

# Groundwater Transfers in Nebraska

Daugherty Water for Food Global Institute

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THE DAUGHERTY  
**WATER for FOOD**  
GLOBAL INSTITUTE  
*at the University of Nebraska*



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## Daugherty Water for Food Global Institute

The University of Nebraska founded the Daugherty Water for Food Global Institute (DWFI) in 2010 to address the global challenge of achieving food security with less stress on water resources through improved water management in agricultural and food systems. The institute is committed to ensuring a water- and food-secure world while maintaining the use of water for other vital human and environmental needs. The institute's approach is to extend the University of Nebraska's expertise through strong partnerships with other universities and public and private sector organizations. DWFI develops research, education, and engagement programs in a focused effort to increase food security while ensuring the sustainability of water resources and agricultural systems. The institute works locally and internationally, bridging the water and agriculture communities and worlds of small- and large-holder farmers to deliver innovative solutions to this complex global challenge.

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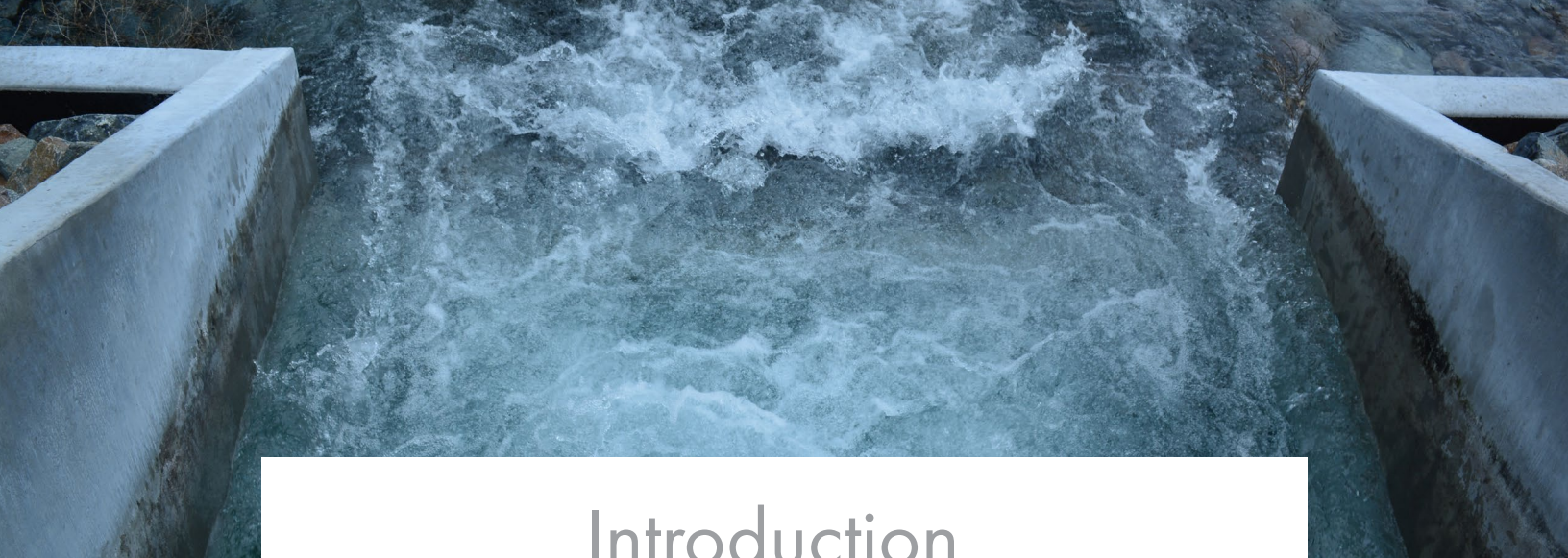
# Executive Summary

Groundwater transfer mechanisms are a flexible agricultural water management approach that can help lower growers' production risks without jeopardizing environmental needs. While groundwater transfers are currently popular in the water policy debate, there is little documented practical experience of their implementation, and in particular of how transfer design can be adapted to local hydrologic needs.

Within the state of Nebraska, a wide variety of formal and informal groundwater transfer schemes have been operating for decades. This report shares findings from studying rules, regulatory frameworks, and practices around groundwater transfers in Nebraska. The unique structure of these transfers is a result of a strong and tested regulatory and non-regulatory local groundwater management focus in the state. The report is intended to provide practical guidance to other regions interested in designing groundwater transfer systems to address increasing pressures on water resources.

There are three key insights:

1. Groundwater transfer systems can be designed to reflect local hydrologic complexity while meeting local agricultural needs and conservation goals. Groundwater transfer designs vary enormously across the state in terms of objectives, structure, expected hydrological outcomes, and permitting process.
2. The process of transferring groundwater rights between buyers and sellers involves economic, legal, and regulatory dimensions that each introduce potential hurdles and transaction costs. The steps necessary for a transfer to make economic sense, to be legal under existing institutional frameworks, and to be successfully permitted, must all be considered in transfer design. In this report, a three-step decision process is emphasized where the economic basis, the enabling environment, and the transfer implementation itself are described as distinct sets of decisions that must be understood in their local context.
3. Different formal and informal groundwater markets can – and should – coexist, as they provide different kinds of benefits, including risk management, to transfer participants. In Nebraska, many of the Natural Resources Districts allow both informal and formal groundwater transfers. These different types of transfers are managed through distinct processes.



# Introduction

Water markets are a popular water management tool used to address local water variability concerns. Water markets are widespread globally and have existed for at least 1,000 years. They provide flexibility by reallocating water from lower value to higher value uses, subject to physical and regulatory constraints and, in some cases, desired environmental goals. For agricultural producers, water markets allow adaptation to changing local conditions and reduce production risks associated with lack of water availability. Carefully designed water markets can provide benefits to agricultural outcomes without compromising water availability conditions for urban and environmental sectors (Young et al., 2021).

There is a current surge in interest in market mechanisms for water reallocation, driven by increasing competition for water as well as by weather extremes and climate change. In particular, there is a focus on groundwater markets as a management tool. For example, new groundwater markets are intended to be a cornerstone of policy implementation for California's Sustainable Groundwater Management Act (Babbitt et al. 2017).

The purpose of this report is twofold:

- to document the variety of approaches to groundwater transfers existing across a small geographic area, and to interpret the motivations underlying these approaches, and
- to provide guidelines for practitioners interested in establishing new water markets.

This report shares findings from studying rules, regulatory frameworks, and practices around groundwater transfers in Nebraska.<sup>1</sup> The unique structure of these transfers is a result of a strong and tested regulatory and non-regulatory local groundwater management focus in the state. Learning from Nebraska's diverse groundwater market schemes

can help other regions interested in addressing growing groundwater availability concerns by implementing groundwater markets.

Groundwater transfers in Nebraska are unique due to their long history, high variability, and strong regulatory framework design. The state's one-of-a-kind system of 23 Natural Resources Districts (NRDs) has the ability to create unique rules for groundwater management that match local hydrology needs. These districts regulate and administer groundwater transfers, which is one of the incentive-based water management tools used to lower drought risk to farmers in Nebraska.

This report consists of three main sections. The first section provides an overview of Nebraska's agricultural irrigation. This section discusses hydrologic variability, describes how water governance seeks to match local hydrologic complexity, and defines the role of incentive-based water management tools.

The second section of the report shares a three-step decision process for water rights buyers and sellers. This section explains how avoiding knowledge gaps during these three steps can help prevent failures in water market design. These steps highlight the role of multiple entities that affect decisions related to buying and selling water rights. The three-step decision process is illustrated using a Nebraska-specific context.

The third section discusses lessons learned from studying groundwater market schemes in seven Natural Resources Districts. The districts represent a broad range of hydrologic setting and management needs. Findings highlight key differences across groundwater markets in Nebraska, including groundwater market types, environmental and conservation goals, and transaction costs.

<sup>1</sup> Surface water transfers and hydrologically connected water transfers also happen in Nebraska. This report focuses only on groundwater transfers.

# Irrigation in Nebraska

## Hydrologic complexity

Nebraska has the most irrigated area – about 8.6 million acres – of any state in the United States (US). The majority of this area (~89%) is irrigated with groundwater (IWMS 2019, Dieter et al. 2018). Most of the groundwater withdrawals in the state (~93%) are used for agricultural irrigation (Dieter et al. 2018) and pumped through about 100,000 wells. Center pivot irrigation systems, a mechanized irrigation system invented and commercialized in the High Plains region, are the dominant application mode.

The largest source of groundwater in Nebraska is the High Plains Aquifer. The aquifer underlies a 174,000 mi<sup>2</sup> area, including portions of eight states: South Dakota, Wyoming, Colorado, Nebraska, Kansas, New Mexico, Oklahoma, and Texas (McGuire 2017). Nebraska covers about 36% (64,000 mi<sup>2</sup>) of the aquifer area but stores about two-thirds of the aquifer's water volume (Korus et al. 2013, Young et al. 2022). On average, the thickness of Nebraska's portion of the High Plains Aquifer is about 600 feet, but it has significant spatial variability (e.g., more than 1,000 feet in the Sand Hills area) (Korus et al. 2013). Local topographic conditions add to the variability of groundwater availability, as areas covered in sand dunes create an excellent environment for aquifer recharge.

Irrigation in Nebraska began to intensify in the 1950s, with the commercialization of center pivot irrigation technology systems, which quickly became popular in the region and globally. The new technology allowed pumping of large quantities of groundwater and helped to reduce production risks posed by severe droughts. Despite this, groundwater levels in Nebraska from the 1950s until the present day have not changed as much as they have in other U.S. regions such as Texas (McGuire 2017).

Water availability in Nebraska also differs from the eastern portion of the state to the western portion. To a large extent this is due to the difference in average annual rainfall across the state. Average yearly precipitation varies from under 12 inches of rainfall in the west to above 32 inches of rainfall in the southeast (Korus et al. 2013). This contributes to varying demand for irrigation water, with a large increase as one moves westwards across the state.

Taken together, the precipitation gradient and hydrologic complexity across the state produce very high spatial variability of water available for irrigation. This spatial variability in turn requires locally-adapted water governance to sustain long-term agricultural production and water availability.

## Groundwater governance

Groundwater in Nebraska is managed by a system of local resource management districts. The state's 23 NRDs were established in 1972. Boundaries for each NRD are based on major river basins. The districts cover the entire state. They are governed by locally elected boards of directors and managed by professional staff. All the NRDs have the power to implement regulations and enforce them. Their activities are primarily funded through local property taxes.

The NRDs prioritize the most critical local issues associated with twelve areas of responsibility mandated by the state (Hoffman and Zellmer 2013). One of their main responsibilities is ensuring long-term groundwater sustainability and preventing groundwater depletion. To meet their sustainability goals, NRDs use a variety of regulatory and voluntary, incentive-based, management approaches. Each NRD is able to design and implement its own set of management tools. These tools are typically designed to meet local hydrological complexity and needs. Regulatory tools in many districts include well-spacing requirements, moratoria on irrigation wells or irrigated land development, mandating the installation of flowmeters on irrigation wells, requiring water use reporting to help verify compliance, and imposing controls on water volume extraction by using groundwater allocation systems. The majority of the districts (18 out of 23)<sup>2</sup> enforce groundwater allocation controls, or are ready to enforce them if specified groundwater depletion levels are reached. Generally, allocation systems are designed to limit groundwater pumping to a specified volume over a specified multi-year period (e.g., 60 inches over a 5-year period in the Middle Republican NRD). In many districts, only a portion of the managed area has allocation limits in place, as determined by local hydrology. Regulatory water conservation approaches such as allocations can constrain growers' ability to apply enough water to meet the irrigation requirements of their crops in dry years.

## Incentive-based water management tools

Incentive-based water management tools are created to motivate water users and managers to change their water management practices and align them with long-term environmental and conservation goals. General examples of these tools include water quantity markets, water quality permit transfers, payments for watershed services, and subsidies for adopting some technologies or different water management practices (e.g., cost-share programs). Some incentive-based water management tools require a strong regulatory framework in place to be implemented. In Nebraska, some of the non-regulatory tools that the NRDs have made available to irrigating growers include saving (banking) of unused allocation water with the intention to use it in the next allocation period. Another popular non-regulatory tool that is administered by NRDs, groundwater transfers, is the focus of this report.

Incentive-based water management tools are intended to provide flexibility and innovative opportunities for producers to help them adapt to various challenges, such as severe and prolonged droughts. They are different from strict government mandates or large infrastructure projects, which tend to be costly and difficult to adapt to changing local conditions. As a result, incentive-based management techniques may be preferred by various agricultural stakeholders, including producers, water managers, policymakers, environmental engineers, non-governmental agencies, and corporations.

Water quantity markets are one of the most prominent examples of incentive-based water management tools. A typical water market constitutes a voluntary transfer of a right to use a specified amount of water in a specified location and time, and for a specified use. When the right is transferred to another user, that is usually done in exchange for an agreed-upon financial compensation. It is a mechanism that allows reallocation of water to be used in times and places that need it most. When carefully designed, water markets can be used to provide flexibility and lower drought risk in agricultural areas by moving water from lower to higher value uses to overcome drought conditions and support crop yields without compromising water needs for urban and environmental sectors.

Much academic literature distinguishes between formal and informal water markets and there are multiple definitions in use. Here, we define a formal water transfer as a transaction that includes the transfer of a property right. An informal water transfer, then, is a reallocation of water across space and/or time without transfer of the underlying property right.

*<sup>2</sup>Based on information collected through conversations with personnel from 23 NRDs in 2021.*

# The decision process for agricultural groundwater rights buyers and sellers

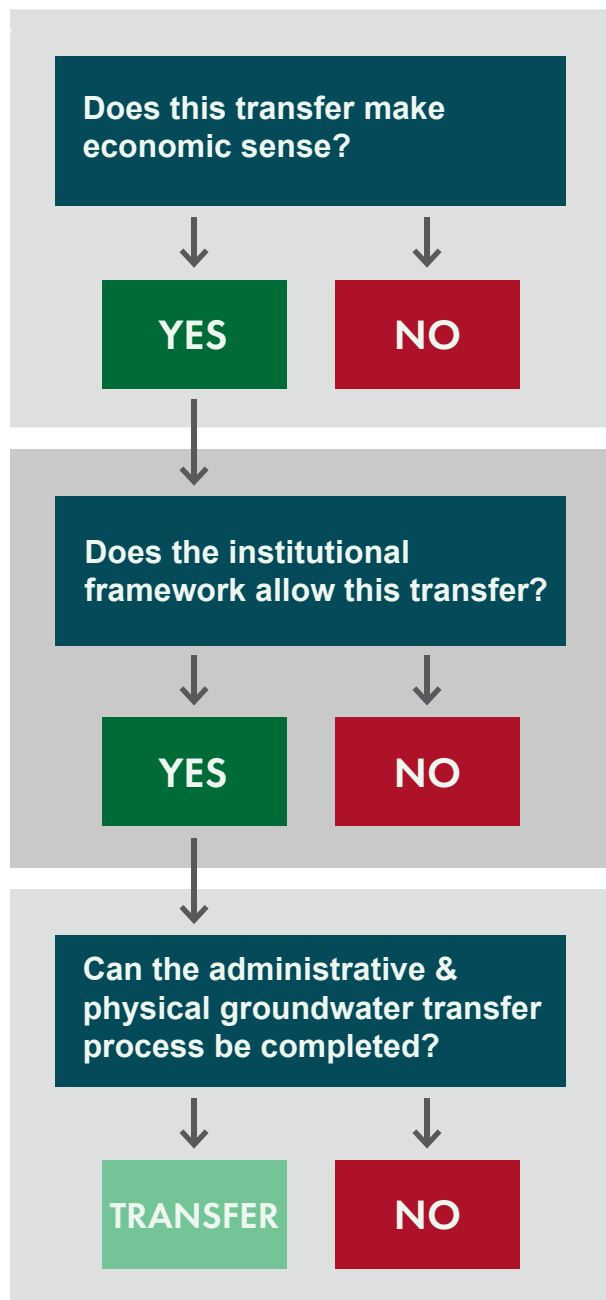


Figure 1. Three-step decision process for groundwater rights buyers and sellers.

Agricultural groundwater transfers can reduce production risk for farmers and help reach sustainable water management goals; however, they are often complex. Water market schemes can fail due to knowledge gaps specific to a local context, including economic basis, institutional requirements, or infrastructure needs. To increase the likelihood of successful outcomes, water market designs should reflect the three-step decision process framework important to water rights buyers and sellers (Figure 1). This framework is highly shaped by local conditions and different stakeholder groups influencing farmers' decisions. Water market participation is ultimately a private resource use decision occurring within a regulatory framework.

For buyers and sellers to consider a water transfer, first, it should make economic sense. Farmers need to understand the relative profitability of irrigated and non-irrigated land. After an economic need is identified and justified, the next step requires considering the institutional framework defining the transfer-enabling environment allowing water markets to take place legally. Last, when the eligibility of a groundwater transfer is confirmed, it is essential to consider the administrative and physical infrastructure needs associated with the transfer. This step is designed to help to understand the full costs and procedural details associated with the transfer execution. The three-step decision process for water rights buyers and sellers is discussed in further detail in the following pages which also considers a Nebraska-specific context (see also Figure A1, page 16).

## Economic basis

For buyers and sellers of agricultural water rights to enter a water market, expected profits from either selling or buying groundwater rights need to be clear. Growers' planning and real-time production decisions are complex, affected by various factors (e.g., input and commodity prices, technology, weather patterns), and are not made in isolation. To better understand potential returns from water access in agriculture, farmers work with and are influenced by many different stakeholder groups belonging to the agricultural sector ecosystem. Figure A1 (page 16) illustrates entities influencing Nebraska growers' decisions, including commodity and producer groups (e.g., Nebraska Commodity Boards, Nebraska Corn Growers Association, Nebraska Soybean Association, Nebraska Farm Bureau), agricultural lenders (e.g., commercial banks and farm credit services of America), government agencies (e.g., Risk Management Agency, Agricultural Research Service, Natural Resources Conservation Service), conservation groups (e.g., The Nature Conservancy), as well as university research, extension, and education programs (e.g., the Testing Agricultural Performance Solutions program led by the University of Nebraska-Lincoln). Some entities, including agricultural retailers (e.g., Bayer, Corteva, Syngenta), provide farmers with agronomic support services. Growers also work with crop and irrigation consultants and data providers (e.g., private agronomists and irrigation engineers, data providers such as The Climate Corporation).

## Enabling environment

Agricultural water users seeking to buy or sell groundwater rights need to understand whether water transfers are legally allowed in their environment. The enabling environment provides a legal framework for groundwater transfer design and implementation, which is shaped by the structure of water institutions. It requires an understanding of relevant federal, state, and local level water laws, local water regulations and practices, and the knowledge of who can hold water rights and engage in water transfers.

The enabling environment is primarily defined by the underlying water governance system that the state and local groundwater and surface water laws are based on. In Nebraska, groundwater law follows the correlative and reasonable use doctrines (Figure A1, page 16). The system of the two doctrines allows for the separating water rights from the land and transferring them to be used in a different location or for a different purpose (Aiken 1980). Based

on this system, water shortages are managed by proportionately reducing all affected water users' allocations (Aiken 1980). This is different from Nebraska's surface water law system, which is defined by the prior appropriation doctrine that manages water use and availability based on the seniority system. Surface water law is relevant for groundwater transfers in Nebraska because groundwater and surface water are hydrologically connected in many areas across the state. Laws governing both types of water need to be considered to better understand the limitations of groundwater availability and for hydrologically connected water transfers (often called "commingled water transfers"), which are legal in the state; however, they are not frequent due to institutional and hydrological complexity.

The interconnectedness of surface water and groundwater in Nebraska was legally recognized in 2004 with the passage of LB 962 by the Nebraska unicameral legislation (Bleed and Babbitt 2015, Nebraska Legislature 2004). This had significant implications for the regulatory rules that set the structure for voluntary incentive-based water management tools, such as water transfers. As a result of LB 962, Nebraska's Department of Natural Resources, which is responsible for managing Nebraska's surface water, and the 23 NRDs responsible for managing groundwater, were tasked to collaborate on the development of integrated water management plans and basin-wide plans. These plans impose consumptive groundwater use limits to restore water levels, which in turn impact groundwater transfer rules that are designed and administered by local NRDs. NRDs are also accountable for the impacts of their constituents' groundwater pumping on streamflow depletion, based on several multi-state agreements such as the Republican River Compact (Figure A1, page 16) and the Platte River Recovery Implementation Program.<sup>3</sup>

The most common groundwater transfers in Nebraska are between land-owning growers. Agricultural groundwater market schemes, however, also need to consider what entities can hold water rights for other uses (e.g., environmental flows, surface water, municipalities, and large industries). Knowing the range of potential uses and rightsholders can impact market activity, the spatial water availability to trade, and the value of a water right.

<sup>3</sup>The Platte River Recovery Implementation Program (PRRIP) was created to protect habitat conditions for several species recognized by the federal Endangered Species Act (1973). Streamflow targets under PRRIP are voluntary. In this precompliance setting, attaining the targets is intended to remove the need for stringent and costly regulation.



## Transfer implementation

Understanding the administrative and physical transfer implementation process is the third step in the groundwater transfer decision-making process. This step is designed to provide better knowledge associated with groundwater transfer transaction costs, including expectations about the time needed to complete the transfer, as well as necessary investments or disinvestments in physical infrastructure.

The administrative groundwater transfer implementation process entails different procedures set by different entities (Figure A1, page 16). Engagement with some of these entities is optional but often preferred. For example, water rights buyers and sellers might seek to consider working with brokers who can help them find other people seeking to enter a water market. Also, water lawyers can be consulted for legal advice during the process.

In Nebraska, one of the most significant administrative steps is working with local NRD staff, where the application for a groundwater transfer right permit is submitted and the decision on whether to approve or deny a transfer is made. To decide on a transfer approval, staff at many NRDs analyze transfer eligibility based on their local groundwater transfer rules, including the potential impact that transfer could have on streamflow depletion. NRDs also issue well drilling permits and work with other institutions (e.g., Nebraska Department of Natural Resources, surface water irrigation districts) to co-administer a hydrologically connected water transfer.

Other procedures that need to be followed during a formal groundwater transfer include obtaining a title search report, identifying lienholders and getting their consent, and recording the transfer and updating the title (e.g., county clerk's office).

For physical implementation, the main entities and associated costs to consider include well drilling and pump installation contractors (e.g., Nebraska Well Drillers Association) and irrigation system technology dealers (e.g., Valley Irrigation, Lindsay, Reinke). It is also important to understand other potential needs and costs, including whether the NRD requires the installation of irrigation flowmeters and the energy use associated with irrigation.



# Lessons learned: Key differences in groundwater transfers across Nebraska

Groundwater markets were studied in seven NRDs: Central Platte NRD, Middle Republican NRD, North Platte NRD, Tri-Basin NRD, Twin Platte NRD, Upper Big Blue NRD, and Upper Republican NRD (Figure 2). Each district's rules and regulations related to groundwater transfers were analyzed. Researchers talked with district representatives to understand the context associated with the transfers. Infographics summarizing the local groundwater transfer rules, practices, and background for each district studied are provided in the appendix (p. 17-29). Key findings discussed below highlight the main differences across groundwater market structures in Nebraska.

## Groundwater transfer types

A groundwater transfer entails a change in the groundwater use location, purpose, or point of withdrawal. There are two major types of groundwater transfers in Nebraska. Formal transfers of groundwater constitute a transfer of a property right. Locally, such transfers are most often understood as transfers of certified irrigated acres. A certified irrigated acre is an acre of agricultural land that has a history of documented irrigation. Thus, a formal transfer of groundwater that was used to apply water on a specified area of agricultural land indicates a loss of a groundwater pumping right used to irrigate that land. As a result, the historically affected irrigated acres would need to be decertified, and an irrigation well associated with those acres may need to be decommissioned.

Nominally, like formal groundwater transfers, informal groundwater transfers are regulated by NRDs, but they do not include the transfer of a property right. This process does not involve the decertification of irrigated acres or the decommissioning of wells. There are multiple types of informal transfers, and the language used to define them varies across districts. The most common informal transfers are transfers that allow joint operation of two or more irrigated tracts, which usually are called "pooling." Pooling allows some wells in a commonly managed group to increase their groundwater pumping above their individually allowed amounts if others in the group reduce their use by an equal amount. Thus, pooling

corresponds to transferring groundwater for a defined amount (based on allocation), length of time, and location. Locally, however, this process is usually thought of as combined water allocation management, not a groundwater transfer. A different popular type of informal groundwater transfer is the process of allowing landowners to pump groundwater from their well onto a neighboring parcel of land. In some cases, the neighboring land has to be under different ownership (e.g., Tri-Basin NRD).

Most NRDs have defined regulatory processes for both formal and informal groundwater transfers. Typically, districts that use groundwater allocations also have frameworks for pooling. Two out of seven studied districts – the Central Platte and Twin Platte NRDs – do not have rules or procedures for informal transfers described above, and they do not enforce groundwater allocation systems. One district, the Upper Big Blue NRD, does not have a regulatory process for formal groundwater transfers but does define processes for three types of pooling agreements and one additional type of informal groundwater transfer, allowing landowners to pump groundwater from their well onto a neighboring survey section.<sup>4</sup>

The administrative transfer implementation process is significantly simpler and less expensive for informal groundwater transfers than for formal transfers. This is because the entities and procedural steps involved in property title transfers only need to be considered for formal transfers. Parties involved in informal transfers generally do not need to consider the physical implementation process, as the required infrastructure should already be in place. In addition, analyses for potential groundwater transfer impacts to streamflow are performed only when applying for formal transfers, although the extent of those analyses varies across NRDs due to hydrologic characteristics and associated environmental concerns.

<sup>4</sup>A survey section is an area covering one square mile (640 acres).

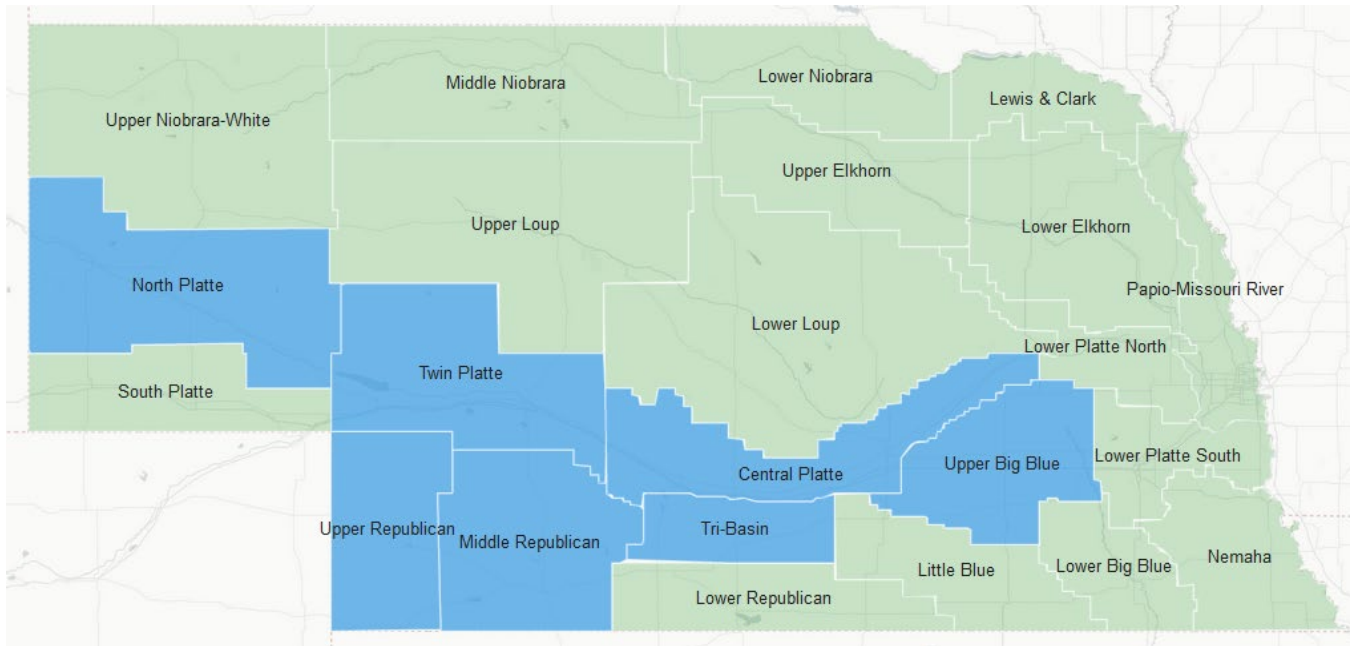


Figure 2. Nebraska's 23 Natural Resources Districts regulate and administer groundwater transfers. Highlighted in blue are the NRDs mentioned in this report and in the case studies highlighted at the end.

## Conservation and environmental goals

Conservation and environmental goals in Nebraska reflect state and local groundwater sustainability needs as well as requirements stated in federal environmental protection law and interstate agreements. Surface water and groundwater are hydrologically linked. In Nebraska, an implication of this is that the management of many surface water issues is dominated by groundwater use decisions. Since 2004, the connection between surface water and groundwater has been legally recognized in Nebraska. As a result, the NRDs must explicitly model and manage the impacts of their constituents' groundwater pumping on hydrologically connected surface water. For some NRDs, surface water-groundwater interaction is the dominant issue that they must address. Because groundwater transfers alter the location and timing of groundwater pumping, they also alter the local impacts of pumping on surface water. This requires additional consideration in the transfer process. The administrative approval processes for formal transfers vary across the districts because the regulatory transfer rules are designed to meet local hydrologic complexity needs, as well as to stay accountable to responsibilities stated in mandated and voluntarily agreed-upon legal contracts (e.g., the Republican River Compact, the Platte River Basin plan).

Most districts do not allow groundwater transfers to result in groundwater level decline or in a net increase in streamflow depletion. Each of these conditions is assured through adjustments to the amount of water that is transferred. To understand the potential effect

of a groundwater transfer, NRDs usually perform a 40- or 50-year impact analysis on expected streamflow and consumptive water use. Results of these analyses are used to make adjustments to transfer size and, in some cases, to decide whether to approve the formal groundwater transfer being considered. The number of adjustments made is determined by each NRD board of directors. This decision making process appears to have been carried out by each district independently, rather than through a state-level coordinating mechanism. As a result, there is a large variety of adjustment mechanisms tailored to local needs.

Although the distinction between pumped water and consumptive water use is not mentioned in NRD groundwater transfer rules, it is accounted for. To ensure there is not a net increase of consumptive water use, certified irrigated acreage may be adjusted during the formal groundwater transfer process. The amount of water consumed via irrigation depends on the types of crops planted and the irrigation technology systems in use. Large adjustments for consumptive water use are generally not needed because corn and soybeans, the most popular crops grown in Nebraska, have similar crop irrigation requirements, and both crops are typically irrigated with center pivot irrigation systems.

When crop water requirements or irrigation technology vary significantly between the origin and destination of a groundwater transfer, the amount of water transferred is adjusted for the expected consumptive use. For example, moving water from furrow-irrigated corn to center pivot-irrigated corn

will result in a reduction in the certified irrigated acreage to offset the increased technical efficiency of center pivot irrigation relative to furrow irrigation. Adjusting certified irrigated acreage ensures that the consumptive water use associated with the transferred water right will not increase. Adjustment happens to the certified irrigated acreage (the land base) because under most NRD allocation rules, all irrigated fields within an NRD have the same allocation per acre (i.e., the same irrigation depth). Additional adjustments may occur to account for the expected changes in the effects of groundwater pumping on surface water resulting from a transfer.

In some cases, local districts provide specifications around groundwater transfer direction and boundaries in their rules and regulations documents. These specifications provide general guidelines addressing concerns about the impacts of pumping on streamflow. For example, in the Upper Republican NRD, formal groundwater transfers are allowed to occur within a 36-square mile block centered on the section of the originating well (often referred to as a “floating township”). In the Central Platte NRD, groundwater pumping rights can be transferred westward from an originating well if the distance does not exceed one mile. Often, final adjustments around a specific groundwater transfer are determined on a case-by-case basis.

For informal transfers, impacts on streamflow depletion are not accounted for. However, in some cases, boundary specifications for informal transfers are also provided. For example, in the North Platte NRD, informal transfers allow growers to combine their groundwater allocations across multiple fields within a three-mile box, and these fields are not required to be contiguous.

## Transaction costs

Groundwater transfer transaction costs can play an important role in incentivizing or discouraging local water transfers. Different administrative and physical transfer implementation components need to be considered to understand the full scope of the transaction costs associated with each transfer. The administrative cost that differs most across Nebraska is the transfer impact analysis fee. This fee does not apply for informal groundwater transfers; the analysis tends to be done only for transactions involving a transfer of a property right. For formal transfers, the cost can be as low as \$0 (e.g., Upper Republican NRD) or \$20 (e.g., Middle Republican NRD), or as high as \$10,000 (e.g., North Platte NRD) per transfer.

Administrative transfer application fees usually vary from \$100 (e.g., Middle Republican NRD, Tri-Basin

NRD) to \$200 (e.g., Central Platte NRD, Twin Platte NRD). Typically, there are no administrative fees associated with informal transfers. However, the Upper Big Blue NRD charges a \$50 fee to authorize transfers allowing pumping of groundwater onto a connected survey section without discontinuing the right to pump groundwater onto the original well.

The title search costs for formal transfers might add a few hundred dollars, especially if the search needs to happen in a different county. The major physical implementation costs that need to be considered for formal transfers include expenses associated with drilling or decertifying a well and investment in irrigation equipment.

## Other differences

Nebraska’s groundwater markets also vary in size, activity level, and the language used to describe their rules and processes. For some formal transfers, there is a minimum transfer requirement that varies from one to four acres. In practice, transfers most often vary between seven and 140 acres, which corresponds to the size of a corner lot that a center pivot irrigation system cannot reach combined with a full lot that a center pivot can irrigate. For informal transfers, groundwater transfer size often depends on allocation system management and irrigation needs.

Transfer activity for formal transfers can vary from less than one transfer per year to more than 200 transfers per year. Higher activity correlates with commodity prices. For example, in 2021, as the prices of corn were increasing, most studied NRDs reported having significantly more transfer applications. For lower activity, transaction costs might have an impact. Transfer activity for informal transfers can vary from zero transfers in some districts to districts having about 35% of wells managed jointly.

Differences in the language used to define and describe groundwater transfers highlight NRDs’ efforts to focus on local interests, ensuring that terminology and rules are understood by local constituents and work well for them. In studied districts’ rules and regulations, formal groundwater transfers were called “reassigning of certified acres” (e.g., Tri-Basin NRD), “permanent transfers of acres” (e.g., Middle Republican NRD), and “transfers” (e.g., North Platte NRD). Informal transfers allowing joint operation of two or more irrigated tracts were often called “pooling,” but the same action can also be called “pre-existing allocation units” or “designated allocation units” (e.g., North Platte NRD). Another type of informal transfers can be called “groundwater transfers” (e.g., Tri-Basin NRD).



## Conclusion

Groundwater transfer programs operating in Nebraska provide a strong, adaptable template for practitioners in other states or countries.

Three key insights emerge:

First, Nebraska's groundwater management experiences highlight the importance of having a full understanding of local hydrology and local water needs. Groundwater management institutions in Nebraska have evolved to match locally prioritized water sustainability needs. The variability of groundwater transfer designs in Nebraska reflects the local focus of groundwater management institutions and can provide adaptability to local conditions and practices. Flexible design that intentionally matches transfer rules to hydrologic complexity may reduce production risks to growers as well as regional regulatory risks.

Second, when designing new water markets or seeking to address frictions in existing market schemes,

it is critical to understand the range of decisions important to water rights buyers and sellers. This report emphasizes a three-step decision process that considers the economic basis, the enabling environment, and transfer implementation itself as distinct sets of decisions that must be understood in their local context. There are potential hurdles and transaction costs at each step of the process, with different local stakeholder groups often involved.

Third, as observed across Nebraska, multiple groundwater transfer mechanisms often coexist and provide multiple pathways to achieve water policy goals. Many of the Natural Resources Districts in Nebraska allow both informal and formal groundwater transfers. These different types of transfers are managed through distinct processes and should be viewed as complementary to, rather than competitive with, each other.

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## Appendix

- 16 Three-step decision process for groundwater rights buyers and sellers, and Nebraska-specific context
- 17 Case study: Central Platte NRD
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Does this transfer make economic sense?



YES



NO

Does the institutional framework allow this transfer?



YES



NO

Can the administrative & physical groundwater transfer process be completed?



TRANSFER



NO

### ECONOMIC BASIS

For buyers and sellers to consider a transfer, it should make economic sense. Farmers need to understand the relative profitability of irrigated and non-irrigated land. Many entities help growers to better understand potential returns from water access in agriculture.

#### INFLUENCERS

- Commodity and producers' groups (e.g., Nebraska Commodity Boards, Nebraska Corn Growers Association, Nebraska Farm Bureau)
- Agricultural lending entities (e.g., Farm Credit Services of America)
- USDA agencies (e.g., Risk

#### AGRONOMIC SUPPORT SERVICES

- Management Agency, Agricultural Research Service, Natural Resources Conservation Service
- Conservation groups (e.g., The Nature Conservancy)
- University research, extension, and education (e.g., Testing Ag Performance Solutions)
- Agricultural retailers (e.g., Bayer, Corteva, Syngenta)
- Crop & irrigation consultants
- Data providers (e.g., The Climate Corporation)

### ENABLING ENVIRONMENT

Federal, state, and local level water law, regulations, and institutional support structure allowing water transfers to take place legally.

#### REGULATORY/ENABLING FRAMEWORK

- Correlative and reasonable use doctrines for groundwater
- Prior appropriation doctrine for surface water
- The Endangered Species Act (1973)
- Nebraska Legislative Bill 962 (2004)
- Natural Resources Districts (NRDs)
- Nebraska Dept. of Natural Resources
- Integrated Management Plans
- Basin-wide Plans
- Multi-state agreements & programs
- The Republican River Compact
- The South Platte River Compact
- The Upper Niobrara River Compact
- The Big Blue River Compact
- The North Platte Settlement
- The Platte River Recovery Implementation Program
- Water rights holders
- Other agricultural landowners
- NRDs (instream flows)
- Public Water Suppliers (instream flows)
- Game and Parks Commission (instream flows)
- Other surface water rights holders

### TRANSFER IMPLEMENTATION

Administrative and physical infrastructure needs that must be considered to understand the costs and procedural details associated with the transfer execution.

#### ADMINISTRATIVE PROCESS

- Water brokers (match sellers and buyers)
- Water lawyers (provide legal advice)
- County Assessor/Register of Deeds Office (provide title search report, identify lienholders)
- Lienholders (give consent)

#### PHYSICAL IMPLEMENTATION

- Natural Resources Districts (analyze streamflow impact, issue well permits, approve transfers, co-administer hydrologically connected water transfers with Dept. of Natural Resources & irrigation districts)
- County clerk's office (record the transfer, update the title)
- Well drilling and pump installation contractors (e.g., Nebraska Well Drillers Association)
- Irrigation equipment dealers (e.g., Valley Irrigation, Lindsay, Reinke)
- Irrigation flowmeters
- Energy (e.g., public power districts)

The graphic identifies three major steps in the agricultural groundwater transfer process. Each decision comprises main entities, institutional support structures, or procedures that need to be considered to make well-informed decisions. This work was supported by USDA.

**R. Rimšaitė and N. Brozović, Daugherty Water for Food Global Institute, September 2022**



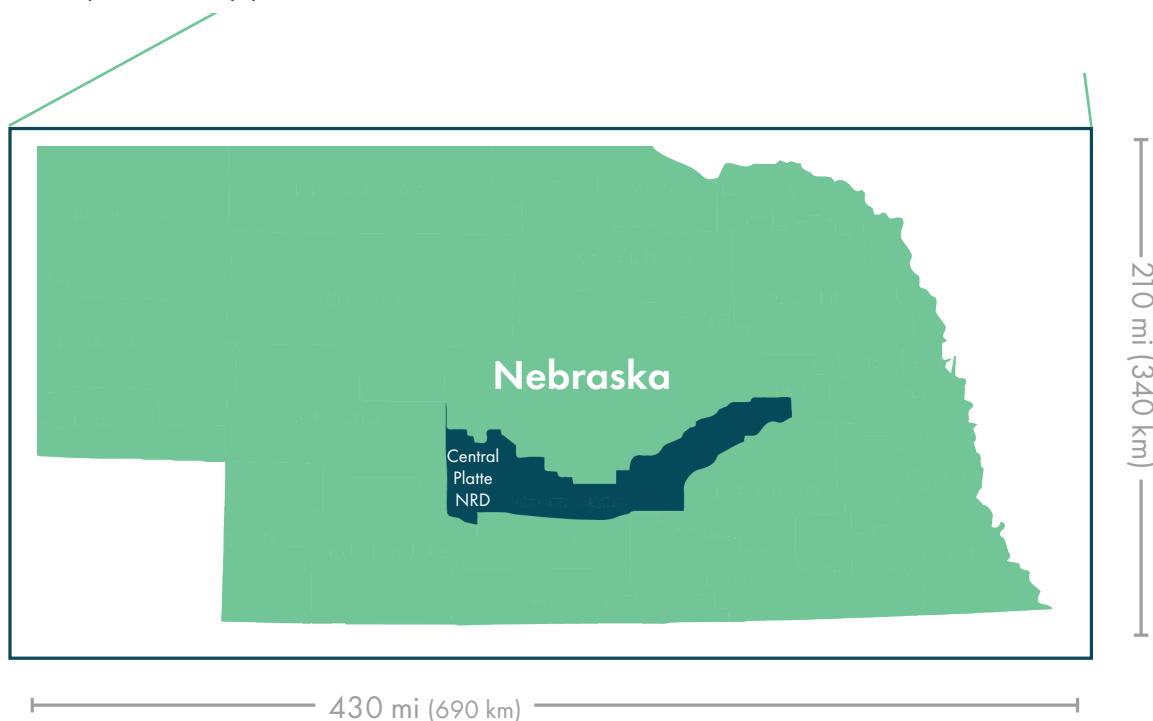
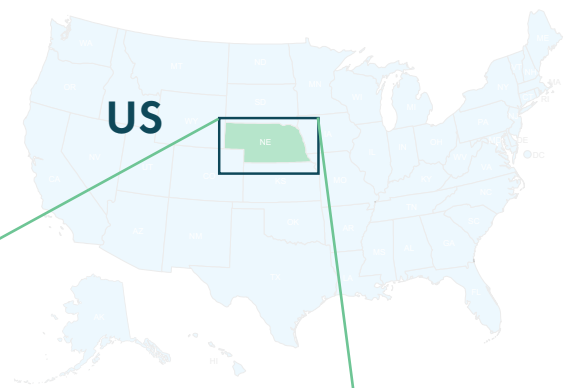
# TRANSFERRING GROUNDWATER IN THE HIGH PLAINS

Central Platte Natural Resources District, Nebraska



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- ▶ The Central Platte Natural Resources District (CPNRD) manages groundwater use for crop irrigation to ensure the long-term sustainability of its supply. The CPNRD is accountable for the impacts of groundwater pumping on streamflow governed by a large-scale endangered species program. The district also seeks to prevent long-term groundwater depletion.
- ▶ CPNRD restricts groundwater use for irrigation by imposing a well drilling moratorium and measuring static water levels. Groundwater allocation and metering systems are not currently enforced in the district. Groundwater pumping rights must be obtained via transfer before new land can be irrigated.
- ▶ Growers can formally transfer their groundwater pumping rights separately to land ownership. To be approved, groundwater transfers must be determined to have no net negative impacts on streamflow. Some change to the amount of groundwater pumping rights transferred is needed to adjust for expected net impact resulting from the transfer.
- ▶ The frequency and size of formal groundwater transfers vary greatly. Transaction costs include fees associated with the formal transfer application and, if a transfer is higher than a specified threshold, a property title search. Transaction size can depend on the irrigation technology used (e.g., a transition to full center pivot). Groundwater transfer activity appears to be positively correlated with crop commodity prices.





## BACKGROUND

CPNRD, in central Nebraska, receives an average of 18-26 inches of rainfall per year. There are 1,029,213 irrigated agricultural acres. Of these, 937,674 acres are irrigated solely with groundwater, 14,359 acres use surface water, and the rest use a mix of surface water and groundwater. The main crops grown in the area are corn, soybeans, and alfalfa. There are approximately 19,000 active wells in the district, of which about 600 are measured for static water levels in spring and fall. CPNRD requires to obtain groundwater pumping rights via transfer before starting to irrigate new agricultural land, and there is a well drilling moratorium. The district helps meet the streamflow goals set by the Platte River Recovery Implementation Program.



## GROUNDWATER TRANSFERS

The groundwater transfer process in CPNRD begins with a discussion between an applicant and CPNRD staff to determine whether a proposed transfer would meet the district's key requirements. If they are met, an applicant can submit a groundwater transfer request which requires a \$200 payment to cover administrative costs. Transfers must be at least one acre. All transfers that exceed 4 acres require a property title search with the Registrar of Deeds and consent of any lienholder. When transfer filing involves multiple counties, transaction costs increase by an additional \$50. Transfer size in CPNRD varies between 7 and 140 acres, which corresponds to the sizes of a corner lot that a center pivot can't reach and a full center pivot. Transfer activity in CPNRD fluctuates between 5 and 200 transfers per year, but there are typically more than 100 transfers each year. The higher number of transfers corresponds to higher corn and soybean prices. Most of those transfers are between irrigators. Groundwater transfers for cattle feedlots and industry also happen on occasion. Groundwater transfers in the district are approved by CPNRD staff.



## TRANSFER DIRECTION & BOUNDARIES

In CPNRD, groundwater can't be transferred between river basins, and the transfer can't have an impact on another river basin. Within the Platte River Basin, there are restrictions on the purchase of water rights based on an assessment of sustainable irrigated area and transfers aren't allowed to some areas (e.g., over-appropriated area above Elm Creek). If the transfer doesn't lead to lower or higher streamflow depletion based on CPNRD's data, no adjustment is made to the amount of water transferred. Generally, based on CPNRD's hydrogeology, to protect streamflow, groundwater pumping rights can be transferred westward from an originating well if the distance doesn't exceed one mile. The distance is not limited when transferring groundwater in any other direction. The amount of groundwater pumping rights that are transferred is adjusted so that no net change in impact on streamflow occurs. The exact adjustment is determined on a case-by-case basis. Due to the adjustments, it is less expensive to transfer groundwater away from the stream (from higher to lower streamflow depletion areas) than to transfer groundwater towards the stream (from lower to higher streamflow depletion areas).



## OTHER POINTS OF INTEREST

(i) CPNRD was the first NRD in Nebraska to create a water bank system to address sustainability challenges in some of their Platte River watershed areas, which helps protect species dependent on river flows as well as municipal and agricultural well fields. It is done through regulation and acquisition of groundwater and surface water rights from willing sellers within the district. (ii) Growers who can legally irrigate with both groundwater and surface water ("commingled") on their property are able to transfer their water, but these transfers are very infrequent. They would need to be co-administered by the State of Nebraska Department of Natural Resources (NeDNR) and relevant irrigation districts, because surface water is not overseen by the Natural Resources Districts. (iii) In 2015, CPNRD partnered with private irrigation canal companies and NeDNR to rehabilitate four surface water canals, which resulted in better surface water irrigation, excess flows management, and groundwater recharge.

*Transferring Groundwater Factsheet #5, Central Platte Natural Resources District  
R. Rimsaite, S. Munezero, and N. Brozović  
Daugherty Water for Food Global Institute, October 2021  
This work was supported by USDA under contract number OCE 58-0111-20-007*

**Transfer** means a change in the groundwater use location, purpose, or point of withdrawal.

A **formal transfer** is a transfer of a property right. In CPNRD, formal transfers of groundwater rights between wells are called "transfers."

An **informal transfer** is a reallocation of water across space/time without transfer of a property right. Informal transfers, often called "pooling," allow joint operation of two or more irrigated tracts. In CPNRD, there are no such informal transfers.

**Transfer direction** must be considered when there are concerns about impacts of groundwater pumping on streamflow.

**Transfer boundaries** define the area within which groundwater can be transferred.

# TRANSFERRING GROUNDWATER IN THE HIGH PLAINS

Middle Republican Natural Resources District, Nebraska



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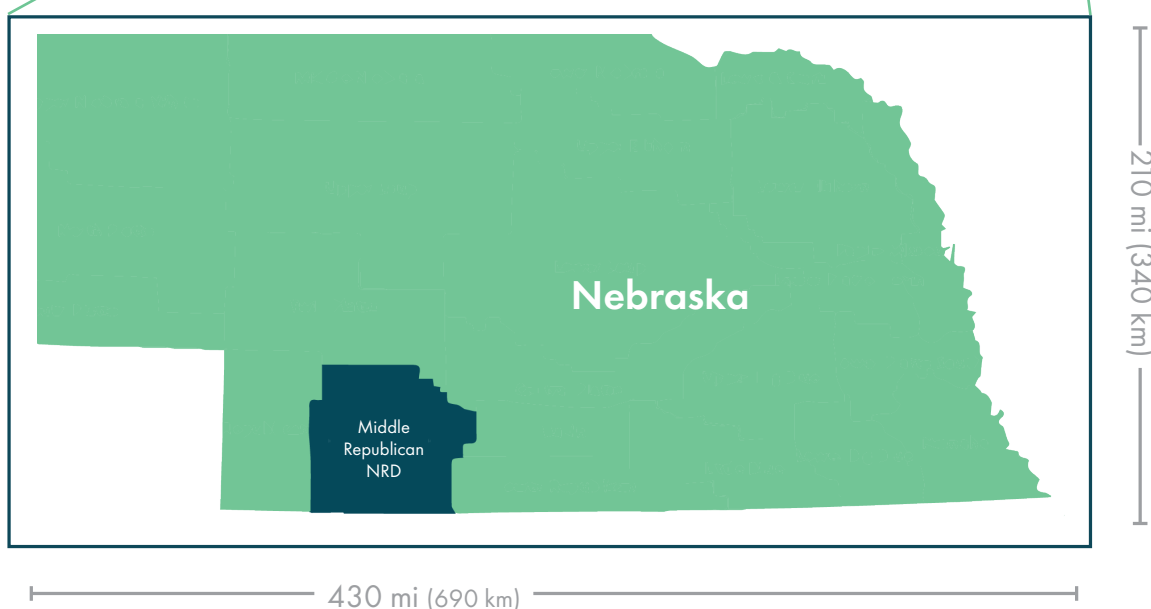
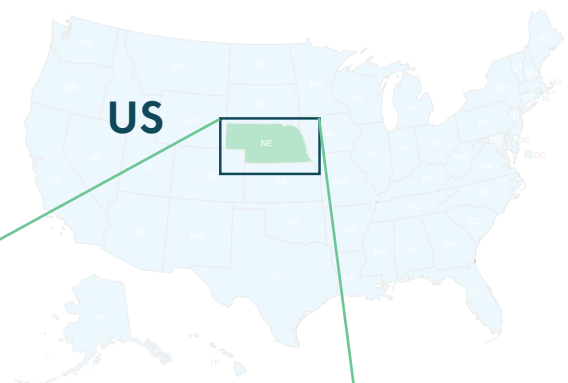
▶ The Middle Republican Natural Resources District (MRNRD) manages groundwater use for crop irrigation to ensure the long-term sustainability of its supply. The MRNRD is accountable for the impacts of groundwater pumping on streamflow governed by interstate compact. The district also seeks to prevent long-term groundwater depletion and limit irrigated land development.

▶ Groundwater use for irrigation is restricted with mandatory metering and a 5-year allocation system that allows banking of allocation between those 5-year periods. Most growers are able to use their banked allocation and, to date, have not needed to stop irrigating even during extended drought periods.

▶ Growers can formally transfer their groundwater pumping rights separately to land ownership. To be approved, groundwater transfers must be determined to have no net negative impacts on streamflow, groundwater depletion, or irrigated land development.

▶ Formal groundwater transfers are usually small and infrequent. Transaction costs include a small transfer safety analysis fee and, when approved, an administrative transfer fee. Transaction activity appears to be impacted by growers seeking to earn more returns from the irrigation technology used (e.g., a transition from partial to full center pivot).

▶ In MRNRD, informal groundwater transfers occur more frequently than formal transfers. These arrangements allow for localized and restricted reallocation of groundwater pumping rights with very little administrative burden and no transfer of the property right.





## BACKGROUND

MRNRD, in southwest Nebraska, falls in the middle area of the Republican River Basin. The area receives an average of 20-22 inches of rainfall per year. There are 335,000 irrigated agricultural acres. Of these, 260,000 acres use groundwater only. The rest use either surface water or a mix of both surface water and groundwater. The main crops are corn and soybeans, although some wheat and alfalfa are also grown in the area. MRNRD sets a 5-year pumping allocation of 60 inches and meters and monitors all groundwater wells to verify compliance. Banking of unused water, called “carryforward” in MRNRD, is permitted, which allows exceeding the 60 inch-rule, but by no more than 12 inches during an allocation period. If the Republican River water supply is determined to be in shortage (“Compact Call Year”), the allocation is 15 inches for that year, and a grower is not allowed to exceed it.



## GROUNDWATER TRANSFERS

For a formal groundwater transfer to be approved by the MRNRD, it needs to go through a special application process, “variance request”, which relies on an evaluation of three criteria. Transferred groundwater pumping rights can’t result in an increase in (i) streamflow depletion, (ii) groundwater level decline, or (iii) irrigation development. Applicants pay \$20 for a transfer safety analysis to determine if the transfer complies with these criteria. The analysis costs \$20 to an applicant and is done by comparing the location centered at the originating well with the destination location centered at a well where groundwater is proposed to be withdrawn (a “floating township” analysis, in MRNRD terminology). If the formal transfer is determined safe, an applicant needs to pay the administrative fee for the transfer, which is \$100. About 20% of the 10-15 formal transfer applications received annually are approved. Growers whose applications aren’t approved are allowed to appeal to the Groundwater Committee and then the Board of Directors. MRNRD has approved formal transfers as large as 130 acres, but, on average, most transfers are between 20-40 acres. Most of those transfers are between irrigators. Formal transfers are not allowed when the Republican River supply is determined to be in shortage. Informal transfers allow growers to combine their groundwater allocation across multiple fields. For informal transfers to be approved by the MRNRD, the landowners need to submit a request, and the areas need to be determined to be actively used for agriculture and under “common management” (e.g., family member ownership, landlord/tenant leases).



## TRANSFER DIRECTION & BOUNDARIES

Groundwater pumping rights can be transferred at any distance and in any direction within the MRNRD as long as the transfer doesn’t cause an increase in streamflow depletion, groundwater level decline, or irrigation development. Transfers are automatically rejected if they don’t meet one of the criteria. For informal transfers, these potential impacts are not accounted for. Informal transactions can happen between non-adjacent fields.



## OTHER POINTS OF INTEREST

Growers who can legally irrigate with both groundwater and surface water (“commingled”) on their property are able to transfer their water, but that hasn’t occurred yet in MRNRD. The transfers would need to be co-administered by the Nebraska Department of Natural Resources and relevant irrigation districts because surface water is not overseen by the Natural Resources Districts.

**Transfer** means a change in the groundwater use location, purpose, or point of withdrawal.

A **formal transfer** is a transfer of a property right. In MRNRD, formal transfers are called the “permanent transfer of acres.”

An **informal transfer** is a reallocation of water across space/time without transfer of a property right. Informal transfers, often called “pooling,” allow joint operation of two or more irrigated tracts.

**Transfer direction** must be considered when there are concerns about impacts of groundwater pumping on streamflow.

**Transfer boundaries** define the area within which groundwater can be transferred.

**Commingling** means that both groundwater and surface water are legally available for use on the same irrigated acres.

*Transferring Groundwater Factsheet #4, Middle Republican Natural Resources District  
R. Rimsaite, S. Munezero, and N. Brozović  
Daugherty Water for Food Global Institute, September 2021  
This work was supported by USDA under contract number OCE 58-0111-20-007*

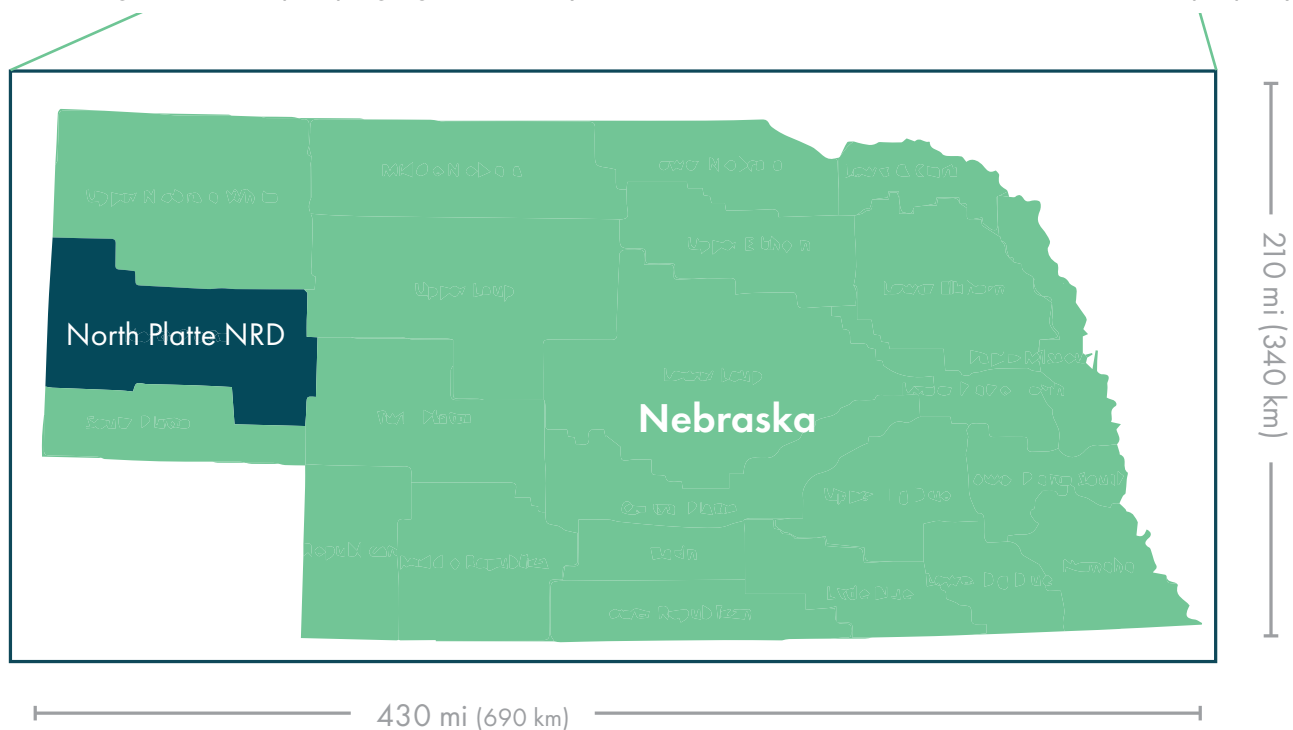
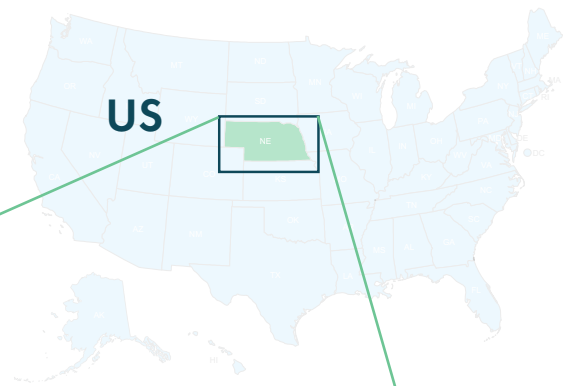
# TRANSFERRING GROUNDWATER IN THE HIGH PLAINS

North Platte Natural Resources District, Nebraska



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- ▶ In the North Platte Natural Resources District (NPNRD), water demand for crop irrigation is high due to low annual rainfall. The NPNRD is accountable for the impacts of groundwater pumping on streamflow governed by interstate compact. The district is also concerned about local long-term groundwater depletion.
- ▶ Groundwater use for irrigation is restricted, with mandatory metering and a 5-year allocation system. Especially during droughts, some growers exhaust their allocation and must stop irrigating.
- ▶ Growers can formally transfer their groundwater pumping rights separately to land ownership. Groundwater transfers must be determined to not have any negative impacts on streamflow and downstream water users.
- ▶ The process of determining that the change of pumping location is acceptable is expensive. Given the district's water accounting rules, there is a high likelihood of negative third party impacts from transfers. As a result of both issues, formal groundwater transfer applications are relatively infrequent and tend to be large transactions.
- ▶ Informal groundwater transfers are more common. These arrangements allow for localized and restricted reallocation of groundwater pumping rights with very little administrative burden and no transfer of the property right.





## BACKGROUND

NPNRD, in the Nebraska Panhandle, is a dry, hilly, and sandy area with an average of 14-18 inches of rainfall annually. There are 450,000 irrigated agricultural acres. Of these, 120,000 acres use groundwater only. The rest use either surface water or mix of surface water and groundwater. The main crops are corn, sugar beets, dry edible beans, alfalfa, wheat, and potatoes. NPNRD sets a 5-year pumping allocation of 70 inches (60 inches in one subarea, Pumpkin Creek) and meters and monitors all groundwater wells to verify compliance.



## GROUNDWATER TRANSFERS

The formal transfer process requires a hydrologic study of expected 50-year impacts of the transfer. The applicant is responsible for the study, which costs \$10,000. NPNRD Board members, who approve groundwater transfers, base their decisions on study findings. Over the past 8 years, 4 formal groundwater transfers from irrigators to municipal buyers occurred, and there were no formal transfers between irrigators.



## TRANSFER DIRECTION

For formal transfers, hydrologic analysis determines whether the transfer will have a negative impact on streamflow. Practically speaking, this means that formal transfers must move the point of groundwater extraction away from streams for approval. Under current rules, groundwater transfers are not adjusted to account for changes in stream impacts. For informal transfers, no accounting for stream impacts occurs.



## TRANSFER BOUNDARIES

Transfer boundaries for formal transfers are case-by-case and determined based on factors including canal operations, hydrology, land use, and other stream impact conditions. Informal transfers typically allow growers to combine their groundwater allocations across multiple fields within a 3-mile box. Initial and final transfer points do not need to be contiguous.



## OTHER POINTS OF INTEREST

Some irrigated acres have the right to both surface water and groundwater (“commingled”). The accounting for such acres is complex and specific rules apply to the transfer of commingled rights. While technically possible, commingled water transfers are unlikely as multiple other agencies would need to be involved in the approval process (unlike groundwater, surface water is not overseen by the Natural Resources Districts, but is co-managed by different state and local entities in Nebraska). Within the area administered by NPNRD, there are also some irrigators who have only surface water rights; transfers of such rights are frequent.

*Transferring Groundwater Factsheet #1, North Platte Natural Resources District  
R. Rimsaite, S. Munezero, and N. Brozović  
Daugherty Water for Food Global Institute, May 2021  
This work was supported by USDA under contract number OCE 58-0111-20-007*

**Transfer** means a change in the groundwater use location, purpose, or point of withdrawal.

A **formal transfer** is a transfer of a property right. In NPNRD, formal transfers of groundwater rights between wells are called “transfers.”

An **informal transfer** is a reallocation of water across space/time without transfer of a property right. Informal transfers, often called “pooling,” allow joint operation of two or more irrigated tracts. In NPNRD, informal groundwater transfers occur within groups of wells that have been declared as “Pre-existing Allocation Units” or “Designated Allocation Units.”

**Transfer direction** must be considered when there are concerns about impacts of pumping on streamflow.

**Transfer boundaries** define the area within which groundwater can be transferred.

**Commingling** means that both groundwater and surface water are legally available for use on the same irrigated acres.

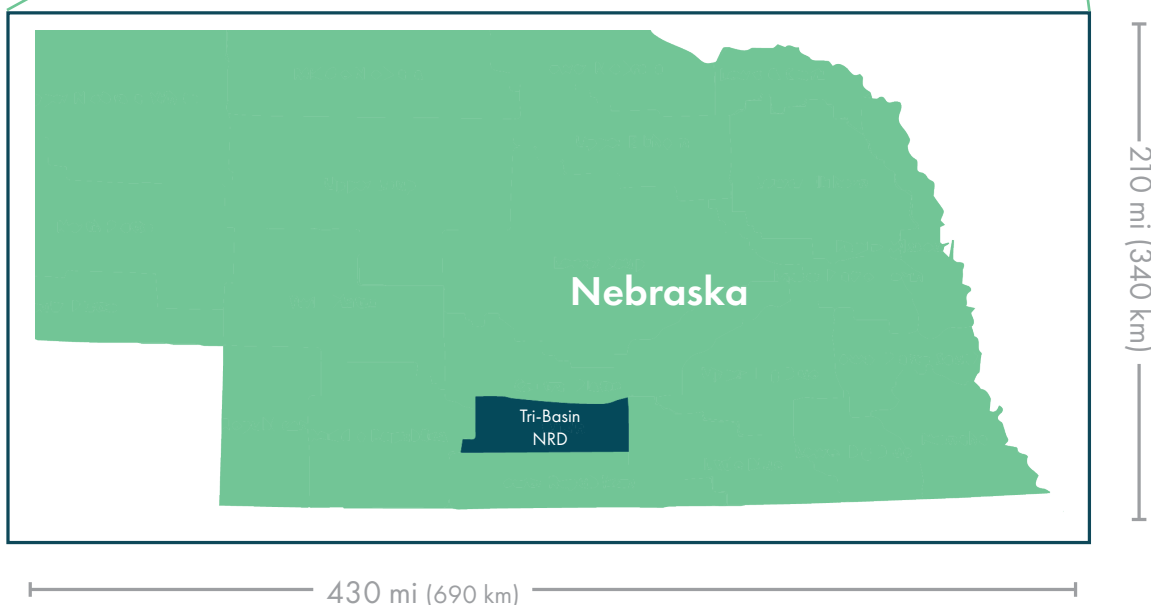
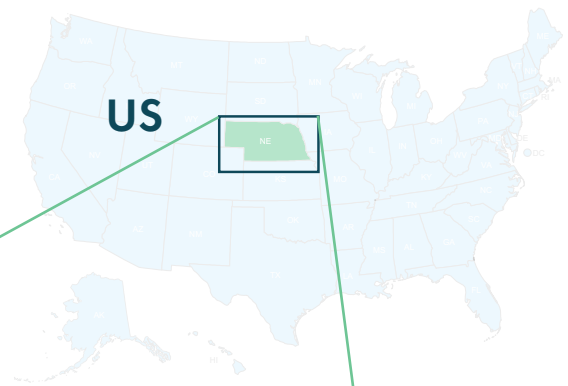
# TRANSFERRING GROUNDWATER IN THE HIGH PLAINS

## Tri-Basin Natural Resources District, Nebraska



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- ▶ The Tri-Basin Natural Resources District (TBNRD) manages groundwater use for crop irrigation to ensure the long-term sustainability of its supply. The TBNRD is accountable for the impacts of groundwater pumping on streamflow governed by interstate compact. The district also seeks to prevent long-term groundwater depletion.
- ▶ Portions of the TBNRD fall into three different hydrologic basins, each with its own water issues. As a result, different parts of the TBNRD have different basin-specific rules and regulations. Among other things, TBNRD requires groundwater use reports, meters a portion of groundwater wells, has imposed a well drilling moratorium, and enforces a 3-year groundwater allocation in an area of the district experiencing significant decline in groundwater.
- ▶ Growers can formally transfer their groundwater pumping rights separately to land ownership. To be approved, groundwater transfers must be determined to have no net negative impacts on streamflow. Some adjustment to the amount of groundwater rights transferred may be needed to avoid any expected net impact resulting from the transfer.
- ▶ Formal groundwater transfers have a minimum transfer amount requirement. Transaction costs include fees associated with the formal transfer application and a property title search. Groundwater transfers are usually small and not very frequent. Transaction activity appears to be positively correlated with crop commodity prices.
- ▶ In TBNRD, informal groundwater transfers must be metered and they occur more frequently than formal transfers. There are two types of informal transfers. These arrangements allow for localized and restricted reallocation of groundwater pumping rights with very little administrative burden and no transfer of the property right.





## BACKGROUND

TBNRD, in south-central Nebraska, comprises portions of three different river basins: the Republican River, the Platte River, and the Little Blue River. The area receives an average of 22-24 inches of rainfall per year. There are 580,575 irrigated agricultural acres. Of these, 466,247 acres are irrigated solely with groundwater. Fewer than 20,000 acres are irrigated exclusively with surface water; the rest use a mix of surface water and groundwater. The main crops grown in the area are corn and soybeans. TBNRD sets a 3-year pumping allocation of 27 inches in Union Township to protect declining groundwater supply there. About 30% of wells in the Little Blue Basin and 20% of wells in the Platte River Basin are metered. All the wells located in the Republican River Basin are metered as a compliance condition for the interstate Republican River Compact.



## GROUNDWATER TRANSFERS

The administrative fee for a formal groundwater transfer is \$100. Formal transfers must be at least 3 acres. Typically, such transfers involve 10-15 acres. Formal groundwater transfers in TBNRD need to be agreed to by any land lienholders, approved by the Board of Directors, reported to county assessors, and certified by county clerks. There are usually about 8-10 formal transfers annually but there can be up to 30 transactions per year when corn prices are high. Most of those transfers are between irrigators. Groundwater transfers for cattle feedlots and industry also happen occasionally. Informal groundwater transfers occur frequently between irrigators. They require TBNRD's approval but don't need to be recorded at the clerk's office and there's no fee associated with them. These transfers are monitored via flowmeters. Agreements to pump water from a well onto neighboring property are popular throughout the district, especially where center pivots are located on two adjacent parcels. Informal transfers in Union Township allow growers to combine their groundwater allocation across multiple fields. In TBNRD, most transfer approval processes are river basin-specific.



## TRANSFER DIRECTION & BOUNDARIES

Groundwater can't be transferred between river basins in TBNRD. Within the Platte River Basin, there are restrictions on the purchase of water rights based on an assessment of sustainable irrigated area and transfers aren't allowed to some areas. If the transfer doesn't lead to higher streamflow depletion based on TBNRD's data, no adjustment is made to the amount of water transferred. Formal transfers from lower to higher streamflow depletion areas are discouraged and for them to be approved, the quantity of groundwater pumping rights transferred may need to be adjusted so that there is no net increase in stream impacts. The exact adjustment is determined on a case-by-case basis.

Within the Republican River and the Little Blue River basins, formal transfers can happen anywhere, except in a small number of townships where groundwater levels are on a long-term declining trend. Formal transfers can happen within each of those townships but groundwater pumping rights can't be transferred into these townships from other areas. For informal transfers in all river basins, impacts on streams are not accounted for.



## OTHER POINTS OF INTEREST

Growers who can legally irrigate with both groundwater and surface water ("commingled") on their property can transfer their water only to parcels that also have both groundwater and surface water with a condition to maintain their surface water contract. This is because diversion and use of surface water provides extra groundwater recharge. Informal groundwater transfers involving commingled water are valid until the end of the calendar year in which they were approved.

*Transferring Groundwater Factsheet #3, Tri-Basin Natural Resources District  
R. Rimsaite, S. Munezero, and N. Brozović  
Daugherty Water for Food Global Institute, July 2021  
This work was supported by USDA under contract number OCE 58-0111-20-007*

**Transfer** means a change in the groundwater use location, purpose, or point of withdrawal.

A **formal transfer** is a transfer of a property right. In TBNRD, formal transfers are called the "reassigning of certified irrigated acres."

An **informal transfer** is a reallocation of water across space/time without transfer of a property right. Informal transfers, often called "pooling," allow joint operation of two or more irrigated tracts. In TBNRD, besides "pooling," which occurs only in Union Township, informal transfers are called "groundwater transfers," which allow landowners to pump groundwater from their well onto a neighboring parcel under different ownership.

**Transfer direction** must be considered when there are concerns about impacts of groundwater pumping on streamflow.

**Transfer boundaries** define the area within which groundwater can be transferred.

**Commingling** means that both groundwater and surface water are legally available for use on the same irrigated acres.



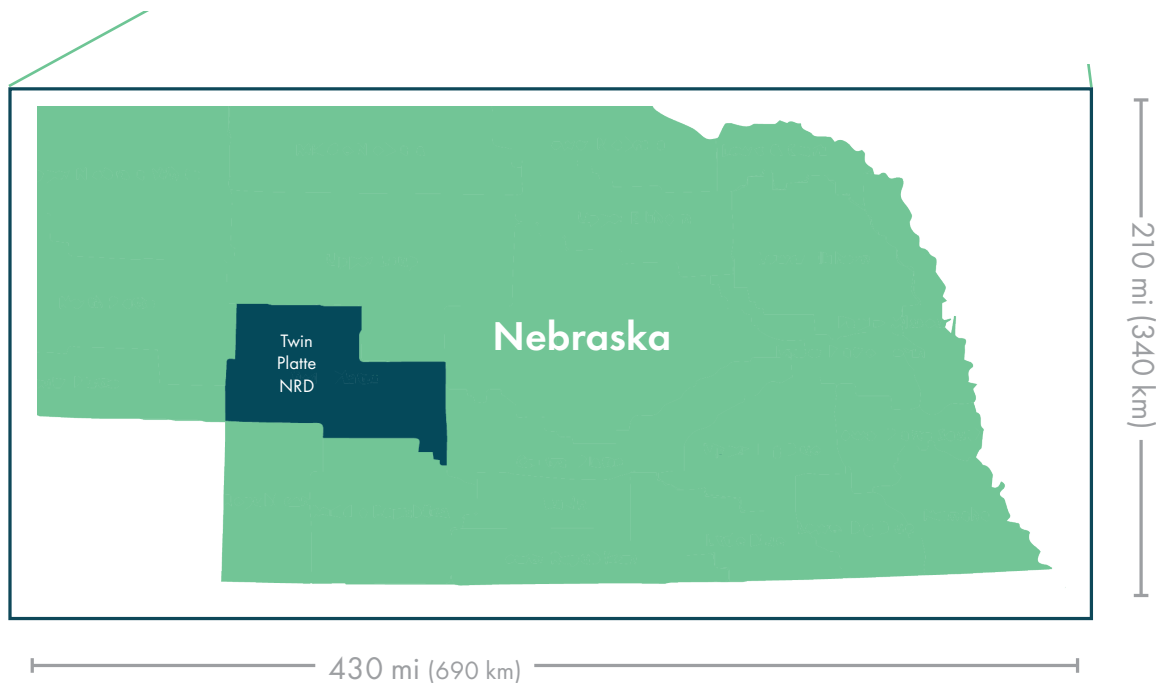
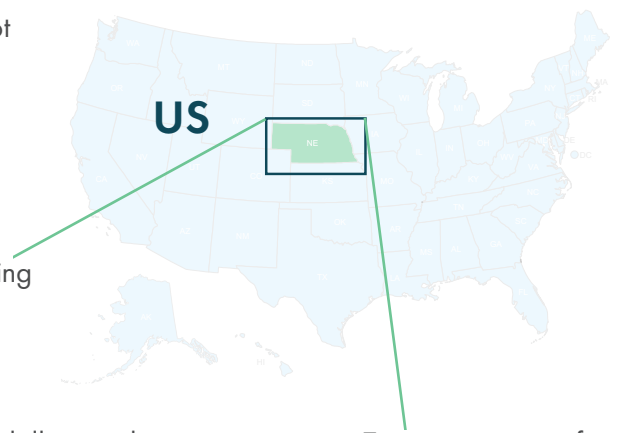
# TRANSFERRING GROUNDWATER IN THE HIGH PLAINS

## Twin Platte Natural Resources District, Nebraska



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- ▶ In the Twin Platte Natural Resources District (TPNRD), water demand for crop irrigation is generally high due to low average annual rainfall. The district seeks to ensure groundwater supply sustainability and prevent long-term groundwater depletion. The TPNRD is accountable for the impacts of groundwater pumping on streamflow governed by the Platte River Basin and local integrated management plans.
- ▶ TPNRD limits groundwater use for irrigation by imposing a well drilling moratorium. Water use in the district has also been managed by implementing a water data program, providing growers with real time information through an online dashboard. Groundwater allocations and metering systems are not used in the district.
- ▶ Growers can formally transfer their groundwater pumping rights separately to land ownership. To be approved, groundwater transfers must be determined to have no net negative impacts on streamflow. Some adjustment to the amount of groundwater pumping rights transferred may be needed to avoid any anticipated net impact resulting from the transfer.
- ▶ The frequency and size of formal groundwater transfers vary greatly. Transaction costs include fees associated with the formal transfer application and, when necessary, additional costs for well drilling and irrigation systems. Transaction size often depends on the area needed to transition to a full center pivot irrigation system. Groundwater transfer activity appears to be positively correlated with crop commodity prices.





## BACKGROUND

TPNRD, in west-central Nebraska, receives an average of 18-22 inches of rainfall per year. There are 320,000 acres irrigated solely with groundwater and about 45,000 acres that use a mix of surface water and groundwater. The main crops grown in the area are corn and soybeans, though TPNRD also produces sugar beets, alfalfa, and potatoes. The district imposes a well drilling moratorium and measures groundwater levels at 135 sites in real time via water level sensors and wireless transmitters. Water use in the Platte River Basin is limited by an interstate compact with Colorado. The district must be in compliance with the basin integrated management plan and the district's integrated management plan that was agreed by the state and TPNRD.



## GROUNDWATER TRANSFERS

The non-refundable administrative fee for a formal permanent groundwater transfer permit is \$200. The transfer process requires estimation of the potential impacts of the transfer on streamflow resulting from surface water-groundwater interaction. Without an additional fee, the district estimates 50-year impacts of any formal transfer on streamflow using pre-existing outputs of a hydrological model. Once approved by the TPNRD Board of Directors, the transfer permit is valid for one calendar year. Transfer size in TPNRD varies between 6 and 130 acres, which corresponds to the sizes of a corner lot and an area needed for a full center pivot, respectively. Transfer activity in TPNRD fluctuates between 5 and 140 transfers per year. More frequent transfers seem to be driven by higher corn and soybean prices. Most transfers are between irrigators, though groundwater transfers for cattle feedlots and industry also occur occasionally.



## TRANSFER DIRECTION & BOUNDARIES

If the transfer doesn't lead to higher streamflow depletion based on TPNRD's hydrologic model, no adjustment is made to the amount of water transferred. Transfers from lower to higher streamflow depletion are discouraged, and to be approved, the quantity of groundwater pumping rights transferred may need to be adjusted so there is no net expected increase in stream impact over a 50 year period. The exact adjustment is determined on a case-by-case basis. The distance within the district between buyer and sellers is not limited when transferring groundwater.



## OTHER POINTS OF INTEREST

(i) Growers who can legally irrigate with both groundwater and surface water ("commingled") on their property are able to transfer their water, but these transfers are very infrequent (3-4 transfers over the last 15 years) and need to be co-administered by the Nebraska Department of Natural Resources (NeDNR) and relevant ditch company because surface water is not overseen by the NRDs. (ii) In 2021, TPNRD began monitoring groundwater levels using water level sensors and wireless transmitters, which allows to observe the aquifer's seasonal fluctuation in real time.

**Transfer** means a change in the groundwater use location, purpose, or point of withdrawal.

A **formal transfer** is a transfer of a property right. In TPNRD, formal transfers of groundwater rights between wells are called "transfer of certified acres."

An **informal transfer** is a reallocation of water across space/time without transfer of a property right. Informal transfers, often called "pooling," allow joint operation of two or more irrigated tracts. In TPNRD, there are no such informal transfers.

**Transfer direction** must be considered when there are concerns about impacts of groundwater pumping on streamflow.

**Transfer boundaries** define the area within which groundwater can be transferred.

*Transferring Groundwater Factsheet #7,  
Twin Platte Natural Resources District  
R. Rimsaite, S. Munezero, and N. Brozović  
Daugherty Water for Food Global Institute, January 2022  
This work was supported by USDA  
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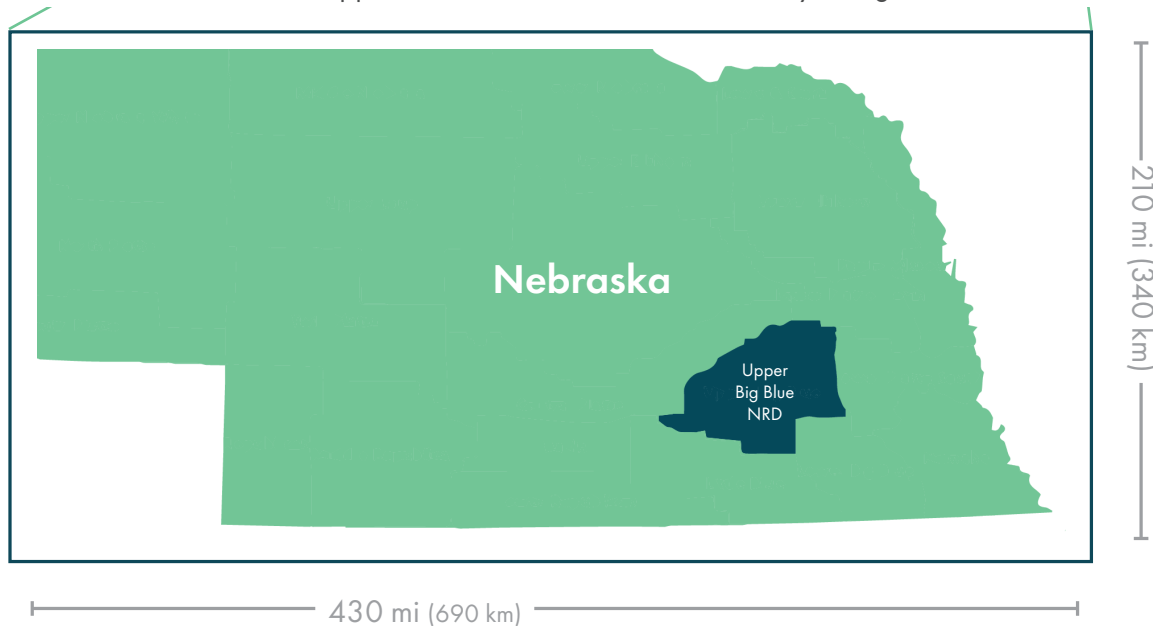
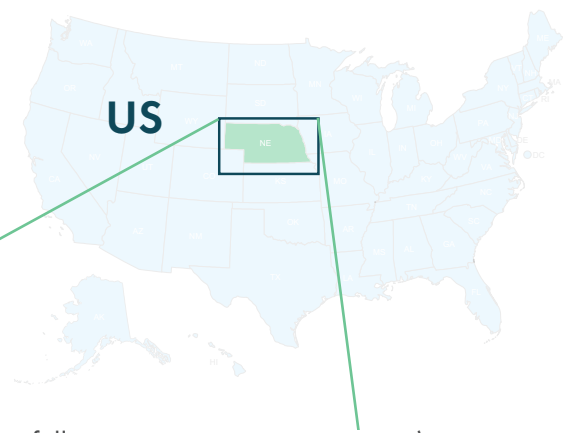
# TRANSFERRING GROUNDWATER IN THE HIGH PLAINS

## Upper Big Blue Natural Resources District, Nebraska



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*at the University of Nebraska*

- ▶ The Upper Big Blue Natural Resources District (UBBNRD) manages groundwater use for crop irrigation to ensure the long-term sustainability of its supply. The UBBNRD is accountable for the impacts of groundwater pumping on streamflow governed by interstate compact. The district also seeks to prevent long-term groundwater depletion.
- ▶ Groundwater use for irrigation is restricted with mandatory metering and water use reports. Currently, there is no moratorium for well drilling or agricultural acre development in the district. The district is prepared to use an allocation system if groundwater availability reaches a predetermined low level.
- ▶ Groundwater transfers in UBBNRD allow pumping water from a well onto a parcel of land located either within the same survey section or in a connected survey section without discontinuing the right to pump the same amount of water onto the original parcel. Models are currently being developed to help understand the connection between groundwater and surface water in the Big Blue River basin, which in the future might be used to better understand transfer impacts to streamflow.
- ▶ UBBNRD regulations limit the size of the transfer and the distance that groundwater can be transferred. For agricultural groundwater transfers, transaction size is limited by the size of the source and destination tracts involved in the transfer, as well as the irrigation technology used (e.g., it usually doesn't exceed the amount needed for a full center pivot irrigation system).
- ▶ The frequency of groundwater transfers depends on the transfer boundary rule. Transactions occurring within one survey section have less administrative burden and are more common. Transaction costs for transfers outside one survey section include fees associated with the transfer application and, when needed, fees for hydrologic evaluation and well construction.





## BACKGROUND

UBBNRD, in southeastern Nebraska, covers a 2,865 square mile area in the upper portion of the Big Blue River watershed. The majority of the district is outside the areas of limited groundwater availability (a “High-Risk groundwater area” in UBBNRD terminology) and receives an average of 26-28 inches of rainfall per year. There are 1.24 million acres irrigated solely with groundwater. Less than 50,000 acres use surface water. The main crops grown in the area are corn and soybeans. There are approximately 12,000 active wells in the district. To verify groundwater use compliance, UBBNRD meters and monitors all groundwater wells, and there’s an allocation system ready to be implemented if groundwater supply drops to a trigger level. First, a 3-year allocation of 30 inches would be implemented, which, if necessary, would be followed by a 5-year allocation of 45 inches.



## GROUNDWATER TRANSFERS

In UBBNRD, authorized groundwater transfers allow pumping groundwater from a well on one survey section onto a connected survey section without discontinuing the right to pump groundwater onto the original tract. The process may result in doubling water withdrawals from the same well. For this type of transfer, an applicant needs to pay a \$50 fee and receive authorization from the district’s board of directors. Transfer size is limited to the number of acres that can be irrigated on the tract where the originating well is located. Agricultural water transfer size in UBBNRD can’t exceed water needed to irrigate 160 acres. On average, there have been about five such transfers per year. Most transactions are for agricultural uses, but transfers to large water users (withdrawing more than 500 acre-feet per year), like the ethanol industry or municipalities, also occur on occasion. These large water transfers require the applicant to go through a hydrologic evaluation, which helps to understand water availability for such a withdrawal and potential impact to existing water users. This evaluation is done by an independent private firm. Then, for large water transfers, a new well usually needs to be constructed. The evaluation and well construction add additional costs for the applicant.

Groundwater transfers from one well onto a parcel within the same survey section, which can be owned or operated by one or multiple people, don’t need to be authorized or approved by the district. For these transactions, land operators don’t need to pay a fee; they only need to inform the district about a change in irrigation practice. Such water transactions are more frequent.



## TRANSFER DIRECTION & BOUNDARIES

Since 2014, groundwater can’t be transferred from, to, or within the designated “High-Risk” areas. Transfers that started prior to 2014 are allowed to continue, but the number of irrigated acres can’t be increased. Outside these areas, water from an originating well can be transferred within the same survey section or from one survey section onto a directly connected survey section. There are no rules specifying transfer direction within these boundaries.



## OTHER POINTS OF INTEREST

In 2021, UBBNRD developed and implemented a water accounting software. The platform improves water use monitoring and tracks information provided in mandatory water reporting.

*Transferring Groundwater Factsheet #6,  
Upper Big Blue Natural Resources District  
R. Rimsaite, S. Munezero, and N. Brozović  
Daugherty Water for Food Global Institute, December 2021  
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### A **survey section**

is an area covering one square mile (640 acres).

**Transfer** means a change in the groundwater use location, purpose, or point of withdrawal.

### A **formal transfer**

is a transfer of a property right. In UBBNRD, there are no such formal transfers.

### An **informal transfer**

is a reallocation of water across space/time without transfer of a property right. Informal transfers, often called “pooling,” allow joint operation of two or more irrigated tracts when an allocation system is implemented (“agreement pool” in UBBNRD terminology). In UBBNRD, “pooling” can also mean groundwater transfers from one well within the same survey section (defined as “owner-operator pool” or “well pool”). Besides “pooling,” informal transfers are called “groundwater transfers,” which allow landowners to pump groundwater from their well onto a neighboring survey section.

### **Transfer direction**

must be considered when there are concerns about impacts of groundwater pumping on streamflow.

**Transfer boundaries** define the area within which groundwater can be transferred.

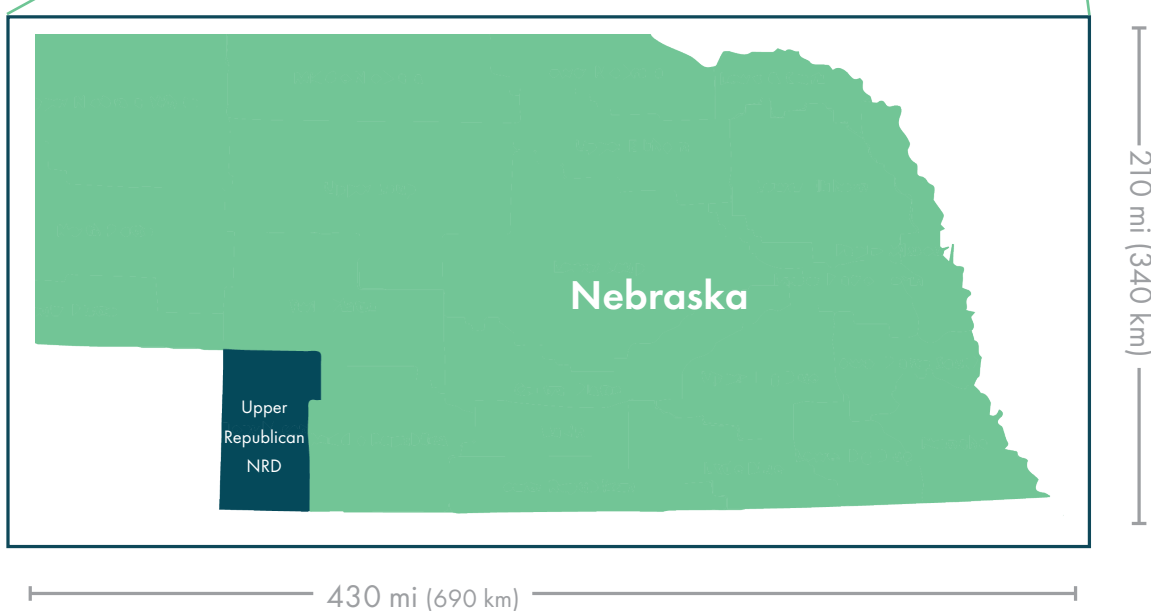
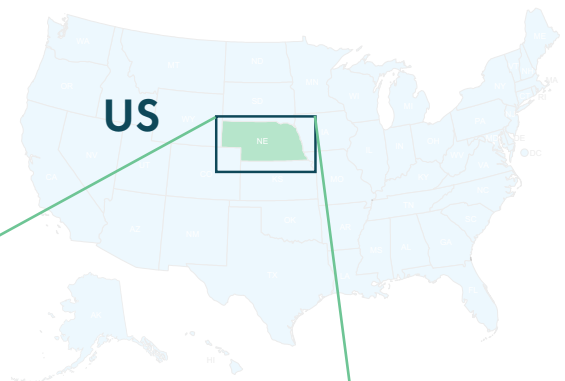
# TRANSFERRING GROUNDWATER IN THE HIGH PLAINS

Upper Republican Natural Resources District, Nebraska



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- ▶ In the Upper Republican Natural Resources District (URNRD), water availability for crop irrigation is highly variable. Irrigation demand is generally high due to low average annual rainfall. The URNRD is accountable for the impacts of groundwater pumping on streamflow governed by interstate compact. The district is also concerned about local long-term groundwater depletion.
- ▶ Groundwater use for irrigation is restricted, with mandatory metering and a 5-year allocation system that allows banking of allocation between periods. Many growers are able to use their banked allocation and, to date, have not needed to stop irrigating even during extended drought periods. Growers who have been using their entire base allocation in prior years, however, don't have banked allocations and sometimes need to acquire more groundwater to irrigate their crops, especially during dry years.
- ▶ Growers can formally transfer their groundwater pumping rights separately to land ownership. To be approved, groundwater transfers must be determined to have no net negative impacts on streamflow. Some adjustment to the amount of groundwater rights transferred may be needed to avoid expected net impact resulting from the transfer.
- ▶ Formal groundwater transfers are usually small and, despite the absence of administrative fees, are not very frequent. Transaction activity appears to be positively correlated with crop commodity prices.
- ▶ Informal groundwater transfers are common. These arrangements allow for localized and restricted reallocation of groundwater pumping rights with very little administrative burden and no transfer of the property right.





## BACKGROUND

URNRD, in the southwestern corner of Nebraska, shares borders with Colorado and Kansas. The district receives 17-20 inches of rainfall annually. There are 450,000 agricultural acres irrigated with groundwater. Only about 3,000 acres are irrigated with surface water. The main crops are corn and soybeans, though URNRD producers also grow forage, potatoes, and dry edible beans. URNRD sets a 5-year pumping allocation of 65 inches, and meters and monitors all groundwater wells to verify compliance. Banking of unused allocation, called “carryforward” in URNRD, is allowed. Usage above the 65-inch allocation within the given 5-year period is permitted. However, if the usage of carryforward in the grower’s account exceeds 7.5 inches during an allocation period, the grower incurs a quantitative penalty to their future allocation.



## GROUNDWATER TRANSFERS

In URNRD, to prevent an increase in water use, the formal groundwater transfer process limits the quantity of pumping rights transferred to the annual average percentage of the allocation that was used from the originating well during the last 5 years. The formal process also requires estimation of the potential impacts of the transfer on streamflow resulting from surface water-groundwater interaction. The district estimates the 50-year impacts of any formal transfer on streamflow (40-year impacts are used in areas not covered by the interstate Republican River Compact). Analyses are based on pre-existing outputs of a hydrological model and do not incur a fee. On average, there are between 6 and 12 formal transfers annually. Together, these don’t exceed more than 3,000 irrigated acres per year. Most transfers are for crop production, but occasionally groundwater has been transferred to feedlots or an ethanol plant. Groundwater transfers need to be approved by the Board of Directors, but the administrative process for informal groundwater transfer agreements is much simpler than for formal transfers. Informal transfers, which allow combining allocations of tracts, do not require stream impact analysis, and as a result, occur frequently. Roughly 70% of wells in URNRD are in pooling agreements.



## TRANSFER DIRECTION & BOUNDARIES

Formal groundwater transfers can occur approximately within a 36-square mile block centered on the section of the originating well (a “floating township” in URNRD terminology). Groundwater pumping rights can be transferred further than 6 miles if the transfer reduces expected stream depletion. If the transfer doesn’t lead to higher streamflow depletion based on URNRD’s data, no adjustment is made to the amount of water transferred. Formal transfers from lower to higher streamflow depletion are discouraged, and for them to be approved, the quantity of groundwater pumping rights transferred may need to be adjusted so that there is no net increase in stream impacts. Informal transfers typically allow growers to combine their groundwater allocations across multiple fields within a 36-mile block without needing to account for changes in expected streamflow impacts.



## OTHER POINTS OF INTEREST

(i) URNRD was one of the first agricultural water districts in the world to implement mandatory metering for all wells, starting in 1978 and completed by 1982; (ii) URNRD has acquired several large agricultural operations, both in its own area and in adjacent areas, retiring the land from agricultural production and instead using the water rights for stream augmentation to maintain compliance with the Republican River Compact; (iii) Unlike in some other western Nebraska NRDs, there are only three fields within URNRD with both surface and groundwater rights available.

**Transfer** means a change in the groundwater use location, purpose, or point of withdrawal.

A **formal transfer** is a transfer of a property right. In URNRD, formal transfers of groundwater rights between wells are called “transfers.”

An **informal transfer** is a reallocation of water across space/time without transfer of a property right. Informal transfers, often called “pooling,” allow joint operation of two or more irrigated tracts.

**Transfer direction** must be considered when there are concerns about impacts of pumping on streamflow.

**Transfer boundaries** define the area within which groundwater can be transferred.

*Transferring Groundwater Factsheet #2, Upper Republican Natural Resources District  
R. Rimsaite, S. Munezero, and N. Brozović  
Daugherty Water for Food Global Institute, June 2021  
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