

## **2019 Forecast of Allowable Depletions in the Republican River Basin**

*Nebraska Department of Natural Resources  
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### **Background**

The State of Nebraska is party to an interstate compact for the management of the Republican River Basin with the states of Colorado and Kansas, administered by the Republican River Compact Administration (RRCA). Pursuant to the current integrated management plans (IMPs) and Neb. Rev. Stat. § 46-715(6), the Nebraska Department of Natural Resources (NeDNR) in consultation with the Lower Republican Natural Resources District, Middle Republican Natural Resources District, and Upper Republican Natural Resources District (Districts) is required to provide an annual short-term and long-term forecast of maximum allowable depletions to streamflow that will ensure compliance with interstate compacts. The NeDNR has determined that the short-term forecast applies to the upcoming year (2019) and that the long-term forecast estimates what conditions may be ten years into the future. Therefore, this document includes the dry-year forecast of allowable depletions to streamflow in 2019 and 2029.

The States of Nebraska, Colorado, and Kansas, acting through the RRCA, adopted a “*Resolution Approving Long-Term Agreements Related to the Operation of Harlan County Lake for Compact Call Years*” (Resolution). The August 24, 2016, Resolution outlines certain actions that Nebraska will take toward Compact compliance during years forecast as Compact Call Years as outlined in the Monitoring sections of the District Integrated Management Plans. Compliance with the terms of the Resolution constitutes compliance with the Final Settlement Stipulation and Compact.

### **Short-Term Forecast**

The outcome of Nebraska’s short-term forecast is largely dependent on three key elements, much of which are from data secured through the RRCA Compact accounting procedures. These three elements are detailed in the following sections.

#### **1. Applicable compliance tests for 2019**

The first key element of the short-term forecast is the identification of the averaging period that will be utilized for assessing compliance for the upcoming year. The compliance tests use five-year averaging upstream of Hardy in every year and may include an additional test based on two-year averaging upstream of Guide Rock. The averaging period and applicable accounting points are determined based on projections of the total irrigation water supplies available to the Nebraska Bostwick Irrigation District and Kansas Bostwick Irrigation District pursuant to the Resolution. The current projection is that 2019 will require the use of five-year averaging to measure Nebraska’s Compact compliance upstream of Hardy, but that the additional test of two-year averaging upstream of Guide Rock will not apply.

## 2. Previous year balances

The second key element in the short-term forecast is an evaluation of the recent Republican River Compact accounting balances for the State of Nebraska as determined using the current Republican River Compact Administration (RRCA) accounting procedures. These procedures allow for the determination of Nebraska’s Compact balance for years through the current year (2018). Nebraska’s Compact balances through 2017 have been approved and finalized by the RRCA. The 2018 balances are provisional. The information used to estimate the 2018 Compact balances are presented in Table 1. Nebraska’s 2015 and 2016 RRCA-approved balances upstream of Hardy and Nebraska’s 2017 RRCA-approved balances and 2018 provisional balances upstream of Guide Rock and Hardy are presented in Table 2.

Table 1. Information Used (acre-feet) for 2018 provisional Accounting.

Item	Information Source
Groundwater Use	2017 Pumping records
Surface Water Use	Estimated from preliminary data and previous years values
Stream Flow	Provisional records, end-of-year estimated
Evaporation	T-1 and provisional, end-of-year estimated records

Table 2. Nebraska’s 2015, 2016, and 2017 RRCA-approved balances and 2018 provisional balances upstream of Guide Rock and Hardy, as applicable to the forecast.

Year	RRCA Status	Upstream of Guide Rock Balance	Upstream of Hardy Balance
2015	Approved	-	16,500
2016	Approved	-	23,600
2017	Approved	29,200	35,800
2018	Nebraska Provisional	-15,400	600
2017-2018 Balance		13,900	-
2015-2018 Balance		-	76,500

Note: Values are rounded to the nearest one hundred acre-feet. 2018 values are preliminary and have not been approved by the RRCA.

## 3. Forecast of available water supplies and consumption for 2019

The third key element is the forecast of available water supplies and consumption within Nebraska for the upcoming year. To carry out this forecast, NeDNR uses a simplified method of estimating the streamflow-related available water supply of the Republican River Basin for Nebraska’s use. The water supply is related to eight variables:

- Surface water consumptive use in Colorado,

- Surface water consumptive use in Kansas,
- Surface water consumptive use in Nebraska,
- Groundwater consumptive use in Colorado,
- Groundwater consumptive use in Kansas,
- Groundwater consumptive use in Nebraska,
- Nebraska’s Imported Water Supply Credit, and
- Surface water flow at the Kansas – Nebraska state line.

These eight variables may be estimated for the next year:

- Surface water consumption in Colorado is estimated using a two-year average,
- Surface water consumption in Kansas is related to the water available for irrigation in Harlan County Lake at the end of each year,
- Surface water consumption in Nebraska is related to water available for irrigation in the five Bureau of Reclamation project reservoirs in Nebraska at the start of each year,
- Groundwater consumption and the Imported Water Supply Credit are estimated in all three states using a two-year average, and
- Streamflow is estimated assuming that the upcoming year is a dry year and is based on the volume of water in Harlan County Lake and the most recent five years of streamflow.

Historically, Nebraska’s share of the available water supply has been approximately half of the total water supply calculated using these methods. The information used to estimate the 2018 Compact balance as well as forecast of the available water supply and allowable depletions for 2019 are summarized in Table 3.

Table 3. Information Used (acre-feet) for 2019 Forecast of Allowable Depletions.

Year	Item	Information Source
2019 Forecast	Groundwater Consumptive Use and Imported Water Supply Credit	Average of 2017 and 2018
	Surface Water Consumptive Use	Colorado: Previous two-year average
		Kansas: + (.1858 x HCL content) + 9,575
		Nebraska: - (0.0000004) x (NE lake volume) <sup>2</sup> + (0.5151) x (NE lake volume) - 41,518
Stream Flow	+ (5-year average of state line flows) x 0.41 + 0.23 x HCL content - 27,450	

Utilizing the data sources outlined in Table 3, the required components of the forecast can be calculated (Table 4).

Table 4. 2019 Forecast values in acre-feet, where GWCBCU is defined as groundwater computed beneficial consumptive use and SWCBCU is defined as surface water computed beneficial consumptive use.

Forecast Component	Forecast Value Upstream of Guide Rock	Forecast Value Upstream of Hardy
Colorado GWCBCU	32,720	32,720
Kansas GWCBCU	23,280	23,280
Nebraska GWCBCU	203,040	205,570
Nebraska Imported Water Supply Credit	21,670	21,670
Colorado SWCBCU	760	760
Kansas SWCBCU	56,300	56,300
Nebraska SWCBCU	94,180	95,220
Streamflows	72,810	88,290

The 2019 Compact balances – of allocations (available water supply), computed beneficial consumptive use (CBCU, groundwater and surface water consumption), and Imported Water Supply Credit – are calculated from the forecast procedures contained in the Monitoring and Studies Section of the IMPs (Table 5).

Table 5. Forecast 2019 Allocations (available water supply), Computed Beneficial Consumptive Use (CBCU, groundwater and surface water consumption), Imported Water Supply Credit, and Compact Balances for Guide Rock and Hardy in acre-feet.

Year	Allocation	Computed Beneficial Consumptive Use	Imported Water Supply Credit	Allocation - CBCU + IWS Credit (Balance)
2019 Forecast upstream of Guide Rock	241,500	297,200	21,700	-34,000
2019 Forecast upstream of Hardy	251,100	300,800	21,700	-28,100

Note: Values are rounded to the nearest one hundred acre-feet.

Combining the results from the three key elements (applicable compliance test for 2019, previous years' balances, and forecast of available water supplies and consumption for 2019), Nebraska's 2015-2019 five-year total balance upstream of Hardy is forecast to be positive, and the additional two-year averaging test upstream of Guide Rock will not be applicable (Table 6).

Table 6. 2015-2017 approved Compact balance total upstream of Hardy, 2018 provisional balances upstream of Guide Rock and Hardy, and 2019 forecast balances upstream of Guide Rock and Hardy in acre-feet.

Year	Upstream of Guide Rock Balance	Upstream of Hardy Balance
2015-2017 total, approved	-	75,900
2018, provisional	-15,400	600
2019, forecast	-34,000	-28,100
Two-year (2018-2019) Total	-49,400 (N/A)	-
Five-year (2015-2019) Total	-	48,400

Note: Values are rounded to the nearest one hundred acre-feet. 2018 values are preliminary and have not been approved by the RRCA.

### Compact Call Year Evaluation

The Monitoring sections of the District IMPs specifies the process that will be completed by NeDNR to determine Compact Call Years. The process is completed in a flowchart/checklist manner until a determination of whether or not the following year will be a Compact Call Year is made. Based on review of the checklist, a Compact Call Year designation for the basin upstream of Hardy is determined for 2019. Although Nebraska will not be required to meet the additional two-year averaging test for the basin upstream of Guide Rock, conditions fail to pass the Early Warning System for Water-Short Year Compliance as outlined in the IMPs.

### Resolution provisions for Compact Call Years

Nebraska's 2018 Compact compliance required meeting both the five-year averaging test upstream of Hardy and the two-year averaging test upstream of Guide Rock. As illustrated in Table 2, the balances for both tests are positive, so no additional Remaining Compact Compliance Volume (RCCV) will be accrued from 2018; therefore, RCCV remains at the current value of -9,300 acre-feet.

Pursuant to the RRCA Resolution, Nebraska is to make good faith efforts to ensure that by June 1, 2019, the Kansas Account (in Harlan County Lake) contains sufficient water supplies to meet the terms of the Resolution. Representatives from Kansas did not request additional RCCV water supplies to be available for the Kansas Account prior to June 1, 2019; however, subject to the terms of the Resolution, Kansas may request that any RCCV be made available in the Kansas Account following October 1, 2019.

### Summary of the Short-Term Forecast for 2019

Nebraska's 2019 compliance will be measured by the five-year average upstream of Hardy, as well as, the ability to make good faith efforts towards supplying RCCV after October 1, 2019, should it be requested by Kansas. Since Nebraska's 2015-2019 five-year average upstream of Hardy is projected to be positive, District obligations for 2019 are forecast to only include the current levels of RCCV as illustrated in Table 7.

Table 7. Remaining Compact Compliance Volume obligation for each District within the Basin in acre-feet.

Year	LRNRD	MRNRD	URNRD
Total Remaining Compact Compliance Volume	-4,100	-4,600	-600

Note: Values are rounded to the nearest one hundred acre-feet.

Due to the Compact Call Year designation for 2019, the IMPs between each of the Districts and NeDNR require that each District within the basin that has a projected obligation submit a plan outlining their proposed management actions to NeDNR by January 31, 2019. The plan must describe the actions they will take to ensure compliance with the IMP, which includes providing the RCCV obligation should Kansas request it in 2019. If NeDNR determines that a District’s management actions are insufficient, then that District will be required to curtail all groundwater uses in the Ten Percent in Five Year Area.

If Districts choose to use augmentation pumping as their management action, then sufficient augmentation capacity will be demonstrated by the Districts to ensure Compact compliance in 2019.

NeDNR will issue an order designating 2019 as a Compact Call Year and, should it be necessary, carry out administration of natural flow and storage surface water appropriations within the basin. The Department will coordinate with the Districts to provide updated water supply projections throughout 2019 and inform the Districts if Kansas requests RCCV in the Fall of 2019.

**Long-Term Forecast**

Due to the absence of a long-term trend in water supply, the lowest water supply in the future is likely to be similar to the lowest available supply in the past. Historically, the lowest water supplies that have been available to Nebraska were approximately 200,000 acre-feet. Therefore, the maximum amount of water that may be available from streamflow for beneficial use ten years in the future (2029), assuming several consecutive dry years, is estimated to be approximately 200,000 acre-feet. In an effort to continue to ensure long-term Compact compliance through future dry years, the Compliance Standards in the Integrated Management Plans outline objectives to maintain groundwater depletions at a relatively constant level over the long-term. The NeDNR and Districts will continue to evaluate the trends in long-term groundwater depletions over typical wet and dry cycles (approximately 12 years) and jointly assess if additional management actions are necessary to accomplish this objective.