

Net Impacts Analysis for the Republican River Basin

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Purpose

This report contains NeDNR’s analysis of the net impacts of augmentation pumping for the Nebraska Cooperative Republican Platte Enhancement project (N-CORPE) and Rock Creek Augmentation project. NeDNR’s net impacts analysis fulfills 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.” All 2021 data are provisional at the time of this report.

Methods

As part of implementation of each augmentation project, the project operators (i.e., an NRD or an interlocal cooperative agreement consisting of multiple NRDs, as described below for each project) purchased land that had previously been used for irrigation, including the groundwater rights for that land. This evaluation provides the most recent estimate of the difference in depletions from the historical operation of each augmentation project and depletions from a simulated continuation of irrigation pumping on the purchased land.

Augmentation projects are evaluated for their affect to streamflow quantity in two ways: the increasing streamflow through direct addition of pumped groundwater, and the impacts to baseflows (groundwater discharge to the stream) from changes in groundwater pumping, with the sum of these being the net streamflow impacts. The amount of direct groundwater addition to streamflow is metered by the NRDs and reported to NeDNR. The impacts to baseflow are determined by comparing model-estimated impacts from two simulations:

- The historical simulation that includes all augmentation pumping but ceases irrigation operations once the project was initiated, and
- An estimated irrigation simulation where an estimation of net irrigation pumping for lands purchased through the development of the augmentation project is included and augmentation pumping from the beginning of the project through 2021 is excluded. “Net irrigation pumping” in

this simulation refers to estimated irrigation pumping and the associated estimated change in recharge.

The difference between the scenarios is that for the period after the augmentation projects were initiated, the historical scenario uses actual augmentation pumping data, whereas the comparison simulation estimates the irrigation that would have occurred had the project lands continued to be used for irrigation.

Simulations were carried out using the RRCA groundwater model. All 2021 data are provisional.

Analyses

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. The N-CORPE augmentation project was operational each year from its first year through 2017 to offset depletions for Compact compliance; 2018 and 2019 operations were for maintenance purposes; and 2020 and 2021 operations primarily utilized the project's north pipeline to the Platte River for part of Twin Platte NRD's integrated management plan requirements. Cumulative augmentation for the N-CORPE project is shown in Figure 1. The difference between modeled CBCU (depletions) from N-CORPE augmentation pumping and modeled CBCU from estimated net irrigation pumping on the N-CORPE purchased acres, had those acres been used for irrigation, is shown in Figure 2.

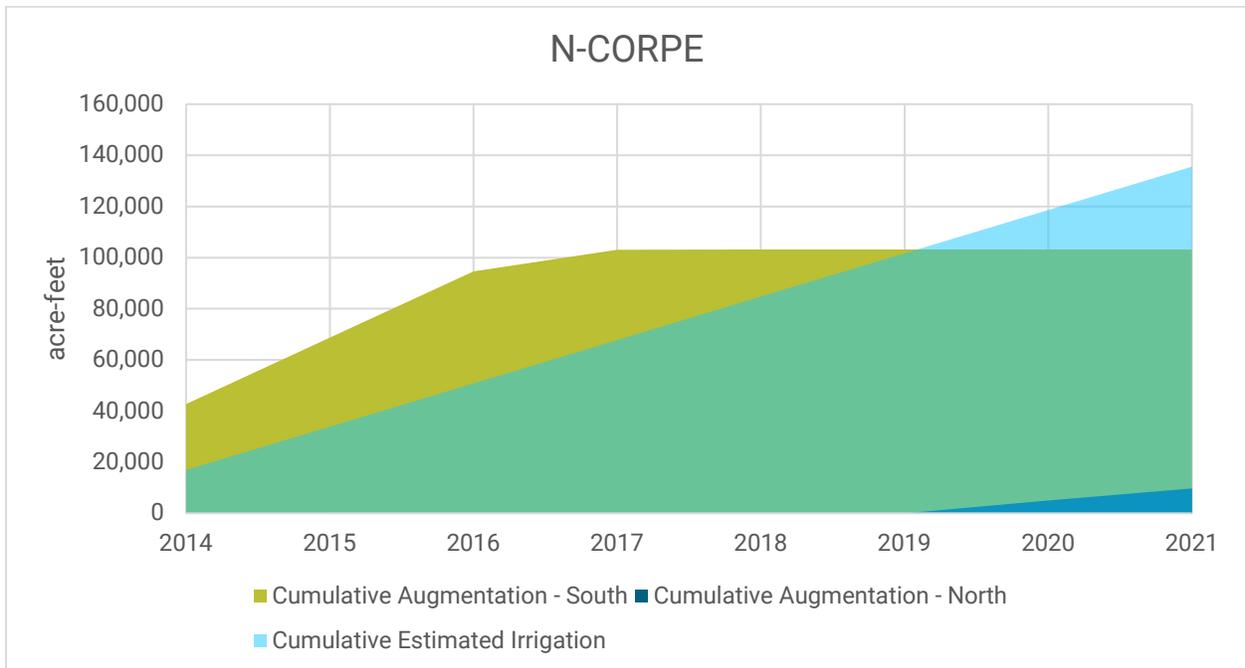


Figure 1: Cumulative water use for augmentation and estimated irrigation pumping on acres purchased under the N-CORPE Augmentation Project.

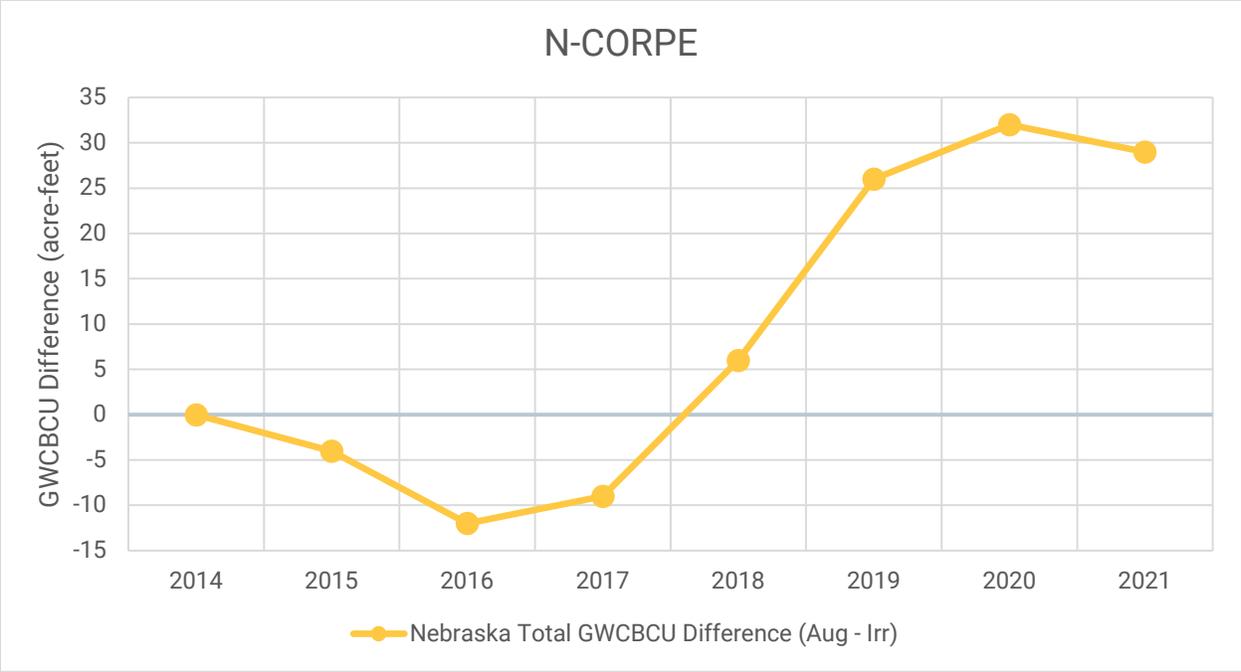


Figure 2: The difference between modeled CBCU (depletions) from N-CORPE Augmentation pumping and modeled CBCU from estimated net irrigation pumping on the N-CORPE purchased acres had those acres been used for irrigation. In this figure, a positive groundwater CBCU (GWBCU) difference indicates that modeled depletions from augmentation were greater than modeled CBCU from estimated net irrigation pumping.

The evaluation of net depletive effects considers both the difference in depletions between the augmentation and estimated irrigation scenarios, described above, and the amount of streamflow added through augmentation. Net depletive effects from 2014–2019 operation were offset by augmentation pumping, so no additional offsets were needed for those years. Based on current projections, 2020 and 2021 net depletive effects may not be fully offset by augmentation pumping (Figure 3). An analysis of potentially negatively impacted downstream surface water users and the additional mitigation activities N-CORPE has already enacted should be initiated. “Additional mitigation activities” refers to offsets other than currently represented augmentation pumping and the cessation of irrigation on N-CORPE lands, since these two mitigation activities are already accounted for in the evaluation of net depletive effects depicted in Figure 3.

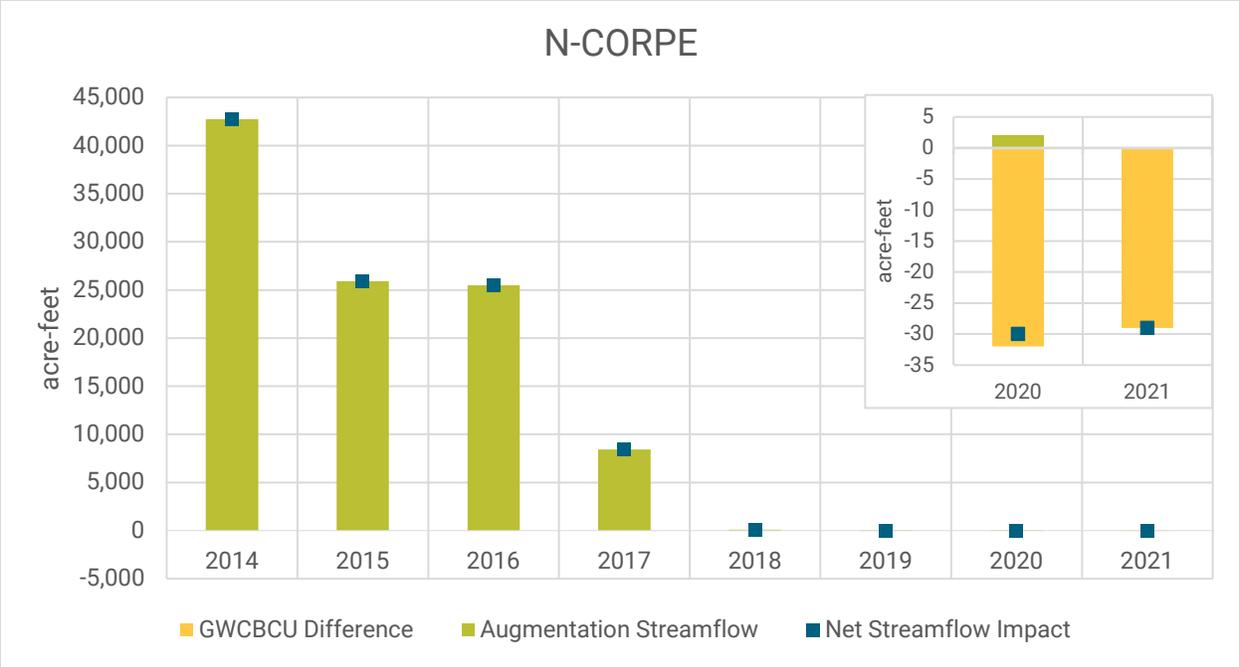


Figure 3: The net impacts to streamflow from the N-CORPE Augmentation Project. 2021 data are provisional as of this report. An inset is included to show a closeup of 2020–2021. In this figure, a positive value indicates a net increase in streamflow due to N-CORPE operations, and a negative value indicates net depletions to streamflow. Because of this, the GWBCU Difference values in this chart are represented as the inverse of the GWBCU values in Figure 2. The Net Streamflow Impact is the sum of GWBCU Difference and Augmentation Streamflow.

An additional analysis was completed to determine the groundwater impacts to streamflow from the 2020 and 2021 N-CORPE pumping for delivery to the Upper Platte Basin separately from previous years' pumping toward Republican Basin water supply. Due primarily to the distance of the N-CORPE wells to Republican streams, there is a time lag between groundwater pumping from the N-CORPE wells and impacts to Republican streams. This resulted in no impact to Republican Basin streamflow of 2020 and 2021 N-CORPE pumping for delivery to the Upper Platte Basin. In other words, all depletive impacts in 2020 and 2021 were due to previous years' augmentation pumping. We will continue this additional scenario in future years as there may be lagged impacts of the 2020 and 2021 Upper Platte augmentation pumping.

Rock Creek Augmentation Project

The Rock Creek augmentation project is operated by Upper Republican NRD. The Rock Creek augmentation project was operational each year from 2013 through 2017 to offset depletions for Compact compliance, and through 2021 for maintenance purposes. Cumulative augmentation for the Rock Creek project is shown in Figure 5, along with a cumulative estimation of irrigation pumping had the Rock Creek purchased acres continued to be used for augmentation. The difference between modeled CBCU (depletions) from Rock Creek augmentation pumping and modeled CBCU from estimated net irrigation pumping on the Rock Creek purchased acres, had those acres been used for irrigation, is shown in Figure 6.

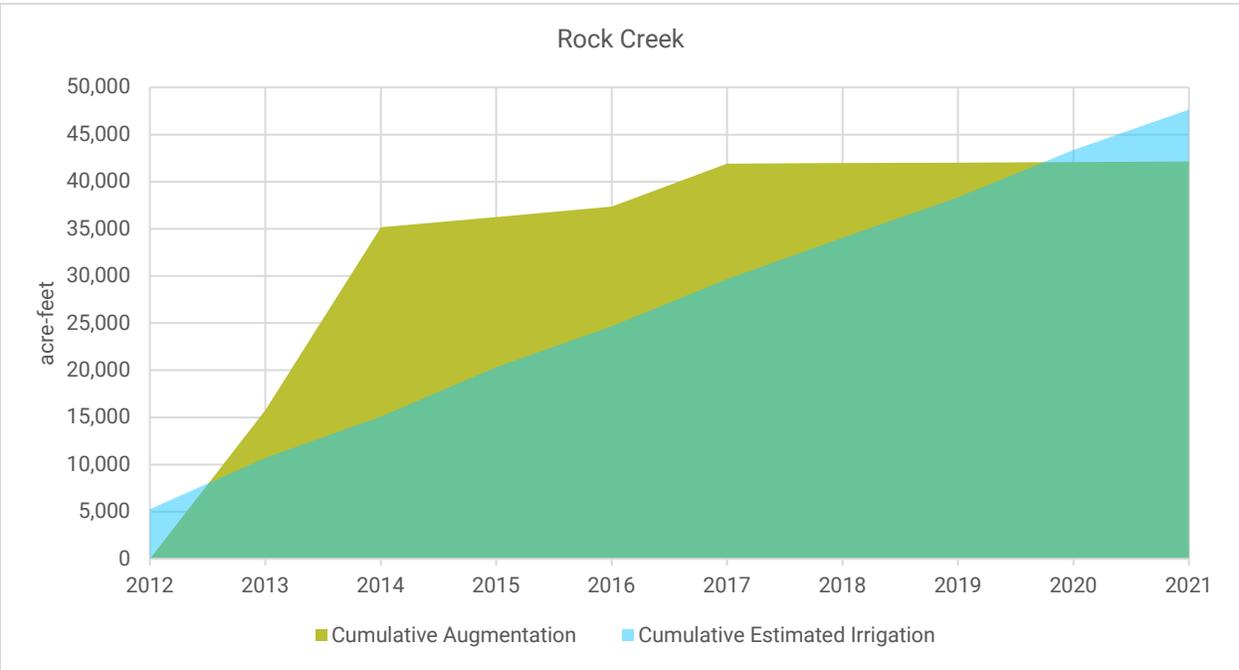


Figure 4: Cumulative water use for augmentation and estimated irrigation pumping on acres purchased under the Rock Creek Augmentation Project.

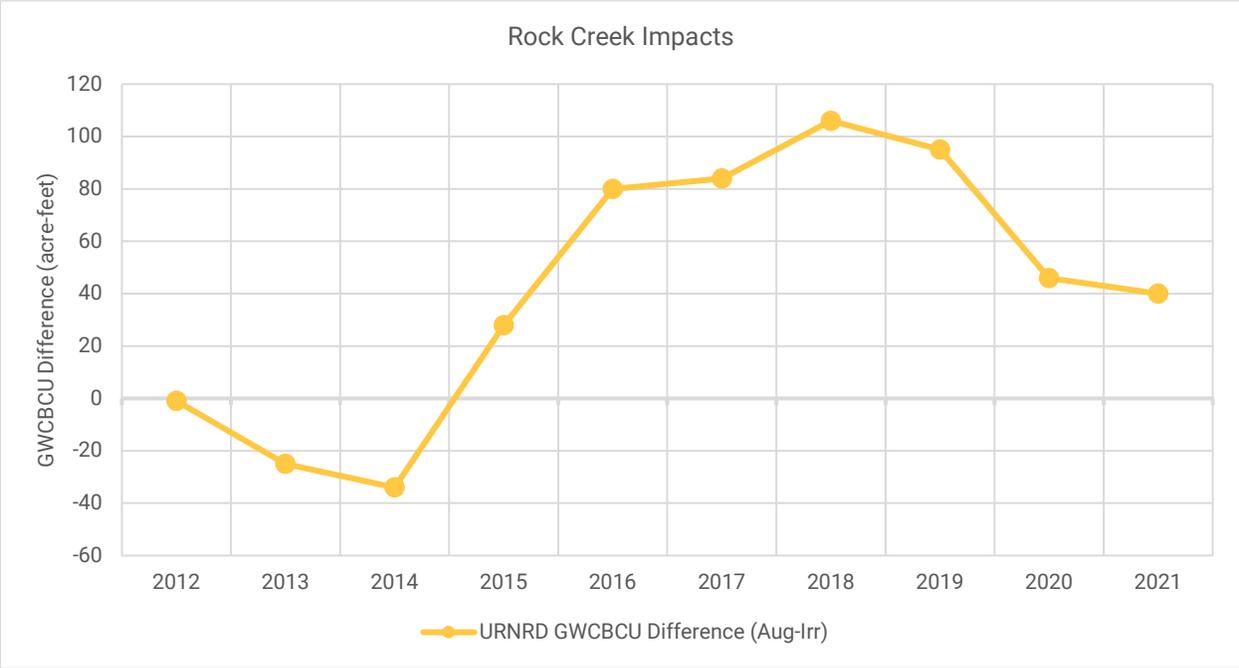


Figure 5. The difference between modeled CBCU (depletions) from Rock Creek Augmentation pumping and modeled CBCU from estimated net irrigation pumping on the Rock Creek purchased acres had those acres been used for irrigation. In this figure, a positive groundwater CBCU (GWBCU) difference indicates that modeled depletions from augmentation were greater than modeled CBCU from estimated net irrigation pumping.

The evaluation of net depletive effects considers both the difference in depletions between the augmentation and estimated irrigation scenarios, described above, and the amount of streamflow added

through augmentation. Any net depletive effects through 2017 were offset by augmentation pumping in those years. A small net depletive effect of Rock Creek in 2020 was offset by the pumping that occurred in 2020 for maintenance purposes, and a small net depletive effect of Rock Creek in 2021 is projected to be offset by the pumping that occurs in 2021 for maintenance purposes (Figure 6).

Augmentation pumping alone did not fully offset augmentation pumping from Rock Creek in 2018 and 2019. A 2019 analysis by NeDNR concluded that maintenance pumping plus temporary buyouts and permanent decertifications located either upstream of the Rock Creek confluence with the Republican River or in close proximity to the eastern end of the Rock Creek subbasin provides a total offset that well exceeds the new depletions from previous Rock Creek augmentation pumping, mitigating any potential effects to downstream users. See *First Annual Report for the Republican River Basin-Wide Plan: Data and Progress Updates, 2014–2018* (February 2020) for details.

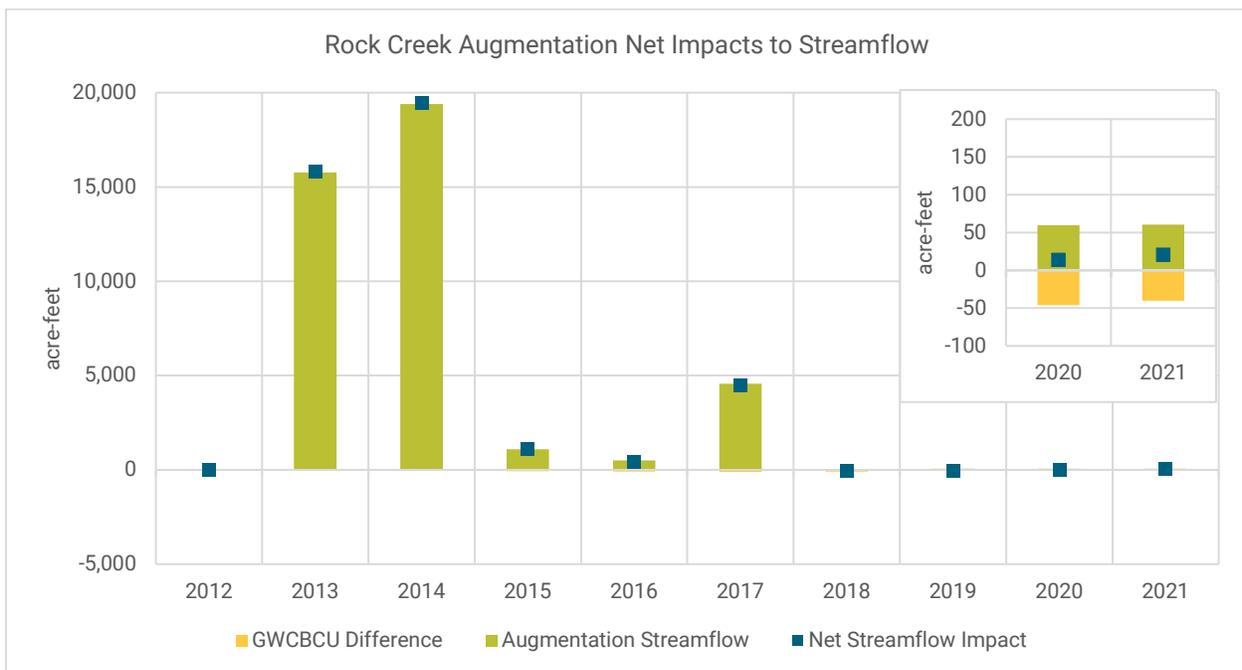


Figure 6: The net impacts to streamflow from the Rock Creek Augmentation Project. 2021 data are provisional as of this report. An inset is included to show a closeup of 2020–2021. In this figure, a positive value indicates a net increase in streamflow due to Rock Creek project operations, and a negative value indicates net depletions to streamflow. Because of this, the GWCBCU Difference values in this chart are represented as the inverse of the GWCBCU values in Figure 6. The Net Streamflow Impact is the sum of GWCBCU Difference and Augmentation Streamflow.