, Nebraska, and Colorado posted preliminary data by April 15, 2017. The status and details of the preliminary data exchange was discussed at the November 21 and February 3, 2016, EC meetings (Attachments 3 and 4). Nebraska posted final data on April 13, April 20, April 25, and July 18, 2017, and Kansas posted final data on April 11, June 28, and July 18, 2017. The Colorado procedure for 2016 uses the metered pumping for those wells covered by the Metering Rules with acreage data from 2010. Wells without meter records in parts of two counties use average application rates from Kit Carson County along with the acreage associated with each well. Due to data availability issues, Colorado's crop irrigation requirement-based estimate of pumping was distributed August 10, 2017.
 - c. In advance of the July 2017 meeting, Willem Schreüder of Principia Mathematica executed the most recent model run for 2016 using full-year temperature and precipitation data, river data, and augmentation pumping information. He also executed a preliminary model run for 2017 using temperature data, long-term average precipitation data, 2016 evaporation data, river data, and pipeline information. This information has been posted to the RRCA website.
 - d. The Committee continued to discuss updating documentation of the modeling processes. Principia Mathematica will continue to update the modeling process documentation. The write-up for the update will have two versions of the processing programs: 2001 to 2006 and 2007 skipping intermediate steps and describing the current procedure for running the model (5 run).
 3. When possible, continue efforts to resolve concerns related to varying methods of estimating ground and surface water irrigation recharge and return flows within the Republican River Basin and related issues.
 - a. Assignment ongoing.
 - b. Kansas is working on a scope and needs document for this task regarding changes in irrigation efficiency through time.
 4. When possible, continue efforts to finalize accounting for 2006-2015.
 - a. Assignment complete.
 - b. The RRCA approved final accounting for years 2006-2015 at the May 25, 2017 Special Meeting.

5. Work to resolve issues preventing agreement on final accounting for 2006-2015, as identified in the 2016 EC Report. These issues include:
 - a. Kansas's request for beginning and ending meter data from other states.
 - i. Assignment complete.
 - ii. Kansas has reviewed Colorado's annual meter data for 2015, 2014, 2013, and 2012 and its application in the RRCA Model and has found these to be acceptable.
 - b. Reaching consensus about how to model Bonny Reservoir.
 - i. Assignment complete.
 - ii. The 3-states have reached an agreement that dictates how Bonny Reservoir will be represented in the RRCA Groundwater Model for the foreseeable future.
6. When possible, discuss developing an application and approval process for future augmentation plans.
 - a. Assignment not completed.
 - b. Due to ongoing consideration of this topic at Three-States meetings throughout the year, the EC deferred discussion of this assignment.
7. Continue to explore options for sharing evaporation charges for Harlan County Lake when accounts exist separate from the project water supplies of Bostwick Irrigation District and explore potential means to adjust the compact accounting of Harlan County Lake for the mutual benefit of the States.
 - a. Assignment complete.
 - b. The RRCA approved a resolution approving long-term operation of Harlan County Lake for compact call years and adopted revised accounting procedures for evaporation charges for Harlan County Lake when accounts exist separate from the project water supplies of Bostwick Irrigation District.
8. Assign responsibility for collecting specific fields of data collected for the annual data exchange by determining who has the best available data and assigning them the responsibility of populating those fields in order to avoid confusion between multiple datasets.
 - a. Assignment ongoing.
 - b. The EC is utilizing the SWInputs spreadsheet to collaborate and agree upon which source/state has the responsibility of populating data fields.
9. Create a document memorializing when RRCA Accounting Procedures have changed over the years and incorporate it into the Accounting Procedures.
 - a. Assignment ongoing.
 - b. Kansas is spearheading this document and the work has yielded a draft document that was presented to the RRCA during at the 2016 annual meeting. The draft document is broken out into Accounting Procedure changes, Model

Update and Resolution Action, and how the document is kept current. Kansas is in the process of producing a final draft for review by the EC.

10. Create a RRCA oriented public website
 - a. Assignment ongoing.
 - b. Since the 2016 annual meeting, more content has been added to the site and the site has changed platforms from Go Daddy to WordPress. The EC requests direction from the commissioners on when and how to make this website public and how and when to change its content.

OTHER COMMITTEE ACTIVITIES

1. Updates on the status of the development and review of RRCA annual reports for 2015, and 2016 were given by the states at each quarterly EC meeting.
2. The EC held an informal call on May 23, 2017 to discuss preparations for the upcoming May 25, 2017 RRCA special meeting.
3. The EC discussed Nebraska's 2017 water administration and management actions being taken by Nebraska for Compact compliance.

ITEMS FOR RRCA DISCUSSION & ACTION

Based upon the EC discussions and information presented in this report, the EC recommends RRCA discussion and potential action on the following items:

1. Agreement that the Data Exchange & Modeling Results for 2016 were performed. The EC has examined the data exchanged and the results from Principia Mathematica and agrees that the 2016 modeling runs are complete.
2. Discussion and potential action on the proposed 2016 accounting presented in Attachment 5 and spreadsheet titled "RRCA_Accounting_2016_Final.xlsx". The EC recommends the proposed 2016 accounting for approval by the RRCA.
3. Discussion and direction on the specific modeling and data tasks to be assigned to Principia Mathematica for 2017.
4. Discussion and direction on the use of the web-based RRCA accounting compilation developed by Willem Schreuder. This tool presents all accounting inputs and compliance tables from 1995 on, and will be updated each year as accountings are approved. There are small numeric differences in some tables in some years between the web-based tool and the official, approved accountings. Should the web-based tool be available to the public or should only the official approved accountings, which are not compiled over the years, be the only data available? Though the web-based version is very useful and convenient, the EC is concerned that the discrepancies could cause confusion to the public.
5. During 2015-2016 the engineering committee worked to develop an RRCA website geared toward public information – history of the compact and the administration, links to compact-related data and reports, state information, etc. At the 2016 annual meeting, the administration directed the EC to continue its work on the website. Since the 2016

annual meeting, more content has been added to the site and the site has changed platforms from Go Daddy to WordPress. The EC requests direction from the commissioners on the content that the RRCA wants published to the website, when to make the website public, and how and when to update its content. The EC recommends the commissioners create a website committee that will report to the EC committee. The website committee would consist of one representative from each state. The website committee's assignment would be to develop a draft plan to the EC by December 31, 2017. The EC would review and revise the plan and submit it to the commissioners by April 2018. The draft plan would include details on what information and data would be published to the public website vs what would be on the internal only website and the plan would describe protocols for updating and changing the content of the website.

6. Discussion of the recommended EC assignments and other potential assignments for the next year and agreement on a final set of assignments. The EC presents the list of eleven items in this report as recommended assignments to report on at the 2017 annual meeting of the RRCA.

RECOMMENDED ASSIGNMENTS FOR THE COMING YEAR

The Engineering Committee recommends that the Republican River Compact Administration assign the following tasks:

1. Meet quarterly to review the tasks assigned to the committee.
2. Exchange by April 15, 2018, the information listed in Section V of the RRCA Accounting Procedures and Reporting Requirements, and other data required by that document, including all necessary documentation. By July 15, 2018, the states will exchange any updates to these data.
3. Finalize the 2017 accounting and recommend for approval by the RRCA
4. When possible, continue efforts to resolve concerns related to varying methods of estimating ground and surface water irrigation recharge and return flows within the Republican River Basin and related issues.
5. Continue work to assign responsibility for collecting specific fields of data collected for the annual data exchange by determining who has the best available data and assigning them the responsibility of populating those fields to avoid confusion between multiple datasets.
6. Continue work on creating a document memorializing when RRCA Accounting Procedures have changed over the years and incorporate it into the Accounting Procedures.
7. Provide updates on the progress of new and ongoing management strategies for maintaining compact compliance.
8. Continue efforts to develop and publish an administrative website that would be an informational page for the public.

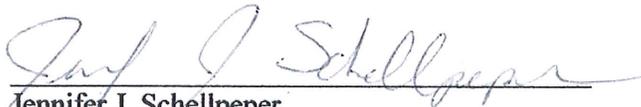
9. Continue work and provide future updates on improving accounting tools developed by the Engineering Committee.
10. Work on improving the understanding of/operation of the inputs to the accounting from the Lovewell Ops worksheet.
11. Prepare the RRCA meeting reports for the following dates for approval by the RRCA at the 2018 annual meeting: August 24, 2016 annual meeting (CO); May 25, 2017 special meeting (CO), and 2017 annual meeting (CO).

The Engineering Committee Report and the exchanged data will be posted on the web at www.republicanrivercompact.org.

SIGNED BY



Ivan Franco
Chair, Engineering Committee Member for Colorado



Jennifer J. Schellpeper
Engineering Committee Member for Nebraska



Chris Beightel
Engineering Committee Member for Kansas

Attachment 1 to the 2017 Engineering Committee Report

Final Meeting Notes for
**QUARTERLY MEETING of the
ENGINEERING COMMITTEE of the
REPUBLICAN RIVER COMPACT ADMINISTRATION**
November 21st, 2016, 12:30 PM Mountain, 1:30 PM Central

Attendees:

Ivan Franco	Colorado	Zablon Adane	Nebraska
Willem Schreuder	Principia Mathematica	David Kracman	The Flatwater Group
Jennifer Schellpeper	Nebraska	Jesse Bradley	The Flatwater Group
Mahesh Pun	Nebraska	Chris Beightel	Kansas
Kari Burgert	Nebraska	Chelsea Erickson	Kansas
Carol Flaute	Nebraska	Hongsheng Cao	Kansas

1. Introductions
2. Review/Modify Agenda
 - a. No changes to the agenda
3. Publication of RRCA Annual Reports
 - a. 2014 Report (Nebraska)
 - i. The cover letter for the report is being drafted and will be distributed when complete. Nebraska suggested that each state distribute the report to their respective governor's once complete. Nebraska would send a final copy to the office of the U.S. President. The other states agreed.
 - b. 2015 Reports (Nebraska)
 - i. October 2014 – Review complete by all states
 - ii. November 2014 – Drafted for second iteration of review
 - iii. March 2015 – The minutes are prepared and ready for first draft review
 - iv. August 2015 Annual – The minutes are prepared and ready for first draft review
 - c. 2016 Reports (Colorado)
 - i. Franco reported that he has not yet begun drafting the 2016 meeting minutes. It is anticipated that some progress might be made by the next Engineering Committee meeting.
4. Modeling and Data Tasks for Principia Mathematica
 - a. Documentation
 - i. Schreuder informed the group that due to recent activities undertaken by the RRCA there is a need for modification to his previously completed work. Schreuder intends to work on amending his past work before making any new progress on this assignment.
 1. Beightel raised a question about the status of the Principia Mathematica contract. Specifically, the question was whether the three-states needed to renew the contract with Principia, and if so by what process. The

group felt as though this matter could be resolved without having RRCA action taken but tasked Colorado with investigating the status of the contract(s) further.

5. Data Exchange
 - a. 2016 Accounting
 - i. Nebraska has continued to distribute the monthly accounting updates to each state. No further discussion on 2016 accounting.
 - b. 2017 Accounting
 - i. No substantive discussion on 2017 accounting.

6. Finalization of 2016 and previous years accounting
 - a. List of issues preventing finalization of accounting
 - i. Modeling Bonny Reservoir
 1. Kansas and Colorado discussions
 - a. This issue has been resolved in the 3-States Meetings. Beightel reminded the group that the provisions of the FSS will to be used when modeling Bonny Reservoir. Schreuder agreed with Beightel and added a little more information noting that moving forward Bonny Reservoir would be modeled as full as the FSS spells out.
 - ii. Beginning and Ending Meter Data
 1. Review of Colorado Data (Kansas)
 - a. Beightel asked Colorado if the 2015 CIR predictions had been completed and loaded on the RRCA website. Franco confirmed that this analysis likely hadn't been loaded onto the website and that he would follow up with Jim Slattery on the status. Beightel believed that this issue might be close to being put to bed if the 2015 CIR analysis could be provided.
 - iii. Discuss annual data exchange and who has the best available data.
 1. Procedure for populating current year Surface Water inputs
 2. Schreuder discussed his desire to include new fields in the SW Inputs spreadsheet to account for Nebraska augmentation projects.
 - b. Continue work and provide future update on improving accounting tools developed by the Engineering Committee.
 - i. 1995-2015 accounting spreadsheet from Schreuder
 1. Schreuder will incorporate any new changes to the SW Inputs spreadsheet and load an updated version on the website for review.
 2. Nebraska will start draft report of 2007-2015 accounting for Engineering Committee submission to RRCA at annual meeting.

7. By December 31, 2016, unify accounting procedures and reporting requirements approved by all RRCA resolutions including determining the appropriate model run or runs to be performed by Principia Mathematica.
 - a. Bradley walked through a draft version of the Accounting Procedures and Reporting Requirements (Revised August 24, 2016). Bradley noted that the sections in red are new

and the base document is the version Colorado distributed which incorporated the proposed CCP accounting changes. Bradley also noted that changes appearing in green have already been approved. An example of applying the proposed accounting procedures changes was also provided as Attachment 8.

8. Harlan County Lake–Evaporation Charges and Compact Accounting Adjustments
 - a. Continue to explore options for sharing evaporation charges for Harlan County Lake when accounts exist separate from the project water supplies of Bostwick Division and explore potential means to adjust the compact accounting of Harlan County Lake for the mutual benefit of the States.
 - b. Examples for calculating the incremental increase in reservoir areas
 - c. Ongoing discussions at Three-States Meetings
 - i. Beightel made a quick comment regarding Kansas exclusive accounts. How this account works will have to be figured out at a later time. There was no further discussion on the matter.
9. Estimating Ground and Surface Water Irrigation Recharge and Return Flows
 - a. Draft scope and needs document regarding changes in irrigation efficiency (Kansas)
 - i. Kansas continues to work on this document but does not have anything ready for distribution at this time.
10. Creating a New RRCA-oriented Website
 - a. Draft administrative website (Kansas)
 - i. Erickson informed the group that the old draft has been heavily modified and it is now going to be completely done away with. Further review of this draft is not required. Kansas will now be using Word Press, for various reasons, to build the website and a new draft version is in the works and will be distributed to the group when ready. Schreuder noted that Word Press will integrate well with his website.
11. Draft a document memorializing when and how RRCA Accounting Procedures have changed
 - a. Erickson is still working on this document. When a draft is complete it will be distributed to the group.
12. Future Augmentation Plans
 - a. Ongoing discussions at Three-States Meetings
 - i. Each state will keep one another apprised of future augmentation plans.
13. Summary of Meeting Actions/Assignments
 - Franco will investigate the renewal of Principia Mathematica contract.
 - Franco will investigate the status of Colorado’s 2015 CIR projections and report back.
 - Schreuder will prepare updated SWInput sheet and post on the website.
 - Beightel will work on getting comments back on the updated Accounting Procedures.
 - Nebraska will start draft report of 2007-2015 accounting for Engineering Committee submission to RRCA at annual meeting.

14. Future Meeting Schedule

February 1st, 2017 at 12:30 MST

15. Adjournment

Meeting concluded at 1pm MST

Attachment 2 to the 2017 Engineering Committee Report

FINAL MEETING NOTES for the
**QUARTERLY MEETING of the
ENGINEERING COMMITTEE of the
REPUBLICAN RIVER COMPACT ADMINISTRATION**

February 3rd, 2017, 12:30 PM Mountain, 1:30 PM Central

Attendees:

Ivan Franco	Colorado	Jesse Bradley	Flatwater Group
Willem Schreuder	Principia Mathematica	Chris Beightel	Kansas
Jennifer Schellpeper	Nebraska	Chelsea Erickson	Kansas
Kari Burgert	Nebraska	Hongsheng Cao	Kansas
Zablon Adane	Nebraska	Sam Perkins	Kansas
Carol Flaute	Nebraska		

1. Introductions
2. Review/Modify Agenda
3. Publication of RRCA Annual Reports
 - a. 2014 Report (Nebraska)
 - i. This report has been distributed to each state and is considered complete.
 - b. 2015 Reports (Nebraska)
 - i. October 2014 – Review is complete, and the final copy has been distributed to each state.
 - ii. November 2014 – Second draft is forthcoming.
 - iii. March 2015 - First draft has been sent to Kansas for edits then coming to Colorado.
 - iv. August 2015 Annual – First draft sent to Kansas for edits then coming to Colorado.
 - c. 2016 Reports (Colorado)
 - i. Franco is working on the November 24th Special Meeting minutes, and those are forthcoming.
4. Modeling and Data Tasks for Principia Mathematica
 - a. Documentation
 - i. Schreuder hasn't had a chance to get any work done on this matter. Schreuder noted that he has a contract with Nebraska covering several years sitting on his desk waiting for finalization. Beightel anticipates Kansas will be renewing its contract soon.
5. RRCA Data Exchange
 - a. 2016 Accounting – Nebraska is working on getting set for April 15th data exchange. Schreuder said that precipitation and reservoir data is updated through 2016. Schreuder will also put together preliminary 2017 run as soon as he can. Bradley asked if the 2016 run would include all updated precipitation and reservoir data. Schreuder noted it would

be a good idea if someone contacted the USGS regarding their data finalization for the year.

- b. 2017 Accounting – A preliminary accounting update would be provided to Kansas and Colorado by May 10th pursuant to the August 24, 2016 resolution.

6. Finalization of 2016 and previous years' accounting

- a. List of issues preventing finalization of accounting

- i. Modeling Bonny Reservoir

1. Kansas and Colorado discussions

- a. Schreuder was asked if he is using version 12S2 for the run? It was noted that conductance values in the Bonny stream cells seem to be set to zero which may not be appropriate. Schreuder stated that he thought version 12S3 is the newest version that includes CCP and reorganizes the stream package. Schreuder said that he will provide definitions and descriptions of 12S2 and 12S3 model updates. He also suggested requesting that the RRCA formally adopt 12S3.

- ii. Beginning and Ending Meter Data

1. Review of Colorado Data (Kansas) – Kansas hasn't had a chance to look at Colorado's most recent CIR data. Kansas has looked at data from previous years and wants to compare Colorado's 2015 meter data with its CIR data.

- iii. Discussion of annual data exchange and who has the best available data

1. Procedure for populating current year Surface Water inputs

- a. The group seemed comfortable with the data in the SWInputs sheet. Schreuder has some minor changes to implement Harlan County Lake agreements.

- b. Continue work and provide future update on improving accounting tools developed by the Engineering Committee

- i. 1995-2015 accounting spreadsheet from Schreuder

- ii. Draft report of 2007-2015 accounting for submission to RRCA (Nebraska)

1. Schreuder will be reviewing the spreadsheet provided by Nebraska that was used to generate the draft report. Schreuder noted that he will use the spreadsheet to check Main Stem accounting issues which he believes are still lingering. Schreuder wants to work on this via email exchanges.
 2. Colorado water short year calculations may need to be changed after discussion at the upcoming 3-States meeting.
 3. It was discussed that augmentation water supply inputs need to be explicitly presented in the accounting report. Kansas will be reviewing how augmentation is handled in the calculations.
 4. Beightel asked where the draft accounting comes from that Schreuder posted on his website. Schreuder informed the group that a program (*mkacct*) applies the Accounting equations and uses the SWInputs sheet

- pulled from a .dbf file. Schreuder noted that the program output can be used as a check of the spreadsheet provided by Nebraska.
5. The committee reaffirmed that the accounting inputs for approved years through 2006 would remain as they were approved, and if needed for programming purposes, Schreuder would note any discrepancies between approved data and updated/corrected values since approval.
 6. Beightel noted that the Harlan County Lake Warren Act water evaporation was not included in the draft accounting report but should be added.
7. By December 31, 2016, unify accounting procedures and reporting requirements approved by all RRCA resolutions including determining the appropriate model run or runs to be performed by Principia Mathematica.
 - a. This is now the latest draft trying to deal with and incorporate all of the Kansas edits. This new version started with the previously approved changes by resolution at the 2016 Annual Meeting and includes redline of the proposed HCL/CCP resolutions changes. Kansas also wants to add daily augmentation data to the annual reporting requirement for Nebraska similar to Colorado's approach.
 8. Harlan County Lake–Evaporation Charges and Compact Accounting Adjustments
 - a. Continue to explore options for sharing evaporation charges for Harlan County Lake when accounts exist separate from the project water supplies of Bostwick Division and explore potential means to adjust the compact accounting of Harlan County Lake for the mutual benefit of the States
 - b. Examples for calculating the incremental increase in reservoir areas
 - c. Ongoing discussions at Three-States Meetings
 - i. Kansas noted that they would eventually like Kansas exclusive data in the accounting. Otherwise, no further discussion on the matter.
 9. Estimating Ground and Surface Water Irrigation Recharge and Return Flows
 - a. Draft scope and needs document regarding changes in irrigation efficiency (Kansas)
 - i. Kansas continues to work on this document but does not have anything ready for distribution now.
 10. Creating a New RRCA-oriented Website
 - a. Draft administrative website (Kansas)
 - i. Chelsea informed the group that the website is being worked on but is still too rough to distribute a first draft. Schreuder thinks when its further along he can push it into the restricted area of the website, and the group can view it there.
 11. Draft a document memorializing when and how RRCA Accounting Procedures have changed
 - a. This document continues to be drafted. Chelsea is parsing data out of the actual annual reports to serve as references.

12. Future Augmentation Plans

- a. Ongoing discussions at Three-States Meetings
 - i. Each state will keep one another apprised of future augmentation plans. No updates now.

13. Summary of Meeting Actions/Assignments

- a. Franco will contact the USGS to touch base on annual data completion.
- b. Schreuder will frame up a document of Version 12S3 for discussion.
- c. All states would exchange updates to 2007-2015 accounting for the draft report.
- d. All states would discuss the latest draft accounting procedures, and Nebraska would follow-up on the proposed changes in the document.

14. Future Meeting Schedule

April 27th, 2017, at 12:30 MST

15. Adjournment

Meeting concluded at 1:37 pm MST

Attachment 3 to the 2017 Engineering Committee Report

Final Meeting Notes for the
**QUARTERLY MEETING of the
ENGINEERING COMMITTEE of the
REPUBLICAN RIVER COMPACT ADMINISTRATION**
May 11, 2017, 9:30 AM Mountain

Attendees:

Ivan Franco	Colorado	Jesse Bradley	Nebraska
Willem Schreuder	Principia Mathematica	Chris Beightel	Kansas
Jennifer Schellpeper	Nebraska	Chelsea Erickson	Kansas
Kari Burgert	Nebraska		
Zablon Adane	Nebraska		

1. Introductions
2. Review/Modify Agenda
 - a. No changes to the agenda however it was agreed that the focus of the meeting would be only unapproved accounting issues to facilitate actions planned for the May 25, 2017, Special Meeting.
3. Publication of RRCA Annual Reports
 - a. 2015 Reports (Nebraska) – Discussion postponed until next EC Meeting
 - i. November 2014
 - ii. March 2015
 - iii. August 2015 Annual
 - b. 2016 Reports (Colorado) – Discussion postponed until next EC Meeting
4. Modeling and Data Tasks for Principia Mathematica
 - a. Documentation
 - i. Discussion postponed until next EC Meeting
5. RRCA Data Exchange - Discussion postponed until next EC Meeting
 - a. 2016 Accounting
 - b. 2017 Accounting
6. Finalization of 2016 and previous years accounting
 - a. List of issues preventing finalization of accounting
 - i. Modeling Bonny Reservoir
 1. Kansas and Colorado discussions
 - ii. Beginning and Ending Meter Data
 1. Review of Colorado Data (Kansas)
 - iii. Discussion of annual data exchange and who has the best available data.
 1. Procedure for populating current year Surface Water inputs

- a. Schreuder noted that USGS streamflow data for 2016 was downloaded and went smoothly. Franco offered to send a thank you to the USGS.
- b. Continue work and provide future update on improving accounting tools developed by the Engineering Committee.
 - i. 1995-2015 accounting spreadsheet from Schreuder
 - ii. Draft report of 2007-2015 accounting for submission to RRCA (Nebraska)
 1. This task is now considered complete.
 2. The group agreed to make a minor change to the draft Resolution Approving Accounting Changes.
 3. The group reviewed the draft changes to the RRCA Rules and Regulations. It was agreed that a redline version and clean version of the rules would be presented to the commissioners.
 4. The group reviewed the draft Accounting Procedures and Reporting Requirements.
 - a. Beightel commented on Table 5E language. Specifically, adding the words “generated in the sub-basin” to column 5.
 - b. The group agreed for simplicities sake to define RWS credit the first time it is mentioned.
 - c. A redline and clean version will be distributed for the commissioners.
 - iii. The group agreed to propose for adoption by the commissioners the summary documents prepared by Nebraska for years 2005-2006. Beightel suggested instead incorporating the sheet David Barfield distributed, however the group decided against this change.
 - iv. The group discussed the following changes to the summary documents Nebraska prepared for years 2007 through 2015.
 1. Noting that the accounting points that had changed were Guide Rock and North Fork.
 2. Removing “b. Stream network reconfigurations” from the cover summary since we are using model version 12S2.
 3. Agreement was reached that the final 2007 to 2015 groundwater model runs were completed.
 4. Beightel requested a footnote be added regarding the States’ positions on the Unallocated Supply of the South Fork.
 5. Schreuder noted that the Beaver Creek Reduction in Table 5A would need to be calculated by a different method for the start-up years. It was decided to use the single year allocation from approved accounting for 2003 to 2006.
 6. Schreuder noted that Nebraska’s Share of Unused Colorado Allocation in Table 5C and D would need to be populated with a number in the spreadsheet. It was decided to use zero for this value for 2005 and 2006.

7. The groundwater impacts above and below Guide Rock will be calculated on totals as we have been doing versus the sum of the sub-basins.
7. By December 31, 2016 unify accounting procedures and reporting requirements approved by all RRCA resolutions including determining the appropriate model run or runs to be performed by Principia Mathematica.
 - a. This task is considered complete
8. Harlan County Lake–Evaporation Charges and Compact Accounting Adjustments - Discussion postponed until next EC Meeting
 - a. Continue to explore options for sharing evaporation charges for Harlan County Lake when accounts exist separate from the project water supplies of Bostwick Division and explore potential means to adjust the compact accounting of Harlan County Lake for the mutual benefit of the States.
 - b. Examples for calculating the incremental increase in reservoir areas
 - c. Ongoing discussions at Three-States Meetings
9. Estimating Ground and Surface Water Irrigation Recharge and Return Flows
 - a. Draft scope and needs document regarding changes in irrigation efficiency (Kansas)
 - i. Discussion postponed until next EC Meeting
10. Creating a New RRCA-oriented Website
 - a. Draft administrative website (Kansas)
 - i. Discussion postponed until next EC Meeting
11. Draft a document memorializing when and how RRCA Accounting Procedures have changed
 - a. Discussion postponed until next EC Meeting
12. Future Augmentation Plans
 - a. Ongoing discussions at Three-States Meetings
 - i. Discussion postponed until next EC Meeting
13. Summary of Meeting Actions/Assignments
 - a. Nebraska will provide copies of the documents
14. Future Meeting Schedule
 - a. May 23, 2017 at 12:30 MST
 - b. July 18th, 2017 at 12:30 MST
15. Adjournment
 - a. Meeting concluded at 10:35 am MST

Attachment 4 to the 2017 Engineering Committee Report

Final Meeting minutes
**QUARTERLY MEETING of the
ENGINEERING COMMITTEE of the
REPUBLICAN RIVER COMPACT ADMINISTRATION**
July 18, 2017, 12:30 PM Mountain

Attendees:

Ivan Franco	Colorado	Jesse Bradley	Nebraska
Willem Schreuder	Principia Mathematica	Chris Beightel	Kansas
Jennifer Schellpeper	Nebraska	Chelsea Erickson	Kansas
Kari Burgert	Nebraska	Hongsheng Cao	Kansas

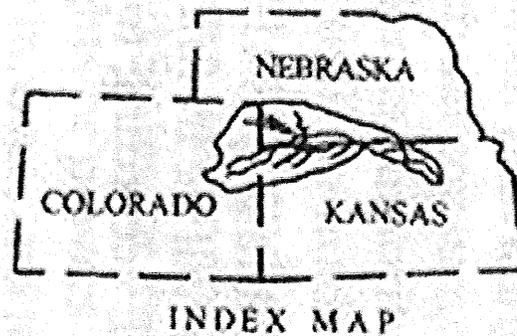
1. Introductions
2. Review/Modify Agenda
3. Publication of RRCA Annual Reports
 - a. 2015 Reports (Nebraska)
 - i. November 2014 – Revisions have been made and the final version will be distributed to each state.
 - ii. March 2015 – Kansas forwarded comments to Colorado in April 2017
 - iii. August 2015 Annual – Kansas forwarded comments to Colorado in April 2017
 - b. 2016 Reports (Colorado)
 - i. November 24, 2015 – Kansas and Nebraska have provided initial comments. Further comments are forthcoming from Kansas.
 - ii. August 24, 2016 Annual - Colorado reported that a draft version is forthcoming for review
4. Modeling and Data Tasks for Principia Mathematica
 - a. Documentation
 - i. Schreuder hasn't had a chance to make any further progress on this matter. The group had a discussion regarding the future of the internal accounting that Schreuder produced. The accounting can serve as a useful tool for the public but has differences from the approved accounting. It was agreed that, for now, only posting the approved accounting to the public RRCA site was the most prudent course of action.
5. RRCA Data Exchange
 - a. 2016 Accounting
 - i. Schreuder noted that the Courtland Canal accounting values have some slight discrepancies and Hongsheng is working on addressing some of these values with Schreuder. Schreuder will update surface water inputs sheet after reviewing the final data that will be provided by Kari Burgert and rerun accounting for final review. Schreuder noted that from now going forward the approved values in the surface water inputs sheet will be password protected (rrca is the password).

- ii. Kari Burgert pointed out that some new values approved in the most recent accounting procedures, such as RCCV, are not included in the SWinputs sheet and she would supply these values to Schreuder.
 - b. 2017 Accounting
 - i. Preliminary accounting for the year has been performed by Schreuder. He noted that, as usual, almost all the data is a rerun of last year's data.
- 6. Finalization of 2016 accounting:
 - a. List of issues preventing finalization of accounting
 - i. Discussion of annual data exchange and who has the best available data.
 - 1. Procedure for populating current year Surface Water inputs
 - a. Schreuder noted that Nebraska filed in the SW Inputs Sheet and Kansas supplied him their own input sheet. The only remaining question in Schreuder's mind is the Courtland data that comes from each state.
 - b. Bradley wanted to know what Schreuder is looking for in all the inputs into the Courtland calculations. Schreuder is still unsure of how some of the values are produced and would like to see these values reduce this to fundamental calculations. Beightel suggested that the EC coordinate a meeting to focus on understanding and potentially improving the Courtland Canal/Lovewell Ops spreadsheet.
 - b. Continue work and provide future update on improving accounting tools developed by the Engineering Committee.
 - i. 1995-2015 accounting spreadsheet from Schreuder
 - 1. The group agreed that the spreadsheet is up and running and Beightel suggested getting some direction from the commissioners on what to do with this product.
- 7. Harlan County Lake–Evaporation Charges and Compact Accounting Adjustments
 - a. Continue to explore options for sharing evaporation charges for Harlan County Lake when accounts exist separate from the project water supplies of Bostwick Division and explore potential means to adjust the compact accounting of Harlan County Lake for the mutual benefit of the States.
 - b. Examples for calculating the incremental increase in reservoir areas
 - c. Ongoing discussions at Three-States Meetings
 - i. This has been resolved and is not recommended as a future assignment
- 8. Estimating Ground and Surface Water Irrigation Recharge and Return Flows
 - a. Draft scope and needs document regarding changes in irrigation efficiency (Kansas)
 - i. Beightel reported that work continues on this task but no update at this time.
- 9. Creating a New RRCA-oriented Website
 - a. Draft administrative website (Kansas)
 - i. Erickson has distributed a new draft version of the website for review.

- ii. Beightel proposed drafting some questions for the commissioners to get better direction on this task.
10. Draft a document memorializing when and how RRCA Accounting Procedures have changed
 - a. Chelsea reported that a final draft is in the works but won't be ready by this year's annual meeting.
 - b. Jennifer pointed out that she believed the EC was given an additional task at the special meeting to produce short summary explaining the history of Table 4A in the approved accounting.
11. Future Augmentation Plans
 - a. Ongoing discussions at Three-States Meetings
 - i. Beightel noted that this task now seemed complete but that it could remain on the agenda as a place for each state to provide an update on augmentation activities.
12. Summary of Meeting Actions/Assignments
 - a. Honsheng and Kari will be providing Schreuder with corrected/missing data and he will provide a final version of the accounting on the website for review.
 - b. Beightel will draft an email articulating his thoughts on the website assignment and what he would like from the commissioners.
 - c. Franco will draft a copy of the Engineering Committee report for review by the group.
13. Future Meeting Schedule
Annual Meeting August 22nd in Burlington
14. Adjournment
Meeting concluded at 1:40 p.m. MST

Attachment 5 to the 2017 Engineering Committee
Report

**Republican River Compact
Accounting Inputs and Tables
Summarized for Accounting Year
2016**



August 22, 2017

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INPUTS

Calendar Year		2016
Groundwater Data		
North Fork Subbasin	GW CBCU Colorado	16,820
	GW CBCU Kansas	0
	GW CBCU Nebraska	1,155
Arikaree Subbasin	GW CBCU Colorado	2,638
	GW CBCU Kansas	183
	GW CBCU Nebraska	147
Buffalo Subbasin	GW CBCU Colorado	488
	GW CBCU Kansas	0
	GW CBCU Nebraska	3,514
Rock Subbasin	GW CBCU Colorado	120
	GW CBCU Kansas	0
	GW CBCU Nebraska	4,994
South Fork Subbasin	GW CBCU Colorado	13,883
	GW CBCU Kansas	5,717
	GW CBCU Nebraska	904
Frenchman Subbasin	GW CBCU Colorado	1,611
	GW CBCU Kansas	0
	GW CBCU Nebraska	82,036
Driftwood Subbasin	GW CBCU Colorado	0
	GW CBCU Kansas	0
	GW CBCU Nebraska	932
Red Willow Subbasin	GW CBCU Colorado	0
	GW CBCU Kansas	0
	GW CBCU Nebraska	8,748
Medicine Creek Subbasin	GW CBCU Colorado	0
	GW CBCU Kansas	0
	GW CBCU Nebraska	21,225
Beaver Subbasin	GW CBCU Colorado	0
	GW CBCU Kansas	6,513
	GW CBCU Nebraska	4,543
Sappa Subbasin	GW CBCU Colorado	0
	GW CBCU Kansas	1,617
	GW CBCU Nebraska	2,159
Prairie Dog Subbasin	GW CBCU Colorado	0
	GW CBCU Kansas	4,342
	GW CBCU Nebraska	0
Mainstem Subbasin	GW CBCU Colorado	(2,436)
	GW CBCU Kansas Above Guide Rock	(53)
	GW CBCU Kansas Below Guide Rock	43
	GW CBCU Nebraska Above Guide Rock	72,496
	GW CBCU Nebraska Below Guide Rock	2,233

Import Water Data		
North Fork Subbasin	Imported Water Nebraska	0
Arikaree Subbasin	Imported Water Nebraska	0
Buffalo Subbasin	Imported Water Nebraska	0
Rock Subbasin	Imported Water Nebraska	0
South Fork Subbasin	Imported Water Nebraska	0
Frenchman Subbasin	Imported Water Nebraska	0
Driftwood Subbasin	Imported Water Nebraska	0
Red Willow Subbasin	Imported Water Nebraska	50
Medicine Creek Subbasin	Imported Water Nebraska	10,687
Beaver Subbasin	Imported Water Nebraska	0
Sappa Subbasin	Imported Water Nebraska	28
Prairie Dog Subbasin	Imported Water Nebraska	0
Mainstem Subbasin	Imported Water Nebraska Above Guide Rock	9,128
	Imported Water Nebraska Below Guide Rock	(12)
	Total	19,881

Calendar Year		2016
SW Pumping Data		
North Fork Subbasin	SW Diversions - Irrigation - Non-Federal Canals- Colorado	478
	SW Diversions - Irrigation - Small Pumps - Colorado	158
	SW Diversions - M&I - Colorado	0
Arikaree Subbasin	SW Diversions - Irrigation - Non-Federal Canals- Colorado	62
	SW Diversions - Irrigation - Small Pumps - Colorado	0
	SW Diversions - M&I - Colorado	0
	SW Diversions - Irrigation - Non-Federal Canals- Kansas	0
	SW Diversions - Irrigation - Small Pumps - Kansas	0
	SW Diversions - M&I - Kansas	0
	SW Diversions - Irrigation - Non-Federal Canals - Nebraska	0
	SW Diversions - Irrigation - Small Pumps - Nebraska	0
	SW Diversions - M&I - Nebraska	0
Buffalo Subbasin	SW Diversions - Irrigation - Non-Federal Canals- Colorado	0
	SW Diversions - Irrigation - Small Pumps - Colorado	0
	SW Diversions - M&I - Colorado	0
	SW Diversions - Irrigation - Non-Federal Canals - Nebraska	150
	SW Diversions - Irrigation - Small Pumps - Nebraska	10
	SW Diversions - M&I - Nebraska	0
Rock Subbasin	SW Diversions - Irrigation - Non-Federal Canals - Nebraska	0
	SW Diversions - Irrigation - Small Pumps - Nebraska	0
	SW Diversions - M&I - Nebraska	0
South Fork Subbasin	SW Diversions - Irrigation - Non-Federal Canals- Colorado	3
	SW Diversions - Irrigation - Small Pumps - Colorado	0
	SW Diversions - M&I - Colorado	0
	SW Diversions - Irrigation - Non-Federal Canals- Kansas	0
	SW Diversions - Irrigation - Small Pumps - Kansas	0
	SW Diversions - M&I - Kansas	0
	SW Diversions - Irrigation - Non-Federal Canals - Nebraska	0
	SW Diversions - Irrigation - Small Pumps - Nebraska	0
SW Diversions - M&I - Nebraska	0	
Frenchman Subbasin	SW Diversions - Irrigation - Non-Federal Canals - Nebraska	0
	SW Diversions - Irrigation - Small Pumps - Nebraska	0
	SW Diversions - M&I - Nebraska	0
Driftwood Subbasin	SW Diversions - Irrigation - Non-Federal Canals- Kansas	0
	SW Diversions - Irrigation - Small Pumps - Kansas	0
	SW Diversions - M&I - Kansas	0
	SW Diversions - Irrigation - Non-Federal Canals - Nebraska	0
	SW Diversions - Irrigation - Small Pumps - Nebraska	0
	SW Diversions - M&I - Nebraska	0
Red Willow Subbasin	SW Diversions - Irrigation - Non-Federal Canals - Nebraska	0
	SW Diversions - Irrigation - Small Pumps - Nebraska	48
	SW Diversions - M&I - Nebraska	0
Medicine Creek Subbasin	SW Diversions - Irrigation - Non-Federal Canals - Nebraska - Above Gage	0
	SW Diversions - Irrigation - Small Pumps - Nebraska - Above Gage	30
	SW Diversions - M&I - Nebraska - Above Gage	0
	SW Diversions - Irrigation - Non-Federal Canals - Nebraska -Below Gage	0
	SW Diversions - Irrigation - Small Pumps -Nebraska - Below Gage	189
SW Diversions - M&I - Nebraska - Below Gage	0	

Calendar Year		2016
SW Pumping Data, continued		
Beaver Subbasin	SW Diversions - Irrigation - Non-Federal Canals- Colorado	0
	SW Diversions - Irrigation - Small Pumps - Colorado	0
	SW Diversions - M&I - Colorado	0
	SW Diversions - Irrigation - Non-Federal Canals- Kansas	0
	SW Diversions - Irrigation - Small Pumps - Kansas	5
	SW Diversions - M&I - Kansas	0
	SW Diversions - Irrigation - Non-Federal Canals - Nebraska - Above Gage	0
	SW Diversions - Irrigation - Small Pumps - Nebraska - Above Gage	0
	SW Diversions - M&I - Nebraska - Above Gage	0
	SW Diversions - Irrigation - Non-Federal Canals - Nebraska -Below Gage	0
	SW Diversions - Irrigation - Small Pumps -Nebraska - Below Gage	0
	SW Diversions - M&I - Nebraska - Below Gage	0
	Sappa Subbasin	SW Diversions - Irrigation - Non-Federal Canals- Kansas
SW Diversions - Irrigation - Small Pumps - Kansas		0
SW Diversions - M&I - Kansas		0
SW Diversions - Irrigation - Non-Federal Canals - Nebraska - Above Gage		0
SW Diversions - Irrigation - Small Pumps - Nebraska - Above Gage		154
SW Diversions - M&I - Nebraska - Above Gage		0
SW Diversions - Irrigation - Non-Federal Canals - Nebraska -Below Gage		0
Prairie Dog Subbasin	SW Diversions - Irrigation - Small Pumps -Nebraska - Below Gage	0
	SW Diversions - M&I - Nebraska - Below Gage	0
	SW Diversions - Irrigation - Non-Federal Canals- Kansas	0
	SW Diversions - Irrigation - Small Pumps - Kansas	384
	SW Diversions - M&I - Kansas	379
Mainstem Subbasin	SW Diversions - Irrigation - Non-Federal Canals - Nebraska -Below Gage	0
	SW Diversions - Irrigation - Small Pumps -Nebraska - Below Gage	45
	SW Diversions - M&I - Nebraska - Below Gage	0
	SW Diversions - Irrigation - Non-Federal Canals- Kansas	0
	SW Diversions - Irrigation - Small Pumps - Kansas	713
	SW Diversions - M&I - Kansas	0
	SW Diversions - Irrigation - Non-Federal Canals - Nebraska	3,078
	SW Diversions - Irrigation - Small Pumps - Nebraska	1,041
Non-Federal SW Consumptive Use	SW Diversions - M&I - Nebraska	0
	SW Diversions - Irrigation - Non-Federal Canals - Nebraska Below Guide Rock	0
	SW Diversions - Irrigation - Small Pumps - Nebraska Below Guide Rock	655
	SW Diversions - M&I - Nebraska - Below Guide Rock	0
	% Non-Federal Canal Diversion Consumed	60%
	% Small Surface Water Pumps Consumed	75%
	% Municipal And Industrial SW Consumed	50%

Calendar Year		2016
Non-Federal Reservoir Evaporation Data		
North Fork Subbasin	Non-Federal Reservoir Evaporation - Colorado	37
Arikaree Subbasin	Non-Federal Reservoir Evaporation - Colorado	0
	Non-Federal Reservoir Evaporation - Kansas	13
	Non-Federal Reservoir Evaporation - Nebraska	0
Buffalo Subbasin	Non-Federal Reservoir Evaporation - Colorado	0
	Non-Federal Reservoir Evaporation - Nebraska	6
Rock Subbasin	Non-Federal Reservoir Evaporation - Nebraska	81
South Fork Subbasin	Non-Federal Reservoir Evaporation - Colorado	25
	Non-Federal Reservoir Evaporation - Kansas	118
	Non-Federal Reservoir Evaporation - Nebraska	0
Frenchman Subbasin	Non-Federal Reservoir Evaporation - Nebraska	47
Driftwood Subbasin	Non-Federal Reservoir Evaporation - Kansas	9
	Non-Federal Reservoir Evaporation - Nebraska	0
Red Willow Subbasin	Non-Federal Reservoir Evaporation - Nebraska	184
Medicine Creek Subbasin	Non-Federal Reservoir Evaporation - Nebraska - Above Gage	215
	Non-Federal Reservoir Evaporation - Nebraska - Below Gage	1
Beaver Subbasin	Non-Federal Reservoir Evaporation - Colorado	0
	Non-Federal Reservoir Evaporation - Kansas	216
	Non-Federal Reservoir Evaporation - Nebraska - Above Gage	71
	Non-Federal Reservoir Evaporation - Nebraska - Below Gage	0
Sappa Subbasin	Non-Federal Reservoir Evaporation - Kansas	232
	Non-Federal Reservoir Evaporation - Nebraska - Above Gage	29
	Non-Federal Reservoir Evaporation - Nebraska - Below Gage	2
Prairie Dog Subbasin	Non-Federal Reservoir Evaporation - Kansas	258
	Non-Federal Reservoir Evaporation - Nebraska	11
Mainstem Subbasin	Non-Federal Reservoir Evaporation - Kansas	81
	Non-Federal Reservoir Evaporation - Nebraska - Above Guide Rock Gage - Whole Basin Value:	733
	Non-Federal Reservoir Evaporation - Nebraska - Below Guide Rock Gage - Whole Basin Value:	34

Stream Gage Data		
North Fork Subbasin	North Fork Republican River At Colorado-Nebraska State Line	28,091
Arikaree Subbasin	Arikaree River At Haigler	397
Buffalo Subbasin	Buffalo Creek Near Haigler	1,536
Rock Subbasin	Rock Creek At Parks	4,613
South Fork Subbasin	South Fork Republican River Near Benkelman	3,898
Frenchman Subbasin	Frenchman Creek At Culbertson	18,852
Driftwood Subbasin	Driftwood Creek Near McCook	3,280
Red Willow Subbasin	Red Willow Creek Near Red Willow	3,936
Medicine Creek Subbasin	Medicine Creek Below Harry Strunk	57,014
Beaver Subbasin	Beaver Creek Near Beaver City	809
Sappa Subbasin	Sappa Creek Near Stamford	5,376
Prairie Dog Subbasin	Prairie Dog Creek Near Woodruff	2,839
Mainstem Subbasin	Republican River At Guide Rock	47,639
	Republican River Near Hardy	80,515

Hardy Gage Data		
USGS Gage 06853500 Republican River Near Hardy, NE		
Mainstem Subbasin	January	5,429
	February	6,532
	March	6,415
	April	6,625
	May	13,501
	June	5,901
	July	4,844
	August	6,153
	September	9,868
	October	5,278
	November	5,286
	December	4,685
		ANNUAL

ACCOUNTING TABLES

Table 1: Annual Virgin and Computed Water Supply, Allocations, and Computed Beneficial Consumptive Uses by State, Main Stem, and Sub-Basin

2016 Basin	Virgin Water Supply	Computed Water Supply	Allocations				Computed Beneficial Consumptive Use			
			Colorado	Kansas	Nebraska	Unallocated	Colorado	Kansas	Nebraska	Nebraska
North Fork	40,370	40,370	9,040	0	9,930	21,400	17,260	0	3,550	
Arikaree	3,430	3,430	2,690	170	580	(10)	2,680	200	150	
Buffalo	5,650	5,650	0	0	1,860	3,790	490	0	3,620	
Rock	9,310	9,310	0	0	3,720	5,590	120	0	5,080	
South Fork	24,850	24,850	11,030	9,990	350	3,480	14,210	5,840	900	
Frenchman	106,320	106,230	0	0	56,940	49,290	1,610	0	84,780	
Driftwood	1,420	1,420	0	100	230	1,090	0	10	930	
Red Willow	16,390	14,600	0	0	2,800	11,800	0	0	9,140	
Medicine	42,600	46,980	0	0	4,280	42,700	0	0	21,610	
Beaver	12,150	12,150	2,430	4,710	4,930	80	0	6,730	4,610	
Sappa	8,700	8,700	0	3,580	3,580	1,540	0	1,850	2,310	
Prairie Dog	13,570	9,950	0	4,550	760	4,640	0	7,120	40	
Main Stem	130,010	116,190	0	59,370	56,820	0	(2,440)	29,570	119,400	
Total All Basins	414,770	399,830	25,190	82,470	146,780	145,390	33,930	51,320	256,120	
Main Stem Including Unallocated		261,580	0	133,660	127,920					
Total	414,770	399,830	25,190	156,760	217,880	0	33,930	51,320	256,120	

Table 2: Original Compact Virgin Water Supply and Allocations

Basin	Virgin Water Supply	Colorado Allocation	% of Basin Supply	Kansas Allocation	% of Basin Supply	Nebraska Allocation	% of Basin Supply	Unallocated	% of Basin Supply
North Fork	44,700	10,000	22.4%			11,000	24.6%	23,700	53.0%
Arikaree	19,610	15,400	78.5%	1,000	5.1%	3,300	16.8%	(90)	-0.4%
Buffalo	7,890					2,600	33.0%	5,290	67.0%
Rock	11,000					4,400	40.0%	6,600	60.0%
South Fork	57,200	25,400	44.4%	23,000	40.2%	800	1.4%	8,000	14.0%
Frenchman	98,500					52,800	53.6%	45,700	46.4%
Driftwood	7,300			500	6.9%	1,200	16.4%	5,600	76.7%
Red Willow	21,900					4,200	19.2%	17,700	80.8%
Medicine	50,800					4,600	9.1%	46,200	90.9%
Beaver	16,500	3,300	20.0%	6,400	38.8%	6,700	40.6%	100	0.6%
Sappa	21,400			8,800	41.1%	8,800	41.1%	3,800	17.8%
Prairie Dog	27,600			12,600	45.7%	2,100	7.6%	12,900	46.7%
Tributaries Sub-Total	384,000							175,500	
Main Stem	94,500								
Main Stem + Unallocated	270,000			138,000	51.1%	132,000	48.9%		
Total	478,900	54,100		190,300		234,500			

Table 3A: Table to Be Used to Calculate Colorado's Five-Year Running Average Allocation and Computed Beneficial

	Col. 1	Col. 2	Col. 3	Col. 4
Year	Allocation	Computed Beneficial Consumptive	Imported Water Supply Credit and CORWS	Difference between Allocation and the Computed Beneficial Consumptive Use offset by Imported Water Supply Credit and CORWS Credit Col 1 – (Col 2- Col 3)
2012	20,620	22,300	0	(1,680)
2013	18,690	28,640	0	(9,950)
2014	21,900	32,100	7,448	(2,752)
2015	24,760	33,780	10,760	1,740
2016	25,190	33,930	10,130	1,390
Avg 2012-2016	22,230	30,150	5,670	(2,250)

Table 3B: Table to Be Used to Calculate Kansas's Five-Year Running Average Allocation and Computed Beneficial

	Col. 1	Col. 2	Col. 3	Col. 4
Year	Allocation	Computed Beneficial Consumptive	Imported Water Supply Credit	Difference between Allocation and the Computed Beneficial Consumptive Use offset by Imported Water Supply Credit Col 1 – (Col 2- Col 3)
2012	212,210	66,810	NA	145,400
2013	137,140	60,920	NA	76,220
2014	102,760	60,060	NA	42,700
2015	163,420	50,890	NA	112,530
2016	156,760	51,320	NA	105,440
Avg 2012-2016	154,460	58,000	NA	96,460

Table 3C: Table to Be Used to Calculate Nebraska's Five-Year Running Average Allocation and Computed Beneficial

	Col. 1	Col. 2	Col. 3	Col. 4
Year	Allocation	Computed Beneficial Consumptive	Imported Water Supply Credit and NERWS	Difference between Allocation and the Computed Beneficial Consumptive Use offset by Imported Water Supply Credit and NERWS Credit Col 1 – (Col 2- Col 3)
2012	266,320	250,110	14,765	30,975
2013	200,480	216,850	28,229	11,859
2014	168,970	206,010	75,136	38,096
2015	223,860	243,530	36,171	16,501
2016	217,880	256,120	61,816	23,576
Avg 2012-2016	215,500	234,520	43,220	24,200

Table 4A: Colorado Compliance with the Sub-basin Non-impairment Requirement
Table 4A is left unpopulated pursuant to the August 24, 2016 "RESOLUTION BY THE REPUBLICAN RIVER COMPACT
ADMINISTRATION APPROVING OPERATION AND ACCOUNTING FOR THE COLORADO COMPACT COMPLIANCE PIPELINE AND
COLORADO'S COMPLIANCE EFFORTS IN THE SOUTH FORK REPUBLICAN RIVER BASIN", paragraph E.

2016	Col 1	Col 2	Col 3	Col 4	Col 5	Col 6
Sub-basin	Colorado Sub-basin Allocation (Five-year Running Average)	Unallocated Supply (Five-year Running Average)	Credits from Imported Water Supply and CORWS Credit (Five-year Running Average)	Total Available Supply (Five-year Running Average)	Colorado Computed Beneficial Consumptive Use (Five-year Running Average)	Difference Between Available Supply and Computed Beneficial Consumptive Use (Five-year Running Average)
North Fork						
Arikaree						
South Fork						
Beaver						

Table 4B: Kansas's Sub-Basin Non-impairment Compliance

2016

	Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7
Sub-basin	Kansas Sub-basin Allocation (Five-year Running Average)	Unallocated Supply (Five-year Running Average)	Unused Allocation from Colorado (Five Year Running Average)	Credits from Imported Water Supply (Five-year Running Average)	Total Available Supply Col 1 + Col 2 + Col 3 + Col 4 (Five-year Running Average)	Kansas Computed Beneficial Consumptive Use (Five-year Running Average)	Difference Between Available Supply and Computed Beneficial Consumptive Use Col 5 - Col 6 (Five-year Running Average)
Arikaree	118	(10)	94	N/A	202	192	10
South Fork	8,952	3,116	0	N/A	12,068	5,536	6,532
Driftwood	62	688	0	N/A	750	12	738
Beaver	3,410	54	1,760	N/A	5,224	5,000	224
Sappa	2,284	990	0	N/A	3,274	486	2,788
Prairie Dog	4,450	4,544	0	N/A	8,994	7,074	1,920

Table 5A: Colorado's Compliance During Water-Short Year Administration

Year	Col. 1 Is the year Water Short Pursuant to Ill.J? (Yes or No)	Col. 2 Statewide Allocation	Col. 3 Beaver Creek Reduction Pursuant to Table 5F	Col. 4 Allocation - Beaver Creek Reduction (Col. 2 - Col.3)	Col. 5 Computed Beneficial Consumptive (excluding the Beaver Creek Sub-basin)	Col. 6 Imported Water Supply Credit - IWS Beaver Creek + CORWS Credit	Col. 7 Difference between Allocation and the Computed Beneficial Consumptive Use offset by Imported Water Supply Credit and CORWS Credit (Col. 4 - Col. 5 + Col. 6)
2012	No	20,620	0	20,620	22,300	0	(1,680)
2013	Yes	18,690	1,054	17,636	28,640	0	(11,004)
2014	Yes	21,900	1,228	20,672	32,100	7,448	(3,980)
2015	Yes	24,760	1,406	23,354	33,780	10,760	334
2016	Yes	25,190	1,650	23,540	33,930	10,130	(260)
Avg 2012-2016	Yes	22,230	1,070	21,160	30,150	5,670	(3,320)

Table 5F: Colorado's Beaver Creek Reduction During Water-Short Years

Water Short Year (WSY) Pursuant to Ill.J	Beaver Creek Allocation	Reduction = Average of last five WSY Beaver Creek Allocations
Col. 1	Col. 2	Col. 2
2002	770	N/A
2003	260	N/A
2004	360	N/A
2005	910	N/A
2006	1,420	N/A
2007	2,320	744
2013	1,130	1,054
2014	1,250	1,228
2015	2,130	1,406
2016	2,430	1,650

**Table 5B: Kansas's Compliance During Water-Short Year Administration
Kansas**

Year	Allocation				Computed Beneficial Consumptive Use	Imported Water Supply Credit	Difference Between Allocation and the Computed Beneficial Consumptive Use offset by Imported Water Supply Credit
	1	2	3	4			
Column					5	6	7
	Sum Sub-basins	Kansas' Share of Unallocated Supply	Kansas' Share of the Unused Colorado Allocation	Total Col 1 + Col 2 + Col 3			Col 4 - (Col 5 - Col 6)
2015	20,320	4,640	1,088	26,048	18,730	N/A	7,318
2016	23,100	5,529	1,247	29,876	21,750	N/A	8,126
Avg 2015-2016	21,710	5,084	1,168	27,962	20,240	N/A	7,722

Table 5C: Nebraska's Compliance During Water-Short Year Administration

Year Column	Allocation			Computed Beneficial Consumptive Use			Imported Water Supply Credit and NERWS Credit Col 8	Difference Between Allocation and Computed Beneficial Consumptive Use offset by Imported Water Supply Credit Above Guide Rock and NERWS Credit Col 9	
	Col 1	Col 2	Col 3	Col 4	Col 5	Col 6			Col 7
	State-Wide Allocation	Allocation Below Guide Rock	Allocation Above Guide Rock	Nebraska's Share of Unused Colorado Allocation	State-Wide CBCU	CBCU Below Guide Rock	CBCU Above Guide Rock	Credits Above Guide Rock	Col 3 + Col 4 - (Col 7 - Col 8)
2015	223,860	33,485	190,375	1,042	243,530	2,941	240,590	36,195	(12,977)
2016	217,880	12,878	205,002	1,193	256,120	2,758	253,362	61,841	14,675
Avg 2015-2016	220,870	23,180	197,690	1,120	249,830	2,850	246,980	49,020	850

Table 5D: Nebraska's Compliance Under a Alternative Water-Short Year Administration Plan

Year	Allocation		Computed Beneficial Consumptive Use		Imported Water	Difference Between Allocation			
Column	Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7	Col 8	Col 9
	State-Wide Allocation	Allocation Below Guide Rock	Allocation Above Guide Rock	Share of Unused Colorado Allocation	State-Wide CBCU	CBCU Below Guide Rock	CBCU Above Guide Rock	Credits Above Guide Rock	Col 3 + Col 4 - (Col 7 - Col 8)
2014	168,970	6,305	162,665	631	206,010	2,335	203,675	75,161	34,782
2015	223,860	33,485	190,375	1,042	243,530	2,941	240,590	36,195	(12,977)
2016	217,880	12,878	205,002	1,193	256,120	2,758	253,362	61,841	14,675
Avg 2014-2016	203,570	17,560	186,010	960	235,220	2,680	232,540	57,730	12,160

Table 5E: Nebraska's Tributary Compliance During Water-Short Year Administration

Year	Allocation			Computed Beneficial Consumptive Use	Imported Water Supply Credit and NERWS generated in	Allocation - (CBCU - IWS NERWS)
	Sub-Basin Total	Nebraska's Share of Unallocated Supply	Total			
2015	86,920	67,609	154,529	132,710	29,223	51,042
2016	89,960	71,096	161,056	136,720	52,742	77,078
Avg 2015-2016	88,440	69,352	157,792	134,715	40,983	64,060

ATTACHMENTS

Attachment 1: Sub-basin Flood Flow Thresholds

Sub-basin	Sub-basin Flood Flow Threshold Acre-feet per Year ^e
Arikaree River	16,400
North Fork of Republican River	33,900
Buffalo Creek	9,800
Rock Creek	9,800
South Fork of Republican River	30,400
Frenchman Creek	51,900
Driftwood Creek	9,400
Red Willow Creek	15,100
Medicine Creek	55,100
Beaver Creek	13,900
Sappa Creek	26,900
Prairie Dog	15,700

^e Flows considered to be Flood Flows are flows in excess of the 94% flow based on a flood frequency analysis for the years 1971-2000. The Gaged Flows are measured after depletions by Beneficial Consumptive Use and change in reservoir storage.

Attachment 6: Computing Water Supplies and Consumptive Use Above Guide Rock

Year	Total Mainstem CWS	Hardy Gage	Superior Courtland Diversion Dam	Courtland Canal Diversions	Superior Canal Diversion	Courtland Canal Returns	Superior Canal Returns	Total Bostwick Returns	NE CBCU			KS CBCU			Total CBCU			Gain Guide Rock to Hardy	VWS Guide Rock to Hardy	Mainstem VWS Above Guide Rock	NE MS Allocation Above Guide Rock	KS MS Allocation Above Guide Rock	Nebraska Guide Rock to Hardy Allocation	Kansas Guide Rock to Hardy Allocation
									Below Guide Rock	Guide Rock	Rock	Below Guide Rock	Guide Rock	Rock	Below Guide Rock	Guide Rock	Rock							
2012	221,940	139,460	116,248	74,730	9,744	9,526	5,785	15,311	3,558	786	4,344	7,901	12,245	209,695	102,541	107,154	5,988	6,257	209,695	44,379	46,376	7,264	7,591	6,257
2013	105,610	44,745	24,835	70,402	6,161	5,048	3,679	8,727	3,000	673	3,673	11,183	14,855	90,755	44,379	46,376	7,264	7,591	90,755	21,573	22,544	6,305	6,588	7,591
2014	57,010	50,362	35,041	59,654	0	5,278	0	5,278	2,335	515	2,850	10,043	12,893	44,117	21,573	22,544	6,305	6,588	44,117	21,573	22,544	6,305	6,588	6,588
2015	141,780	104,931	29,772	57,452	6,571	5,792	4,414	10,206	2,941	582	3,523	64,953	68,476	73,304	35,846	37,459	33,485	34,991	73,304	35,846	37,459	33,485	34,991	34,991
2016	116,190	80,515	47,639	57,452	6,308	5,619	4,259	9,877	2,758	578	3,336	22,999	26,335	89,855	43,939	45,916	12,878	13,457	89,855	43,939	45,916	12,878	13,457	13,457

COURTLAND CANAL											
	2012	2013	2014	2015	2016		2012	2013	2014	2015	2016
Return Flow From Courtland Canal To Republican River Above Lovewell From Kansas	955	975	813	784	563						
Return Flow From Courtland Canal To Republican River Above Hardy From Nebraska	8,572	4,073	4,465	5,027	5,055						
Courtland Canal Diversions At Headgate	74,730	70,402	59,654	57,452	44,129						
Courtland Canal At Kansas-Nebraska State Line	63,637	65,021	54,209	50,960	37,548						
NE Courtland Canal CBCU (includes transportation loss)	640	414	0	361	416						
Superior Canal CBCU	3,959	2,482	0	2,157	2,049						

NEBRASKA											
	2012	2013	2014	2015	2016		2012	2013	2014	2015	2016
SW Diversions - Irrigation - Small Pumps - Nebraska Below Guide Rock	1,271	850	476	786	655						
SW Diversions - M&I - Nebraska - Below Guide Rock	0	0	0	0	0						
SW Non-Federal Reservoir Evaporation - Below Guide Rock	299	50	67	14	34						
SW Return - Irrigation	318	213	119	197	164						
SW Return - M&I	0	0	0	0	0						
GW CBCU Nebraska Below Guide Rock	2,306	2,312	1,911	2,337	2,233						

KANSAS											
	2012	2013	2014	2015	2016		2012	2013	2014	2015	2016
SW CBCU - Irrigation - Small Pumps	712	582	484	554	535						
SW CBCU - M&I	0	0	0	0	0						
GW CBCU Kansas Below Guide Rock	74	91	31	28	43						

2016
Attachment 7: Calculations of Return Flows from Bureau of Reclamation Canals

Canal	Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7	Col 8	Col 9	Col 10	Col 11	Col 12
Canal	Canal Diversion	Spill to Waste-Way	Net Diversion	Field Deliveries	Canal Loss	Average Field Loss Factor	Field Loss	Total Loss from District	Percent Field and Canal Loss That Returns to the Stream	Estimated Percent Loss*	Total return to Stream from Canal and Field Loss	Return as Percent of Canal Diversion
Name Canal	Headgate Diversion	Sum of measured spills to river	Col 2 - Col 3	Sum of Deliveries to the field	Col 4 - Col 5	1-Weighted Average Efficiency of Application System for the District*	Col 5 x Col 7	Col 6 + Col 8	Col 9	Col 10	Col 10 + Col 3	Col 11/Col 2
Σ Irrigation Season												
Σ Non-Irrigation Season												
Culbertson	7,360	0	0	7,210	440	30%	132	6,902	82%	5,810	79%	
Culbertson Extension	0	0	0	0	0	30%	0	0	92%	0	100.0%	
Meeker - Driftwood	17,458	2,039	15,419	5,272	10,147	30%	1,582	11,729	82%	11,656	100%	
Red Willow	0	0	0	0	0	30%	0	0	92%	0	100.0%	
Bartley	8,600	2,043	6,557	2,067	4,490	30%	620	5,110	82%	6,233	72.5%	
Cambridge	30,337	3,884	26,453	10,807	15,646	30%	3,242	18,888	82%	19,372	63.9%	
Naponee	1,075	84	991	420	571	35%	147	718	82%	673	62.6%	
Franklin	18,229	1,278	16,951	7,138	9,813	35%	2,498	12,311	82%	11,373	62.4%	
Franklin Pump	1,331	47	1,284	764	520	35%	267	787	82%	693	52.0%	
Almena	0	0	0	0	0	35%	0	0	92%	0	100.0%	
Superior	6,308	687	5,621	1,834	3,787	31%	569	4,356	82%	4,259	67.5%	
Nebraska Courtland	557	0	557	500	57	23%	115	172	82%	141	25.3%	
Courtland Canal Above Lovewell (KS)	19,762	0	19,762	7,626	12,136	23%	1,754	13,890	82%	11,390	57.6%	
Courtland Canal Below Lovewell	28,871	0	28,871	15,826	13,045	23%	3,640	16,685	82%	13,682	47.4%	

Flood Flow Calculations Based on Accounting Procedures III.B.1 and Attachment 1.

Hardy Gage Monthly Data (acre-feet)					
	2012	2013	2014	2015	2016
January	17,407	1,926	1,704	1,390	5,429
February	16,861	1,829	4,733	2,093	6,532
March	40,124	1,993	4,560	2,027	6,415
April	32,868	4,479	1,638	2,364	6,625
May	12,327	8,376	2,138	34,054	13,501
June	6,329	3,215	5,818	36,781	5,901
July	5,155	2,648	5,726	7,906	4,844
August	2,900	9,386	6,893	7,712	6,153
September	1,182	3,588	4,491	2,180	9,868
October	1,289	2,523	4,717	1,690	5,278
November	1,525	3,771	4,167	1,944	5,286
December	1,492	1,012	3,779	4,790	4,685
ANNUAL	139,459	44,746	50,364	104,931	80,515
Over 400K	0	0	0	0	0

5-month Consecutive Period Flows (acre-feet)					
	2012	2013	2014	2015	2016
Jan-May	119,587	18,603	14,773	41,928	38,501
Feb-Jun	108,509	19,892	18,887	77,319	38,973
Mar-Jul	96,803	20,711	19,880	83,132	37,285
Apr-Aug	59,579	28,104	22,213	88,817	37,023
May-Sep	27,893	27,213	25,066	88,633	40,266
Jun-Oct	16,855	21,360	27,645	56,269	32,043
Jul-Nov	12,051	21,916	25,994	21,432	31,428
Aug-Dec	8,388	20,280	24,047	18,316	31,269

2-month Consecutive Period Flows (acre-feet)					
	2012	2013	2014	2015	2016
Jan-Feb	34,268	3,755	6,437	3,483	11,960
Feb-Mar	56,985	3,822	9,293	4,120	12,946
Mar-Apr	72,992	6,472	6,198	4,391	13,039
Apr-May	45,195	12,855	3,776	36,418	20,126
May-Jun	18,656	11,591	7,956	70,835	19,402
Jun-Jul	11,484	5,863	11,544	44,687	10,744
Jul-Aug	8,055	12,034	12,619	15,618	10,996
Aug-Sep	4,082	12,974	11,384	9,892	16,020
Sep-Oct	2,471	6,111	9,208	3,870	15,146
Oct-Nov	2,814	6,294	8,884	3,634	10,564
Nov-Dec	3,017	4,783	7,946	6,734	9,971

Final Sub-basin Flood Flows					
	2012	2013	2014	2015	2016
North Fork Flood Flow	0	0	0	0	0
Arikaree Flood Flow	0	0	0	0	0
Buffalo Flood Flow	0	0	0	0	0
Rock Flood Flow	0	0	0	0	0
Southfork Flood Flow	0	0	0	0	0
Frenchman Flood Flow	0	0	0	0	0
Driftwood Flood Flow	0	0	0	0	0
Red Willow Flood Flow	0	0	0	0	0
Medicine Creek Flood Flow	0	0	0	0	0
Beaver Flood Flow	0	0	0	0	0
Sappa Flood Flow	0	0	0	0	0
Prairie Dog Flood Flow	0	0	0	0	0
Mainstem Flood Flow	0	0	0	0	0

Sub-basin Flows Above Attachment 1 Flood Flow Thresholds					
	2012	2013	2014	2015	2016
North Fork	0	0	0	0	0
Arikaree	0	0	0	0	0
Buffalo	0	0	0	0	0
Rock	0	0	0	0	0
South Fork	0	0	0	0	0
Frenchman	0	0	0	0	0
Driftwood	0	0	0	0	0
Red Willow	0	0	0	0	0
Medicine Creek	0	0	0	0	0
Beaver	0	0	0	0	0
Sappa	0	0	0	0	0
Prairie Dog	0	0	0	0	0
Sub-basin Sum	0	0	0	0	0

5-month Consecutive Period Test					
	2012	2013	2014	2015	2016
Jan-May	0	0	0	0	0
Feb-Jun	0	0	0	0	0
Mar-Jul	0	0	0	0	0
Apr-Aug	0	0	0	0	0
May-Sep	0	0	0	0	0
Jun-Oct	0	0	0	0	0
Jul-Nov	0	0	0	0	0
Aug-Dec	0	0	0	0	0
TOTAL	0	0	0	0	0

2-month Consecutive Period Test					
	2012	2013	2014	2015	2016
Jan-Feb	0	0	0	0	0
Feb-Mar	0	0	0	0	0
Mar-Apr	0	0	0	0	0
Apr-May	0	0	0	0	0
May-Jun	0	0	0	0	0
Jun-Jul	0	0	0	0	0
Jul-Aug	0	0	0	0	0
Aug-Sep	0	0	0	0	0
Sep-Oct	0	0	0	0	0
Oct-Nov	0	0	0	0	0
Nov-Dec	0	0	0	0	0
TOTAL	0	0	0	0	0

Combined Test					
	2012	2013	2014	2015	2016
FINAL TOTAL	0	0	0	0	0

