Engineering Committee Report Republican River Compact Administration

August 31st, 2022

EXECUTIVE SUMMARY

The Engineering Committee (EC) met four times since the August 25, 2021, 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) finalize 2021 accounting; 4) continue work on documenting historical changes to the RRCA Accounting Procedures; 5) provide updates on the progress of new and ongoing management strategies for maintaining compact compliance; 6) continue development and maintenance of the RRCA administrative website that serves as an informational page for the public and provide regular updates to the EC; 7) continue work and provide updates on improving accounting tools developed by the Engineering Committee; 8) prepare the 2021 RRCA annual meeting report; and 9) retain a contract with Principia Mathematica for the period and scope outlined by the commissioners.

Ongoing assignments include: 1) hold quarterly meetings; 2) continue work on documenting historical changes to the RRCA Accounting Procedures; 3) provide updates on the progress of new and ongoing management strategies for maintaining compact compliance; 4) work on maintaining and enhancing the RRCA public website; 5) continue work and provide future updates on improving accounting tools developed by the Engineering Committee.

The EC recommends discussion by the RRCA on the exchange of data, modeling results, and proposed accounting for 2021; modeling and data tasks to be assigned to Principia Mathematica for 2022; the document summarizing historical changes to the RRCA Accounting Procedures; Kansas's climate-based pumping estimations; and recommended EC assignments and other potential assignments for the next year.

Details of the various EC tasks are described further in the remainder of this report, including:

Attachment 1: Minutes of the quarterly meetings of the EC
Attachment 2: Accounting Inputs and Accounting Tables from the RRCA Accounting for 2021 recommended by the EC for approval by the RRCA (Task 3)

COMMITTEE ASSIGNMENTS AND RELATED WORK ACTIVITIES

1. Meet quarterly to review the tasks assigned to the committee.
    a. The EC met November 4, 2021; January 20, 2022; April 15, 2022; and July 14, 2022. See Attachment 1 for the approved minutes of these meetings.
    b. The EC recommends that this task continue.
2. Exchange by April 15, 2022, 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, 2022, the states will exchange any updates to these data.

   a. Nebraska posted its data on April 15, 2022, and provided an update on July 12, 2022.

   b. Kansas posted its data on April 12, 2022, and provided an update to the data on July 12, 2022.

   c. Colorado posted its data on April 5, 2022, and added Crop Irrigation Requirement (CIR) data on June 27, 2022.

3. Finalize the 2021 accounting and recommend it for approval by the RRCA.

   a. Colorado, Kansas, and Nebraska accounting data for 2021 are final and the EC hereby recommends approval of the accounting by the RRCA.

   b. The applicable summary accounting tables are presented in Attachment 2.

4. Continue work on creating a document memorializing when RRCA Accounting Procedures have changed over the years and incorporate it into the Accounting Procedures (AP).

   a. The EC made updates to this document on January 10, 2022, and has posted the document to the RRCA public website "www.republicanriver.org". The EC will continue to maintain the AP tracking document and publish it on the website.

5. Provide updates on the progress of new and ongoing management strategies for maintaining compact compliance.

   a. Nebraska provided updates on efforts by the NRDs to install telemetry on groundwater well meters within their respective districts. There was also discussion on the wildfires, which had struck the state during 2022, and that Tri-Basin NRD had issued exemptions for a period allowing wells to be used for fire suppression without having the pumping counting towards any annual allocation. Nebraska also gave updates on the drought planning exercise with stakeholders in the basin, which was held on May 19, 2022.

   b. Kansas provided updates on water rights in the Lower Republican River, which were curtailed in an effort to protect statutorily defined minimum desirable stream flows. The EC heard several updates on the status of automation efforts on the Courtland Canal along with preliminary information on the status of the Bureau of Reclamation-sponsored Regional Conservation Partnership Program in the Upper Republican River Basin which will focus on phreatophyte removal along the river channel.

   c. The EC discussed the climate-based analyses for evaluating water savings proposal by Kansas. The EC discussed possible use of these methods to predict groundwater pumping to improve prospective compact accounting estimates for planning purposes.

   d. Colorado provided updates on deliveries by the Colorado Compliance Pipeline.

   e. The EC recommends this task as a recurring assignment.

6. Continue efforts to develop and publish an administrative website that would be an informational page for the public.
    a. State staff have maintained and updated the website, which is accessible to the public, and reported back to the EC.
    b. The EC recommends this task as a recurring assignment.
7. Continue work and provide future updates on improving accounting tools developed by the Engineering Committee.
    a. The EC continues to use the website accounting tool to validate the accounting spreadsheet results.
    b. The EC discussed the overlap in the Courtland Canal above Lovewell and Attachment 7 inputs and calculations that when combined with varying data sources were causing inconsistencies in the accounting spreadsheet. The EC will continue to pursue this issue to improve the accounting spreadsheet.
    c. The EC recommends this task as a recurring assignment.
8. Prepare the 2021 RRCA annual meeting report for approval by the RRCA at the 2022 annual meeting.
    a. The report has been finalized and approved by the EC and is hereby recommended for approval by the RRCA.
9. Retain a contract with Principia Mathematica for the period and scope outlined by the commissioners.
    a. Principia Mathematica (Willem Schreüder) informed the EC that contracts had been renewed with both Colorado and Nebraska. Willem noted that Kansas has fulfilled its financial obligation without a formal contract in place and this has not been an issue and can continue.

ITEMS FOR RRCA DISCUSSION & ACTION

1. Data exchange and modeling results for 2021. The EC recommends the proposed 2021 accounting presented in Attachment 2 and in the spreadsheet titled "RRCA Accounting 2021 Final.xlsx" for approval by the RRCA. Upon approval of the accounting, the above-mentioned spreadsheet file will be placed on the public website.
2. Modeling and data tasks to be assigned to Principia Mathematica for 2022. The EC recommends that Principia Mathematica continue to maintain the web-based accounting tool and perform periodic model and accounting updates at the same level of service as in 2021.
3. The document summarizing historical changes to the RRCA Accounting Procedures is current and being maintained by the EC. The EC recommends that the document continue to be maintained by the EC as an ongoing assignment.
4. Kansas' climate-based pumping estimator is showing potential to be useful in improving early groundwater modeling forecasts. The EC recommends that it be

assigned to continue evaluating the climate-based pumping estimator as a forecasting tool as part of Assignment 7 below.

5. 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 following list of recommended assignments to report on at the 2022 annual meeting of the RRCA.

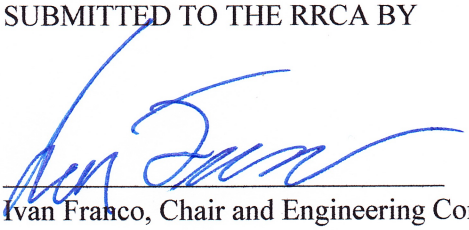
RECOMMENDED ASSIGNMENTS FOR THE COMING YEAR

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

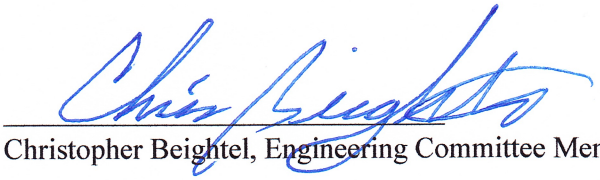
1. Meet quarterly to review the tasks assigned to the committee.
2. Exchange by April 15, 2023, the information listed in Section V of the RRCA Accounting Procedures and Reporting Requirements, and other data required by that document, including all necessary documentation. By July 15, 2023, the states will exchange any updates to these data.
3. Finalize the 2022 accounting and recommend it for approval by the RRCA.
4. Maintain and publish updates to *Summary of Historical Changes to the RRCA's Accounting Procedures and Reporting Requirements* as necessary.
5. Provide updates on the progress of new and ongoing management strategies for maintaining compact compliance.
6. Continue development and maintenance of the RRCA administrative website that serves as an informational page for the public and provide regular updates to the EC.
7. Continue work and provide future updates on improving accounting tools developed by the Engineering Committee.
8. Prepare the 2022 RRCA annual meeting report for approval by the RRCA at the 2023 annual meeting.

The Engineering Committee Report and the exchanged data will be posted on the web at

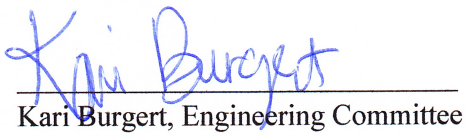
SUBMITTED TO THE RRCA BY



Ivan Franco, Chair and Engineering Committee Member for Colorado



Christopher Beightel, Engineering Committee Member for Kansas



Kari Burgert, Engineering Committee Member for Nebraska

MINUTES for the
QUARTERLY MEETING of the
ENGINEERING COMMITTEE of the
REPUBLICAN RIVER COMPACT ADMINISTRATION
November 4, 2021 10:00 AM Mountain Time

Meeting was held via Google meeting.

Attendees:

Chris Beightel KS
Kari Burgert, NE
Hongsheng Cao, KS
Sam Capps, NE
Alexa Davis, NE
Chelsea Erickson, KS
Willem Schreüder, CO
Elizabeth Esseks, NE
Ivan Franco, CO

1. Introductions
   1.1. The meeting started at approximately 10:00 a.m. MT
2. Review/Modify Agenda
   2.1. No revisions or modifications to the agenda.
3. Review and Update Progress on Engineering Committee Task List
   3.1. Meet quarterly to review the tasks assigned to the committee.
   - The three remaining Engineering Committee meeting have been scheduled and there is no need for modification of the planed dates and times.

   3.2. Exchange by April 15, 2022, 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, 2022, the states will exchange any updates to these data.

   - No substantive comments from any of the three states at this point.
   - Willem sent a preliminary run for the 2021 year on November 2nd to the three states. The run repeats the 2019 data for each state as 2020 was an outlier year. The methodology proposed by Sam Perkins has not been incorporated yet in any form but a preliminary sensitivity analysis does not yield much difference between 2019 and the suggested year. However, Willem still believes it may provide benefit. Willem noted that in updating the Evapotranspiration for November 2021 some data had been updated from August 2021.

   3.3. Finalize the 2021 accounting and recommend it for approval by the RRCA.

   - Courtland Canal Data is in two locations in the accounting.
     - Kari suggested moving this task under "Continue work and provide future updates on improving accounting tools developed by the Engineering Committee". At this point we will leave it here and move it if we do not make the deadline.
     - Kari provided a quick summary of the issue. The Bureau of Reclamation provides Courtland Canal data in the monthly water distributions and in a worksheet called "Court wrk sht" a. Discussion with the Bureau last year indicated that there are differences in the data based on who and when they are filled in. We also have been obtaining data for the stateline flows from the USGS. The Courtland Canal data are input into the RRCA accounting spreadsheets in multiple locations, including Inputs tab, Attachment 7 tab, and a CourtlanAvLove tab. These multiple source spreadsheets and multiple input locations double up on the same data, and this can lead to confusion and discrepancies in the calculations.
     - **Action Item: Kari will draft an email distilling down where we have seen issues with the data reporting in order to get a good sense of the issue and for the EC to be able to**

provide feedback to the USBR.

3.4. Maintain and publish updates to Summary of Historical Changes to the RRCA's Accounting Procedures and Reporting Requirements as necessary.

- Ivan noted that this document had tentative changes that needed to be made upon expected actions at the 2021 RRCA Annual Meeting. These actions were taken as expected (PRISM data change) and the changes should be implemented into the current working version. Kari will provide an updated version of this document to the group.
- **Action Item: Kari will integrate the changes into this document and distribute to the group.**

3.5. Provide updates on the progress of new and ongoing management strategies for maintaining compact compliance.

- Chris provided general information regarding the automation of the diversion gate at the Guide Rock dam. Lovewell Reservoir is full and diversions into the reservoir have ceased. In northwest Kansas staff is working on dispersing settlement funds. One potential project is the construction of several low head dams in the area.
- Chelsea noted that the Kansas Water Office applied for a grant and were awarded monies to clean up Phreatophytes on the South Fork of the Republican River. It seems this will not commence until fall of 2022.
- Sam Capps noted that Nebraska is working on contracts with NBID and Frenchman Valley/Creek on gate automations and well projects. There are also irrigation retirement contracts in the works with multiple NRDs along with well telemetry that is moving forward.
- Willem noted that the CCP should start around November 11th with a total anticipated delivery of about 9,000 acre-feet with about 2,500 and 3,000 acre-feet delivered by the end of the year.

3.6. Continue development and maintenance of the RRCA administrative website that serves as an informational page for the public and provide regular updates to the EC.

- Chelsea is interested in adding a gage page to the website but has not made any progress on this yet. There is talk of the USGS restructuring there gage website so she is holding until there is some action on this front.
- Kari noted that Alexa Davis will be the new representative for Nebraska on the website committee.

3.7. Continue work and provide future updates on improving accounting tools developed by the Engineering Committee.

- **Consider/Implement the refinement for pumping estimates proposed by Kansas**
- At this time, there is no discussion on this subject.

3.8. Prepare the 2021 RRCA annual meeting report for approval by the RRCA at the 2021 annual meeting

- Kari has noted that the Transcript has been received and is being reviewed. This will be distributed to the other states in the near future. Kari noted that the nature of the changes would focus on necessary changes versus minor capitalization or grammatical errors.
- **Action item: Nebraska will prepare initial proposed edits and send to the other two states for comment.**

3.9. Retain a contract with Principia Mathematica for the period and scope outlined by the commissioners.

- Willem noted that each state is handling their contracts differently and in December of each year he sends each state a bill and has not had an issue with payment (at times with a contract in place or without one).
- Kansas believes they have been paying Willem without a contract.
-

4. Summary of Meeting Actions/Assignments (in bold)
    - **Kari will send out an email with summarizing the Courtland Canal issue.**
    - **Kari will send out an update of the Summary of Historical Changes document.**
    - **Each state will review how they have handled Willems contract for further discussion at the next meeting.**
5. Future Meetings

    5.1. The next meeting is scheduled to be held January 13, 2022 at 10 am MST.
6. Adjourn

    6.1. The meeting adjourned at approximately 10:35 a.m.

MINUTES for the
QUARTERLY MEETING of the
ENGINEERING COMMITTEE of the
REPUBLICAN RIVER COMPACT ADMINISTRATION
January 20, 2022 10:00 AM Mountain Time

Meeting was held via Google meeting.

Attendees:

Chris Beightel KS
Kari Burgert, NE
Hongsheng Cao, KS
Willem Schreüder, CO
Elizabeth Esseks, NE
Ivan Franco, CO

1. Introductions
   1.1. The meeting started at approximately 10:00 a.m. MT
2. Review/Modify Agenda
   2.1. No revisions or modifications to the agenda.
3. Review and Update Progress on Engineering Committee Task List
   3.1. Meet quarterly to review the tasks assigned to the committee.
   - The two remaining Engineering Committee meeting have been scheduled and there is no need for modification of the planed dates and times.

   3.2. Exchange by April 15, 2022, 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, 2022, the states will exchange any updates to these data.

   - Kari let the group know that Nebraska would soon be emailing the Bureau of Reclamation requesting the canal data. In an effort to coordinate, she would copy staff from Kansas and Colorado when that email is sent.

   3.3. Finalize the 2021 accounting and recommend it for approval by the RRCA.

   - Courtland Canal Data is in two locations in the accounting.
     - Willem's most recent model update was done on January 3, 2022, which utilized the best estimate of canal diversion and gage flow data. Willem does not anticipate much of a change in the gage flows. The PRISM data will continue to be updated over the next several months, as there may be some small changes.
     - Kari reported that Nebraska is still working on drafting an email that distills down where we have seen issues with data reporting.
     - **Action Item: Kari will draft an email distilling down where we have seen issues with the data reporting in order to get a good sense of the issue and for the EC to be able to provide feedback to the USBR.**

   3.4. Maintain and publish updates to Summary of Historical Changes to the RRCA's Accounting Procedures and Reporting Requirements as necessary.

   - The document is currently up to date. No additional discussion was needed.

   3.5. Provide updates on the progress of new and ongoing management strategies for maintaining compact compliance.

   - No updates from Kansas
   - Kari noted that Nebraska had published and sent out the Water Supply Forecast for 2022 to each of the states. There were no questions from the group.

- Willem noted that the Compact Compliance Pipeline will likely shut off in around the middle of April. The initial forecast is predicting about 9,000 acre-feet total for 2022 with 6,000 coming in the spring and 3,000 acre-feet in the fall. This may change slightly as the year progresses.

3.6. Continue development and maintenance of the RRCA administrative website that serves as an informational page for the public and provide regular updates to the EC.

- Chelsea was not on the call. Ivan noted that there might be the potential additional of a gauge flow page at some point in the future but there has been no progress on this issue.
- There was some discussion from the group concerning the Summary of Historical Changes document and whether or not it was available on the website.
    - **Action item: Kansas will follow-up to see if the Summary of Historical Changes document can be uploaded to the website.**

3.7. Continue work and provide future updates on improving accounting tools developed by the Engineering Committee.

- **Consider/Implement the refinement for pumping estimates proposed by Kansas**
- Chris noted that he did not have anything significant to add at this time. He is waiting to hear back from Willem when he gets more time to look at the estimate methodology.
- Willem pointed out that early on in the year there is no way of knowing what the precipitation will be. As the year progresses additional data becomes available which might make an August/September estimate useful. Willem noted that Sam indicated decent correlation existed by August/September between precipitation and summertime pumping.
- Kari took an opportunity to let the group know that the NRDs are working on telemetry equipment on each well to get pumping data more quickly. Kari noted that it may be around 1/3 of the wells in the NRDs that are currently done and in coming years, the NRDs are planning on having all the wells connected.
- Willem asked why the wells were all getting telemetry considering the cost. Kari thought that Sam Capps, NeDNR, might have more information on this point and suggested that she follow up at the next meeting with more information. Kari pointed out that staff is visiting each well each year and taking readings and not having to do this would save labor.
    - **Action item: Nebraska will prepare to answer questions on the topic at the next EC meeting.**

3.8. Prepare the 2021 RRCA annual meeting report for approval by the RRCA at the 2021 annual meeting

- Elizabeth noted that the court reporter has the edited transcripts and is working on returning a final product.

3.9. Retain a contract with Principia Mathematica for the period and scope outlined by the commissioners.

- Willem noted that Colorado and Nebraska have renewed their contracts. Kansas paid the annual amount due but does not have a contract (and has not for some time). However, both Willem and Chris do not see this as an issue and everything will continue in the same manner.

4. Summary of Meeting Actions/Assignments (in bold)
    - **Kari will send out an email with summarizing the Courtland Canal issue.**
    - **Nebraska will be ready to field questions on telemetry at the next meeting.**
    - **Chelsea will investigate getting the Summary of Historical Changes document loaded to the website.**
5. Future Meetings

5.1. The next meeting is scheduled to be held April 15, 2022 at 10 am MST.

6. Adjourn
   6.1. The meeting adjourned at approximately 10:33 a.m.

MINUTES for the
QUARTERLY MEETING of the
ENGINEERING COMMITTEE of the
REPUBLICAN RIVER COMPACT ADMINISTRATION
April 15, 2022 10:00 AM Mountain Time

Meeting was held via Google meeting.

Attendees:

Chris Beightel KS	Samantha Capps, NE
Kari Burgert, NE	Elizabeth Esseks, NE
Hongsheng Cao, KS	Ivan Franco, CO
Alexa Davis, NE	Sam Perkins, KS

1. Introductions
   1.1. The meeting started at approximately 10:00 a.m. MT
2. Review/Modify Agenda
   2.1. No revisions or modifications to the agenda.
3. Review and Update Progress on Engineering Committee Task List
   3.1. Meet quarterly to review the tasks assigned to the committee.
   - One remaining Engineering Committee meeting has been scheduled and there is no need for modification of the planed date and time.

   3.2. Exchange by April 15, 2022, 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, 2022, the states will exchange any updates to these data.

   - Nebraska is in the process of sending out data. Kansas and Colorado have disseminated their data.

   3.3. Finalize the 2021 accounting and recommend it for approval by the RRCA.

   - Courtland Canal Data is in two locations in the accounting.
     - Nebraska is still working on the email summarizing their concerns. No update at this time.
     - Kansas noted that there will be a slight update to their data in July as is usually the case.
     - **Action Item: Kari will draft an email distilling down where we have seen issues with the data reporting in order to get a good sense of the issue and for the EC to be able to provide feedback to the USBR.**

   3.4. Maintain and publish updates to Summary of Historical Changes to the RRCA's Accounting Procedures and Reporting Requirements as necessary.

   - The document is currently up to date. Chelsea used the most current version (January 10th 2022) of this document and posted this document to the website. Chelsea asked if should include a date noting the current version in the header/footer. The group had no issue including this in the header/footer.

   3.5. Provide updates on the progress of new and ongoing management strategies for maintaining compact compliance.

   - Kansas noted that orders had gone out to some 200 water rights in the lower Republican River curtailing them for minimum desirable stream flows. The was caused by a flow trigger at the Clay Center gage. Chris was not able to speak with Kansas Bostwick Irrigation district to get an update on automating the Courtland Canal. Chris felt the District was getting close to having the Guide Rock diversion automated and when complete, the river would be swept to start filling Lovewell Reservoir. Chris had no update on the RCPP project in the Upper Republican.
   - Nebraska had an update on fires throughout the Republican Basin. Sam noted that a larger fire

recently burned thru the Tri-Basin NRD and the Lower Republican NRD. Frenchman Cambridge reported losses to canal infrastructure and pivots in the area. Tribasin NRD has issued an exemption thru June 1st to allow pumping for fire suppression without having this pumping count against annual allocations. Sam noted that a drought planning exercise is scheduled to be held on May 19th .

- Colorado gave an update on the CCP confirming that the pumping would match the most recent projections of approximately 9,500 acre-feet, with 2/3rd of the water being pumped in the spring 2022.
- Nebraska gave an update on the telemetry work in the state. The NRDs own the meters and provide service to the meters. The funding is mixed between the NRDs, state, BOR providing the bulk of the funding. The NRD's are pushing this forward for better real time data for irrigator water use. The Middle Republican is working towards producing a dashboard for irrigators to make better management decisions. Kansas noted that they are also interested in implementing a telemetry program. Nebraska encouraged Kansas to reach out to the Upper and Middle Republican NRDs if they wanted to discuss specifics. Nebraska noted that BOR, thru a WaterSmart Grant, pays for 50 percent of the total cost and DNR/NRD split the rest 60/40.
    - **Action item: Colorado will follow-up to see if they can provide any additional information on the Bonny Reservoir Rehabilitation project.**

3.6. Continue development and maintenance of the RRCA administrative website that serves as an informational page for the public and provide regular updates to the EC.

- Chelsea gave on update on update plans for the website. Chelsea proposed including a link to the USGS gage data to make this available on the site with minimal effort/duplication. Nebraska also noted that a couple of the gages are serviced by Nebraska and links could also be included.

3.7. Continue work and provide future updates on improving accounting tools developed by the Engineering Committee.

- Consider/Implement the refinement for pumping estimates proposed by Kansas
- No discussion. Differed to next meeting.

3.8. Prepare the 2021 RRCA annual meeting report for approval by the RRCA at the 2021 annual meeting

- Elizabeth noted that the transcript is 99% done and a draft report would be disseminated soon.

3.9. Retain a contract with Principia Mathematica for the period and scope outlined by the commissioners.

- No discussion needed

4. Summary of Meeting Actions/Assignments (in bold)
    - **Kari will send out an email summarizing the Courtland Canal data issue.**
    - **Colorado will see if more information is available regarding the Bonny Rehabilitation Project.**
    - **Colorado will set a date and location for the Annual Meeting.**
5. Future Meetings

5.1. The next meeting is scheduled to be held July 14, 2022 at 10 am MST.

6. Adjourn

6.1. The meeting adjourned at approximately 10:39 a.m.

MINUTES for the
QUARTERLY MEETING of the
ENGINEERING COMMITTEE of the
REPUBLICAN RIVER COMPACT ADMINISTRATION
July 14, 2022 10:00 AM Mountain Time

Meeting was held via Google meeting.

Attendees:

Chris Beightel, KS
Kari Burgert, NE
Hongsheng Cao, KS
Jesse Bradley, NE
Chelsea Erickson, KS
Samantha Capps, NE
Brian Flynn, NE
Ivan Franco, CO
Sam Perkins, KS

1. Introductions
   1.1. The meeting started at approximately 10:00 a.m. MT
2. Review/Modify Agenda
   2.1. No revisions or modifications to the agenda.
3. Review and Update Progress on Engineering Committee Task List
   3.1. Meet quarterly to review the tasks assigned to the committee.
   - No remaining Engineering Committee meetings. Annual Meeting scheduled for August 31st.

   3.2. Exchange by April 15, 2022, 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, 2022, the states will exchange any updates to these data.

   - Willem had sent an email earlier in the week noting that Table 3C in the proposed 2021 accounting referenced GM_output tab row 32 and should likely be changed to reference GM_output row 31. Nebraska agreed to this change and will send out revised accounting.

   3.3. Finalize the 2021 accounting and recommend it for approval by the RRCA.

   - Courtland Canal Data is in two locations in the accounting.
     - Nebraska informed the group that they continue to work on an email detailing Courtland Canal Data improvements. They noted that the EC had agreed to use the Stateline flows from the USGS rather than USBR, but this results in differences from calculated values on the "Court wrk sht" that USBR provides which are inputs to the accounting. Nebraska will use the calculated values from the USBR in the revised accounting spreadsheet for 2021; the discrepancy is small but it would be good to find a way to avoid this.
     - **Action Item: Kari will draft an email distilling down where we have seen issues with the data reporting in order to get a good sense of the issue and for the EC to be able to provide feedback to the USBR.**

   3.4. Maintain and publish updates to Summary of Historical Changes to the RRCA's Accounting Procedures and Reporting Requirements as necessary.

   - No discussion necessary

   3.5. Provide updates on the progress of new and ongoing management strategies for maintaining compact compliance.

   - Nebraska noted that they held a Republican River drought exercise on May 19th with stakeholders in the basin. Sam noted that the NRDs came away with a good sense of how the state would handle future drought situations.
   - Kansas noted that they received a communication from Pete Gile at Kansas-Bostwick and the

automation efforts on the Courtland Canal are going well. There is also a high likelihood of implementing automation technology in the lower part of the canal coming out of Lovewell Reservoir.

- Kansas gave a short update on the Regional Conservation Partnership Program. The program would largely consist of phreatophyte removal and efficiency improvements on rangeland wells. Kansas noted that the program is still at the national review level and any actual work is not expected to occur soon.

3.6. Continue development and maintenance of the RRCA administrative website that serves as an informational page for the public and provide regular updates to the EC.

- Chelsea noted that there have been no changes to the website worth noting. Chelsea noted that a "security certificate" is in the works with Kansas IT to keep the website up-to-date and secure.

3.7. Continue work and provide future updates on improving accounting tools developed by the Engineering Committee.

- **Consider/Implement the refinement for pumping estimates proposed by Kansas**
- Chris noted that Sam had done some additional work on this topic and that the materials would be forwarded along as time permits. Willem noted that the pumping estimate methodology would be useful to utilize at the end of August to help get a better handle on the current year's pumping estimate. Sam noted that the current predictions for 2022 result in a 2-inch increase in pumping for Colorado and Kansas over last year and a 2 ½-inch increase for Nebraska. Sam noted that his 2021 prediction is about 4/10th off with data through August to give us an idea of how accurate these predictions might be. Willem theorized that this data could be used in determining a ratio of current year to last year's pumping. This would result in a uniform factor, which could be applied to each state's prior year pumping. Sam felt this approach could work well.

- **Action Item: Sam will continue to assist Willem in improving the 2022 pumping estimate and future in-year estimates.**

3.8. Prepare the 2021 RRCA annual meeting report for approval by the RRCA at the 2021 annual meeting

- Colorado will finish reviewing the draft document as soon as possible and forward it along to Kansas.

3.9. Retain a contract with Principia Mathematica for the period and scope outlined by the commissioners.

- No significant discussion on this matter.

4. Summary of Meeting Actions/Assignments (in bold)
   - **Kari will send out an email with summarizing the Courtland Canal issue.**
   - **Sam will continue to work with Willem on a 2022 pumping estimate.**
5. Future Meetings

   5.1. The next meeting will be the Annual Meeting on August 31, 2022 at 10 am MST.
6. Adjourn

   6.1. The meeting adjourned at approximately 10:39 a.m.

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Accounting Inputs

Calendar Year		**2021**
Groundwater Data		
North Fork Subbasin	GW CBCU Colorado	*17,951*
	GW CBCU Kansas	*0*
	GW CBCU Nebraska	*1,272*
Arikaree Subbasin	GW CBCU Colorado	*1,443*
	GW CBCU Kansas	*115*
	GW CBCU Nebraska	*110*
Buffalo Subbasin	GW CBCU Colorado	*437*
	GW CBCU Kansas	*0*
	GW CBCU Nebraska	*3,569*
Rock Subbasin	GW CBCU Colorado	*82*
	GW CBCU Kansas	*0*
	GW CBCU Nebraska	*5,113*
South Fork Subbasin	GW CBCU Colorado	*13,764*
	GW CBCU Kansas	*5,176*
	GW CBCU Nebraska	*774*
Frenchman Subbasin	GW CBCU Colorado	*200*
	GW CBCU Kansas	*0*
	GW CBCU Nebraska	*79,922*
Driftwood Subbasin	GW CBCU Colorado	*0*
	GW CBCU Kansas	*0*
	GW CBCU Nebraska	*828*
Red Willow Subbasin	GW CBCU Colorado	*0*
	GW CBCU Kansas	*0*
	GW CBCU Nebraska	*8,862*
Medicine Creek Subbasin	GW CBCU Colorado	*0*
	GW CBCU Kansas	*0*
	GW CBCU Nebraska	*20,562*
Beaver Subbasin	GW CBCU Colorado	*0*
	GW CBCU Kansas	*5,163*
	GW CBCU Nebraska	*3,228*
Sappa Subbasin	GW CBCU Colorado	*0*
	GW CBCU Kansas	*1,241*
	GW CBCU Nebraska	*1,560*
Prairie Dog Subbasin	GW CBCU Colorado	*0*
	GW CBCU Kansas	*2,724*
	GW CBCU Nebraska	*0*
Mainstem Subbasin	GW CBCU Colorado	*(3,839)*
	GW CBCU Kansas Above Guide Rock	*(353)*
	GW CBCU Kansas Below Guide Rock	*56*
	GW CBCU Nebraska Above Guide Rock	*62,951*
	GW CBCU Nebraska Below Guide Rock	*2,534*

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	*49*
Medicine Creek Subbasin	Imported Water Nebraska	*10,693*
Beaver Subbasin	Imported Water Nebraska	*0*
Sappa Subbasin	Imported Water Nebraska	*29*
Prairie Dog Subbasin	Imported Water Nebraska	*0*
Mainstem Subbasin	Imported Water Nebraska Above Guide Rock	*10,699*
	Imported Water Nebraska Below Guide Rock	*(14)*
	Total	***21,456***
SW Pumping Data		
North Fork Subbasin	SW Diversions - Irrigation -Non-Federal Canals- Colorado	195
	SW Diversions - Irrigation - Small Pumps - Colorado	22
	SW Diversions - M&I - Colorado	0
Arikaree 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	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	98

Calendar Year		2021
	SW Diversions - Irrigation - Small Pumps - Nebraska	6
	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	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	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	79
	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	62
	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	61
	SW Diversions - M&I - Nebraska - Below Gage	0
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	14
	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	0
	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	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
Prairie Dog Subbasin	SW Diversions - Irrigation - Non-Federal Canals- Kansas	0
	SW Diversions - Irrigation - Small Pumps - Kansas	519
	SW Diversions - M&I - Kansas	376
	SW Diversions - Irrigation - Non-Federal Canals - Nebraska -Below Gage	0
	SW Diversions - Irrigation - Small Pumps -Nebraska - Below Gage	92
	SW Diversions - M&I - Nebraska - Below Gage	0
Mainstem Subbasin	SW Diversions - Irrigation - Non-Federal Canals- Kansas	0
	SW Diversions - Irrigation - Small Pumps - Kansas	889
	SW Diversions - M&I - Kansas	0
	SW Diversions - Irrigation - Non-Federal Canals - Nebraska	1,830
	SW Diversions - Irrigation - Small Pumps - Nebraska	1,461
	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	665
	SW Diversions - M&I - Nebraska - Below Guide Rock	0
Non-Federal SW Consumptive Use		
	% Non-Federal Canal Diversion Consumed	60%
	% Small Surface Water Pumps Consumed	75%
	% Municipal And Industrial SW Consumed	50%

Calendar Year		**2021**
Non-Federal Reservoir Evaporation Data		
North Fork Subbasin	Non-Federal Reservoir Evaporation - Colorado	39
Arikaree Subbasin	Non-Federal Reservoir Evaporation - Colorado	0
	Non-Federal Reservoir Evaporation - Kansas	16
	Non-Federal Reservoir Evaporation - Nebraska	0
Buffalo Subbasin	Non-Federal Reservoir Evaporation - Colorado	0
	Non-Federal Reservoir Evaporation - Nebraska	11
Rock Subbasin	Non-Federal Reservoir Evaporation - Nebraska	127
South Fork Subbasin	Non-Federal Reservoir Evaporation - Colorado	0
	Non-Federal Reservoir Evaporation - Kansas	137
	Non-Federal Reservoir Evaporation - Nebraska	0
Frenchman Subbasin	Non-Federal Reservoir Evaporation - Nebraska	106
Driftwood Subbasin	Non-Federal Reservoir Evaporation - Kansas	16
	Non-Federal Reservoir Evaporation - Nebraska	0
Red Willow Subbasin	Non-Federal Reservoir Evaporation - Nebraska	222
Medicine Creek Subbasin	Non-Federal Reservoir Evaporation - Nebraska - Above Gage	251
	Non-Federal Reservoir Evaporation - Nebraska - Below Gage	3
Beaver Subbasin	Non-Federal Reservoir Evaporation - Colorado	0
	Non-Federal Reservoir Evaporation - Kansas	373
	Non-Federal Reservoir Evaporation - Nebraska - Above Gage	126
	Non-Federal Reservoir Evaporation - Nebraska - Below Gage	0
Sappa Subbasin	Non-Federal Reservoir Evaporation - Kansas	401
	Non-Federal Reservoir Evaporation - Nebraska - Above Gage	46
	Non-Federal Reservoir Evaporation - Nebraska - Below Gage	2
Prairie Dog Subbasin	Non-Federal Reservoir Evaporation - Kansas	270
	Non-Federal Reservoir Evaporation - Nebraska	12
Mainstem Subbasin	Non-Federal Reservoir Evaporation - Kansas	78
	Non-Federal Reservoir Evaporation - Nebraska - Above Guide Rock Gage - Whole Basin Value:	983
	Non-Federal Reservoir Evaporation - Nebraska - Below Guide Rock Gage - Whole Basin Value:	51
Stream Gage Data		
North Fork Subbasin	North Fork Republican River At Colorado-Nebraska State Line	25,846
Arikaree Subbasin	Arikaree River At Haigler	1,635
Buffalo Subbasin	Buffalo Creek Near Haigler	1,583
Rock Subbasin	Rock Creek At Parks	3,583
South Fork Subbasin	South Fork Republican River Near Benkelman	321
Frenchman Subbasin	Frenchman Creek At Culbertson	16,678
Driftwood Subbasin	Driftwood Creek Near McCook	1,999
Red Willow Subbasin	Red Willow Creek Near Red Willow	4,012
Medicine Creek Subbasin	Medicine Creek Below Harry Strunk	22,871
Beaver Subbasin	Beaver Creek Near Beaver City	796
Sappa Subbasin	Sappa Creek Near Stamford	14,925
Prairie Dog Subbasin	Prairie Dog Creek Near Woodruff	6,646
Mainstem Subbasin	Republican River At Guide Rock	115,649
	Republican River Near Hardy	142,152
Hardy Gage Data	USGS Gage 06853500 Republican River Near Hardy, NE	
Mainstem Subbasin	January	7,475
	February	7,332
	March	28,746
	April	20,400
	May	25,198
	June	14,672
	July	8,141
	August	8,550
	September	3,034
	October	2,535
	November	7,470
	December	8,600
	ANNUAL	142,153

Calendar Year		**2021**
Reservoir Data		
South Fork Subbasin	Bonny Reservoir Evaporation	0
	Bonny Reservoir Change In Storage	0
Frenchman Subbasin	Enders Reservoir Evaporation	1,616
	Enders Reservoir Change In Storage	(655)
Red Willow Subbasin	Hugh Butler Lake Evaporation	2,608
	Hugh Butler Lake Change In Storage	(2,618)
Medicine Creek Subbasin	Harry Strunk Lake Evaporation	2,452
	Harry Strunk Lake Change In Storage	2,950
Prairie Dog Subbasin	Keith Sebelius Lake Evaporation	3,342
	Keith Sebelius Lake Change In Storage	(3,444)
Mainstem Subbasin	Swanson Lake Evaporation	8,671
	Swanson Lake Change In Storage	(9,291)
	Harlan County Evaporation Subject to Nebraska/Kansas Split	11,476
	Harlan County Evaporation Charged to Kansas	0
	Harlan County Change In Storage	754
	Lovewell Reservoir Ev charged to the Republican River	1,290
Canal Data		
North Fork Subbasin	Haigler Canal Diversions - Colorado	0
	Haigler Canal Diversions - Nebraska	5,640
	Haigler Canal Diversions	***5,640***
South Fork Subbasin	Hale Ditch Diversions	0
Frenchman Subbasin	~~Champion Canal Diversions~~	~~0~~
	Riverside Canal Diversions	0
	Culbertson Canal Diversions	5,988
	Culbertson Canal Extension Diversions	0
	Culbertson Canal % Return Flow	82%
	Culbertson Canal Extension % Return Flow	100%
Driftwood Subbasin	Meeker-Driftwood Canal Diversions	18,654
	Meeker-Driftwood Canal % Return Flow	59.9%
Red Willow Subbasin	Red Willow Canal Diversions	5,161
	Red Willow Canal % Return Flow	63%
Prairie Dog Subbasin	Almena Canal Diversions	2,593
	Almena Canal % Return Flow	58.0%
Mainstem Subbasin	Bartley Canal Diversion	8,468
	Bartley Canal % Return Flow	67%
	Cambridge Canal Diversion	25,971
	Cambridge Canal % Return Flow	59.2%
	Naponee Canal Diversion	1,381
	Naponee Canal % Return Flow	73%
	Franklin Canal Diversion	20,907
	Franklin Canal % Return Flow	73%
	Franklin Pump Canal Diversions	904
	Franklin Pump Canal % Return Flow	67%
	Superior Canal Diversions	9,551
	Superior Canal % Return Flow	68%
	Courtland Canal Diversions At Headgate	*73,224*
	Diversions to Nebraska Courtland	980
	Nebraska Courtland % Return Flow	27%
	Courtland Canal, Loss in NE assigned to upper Courtland KS	3,712
	Courtland Canal, Loss in NE assigned to delivery to Lovewell	7,815
	Courtland Canal At Kansas-Nebraska State Line	*60,776*
	Courtland Canal Diversions to the Upper Courtland District	24,977
	Courtland Canal Above Lovewell % Return Flow	*58.6%*
	Courtland Canal, Loss assigned to deliveries of water to Lovewell, Stateline to Lovewell	*8,795*
	Courtland Canal Deliveries To Lovewell Reservoir	*30,657*
	Diversions of Republican River water from Lovewell Reservoir to the Courtland Canal below Lovewell	24,651
	Courtland Canal Below Lovewell % Return Flow	*42.4%*
	To allocate Harlan County evaporation:	
	Kansas Bostwick Diversions During Irrigation Season (actual, or 3-year average)	52,212
	Nebraska Bostwick Diversions During Irrigation Season (actual or 3-year average)	30,809

Accounting Tables

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

2021	Virgin Water	Computed	Allocations				Computed Beneficial Consumptive Use		
Basin	Supply	Water Supply	Colorado	Kansas	Nebraska	Unallocated	Colorado	Kansas	Nebraska
North Fork	41,490	41,490	9,290	0	10,210	21,990	18,120	0	4,660
Arikaree	3,320	3,320	2,610	170	560	(20)	1,440	130	110
Buffalo	5,660	5,660	0	0	1,870	3,790	440	0	3,640
Rock	8,900	8,900	0	0	3,560	5,340	80	0	5,240
South Fork	20,160	20,160	8,950	8,100	280	2,830	13,760	5,310	770
Frenchman	99,790	100,450	0	0	53,840	46,610	200	0	82,730
Driftwood	170	170	0	10	30	130	0	20	830
Red Willow	17,930	20,550	0	0	3,950	16,600	0	0	9,590
Medicine	38,440	35,490	0	0	3,230	32,260	0	0	20,910
Beaver	9,700	9,700	1,940	3,760	3,940	60	0	5,550	3,350
Sappa	17,350	17,350	0	7,130	7,130	3,090	0	1,640	1,610
Prairie Dog	11,200	14,640	0	6,690	1,110	6,840	0	8,000	80
Main Stem	197,990	204,980	0	104,740	100,240	0	(3,840)	36,480	119,130
Total All Basins	472,100	482,860	22,790	130,600	189,950	139,520	30,200	57,130	252,650
Main Stem Including Unallocated		344,500	0	176,030	168,470				
Total	472,100	482,860	22,790	201,890	258,180	0	30,200	57,130	252,650

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)
2017	22,960	31,810	11,330	2,480
2018	25,630	35,130	13,578	4,078
2019	22,710	32,740	8,905	(1,125)
2020	24,200	26,910	6,218	3,508
2021	22,790	30,200	9,390	1,980
Avg 2017-2021	23,660	31,360	9,880	2,180

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)
2017	177,230	62,040	NA	115,190
2018	179,780	51,450	NA	128,330
2019	333,300	47,910	NA	285,390
2020	247,750	53,810	NA	193,940
2021	201,890	57,130	NA	144,760
Avg 2017-2021	227,990	54,470	NA	173,520

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)
2017	238,540	242,140	39,439	35,839
2018	241,680	266,080	25,943	1,543
2019	389,300	262,870	26,541	152,971
2020	303,070	252,400	18,995	69,665
2021	258,180	252,650	21,456	26,986
Avg 2017-2021	286,150	255,230	26,470	57,400

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.

2021

	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

2021

	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	172	(12)	678	N/A	838	142	696
South Fork	8,752	3,050	0	N/A	11,802	4,780	7,022
Driftwood	72	810	0	N/A	882	14	868
Beaver	4,492	66	2,316	N/A	6,874	6,422	452
Sappa	7,874	3,404	0	N/A	11,278	2,556	8,722
Prairie Dog	8,388	8,570	0	N/A	16,958	10,948	6,010

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

	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7
Year	Is the year Water Short Pursuant to III.J?* (Yes or No)	Statewide Allocation	Beaver Creek Reduction Pursuant to Table 5F	Allocation - Beaver Creek Reduction (Col. 2 - Col.3)	Computed Beneficial Consumptive (excluding the Beaver Creek Sub-basin)	Imported Water Supply Credit - IWS Beaver Creek + CORWS Credit	Difference between Allocation and the Compuated Beneficial Consumptive Use offset by Imported Water Supply Credit and CORWS Credit (Col. 4 - Col. 5 + Col. 6)
2017	Yes	22,960	0	22,960	31,810	11,330	2,480
2018	No	25,630	1,852	23,778	35,130	13,578	2,226
2019	Yes	22,710	0	22,710	32,740	8,905	(1,125)
2020	No	24,200	0	24,200	26,910	6,218	3,508
2021	No	22,790	0	22,790	30,200	9,390	1,980
Avg 2017-2021	Yes	23,660	370	23,290	31,360	9,880	1,810

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

Water Short Year (WSY) Pursuant to III.J	Beaver Creek Allocation	Reduction = Average of last five WSY Beaver Creek Allocations
	Col. 1	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
2018	2,250	1,852

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 Consumpitve Use offset by Imported Water Supply Credit
Column	1	2	3	4	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)
2020	30,570	8,212	1,702	40,483	23,700	N/A	16,783
2021	25,860	6,607	1,589	34,056	20,650	N/A	13,406
Avg 2020-2021	28,215	7,410	1,645	37,270	22,175	N/A	15,095

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

	Allocation			Computed Beneficial Consumptive Use	Imported Water Supply Credit and AWS	Allocation - (CBCU - IWS-AWS)
Year	Sub-Basin Total	Share of Unallocated Supply	Total			
2019	107,230	86,685	193,915	137,820	11,441	67,536
2020	95,240	78,440	173,680	132,980	10,716	51,416
2021	89,710	68,225	157,935	133,520	10,822	35,237
Avg 2020-2021	92,475	73,333	165,808	133,250	10,769	43,327

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

Year	Allocation				Computed Beneficial Consumptive Use			Imported Water Supply Credit and NERWS Credit	Difference Between Allocation and Computed Beneficial Consumptive Use offset by Imported Water Supply Credit Above Guide Rock and NERWS Credit
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	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)
2020	303,070	17,777	285,293	1,628	252,400	2,266	250,134	18,995	55,783
2021	258,180	6,503	251,677	1,521	252,650	3,084	249,566	21,485	25,116
Avg 2020-2021	280,630	12,140	268,480	1,570	252,530	2,680	249,850	20,240	40,450

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)
2019	389,300	56,294	333,006	1,511	262,870	1,780	261,090	26,541	99,968
2020	303,070	17,777	285,293	1,628	252,400	2,266	250,134	18,995	55,783
2021	258,180	6,503	251,677	1,521	252,650	3,084	249,566	21,485	25,116
Avg 2019-2021	316,850	26,860	289,990	1,550	255,970	2,380	253,600	22,340	60,290

Attachments

Attachment 1: Sub-basin Flood Flow Thresholds

Sub-basin	Sub-basin Flood Flow Threshold Acre-feet per Year[3]
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

[3] 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

Note: At its Annual Meeting on August 21, 2020, the RRCA agreed that the Accounting Procedures (Rev. May 25, 2017) do not properly implement the Flood Flows provisions at the Hardy gage with respect to the calculation of Computed Water Supply above and below Guide Rock. The current implementation could impact Nebraska's Table 5C compliance test, specifically the Allocation above Guide Rock. Nebraska and Kansas each offered proposals to resolve the issue but could not reach agreement on a solution. Due to the infrequent occurrence of Flood Flows, the RRCA deferred resolution of the matter to a future date necessitated by an preceding impact to Nebraska's Table 5C compliance. The states wish to acknowledge and memorialize the issue to encourage work towards its resolution. As it stands, Attachment 6 calculates Virgin Water Supply Guide Rock to Hardy rather than Computed Water Supply Guide Rock to Hardy which would reduce Virgin Water Supply by the relevant Flood Flows as described in Section II. Definitions and Section III. Basic Formulas.

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 Below Guide Rock	NE CBCU Below Guide Rock	KS CBCU Below Ruide Rock	Total CBCU Below Guide Rock	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
2021	204,980	142,152	115,649	44,380	9,551	10,536	6,475	17,011	3,084	723	3,807	9,492	13,299	191,681	93,732	97,949	6,503	6,796

COURTLAND CANAL					
	2017	2018	2019	2020	2021
Return Flow From Courtland Canal To Republican River Above Lovewell From Kansas	789	608	761	536	912
Return Flow From Courtland Canal To Republican River Above Hardy From Nebraska	7,785	4,706	3,519	6,791	9,625
Courtland Canal Diversions At Headgate	62,438	46,704	55,120	44,380	73,224
Courtland Canal At Kansas-Nebraska State Line	52,599	40,559	50,721	35,756	60,776
NE Courtland Canal CBCU (includes transportation loss)	345	405	108	342	711
Superior Canal CBCU	2,616	2,744	1,433	2,046	3,076

NEBRASKA					
	2017	2018	2019	2020	2021
SW Diversions - Irrigation - Small Pumps - Nebraska Below Guide Rock	1,261	1,177	84	552	665
SW Diversions - M&I - Nebraska - Below Guide Rock	0	0	0	0	0
SW Non-Federal Reservoir Evaporation - Below Guide Rock	93	(9)	(6)	84	51
SW Return - Irrigation	315	294	21	138	166
SW Return - M&I	0	0	0	0	0
GW CBCU Nebraska Below Guide Rock	2,546	2,440	1,723	1,769	2,534

KANSAS					
	2017	2018	2019	2020	2021
SW CBCU - Irrigation - Small Pumps	727	518	148	565	667
SW CBCU - M&I	0	0	0	0	0
GW CBCU Kansas Below Guide Rock	53	47	49	51	56

2021

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

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	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	Estimated Percent Loss*	Col 9 x Col 10 + Col 3	Col 11/Col 2
Σ Irrigation Season											
Σ Non- Irrigation Season											
Culbertson	5,111	44	5,067	176	4,891	30%	53	4,944	82%	4,098	80%
	877	0	877	0	877	30%	0	877	92%	807	92.0%
Culbertson Extension	0	0	0	0	0	30%	0	0	82%	0	100%
	0	0	0	0	0	30%	0	0	92%	0	100.0%
Meeker - Driftwood	18,654	1,823	16,831	7,769	9,062	30%	2,331	11,393	82%	11,165	59.9%
	0	0	0	0	0	30%	0	0	92%	0	100.0%
Red Willow	5,161	145	5,016	1,741	3,275	30%	522	3,797	82%	3,259	63.1%
	0	0	0	0	0	30%	0	0	92%	0	100.0%
Bartley	7,703	949	6,754	2,716	4,038	30%	815	4,853	82%	4,928	64.0%
	765	12	753	0	753	30%	0	753	92%	705	92.1%
Cambridge	25,971	1,193	24,778	10,707	14,071	30%	3,212	17,283	82%	15,365	59.2%
	0	0	0	0	0	30%	0	0	92%	0	100.0%
Naponee	1,381	247	1,134	322	812	35%	113	925	82%	1,005	72.8%
	0	0	0	0	0	35%	0	0	92%	0	100.0%
Franklin	20,907	3,189	17,718	4,492	13,226	35%	1,572	14,798	82%	15,324	73.3%
	0	0	0	0	0	35%	0	0	92%	0	100.0%
Franklin Pump	904	117	787	300	487	35%	105	592	82%	602	66.6%
	0	0	0	0	0	35%	0	0	92%	0	100.0%
Almena	2,593	0	2,593	1,085	1,508	30%	326	1,834	82%	1,503	58.0%
Superior	9,551	2,097	7,454	3,066	4,388	31%	950	5,338	82%	6,475	67.8%
	0	0	0	0	0	31%	0	0	92%	0	100.0%
Nebraska Courtland	980	0	980	846	134	23%	195	329	82%	269	27.5%
Courtland Canal Above Lovewell (KS)	24,977	2,286	22,691	9,903	12,788	23%	2,278	15,066	82%	14,640	58.6%
Courtland Canal Below Lovewell	38,977	3,703	35,274	25,502	9,772	23%	5,865	15,637	82%	16,526	42.4%

* The average field efficiencies for each district and percent loss that returns to the stream may be reviewed and, if necessary, changed by the RRCA to improve the accuracy of the estimates.

Attachment 8: Calculations of the Computed Water Supply Adjustment and Remaining Compact compliance Volume for Implementation of 2016 RRCA Resolution

CCV and RCCV Tracking[a]												
	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12
Year	Start of Year RCCV	RCCV Adjustment	CCV	CCV Inflow Into HCL	RCCV Inflow Into HCL	Total CCV and RCCV Inflow Into HCL	Total CCV and RCCV Available for Release	CCV Released from HCL as Flow	CCV Released from HCL as Evaporation	CCV Retained in HCL (at End of Year)	CWSA	End of Year RCCV
	=Col 12 of previous year	b	c			= Col. 4 + Col. 5	=Col. 6 + Col. 10 of previous year			= Col. 7 – (Col. 8 + Col. 9)	=Col. 10 – Col. 10 of previous year	= Col. 1 – Col. 2 + Col. 3 - Col. 6[d]
2007	0	0	0	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0	0	0	0	0	0
2009	0	0	0	0	0	0	0	0	0	0	0	0
2010	0	0	0	0	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0	0	0	0	0	0
2014	0	0	0	0	0	0	0	0	0	0	0	0
2015	0	0	0	8332	0	8332	8332	0	0	8332	8332	0
2016	0	0	41,935	24752	0	24752	33084	5084	4321	23679	15347	9,300
2017	9300	0	20,000	20,000	0	20000	43679	20000	2241	21438	-2241	9,300
2018	9300	0	0	0	0	0	21438	0	1339	20099	-1339	9,300
2019	9300	0	0	0	0	0	20099	0	2340	17759	-2340	9,300
2020	9300	1860	0	0	0	0	17759	0	3889	13870	-3889	7,440
2021	7,440	1860	0	0	0	0	13870	0	1550	12320	-1550	5,580

APV and RWS					RCCV Calc
Colorado		Nebraska			
Aug. Pumping Volume (APV)	Resolution Water Supply Credit (CORWS)	Aug. Pumping Volume (APV) Rock Creek That Passed Sub-basin Gage in the Current Year	Aug. Pumping Volume (APV) N-CORPE That Passed Sub-basin Gage in the Current Year	Resolution Water Supply Credit (NERWS)	Extra CCV Efforts Above CCV (Use with RCCV Calc)
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	15,766	0	15,766	0
7,448	7,448	19,397	42,758	62,155	0
10,760	10,760	1,098	25,932	18,698	8332
10,130	10,130	499	22,803	41,935	449
11,330	11,330	4,563	11,106	20,000	0
13,578	13,578	0	0	0	0
8,905	8,905	0	0	0	0
6,218	6,218	0	0	0	0
9,390	9,390	0	0	0	0

a. Calculations for RCCV, CWSA, & RWS don't start until Oct. 1, 2015

b. See Provision 10 of the RRCA Resolution signed August 24, 2016, titled “Resolution Approving Long-Term Agreement Related to the Operation of Harlan County Lake for Compact Call Years” for the terms of assigning RCCV Adjustment. The RCCV Adjustment for each year is equal to 20% of the unadjusted portion of the RCCV, if it is a non-Compact Call Year, plus any remaining volumetric reductions from the previous four years.

c. In years when the contributions from Nebraska’s water management activities, consistent with the 2016 CCY HCL Operations Resolution, are greater than CCV and the NERWS is equal to the greater contribution volume, CCV in Column 3 should also be set equal to the contribution.

d. The formula for calculation of RCCV is based on calendar year operations and will vary when operations occur in a different calendar year than NERWS Credit is applied.

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

Hardy Gage Monthly Data (acre-feet)					
	2017	2018	2019	2020	2021
January	11,315	4,619	13,289	55,339	7,475
February	6,369	5,521	6,875	33,332	7,332
March	6,420	7,386	61,131	33,775	28,746
April	6,933	3,658	21,669	23,421	20,400
May	33,286	2,309	66,000	31,732	25,198
June	11,956	7,601	69,761	10,810	14,672
July	24,712	3,805	118,015	30,811	8,141
August	5,874	5,065	82,834	8,337	8,550
September	3,532	23,848	30,188	3,488	3,034
October	8,752	17,603	21,527	4,298	2,535
November	2,399	9,231	59,330	7,632	7,470
December	5,575	20,216	75,757	8,265	8,600
ANNUAL	127,122	110,862	626,376	251,239	142,153
Over 400K	0	0	226,376	0	0

Sub-basin Flows Above Attachment 1 Flood Flow Thresholds					
	2017	2018	2019	2020	2021
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	15,988	0	0
Prairie Dog	0	0	25,260	0	0
Sub-basin Sum	0	0	41,248	0	0

5-month Consecutive Period Flows (acre-feet)					
	2017	2018	2019	2020	2021
Jan-May	64,322	23,494	168,964	177,598	89,151
Feb-Jun	64,964	26,475	225,436	133,069	96,348
Mar-Jul	83,307	24,760	336,576	130,548	97,157
Apr-Aug	82,760	22,438	358,279	105,110	76,961
May-Sep	79,359	42,628	366,798	85,177	59,595
Jun-Oct	54,825	57,922	322,325	57,743	36,932
Jul-Nov	45,268	59,552	311,894	54,566	29,730
Aug-Dec	26,132	75,962	269,636	32,020	30,189

5-month Consecutive Period Test					
	2017	2018	2019	2020	2021
Jan-May	0	0	0	0	0
Feb-Jun	0	0	0	0	0
Mar-Jul	0	0	1	0	0
Apr-Aug	0	0	1	0	0
May-Sep	0	0	1	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	3	0	0

2-month Consecutive Period Flows (acre-feet)					
	2017	2018	2019	2020	2021
Jan-Feb	17,683	10,140	20,164	88,671	14,807
Feb-Mar	12,789	12,907	68,006	67,107	36,078
Mar-Apr	13,353	11,045	82,800	57,195	49,146
Apr-May	40,219	5,967	87,669	55,152	45,598
May-Jun	45,242	9,910	135,761	42,541	39,870
Jun-Jul	36,668	11,406	187,776	41,621	22,813
Jul-Aug	30,586	8,870	200,849	39,148	16,691
Aug-Sep	9,406	28,912	113,022	11,825	11,584
Sep-Oct	12,283	41,451	51,715	7,786	5,569
Oct-Nov	11,151	26,834	80,857	11,930	10,005
Nov-Dec	7,974	29,447	135,087	15,898	16,070

2-month Consecutive Period Test					
	2017	2018	2019	2020	2021
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	1	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	1	0	0

Final Sub-basin Flood Flows					
	2017	2018	2019	2020	2021
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	15988	0	0
Prairie Dog Flood Flow	0	0	25260	0	0
Mainstem Flood Flow	0	0	185128	0	0

Combined Test					
	2017	2018	2019	2020	2021
FINAL TOTAL	0	0	4	0	0