Minutes

Fourth Annual Meeting
Republican River Basin-Wide Plan

In-Person: Cambridge, NE
Virtual: Zoom
November 15, 2022
2:00 p.m. Central Time

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Attendance

25 people were in attendance. Those that signed in or attended virtually are listed below.

Meeting Participants

Nebraska Department of Natural Resources (NeDNR):

Kari Burgert (NeDNR)

Sam Capps (NeDNR)

Alexa Davis (NeDNR)

Avery Dresser (NeDNR)

Elizabeth Esseks (NeDNR)

Brian Flynn (NeDNR)

Andy Pedley (NeDNR)

Natural Resources Districts (NRDs):

Nate Jenkins (Upper Republican NRD)

Jack Russell (Middle Republican NRD)

Todd Siel (Lower Republican NRD)

Larry Reynolds (Tri-Basin NRD)

Nick Simonson (Lower Republican NRD)

John Thorburn (Tri-Basin NRD)

Other Attendees:

Scott Dicke (Central Nebraska Public Power and Irrigation District)

Brad Edgerton (Frenchman-Cambridge Irrigation District)

Doug Hallum (Conservation Survey Division, University of Nebraska-Lincoln)

Dale Helms (Stakeholder)

Bill Hoyt (Frenchman-Valley Irrigation District)

Mitch Maguire (Daugherty Water For Food Institute)

Kurt Mantonya (University of Nebraska-Lincoln Public Policy Center (UNL PPC))

Roric Paulman (Stakeholder)

Taylor Smith (UNL PPC)

Ted Tietjen (Stakeholder)

Jerda Garey Vickers (public)

Dustin Wilcox (Nebraska Association of Resources Districts)

Summary of Meeting

1. Welcome and introductions – Sam Capps. The meeting started at 2:05 P.M. Attendees who signed in can be found on the sign-in sheet ("Sign-in Sheet," Attachment A).
    a. Nebraska Open Meetings Act requirements
        i. A copy of the Open Meetings Act was available both in-person and online.
    b. Review agenda and meeting objectives
        i. No changes or additions were made ("Agenda," Attachment B).
    c. Introductions
        i. 19 people attended in person and 6 attended online.
2. Plan implementation progress – Sam Capps

    A draft of the annual report (*Fourth Annual Report for the Republican River Basin-Wide Plan* (Annual Report), Attachment C) was provided to participants. It was also available on the website (rrbwp.nebraska.gov). The purpose and location of each section of the report were provided as a reference.
    a. Annual Report: Plan Implementation Progress 2021 – Sam Capps
        i. Water supplies and uses in the basin (page 3 of Annual Report)
            1. Information on water supplies and uses in the basin can be found in the NRD, NeDNR, and Augmentation Pumping sections.
            2. No management actions were taken for 2021 Compact compliance.
            3. Next year will probably be a Compact Call Year.
        ii. Progress toward Goals, Objectives, and Action Items – Sam Capps
            1. Management activities (page 30 of Annual Report)
                a. Upper Republican NRD (URNRD) – Nate Jenkins
                    i. During 2021, the NRD made progress on increasing water use efficiency, promoting conservation programs, and reducing the effects of undesirable vegetation. Reducing the effects of undesirable vegetation was accomplished through the NRD's support of Southwest Weed Management.
                    ii. The NRD made progress on conserving water for use during drought periods.
                    iii. The NRD started regulating water usage in 1980, and since that time, there have only been six years that were as dry or drier during the growing season (April through September)

than 2021. There was the lowest average usage for a dry year during 2021 (13.8 inches). Low use may be due to producers being more efficient and conservative about irrigation because of the upcoming end of the allocation period. Also, there is a lot of leasing in the district and leaseholders are penalized for exceeding their allocation (e.g., the producer is charged another $20 per acre for each acre-inch the allocation is exceeded).

iv. Since 1895 in Imperial, there have only been seven years when it was drier from April through September than it was in 2022, with five of those years occurring since 2000.

v. Programs to promote water use efficiency and conservation included the district's moisture probe program, funded by the Water Sustainability Fund (WSF). In 2021, the district incentivized the use of 117 probes on approximately 15,000 acres. Assuming 1.5 inches of water was saved per acre, producers saved approximately 2,000 acre-feet of water.

vi. The district continued efforts to retire irrigated acres, using funding from the district and the Water Resources Cash Fund (WRCF). Last year contracts were signed to permanently cease irrigation on 1,622 acres; the total number of acres converted to dryland crop or pasture using district and WRCF funds is 2,824 acres. This is expensive, so ceasing irrigation on acres is not the primary solution to the district's water issues. The average stream depletion factor (SDF) of acres retired was 60%, so a lot of the land was close to the Republican or its tributaries. The district has converted a total of 4,400 acres in the last 10 years to dryland crop or pasture using state, federal, and local funds.

vii. The district continued efforts last year to encourage producers to use evapotranspiration (ET) estimates to improve their irrigation schedules. There are three weather stations in the district that are continuously estimating ET for six crops; the district has ET estimates for eleven different growth stages for each crop. That information is publicized heavily but Jenkins isn't sure how much it is used. The district is converting to an automated meter-reading system so farmers will be able to get their water usage in real-time or near real-time. They will be able to compare usage to ET estimates from the closest

weather station. Jenkins hopes the information will be used more as producers become familiar with the tools.

b. Middle Republican NRD (MRNRD) – Jack Russell
   i. The district has seen water savings with soil moisture probes similar to URNRD's estimates of 1 – 1.5 inches per acre.
   ii. A lot of the progress on goals and objectives depends on how they react to what happens in the district. For example, there were fires last spring and producers ran pivots to help fight the fires. The district tracked water use with telemetry meters, and water used to fight fires didn't count against the producer's consumptive use. Middle Republican owns a lake; when there were fires near the lake, helicopters dipped out of the lake for about a week to fight the fires. The district has done a lot of work replanting trees lost during the fires west of Cambridge. The drought workshop in May 2022 focused on improving communication and sharing information with farmers and first responders to coordinate efforts about where firefighters could fill their trucks. These were reactive responses to what happened in the district.
   iii. Drought is another major issue in the Basin. There is a line just west of Harry Strunk Lake that marks a dramatic change in precipitation west to east; west of the line there was about 0.2 inches of rain and east of the line there was as much as 14 to 16 inches of rain during the summer. The drought generated a lot of interest in telemetry meters and how much water people were using. The district is coming to the end of an allocation period, and there is an adjustment or penalty for exceeding the allocation.
   iv. The district is about 60% done installing telemetry meters on all wells in the district. The district is working with a consultant on a dashboard and once meters are installed, farmers will have a phone app that will give them real-time water usage.
   v. The district utilized Natural Resources Conservation Service (NRCS) WaterSMART grant funds to install approximately 250 soil moisture probes that targeted higher depletion areas and achieved significant water savings.
   vi. The district has been able to access funding through NRCS, WSF, WRCF, and WaterSMART; Russell encouraged others to

coordinate their resources to optimize external funding for projects.

vii. The district has a pending WaterSMART grant to finish installing telemetry meters across entire district; they anticipate finishing the project within two years.

viii. Using WSF funding, the district finished taking Airborne Electromagnetic (AEM) readings on the rest of the irrigated land in the NRD; the data is being processed. Middle Republican is only 12% irrigated, which is a small amount compared to other districts in the Basin. The short-term goal is to use the data to identify areas where transfers would be feasible and beneficial; the long-term goal is to make the district balanced for water use in the long term.

ix. The district has done some land retirements if people who are interested ask about the program.

x. The district is rebuilding the P2 watershed dam west of McCook, using $2.5 million from NRCS.

xi. The new allocation period will start January 1, 2023. The allocation will be the same (12 inches per year for the next 5-year period); producers can carry over 12 inches maximum of unused allocation from the previous year, with a hard cap of 15 inches.

c. Lower Republican NRD (LRNRD) – Todd Siel

i. The district is at the end of their allocation period; the base allocation is 9 inches per year, for a total of 45 inches over the five-year period. Producers can carry over as much as 9 inches per year from the previous year; over 80% of producers had more than 28 inches at the start of this year.

ii. Usage in 2021 was a little over 6 inches; in 2022 with most of the meters read, the projected usage is approximately 10 inches. This year the district was dry to the west, but the eastern third of the district had timely rains and corresponding lower usage.

iii. The district supports water conservation programs like those described by Jenkins and Russell, including funding, support, and volunteer time to Twin Valley Weed Management.

iv. Irrigators in the district have converted to pivots and variable rate irrigation, which has reduced usage significantly.

v. The district has a lot of projects with telemetry and flow meters. The district received a WaterSMART grant for $2 million (total project is $4.3 million) to convert all meters to telemetry-enabled meters; this first grant will cover one-third of the meters and will focus on the Rapid Response areas with high SDF.

vi. The district is also working on a new augmentation project and several NRCS Watershed and Flood Prevention Operations Program (WFPO) watershed projects.

vii. Many producers had a lot of water coming into the last year of the allocation period, and some producers have expressed concern that the district might lower the allocation because producers have been so efficient. The allocation will be the same for the next five years.

viii. The district rewrote their groundwater rules and regulations, which included some minor changes.

d. Tri-Basin NRD (TBNRD) – John Thorburn

i. Thorburn reported that 2021 was an average year, and average usage was 7 inches.

ii. The district's Water Conservation Incentive Program (WCIP) is like a voluntary allocation program that provides an incentive for producers to accept an allocation in exchange for benefits. Approximately 1500 acres are enrolled in the program.

iii. The district has provided crop water use data to producers for years, initially through an 800-phone number and since last year by text messages five days per week. The text messages have been popular. Thorburn likes the idea of data on a dashboard and believes it would be the most effective way to deliver the data.

iv. 2021 was an average year for working with producers on improving irrigation efficiency, especially compared to 2022.

v. The 2022 wildfire in Gosper County burned all residue, insecticide, and fertilizer in the fields and damaged irrigation equipment. It was challenging for producers to start over at that point, but they managed it well. Irrigation dealers prioritized producers affected by the fires.

e. NeDNR – Sam Capps

i. 5-Year Technical Analysis –

1. Capps reviewed the requirements from Statute and the Basin Wide Plan.
2. NeDNR and the NRDs have been in discussion for the past year about how to move forward with the 5-Year Technical Analysis.
3. The results of the first 5-Year Technical Analysis will be presented at the 2023 Annual Meeting, and the report will be presented to the legislature in 2024.
4. The first report will cover fewer than 5 years, but subsequent reports will cover 5 years.
5. Capps reviewed progress on the Analysis to date and plans going forward.
6. This Analysis is our only opportunity to make necessary changes to the Plan.

2. Measurable Hydrologic Objectives (MHOs) (page 64 of Annual Report) MHOs B and C are evaluated in the 5-Year Technical Analysis. MHOs A, D, and E are evaluated annually.
   a. For each MHO assessment, the report contains a description of the assessment and a table of results.
      i. MHO A (page 64 of Annual Report) – MHO A is being achieved by all the Republican NRDs. TBNRD uses a 3-Year Net Average to establish a hydrologically balanced status, which TBNRD maintained in 2021.
      ii. MHO B and C (page 68 of Annual Report) – No assessment is required for 2021.
      iii. MHO D (page 68 of Annual Report) – MHO D is being achieved for 2021 in all the Republican NRDs. No portion of the rapid response area is part of the TBNRD.
      iv. MHO E (page 69 of Annual Report) – Surface water was not administered in the URNRD, MRNRD, and LRNRD to ensure compact compliance, so MHO E is being achieved.

b. Drought Planning Exercise – Andy Pedley ("Drought Exercise Presentation," Attachment D).
   i. The Drought Planning Exercise took place in May 2022 in accordance with Action Item 2.8.1. Areas of focus included looking at the logistics of increasing storage water, evaluating management action to identify

long-term availability and trends, and developing metrics to assess the success of actions.

ii. Findings included confirming that the existing policies in the basin (Republican River Compact Administration (RRCA) documents, the Basin-Wide Plan, and the NRDs' rules and regulations) are effective at managing water quantity; drought is cyclical; and communication is very important (communication between responders and communication to the public). Outcomes are yet to be realized, depending on next steps.

iii. A representative of the Nebraska Department of Agriculture participated in the exercise, and one indirect positive outcome is that there may be interest in revisiting the state-wide drought plan.

iv. Recommendations include developing a basin-wide drought plan (which could make the Basin eligible for additional drought planning funding), applying for a USBR WaterSMART grant, developing a Basin drought dashboard, and developing drought impacts reporting tools.

v. The project report is being finalized and will contain exercise outcomes and survey results.

c. Feasibility and potential impacts of planned projects

i. Platte-Republican Diversion Project - Todd Siel

1. A hearing regarding the project was held on July 19, 2021, and TBNRD and LRNRD are awaiting a ruling from NeDNR about the status of objectors to the water right application.

ii. Nebraska Bostwick Irrigation District (NBID) Superior Canal Project – Todd Siel

1. NBID and NeDNR were awarded a WaterSMART grant for the Superior Canal Project. NBID experiences conveyance loss between Harlan County Lake and the Superior Canal.
2. The project may include a river diversion in the Superior area.

iii. NRCS Watershed Grants – Todd Siel

1. LRNRD has funding for United States Department of Agriculture NRCS WFPO grants for Turkey Creek and Thompson Creek.
2. LRNRD is finalizing alternatives for the Turkey Creek and Thompson Creek projects. The district is looking at diversion structures and well augmentation.
3. The third watershed (Flag Creek) went to the NRCS's Preliminary Investigative Feasibility Report (PIFR). LRNRD is awaiting final results.

The district is also looking at a small augmentation project in that watershed.

iv. Water market feasibility survey – Sam Capps

1. NeDNR and the NRDs are working with the University of Nebraska Public Policy Center on a survey to determine interest in a water market in the basin.
2. NeDNR and the NRDs will pursue a water market pilot project if survey results indicate that there is interest in a water market.
3. There was general discussion of existing, informal water markets and the challenges of developing new, more formal water markets in the basin. Thorburn and Jenkins described certified acre transfers in their districts; Jenkins noted that transfers are subject to complex rules and board decisions that vary transfer to transfer.

3. Collaboration

a. Existing and potential new water conservation programs

i. Capps reviewed existing decertification programs.

ii. Thorburn described the TBNRD WCIP.

1. WCIP is a voluntary five-year allocation program. The main benefit to producers of accepting a limit on how much they can pump is that they can irrigate acres that are not certified. There is a monetary incentive of $4 to $5 per acre-inch for saving water.
2. There were no new sign-ups this year.

b. Information sharing about water user management practice improvements

i. Future opportunities to encourage and support water users to share information about management practice improvements – Sam Capps

1. Roric Paulman described penalties up to $100 per acre-inch for tenant producers in the Platte Basin who exceed their allocation. The penalty depends on several factors, including how long the lease is, where the producer is, and what the producer is farming.
2. Larry Reynolds reported that the TBNRD board passed a resolution that in the event of a natural disaster such as wildfires, water pumped to mitigate wildfires would not count against the producer's allocation. The district circulated the resolution to the other basin NRDs; if there is consensus, they plan to ask NeDNR to take the resolution to the RRCA for approval/acknowledgement.
3. There was general discussion about improving access to water in a natural disaster.

ii. Guest speaker/presentation

1. Ted Tietjen and Mitch Maguire gave an update on the Parallel 41 and HUC 12 project ("Parallel 41 & HUC 12 2021," Attachment E).
2. Brad Edgerton from Frenchman-Cambridge Irrigation District discussed the canal automation projects on the Cambridge and Meeker-Driftwood canals ("Meeker-Driftwood Canal SCADA and TCC Modernization Project," Attachment F). Automation of the Cambridge canal has reduced or eliminated spills at the end of the canal. During July, the district delivered 75% of the water they put in the Cambridge canal and was allocated an additional two inches. The district is plans to add telemetry to their meters to improve efficiency.

4. Conflicts Resulting from Implementation of the Plan, if any – Sam Capps (page 99 of *Republican River Basin-Wide Plan*)
   a. The Basin-Wide Plan includes conflict resolution procedures for any conflicts resulting from implementation of the Plan.
   b. No conflicts were submitted for consideration prior to this meeting.
5. Public comment
   a. There was general discussion but no public comments.
   b. Capps mentioned the Compact Call Year handout ("Republican Basin Compact Call Year Decision Timeline," Attachment G) as a resource since 2023 will likely be a Compact Call Year.

Attachment A

2022 Annual Republican Basin-Wide Plan Annual Meeting

November 15, 2022 | Cambridge, NE | 2:00 p.m. (CST)

SIGN-IN SHEET

	Name:	Representing (Self or Organization):
1.	Jeff Tiedy	HVC 12
2.	Dale Helms	Self
3.	Kurt Mantonya	Public Policy Center
4.	Taylor Smith	Public Policy Center
5.	Larry Reynolds	Tri Basin
6.	John Thorburn	Tri-Basin NRD
7.	Nate Jenkins	Upper Republican
8.	Alexa Davis	NeDNR
9.	Sam Capps	NeDNR
10.	Todd Siel	LRNRD
11.	Nick Simonson	2RNRD
12.	Brad Edgerton	FCID
13.	Kari Burgert	NeDNR
14.	Avery Dresser	NeDNR
15.	Jade Rusch	MRNRD
16.	Ronic Poulman	Bochner
17.	Mitch Maguire	DWFI
18.	Bill Hoyt	FVID
19.	Elizabeth Esseks	NeDNR
20.		

Attachment B

Fourth Annual Meeting
Republican River Basin-Wide Plan

Tuesday, November 15, 2022
2:00 pm Central Time (1:00 pm Mountain Time)

Cambridge Community Building
722 Patterson Street
Cambridge, NE
Virtual participation option via Zoom

Agenda

1. Welcome and introductions
    a. Nebraska Open Meetings Act requirements
    b. Review agenda and meeting objectives
    c. Introductions
2. Plan implementation progress
    a. Annual Report: Plan Implementation Progress 2021
        i. Water supplies and uses in the basin
        ii. Progress toward goals and objectives of the plan
            1. Management activities
            2. Measurable Hydrologic Objectives (MHOs)
    b. Drought report
    c. Feasibility and potential impacts of planned projects
    d. Water market feasibility survey
3. Collaboration
    a. Existing and potential new water conservation programs
    b. Information sharing about water user management practice improvements
        i. Future opportunities to encourage and support water users to share information about management practice improvements
        ii. Guest speaker/presentation
4. Conflicts Resulting from Implementation of the Plan, if any
    a. None submitted for consideration
5. Public comment

Attachment C

Fourth Annual Report for the Republican River Basin-Wide Plan

Data and Progress Updates, 2021

Presented at the Annual Meeting

November 15, 2022

Jointly prepared by
Upper Republican Natural Resources District
Middle Republican Natural Resources District
Lower Republican Natural Resources District
Tri-Basin Natural Resources District
&
Nebraska Department of Natural Resources

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Introduction

The *Republican River Basin-Wide Plan* (basin-wide plan) was developed by Nebraska Department of Natural Resources (NeDNR) and Upper Republican, Middle Republican, Lower Republican, and Tri-Basin Natural Resources Districts (NRDs), in consultation and collaboration with a Stakeholder Advisory Committee. The time frame to implement the basin-wide plan is approximately 25 years, spanning from the effective date of the basin-wide plan (March 1, 2019) to April 17, 2044, which is 30 years after the operative date of LB 1098 (2014), as specified in *Neb. Rev. Stat.* § 46-755.

Action Item 3.2.2 of the basin-wide plan specifies that NeDNR and the NRDs will annually exchange reports containing data and information about water supplies and uses in the Republican River Basin, management activities, and progress toward the goals and objectives of the basin-wide plan. This report contains the data and information about plan implementation progress for the 2021 calendar year, to be exchanged by NeDNR and the NRDs at the following year's annual meeting.

Water Supplies and Uses in the Basin

In accordance with the requirements of *Neb. Rev. Stat.* §§ 46-755 (5)(a) and 46-755 (5)(b), the basin-wide plan contains a monitoring plan, which includes a process to gather and evaluate data, information, and methodologies to increase understanding of the surface water and hydrologically connected groundwater system within the basin and to test the validity of the conclusions, information, and assumptions upon which the plan is based.

One component of the monitoring plan is a list of data on water supplies and uses in the Republican River Basin that will be reported annually by NeDNR and the NRDs (Table 3.1 of the basin-wide plan). As stated in the basin-wide plan's Monitoring section, it will take time for NeDNR and the NRDs to prepare each category of data for distribution; some of the listed data are readily available within existing data sets, while others will take significantly longer for methodology development. As a result, NeDNR and the NRDs will gradually increase the number of data items that will be reported on each year as they are able. In addition, as also noted in the plan, the list of data reported is subject to change as data needs and resources change over time.

This annual report contains data for the year 2021. The following data are included in this annual report:

Groundwater Levels and Observation Well Locations

The locations of wells used to monitor groundwater levels for all NRDs in the District are shown in Figure 1. Groundwater level data are provided to NeDNR by each NRD as part of the analysis of Measurable Hydrologic Objective (MHO) C for the basin-wide plan. A summary of the data will be provided in the report of the next five-year technical analysis for the plan. Groundwater level data are available from the NRD upon request.

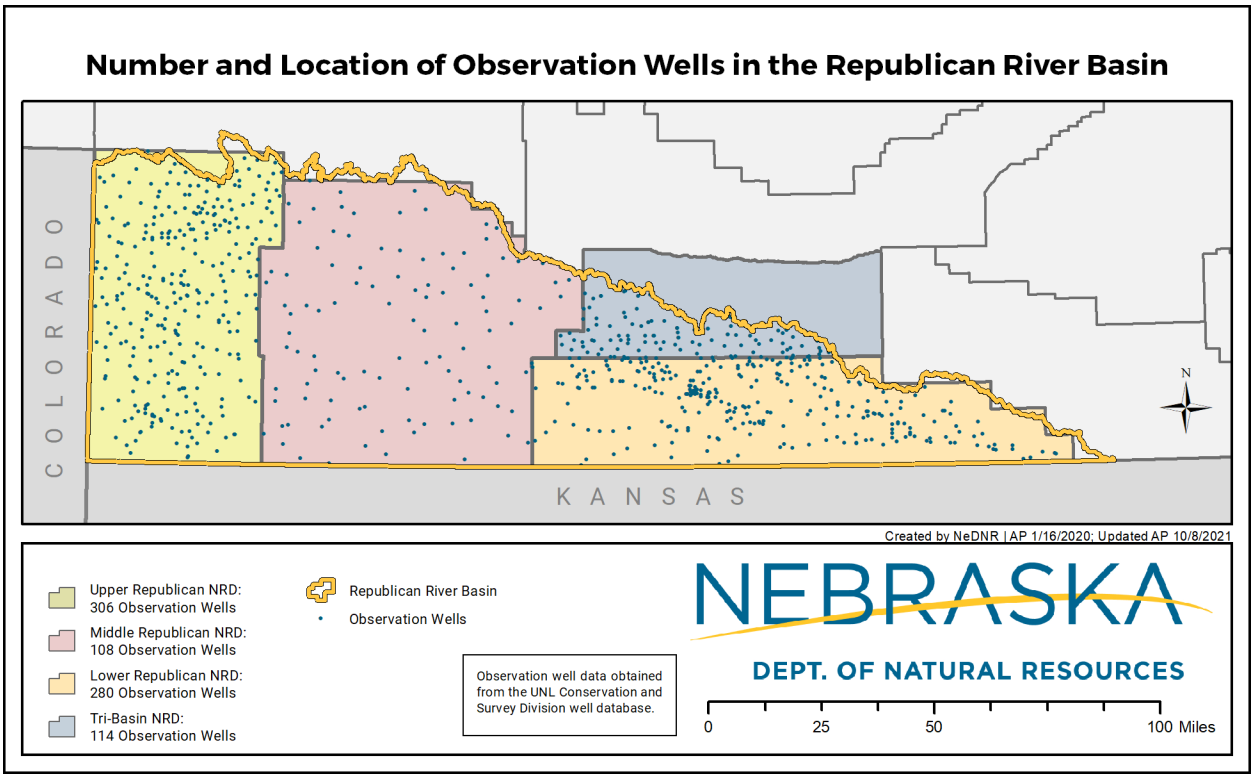

Figure 1. Location and number of groundwater observation wells within the Republican River Basin, by NRD, according to the University of Nebraska-Lincoln (UNL) Conservation and Survey Division well database.

Upper Republican Natural Resources District

Current Allocations

Upper Republican NRD's allocations and related rules for the 2018–2022 allocation period are summarized in Table 1. In this context, an allocation is a regulatory measure that stipulates the amount of water available to be used for irrigation.

Table 1. Summary of current allocation for groundwater irrigation use in Upper Republican NRD, 2018–2022 allocation period.

Total Allocation	65 Inches/Acre/5 Years
Annual or Base Allocation	Allocation is over 5 Years, not annual
Maximum Annual Use	65 Inches/Acre
Carry over amount that can be used in the following allocation period	7.5 Inches/Acre (Max)
Hard Cap	None
Pooling allowed?	Yes
How are the allocations affected by surface water use?	Allocations are not affected by surface water use. Irrigators may use their full groundwater allocation, regardless of any surface water use.
Special allocations for designated groundwater management areas? Or subbasins?	None
Rapid Response Area Allocations?	Rapid Response Area allocations will not be needed unless augmentation projects are insufficient to meet Republican River Compact obligations. Rapid Response Area allocations would depend upon projected Compact shortfalls.
Penalty for exceeding allocation	For every inch of excess use, 2 inches of allocation lost for next allocation period.
Penalty for exceeding carry over	2 inches carry-over deducted for every inch of carry-over used above 7.5 inches

Annual Groundwater Use for Irrigation

Annual groundwater use for irrigation in Upper Republican NRD, for 2021, is summarized in Table 2. This summary includes:

- The total number of certified acres within the district. For the purposes of this report, certified acres are those on which the NRD allows irrigation with groundwater.
- The total number of effective acres within the district. For the purposes of this report, effective acres are acres where groundwater irrigation was possible (i.e., certified acres minus acres enrolled in a conservation program prohibiting irrigation).
- The total volume of groundwater pumped for irrigation within the district.
- The average depth of water applied for irrigation on effective acres within the district.

Table 2. Annual groundwater use for irrigation in Upper Republican NRD, 2021. The difference between certified and effective acres is described in the body of the report.

Year	Certified Acres	Effective Acres	Volume Pumped (acre-feet)	Average Depth (inches/effective acre)
2021	429,694	429,694	495,245	13.8

Conservation and Irrigation Decertification Programs

Irrigation water cannot be used on acres enrolled in a permanent or temporary irrigation decertification program. Table 3 summarizes the number of acres within Upper Republican NRD that were enrolled in decertification programs in 2021. During 2021, decertification programs in effect in this NRD included the Conservation Reserve Enhancement Program (CREP), the Agricultural Water Enhancement Program (AWEP), and a permanent irrigation decertification program jointly funded by Upper Republican NRD and the State of Nebraska. Contracts to decertify a total of 855 acres were signed in 2021. Many, but not all, of the acres in the new program are also enrolled in CREP; those that are will be permanently barred from being irrigated after CREP contracts expire.

Table 3. Acres within Upper Republican NRD that will no longer be irrigated due to enrollment in a permanent or temporary decertification program. During 2021, decertification programs in effect in this NRD included CREP, AWEP, and the NRD's own decertification program, partially funded by the State's Water Resources Cash Fund (WRCF). *CREP data are as of September 30, 2021.

Year	Acres Enrolled in CREP*	Acres Enrolled in AWEP	Acres Enrolled in WRCF programs	Acres Enrolled in Other Decertification Programs
2021	8,790.22	1,546	2,824	0

Groundwater Levels and Observation Well Locations

The locations of wells used to monitor groundwater levels for all NRDs in the District are shown in Figure 1 (page 5). Groundwater level data are provided to NeDNR by this NRD as part of the analysis of MHO C for the basin-wide plan. A summary of the data will be provided in the report of the next five-year technical analysis for the plan. Groundwater level data are available from the NRD upon request.

Curtailment of Groundwater Pumping for Compact Compliance

Under the Integrated Management Plan (IMP) jointly developed by Upper Republican NRD and NeDNR, curtailment of groundwater pumping in an area called the "Rapid Response Area" may be required by the NRD if necessary for compliance with Nebraska's obligations under the Compact. During 2021, Upper Republican NRD did not curtail groundwater pumping in the Rapid Response Area for Compact compliance at any time.

Middle Republican Natural Resources District

Current Allocations

Middle Republican NRD's allocations and related rules for the 2018–2022 allocation period are summarized in Table 4. In this context, an allocation is a regulatory measure that stipulates the amount of water available to be used for irrigation.

Table 4. Summary of current allocations for groundwater irrigation use in Middle Republican NRD, 2018–2022 allocation period.

Total Allocation	60 Inches/Acre/5 Years
Annual or Base Allocation	12 Inches/Acre/Year
Maximum Annual Use	60 Inches/Acre (15 Inches/Acre in a Compact Call Year)
Carry over amount that can be used in the following allocation period	12 Inches/Acre (Max)
Hard Cap	15 Inches/Acre/Year
Pooling allowed?	Yes
How are the allocations affected by surface water use?	Allocations are not affected by surface water use. Irrigators may use their full groundwater allocation, regardless of any surface water use.
Special allocations for designated groundwater management areas? Or subbasins?	None
Rapid Response Area Allocations?	None
Penalty for exceeding allocation	See explanation below*
Penalty for exceeding carry over	See explanation below*

***Middle Republican NRD Penalty for exceeding allocation:**

If an operator has exceeded his or her allocation, the allocation for the next allocation period shall be reduced by the number of acre inches by which said allocation was exceeded in the prior

period. A penalty of 1 inch for every inch over the first 3 inches and 2 inches for every inch over 3 inches of overuse will be applied.

Overuse of the adjusted base allocation during a Compact Call Year shall result in a penalty of 2 inches for every inch over the first 3 inches and 3 inches for every inch over 3 inches of overuse will be applied. This penalty will result in a correction to the remaining allocation following the Compact Call Year. This penalty shall be in addition to the penalties imposed by Rule 5-4.16 if the Compact Call Year is the last year of an allocation period.

Annual Groundwater Use for Irrigation

Annual groundwater use for irrigation in Middle Republican NRD, for 2021, is summarized in Table 5. This summary includes:

- The total number of certified acres within the district. For the purposes of this report, certified acres are those on which the NRD allows irrigation with groundwater.
- The total number of effective acres within the district. For the purposes of this report, effective acres are acres where groundwater irrigation was possible (i.e., certified acres minus acres enrolled in a conservation program prohibiting irrigation).
- The total volume of groundwater pumped for irrigation within the district.
- The average depth of water applied for irrigation on effective acres within the district.

Table 5. Annual groundwater use for irrigation in Middle Republican NRD, 2021. The difference between certified and effective acres is described in the body of the report.

Year	Certified Acres	Effective Acres	Volume Pumped (acre-feet)	Average Depth (inches/effective acre)
2021	298,473.28	284,754.99	267,437.95	11.27

Conservation and Irrigation Decertification Programs

Irrigation water cannot be used on acres enrolled in a permanent or temporary irrigation decertification program. Table 6 summarizes the number of acres within Middle Republican NRD that were enrolled in decertification programs in 2021. During 2021, decertification programs in effect in this NRD included CREP and AWEP. In 2021, Middle Republican NRD did not enter into any new contracts with landowners to permanently decertify additional acres from groundwater irrigation.

Table 6. Acres within Middle Republican NRD that will no longer be irrigated due to enrollment in a permanent or temporary decertification program. During 2021, decertification programs in effect in this NRD included CREP and the NRD's own permanent decertification program, which is partially funded by the WRCF. *CREP data are as of September 30, 2021.

Year	Acres Enrolled in CREP *	Acres Enrolled in AWEP	Acres Enrolled in WRCF programs	Acres Enrolled in Other Decertification Programs
2021	14,842.27	0	118.77	0

Groundwater Levels and Observation Well Locations

The locations of wells used to monitor groundwater levels for all NRDs in the District are shown in Figure 1 (page 5). Groundwater level data are provided to NeDNR by this NRD as part of the analysis of MHO C for the basin-wide plan. A summary of the data will be provided in the report of the next five-year technical analysis for the plan. Groundwater level data are available from the NRD upon request.

Curtailment of Groundwater Pumping for Compact Compliance

Under the IMP jointly developed by Middle Republican NRD and NeDNR, curtailment of groundwater pumping in an area called the "Rapid Response Area" may be required by the NRD if necessary for compliance with Nebraska's obligations under the Compact. During 2021, Middle Republican NRD did not curtail groundwater pumping in the Rapid Response Area for Compact compliance at any time.

Lower Republican Natural Resources District

Current Allocations

Lower Republican NRD's allocations and related rules for the 2018–2022 allocation period are summarized in Table 7. In this context, an allocation is a regulatory measure that stipulates the amount of water available to be used for irrigation.

Table 7. Summary of current allocations for groundwater irrigation use in Lower Republican NRD, 2018–2022 allocation period.

Total Allocation	45 Inches/Acre/5 Years
Annual or Base Allocation	9 Inches/Acre/Year
Maximum Annual Use	45 Inches/Acre (13 Inches/Acre in a Compact Call Year)
Carry over amount that can be used in the following allocation period	9 Inches/Acre (Max)
Hard Cap	13 Inches/Acre/Year (in a Compact Call Year)
Pooling allowed?	Yes
How are the allocations affected by surface water use?	Allocations are not affected by surface water use. Irrigators may use their full groundwater allocation, regardless of any surface water use.
Special allocations for designated groundwater management areas? Or subbasins?	None
Rapid Response Area Allocations?	See explanation below**
Penalty for exceeding allocation	See penalty explanation below***
Penalty for exceeding carry over	See penalty explanation below***

****Lower Republican NRD Rapid Response Area Allocations:**

During Non-Compact Call years, the Rapid Response Area has the same Allocation as the rest of the District. During a Compact Call Year, the Allocation shall be set at the maximum allowable that would not cause the District's depletions to streamflow to exceed the District's allowable Ground Water depletions after taking into consideration other actions and controls that the District would implement. As set forth in the IMP, NeDNR will perform all calculations relating to the District's forecasted allowable Ground Water depletions, forecasted depletions, and potential yield from implementing actions and controls.

*****Lower Republican NRD Rule 3-2 Penalties:**

3-2.1. Unless otherwise provided, imposition of penalties shall be at the discretion of the Board and may include, but are not limited to:

(a) A reduction (in whole or in part) of a Person's Allocation of Ground Water;
(b) A reduction (in whole or in part) of a Person's Certified Irrigated Acres; and
(c) Decommissioning of Water Wells.

3-2.2. Where penalties are enumerated in the Rules and Regulations, the Board may impose additional penalties, up to and including a permanent forfeiture of Certified Irrigated Acres, and/or a permanent forfeiture of all future Allocations, under the following circumstances: (1) previous violations of any Rule or Regulation, (2) multiple violations of these Rules and Regulations, (3) engaging in willful and wanton misconduct, or (4) certification by the record owner to the District of the non-irrigation status of certain Certified Irrigated Acres in order to opt-out of an Occupation Tax levied by the District, which status is later found to be false in whole or in part.

3-2.3. Any Person who violates a cease and desist order issued by the District pursuant to *Neb. Rev. Stat.* § 46-707(h) may be subject to a civil penalty assessed pursuant to *Neb. Rev. Stat.* § 46-745.

Annual Groundwater Use for Irrigation

Annual groundwater use for irrigation in Lower Republican NRD, for 2021, is summarized in Table 8. This summary includes:

- The total number of certified acres within the district. For the purposes of this report, certified acres are those on which the NRD allows irrigation with groundwater.
- The total number of effective acres within the district. For the purposes of this report, effective acres are acres where groundwater irrigation was possible (i.e., certified acres minus acres enrolled in a conservation program prohibiting irrigation).
- The total volume of groundwater pumped for irrigation within the district.
- The average depth of water applied for irrigation on effective acres within the district.

Table 8. Annual groundwater use for irrigation in Lower Republican NRD, 2021. The difference between certified and effective acres is described in the body of the report.

Year	Certified Acres	Effective Acres	Volume Pumped (acre-feet)	Average Depth (inches/effective acre)
2021	320,200.10	308,268.02	163,468.92	6.32

Conservation and Irrigation Decertification Programs

Irrigation water cannot be used on acres enrolled in permanent or temporary irrigation decertification program. Table 9 summarizes the number of acres within Lower Republican NRD that were enrolled in decertification programs in 2021. During 2021, decertification programs in effect in this NRD included CREP) and AWEP.

Table 9. Acres within Lower Republican NRD that will no longer be irrigated due to enrollment in a permanent or temporary decertification program. During 2021, decertification programs in effect in this NRD included CREP and other decertification programs. *CREP data are as of September 30, 2021.

Year	Acres Enrolled in CREP *	Acres Enrolled in AWEP	Acres Enrolled in WRCF programs	Acres Enrolled in Other Decertification Programs
2021	6,724.26	0	0	5,207.82

Groundwater Levels and Observation Well Locations

The locations of wells used to monitor groundwater levels for all NRDs in the District are shown in Figure 1 (page 5). Groundwater level data are provided to NeDNR by this NRD as part of the analysis of MHO C for the basin-wide plan. A summary of the data will be provided in the report of the next five-year technical analysis for the plan. Groundwater level data are available from the NRD upon request.

Curtailment of Groundwater Pumping for Compact Compliance

Under the IMP jointly developed by Lower Republican NRD and NeDNR, curtailment of groundwater pumping in an area called the "Rapid Response Area" may be required by the NRD if necessary for compliance with Nebraska's obligations under the Compact. During 2021, Lower Republican NRD did not curtail groundwater pumping in the Rapid Response Area for Compact compliance at any time.

Tri-Basin Natural Resources District

Current Allocations

Tri-Basin NRD's allocations and related rules for the 2021-2023 allocation period are summarized in Table 10. In this context, an allocation is a regulatory measure that stipulates the amount of water available to be used for irrigation.

Table 10. Summary of current allocations for groundwater irrigation use in the Tri-Basin NRD, 2021-2023 allocation period.

Total Allocation	27 Inches/Acre/3 Years
Annual or Base Allocation	9 Inches/Acre/Year
Maximum Annual Use	27 Inches/Acre
Carry over amount that can be used in the following allocation period	9 Inches/Acre (Max)
Hard Cap	None
Pooling allowed?	Yes
How are the allocations affected by surface water use?	Allocations are not affected by surface water use. Irrigators may use their full groundwater allocation, regardless of any surface water use.
Special allocations for designated groundwater management areas? Or subbasins?	Allocation only required in Phase 3 groundwater quantity management areas. Current Phase 3 area is Township 5 North, Range 22 West (Union Twp.) in Gosper County.
Rapid Response Area Allocations?	None
Penalty for exceeding allocation	1.5 times the overuse amount
Penalty for exceeding carry over	1.5 times the overuse amount

Annual Groundwater Use for Irrigation

Annual groundwater use for irrigation in Tri-Basin NRD, for 2021, is summarized in Table 11. This summary includes:

- The total number of certified acres within the district. For the purposes of this report, certified acres are those on which the NRD allows irrigation with groundwater.
- The total number of effective acres within the district. For the purposes of this report, effective acres are acres where groundwater irrigation was possible (i.e., certified acres minus acres enrolled in a conservation program prohibiting irrigation).
- The total volume of groundwater pumped for irrigation within the district.
- The average depth of water applied for irrigation on effective acres within the district.

Table 11. Annual groundwater use for irrigation in the Republican River Basin portion of Tri-Basin NRD, 2021. The difference between certified and effective acres is described in the body of the report.

Year	Certified Acres	Effective Acres	Volume Pumped (acre-feet)	Average Depth (inches/effective acre)
2021	190,488.76	176,459.70	103,410.59	7.1

Conservation and Irrigation Decertification Programs

Irrigation water cannot be used on acres enrolled in a permanent or temporary irrigation decertification program. Table 12 summarizes the number of acres within the Republican River Basin portion of Tri-Basin NRD that were enrolled in decertification programs in 2021. During 2021, the decertification program in effect in the Republican River Basin portion of this NRD included CREP.

Table 12. Acres within the Republican River Basin portion of Tri-Basin NRD that will no longer be irrigated due to enrollment in a permanent or temporary decertification program. During 2021, the decertification program in effect in this NRD included CREP. *CREP data are as of September 30, 2021.

Year	Acres Enrolled in CREP *	Acres Enrolled in AWEP	Acres Enrolled in WRCF programs	Acres Enrolled in Other Decertification Programs
2021	1,910.69	0	0	0

Tri-Basin NRD Water Conservation Incentive Program (WCIP) is intended to address two natural resources management issues: ensuring sustainability of groundwater supplies and protecting streamflows from diminishment due to groundwater pumping. The goal of this voluntary program is to reduce groundwater pumping and increase irrigation water use efficiency in Tri-Basin NRD. Acres enrolled in the WCIP program in 2021 are listed in Table 13.

Tri-Basin will allow landowners to enroll up to 8000 NRD-certified irrigated acres in the program. Any parcel enrolled is subject to a voluntary five-year allocation of groundwater pumping for irrigation. The allocation is equivalent to the average corn irrigation requirement, as determined by the University of Nebraska-Lincoln (UNL). Once the enrollment limit is reached, water savings to the district are expected to reach at least 650 acre-feet per year. Incentives in this program will likely be most attractive to landowners

in phase two and phase three groundwater quantity management areas, so the water-use reductions should be greatest where the need is greatest (there are approximately 30,000 certified irrigated acres in Tri-Basin NRD's phase two and phase three townships).

In exchange for their participation, if landowners use less than their full allocation, they will be paid for the equivalent of one acre-inch of water credit per acre per year, with the opportunity to sell additional unused credits to the NRD at a set price. In addition to NRD purchases, landowners will have the opportunity to sell water credits on the open market at any agreed-upon price (private transactions require NRD board approval). Landowners will also be granted flexibility to irrigate any acres within enrolled parcels and to share (pool) allocations between parcels. Pooling agreements will be required to enable sharing allocations between parcels under different ownership.

Table 13. Acres in the Republican River Basin enrolled in the Tri-Basin NRD's WCIP in 2021. The "New Acres Enrolled" column indicates the number of acres that were added to the program in the year indicated. The "Total Acres Enrolled" column indicates the total number of acres enrolled as of the year indicated.

Year	New Acres Enrolled	Total Acres Enrolled
2021	133.86	1,580.33

Groundwater Levels and Observation Well Locations

The locations of wells used to monitor groundwater levels for all NRDs in the District are shown in Figure 1 (page 5). Groundwater level data are provided to NeDNR by this NRD as part of the analysis of MHO C for the basin-wide plan. A summary of the data will be provided in the report of the next five-year technical analysis for the plan. Groundwater level data are available from the NRD upon request.

Nebraska Department of Natural Resources

The Republican River Basin is located at the intersection of Nebraska, Colorado, and Kansas (Table 14 and Figure 2). The Compact, administered by the Republican River Compact Administration (RRCA) is an interstate agreement that allocates consumption of the waters of the Republican River Basin among the three states. Unless otherwise indicated, the data reported in the NeDNR section of this report are from the RRCA's approved accounting data, data Nebraska provided to Colorado and Kansas as part of the RRCA's annual data exchange, or calculations using the RRCA groundwater model.

Table 14. Area of Nebraska, Kansas, and Colorado within the Republican River Basin (United States Geological Survey (USGS) Hydrologic Unit Code: 102500).

State	Republican River Basin Area (mi^2)
Colorado	7,816
Kansas	7,551
Nebraska	9,546

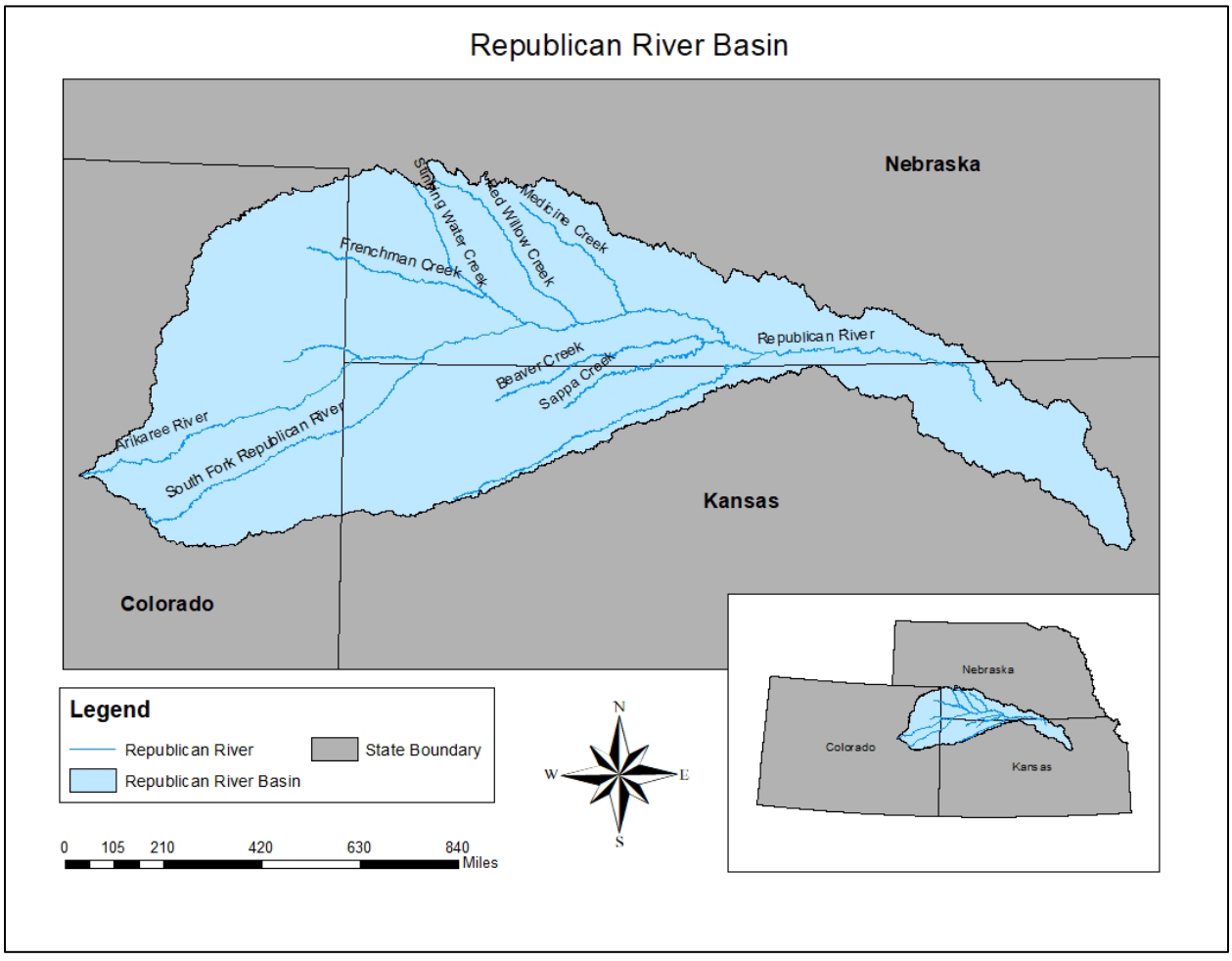

Figure 2. Extent of Republican River Basin within Nebraska, Kansas, and Colorado (USGS Hydrologic Unit Code: 102500).

Precipitation

Annual precipitation data used in RRCA analyses is measured at National Weather Service cooperative stations across the Republican River Basin in Nebraska, quality-controlled, and filled in with PRISM (Parameter-Elevation Regressions on Independent Slopes Model) data by the RRCA, as necessary. In 2021, annual precipitation data used in RRCA analyses ranged from 14.19 inches to 33.00 inches. Figure 3 displays 2021 precipitation data at each of the cooperative stations used by the RRCA; additional stations outside of Nebraska and the basin are used by the RRCA to interpolate precipitation across the whole RRCA model area which extends beyond the basin boundary.

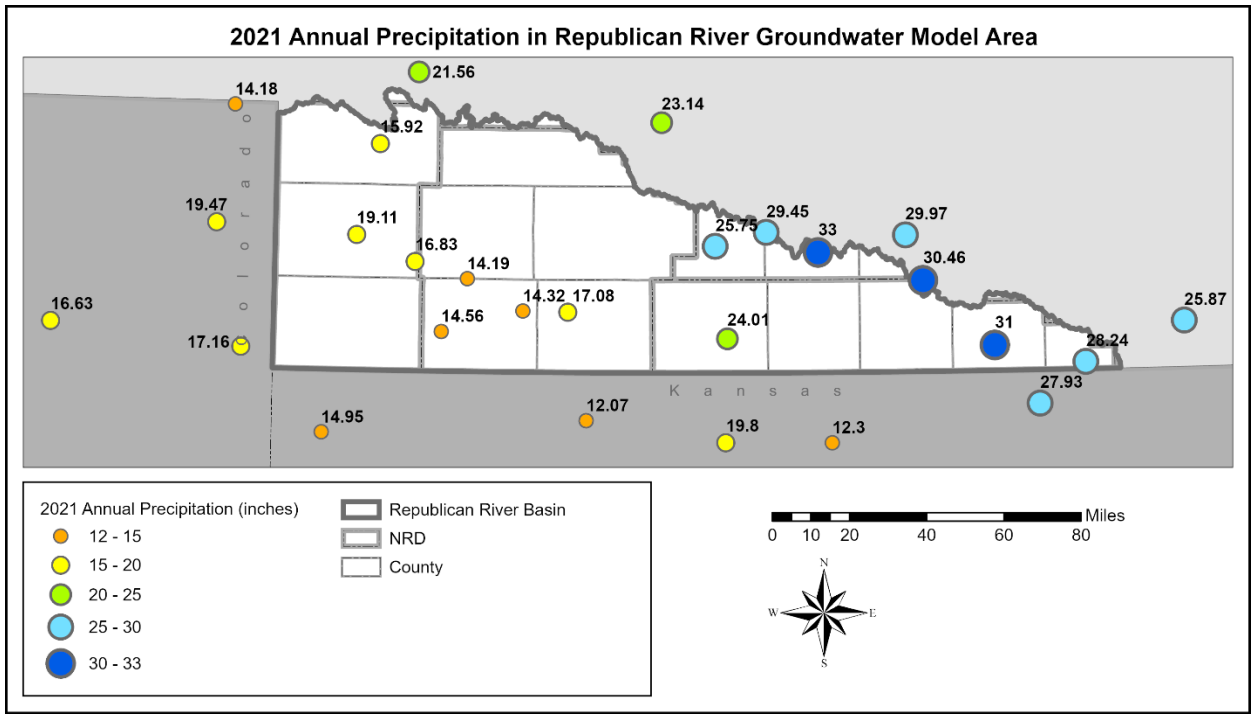

Figure 3. 2021 annual precipitation in inches from National Weather Service cooperative stations, as used in RRCA groundwater model processing.

Streamflow

Under the Republican River Compact, allocations within each Republican River subbasin include the streamflow at the downstream end of the subbasin. Subbasin streamflow is measured for the Compact by 13 USGS streamgages and one NeDNR streamgage (Figure 4 and Table 15). The most downstream streamgages in Nebraska are on the Main Stem of the Republican River at Guide Rock and Hardy. Table 15 presents the total amount of water in acre-feet measured past each of the streamgages in 2021. For more details and to obtain continuous stream and reservoir, partial year, canal, canal return flow, and miscellaneous spot measurement data from over 250 gaging sites visit the NeDNR website: *https://nednr.nebraska.gov/RealTime/*.

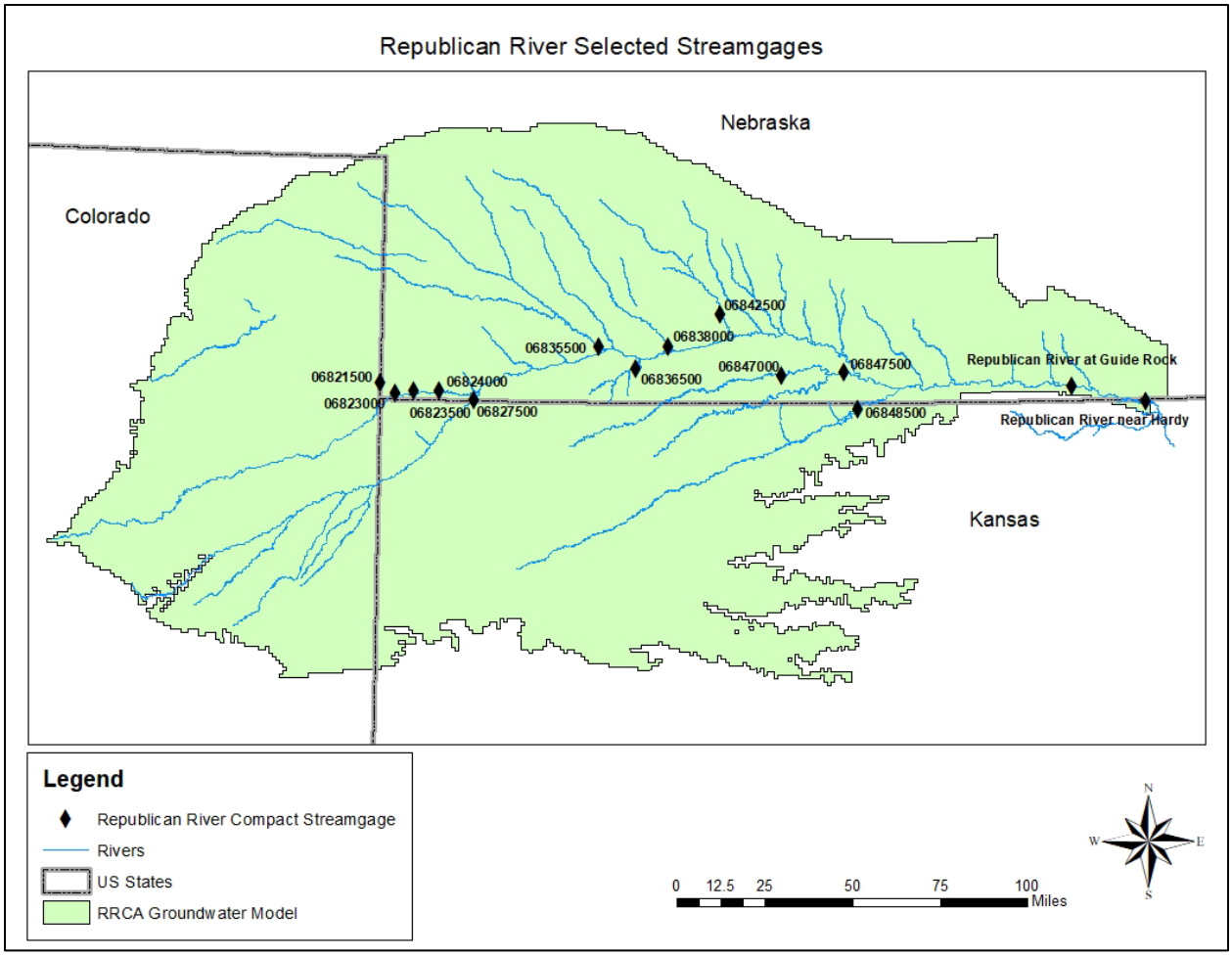

Figure 4. Location of subbasin streamgages within the Republican River Basin.

Table 15. Annual streamflow volumes in acre-feet from Republican River subbasin streamgages used in the Republican River Compact accounting.

Annual Streamflow (acre-feet)	
Streamgage	**2021**
USGS 06823000 - North Fork of the Republican River at Colorado-Nebraska State Line	25,846
USGS 06821500 - Arikaree River at Haigler	1,635
USGS 06823500 - Buffalo Creek near Haigler	1,583
USGS 06824000 - Rock Creek at Parks	3,583
USGS 06827500 - South Fork Republican River near Benkelman	321
USGS 06835500 - Frenchman Creek at Culbertson	16,678
USGS 06836500 - Driftwood Creek near McCook	1,999
USGS 06838000 - Red Willow Creek near Red Willow	4,012
NeDNR 06842500 - Medicine Creek below Harry Strunk Lake	22,871
USGS 06847000 - Beaver Creek near Beaver City	796
USGS 06847500 - Sappa Creek near Stamford	14,925
USGS 06848500 - Prairie Dog Creek near Woodruff, Kansas	6,646
USGS 06853020 - Republican River at Guide Rock	115,649
USGS 06853500 - Republican River near Hardy	142,152

Irrigated Acres

For the Republican River Compact Administration Groundwater Model, Nebraska currently reports irrigated acres as one of the following:

1. Groundwater-only irrigated acres.
2. Surface water-only irrigated acres or surface water and groundwater (commingled) irrigated acres.

Acres irrigated with groundwater are reported with metered pumping annually by the NRDs to NeDNR or are estimated for the portions of the RRCA model area that are in NRDs without metered pumping. Acres irrigated with surface water and commingled water are flagged annually based on use from a master database developed from water right information. Annual irrigated acres within the RRCA model from 2021 have been divided into the two reporting methods and groundwater acres have been delineated by the NRD that the model cells primarily overlay (Figure 5). Nebraska annual total surface water and commingled, and groundwater irrigated acres are also presented in Table 16. The groundwater-irrigated acres shown in Figure 5 and Table 16 for Tri-Basin NRD include acres that are in the Platte, Little Blue, and Republican River Basins because all of Tri-Basin NRD is included in the RRCA groundwater model area.

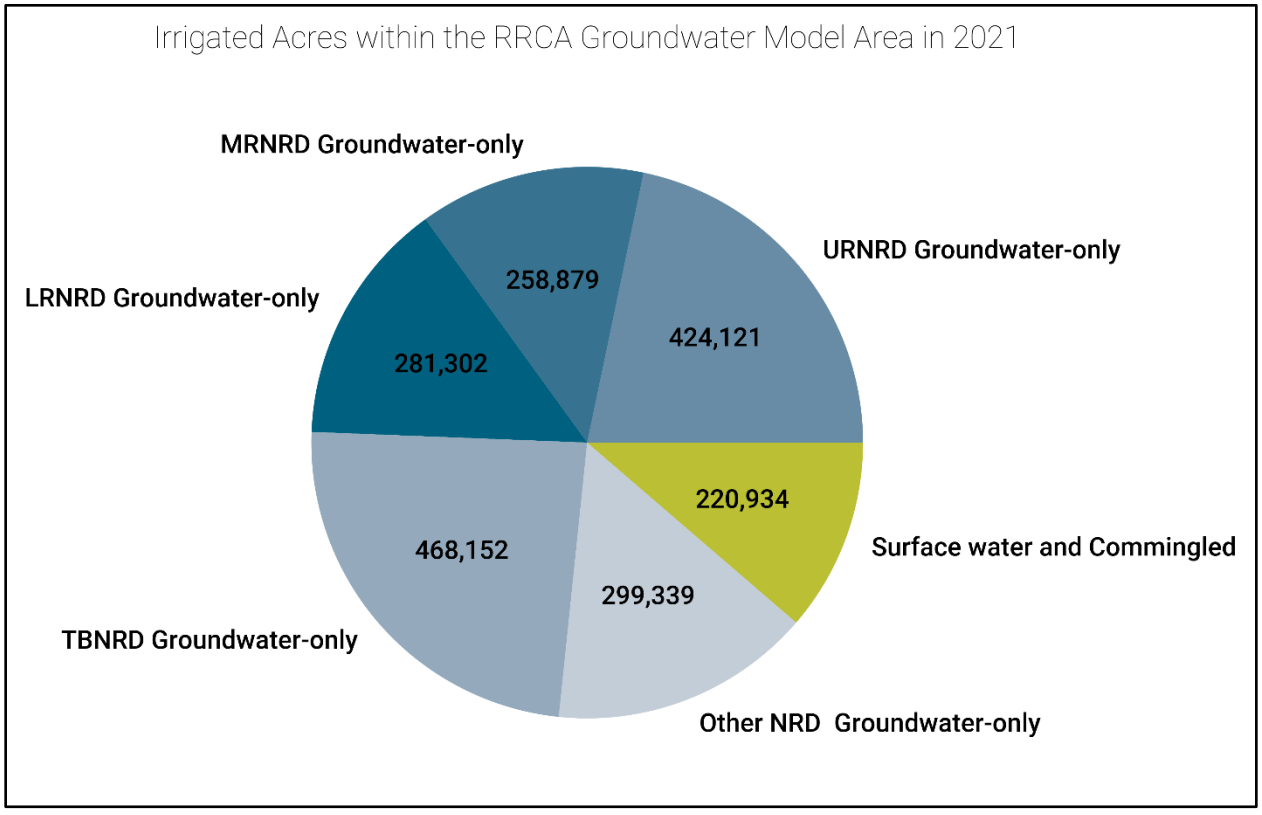

Figure 5. Irrigated Acres within the RRCA Groundwater Model Area in 2021.

Table 16. Annual division of acres irrigated by surface water and commingled, or acres irrigated by only groundwater in the Nebraska portion of the RRCA groundwater model.

Area and Irrigation Type	2021
Nebraska Model Area – Surface Water and Commingled	220,934
Upper Republican NRD – Groundwater-only	424,121
Middle Republican NRD – Groundwater-only	258,879
Lower Republican NRD – Groundwater-only	281,302
Tri-Basin NRD – Groundwater-only	468,152
Other – Groundwater-only	299,339

Allocation and Computed Beneficial Consumptive Use (CBCU)

Under the Republican River Compact, the total water supply and how much of the total supply each state is entitled to beneficially use is referred to as "allocation." The allocations are calculated from the water supply of the basin if it had been undepleted by the activities of man. Each state is allotted a fixed percentage of the undepleted water supply in each of the Republican River subbasins to obtain the states' allocations. The calculated uses of the water supplies are referred to as "Computed Beneficial Consumptive Use" (CBCU). The CBCU in the Republican River Basin includes direct surface water uses, such as reservoir evaporation and consumption of diverted water, and withdrawal or interception of streamflow by groundwater pumping (groundwater depletions to streamflow). Groundwater pumping can have a lagged effect on streamflow. The RRCA groundwater model considers the effects of pumping since early well development in the 1940s, therefore, the groundwater consumptive use of streamflow in each year is impacted by pumping in that year and all previous years. Table 17 presents total CBCU in Colorado, total CBCU in Kansas, and the breakdown of total CBCU as surface water or groundwater CBCU from Nebraska.

Nebraska groundwater CBCU are presented for the effects of pumping from each NRD's portion of the basin separately (Upper Republican, Middle Republican, Lower Republican, and Tri-Basin NRDs) and all other NRDs within the model area collectively (Other NRD) in Table 17. Each NRD's groundwater CBCU is equivalent to the net depletions to streamflow due to groundwater pumping within that NRD.

Table 17. Annual total CBCU by Kansas and Colorado and annual Nebraska total surface water CBCU and division of groundwater CBCU (i.e., net depletions to streamflow) by each NRD. The sum of Nebraska CBCU presented in this table may vary slightly from the statewide CBCU in Nebraska's Compact compliance tables due to rounding.

CBCU (acre-feet)	
	2021
Colorado	30,200
Kansas	57,130
Nebraska Surface Water	61,370
Lower Republican NRD Groundwater	48,529
Middle Republican NRD Groundwater	51,062
Upper Republican NRD Groundwater	75,496
Tri-Basin NRD Groundwater	13,646
Other NRD Groundwater	2,551

Reservoir Storage and Evaporation

Federal Reservoir Storage

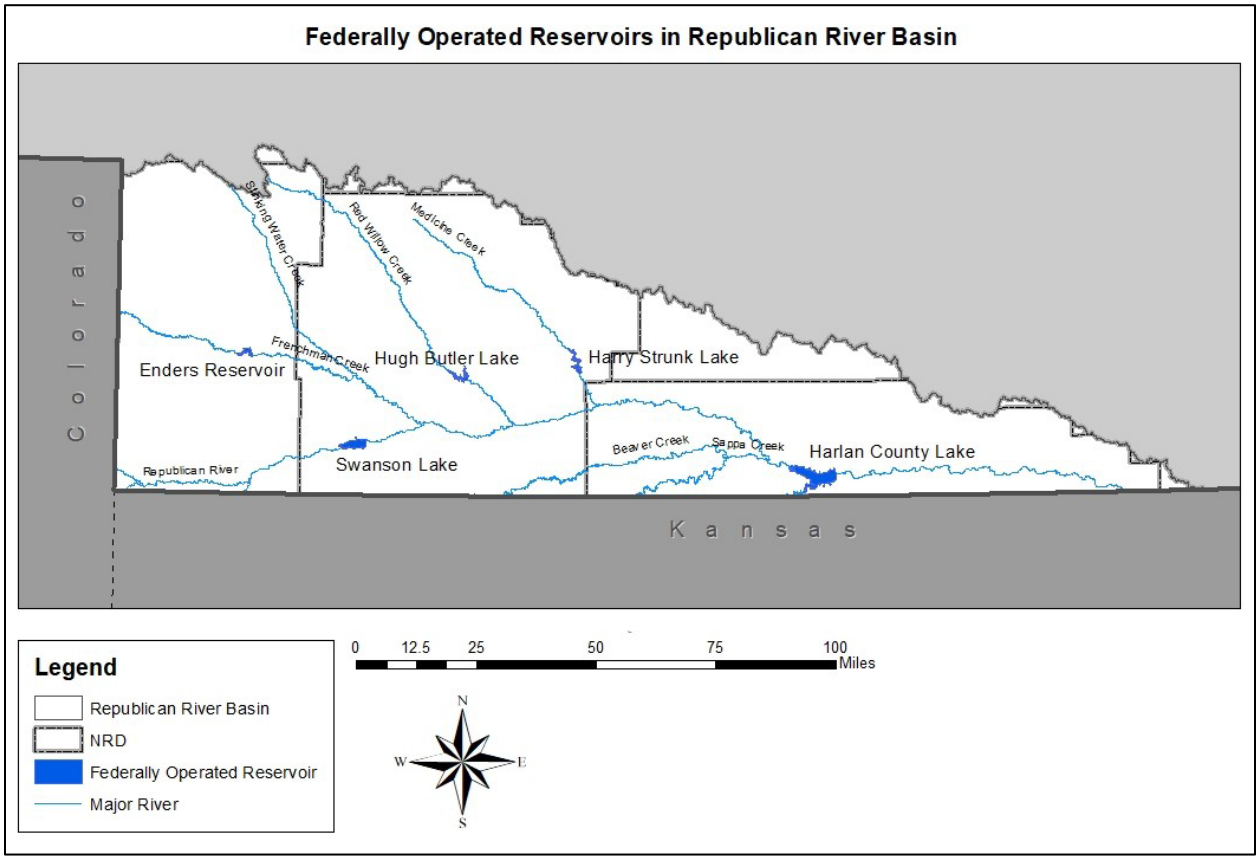

Figure 6. Location of federal reservoirs located in Nebraska portion of the Republican River Basin.

There are five federally operated reservoirs within the Republican River Basin in Nebraska: Enders Reservoir on Frenchman Creek, Hugh Butler Reservoir on Red Willow Creek, Harry Strunk Reservoir on Medicine Creek, and Swanson Lake and Harlan County Lake on the Republican River (Figure 6). Annual end of year storage volumes for 2021 for each Republican River Basin reservoir in Nebraska are shown in Figure 7. Storage data were obtained from the United States Bureau of Reclamation (USBR), which are available on the USBR's automated data system HydroMet at *https://www.usbr.gov/gp/hydromet/*.

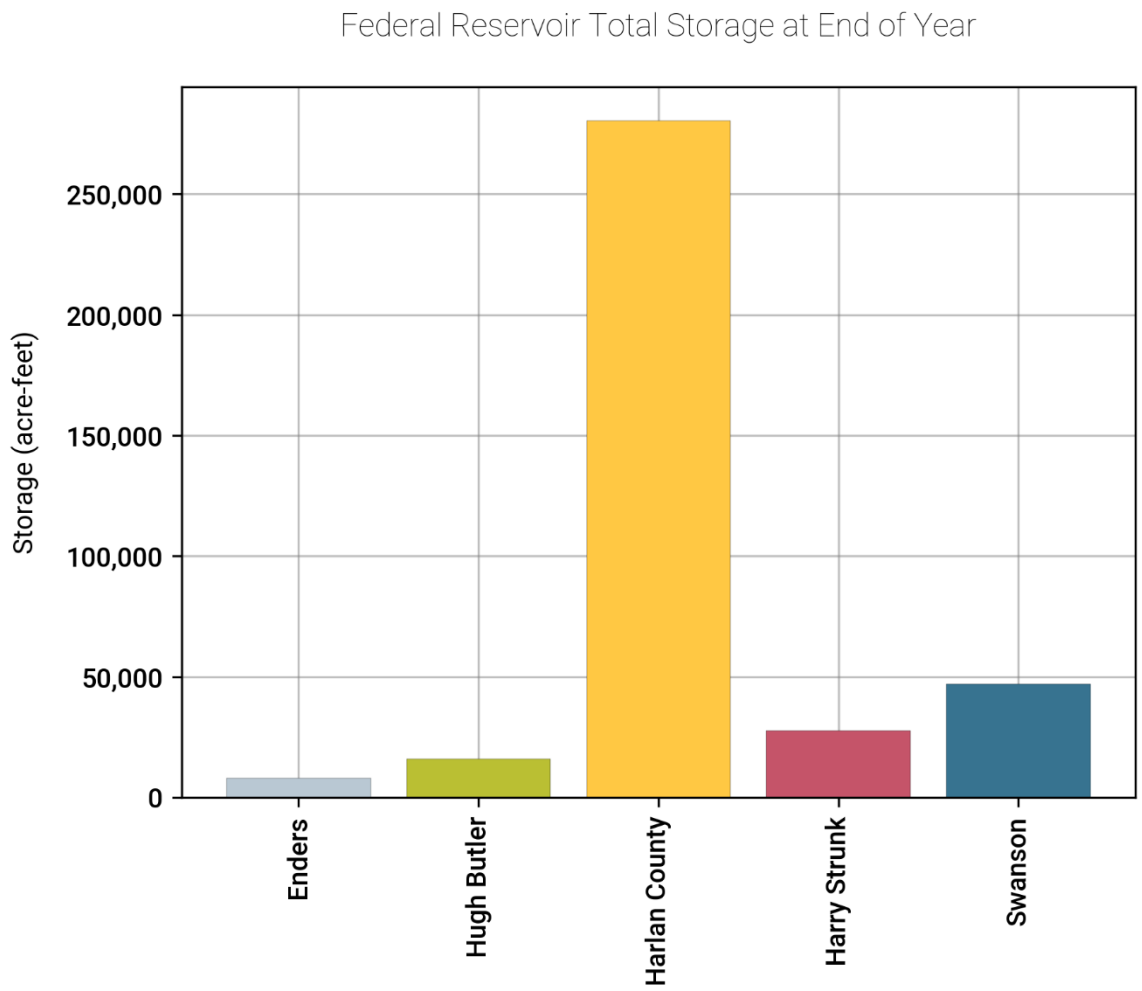

Figure 7. 2021 end-of-year reservoir contents for the federally operated reservoirs within the Republican River Basin in Nebraska: Enders Reservoir on Frenchman Creek, Hugh Butler Reservoir on Red Willow Creek, Harry Strunk Reservoir on Medicine Creek, and Swanson Lake and Harlan County Lake on the Republican River.

Reservoir Evaporation

Net evaporation from Republican River Basin reservoirs in Nebraska in 2021 was 26,823 acre-feet from the five federal reservoirs and 1,940 acre-feet from non-federal reservoirs. Federal and non-federal reservoir evaporation are beneficial consumptive uses of surface water. For the RRCA, federal and non-federal reservoir CBCU are calculated as net evaporation, which is evaporation from the reservoir minus precipitation directly intercepted by the reservoir.

Surface Water Municipal and Industrial CBCU

During the reporting year, there were no permitted municipal nor industrial uses of surface water in the Republican River Basin. For more information on surface water permitting, visit NeDNR's Surface Water Permitting and Data website at: *https://dnr.nebraska.gov/surface-water*.

Surface Water Administration for Compact Compliance

Under the IMPs jointly developed by NeDNR and Upper Republican, Middle Republican, and Lower Republican NRDs, NeDNR may administer and regulate surface water, if necessary, to ensure compliance with Nebraska's obligations under the Compact during Compact Call Years. Compact Call Years are years in which NeDNR's analysis following the forecast procedures contained in the IMPs for Upper Republican, Middle Republican, and Lower Republican NRDs indicate the potential for noncompliance with the Compact if sufficient management actions are not taken. There was not a Compact Call in 2021.

Surface water is also administered under the Water-Short Year provisions of the Final Settlement Stipulation (FSS) for the Compact. This type of water administration is triggered automatically under the terms of the FSS: whenever the projected or actual irrigation supply available in Harlan County Lake is less than 130,000 acre-feet and water is needed for direct diversion at Guide Rock, Nebraska must close appropriations downstream of Harlan County Lake that are junior to February 26, 1948. Because this type of water administration is triggered automatically, it is not considered a management action for the purposes of evaluating the basin-wide plan's MHO E.

Qualitative Evaluation of Net Effect of Management Actions for Compact Compliance

Action Item 1.2.1 of the basin-wide plan is to qualitatively evaluate the net effect on water supplies of any management actions that are taken for Compact compliance. As described in the previous subsection, "Surface Water Administration for Compact Compliance," and in the subsection entitled "Curtailment of Groundwater Pumping for Compact Compliance" within each NRD's section for reporting water supplies and uses (pages 8, 11, 14), neither surface water administration nor curtailment of groundwater pumping occurred in 2021. In addition, as stated in the progress summary for Action Item 1.1.2 (page 39) no management actions were necessary as offsets in 2021.

Some actions were taken in 2021 that will help with Compact compliance in future years. NeDNR and all four NRDs worked to enroll or reenroll landowners in temporary or permanent irrigation decertification programs (pages 7, 10, 14, and 16). Upper Republican, Middle Republican, and Lower Republican NRDs specify district-wide allocations on groundwater usage (pages 6, 9, and 12). Tri-Basin NRD specifies allocations on groundwater usage within Phase 3 groundwater quantity management areas (page 15), and other landowners within Tri-Basin NRD are enrolled in their Water Conservation Incentive Program (WCIP) to incentivize water conservation (page 16). Both decertification programs and allocation programs are expected to have a positive effect on water supplies by reducing consumptive use of water.

Augmentation Pumping

This section contains a summary of pumping data for the augmentation projects in the basin.

NeDNR annually evaluates the net impacts of augmentation pumping for the Nebraska Cooperative Republican Platte Enhancement project (N-CORPE) and Rock Creek Augmentation projects, to fulfill a requirement of the IMPs jointly developed by NeDNR and Upper Republican, Middle Republican, and Lower Republican NRDs. The IMPs state that "…NeDNR will annually evaluate whether offsets are necessary to mitigate new net depletions resulting from augmentation pumping or other management actions." The most recent analysis is available in the report *Net Impacts Analysis for the Republican River Basin* (November 15, 2022), which is available on NeDNR's website (*https://dnr.nebraska.gov*).

N-CORPE Augmentation Project

The Nebraska Cooperative Republican Platte Enhancement project (N-CORPE) is operated through an interlocal cooperative agreement formed in 2012 by Upper Republican NRD, Middle Republican NRD, Lower Republican NRD, and Twin Platte NRD. A summary of N-CORPE pumping for 2021 is provided in Table 18.

Table 18. Summary of N-CORPE augmentation project pumping. The "Days Pumped for Compact Compliance" column indicates the number of days the project was pumped to augment streamflow for Republican River Compact compliance purposes. The "Total Pumped Volume" column provides the volume of water pumped in that year for all other purposes, including augmentation and maintenance pumping.

Year	Days Pumped for Compact Compliance	Total Pumped Volume (acre-feet)
2021	0	2,264

Rock Creek Augmentation Project

The Rock Creek augmentation project is operated by Upper Republican NRD. A summary of Rock Creek augmentation project pumping for 2021 is provided in Table 19.

Table 19. Summary of Rock Creek augmentation project pumping. The "Days Pumped for Compact Compliance" column indicates the number of days the project was pumped to augment streamflow for Compact compliance purposes. The "Total Pumped Volume" column provides the volume of water pumped in that year for all other purposes, including augmentation and maintenance pumping.

Year	Days Pumped for Compact Compliance	Pumped Volume (acre-feet)
2021	0	66

Turkey Creek Augmentation Well

The Turkey Creek augmentation well is operated by Tri-Basin NRD as part of the NRD's Republican Basin Streamflow Augmentation Project. Since construction was completed in 2016, this well has not been operated for augmentation purposes.

Figure 8. Headwaters of Turkey Creek, Gosper County; courtesy of Tri-Basin NRD.

Progress toward Goals, Objectives, and Action Items

Progress toward the basin-wide plan's goals, objectives, and action items is described below, in two subsections. The "Management Activities" subsection summarizes progress toward the plan's goals, objectives, and action items. The "Assessment of Measurable Hydrologic Objectives (MHOs)" subsection contains the results of the MHO assessments used to evaluate overall plan progress. Specific progress report details can be found on the following pages:

Management Activities

Under *Neb. Rev. Stat.* § 46-755 (4), the basin-wide plan was required to include a timeline of up to 30 years after April 17, 2014, to meet the plan's goals and objectives. The basin-wide plan took effect on March 1, 2019. This section summarizes progress toward the basin-wide plan's goals, objectives, and action items during the 2021 calendar year, first as a visual snapshot of overall plan progress (beginning on page 32) followed by summaries describing progress on individual action items (beginning on page 39).

Two icons are displayed beside each action item in both the visual progress snapshot and the progress summaries. One symbol indicates when the action item is to be completed, according to the implementation schedule in the basin-wide plan. The other symbol indicates progress made on that action item during 2021. Figure 9 is a key describing the meanings of the symbols used throughout the "Management Activities" section.

Republican River Basin-Wide Plan Progress Summary Key

Symbols indicating when action item is to be completed, per plan schedule

When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years
				
To be completed when beneficial, feasible, and economically viable; at NeDNR and NRDs' discretion	To be completed every year	To be completed in every year that the triggering circumstances described in the plan occur	To be completed by a certain year; likely can be "completed indefinitely"	To be completed every five years, either corresponding with the five-year analysis or in the following year, as specified in the basin-wide plan

Symbols indicating progress during report year

Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A
Fully complete and no longer able to be worked on in the future	Recurring task completed during report year	Work on this action item is ongoing, generally progressing	Not completed as planned during report year	Not started as planned during report year	Did not need to be completed during report year

Figure 9. Key to symbols used throughout the "Management Activities" section. The report year for this report is 2021.

Progress Snapshot

This section contains a snapshot of overall progress on the basin-wide plan's goals and objectives. Visual summaries of progress on each goal can be found in the following locations:

- Goal 1 visual summary: Table 20, beginning on page 32;
- Goal 2 visual summary: Table 21, beginning on page 34;
- Goal 3 visual summary: Table 22, beginning on page 37; and
- Goal 4 visual summary: Table 23, beginning on page 38.

Each of these four tables spans multiple pages.

Table 20. Visual summary of progress on Goal 1 during 2021. The "Time-Frame" column indicates the expected timeframe for each action item, as indicated in the basin-wide plan. The "Action Taken" column refers to whether the action item was worked on in 2021, and the "Progress" column contains more information about progress during 2021. For details about the progress on each action item, see the page number indicated in the rightmost column.

Action Item	Description	Time Frame	Action Taken	Progress	Page
Goal 1	**Maintain Nebraska's compliance with the Republican River Compact and applicable laws**				
Obj. 1.1	**Coordinate basin-wide management actions with Compact compliance efforts and adherence to state laws**				
1.1.1	*Review each basin-wide plan management action prior to implementation to ensure it does not negatively impact efforts to achieve Compact compliance in the most efficient and cost-effective way practicable while adhering to state laws.*		Yes		39
1.1.2	*Implement appropriate offsets for any basin-wide plan action that would exceed Nebraska's allocation under the Compact*		No	**N/A**	39
Obj. 1.2	**Understand effects of management actions for compact compliance on water supplies for State's water users**				
1.2.1	*Qualitatively evaluate the net effect on water supplies of any management actions that are taken for Compact compliance*		Yes		40
Obj. 1.3	**Assess progress toward meeting the goals and objectives of the Plan, and share the results of this assessment with the Public and the Nebraska Legislature**				
1.3.1	*Within five years after the adoption of this Plan, and every five years thereafter, conduct a technical analysis of the actions taken to determine the progress toward meeting the goals and objectives of the Plan*		No	**N/A**	40

Symbol Legend – See Figure 9 on page 31

Action Item	Description	Time Frame	Action Taken	Progress	Page
1.3.2	*Evaluate progress toward each of the Plan's measurable hydrologic objectives at the intermediate dates specified in the Plan for each one.*				
MHO A:	*Maintain each NRD's net groundwater depletions to streamflow within its portion of Nebraska's allowable groundwater depletions to streamflow.*	ANNUAL	Yes		40
MHO B:	*Limit groundwater depletions to streamflow to a relatively constant level over the long-term both across the basin as a whole and within each NRD*	5	No	**N/A**	41
MHO C:	*Ensure there is always enough groundwater for all groundwater uses within the timeframe of this plan, either by stabilizing groundwater levels or managing declining groundwater levels*	5	No	**N/A**	41
MHO D:	*Continue existing and initiate new actions that reduce the need for special regulations in the Rapid Response Area for Compact compliance*	ANNUAL	Yes		41
MHO E:	*Continue existing and initiate new actions that reduce the need for administration of surface water use for Compact compliance*	ANNUAL	Yes		42
1.3.3	*Following each five-year technical analysis (Action Item 1.3.1), share the results of the analysis and any recommended Plan modifications with the public*	5	No	**N/A**	42
1.3.4	*Following each five-year technical analysis (Action Item 1.3.1) and any resulting modifications to the Plan, submit a report to the Legislature of the results of the analysis and progress made under the Plan*	5	No	**N/A**	42

Symbol Legend – See Figure 9 on page 31

Table 21. Visual summary of progress on Goal 2 during 2021. The "Time-Frame" column indicates the expected timeframe for each action item, as indicated in the basin-wide plan. The "Action Taken" column refers to whether the action item was worked on in 2021, and the "Progress" column contains more information about progress during 2021. For details about the progress on each action item, see the page number indicated in the rightmost column.

Action Item	Description	Time Frame	Action Taken	Progress	Page
Goal 2	**Maximize Nebraska's efficient and beneficial consumptive use of its water, increase certainty for long-range planning of water supplies to reduce the need for regulatory actions, and increase collaborative efforts among water management entities and stakeholders across the Basin**				
Obj. 2.1	**Understand potential impacts of actions and establish standard procedure for projects**				
2.1.1	*For each planned new water management project in the Plan, evaluate hydrologic and regulatory feasibility and potential economic and environmental impacts*		Yes		44
2.1.2	*For each project evaluated in accordance with Action Item 2.1.1 in a given year, include a summary of the evaluation in the annual report of that year's activities*		Yes		44
2.1.3	*For projects that are feasible and beneficial, apply for necessary permits, establish new or utilize existing infrastructure, then begin operations*		Yes		45
Obj. 2.2	**Improve the efficiency of use, availability, and reliability of water supplies for current irrigators**				
2.2.1	*Work with irrigation districts and individual groundwater and surface water irrigators to improve the efficiency of the Basin's surface water delivery systems and irrigation water use, when it is both feasible and beneficial to Nebraska's Compact accounting balance*		Yes		45
2.2.2	*Participate in projects to improve the reliability, availability, and sustainability of water supplies in the Basin, which may include but are not limited to* • *Voluntary reduction of irrigated acres (temporary or permanent)* • *Interbasin transfers* • *Conjunctive management projects such as aquifer recharge or streamflow augmentation*		Yes		48
Obj. 2.3	**Provide opportunities for collaboration among Basin's water users**				
2.3.1	*Hold an annual public meeting to discuss Plan implementation and exchange information about the Basin*		Yes		49

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Action Item	Description	Time Frame	Action Taken	Progress	Page
2.3.2	*Work cooperatively to investigate and address conflicts between water users resulting from implementation of this Plan by following the procedures for addressing conflicts that are outlined in this Plan*		No	**N/A**	50
Obj. 2.4	**Promote conservation programs available to the water users in the Basin**				
2.4.1	*Work together to identify, investigate, and discuss existing and potential new water conservation programs*		Yes		50
2.4.2	*Collaborate to promote conservation program opportunities to the Basin's water users*		No		50
Obj. 2.5	**Understand how management activities of independent decision-makers affect water supplies**				
2.5.1	*Study the effects of conservation practices on streamflow, if feasible*		No	**N/A**	51
2.5.2	*As part of each five-year technical analysis, analyze the future impacts to streamflow of past pumping to determine the lag time of these residual impacts*		No	**N/A**	51
2.5.3	*Examine and attempt to estimate the quantity of all inputs and outputs affecting the water supply balance in a small watershed, and consider using the results of this pilot study to create water use and land use guidelines for producers and other land managers, incentivize participation in recommended practices, and determine the value of completing similar studies across the Basin*		Yes		51
Obj. 2.6	**Evaluate the feasibility and potential outcomes of establishing water markets in the Basin**				
2.6.1	*Cooperate in determining the feasibility of water markets in the Basin*		No	**N/A**	52
2.6.2	*Following the water markets feasibility analysis (Action Item 2.6.1), test conclusions through implementation of a water market program in a pilot area, if feasible*		No	**N/A**	52
Obj. 2.7	**Support the NRDs in management of allocations for irrigation purposes and surface water irrigation districts in management of the allotment of their water supply**				
2.7.1	*Periodically evaluate, as part of each five-year technical analysis, the impact of the groundwater allocation and surface water allotment systems as a whole*		No	**N/A**	53

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Action Item	Description	Time Frame	Action Taken	Progress	Page
2.7.2	*As needed, based on the evaluation described in Action Item 2.7.1, recommend changes or improvements to the groundwater allocation and/or surface water allotment systems*	5	No	**N/A**	54
Obj. 2.8	**Conserve water for future use during a drought**				
2.8.1	*Organize and participate in a Basin-wide drought planning exercise*	'23	Yes	▶	54
2.8.2	*Following the drought planning exercise (Action Item 2.8.1) evaluate whether to recommend any changes to the IMPs or this Plan related to conservation of water for future use during a drought*	'24	No	**N/A**	55

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Table 22. Visual summary of progress on Goal 3 during 2021. The "Time-Frame" column indicates the expected timeframe for each action item, as indicated in the basin-wide plan. The "Action Taken" column refers to whether the action item was worked on in 2021, and the "Progress" column contains more information about progress during 2021. For details about the progress on each action item, see the page number indicated in the rightmost column.

Action Item	Description	Time Frame	Action Taken	Progress	Page
Goal 3	**Positive public relations, including information sharing, within and outside the Basin**				
Obj. 3.1	**Improve information sharing with decision-makers and public about solutions within the Basin**				
3.1.1	*Use existing resources to share information about Basin progress and activities with outside entities*		Yes		56
3.1.2	*Educate civic leaders and the public on implementation efforts within the Basin*		Yes		56
3.1.3	*Educate civic leaders and the public about the policies and institutional infrastructure that contribute to the development and implementation of solutions*		Yes		57
3.1.4	*Propose and support changes to laws, policies, and rules that would incentivize reduced water consumption*		No	**N/A**	58
Obj. 3.2	**Improve information sharing with water users who are reliant on the Basin's water supplies**				
3.2.1	*Share data and information related to the Republican River Compact with the public in an easily accessible, user-friendly format*		Yes		58
3.2.2	*Annually prepare and exchange reports containing data and information about water supplies and uses in the Basin, and make these reports publicly known*		Yes		59
3.2.3	*Regularly communicate with the Plan's former Stakeholder Advisory Committee about implementation progress and potential Plan revisions*		Yes		59
3.2.4	*Encourage and support water users to share information about their management practice improvements with other water users and the public*		Yes		60

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Table 23. Visual summary of progress on Goal 4 during 2021. The "Time-Frame" column indicates the expected timeframe for each action item, as indicated in the basin-wide plan. The "Action Taken" column refers to whether the action item was worked on in 2021, and the "Progress" column contains more information about progress during 2021. For details about the progress on each action item, see the page number indicated in the rightmost column.

Action Item	Description	Time Frame	Action Taken	Progress	Page
Goal 4	**When possible, pursue projects that not only benefit water supplies and uses, but also create benefits for fish, wildlife, recreation and conveyance within the Republican River Basin**				
Obj. 4.1	**Protect and enhance fish and wildlife habitat and recreational opportunities**				
4.1.1	*Partner with wildlife-focused organizations on projects that benefit the organizations' habitat and wildlife interests while also helping to fulfill other goals of the Plan*		Yes		62
4.1.2	*Promote public recreation on the river, when doing so can also help to fulfill other goals of the Plan*		Yes		62
4.1.3	*Cooperate in projects to assess and restore riparian wetlands while also helping to fulfill other goals of the Plan*		Yes		62
Obj. 4.2	**Where feasible and beneficial, reduce the effects of undesirable vegetation on water conveyance**				
4.2.1	*Cooperate in removing undesirable vegetation impacting water conveyance and managing reinfestation*		Yes		63

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Progress Summaries

This section contains descriptions summarizing 2021 progress on each action item. For actions marked as not applicable ("N/A") the summaries include explanations of why progress did not need to be taken on those action items in 2021. For a copy of any reference materials mentioned in these summaries, please contact NeDNR or one of the Republican Basin NRDs.

Goal 1	**Maintain Nebraska's compliance with the Republican River Compact and applicable laws**
Obj. 1.1	**Coordinate basin-wide plan management actions with Nebraska's Compact compliance efforts and adherence to applicable state laws**

1.1.1 *Review each basin-wide plan management action prior to implementation to ensure it does not negatively impact efforts to achieve Compact compliance in the most efficient and cost-effective way practicable while adhering to state laws.*

In 2021, all basin-wide plan management actions were reviewed in accordance with Action Item 1.1.1. The Republican Basin NRDs and NeDNR do not expect any 2021 basin-wide plan management actions to negatively impact efforts to achieve Compact compliance in the most efficient and cost-effective way under state law.

Based on our review of the potential future basin-wide plan management actions outlined in the basin-wide plan, we do not expect any will negatively impact Compact compliance efforts or adherence to state laws. As new management actions are proposed, we will thoroughly analyze them at that time.

1.1.2 *Implement appropriate offsets for any basin-wide plan action that would exceed Nebraska's allocation under the Compact*

N/A

For this action item, the basin-wide plan defines offsets as actions that either reduce water use or increase water supply for the purpose of staying within Nebraska's Compact allocation. Nebraska complied with the Compact in 2021 without the need for any offsets by NeDNR or the Republican Basin NRDs. Because no offsets were necessary, this action item is not applicable for 2021.

In years when offsets are required, the volume of water that each NRD needs to make up through management actions is determined through procedures described in the *Monitoring & Studies Technical Memorandum for the URNRD, MRNRD, and LRNRD IMPs* (effective 9/27/2021). The IMPs for Upper Republican, Middle Republican, and Lower Republican NRDs require each district's computed beneficial consumptive water use to remain within its share of Nebraska's Compact allocation. The IMP for the Republican Basin portions of Tri-Basin NRD states that the district will incrementally achieve and sustain a hydrologically balanced condition so that, in combination with imported water contributions from the Platte Basin, streamflow augmentation, and other management

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actions, Tri-Basin NRD water users will not cause a net depletion to streamflow. Through implementation of the IMPs, NeDNR and the Republican Basin NRDs will take any necessary offsetting actions to ensure that Nebraska remains in compliance with the Compact.

Obj. 1.2 **Understand the effects of management actions for Compact compliance on water supplies for Nebraska's water users**

1.2.1 *Qualitatively evaluate the net effect on water supplies of any management actions that are taken for Compact compliance*

This action item was completed during 2021. A qualitative evaluation of the net effect on water supplies of any management actions that were taken for Compact compliance during 2020 was presented at the third annual meeting to review progress on the basin-wide plan, which took place in November 2021. The qualitative evaluation can be found on page 26 of the *Third Annual Report for the Republican River Basin-Wide Plan: Data and Progress Updates, 2020 (November 15, 2021)* and can be downloaded from the basin-wide plan website, *https://rrbwp.nebraska.gov .*

The current year's qualitative evaluation of the net effect of 2021 management actions for Compact compliance on water supplies can be found under "Qualitative Evaluation of Net Effect of Management Actions for Compact Compliance" on page 27 of this report.

Obj. 1.3 **Assess progress toward meeting the goals and objectives of the Plan, and share the results of this assessment with the Public and the Nebraska Legislature**

1.3.1 *Within five years after the adoption of this Plan, and every five years thereafter, conduct a technical analysis of the actions taken to determine the progress toward meeting the goals and objectives of the Plan*

N/A

A five-year technical analysis of actions taken is not necessary at this time. Following the schedule in the basin-wide plan, NeDNR and the Republican Basin NRDs will carry out the first five-year technical analysis in 2023 and repeat it every five years thereafter for the duration of the plan implementation time frame.

1.3.2 *Evaluate progress toward each of the Plan's measurable hydrologic objectives at the intermediate dates specified in the Plan for each one.*

MHO A: *Maintain each NRD's net groundwater depletions to streamflow within its portion of Nebraska's allowable groundwater depletions to streamflow.*

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MHO A was evaluated for 2020, and the results were presented at the third annual meeting to review progress on the basin-wide plan, which took place in November 2021. The analysis and results are described beginning on page 60 of the *Third Annual Report for the Republican River Basin-Wide Plan: Data and Progress Updates, 2020 (November 15, 2021),* which can be downloaded from the basin-wide plan website, *https://rrbwp.nebraska.gov*.

The current year's (2021) evaluation of MHO A can be found under "MHO A Evaluation" on page 64 of this report.

MHO B: *Limit groundwater depletions to streamflow to a relatively constant level over the long-term both across the basin as a whole and within each NRD*

N/A

An assessment of MHO B is not necessary at this time. Following the schedule laid out in the basin-wide plan, MHO B will be assessed in 2023, and every five years thereafter for the duration of the plan implementation time frame, as part of the five-year technical analysis.

MHO C: *Ensure there is always enough groundwater for all groundwater uses within the timeframe of this plan, either by stabilizing groundwater levels or managing declining groundwater levels*

N/A

An assessment of MHO C is not necessary at this time. Following the schedule laid out in the basin-wide plan, MHO C will be assessed in 2023, and every five years thereafter for the duration of the plan implementation time frame, as part of the five-year technical analysis.

MHO D: *Continue existing and initiate new actions that reduce the need for special regulations in the Rapid Response Area for Compact compliance*

MHO D assesses whether groundwater pumping within the Rapid Response Area of Upper Republican, Middle Republican, or Lower Republican NRD was curtailed to ensure Compact compliance during the previous year. There is no Rapid Response Area designated within Tri-Basin NRD.

MHO D was evaluated in 2021 to review progress on the basin-wide plan. Results were presented at the third annual meeting, which took place in November 2021. The analysis and results can be found on page 64 of the *Third Annual Report for the Republican River Basin-Wide Plan: Data and Progress Updates, 2020 (November 15, 2021).* The report can be downloaded from the basin-wide plan website, *https://rrbwp.nebraska.gov*.

The current year's evaluation of MHO D can be found under "MHO D Evaluation" on page 68 of this report.

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The Republican Basin NRDs and NeDNR have undertaken many projects that reduce the potential future need for special regulations in the Rapid Response Area for Compact compliance. Examples of new and existing projects can be found in this report, within the summaries of progress on other plan action items.

MHO E: *Continue existing and initiate new actions that reduce the need for administration of surface water use for Compact compliance*

MHO E assesses whether surface water administration was needed during the previous year to ensure Compact compliance. Note that any administration that is automatically trigged under terms of the Final Settlement Stipulation (FSS) is not evaluated as part of MHO E.

MHO E was evaluated in 2021 to review progress on the basin-wide plan. Results were presented at the second annual meeting, which took place in November 2021. The analysis and results can be found on page 65 of the *Third Annual Report for the Republican River Basin-Wide Plan: Data and Progress Updates, 2020 (November 15, 2021),* which can be downloaded from the basin-wide plan website, *https://rrbwp.nebraska.gov* . The current year's evaluation of MHO E can be found under "MHO E Evaluation" on page 69 of this report.

NeDNR and the Republican Basin NRDs have undertaken many projects that reduce the potential future need for surface water administration for Compact compliance. Some examples are included in this report, within the summaries of progress on other plan action items.

1.3.3 *Following each five-year technical analysis (Action Item 1.3.1), share the results of the analysis and any recommended Plan modifications with the public*

N/A

As explained under action item 1.3.1 above, the five-year technical analysis was not necessary in 2021; therefore, there were also no results to share with the public in 2021. As laid out in the basin-wide plan, NeDNR and the Republican Basin NRDs will carry out the five-year technical analysis and share the results with the public every five years throughout the plan implementation period, beginning in 2023.

1.3.4 *Following each five-year technical analysis (Action Item 1.3.1) and any resulting modifications to the Plan, submit a report to the Legislature of the results of the analysis and progress made under the Plan*

N/A

A report to the legislature summarizing the results of the analysis of a five-year technical analysis is not necessary at this time. As laid out in the basin-wide plan, NeDNR and the Republican Basin NRDs will carry out the five-year technical analysis every five years

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throughout the plan implementation period, beginning in 2023. A report to the Legislature will be submitted following each five-year technical analysis, beginning in 2024.

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Goal 2	**Maximize Nebraska's efficient and beneficial consumptive use of its water, increase certainty for long-range planning of water supplies to reduce the need for regulatory actions, and increase collaborative efforts among water management entities and stakeholders across the Basin**
Obj. 2.1	**Understand the feasibility and potential impacts of Plan actions and establish a standard procedure for projects**

2.1.1 *For each planned new water management project in the Plan, evaluate hydrologic and regulatory feasibility and potential economic and environmental impacts*

and

2.1.2 *For each project evaluated in accordance with Action Item 2.1.1 in a given year, include a summary of the evaluation in the annual report of that year's activities*

Lower Republican NRD utilizes a model for project evaluation and management decisions; the model is being used to evaluate three proposed locations for potential water storage. These efforts will initiate the National Environmental Policy Act (NEPA), which would require analyzing all the components addressed in section 2.1.1. Lower Republican NRD received funding through the U.S Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Watershed and Flood Prevention Operations Program (WFPO) to hire a consultant to further evaluate two of the proposed sites for water storage and other beneficial uses. The WFPO grants that the NRD received for two of the proposed sites will be completed over a 2-year period, starting in March of 2021. Environmental assessment work began in August of 2021. The third site underwent a preliminary investigative feasibility review (PIFR) by NRCS in July of 2021. The results of this review are pending and WFPO funding awards may take up to 18 months from that time.

Lower Republican NRD and NeDNR worked with Nebraska Bostwick Irrigation District (NBID) in 2021, to evaluate the potential feasibility and impacts of a project to increase the efficiency of Superior Canal operations. Their evaluation and findings were summarized in NBID's WaterSMART Water and Efficiency Grant project application, which was approved by the United States Bureau of Reclamation (USBR). Planning and preliminary design is underway.

Middle Republican NRD received a second WaterSMART Water and Efficiency Grant in 2021 for the second phase of a Remote Irrigation Meter and Irrigation Water Conservation Project. The grant was used for over 1,300 telemetry-equipped water meters that will provide near real-time water usage in areas with groundwater declines. The information will help address declines and the reporting of consumptive use.

Actions taken by Middle Republican NRD include installation of 350 telemetry flow meters that enhance water supply through increased water management.

Upper Republican NRD did not undertake any new water management projects requiring evaluation in 2021. However, the district began using a groundwater model they developed to perform a similar analysis of general water policy alternatives and specific

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proposals within the Upper Republican NRD to change locations of groundwater withdrawals.

2.1.3 *For projects that are feasible and beneficial, apply for necessary permits, establish new or utilize existing infrastructure, then begin operations*

Lower Republican NRD is evaluating three proposed locations for water storage. These efforts will initiate the NEPA process which would require analyzing all components addressed in section 2.1.3. The WFPO grants that the Lower Republican NRD received for two of the proposed sites will be completed by March of 2023. The third site was part of a preliminary investigative feasibility review in July of 2021 and WFPO funding awards may take up to 18 months from that time.

In 2020, Tri-Basin and Lower Republican NRDs resubmitted their application (permit number A-19594) for a water right to divert excess flows from the Platte River for delivery to a diversion that would send water down Turkey Creek, a tributary of the Republican River. The application awaits approval by NeDNR. All ongoing and future projects will be developed in compliance with local, state, and federal permitting requirements.

Obj. 2.2 Improve the efficiency of use, availability, and reliability of water supplies for current irrigators

2.2.1 *Work with irrigation districts and individual groundwater and surface water irrigators to improve the efficiency of the Basin's surface water delivery systems and irrigation water use, when it is both feasible and beneficial to Nebraska's Compact accounting balance*

Upper Republican NRD, Middle Republican NRD, Lower Republican NRD, and NeDNR each made progress on this action item in 2021.

In 2021, Upper Republican NRD staff installed telemetry units on approximately 200 irrigation wells in the district, making progress towards the NRD's goal of allowing farmers and Upper Republican NRD staff to get real-time water usage from all 3,300 irrigation wells in the district (Figure 10). Real, or near-real, time usage will help farmers apply needed amounts of water based on soil-moisture and evapotranspiration data with more precision and reduce instances of over-watering. Additionally, usage reports will be constantly adjusted based on most recent water applications to reflect remaining allocation, carry-forward, etc., at the time the report is generated.

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Figure 10. Two different mounting systems for Upper Republican NRD telemetry project.

Upper Republican NRD worked with the Daugherty Water for Food Global Institute at the University of Nebraska-Lincoln (UNL) to install a second eddy-covariance evapotranspiration (ET) tower in the district that calculates evapotranspiration from crops adjacent to the towers. Locally, the district also uses the data from the towers to check the accuracy of ET estimates from nearby, Upper Republican NRD-owned weather stations. The data from the eddy-covariance systems are used as an input in a model that utilizes satellite imagery to estimate ET; the ultimate goal is to develop an easy-to-use application for farmers to get field-specific ET estimates and forecasts to improve their irrigation scheduling.

Middle Republican NRD partnered with the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) in obtaining a WaterSMART Grant from the USBR. This grant runs through the NRCS, targeting the Middle Republican NRD Republican River Rapid Response Area. The project mirrors the Middle Republican NRD WaterSMART Telemetry project, cost-sharing telemetry soil moisture probes on 2600 acres and conversion of 47 acres from flood irrigation to subsurface drip irrigation. NeDNR also contributed to this project through the WRCF.

Middle Republican continued to support Frenchman Cambridge Irrigation District (FCID) on their efficiency efforts.

Middle Republican NRD has an ongoing project with the Frenchman Valley Irrigation District (FVID) to conduct recharge through their surface delivery system and use the water for Compact compliance if necessary. NeDNR continued discussions with FVID in 2021 about potential improvements to FVID's infrastructure.

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Lower Republican NRD has an agreement with NBID that establishes water savings through the placement of automated gates. Lower Republican NRD and NeDNR provided a letter of support for NBID's grant application for water delivery to the Superior Canal and assisted with developing NBID's application.

Lower Republican NRD continues to maintain existing actions and initiate new actions that reduce the need for special regulations in the Rapid Response Area for Compact compliance. These include grant programs that incentivize water saving technology, evaluation of new storage supplies, and continued work on the completion of new projects such as the Platte to Republican High Flow Diversion Project that would utilize excess flows that are not being used in Nebraska but are exiting the state without benefit.

Figure 11. New Rubicon gates on canal operated by Frenchman-Cambridge Irrigation District.

NeDNR signed a contract with the Frenchman-Cambridge Irrigation District (FCID) in 2020 to install upgraded flow measurement and control gates on the Meeker-Driftwood Canal and integrate them into a Supervisory Control and Data Acquisition (SCADA) radio telemetry network (Figure 11). FCID completed almost 80% of this project in 2021, including all of the construction and modifications to the check structures.

NeDNR also signed a contract with the Nebraska Bostwick Irrigation District (NBID) in 2020 to install automated headgates on the Courtland and Superior Canals. Work continued on the project through 2021. The goal of these projects is to eliminate unintended operational spills. The projects also include conjunctive management commitments from FCID and NBID. NeDNR's contribution to these projects is funded through the WRCF. Also in 2021, NeDNR signed a contract with NBID to provide matching funds for a large scale WaterSMART Grant from the Bureau of Reclamation. NBID was awarded a two million dollar grant through WaterSmart, which combined with NeDNR funds will build and install a diversion site on the Republican River on the east side of Superior. When this project is operational, it will save approximately 3,500 to 4,000 acre feet of water from being released from Harlan County Reservoir. The project is expected to be operational by the 2025 water season.

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2.2.2 *Participate in projects to improve the reliability, availability, and sustainability of water supplies in the Basin, which may include but are not limited to:*

- *Voluntary reduction of irrigated acres (temporary or permanent)*
- *Interbasin transfers*
- *Conjunctive management projects such as aquifer recharge or streamflow augmentation*

All four Republican River Basin NRDs participate in the Conservation Reserve Enhancement Program (CREP), which provides federal funding for the temporary removal of environmentally sensitive land from production. Three of the districts also have acres enrolled in the Agricultural Water Enhancement Program (AWEP). Summaries of acres enrolled in CREP and AWEP within each NRD can be found on pages 8, (Upper Republican NRD), page 11 (Middle Republican NRD), page 14 (Lower Republican NRD), and page 16 (Tri-Basin NRD).

Upper Republican NRD entered into agreements with three landowners in 2021 to decertify irrigation rights or appropriations on 456 acres within 2.5 miles of the Republican River or its tributaries. This program is 60% funded by the WRCF and thus far has led to permanent decertification of 2.824 acres with high impact on stream flow. Upper Republican NRD and NeDNR (via the Water Sustainability Fund) also provided cost share for soil moisture probes on approximately 15,000 acres that reduced water use by an estimated 1,900 acre-feet in 2021. Both actions will mitigate stream depletions caused by groundwater pumping.

Middle Republican NRD has a program to decertify irrigation rights or appropriations on cropland. This program is funded by Middle Republican NRD and the WRCF, which is administered by NeDNR. Specific details about the number of contracts entered into with landowners and the number of acres bought out in 2021 are reported under "Conservation and Irrigation Decertification Programs" on page 7.

Middle Republican NRD continues to support the Nebraska Cooperative Republican Platte Enhancement (N-CORPE) augmentation project.

In 2016, Lower Republican NRD established an ongoing program through the Regional Conservation Partnership Program (RCPP). As part of this program, Lower Republican NRD provided for soil moisture sensors, end gun removal and the conversion of gravity irrigation to subsurface drip. The five-year program ended in 2021.

Lower Republican NRD and Tri-Basin NRD submitted an application to NeDNR for an interbasin transfer permit to divert excess flows from the Platte Basin to the Republican Basin as the Platte to Republican Basin High Flow Diversion (PRD) project (permit number A-19594, Figure 12). As filed, it was proposed to always be junior in priority to existing and future Platte River water uses. The permitting process for this project is ongoing. Permitting aspects of this project are described under action item 2.1.3.

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Figure 12. Prescribed burn on Platte-Republican Diversion land, April 20, 2020, courtesy of Tri-Basin NRD.

Lower Republican NRD has agreements with NBID to use water stored in Harlan County Lake for Compact compliance. The stored water is a result of water savings derived from automated gate installations, which received a million dollars from Lower Republican NRD. Additionally, the NRD provided a letter of support for the NBID Superior Canal WaterSMART grant. The grant application was successful, and planning is now underway.

Some additional potential conjunctive management projects NeDNR and the NRDs were involved in with the basin's irrigation districts are described under action item 2.2.1.

Obj. 2.3 Provide opportunities for collaboration among Basin's water users

2.3.1 *Hold an annual public meeting to discuss Plan implementation and exchange information about the Basin*

The first basin-wide plan annual meeting was held in February 2020, which was within the first year of plan implementation.

The second and third basin-wide plan annual meetings were held in November 2020 and November 2021 respectively, in fulfillment of the IMPs for Upper Republican, Middle Republican, and Lower Republican NRDs. The main purpose of these meetings is to present to the public progress by NRDs and NeDNR on Plan implementation in the Basin in the previous year.

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2.3.2 *Work cooperatively to investigate and address conflicts between water users resulting from implementation of this Plan by following the procedures for addressing conflicts that are outlined in this Plan*

N/A

The Republican River NRDs and NeDNR intend to work cooperatively to investigate and address conflicts between water users resulting from implementation of the Basin-Wide Plan by following the procedures for addressing conflicts that are outlined in the Plan. In 2021, no conflicts resulting from implementation of the basin-wide plan were brought to the attention of NeDNR or the NRDs to address.

Obj. 2.4 Promote conservation programs available to the water users in the Basin

2.4.1 *Work together to identify, investigate, and discuss existing and potential new water conservation programs*

Throughout 2021, the Republican Basin NRDs and NeDNR discussed and shared information with each other about existing and potential new water conservation programs as new information became available or new questions were raised by one of the parties. Recent examples include information exchange on federal water conservation grants, flow meter telemetry, stream flow augmentation operations, and water use regulations. The NRDs support individual efforts of other NRDs as well as programs for the whole basin.

Upper Republican NRD coordinated the high-level weather stations with the Middle and Lower Republican NRDs through UNL.

Lower Republican NRD also has an agreement with NBID to use a portion of water savings from automated gates for Compact compliance. The NRD provided one million dollars for the gates. Currently, Lower Republican NRD has indicated support to work with NeDNR on the Superior Canal WaterSMART grant and is currently utilizing a WaterSMART grant from the USBR to implement a program for installing over 1,000 telemetry-enabled flowmeters in the next three years.

Tri-Basin NRD created the Water Conservation Incentive Program (WCIP) to encourage irrigators to accept limits on their water use in exchange for receiving cash payments when they save water within their allocation. Agreements last five years. There were new WCIP contracts for 133.86 acres in the Republican Basin in 2021.

2.4.2 *Collaborate to promote conservation program opportunities to the Basin's water users*

The Republican River Basin NRDs and NeDNR are open to opportunities to collaborate with neighboring NRDs, state and federal government agencies and constituents on programs and projects that promote and incentivize water conservation. Each of the Republican Basin NRDs is actively involved in CREP. Additionally, the NRDs participate in

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the Southwest Weed Management District (SWMD), and Lower Republican NRD is an active member of Twin Valley Weed Management Area (TVWMA). SWMD and TVWMA have removed invasive species in stream corridors that consume water and impede stream flow.

Obj. 2.5 Understand how various water management activities of independent decision-makers affect water supplies

2.5.1 *Study the effects of conservation practices on streamflow, if feasible*

N/A

This action item is to be completed by 2028, when and if funding and staff resources allow. NeDNR and the NRDs have some analytical tools available to them to assist with studies of the effects of conservation practices on streamflow, as described below.

Lower Republican NRD will study the effects of conservation practices on streamflow through the Lower Republican NRD Management Action Opportunity (MAO) model. The RRCA model is run to determine the quantitative effect of a proposed land use change through the MAO model.

Tri-Basin NRD has the most extensive groundwater level monitoring network in Nebraska. Groundwater level data is critical to accurately determining impacts of groundwater pumping on streamflows. Data are shared with state and federal agencies and made available to the public.

NeDNR uses the RRCA model to estimate stream depletions resulting from groundwater pumping, stream accretions resulting from recharge projects, and other parameters.

2.5.2 *As part of each five-year technical analysis, analyze the future impacts to streamflow of past pumping to determine the lag time of these residual impacts*

N/A

Following the schedule in the basin-wide plan, NeDNR and the Republican Basin NRDs will carry out the first five-year technical analysis in 2023 and repeat it every five years thereafter for the duration of the plan implementation time frame.

2.5.3 *Examine and attempt to estimate the quantity of all inputs and outputs affecting the water supply balance in a small watershed, and consider using the results of this pilot study to create water use and land use guidelines for producers and other land managers, incentivize participation in recommended practices, and determine the value of completing similar studies across the Basin*

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This action item is to be completed by 2028.

In 2021, Upper Republican NRD worked with the Daugherty Water for Food Global Institute at the University of Nebraska-Lincoln and the Nebraska Water Balance Alliance to collect water-input data within the HUC-12 watershed of Perkins County. Plans to install multiple weather stations and rain gauges in the HUC-12 watershed were developed in 2021 and installation began in early 2022. NeDNR participated in informational discussions with the research team for this project and provided $4500 in funding. The team presented an update on the project at the November 2021 annual meeting. One goal of the project is to provide real-time crop evapotranspiration to producers for irrigation water management.

In 2021, Middle Republican NRD received a Water Sustainability Grant to use airborne electromagnetic (AEM) technology to model water supply balance in the whole irrigated portion of Middle Republican NRD. Data collection and analysis are ongoing.

Lower Republican NRD will examine the effort required to complete action item 2.5.3 in the coming years, attempting to estimate the quantity of all inputs and outputs affecting the water supply balance in a small watershed and will consider using the results of this pilot study to create water use and land use guidelines for producers and other land managers, incentivize participation in recommended practices, and determine the value of completing similar studies across the Basin.

Obj. 2.6 Evaluate the feasibility and potential outcomes of establishing water markets in the Basin

2.6.1 *Cooperate in determining the feasibility of water markets in the Basin*  **N/A**

This action item is to be completed by 2023. Two large action items from the plan are scheduled to be completed by 2023: this feasibility study and the drought planning exercise described in Action Item 2.8.1, and it was not feasible in 2021 to begin both projects. At this time, NeDNR and the NRDs have been focusing efforts on the drought planning exercise.

Tri-Basin NRD developed the Water Conservation Incentive Program (WCIP) to offer farmers incentives to conserve water. One feature of WCIP is the ability for landowners to trade water use credits.

2.6.2 *Following the water markets feasibility analysis (Action Item 2.6.1), test conclusions through implementation of a water market program in a pilot area, if feasible*  **N/A**

As stated in the basin-wide plan, this action item is contingent upon the findings from the feasibility study in Action Item 2.6.1. If the evaluation in Action Item 2.6.1 indicates that

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water markets in the Basin would be feasible, and if sufficient funding and staff resources are available to do so, then NeDNR and the NRDs will work cooperatively with the US Bureau of Reclamation, the Basin's irrigation districts, and water users in the Basin to conduct a water market pilot program within a portion of the Basin by 2028.

Obj. 2.7 Support the NRDs in management of allocations for irrigation purposes and surface water irrigation districts in management of the allotment of their water supply

2.7.1 *Periodically evaluate, as part of each five-year technical analysis, the impact of the groundwater allocation and surface water allotment systems as a whole*

N/A

Following the schedule in the basin-wide plan, NeDNR and the Republican Basin NRDs will carry out the first five-year technical analysis in 2023 and repeat it every five years thereafter for the duration of the plan implementation time frame.

The NRDs individually review pumping and allocations on a regular basis to comply with the IMPs and groundwater management plans while balancing the allocations so as not to restrict the economic vitality of the NRD or the region, as is consistent with the mission of the *Republican River Basin-Wide Plan*.

Although the Republican River Basin Wide Plan requires a five-year periodic evaluation for the technical analysis to determine the impact of the groundwater allocation, Lower Republican NRD always reviews pumping and allocations to comply with the Integrated Management Plan (IMP) while balancing the allocations so that it does not restrict the economic vitality of the NRD or the region, which is consistent with the mission of the *Republican River Basin-Wide Plan*. Lower Republican NRD does not have authority to manage irrigation district allotments. However, the NRD would support the irrigation districts, their sponsors, and their sponsor's partners in evaluating additional storage of flood water within existing facilities that could be reserved for irrigation supply, aquatic habitat, and recreation. Lower Republican NRD supports NBID and the USBR's effort to develop a lake level management plan with the United States Army Corps of Engineers (USACE). The USACE Kansas City District reservoirs have this implemented. For example, the lake level management plan at Lovewell Reservoir supports the operation of Kansas Bostwick Irrigation District (KBID).

Tri-Basin NRD has only one township in the Republican Basin that is subject to allocation. This allocation was imposed to protect groundwater levels in the local area from diminishment. The allocation requirement is tied to local groundwater levels. If a three-year average of groundwater levels rises above the 1981–1985 average springtime levels for that township, the allocation will be suspended. The other three NRDs have allocations district-wide.

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2.7.2 *As needed, based on the evaluation described in Action Item 2.7.1, recommend changes or improvements to the groundwater allocation and/or surface water allotment systems*

N/A

Following the schedule in the basin-wide plan, NeDNR and the Republican Basin NRDs will carry out this action item by the year following each iteration of Action Item 2.7.1. Therefore, this action will be completed for the first time by 2024 and then repeated every five years thereafter for the duration of the plan implementation timeframe.

Lower Republican NRD would support the irrigation districts, their sponsors, and their sponsor's partners in evaluating additional storage of flood water within existing facilities that could be reserved for irrigation supply, aquatic habitat, and recreation. Lower Republican NRD supports NBID and the USBR's effort to develop a lake level management plan with the USACE. The USACE Kansas City District reservoirs have this implemented. For example, the lake level management plan at Lovewell Reservoir supports the operation of KBID.

Obj. 2.8 Conserve water for future use during a drought

2.8.1 *Organize and participate in a Basin-wide drought planning exercise*

This action item is to be completed by 2023.

Preparation for the drought-planning exercise began in 2020 with the hiring of a graduate research assistant (GRA), working out of the National Drought Mitigation Center (NDMC). The four NRDs and NeDNR shared the cost of supporting the GRA, with NeDNR responsible for 50% and the NRDs collectively responsible for the other 50%. Under NeDNR supervision, in 2021 the GRA and NeDNR staff did extensive research on climate history, regulatory policies, and prior drought impacts in the Basin. This information was used to determine the type of exercise to hold, how to prioritize specific drought impacts, and the types of management actions that might be used to maintain Compact compliance.

In addition to participating in the basin-wide drought planning exercise, Lower Republican NRD is interested in pursuing a plan to reserve flood water for irrigation use within existing structures, which would be beneficial for water supplies during drought periods. Many reservoirs in the USACE Kansas City District have lake management plans that allow additional water to be held back above conservation pools. Additionally, regulatory changes that allow for the modification or change in a reservoir operating plan allowing flood water retention above current levels would conserve water for future use.

Tri-Basin NRD and Central Nebraska Public Power and Irrigation District are also in the early stages of developing a drought management and mitigation plan for the entire NRD.

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2.8.2 *Following the drought planning exercise (Action Item 2.8.1) evaluate whether to recommend any changes to the IMPs or this Plan related to conservation of water for future use during a drought*

N/A

This action item will be completed by the year following completion of the drought planning exercise, and no later than 2024.

In addition to participating in the basin-wide drought plan, Tri-Basin NRD and Central Nebraska Public Power and Irrigation District are in the early stages of developing a drought management and mitigation plan for the entire NRD. Once these efforts are complete an evaluation of recommended changes to Tri-Basin NRD's IMP or the basin-wide plan will be considered.

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Goal 3	Positive public relations, including information sharing, within and outside the Basin
Obj. 3.1	**Improve information sharing with decision-makers and public about solutions within the Basin**

3.1.1 *Use existing resources to share information about Basin progress and activities with outside entities*

The Republican River Basin NRDs and NeDNR use existing information dissemination resources such as newsletters, radio programs, public meetings, websites, social media, and education/outreach events. Some of these resources were used in 2021 to share information about Basin progress and activities with outside entities. Examples are described under Action Item 3.1.2 and 3.1.3.

3.1.2 *Educate civic leaders and the public on implementation efforts within the Basin*

NeDNR and the Republican Basin NRDs participated in education and outreach about plan implementation efforts in 2021. The basin-wide plan identifies some examples of potential outreach topics related to this objective such as efficiency improvements, the NRDs' allocation systems and resulting successes, other management activities and successes, factors that have contributed to streamflow reduction in the Basin, variations in groundwater management that reflect natural wet/dry cycles, realistic expectations for outcomes of projects and policy changes. The following paragraphs provide specific examples of 2021 education and outreach activities related to implementation efforts within the basin.

NeDNR hosts a website about the Republican River Basin-Wide Plan, http://rrbwp.nebraska.gov. The website is a tool for conveying information about basin-wide plan implementation and includes background information about the plan and plan implementation resources such as data, annual meeting materials, and annual reports. Plan development meeting materials are also available on the website. In 2021, NeDNR began discussions on updating and revising website design and content.

Upper Republican NRD described augmentation and other water management programs to members of the Legislature's Natural Resources Committee and University of Nebraska officials. Locally, the NRD shared information about Compact compliance forecasts by posting information on the district's website, the NRD newsletter, and through presentations to community leaders in the District. Upper Republican NRD also helped publicize efforts by Southwest Weed Management District to control invasive species in stream corridors throughout the Basin. The NRD also shared information about District and basin-wide activities with water management groups in eastern Colorado.

Middle Republican NRD shared information through its website and *Irrigation Leader* magazine.

Lower Republican NRD co-hosts the South-Central Nebraska Water Conference with Tri-Basin NRD and the Central Nebraska Public Power and Irrigation District to inform the

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public on the happenings of the water world within South Central Nebraska. NeDNR hosted a booth at this conference. All four NRDs produce newsletters for the public containing information about their activities, including water management activities in the Republican Basin. Lower Republican NRD also provides articles and radio publications on a regular basis to keep constituents informed. Tri-Basin NRD also promotes its programs and policies through radio features on KRVN and promotes the NRD with a booth at county fairs and farm shows.

Each fall, NeDNR publishes an annual report to the Governor and Legislature, entitled Annual Report and Plan of Work for the State Water Planning and Review Process. The report includes a section summarizing activities in the Republican River Basin for the prior fiscal year, as well as a four-year work projection for the basin. The report is available on NeDNR's website, *https://dnr.nebraska.gov*. NeDNR also annually submits a report to the Legislature each fall summarizing WRCF expenditures and accomplishments. Many of the projects described in the report are in the Republican River Basin.

In 2021, NeDNR began developing a StoryMap about the WRCF. A StoryMap is a platform for combining text and maps to illustrate where stories take place. The purpose of the WRCF StoryMap is to showcase the ways in which NeDNR has used the WRCF to support NRD and Irrigation District projects that contribute towards conserving, enhancing, and restoring Nebraska's groundwater and surface water resources. The early stages of StoryMap development included gathering and synthesizing relevant project information, outlining the structure of the story, and creating maps. WRCF StoryMap development is still underway.

3.1.3 *Educate civic leaders and the public about the policies and institutional infrastructure that contribute to the development and implementation of solutions*

NeDNR and the Republican Basin NRDs participated in education and outreach about policies and institutional infrastructure in 2021. The basin-wide plan identifies some examples of potential outreach topics related to this objective as correlative groundwater rights; integrated management plans; the *Republican River Basin-Wide Plan*; the Republican River Compact; other aspects of Nebraska's surface water and groundwater statutes; and other NRD rules, regulations, and plans. The following paragraphs provide specific examples of 2021 education and outreach activities related to the policies and institutional infrastructure that contribute to the development and implementation of solutions.

The NRDs and NeDNR communicate regularly with their legislative representatives and other state senators, as needed. They work to educate civic leaders and the public about the policies and institutional infrastructure that contribute to the development and implementation of solutions, through public outreach such as articles, conferences, and radio news briefs. All four NRDs produce newsletters for the public containing information about their activities, some of which included articles about policies and institutional infrastructure in 2021. In addition, Lower Republican NRD provides education and outreach with conferences and radio news briefs.

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NeDNR and colleagues from Kansas and Colorado maintain a website with information about the Republican River Compact (*http://republicanriver.org/*), which includes background information about the RRCA, annual reports, and other RRCA meeting materials. Upper Republican NRD website is updated with Compact developments and provides a layman's explanation of the Compact and compliance efforts. Both Upper Republican NRD and NeDNR's websites include links to the Compact, the Final Settlement Stipulation, and other important Compact-related documents.

NeDNR and the NRDs also addressed these topics in 2021 at some of the other outreach events described under action item 3.1.2.

3.1.4 *Propose and support changes to laws, policies, and rules that would incentivize reduced water consumption*

N/A

In 2021 there were no proposed changes to laws, policies, and rules that would incentivize reduced water consumption within the Basin. NeDNR and the Republican River Basin NRDs are committed to evaluating all proposals that offer incentives to reduce groundwater use, with the intention of supporting any changes that do not reduce the economic vitality of the region in accordance with the mission of the Basin-Wide Plan.

Upper Republican NRD worked with local NRCS officials to prioritize the District's resource concerns in their programs such as Environmental Quality Incentives Program (EQIP). Decertification of water use and/or tools to improve irrigation scheduling were emphasized.

Obj. 3.2 Improve information sharing with water users who are reliant on the Basin's water supplies

3.2.1 *Share data and information related to the Republican River Compact with the public in an easily accessible, user-friendly format*

All four NRDs and NeDNR exchange water use and groundwater level data annually for RRCA accounting purposes. RRCA annual reports and final RRCA accounting data are available at *http://republicanriver.org/*, and RRCA groundwater model information is available at the RRCA's data site, *https://www.republicanrivercompact.org/*. Information about the Republican River Compact is also available on NeDNR's website and Upper Republican NRD's website. Some RRCA data are also available on NeDNR's INSIGHT (Integrated Network of Scientific Information & GeoHydrologic Tools) website (*http://nednr.nebraska.gov/INSIGHT/*).

NeDNR and the NRDs have worked to make some data from the RRCA annual accounting and groundwater model more easily accessible and user-friendly by including data from these sources each year in the basin-wide plan annual report. NeDNR continues to work to improve the availability and format of RRCA data on this website.

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Middle Republican NRD shared data and information related to the Compact during a NRCS local work group meeting.

3.2.2 *Annually prepare and exchange reports containing data and information about water supplies and uses in the Basin, and make these reports publicly accessible*

All four NRDs and NeDNR share data and information about water supplies and uses in the basin as part of the annual report for the basin-wide plan. This information is shared with the public at the basin-wide plan's annual meeting and through the *Republican River Basin-Wide Plan* website (*http://rrbwp.nebraska.gov*). NeDNR and the NRDs published the first and second annual reports in 2020, and the third annual report in 2021. Reports were first presented at the annual meeting (February 2020, November 2020, and November 2021, respectively) and then published on the basin-wide plan website.

Lower Republican NRD also supports gathering information such as groundwater measurements with the United States Geological Survey and Nebraska Conservation and Survey Division. Information is publicized in annual reports. Lower Republican NRD further provides relevant water balance information at the South-Central Nebraska Water Conference.

Tri-Basin NRD and NeDNR also exchange information about water supplies and uses annually in fulfillment of the IMP for the Republican Basin portion of Tri-Basin NRD. These reports can be downloaded from the NeDNR website (*https://dnr.nebraska.gov*).

3.2.3 *Regularly communicate with the Plan's former Stakeholder Advisory Committee about implementation progress and potential Plan revisions*

All four NRDs and NeDNR work to keep former Stakeholder Advisory Committee members informed about implementation progress and potential plan revisions. This information is primarily shared at the annual meeting for the basin-wide plan.

Information about plan implementation is also shared via email through a GovDelivery contact list for people interested in receiving updates about the basin-wide plan. All stakeholders from the plan development process were added to the list when it was created. One former stakeholder does not have an email account, so printed copies of updates posted to the GovDelivery list are mailed to that individual.

In 2021, NeDNR and Upper Republican NRD, Middle Republican NRD, and Lower Republican NRD worked together on updates to the IMPs jointly developed by NeDNR and each of the three NRDs, including some changes related to ensuring consistency between the IMPs and basin-wide plan. Former basin-wide plan stakeholders were invited to participate in IMP stakeholder meetings. Fifth generation IMPs for Upper, Middle, and Lower Republican NRDs became effective on September 27, 2021. Significant changes to the IMPs included an update to the in-state accounting equation used to assess NRD

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compliance, changes related to the Basin-Wide Plan (including a new goal), and updates related to changes in RRCA procedures.

Notification about the Basin-wide Plan annual meetings is provided on the NRDs' and NeDNR's websites, as well as the basin-wide plan website.

3.2.4 *Encourage and support water users to share information about their management practice improvements with other water users and the public*

All four NRDs and NeDNR encourage and support water users to share information about their management practice improvements with other water users and the public. In 2021, Upper Republican NRD, Middle Republican NRD and Lower Republican NRD provided annual water usage data to UNL from wells within the District. UNL aggregates the data and shares it with neighboring landowners so they understand how their water usage compares to usage in the immediate area.

NeDNR and the NRDs also supported and participated in UNL's Testing Ag Performance Solutions (TAPS) program, an annual competition that provides teams from all over the state with an opportunity to learn from each other about irrigation water management practices and other aspects of crop production. A substantial portion of past TAPS award winners has been from the Republican River Basin. All of the NRDs have had district representation on TAPS teams who've won or placed in the top three of various categories across multiple TAPS competitions. A summary of Republican River Basin TAPS teams and winning TAPS teams from 2017 through 2021 is provided in Table 24.

Table 24. Summary of Republican River Basin TAPS teams and Winning TAPS teams from 2017 through 2021.

NRD or other	Number of Teams	Number of Winning Teams
TBNRD	9	3
URNRD	8	3
MRNRD	23	6
LRNRD	15	3
Basin (NRD not specified)	2	1

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Information sharing about water user management practice improvements is a standing agenda item for the basin-wide plan annual meeting. Discussions about possible opportunities for information sharing have taken place at each of the basin-wide annual meetings.

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Goal 4	**When possible, pursue projects that not only benefit water supplies and uses, but also create benefits for fish, wildlife, recreation and conveyance within the Republican River Basin**
Obj. 4.1	**Where feasible and beneficial, protect and enhance fish and wildlife habitat and public outdoor recreational opportunities**

4.1.1 *Partner with wildlife-focused organizations on projects that benefit the organizations' habitat and wildlife interests while also helping to fulfill other goals of this Plan*

The Republican Basin NRDs continued to partner with wildlife-focused organizations on projects to benefit habitat and wildlife interests in the Basin in 2021. Upper Republican NRD has opened approximately 2,500 acres it owns near the Rock Creek Augmentation project in Dundy County to public hunting and manages the property to successfully re-establish native grass on formerly irrigated cropland. Middle Republican NRD conducts efforts through the N-CORPE Augmentation Project including public outreach, public hunting, and funding opportunities for improvements. "Planting for Pheasants Forever" plantings are provided by the NRD, and the District also participates in the NRCS Regional Conservation Partnership Program (RCPP) Nebraska Forest Service Project. Lower Republican NRD continues to support Nebraska Game and Parks Commission (NGPC) through the lease of office space. Lower Republican NRD provides cost sharing on corners for wildlife. The NRDs also provide support to the Twin Valley Weed Management and Southwest Weed Management Districts for the removal of invasive vegetation throughout the Basin, as described under Action Items 4.1.3 and 4.2.1.

4.1.2 *Promote public recreation on the river, when doing so can also help to fulfill other goals of the Plan*

Lower Republican NRD supports NGPC through lease of office space. Through the Lower Republican NRD office, the NGPC provides public information regarding public recreation on the River and open lands within the Basin.

4.1.3 *Cooperate in projects to assess and restore riparian wetlands while also helping to fulfill other goals of the Plan*

The NRDs provide financial support to weed management districts for the removal of invasive vegetation and noxious weeds throughout the Basin, including for restoration of riparian wetlands. Upper Republican NRD and Middle Republican NRD financially support the Southwest Weed Management District. Lower Republican NRD and Tri-Basin NRD financially support the Twin Valley Weed Management District. The NRDs have also worked with the weed management districts on projects across the basin to restore riparian areas, providing funding and time toward the projects.

Upper Republican NRD has a representative on the board of the Southwest Weed Management District and monitors its progress toward meeting riparian restoration goals.

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Through Lower Republican NRD's financial support of the Twin Valley Weed Management district which eradicates invasive and noxious weeds along the Republican River, both native and desirable species are provided restoration opportunity to succeed as riparian wetlands rather than forested, shrubbed, or palustrine wetlands.

Obj. 4.2 Where feasible and beneficial, reduce the effects of undesirable vegetation on water conveyance

4.2.1 *Cooperate in removing undesirable vegetation impacting water conveyance and managing reinfestation*

As described under Action Item 4.1.3, the NRDs provide financial support to the Southwest and Twin Valley Weed management districts for the removal of invasive vegetation and noxious weeds throughout the Basin. Upper Republican NRD has a representative on the board of the Southwest Weed Management District and has been actively involved in the weed district's activities. Lower Republican NRD financially supports the Twin Valley Weed Management district which eradicates invasive and noxious weeds in the Republican River Basin.

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Assessment of Measurable Hydrologic Objectives (MHOs)

Under *Neb. Rev. Stat.* § 46-755 (4)(b), this basin-wide plan is required to include measurable hydrologic objectives (MHOs) to ensure that reasonable progress is being made toward achieving the goals and objectives of the plan. The basin-wide plan includes five MHOs, which will each be evaluated either annually or every five years, as specified in the basin-wide plan. The MHOs and their assessment schedules are summarized in Table 25. Results of the MHO evaluations are described beginning on page 64.

In the table summarizing the results of each MHO, possible results of the assessment are described, including whether the results indicate that further discussion is required or not. If a result indicates that discussion of next steps is required, this means that NeDNR and the NRDs will discuss the test results and determine what actions will be taken to achieve the MHO in the future, as described in the basin-wide plan.

Table 25. Measurable Hydrologic Objectives (MHOs) agreed to during plan development and adoption. During plan implementation, each MHO is to be evaluated either annually or every 5 years, as specified in the basin-wide plan.

Measurable Hydrologic Objective (MHO)	Evaluation Frequency
MHO A: Maintain each NRD's net groundwater depletions to streamflow within its portion of Nebraska's allowable groundwater depletions to streamflow	Annually
MHO B: Limit groundwater depletions to streamflow to a relatively constant level over the long-term both across the basin as a whole and within each NRD	Every 5 years, beginning in 2023
MHO C: Ensure there is always enough groundwater for all groundwater uses within the timeframe of this plan, either by stabilizing groundwater levels or managing declining groundwater levels	Every 5 years, beginning in 2023
MHO D: Continue existing and initiate new actions that reduce the need for special regulations in the Rapid Response Area for Compact compliance	Annually
MHO E: Continue existing and initiate new actions that reduce the need for administration of surface water use for Compact compliance	Annually

MHO A Evaluation

MHO A Assessment Criteria

MHO A is to maintain each NRD's net groundwater depletions to streamflow within its portion of Nebraska's allowable depletions to streamflow. For the purposes of MHO A, "net groundwater depletions to streamflow" includes augmentation and other management actions.

The basin-wide plan defines the MHO A assessment as follows: for the previous Compact averaging period (2 or 5 years, as determined by Compact accounting procedures), has each NRD's net groundwater

depletions to streamflow for the RRCA model area remained within its portion of Nebraska's allowable groundwater depletions to streamflow, as specified in the IMPs? This MHO is being achieved if the answer to that question is yes for each NRD. The results of this assessment are described in the next subsection.

The MHO A assessment as described above applies only to Upper Republican, Middle Republican, and Lower Republican NRDs, because these are the three NRDs that receive a portion of Nebraska's allowable groundwater depletions to streamflow under the terms of their IMPs. The equivalent test from the IMP for the Republican Basin portion of Tri-Basin NRD is the hydrologically balanced assessment, which evaluates whether Tri-Basin NRD's depletions from groundwater pumping exceeded accretions from the groundwater mound caused by seepage from Platte River canals within in the district, when calculated on a three-year rolling average basis. The results from that analysis are included below, beginning on page 65.

MHO A Evaluation Results for 2021

MHO A evaluation results are summarized in Table 26. For 2021, MHO A is being achieved for Upper Republican, Middle Republican, and Lower Republican NRDs. Each NRD's groundwater net depletions to streamflow remained within its portion of Nebraska's allowable depletions to streamflow, as specified in the IMPs. The evaluation and results for each NRD are described below the summary table.

Table 26. Summary of MHO A results for 2021.

Key to Possible Test Results	 MHO is being achieved. NRD's actual depletions were within its allowable depletions. No further discussion is needed.  MHO is not being achieved. NRD's actual depletions exceeded its allowable depletions. Discussion of next steps is required.		
NRD	**Upper Republican**	**Middle Republican**	**Lower Republican**
NRD's Results for 2021			

According to the Compact accounting procedures, the averaging period applicable to 2021 is five-year averaging.

Allowable groundwater depletions to streamflow for each NRD are defined in the *Monitoring & Studies Technical Memorandum for the URNRD, MRNRD, and LRNRD IMPs*. Each NRD's groundwater depletions to streamflow is calculated using the RRCA groundwater model. An NRD's net depletions are the sum of groundwater depletions and the impacts to Nebraska's Compact balance from management actions taken.

Altogether, the difference between an NRD's allowable groundwater depletions to streamflow and the NRD's groundwater net depletions to streamflow is equivalent to the sum of the NRD's annual balances over the appropriate averaging period where an annual balance is calculated as:

*(Nebraska Allocation + Nebraska Credits – $SWCBCU_{NE}$ – Other NRD CBCU – All NRD Management Actions) * NRD's Applicable Baseline Depletion Percentage – NRD GwCBCU + NRD Management Actions*

The results of the five-year average evaluation for MHO A for 2021 for each NRD are shown in Table 27. Two-year averaging was not evaluated this year as part of MHO A because, under RRCA Accounting Procedures, two-year averaging does not apply for 2021.

Table 27. MHO A evaluation results for 2021, with five-year averaging. Positive values indicate that allowable groundwater depletions to streamflow exceeded actual groundwater net depletions to streamflow. The five-year averaging period for MHO A is evaluated based on the average of the evaluation year (2021) and the previous four years, in conformance with RRCA Accounting Procedures.

	Difference between allowable depletions an actual groundwater net depletions (acre-feet)		
Year	**Lower Republican NRD**	**Middle Republican NRD**	**Upper Republican NRD**
2017	3,862	14,687	17,291
2018	540	-1,919	2,922
2019	40,262	46,951	65,758
2020	14,844	28,487	26,335
2021	2,229	12,180	12,577
5-year average (2017–2021)	**12,347**	**20,077**	**24,976**
5-year average positive?	**Yes**	**Yes**	**Yes**

Tri-Basin NRD Hydrologically Balanced Assessment Results for 2021

The hydrologically balanced assessment from the IMP for the Republican Basin portion of Tri-Basin NRD evaluates whether Tri-Basin NRD's depletions from groundwater pumping and accretions from the mound are hydrologically balanced when calculated on a three-year rolling average basis. This assessment is performed by NeDNR each fall, following finalization of RRCA data for the prior calendar year.

Hydrologically balanced assessment results for 2021 are summarized in Table 28. The analysis and results are explained below the summary table.

Table 28. Summary of results of hydrologically balanced assessment for Tri-Basin NRD for 2021.

Key to Possible Test Results	 In compliance with IMP. On a three-year rolling average basis, depletions from groundwater pumping did not exceed accretions from the mound. Also, sufficient management actions were taken in 2021 to offset net depletions from previous year's test, if any. No further discussion is needed.  Caution. On a three-year rolling average basis, depletions from groundwater pumping exceeded accretions from the mound. Under the terms of the IMP, management actions are required to maintain a hydrologically balanced condition. Discussion of next steps is required.  Insufficient management actions were taken in 2021 to offset net depletions from previous year's assessment. Discussion of next steps is required.
Tri-Basin NRD's Results for 2021	

Full details of the hydrologically balanced assessment for 2021 are included in NeDNR's report for the IMP for the Republican Basin portion of Tri-Basin NRD, entitled *2021 Annual Report of 2020 Data by the Nebraska Department of Natural Resources to Meet the Requirements of the Integrated Management Plan for Those Portions of the Tri-Basin Natural Resources District within the Republican River Basin* (September 29, 2021). The three-year average net effect is positive for 2021 (Figure 13), meaning that mound accretions exceeded groundwater depletions from pumping on a three-year average basis; therefore, no offsets are required in the future as a result of the 2021 test. In addition, no management actions were required to be taken by Tri-Basin NRD in 2021 to offset the results of a previous year's test.

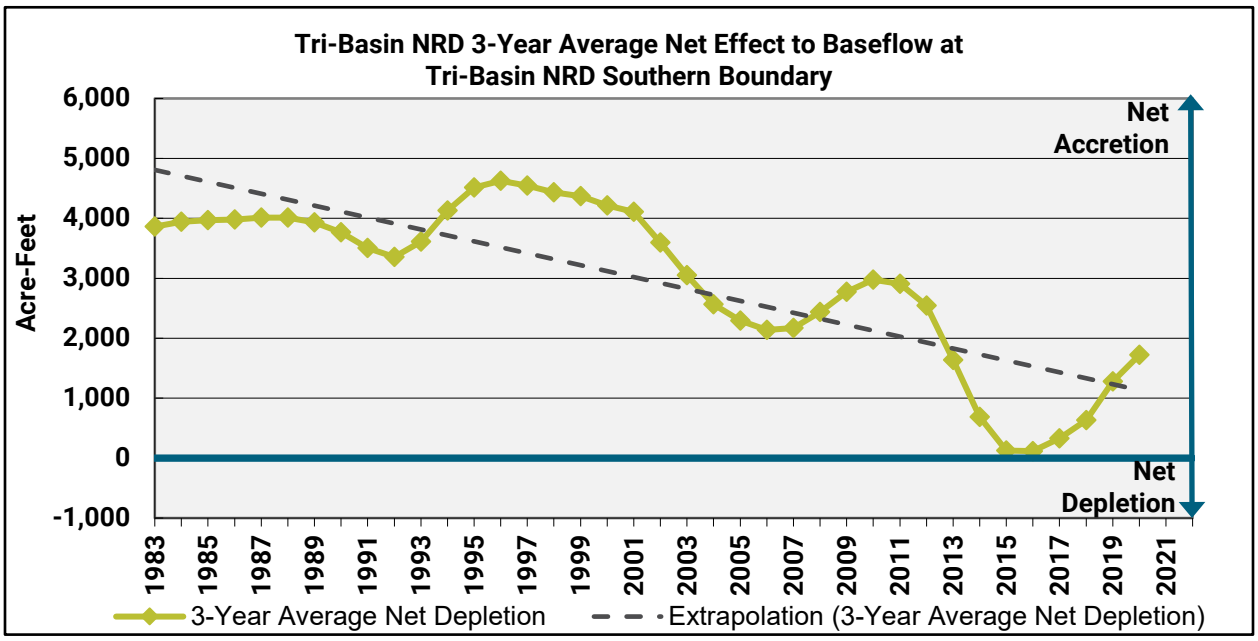

Figure 13. Rolling three-year average net effect to baseflow as the total of modeled values of streamflow depletion and mound accretions, using the August 2020 RRCA Accounting Procedures and the RRCA groundwater model.

MHO B Evaluation

MHO B is evaluated every five years as part of the basin-wide plan's five-year technical review. No MHO B evaluation is required this year.

MHO C Evaluation

MHO C is evaluated every five years as part of the basin-wide plan's five-year technical review. No MHO C evaluation is required this year.

MHO D Evaluation

MHO D Assessment Criteria

MHO D is to continue existing and initiate new actions that reduce the need for special regulations in the Rapid Response Area for Compact compliance.

The basin-wide plan defines the MHO D assessment as follows: during the previous year, has groundwater pumping within the Rapid Response Area of any NRD been curtailed to ensure Compact compliance? This MHO is being achieved if the answer to that question is no for each NRD. The results of this assessment are described in the next subsection.

Note that this assessment only applies to Upper Republican, Middle Republican, and Lower Republican NRDs. The IMPs for those NRDs state that in Compact Call Years, if management actions taken by the NRD are insufficient to ensure compliance, the NRD will implement additional ground water controls and regulations to make up for any expected shortfall, which will include curtailment of groundwater pumping

within the Rapid Response Area (10 Percent/5-Year Area) of the NRD. The purpose of this MHO is to ascertain whether such curtailment occurred.

MHO D Evaluation Results for 2021

MHO D evaluation results are summarized in Table 29. For 2021, MHO D is being achieved for Upper Republican, Middle Republican, and Lower Republican NRDs, as none of the NRDs curtailed pumping within the Rapid Response Area in 2021 to ensure Compact Compliance.

Table 29. Summary of MHO D results for 2021.

Key to Possible Test Results	 MHO is being achieved. NRD did not curtail groundwater pumping within the Rapid Response Area to ensure Compact compliance. No further discussion needed.  MHO is not being achieved. NRD curtailed groundwater pumping within the Rapid Response Area to ensure Compact Compliance. Discussion of next steps is required.		
NRD	**Upper Republican**	**Middle Republican**	**Lower Republican**
NRD's Results for 2021			

MHO E Evaluation

MHO E Assessment Criteria

MHO E is to continue existing and initiate new actions that reduce the need for administration of surface water use for Compact compliance.

The basin-wide plan defines the MHO E assessment as follows: During the previous year, has surface water use within the basin been administered to reduce surface water use to ensure Compact compliance? This MHO is being achieved if the answer to that question is no. The results of this assessment are described in the next subsection.

Note that for the purposes of MHO E, only surface water administration that occurs to fulfill Nebraska's Compact obligations as described in the IMPs for Upper Republican, Middle Republican, and Lower Republican NRDs is included. Surface water administration that is required by the terms of the Final Settlement Stipulation (FSS) is excluded from MHO E. For more information, see "Surface Water Administration for Compact Compliance," page 26.

MHO E Evaluation Results for 2021

MHO E evaluation results are summarized in Table 30. For 2021, MHO E is being achieved, as surface water use within the basin has not been administered for Compact Compliance. For further details, see "Surface Water Administration for Compact Compliance," page 26.

Table 30. Summary of MHO E results for 2021.

Key to Possible Test Results	MHO is being achieved. NeDNR did not administer surface water to ensure Compact compliance, except as required under the Final Settlement Stipulation (FSS). No further discussion needed. MHO is not being achieved. NeDNR administered surface water to ensure Compact Compliance. Discussion of next steps is required.
Results for 2021	

Figure 14. Thunderstorm west of Holdrege, photo courtesy of Tri-Basin NRD.

Attachment D

Republican River Basin Drought Planning Exercise

Andy Pedley | Nebraska Department of Natural Resources

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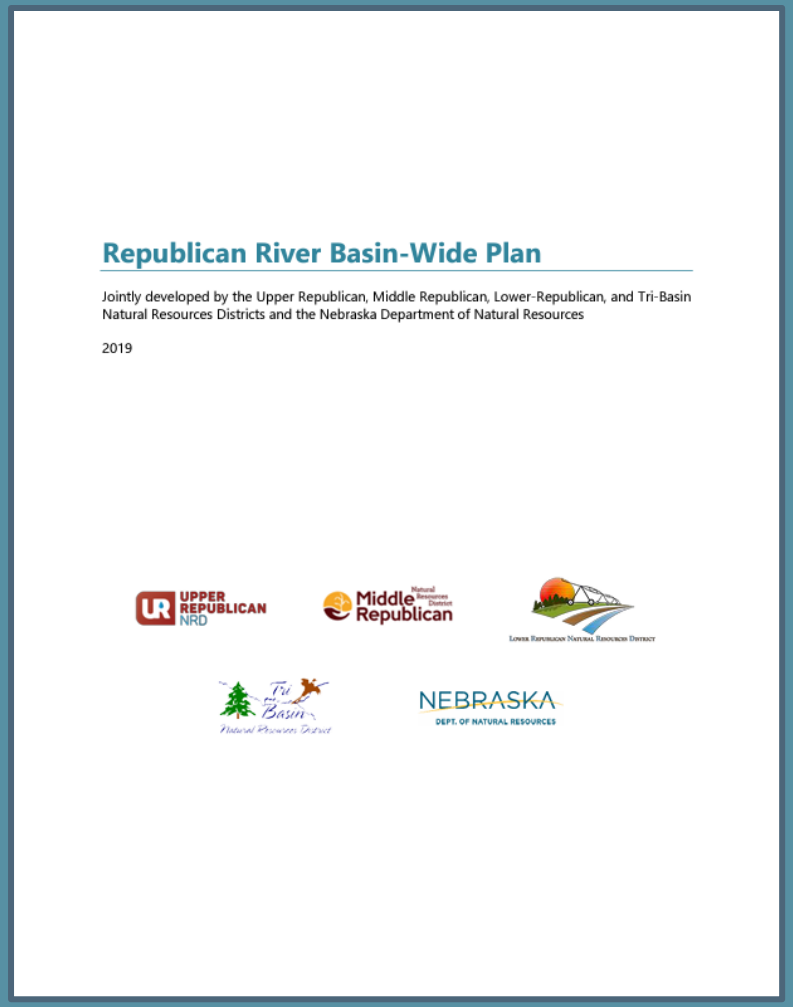
Basin-Wide Plan Action Item 2.8.1

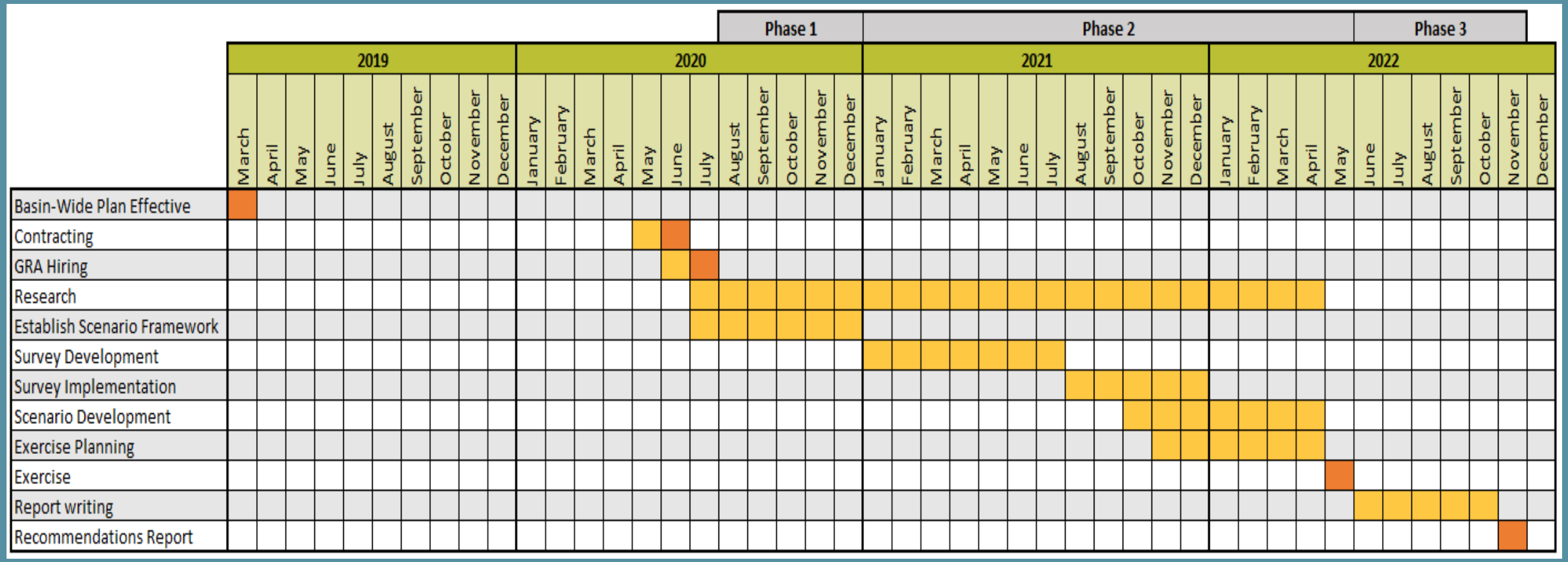


Action Item 2.8.1 Organize and participate in a basin-wide drought planning exercise

NeDNR and the NRDs will organize and participate in a drought planning exercise for the Basin. A drought planning exercise is a workshop or other activity that brings together parties with expertise in various aspects of droughts to plan and prepare for managing drought. Some areas of focus for this exercise will be:

- Increasing understanding of the needs for and logistics of storing water for use during a drought,
- Evaluating existing and potential new management actions to determine the long-term availability trends that provide carry-over storage to meet crop-water needs during drought, and
- Developing metrics that could be used to evaluate whether conservation of water for future use during a drought is successful.

Project Timeline



2020 Exercise Framework

Exercise Type	Description
Workshop	Requires fewer resources, encourages collaboration and coordination among stakeholders, and encourages participation of the general public.
Tabletop	Requires fewer resources, good for education and training, encourages consensus building, collaboration, and coordination among stakeholders, good for plan evaluation and modification.
Game	Moderately expensive to use, encourages collaboration and coordination among stakeholders, and encourages participation of the general public.
Functional	Most expensive to use, good for already existing plans, has limited interaction with experts, more realistic and tense, good for emergency response.

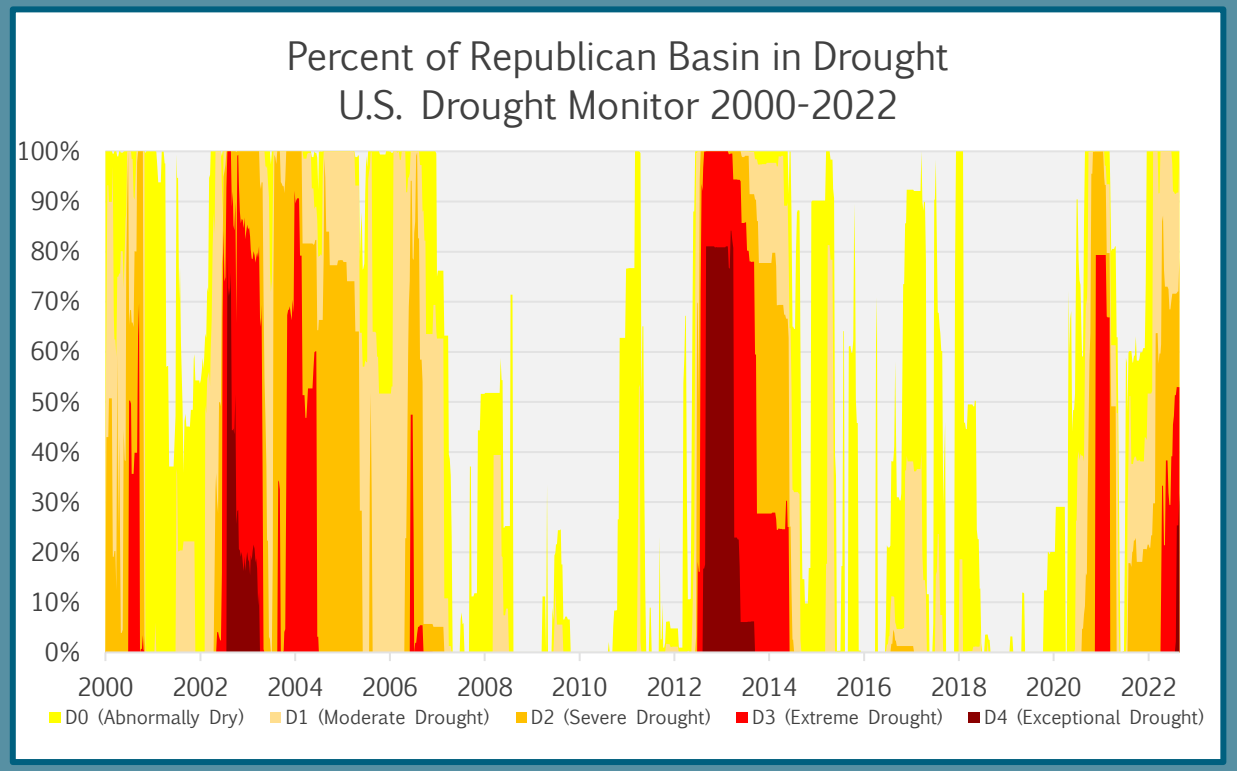
*Chose a hybrid of workshop and tabletop formats.

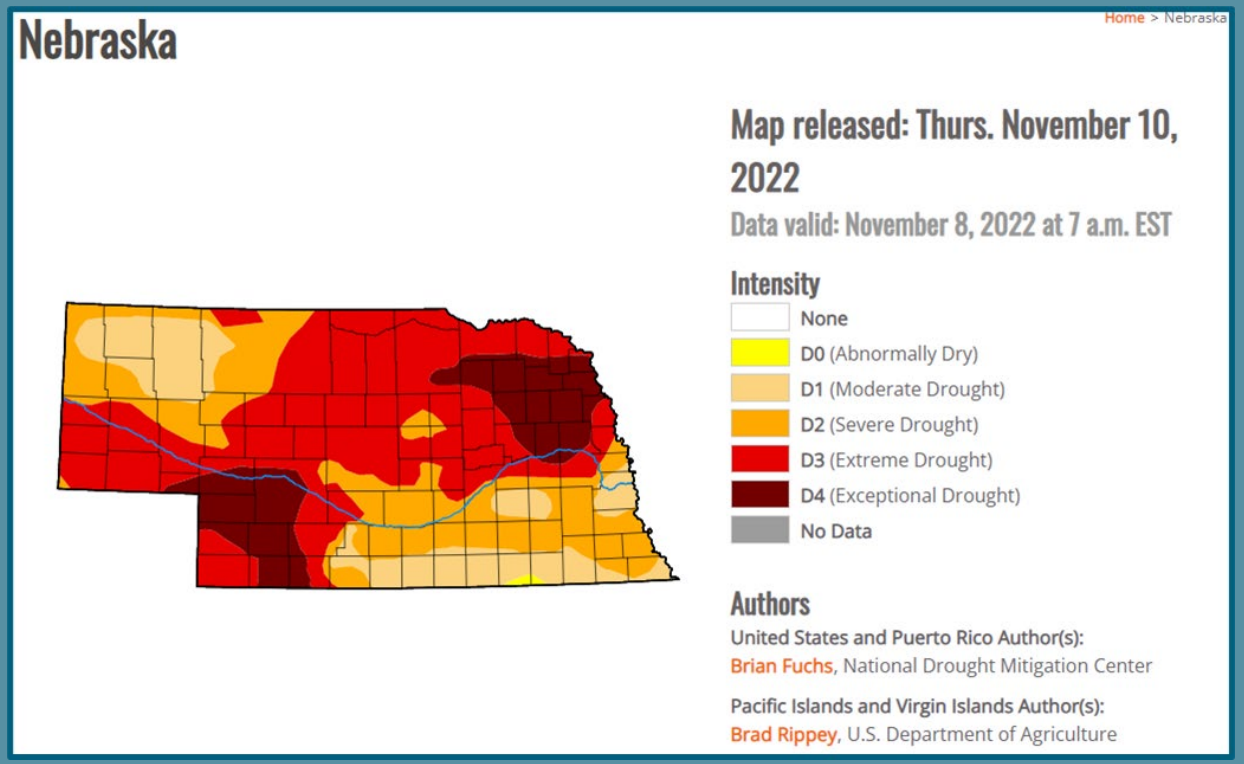
2021 Drought Impacts Research

- In 2021 a Drought Impacts Survey was developed and administered
- Survey results helped to steer the direction of exercise scenarios

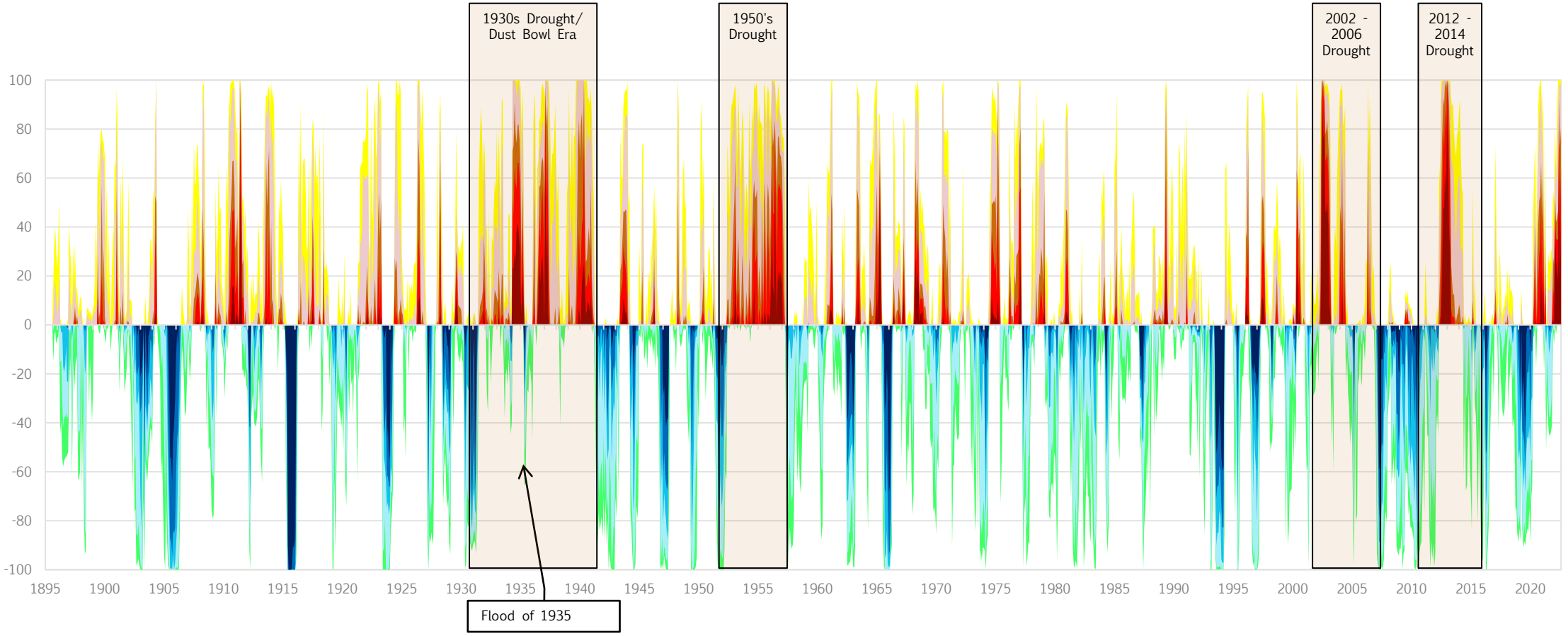
Drought Impacts Category	Drought Impact Areas of Focus
Crop production	Water for irrigation, crop stress, crop disease and reduced crop yield
Livestock production	Reduced grazing, increased mortality, and increased animal stress
Domestic water supply	Water quality issues and low/dry well water level
Public health	Declines in air quality (due to dust, pollen or smoke), stress (mental health issues)
Households	Less water for gardens and increased power bills
Fire	Increased wildfires, property damage and bans on fireworks or controlled burns
Business and industry	Closed businesses and bankruptcy, reduction in production and sales
Recreation and tourism	Reduced water activities, public recreation areas closed and reduced hunting and fishing
Wildlife	Invasive plant and animal species, change in migration, wildlife foraging near people and wildlife disease or mortality

2021 Climate Research

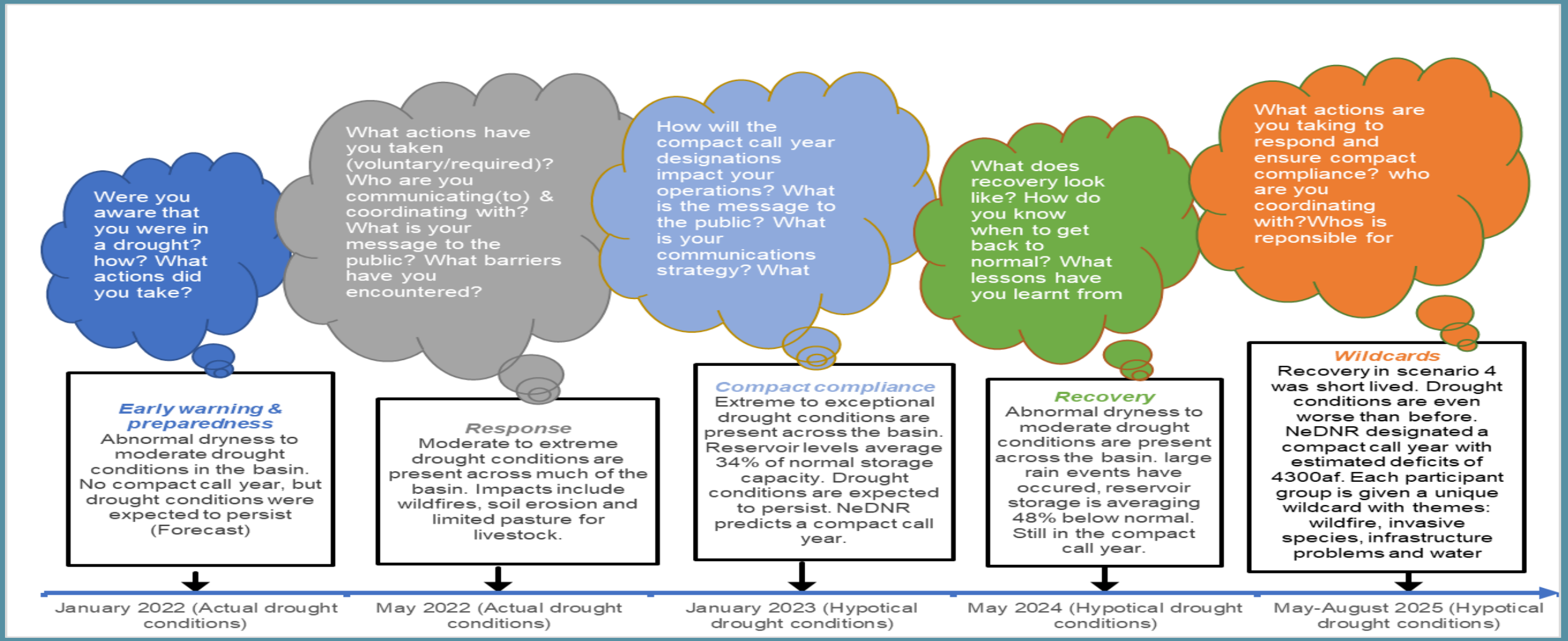




Standard Precipitation Index (SPI)
Republican River Basin 1895-2021

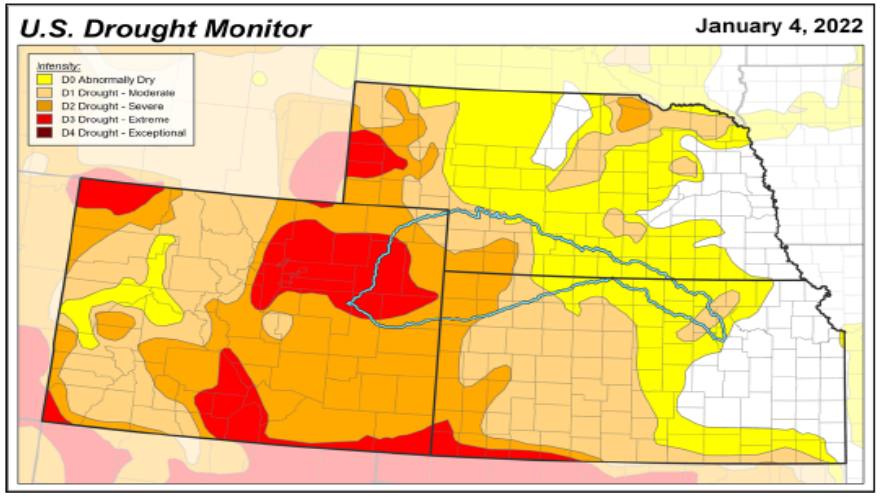


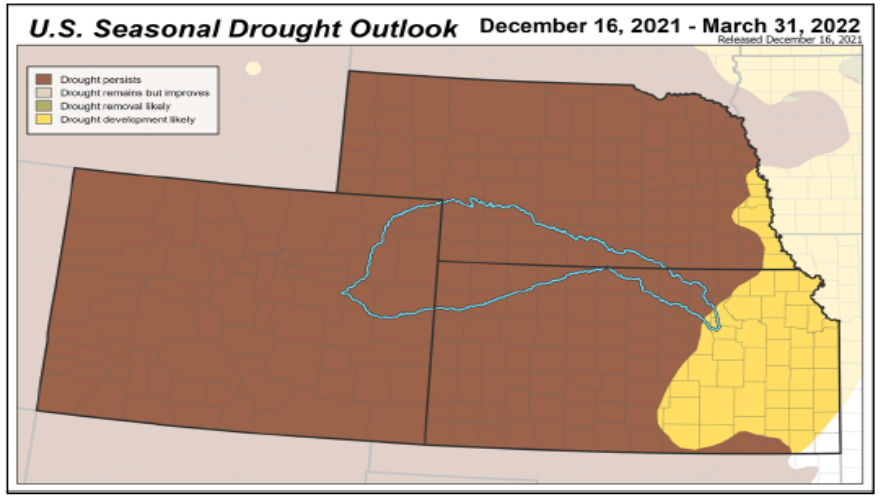
2021 Scenario Development



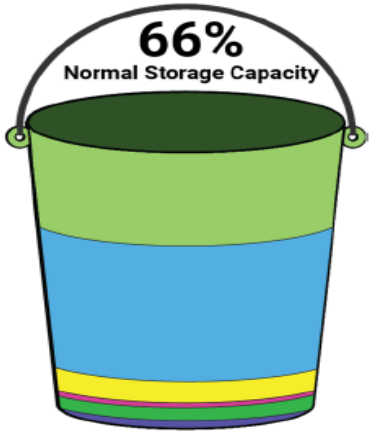
2022 Drought Scenario Exercise

Scenario 1: January 2022





Harlan County Lake Normal Storage: 342,560 AF	82%	Full
Swanson Lake Normal Storage: 112,214 AF	41%	Full
Enders Reservoir Normal Storage: 44,500 AF	18%	Full
Harry Strunk Lake Normal Storage: 37,141 AF	76%	Full
Hugh Butler Lake Normal Storage: 37,776 AF	42%	Full



Federal Reservoir Storage
574,191 AF

Narrative:

Fall of 2021 had record warm temperatures, and by January 2022 areas of the Republican Basin were facing conditions ranging from abnormally dry to extreme drought. The Seasonal Drought Outlook for the early part of 2022 was showed the majority of CO, NE and KS in either persistent drought or with drought expected to develop.

The 2022 Forecast of Allowable Depletions in the Republican River Basin did not indicate that 2022 would be a Compact Call Year and as a result no actions were required for Compact compliance.

2022 Drought Scenario Exercise

Scenario 1: January 2022

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1900-2000 Average	Average Monthly Temp [°F (anomaly)]	24.0	29.1	38.3	50.1	60.5	70.7	76.6	74.5	65.2	53.0	38.0	27.1
	Average Monthly Precip [Inches (anomaly)]	0.46	0.67	1.35	2.24	3.66	3.79	3.26	2.91	2.27	1.42	0.93	0.57
2021	Average Monthly Temp [°F (anomaly)]	30.9 (6.9)	17.2 (-11.9)	45.4 (7.1)	49.5 (-0.6)	60.3 (-0.2)	74.0 (3.3)	75.5 (-1.1)	76.0 (1.5)	29.5 (4.3)	55.0 (2.0)	43.9 (5.9)	**35.7 (8.6)**
	Average Monthly Precip [Inches (anomaly)]	0.79 (0.33)	0.70 (0.03)	6.10 (4.75)	1.34 (-0.90)	5.74 (2.08)	1.61 (-2.18)	3.55 (0.29)	3.82 (0.91)	2.54 (0.27)	1.51 (0.09)	0.30 (-0.63)	0.15 (-.42)

Hottest to Date | Wettest to Date
Top 10% Hottest | Top 10% Wettest
Top 33% Hottest | Top 33%Wettest
Normal | Normal
Top 33% Coldest | Top 33% Driest
Top 10% Coldest | Top 10% Driest
Coldest to Date | Driest to Date

Drought Conditions:

- December 2021 was the warmest December on record (127 years)
- August, September, October and November of 2021 were also relatively warm
- August, September and October was slightly wetter than average
- November and December were drier than average

Impacts:

- What (if any) drought impacts did you see in January of 2022?

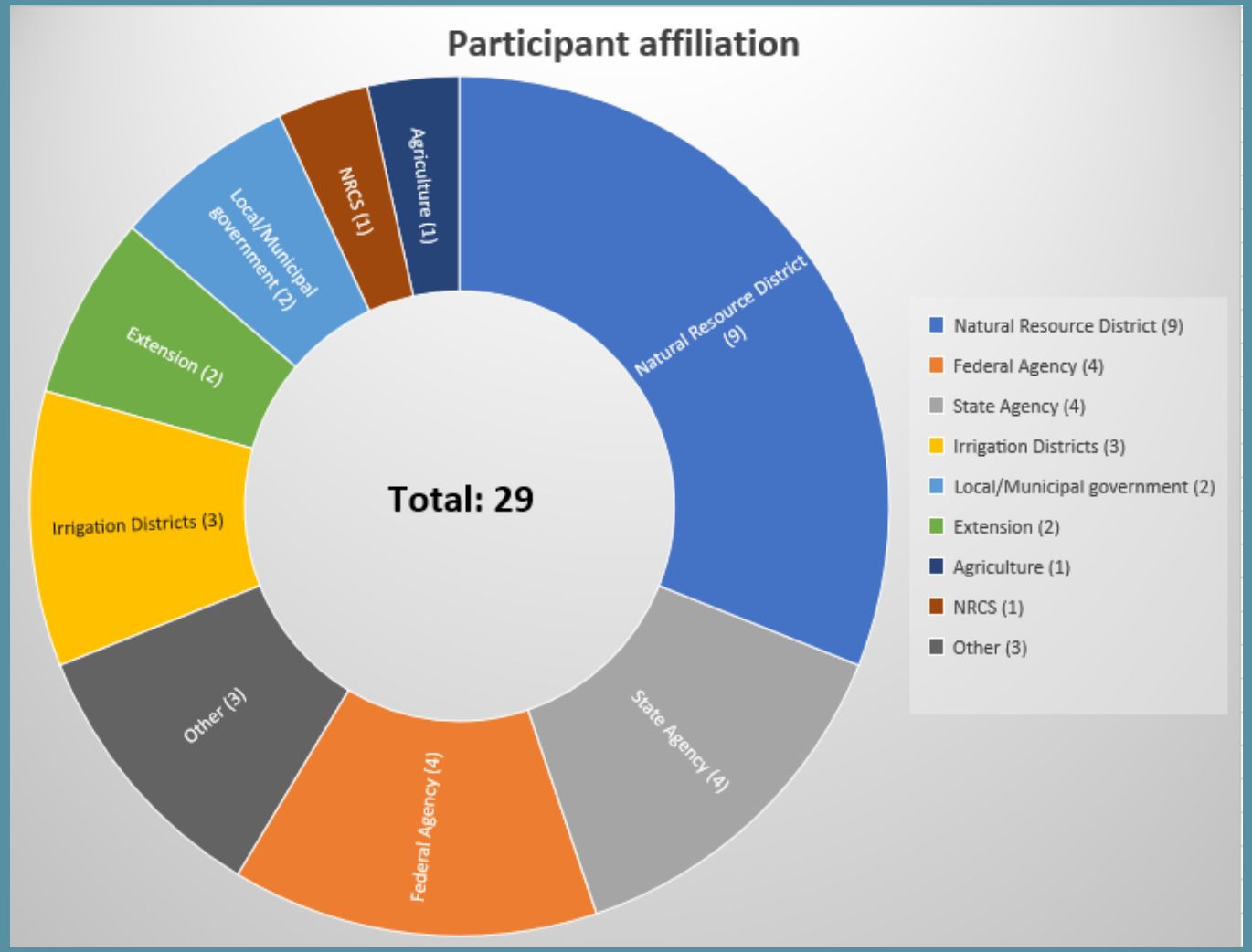
2022 Drought Scenario Exercise (Scenario 5: Wildcards)

- Wildcard #1: Widespread Wildfire
- Wildcard #2: Invasive Species
- Wildcard #3: Infrastructure Problems
- Wildcard #4: Public Water Systems Issues

2022 Exercise Participation

Participants were recruited from the following sectors:

- Republican Basin NRD staff and directors
- Municipal water suppliers
- Farmers and ranchers
- Rural water districts
- Business owners/representatives
- Emergency Management Professionals
- Nebraska Department of Natural Resources staff and director
- Irrigation Districts
- Nebraska Department of Environment and Energy
- US Bureau of Reclamation
- Nebraska Department of Agriculture



2022 Findings, Outcomes and Recommendations

Findings:

- Existing policy (Compact, Basin-Wide Plan, Integrated Management Plans, etc) appears to be adequate for managing water quantity.
- Drought happens. We should plan for it accordingly instead of treating it like a disaster.
- Communication is important.
  - Who needs to be talking to whom?
  - How is information disseminated to the public?

Outcomes:

- Many outcomes yet to be realized
- Started a conversation about Statewide drought planning

Recommendations:

- Proceed with development of a Basin-Wide Drought Plan
  - Cost share funding available through USBR WaterSMART program
  - Will help to improve drought communication in the Basin
  - By using USBR WaterSMART funding, the Basin will be eligible for future grants

Next Steps

- Final project report (December 2022)
- USBR WaterSMART grant application (February 2023)
  - Basin-Wide Drought Contingency Planning
- Basin-Wide Drought Dashboard (ESRI)
  - Drought Impacts Reporting Tool

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THANK YOU

Andy Pedley

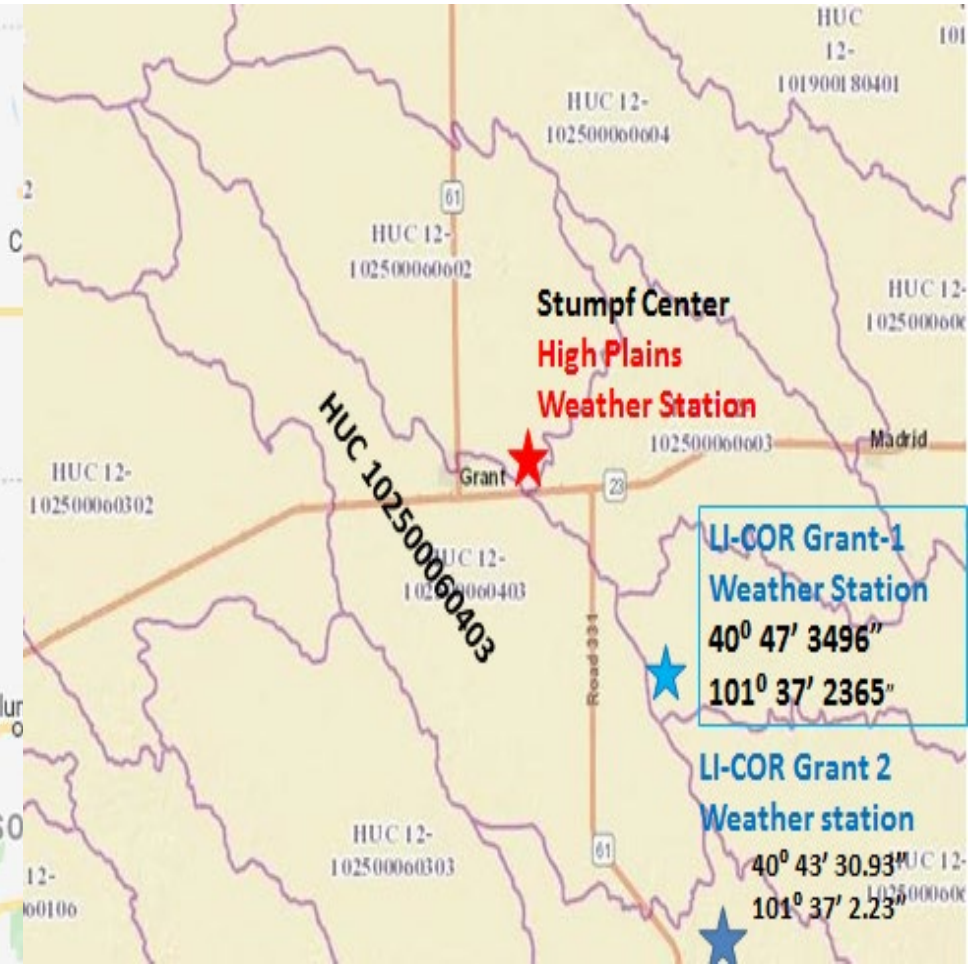
Parallel 41 & HUC 12 Project

Attachment E

Nov 15, 2022 Cambridge

Parallel 41

HUC 12



LI-COR Flux Tower
Grant NE-01

HUC 12 LI-COR Station

Comparing LI-COR Grant 01 to HUC 12 and Fericks Weather Station

LI-Cor Grant 01 compared to the Pessl weather station						10/19/2022
	Grant 01	Grant 01			Pessl	Grant 01 ETc	**Grant 01 ETr**
Month	ETc	ETr	Difference		Fericks ETr	Difference	**Difference**
June	0.137	0.249	0.112		0.000	0.000	**0.000**
July	0.207	0.235	0.029		0.210	0.009	**-0.027**
August	0.162	0.237	0.075		0.220	0.058	**-0.017**
Sepember	0.095	0.248	0.154		0.167	0.073	**-0.416**
Yearly average	**0.150**	**0.242**	**0.092**		**0.199**	**0.047**	**-0.153**

LI-COR HUC 12 compared to the Fericks weather station						10/11/2022
	HUC 12	HUC 12			Pessl	HUC 12 ETc	**HUC 12 ETr**
Month	ETc	ETr	Difference		Fericks ETr	Difference	**Difference**
June		0.000					
July	0.060	0.219	0.042		0.218	0.181	**0.025**
Aug	0.089	0.115	0.167		0.628	0.161	**-0.005**
Sep	0.056	0.245	0.189		0.176	0.120	**-0.069**
Yearly average	**0.069**	**0.193**	**0.133**		**0.341**	**0.154**	**-0.016**

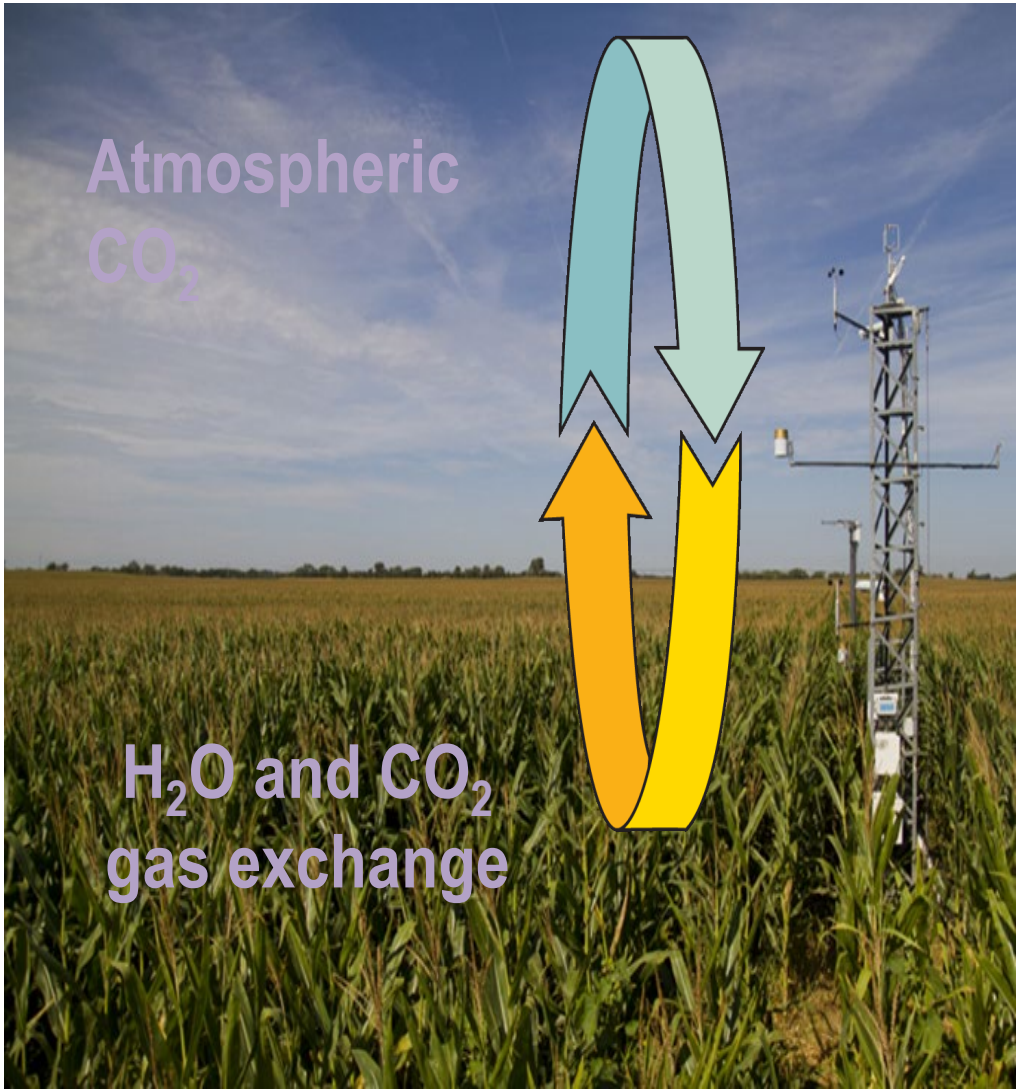
Eddy Covariance and Watershed Vegetative Consumptive Water Use

Eddy Covariance Systems

- An array of sensors that measures various data
  - Net radiation (Net radiometer)
  - Wind speed and direction (3D ultrasonic anemometer)
  - Water vapor and CO_2 (open path CO_2/H_2O analyzer)
  - Soil heat flux plates
  - Other various instrumentation
    - rain gauge, cup anemometer, RH%, pressure

Eddy Covariance Systems: H_20 and CO_2

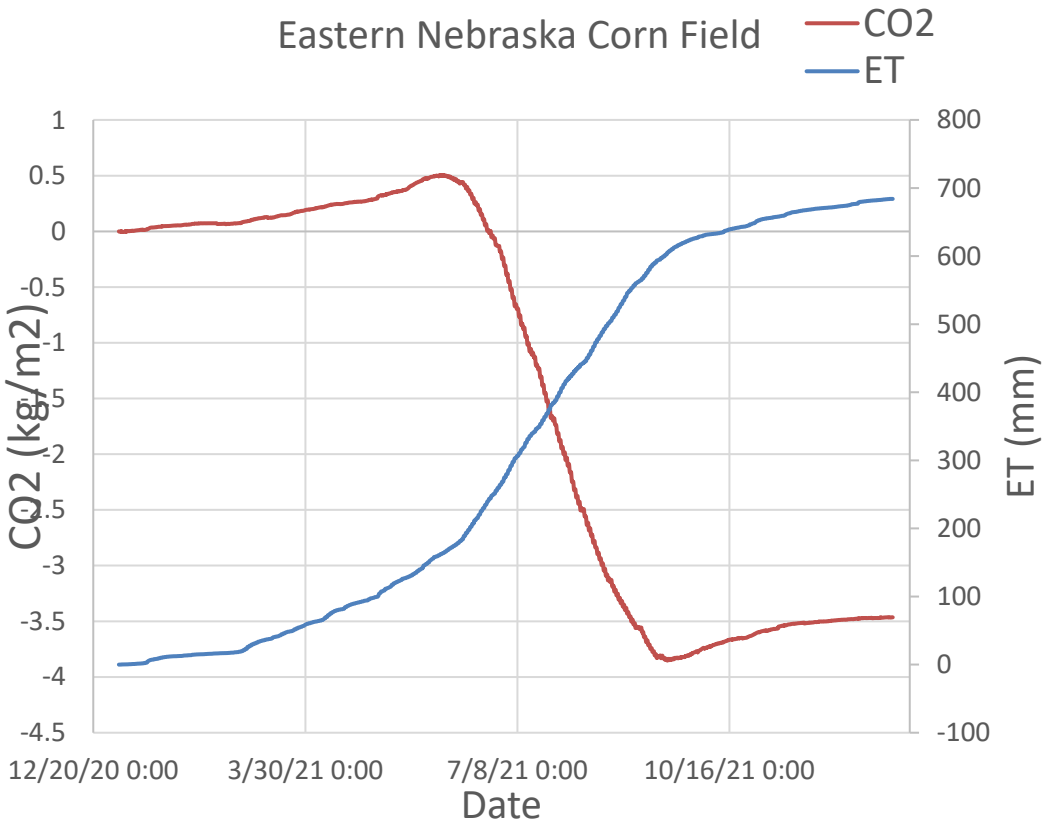
- H_2O and CO_2 measurements
  - Transpiring vegetation will uptake CO_2 and release H_2O
  - Eddy covariance measures the concentration of these gases and the vertical wind speed to determine how much H_2O and CO_2 is moving in/out of and area



Eddy Covariance Systems: H_20 and CO_2

- With eddy covariance systems, the movement of H_2O and CO_2 can be measured continuously, giving us an idea of how much H2O and CO2 is begin transferred to/from the land surface/atmosphere

- ET (evapotranspiration) – evaporation plus transpiration



Eddy Covariance and Watershed Vegetative Consumptive Water Use

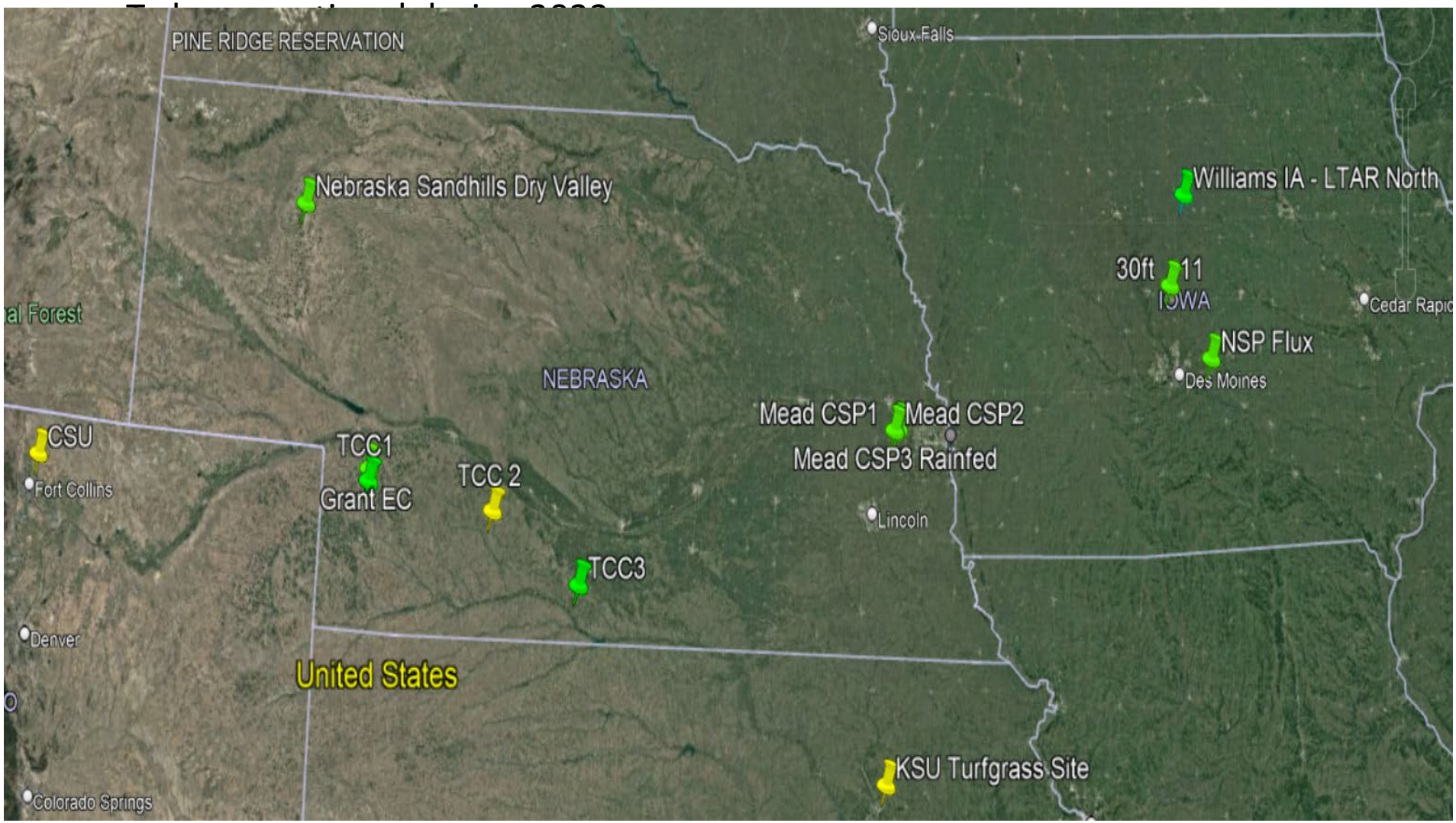
- Eddy covariance systems provide accurate measurement of H_2O and CO_2 exchange at a given location
- Modeling approaches (often utilizing satellite data) can be used to estimate H_2O and CO_2 exchange over large areas
- The measurements from eddy covariance systems can be used to improve accuracy of modeled estimates

Parallel 41 Flux Network Concept

- A network of Eddy Covariance systems to provide real-time energy balance fluxes and gas exchange of different crops and vegetated surfaces, to be used for water balance and crop water productivity estimates in different watersheds and agricultural systems.
- Provide real-time crop actual evapotranspiration for irrigation water management to farmers and water managers
- Use the data for improving the accuracy of spatially distributed satellite-based estimates of evapotranspiration

Parallel 41 Flux Network: Real Time Crop Evapotranspiration

- Installed Eddy Covariance Flux stations with **SmartFlux** and networked with **FluxSuite**: 7 in NE, 3 in IA

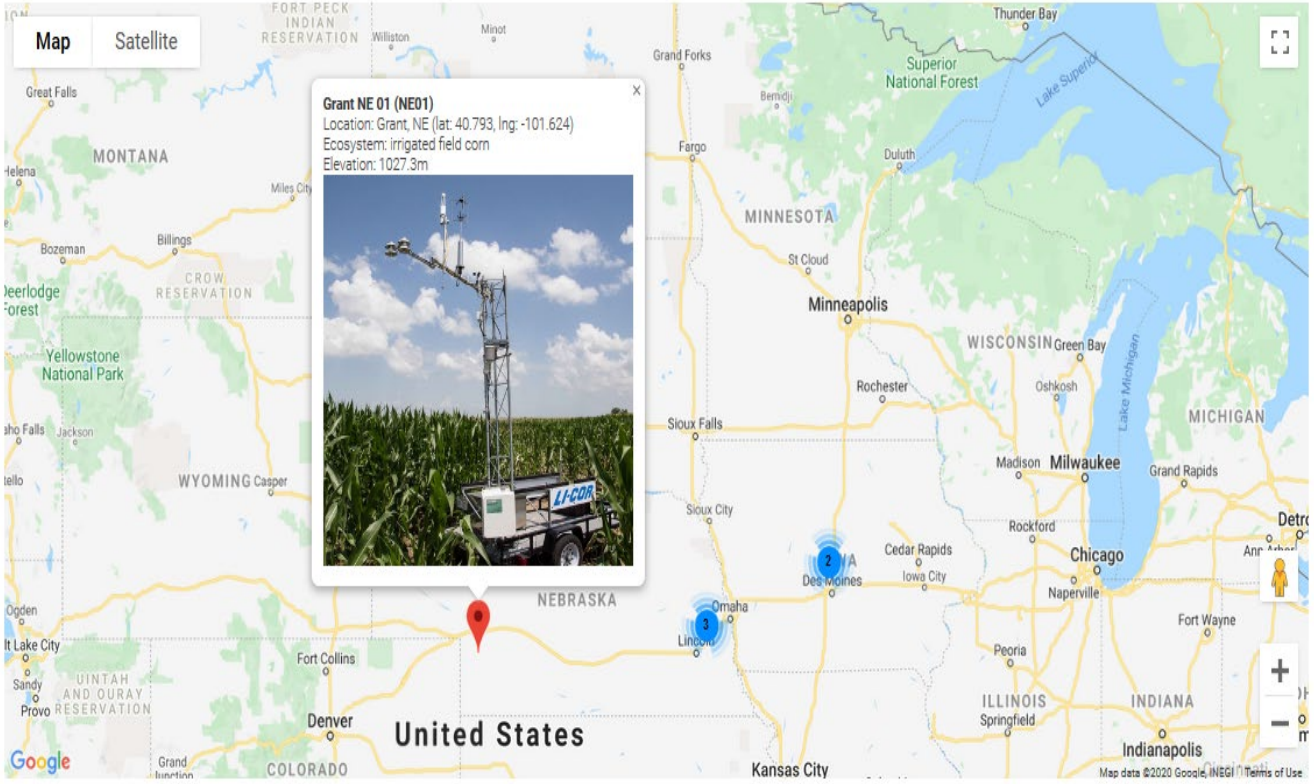


Parallel 41
Flux Network

Home | About | Flux Stations | Producer Dashboard | Resources

Get Started

Pins on the map represent flux station locations. Click a point to view data. Data and graphs will appear below the map.



Grant NE 01

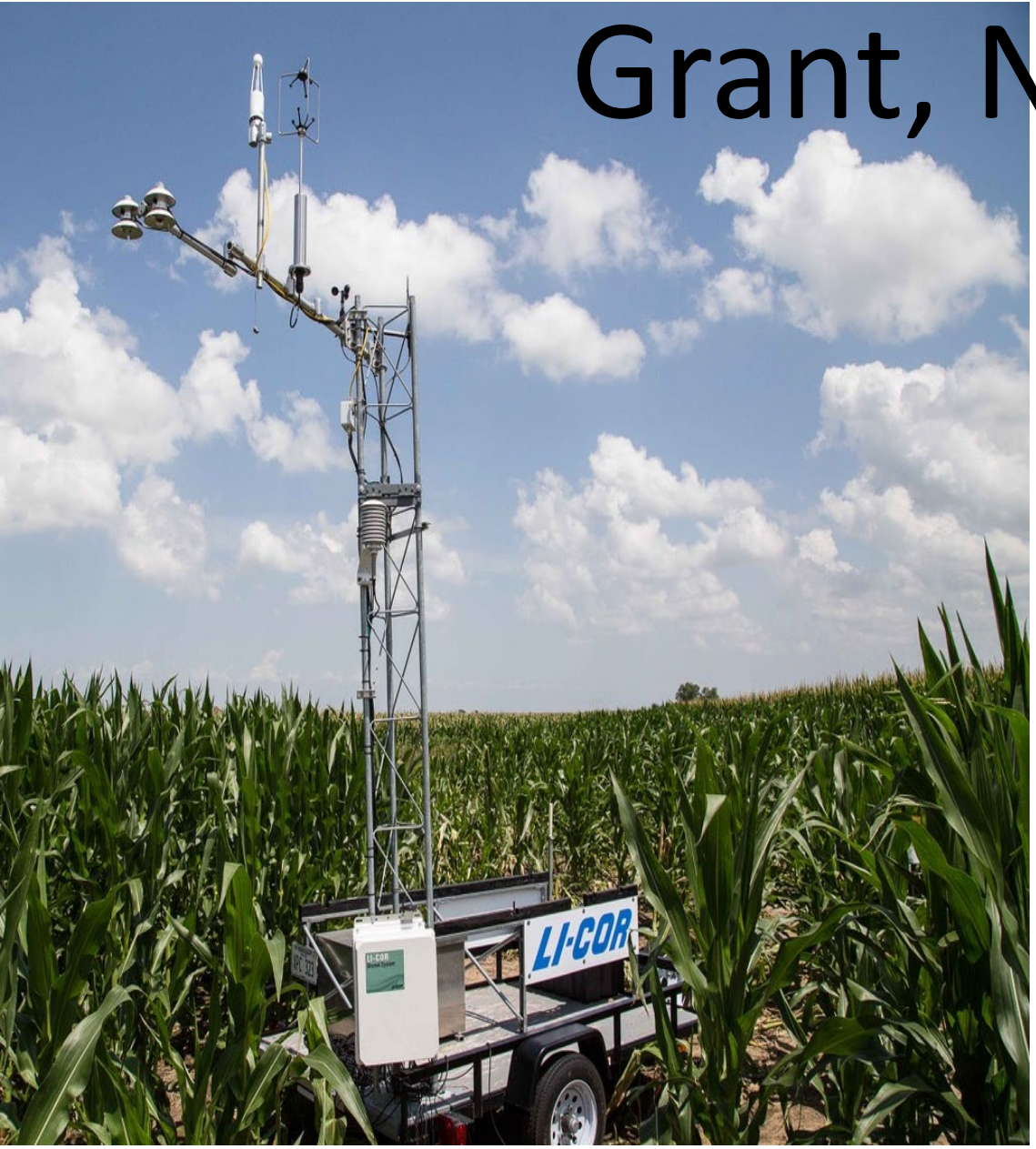
Date	‹ 2019-07-31 ›
ET Units	○ mm ◉ inches
Daily Measured ET (ETc) Value	0.16 inches

ETc of Previous 7 Days	2019-07-25	2019-07-26	2019-07-27	2019-07-28	2019-07-29	2019-07-30	2019-07-31
	0.22	0.23	0.21	0.24	0.24	0.21	0.16

https://parallel41.nebraska.edu/#/


Wind Rose (Grant,NE)
Legend
> 7
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
Grant
N40°47'42"
W101°37'30"
Grant
Road 333
Google Earth
N
2000 ft

Grant, NE



All Stations | Dashboard | Information | Manage Alerts

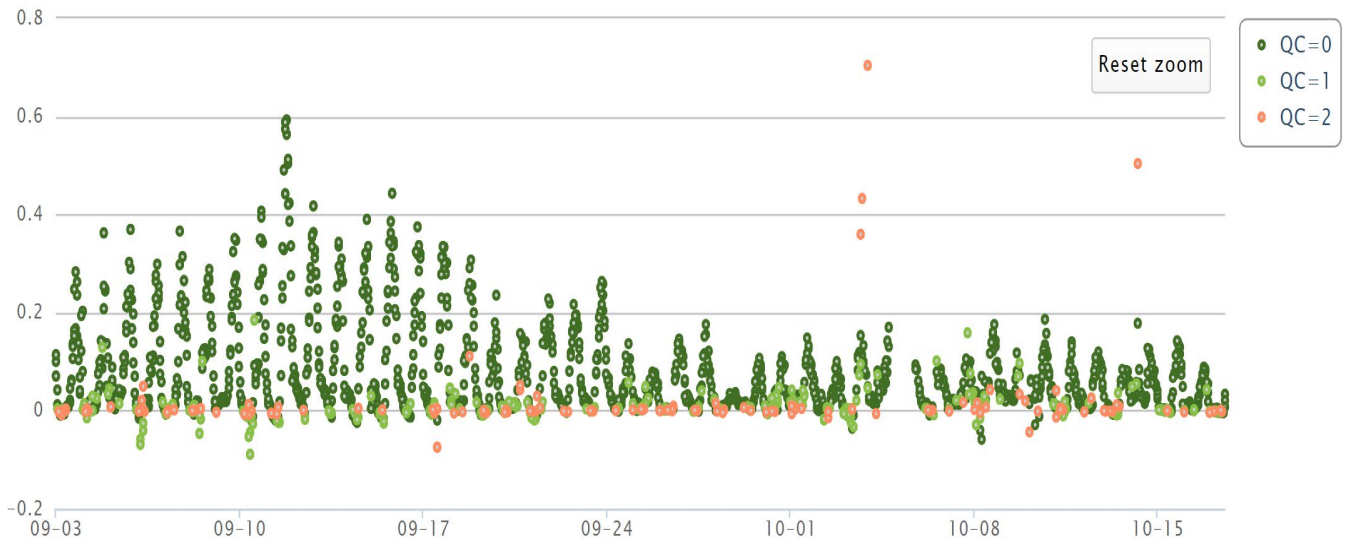
ET (mm)

Field: ET

Start Date: 2018-09-03

End Date: 2018-10-18

QA/QC



ET

LI-COR

Grant NE 01

Date 2021-09-30

ET Units ◉ inches ○ mm

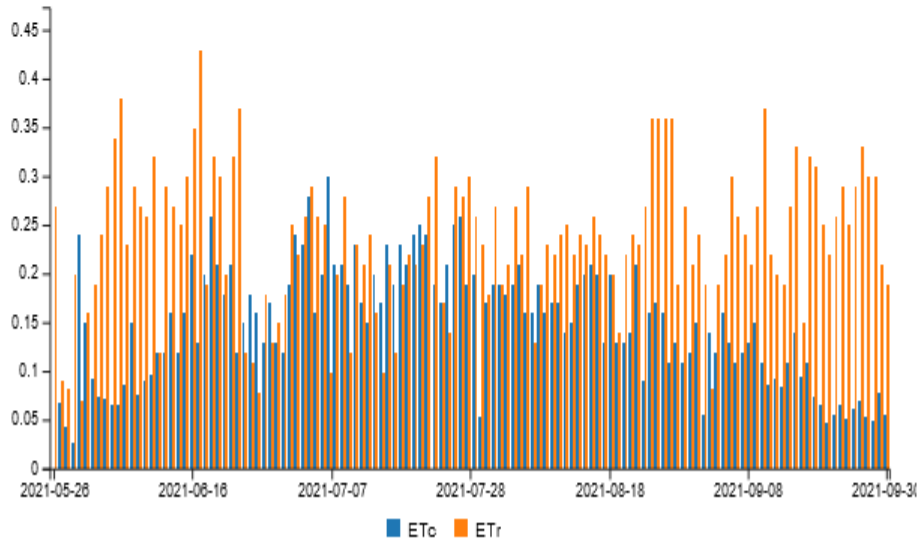
ETc of Previous 7 Days

2021-09-24	2021-09-25	2021-09-26	2021-09-27	2021-09-28	2021-09-29	2021-09-30
0.051	0.063	0.07	0.054	0.05	0.078	0.056

ETr of Previous 7 Days Source: HPRCC

2021-09-24	2021-09-25	2021-09-26	2021-09-27	2021-09-28	2021-09-29	2021-09-30
0.25	0.29	0.33	0.3	0.3	0.21	0.19

Graph of Daily ETc & ETr Values for Date Selected and Previous 128 Days



◉ inches ○ mm

waterforfood.nebraska.edu

HUC 12 #102500060403
33,459 Acres

Irrigated Crop Acres in 2017. 30% Irrigated

Corn	Wheat	Soybeans	Pinto's	Sudan	Sunflowers	Milo	J Millet	Proso	Fallow	Total Acres
6,555	292	2,592	393	195						10,027

Rain Fed (dryland) Crop Acres in 2017. 46.3 % Rain Fed

7,261	2,608	98	913	207	186	530	262	3410	15,475

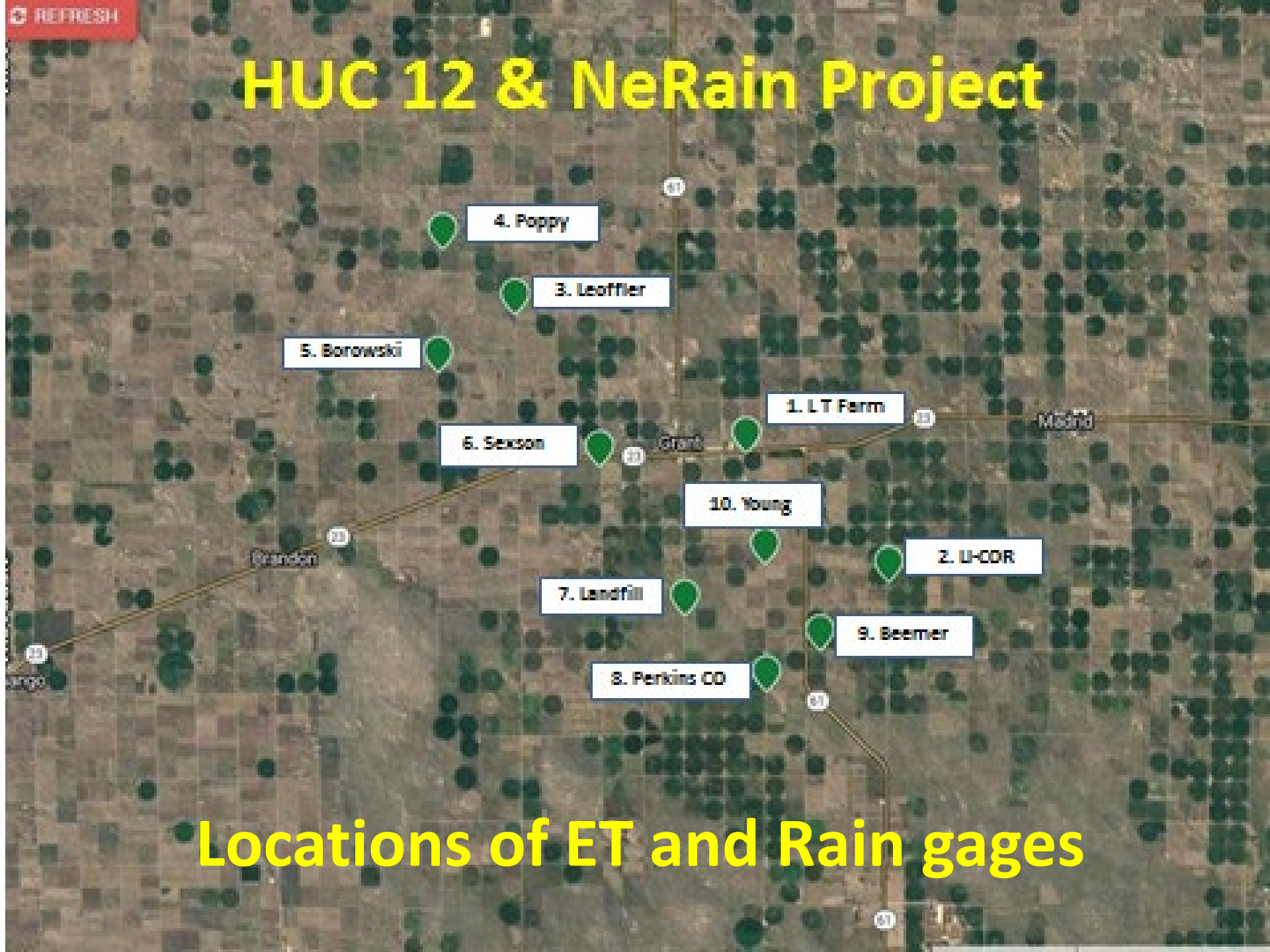
Total tilled crop acres in 2017. 76.2 % Tilled

13,816	2,900	2,690	393	1,108	207	186	530	262	3,410	25,502

Pasture, Grass	CRP,	Shelter Belts,	Buildings/City	Roads/Waste. 15.5 % Pasture	
5,181	452	135	127	572	1,629	7,957

33,459

Total tilled and pasture acres equals 91.7%


REFRESH
HUC 12 & NeRain Project
4. Poppy
3. Leoffler
5. Borowski
1. LT Farm
6. Sexson
Grant
Madrid
10. Young
Brandon
2. LI-CDR
7. Landfill
9. Beemer
8. Perkins CD
Locations of ET and Rain gages

Name# 1 LT Farm

Legal	NE 18-10-38				
NeRain	Perk032				
Revised	10/27/2022				
2021 Monthly summary	Monthly ET Total (inches)	Monthly daily Ave ET (inches)	Yearly total ET (inches)	Monthly rain Total (inches)	Yearly Total Rain (inches)
March	0			2.67	2.67
Arril	0.00	0.000	0.000	2.02	4.69
May	6.10	0.197	6.100	5.68	10.37
June	6.70	0.223	12.800	1.73	12.10
July	4.70	0.152	17.500	0.27	12.37

Name# 2 LI-COR Lampman

Legal	NW 35 10-38				
NeRain	Perk4170				
Revised	10/28/2022				
2021 Monthly summary	Monthly ET Total (inches)	Monthly daily Ave ET (inches)	Yearly total ET (inches)	Monthly rain Total (inches)	Yearly Total Rain (inches)
March	0			2.70	2.70
Arril	0.00	0.000	0.000	1.87	4.57
May	5.40	0.174	5.400	4.20	8.77
June	8.30	0.277	13.700	0.83	9.60
July	8.50	0.274	22.200	0.07	9.67

2021 ET & Rain gage summary

Name	# 3 Hatch 2021		NeRain	Perk4337	
Legal	SW 29-11-39		Revised	10/28/2022	
2021 Monthly summary	Monthly ET Total (inches)	Monthly daily Ave ET (inches)	Yearly total ET (inches)	Monthly rain Total (inches)	Yearly Total Rain (inches)
March	0			3.00	3.00
Arril	0.00	0.000	0.000	1.35	4.35
May	4.40	0.142	4.400	8.90	13.25
June	6.90	0.230	11.300	2.89	16.14
July	5.30	0.171	16.600	0.07	16.21
Aug	9.00	0.290	25.600	0.92	17.13
Sep	**9.50**	**0.317**	**35.100**	**1.68**	**18.81**

2021 ET & Rain gage summary

Name	# 4 Poppe 2021		NeRain	Perk4338	
Legal	SW 24-12-40		Revised	10/28/2022	
2021 Monthly summary	Monthly ET Total (inches)	Monthly daily Ave ET (inches)	Yearly total ET (inches)	Monthly rain Total (inches)	**Yearly Total Rain (inches)**
March	0			3.10	**3.10**
Arril	0.00	0.000	0.000	1.30	**4.40**
May	4.00	0.129	4.000	5.92	**10.32**
June	7.50	0.250	11.500	2.23	**12.55**
July	9.30	0.300	20.800	0.05	**12.60**
Aug	8.30	0.268	29.100	0.61	**13.21**
Sep	**7.20**	**0.240**	**36.300**	**1.69**	**14.90**

Name$ 5 Jessen 2021			NeRain Perk4339			Name# 6 Sexson 2021			NeRain Perk4340		
Legal	SW 36-11-40		Revised	10/28/2022		Legal	NE 16-10-39		Revised	10/29/2022	
2021 Monthly summary	Monthly ET Total (inches)	Monthly daily Ave ET (inches)	Yearly total ET (inches)	Monthly rain Total (inches)	Yearly Total Rain (inches)	2021 Monthly summary	Monthly ET Total (inches)	Monthly daily Ave ET (inches)	Yearly total ET (inches)	Monthly rain Total (inches)	**Yearly Total Rain (inches)**
March	0			3.00	3.00	March	0			2.67	**2.67**
Arril	0.00	0.000	0.000	1.45	4.45	Arril	0.00	0.000	0.000	1.75	**4.42**
May	4.10	0.132	4.100	7.00	11.45	May	2.60	0.084	2.600	5.90	**10.32**
June	9.40	0.313	13.500	4.43	15.88	June	4.40	0.147	7.000	1.92	**12.24**
July	8.30	0.268	21.800	0.16	16.04	July	11.40	0.368	18.400	0.03	**12.27**
Aug	8.70	0.281	30.500	0.86	16.90	Aug	4.30	0.139	22.700	1.37	**13.64**
Sep	**7.60**	**0.253**	**38.100**	**1.99**	**18.89**	**Sep**	**3.90**	**0.130**	**26.600**	**1.24**	**14.88**

Name# 7 Landfill 2021			NeRain	Perk4341			Name# 8 Perkins 2021			NeRain	Perk4348	
Legal	NW 1-9-39		Revised	10/29/2022			Legal	NW 17-9-38		Revised	10/29/2022	
2021 Monthly summary	Monthly ET Total (inches)	Monthly daily Ave ET (inches)	Yearly total ET (inches)	Monthly rain Total (inches)	Yearly Total Rain (inches)		2021 Monthly summary	Monthly ET Total (inches)	Monthly daily Ave ET (inches)	Yearly total ET (inches)	Monthly rain Total (inches)	**Yearly Total Rain (inches)**
March	0			2.65	2.65		March	0			2.70	**2.70**
Arril	0.00	0.000	0.000	1.40	4.05		Arril	0.00	0.000	0.000	1.66	**4.36**
May	5.30	0.171	5.300	5.91	9.96		May	3.30	0.106	3.300	5.62	**9.98**
June	7.40	0.247	12.700	1.41	11.37		June	5.20	0.173	8.500	0.98	**10.96**
July	15.00	0.484	27.700	0.03	11.40		July	6.50	0.210	15.000	0.23	**11.19**
Aug	9.30	0.300	37.000	2.83	14.23		Aug	5.70	0.184	20.700	3.82	**15.01**
Sep	**7.30**	**0.243**	**44.300**	**0.55**	**14.78**		**Sep**	**4.50**	**0.150**	**25.200**	**0.71**	**15.72**

Name# 9 Beemer 2021			NeRain	Perk4348		Name# 10 Young 2021			NeRain	Perk4350	
Legal	NW 9-9-39		Revised	10/29/2022		Legal	SE 33-9-38		Revised	10/29/2022	
2021 Monthly summary	Monthly ET Total (inches)	Monthly daily Ave ET (inches)	Yearly total ET (inches)	Monthly rain Total (inches)	Yearly Total Rain (inches)	2021 Monthly summary	Monthly ET Total (inches)	Monthly daily Ave ET (inches)	Yearly total ET (inches)	Monthly rain Total (inches)	**Yearly Total Rain (inches)**
March	0			2.65	2.65	March	0			2.65	**2.65**
Arril	0.00	0.000	0.000	1.67	4.32	Arril	0.00	0.000	0.000	1.63	**4.28**
May	4.50	0.145	4.500	6.54	10.86	May	5.20	0.168	5.200	6.27	**10.55**
June	9.00	0.300	13.500	1.14	12.00	June	8.80	0.293	14.000	0.92	**11.47**
July	10.20	0.329	23.700	0.12	12.12	July	10.00	0.323	24.000	0.15	**11.62**
Aug	8.60	0.277	32.300	3.16	15.28	Aug	8.70	0.281	32.700	3.39	**15.01**
Sep	**7.20**	**0.240**	**39.500**	**0.87**	**16.15**	**Sep**	**7.70**	**0.257**	**40.400**	**0.64**	**15.65**

Summary of the 10 ET & Rain gages

Revised	10/29/2022	Average for the 10 ET & Rain gages			
2021 Monthly summary	Monthly ET (inches)	Monthly daily Ave ET (inches)	Yearly total ET (inches)	Monthly rain ave (inches)	**Yearly Total Rain (inches)**
March	0.00	0	0	2.78	**2.78**
April	0.00	0	0	1.61	**4.39**
May	4.49	0.145	4.49	6.19	**10.58**
June	7.36	0.245	11.85	1.85	**12.43**
July	8.92	0.288	20.77	0.12	**12.55**
Aug	7.48	0.241	28.25	2.26	**14.81**
Sep	**6.77**	**0.226**	**35.02**	**1.13**	**15.94**

ET and Rainfall summary:			Diff from Average	
Name	**ET**	**Rainfall**	**ET**	**Rainfall**
1. LT Farm	27.1	15.65	- 7.92	-0.29
2. LI-COR	37.6	13.96	+2.58	-1.98
3. Hatch	35.1	18.81	- 0.08	+2.87
4. Poppe	36.3	14.90	+ 1.28	- 1.04
5. Jessen	38.1	18.89	+ 3.08	+2.95
6. Sexson	26.6	14.88	-8.42	-1.06
7. Landfill	44.3	14.78	-9.28	-1.16
8. Perkins	25.2	15.72	-9.82	**-0.22**
9. Beemer	39.5	16.15	+4.48	+0.22
10. Young	40.4	15.65	+5.38	-0.29
Summary	**35.02**	**15.94**		

NEWBA Budget Proposal

4 Davis station upgrades $230 each	= $920
5 All weather rain gauges $41 each	= $205
10 Elec tipping bucket rain gauges $190 each	=$1900
2 Arable weather stations $1800 each	= $3600
Programmer(s) (furnished by DWFI)	?
Repairs and maintenance	= $1000
Travel expense	= $3000
Administration	= $7500
Education and training	= $1000
Total	$19,125

Additional Sources of information about Parallel 41 & HUC 12

Parallel 41.nebaska.edu

nednr.nebraska.gov

www.urnrd.org

>(HUC 12rain gauges)

Attachment F

Meeker-Driftwood Canal SCADA and TCC Modernization Project

Frenchman Cambridge Irrigation District has completed the automation of the Meeker-Driftwood Canal system. This project has modernized 33.7 miles of Meeker-Driftwood Canal and 5.6 miles of Meeker- Driftwood West sub-canal by installing a precision flow management system. The check structures on the canals have been fitted with FlumeGates. These structures are now managed by a central SCADA system that precisely coordinate supplied flows to match demand in the canal. Rubicon's Total Channel Control (TCC) software monitors water delivery by continually writing flow setpoints to each check structure to precisely match all water deliveries, including farm water deliveries, seepage and or groundwater recharge and wasteway spills. The Total Channel Control (TCC) solution utilizes a combination of feed-forward and feed-back control to precisely match downstream water requirements. Reservoir releases can now be made to precisely match the downstream irrigation demand.

On the Meeker-Driftwood main Canal and Driftwood West sub-canal; a total of 51 Flumegates have been installed on 39 check structures, 3 SlipMeters have been installed on two check structures and one Flowlink observation station installed. A total of 8 wasteways are now monitored and during a rain event if water needs to be evacuated from the canal that discharge can be accurately measured and reported. All sites have real-time telemetry that utilizes a 200 Mhz Radio network that constantly updates a central SCADA system.

2021 was a challenging year with Covid-19 and supply chain issues, however, Frenchman Cambridge had nearly 80% of the project completed in 2021. All of the construction and modifications to the check structures was completed in 2021. We experienced delays with some of the radio components so the TCC tuning did not occur until the 2022 irrigation Season.

With the completion of the Meeker-Driftwood Canal SCADA and TCC Modernization Project, Frenchman Cambridge Irrigation District now has two Canal systems and part of the Bartley Canal below our recently built pump station automated. In Total 83% of our 45,669 acres are now under TCC control.

Attachment G

Republican Basin: Compact Call Year Decision Timeline

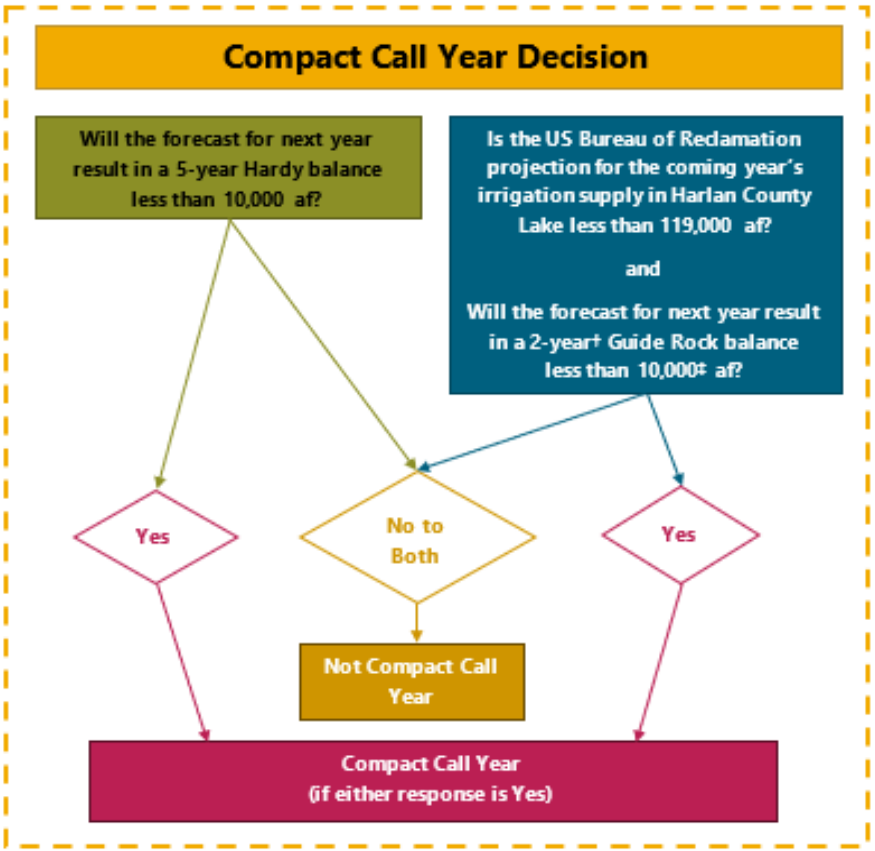


Figure 1. Compact Call Year Decision

What is a Compact Call Year?

A Compact Call Year (CCY) is a year in which Nebraska Department of Natural Resources' (NeDNR) analysis indicates Nebraska may not be in compliance with the Republican River Compact (Compact) unless additional management actions are taken. Forecast procedures are in the *Monitoring & Studies Technical Memorandum for the URNRD, MRNRD, and LRNRD IMPs* (*Memorandum*). The CCY process decision-making procedure is illustrated in the figure to the left.

In a CCY, Nebraska must take additional action to meet its Compact obligations by reducing consumption or generating additional streamflow. This occurs through regulatory or non-regulatory actions; possible groundwater management actions are outlined in the NRDs' Integrated Management Plans (IMPs). For groundwater, the NRDs may need to establish more restrictive, temporary allocations and curtail groundwater pumping in the Basin. For surface water, NeDNR may need to regulate and administer surface water in the Basin.

What is a Forecast?

A forecast is the calculation of the maximum amount of water that may be available from streamflow for beneficial use in the short-term and long-term, while maintaining compact compliance. NeDNR follows the procedures in the *Memorandum* and determines the forecast for the 5-year balance at Hardy and the 2-year balance at Guide Rock.

What is a Water-Short Year?

A Water-Short Year is a year in which the projected or actual irrigation water supply in Harlan County Lake is less than 119,000 acre-feet. This projection is calculated by the US Bureau of Reclamation (Bureau) using methodology described in the *Harlan County Lake Operation Consensus Plan*, one of the documents approved by the US Supreme Court for management of the Republican River Basin. The final Water-Short Year calculation is done in July, using data collected from January through June of that year. The Bureau provides the three Compact states (Colorado, Kansas, and Nebraska) with monthly updates of the projected or actual irrigation supply from Harlan County Lake.

Republican Basin: Compact Call Year Decision Timeline

How does NeDNR use the forecast and Water-Short Year determination to decide if the following year will be a Compact Call Year?

The Compact Call Year decision process is depicted in Figure 1 and the procedures are in the *Memorandum*. Information NeDNR uses to make the decision includes:

- The 5-year forecast for the balance at Hardy, calculated by NeDNR (green box in Figure 1)
- Water-Short Year determination from the Bureau (top of blue box in Figure 1)
- The 2-year forecast for the balance at Guide Rock, calculated by NeDNR (bottom of blue box in Figure 1)

A Compact Call Year will be triggered if:

1. The 5-year forecast for the balance at Hardy is less than 10,000 acre-feet, **AND/OR**
2. There is a Water-Short Year **AND** the 2-year† forecast for the balance at Guide Rock is less than 10,000‡ acre-feet. [†If it is beneficial to use the Alternative Water-Short Year Plan provisions from the Final Settlement Stipulation (i.e., if the previous two years have a greater balance than the last year alone), and if an Alternative Water-Short Year Plan has been approved by the RRCA, then substitute "3-year" for "2-year" in the Guide Rock test. ‡In the second consecutive Compact Call Year, the 10,000 acre-feet threshold for the Guide Rock test will be reduced to 5,000 acre-feet. For the third and subsequent consecutive Compact Call Years, this value will be reduced to zero.]

What happens if there is a Compact Call Year?

1. **December:** NeDNR notifies the NRDs in writing that the following year will be a Compact Call Year and notifies the NRDs how much yield from potential management actions may be needed within the CCY.
2. **January:** The NRDs notify NeDNR in writing about planned management actions to ensure Compact compliance.
3. **January:** NeDNR issues orders to implement surface water controls.
4. **late February or early March:** NeDNR provides a written assessment of the NRDs' planned management actions. If NeDNR determines that proposed management actions are insufficient to ensure compliance with the Compact, the IMPs, or the Republican River Basin-Wide Plan, the NRDs will implement additional controls to make up the remaining deficit.
5. **April:** NeDNR notifies Colorado, Kansas, and relevant federal agencies in writing about preliminary management actions and the anticipated water yield.
6. **May:** NeDNR provides preliminary accounting estimates to the NRDs, Kansas, Colorado, and the Bureau (this occurs monthly from May through December).
7. **June:** NeDNR notifies Colorado, Kansas, and relevant federal agencies in writing about management actions taken and to be taken, and the anticipated water yield.
8. **June 30:** Bureau finalizes Water-Short Year designation.
9. **Prior to October 1:** Nebraska and Kansas review accounting; Kansas can request remaining Compact compliance volume (RCCV).
10. **September-October**: NeDNR notifies the NRDs in writing about the assessment of NRD management actions and identifies specific additional management actions that are required by each NRD.

If you have questions about the Compact Call Year process, please contact Sam Capps, NeDNR, at 402-471-0376.