Nebraska Statewide Groundwater-Level Monitoring Report

2025

Aaron R. Young, Mark E. Burbach, Valentina I. Ita, Susan Olafsen Lackey, R.M. Joeckel, and Jeffrey P. Westrop

Conservation and Survey Division
School of Natural Resources

Nebraska Water Survey Paper Number 94

Institute of Agriculture and Natural Resources
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The Conservation and Survey Division of the University of Nebraska–Lincoln is the agency designated by statute to investigate and interpret the geologically related natural resources of the State, to make available to the public the results of these investigations, and to assist in the development and conservation of these resources. It consists of program areas in geology, water, soils, and remote sensing-geographic information systems.

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FOREWORD

Nebraska Water Issues of Interest in 2025

R.M. Joeckel, Nebraska State Geologist and Director of the Conservation and Survey Division; Senior Associate Director, School of Natural Resources

Surface water

Drought conditions prevailed for much of 2025 throughout Nebraska, however a few noteworthy precipitation events occurred. Flooding occurred in central Nebraska around Grand Island on June 25 and June 26 due to heavy rain from training thunderstorms; Grand Island Mayor Roger Steele subsequently declared an emergency (Carmona and Little, 2025). More than six inches of rain fell on Grand Island on June 25; the second-highest single-day total on record for the city. Multiple severe thunderstorms brought heavy rains and strong winds to central and eastern Nebraska from August 8 to 10, also leading to flash floods in the Valley, Blair, and Lincoln areas (National Weather Service, undated). Following a request by Nebraska Governor Jim Pillen, President Donald Trump approved a major disaster declaration for the 12 impacted counties on October 22 (FEMA, 2025). Overall, below-average flows characterized major rivers in Nebraska during 2025.

After sweeping Department of Government Efficiency (DOGE) cuts to the National Weather Service (NWS) in early 2025, staffing shortfalls severely curtailed operations at the NWS Valley/Omaha office. Advocacy by Nebraska's federal delegation contributed to the rehiring of hundreds of meteorologists and technicians (Salinas II, 2025a, b).

On May 9, State Senator Tanya Storer introduced LR158, a proposal for an interim study of a proposed transfer of administration of part of the Niobrara National Scenic River from the National Park Service to the Nebraska Game and Parks Commission and the Middle Niobrara Natural Resources District (Nebraska Legislature, 2025a; Hammel, 2025a–c). After referral to the Executive Board and the Natural Resources Committee, and following disputes between interested parties, the scheduled hearing on September 19 was canceled due to an unrelated matter; it is unclear whether such a hearing will be rescheduled. LB317, introduced by State Senator Tom Brandt at the request of Governor Pillen, merged Nebraska's Department of Natural Resources and Department of Environment and Energy as the Department of Water, Energy, and Environment on July 1.

The proposed Perkins County Canal remained an issue of contention for Nebraska and Colorado in 2025. On July 16, the State of Nebraska filed a lawsuit against Colorado with the U.S. Supreme Court, charging water-rights interference in potential violation of the 1923 South Platte River Compact. Colorado Attorney General Phil Weiser responded with a filing to the court in October, asserting that Nebraska's claims are poorly substantiated, if not speculative, and both Weiser and Colorado Governor Jared Polis urged rejection of the lawsuit (Wendling, 2025).

Groundwater

Localized groundwater stress was apparent in multiple places in 2025. In May, the Board of Directors of the Little Blue Natural Resources District (NRD) imposed a stay on the construction of new, high-capacity irrigation wells and the expansion of irrigated acres in part of their jurisdiction. Stays in various parts of the district had already been imposed in 2006, 2014, and 2024. The Central Platte NRD hosted the Nebraska Children's Groundwater Festival in May. The board of the Upper Niobrara White NRD voted in September to place the entire district into a Phase I water quality management area out of concern over groundwater nitrates and avoiding additional regulation in the future (Anonymous, 2025). A new Groundwater Management Plan was approved for the Lower Platte North NRD in October and sent for interagency review. The Twin Platte NRD contracted with Olsson consulting (Lincoln) to produce a new groundwater management plan, which was released in mid-August. In preparation for its new Groundwater Management Plan, the Lower Platte South NRD held multiple stakeholder meetings in the fall of 2025.

In the second half of 2025, the town of Fairbury hosted a pilot project using biocatalyst technology from Microvi Biotech, Inc. (Hayward, CA) to reduce elevated nitrate levels in drinking water derived from groundwater (Ball, 2025). The Nebraska Department of Water, Energy, and Environment issued its 2025 Nebraska Groundwater Quality Monitoring Report in November.

On January 16, Senator Tom Brandt introduced LB344, which proposes to modernize groundwater allocation and enhance water management in Nebraska.

This bill was indefinitely postponed and then amended into LB36 by amendment AM645 (Nebraska Legislature 2025b). LB36 had been introduced by Brandt on January 9 and it underwent amendment through provisions or portions of no less than seven other bills (including LB344) introduced in the Nebraska Legislature during 2025 (Nebraska Legislature, 2025c).

A few changes were made in federal regulations pertaining to groundwater in 2025. The definition of "waters of the United States" (WOTUS) under the Clean Water Act was amended with an exclusion for groundwater; other changes deal with the definitions of terms, the exclusion of certain ditches and waste-treatment systems, and wetlands. (EPA Press office, 2025a). The proposed WOTUS changes will be open for public comment into the first week of 2026. The Environmental Protection Agency announced in May that it would maintain the current National Primary Drinking Water maximum contaminant levels for perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS) set in April 2024; the agency may extend the compliance period on these contaminants to as late as 2031 (EPA Press office, 2025b).

SELECT RECENT PUBLICATIONS INVOLVING CSD PERSONNEL

Khalil, M.A., Hallum, D.R., Joeckel, R.M., and Kronda. M., 2025. Integrated 2D time-lapse resistivity tomography and spontaneous potential surveys demonstrate seasonal, use-related patterns of seepage from a water-supply canal system. Journal of Applied Geophysics 238, 105708 [https://doi.org/10.1016/j.jappgeo.2025.105708].

Wise, M.A., Haacker, E., Burbach, M.E, Bitterman, P., & Kopacz, D., 2025. Likelihood of water irrigation efficiency adoption by producers in Eastern Arkansas. Journal of the American Water Resources Association 61(4), e70037 {https://doi.org/10.1111/1752-1688.70037}.

Burbach, M.E., Kennedy, S., Rudnick, R.R., Stockton, M., Burr, C.A., and Rhoades, K., 2025. Producers' views and decision-making related to new management practices and technologies after participating in an experiential farm management competition: A mixed-methods study. Journal of Soil and Water Conservation 80 (3): 261–278. https://doi.org/10.1080/00224561.2025.2484975

Burbach, M.E., Kennedy, S.M., Eaton, W.M., Brasier, K.J., Rudnick, D.R., and Whitmer, W. (2025). Examination of cooperative extension as a bridging organization to enhance cross-boundary collaborative water management. Journal of Extension, 63(3), Article 4.

Westrop, J.P., 2025. Qualitative screening for redox-sensitive elements in groundwater using the presence or absence of rust on irrigation center pivots. Agrosystems, Environment, and Geoscience 8 (2), DOI:10.1002/agg2.70098.

INTRODUCTION

Groundwater-level information is valuable to citizens and stakeholders.
It quantifies the availability of groundwater and informs management decisions.

This report is a synthesis of groundwater-level monitoring programs in Nebraska. It is a continuation of the series of annual reports and maps produced by the Conservation and Survey Division (CSD) of the University of Nebraska in cooperation with the U.S. Geological Survey (USGS) since the 1950s. Groundwater-level monitoring began in Nebraska in 1930 to survey the state's groundwater resources and observe changes in its availability on a regular basis. The CSD and USGS cooperatively developed, maintained, and operated an observation-well network throughout the state. These two agencies were responsible for collecting and archiving this information, and for making it available to the citizens.

Although CSD and USGS still occupy the central roles in the statewide groundwater-level monitoring program, other agencies have assumed the responsibilities of building and maintaining observation networks and measuring groundwater-levels. The CSD and USGS continue to operate some of the original observation wells, but today most measurements are made by agencies such as Natural Resources Districts (NRDs) (Fig.1), U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, and Public Power and Irrigation Districts. Because these agencies are located throughout the state, they can implement groundwater-level monitoring programs using local field staff, landowner contacts, taxing and regulatory authority, and first-hand knowledge of local conditions. Collectively, these agencies have developed an extensive network of observation wells throughout the state.

The CSD provides vital technical expertise to these agencies as they develop and implement groundwater-level monitoring plans. The CSD evaluates the adequacy and accuracy of the groundwater-level data and provides the statewide assessment of groundwater-level changes across many of the state's aquifers (Figs. 2–3).

The CSD has long provided technical services to stakeholders by integrating groundwater-level change data with multiple data sets in order to:

1) Determine the amount of groundwater in storage and its availability for use.
2) Assess the water-supply outlook by identifying changes in the volume of groundwater in storage.
3) Identify areas in which changes in groundwater levels may have an economic impact.
4) Assist state and local agencies in the formulation and administration of resource-management programs.
5) Determine or estimate the rate and direction of groundwater movement, specific yield of aquifers, base flow of streams, sources and amounts of groundwater recharge, and locations and amounts of groundwater discharge.
6) Assess the validity of hydrogeologic interpretations and the assumptions used in developing models of groundwater systems.

The need for this essential information only escalates as water-use pressures steadily increase. The CSD strives to meet this challenge by focusing on fundamental data, building collaborative relationships with the agencies that depend on the information, and providing scientifically accurate information in a timely manner.

Purpose and Methods

Most of the groundwater used in Nebraska is pumped from the High Plains aquifer system (HPA), although there are multiple aquifers in the state (Fig. 2, 3). The HPA underlies parts of eight states, including South Dakota, Wyoming, Nebraska, Colorado, Kansas, Oklahoma, Texas, and New Mexico. In total, Nebraska

Figure 1. Nebraska Natural Resources Districts

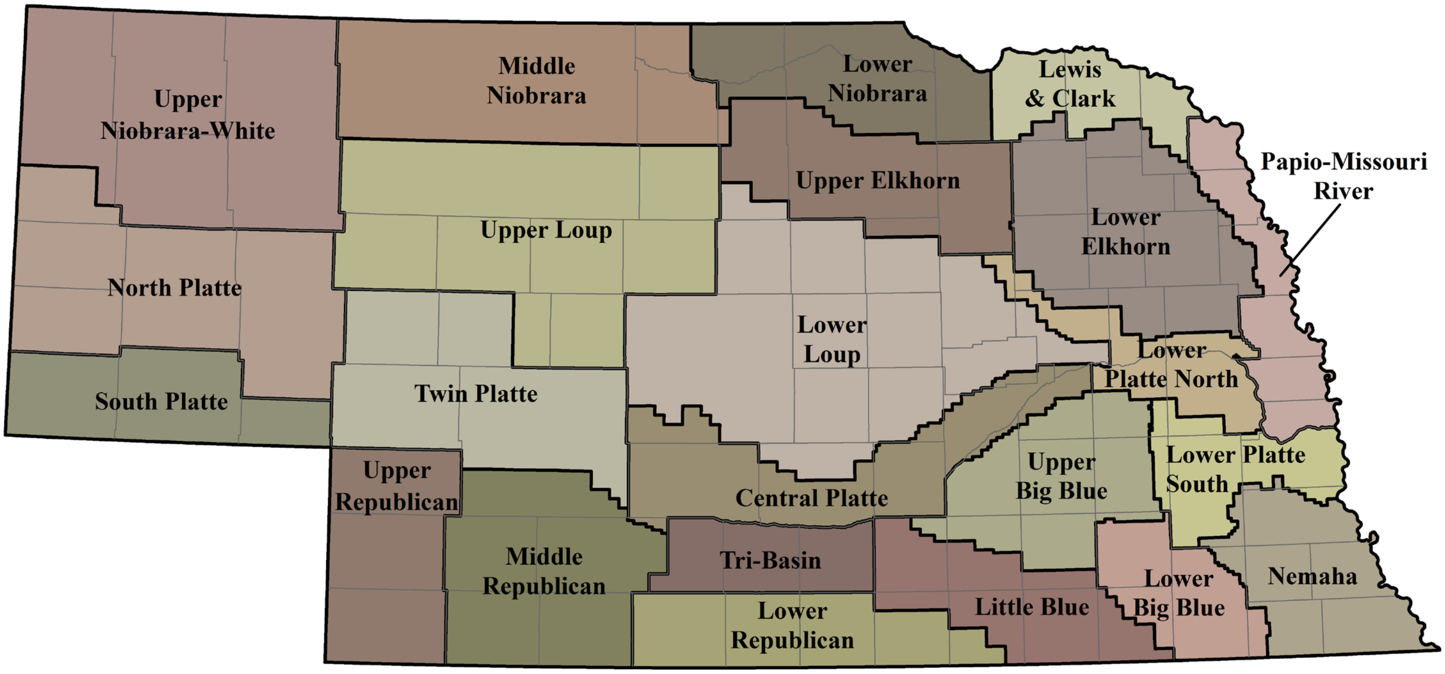
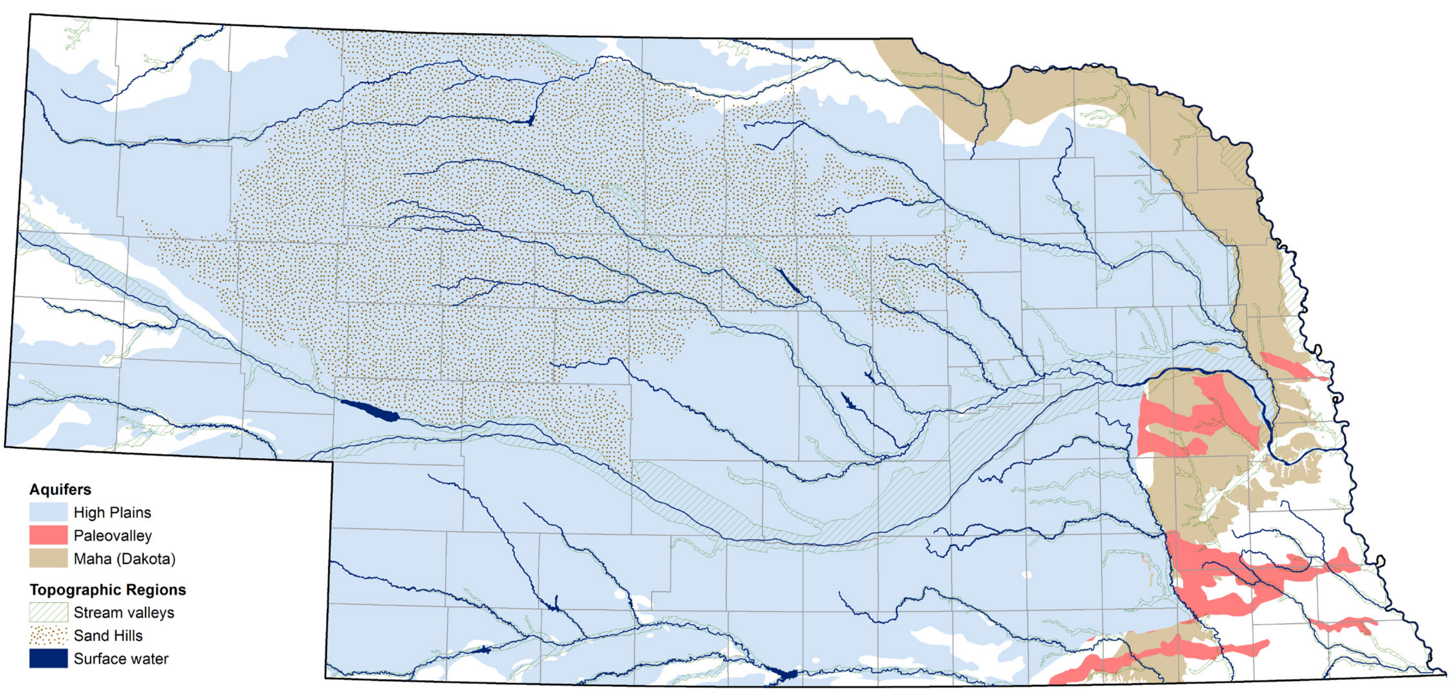


Figure 2. Important Aquifers and Topographic Regions of Nebraska



Note: The aquifer units shown here may contain little or no saturated thickness in some areas.

Figure 3. Generalized Geologic and Hydrostratigraphic Framework of Nebraska

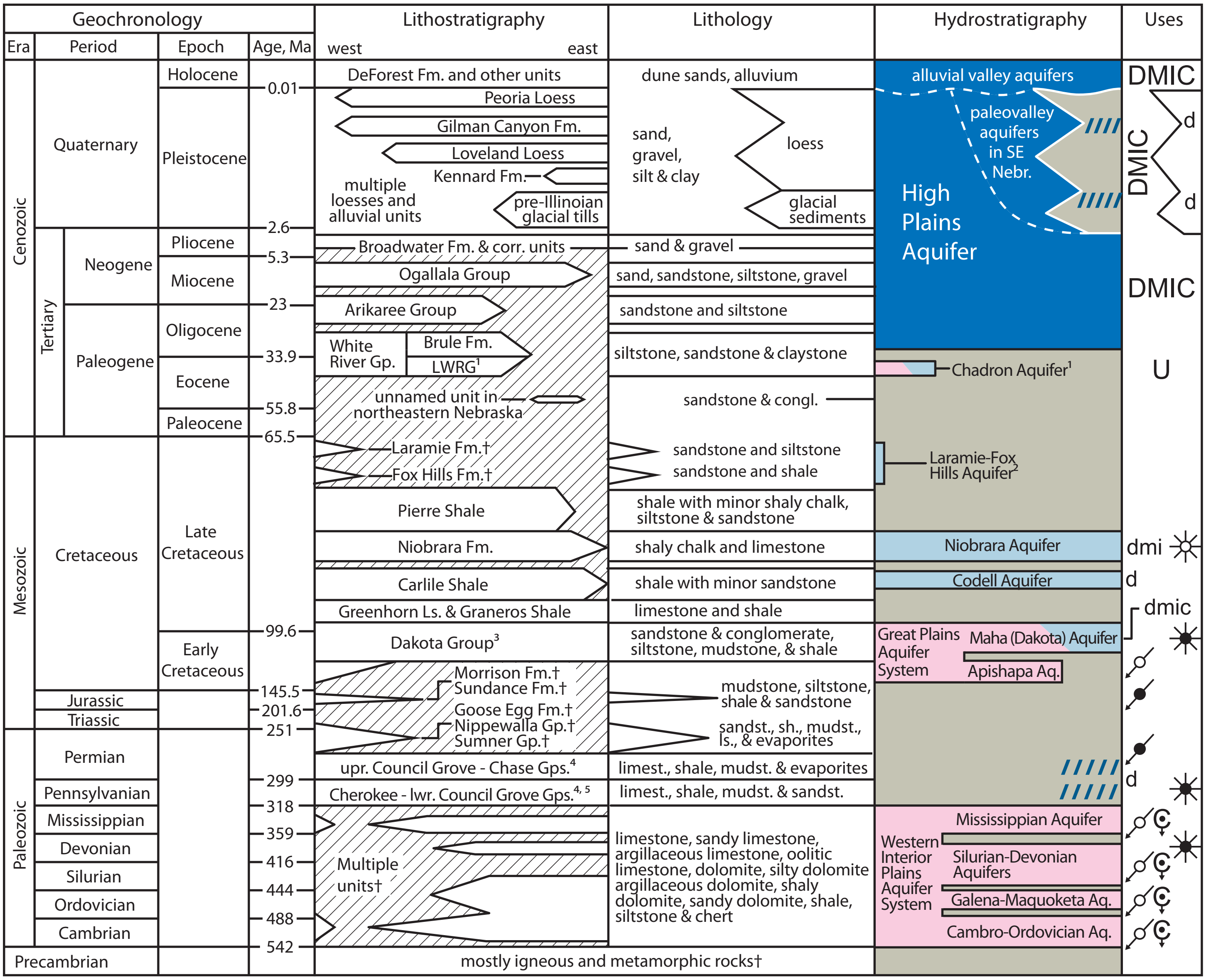


Diagram is not to scale relative to geologic time and stratigraphic thicknesses.

Hydrostratigraphic characteristics and water quality

- primary aquifers with good quality water
- secondary aquifers with good quality water
- secondary aquifers with generally poor quality water
- //// aquitards with local low-yield aquifers
- aquitards

[1] lower White River Group - includes Chamberlain Pass and Chadron Formations according to some authors; "Chadron Aquifer" historically refers to aquifer in lower White River Group

[2] important aquifer in Colorado, but present in Nebraska only in extreme southwestern Panhandle

[3] Dakota Formation in adjacent states

[4] includes correlative units with different names in northwest Nebraska

[5] Cherokee, Marmaton & Pleasanton Groups are not exposed in Nebraska

†present only in subsurface

Groundwater uses and related aspects

- D major domestic use
- d minor domestic use
- I major irrigation use
- i minor irrigation use
- M major municipal use
- m minor municipal use
- C major commercial/industrial use
- c minor commercial/industrial use
- units used for wastewater injection
- units with potential use for wastewater injection
- U unit mined for uranium by in-situ leaching (Dawes Co.)
- unit with potential use for carbon sequestration
- unit producing petroleum or natural gas
- unit with natural gas potential

From: Korus and Joeckel (2011)

overlies approximately 64,600 mi^2 of the HPA, or 36% of the total aquifer by area. By volume as of 2009, Nebraska has approximately 2.040 billion acre-feet of saturated sediments, or 69% of the total volume of the HPA (McGuire et. al., 2012). The greatest area of saturated thickness in the HPA, nearly 1,000 feet, is located under the western portion of the Nebraska Sand Hills (c.f. Korus et. al. 2013, pp. 44).

Although Nebraska is fortunate to have such vast supplies of groundwater, any groundwater supply is vulnerable to depletion through overpumping. According to the 2017 U.S. Census of Agriculture, Nebraska leads the nation in irrigated acres with more than 8.6 million acres. Without proper oversight, irrigation pumping on this scale can rapidly deplete aquifers and lead to large-scale economic hardship. The present report illustrates the changes in groundwater levels in Nebraska at different time scales, resulting from both natural and anthropogenic influenced changes. This information is important to both state and local lawmakers in assessing the current state of Nebraska's groundwater resources, and to local producers in making land management decisions.

This report summarizes changes in Nebraska's groundwater levels over periods of one and ten years prior to 2025, as well as from predevelopment times (generally pre-1960) to 2025. These changes are depicted in maps that delineate regional trends on a statewide basis. **We stress that the maps presented in this report provide overviews of the general locations, magnitudes, and extents of rises and declines. Local conditions, which may vary considerably, are not depicted in the maps in this report and, indeed, they cannot be represented with accuracy at the scale of the maps.** The reader is referred to Figures 1 through 4 for the boundaries of NRDs and the locations of rivers, aquifers, and counties mentioned in the text.

The one- and ten-year changes are presented in the spring 2024 to spring 2025 and spring 2015 to spring 2025 maps, respectively. Groundwater levels measured from thousands of wells throughout the state during the spring of 2025 (Fig. 5) were compared to levels measured in the same wells in the spring of the preceding target year. For the one- and ten-year change maps, contours were generated using computer interpolation. These contours were incorporated into the final maps in areas where the principal aquifer is geographically continuous and in relatively good hydraulic connection, and where data density is comparatively high. In areas not meeting these criteria, the computer-generated contours were manually edited at various scales in order to conform to hydrogeologic boundaries that prevent the flow of groundwater. Such boundaries include: (1) areas where relatively impermeable bedrock units outcrop or exist in the shallow subsurface, such as southeastern Nebraska and in areas of Scotts Bluff County, (2) valley boundaries in eastern Nebraska where alluvial aquifers are a major source of groundwater but upland areas between them lack a primary aquifer, and (3) areas where the HPA is dissected by deeply entrenched parts of the Niobrara, Republican, and Platte River valleys.

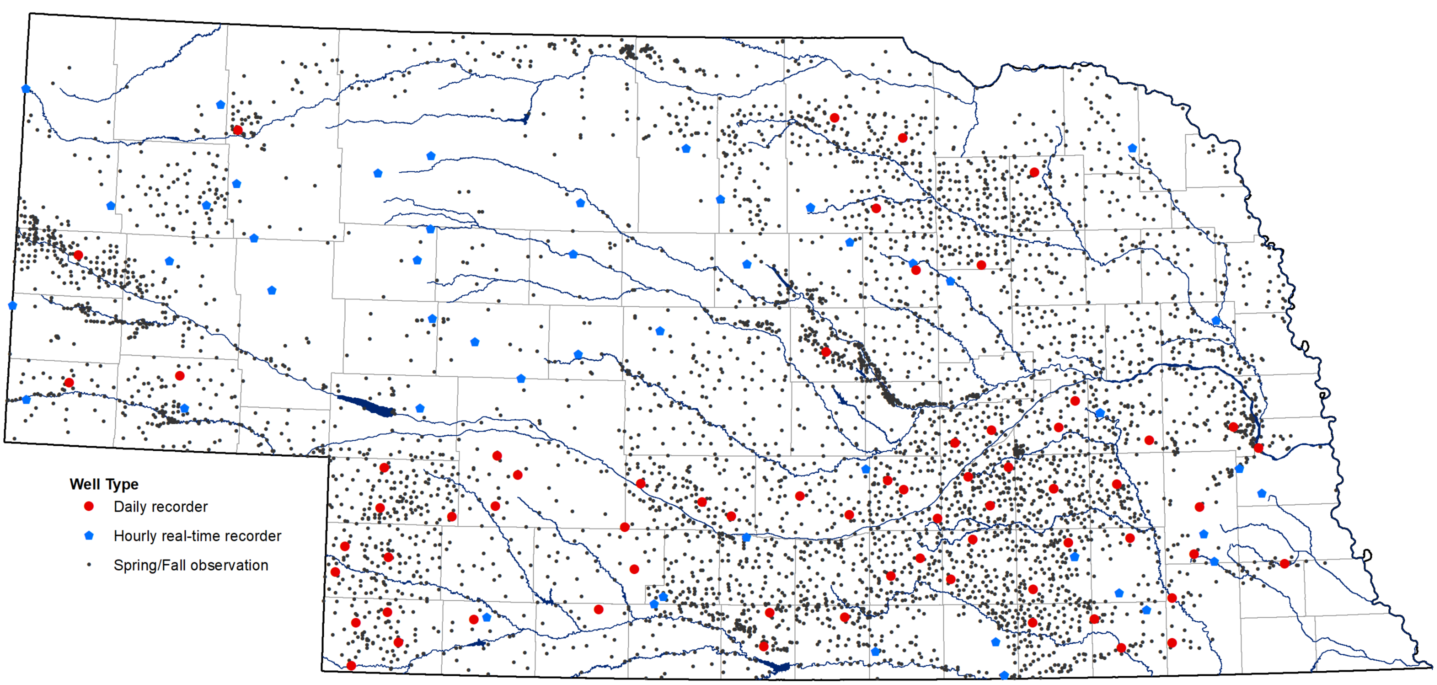
For the predevelopment to spring 2025 map, groundwater levels from wells measured in 2025 were compared to estimated predevelopment groundwater levels in the same wells. An estimated predevelopment groundwater level is the approximate average groundwater level at a well site prior to any development that significantly affects groundwater levels. Predevelopment groundwater levels are generally presumed to be those that predate intensive groundwater irrigation. Such intensive use of groundwater began during the approximate period 1930 to 1960, although not synchronously across the state. Predevelopment map contours were drawn manually with the aid of previously existing maps for similar time periods and with knowledge of major hydrogeologic boundaries.

Areas of sparse data are shown with a hatched pattern on all maps (e.g., Fig. 7). A point-density interpolation was used to determine the number of observation points within a 6-mile (approximately 10-kilometer) search radius. Areas of sparse data were defined as areas with zero observation points within the search radius.

Precipitation maps were prepared by comparing total precipitation over the time period of interest to the 30-year normal provided by the National Climate Data Center (www.ncdc.noaa.gov). The 30-year normal currently in use is calculated on the basis of average annual precipitation during 1991-2020. A precipitation surface is generated using the inverse distance weighted interpolation method in ArcGIS with a 1,640 ft (500 m) cell size. The resulting surface is classified with a defined interval of ten percent and contoured. The resulting contours are smoothed and then converted to polygons.

Figure 4. Counties, Major Cities, and Streams of Nebraska

Figure 5. Location of Observation Wells by Type



Sources: U.S. Geological Survey, Nebraska Water Science Center; U.S. Bureau of Reclamation, Kansas-Nebraska Area Office; Nebraska Natural Resources Districts; Central Nebraska Public Power and Irrigation District; Conservation and Survey Division, School of Natural Resources, University of Nebraska-Lincoln

Factors Causing Groundwater-Level Changes

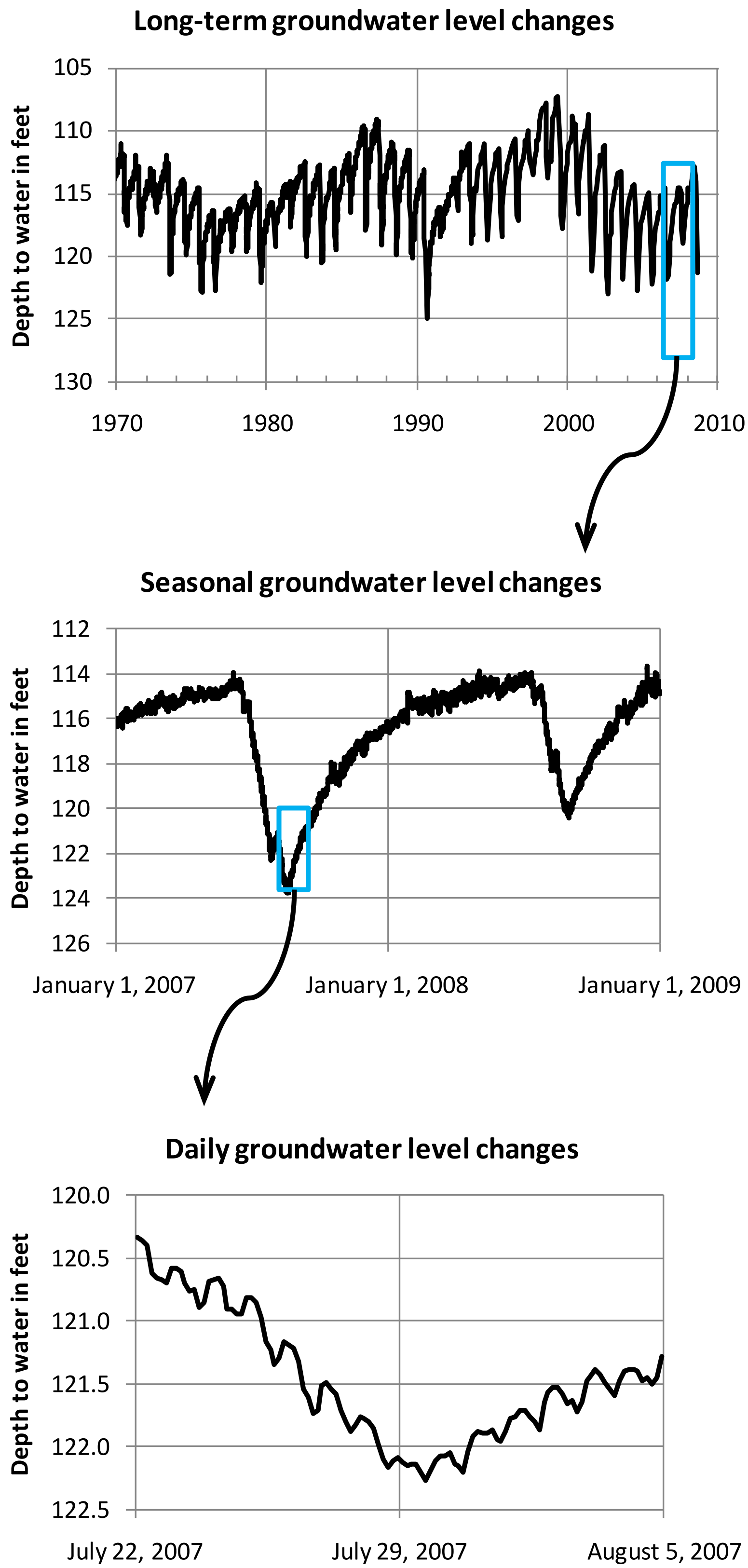
Long-term groundwater-level changes result from the changing balance between recharge to, discharge from, and storage in an aquifer. If recharge and discharge are in balance, such as they were before widespread irrigation development, groundwater levels are generally steady because the amount of water stored in the aquifer does not change. Minor changes in groundwater levels may occur due to natural variations in precipitation and streamflow, but generally the system is in equilibrium. If, however, the rate of recharge exceeds the rate of discharge over a long period, the amount of water stored in the aquifer increases and groundwater levels rise. Conversely, if the rate of discharge exceeds the rate of recharge for a long period, the amount of water in storage is depleted and groundwater levels decline. The magnitudes, locations, and rates of groundwater-level changes are controlled by many factors, including: the aquifer's storage properties, permeability, and saturated thickness; the locations, rates, and pumping schedules of wells; the locations and rates of artificial recharge areas; and the degree of hydraulic connection between the aquifer and surface water bodies.

It is a common misconception that the rate of recharge from precipitation can be used as a "safe yield" or "sustainable limit" on the rate of groundwater extraction from an aquifer (Bredehoeft, 1997). This concept is a gross oversimplification of hydrogeologic processes. The aquifer properties and all sources of recharge and discharge must be taken into consideration. Recharge is provided primarily by precipitation, but also by irrigation return flow and seepage from canals, reservoirs, and streams. Discharge occurs as baseflow to streams and lakes, evapotranspiration, and groundwater pumping. Groundwater levels, therefore, respond to a variety of natural and anthropogenic factors affecting recharge and discharge and are controlled largely by the physical properties of the aquifer. Limiting groundwater extraction to a rate equal to or less than the rate of recharge from precipitation will not prevent depletion of the aquifer. In fact, groundwater "mining" is prone to occur to one degree or another in any heavily pumped aquifer. A holistic, adaptive approach to groundwater management based on hydrologic mass balance is more appropriate. These strategies are discussed by several authors (e.g., Sophocleous, 1997, 1998, 2000; Alley and Leake, 2004; Maimone, 2004; Korus and Burbach, 2009a).

Groundwater-level changes can be observed at many different temporal scales (Fig. 6). Changes may occur over several minutes or hours in response to pumping, floods, or earthquakes. Long-term changes may occur due to the cumulative effects of pumping over many irrigation seasons, prolonged droughts or periods of high rainfall, or seepage from man-made water bodies. Similarly, groundwater levels can be observed at multiple spatial scales. For example, groundwater levels decline around the immediate vicinity of an individual well during pumping, but also from the cumulative effects of many irrigation wells pumped over many irrigation seasons at the scale of an entire regional aquifer. Groundwater levels rise along the banks of a stream during a flood, but they may also rise significantly over an entire drainage basin during a prolonged wet period. The temporal and spatial scales of observation must be taken into account when using the maps presented in this report.

The maps presented in this report were generally created at a scale of 1:557,000 or 1:500,000. **They are intended solely to identify regional conditions and trends at varying time scales throughout the entire state of Nebraska, and not at the local scale.** As such, these changes chiefly reflect the interplay between precipitation, groundwater pumping, and artificial recharge from reservoirs and canals.

Figure 6. Example of Groundwater-Level Changes at Different Temporal Scales



Data from Plymouth Recorder well, Jefferson County

CHANGES IN GROUNDWATER LEVELS, SPRING 2024 TO SPRING 2025

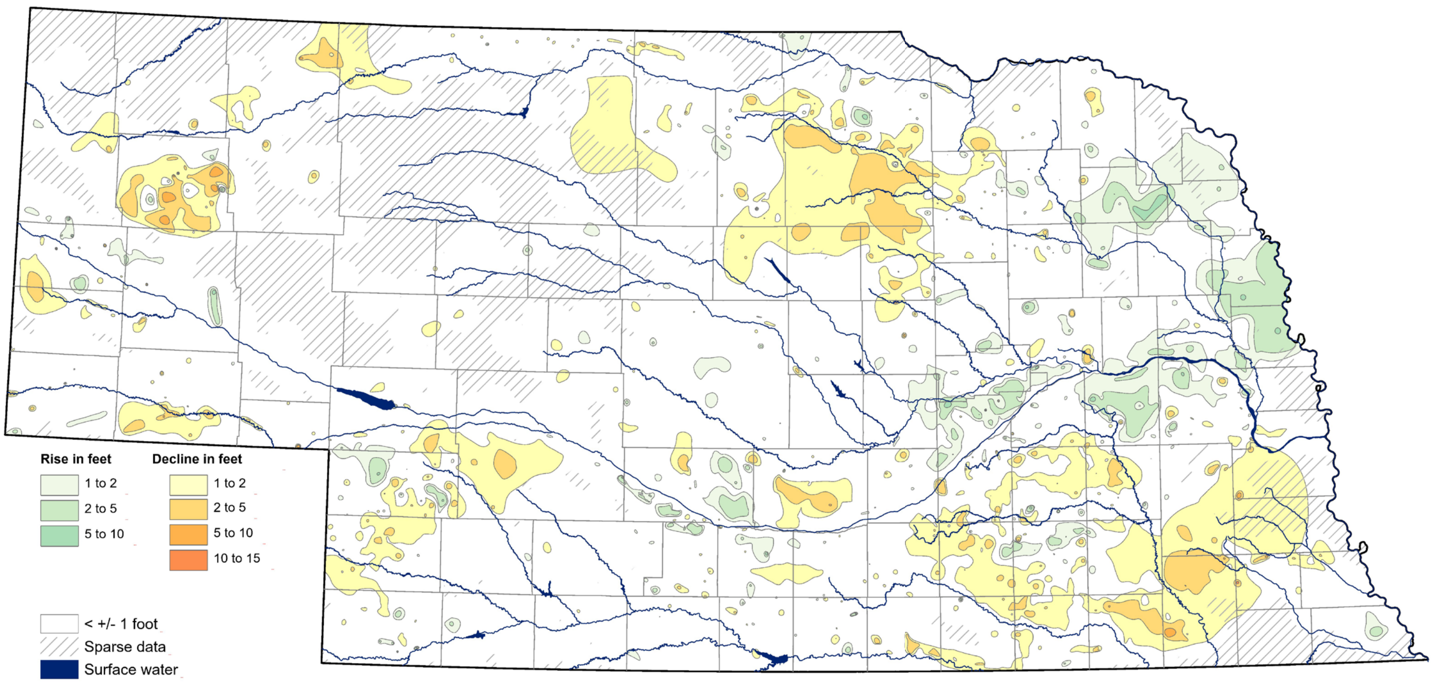
From the spring of 2024 to the spring of 2025, groundwater levels in Nebraska recorded an average decline of 0.29 feet

Groundwater levels in Nebraska generally decreased slightly from the spring of 2024 to the spring of 2025. In total, 4,695 wells were measured consecutively in the spring of 2024 and spring 2025. Groundwater-level declines were recorded in 62% of measured wells, with 25% of all measured wells experiencing a decline of greater than one foot (Fig. 7). Groundwater-level rises were recorded in 37% of measured wells, with only 13% of all measured wells recording a rise greater than one foot. Approximately 1% of wells experienced no change from spring of 2024 to spring of 2025. The average groundwater-level change for all measured wells in Nebraska in the spring of 2024 was a decline of 0.29 feet. From January 2024 to January 2025, precipitation values were above the 30-year average at 67 reporting stations in Nebraska, and below the 30-year average at 105 sites (Fig. 8).

Beginning in January 2024, the western two-thirds of Nebraska were not classified as being in drought, however, the southeastern portion of the state was classified in the extreme drought category. Following a wet spring, by mid-June most of Nebraska was either drought free or classified as abnormally dry. Following a dry summer, drought conditions returned to much of Nebraska, and by mid-October all of Nebraska was classified as being in some level of drought, with more than 50% of the state in the severe drought category. Drought conditions continued to worsen through the winter, particularly in the northern panhandle.

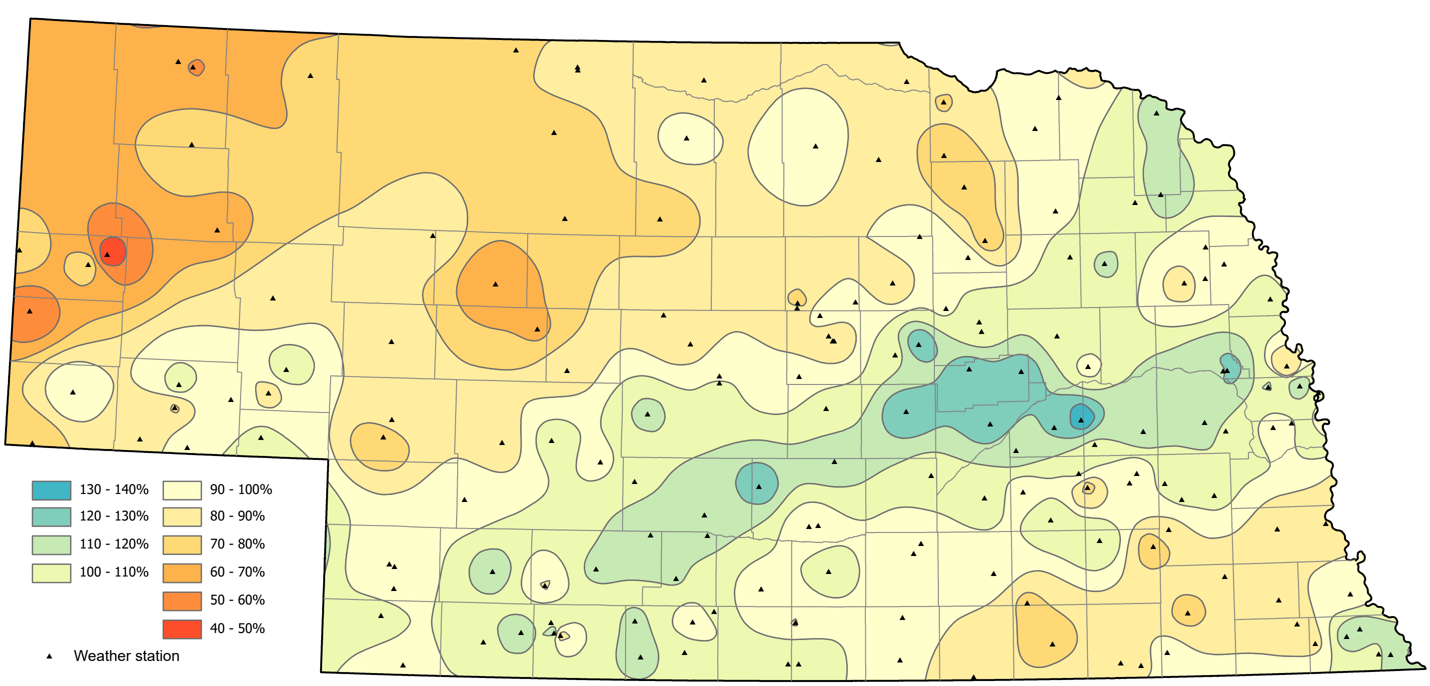
From the spring of 2024 to the spring of 2025, trends in groundwater level changes in Nebraska generally followed patterns in precipitation and drought persistence statewide. Although Nebraska experienced an average water-level decline of 0.29 feet statewide from spring 2024 to spring 2025, groundwater-level declines were moderated by a wet spring and early growing season. Water-level rises were recorded along the Platte River valley in eastern Nebraska, as well as the northeast part of the State. Water-level declines were generally recorded in parts of the State where precipitation values were below the long-term average.

Figure 7. Groundwater-Level Changes in Nebraska - Spring 2024 to Spring 2025



Sources: U.S. Geological Survey, Nebraska Water Science Center; U.S. Bureau of Reclamation, Kansas-Nebraska Area Office; Nebraska Natural Resources Districts; Central Nebraska Public Power and Irrigation District; Conservation and Survey Division, School of Natural Resources, University of Nebraska–Lincoln

Figure 8. Percent of Normal Precipitation - January 2024 to January 2025



Source: High Plains Regional Climate Center, University of Nebraska-Lincoln

CHANGES IN GROUNDWATER LEVELS, SPRING 2015 TO SPRING 2025

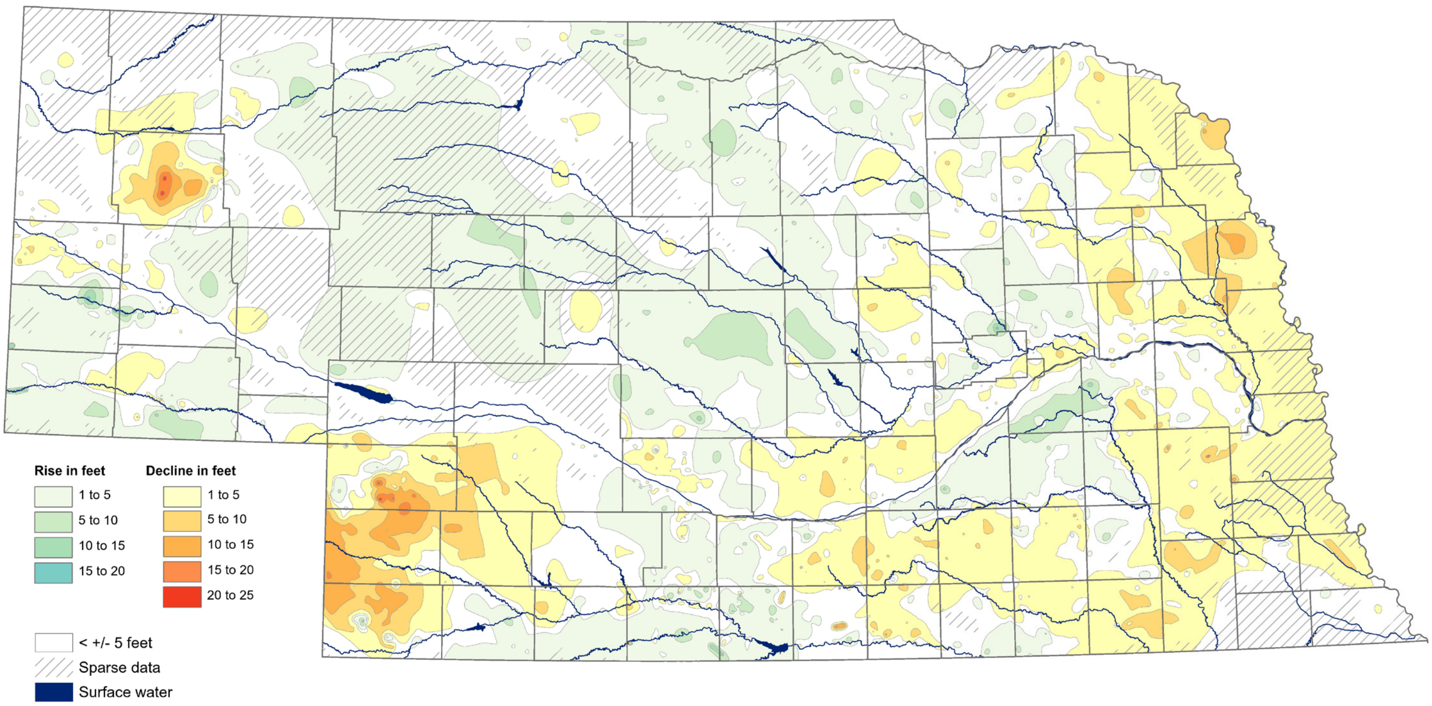
The previous ten years were characterized by major swings in climate from years of record setting precipitation to extended periods of drought

Of 4,013 wells measured in both the spring of 2015 and the spring of 2025, 47% of wells recorded groundwater-level rises, with 32% of wells rising more than one foot (Fig. 19). Groundwater-level declines were recorded in 53% of wells measured in Nebraska from the spring of 2015 to spring 2025, and 37% of measured wells experienced declines of greater than one foot. Groundwater levels in wells have decreased by an average of 0.39 feet statewide over the last 10 years.

Weather conditions from the spring of 2015 to the spring of 2025 were highly variable. This ten-year period began with the emergence from a record-setting drought beginning in the spring of 2012 and persisted through the spring of 2013. Precipitation values over most of Nebraska were near the long-term average from late 2013 through 2014. Between 2014 and 2019, precipitation values generally remained near or slightly above the 30-year average. Precipitation values in early 2019 were well above the 30-year average for much of central and northern Nebraska, with some stations recording nearly double average annual precipitation amounts. Beginning in early 2020, weather stations in Nebraska began recording below-average precipitation for most of the state, with drought conditions persisting throughout most of Nebraska into early 2023. Drought conditions eased for Northern and western Nebraska in 2023 and into 2024. However, drought conditions persisted through the spring of 2024 in most of eastern and southern Nebraska. Drought conditions once again returned to most of the state in late 2024. When compared with the 30-year average, precipitation values statewide from the spring of 2015 to the spring of 2025 were generally close to the long-term average despite large swings in weather (Fig. 10).

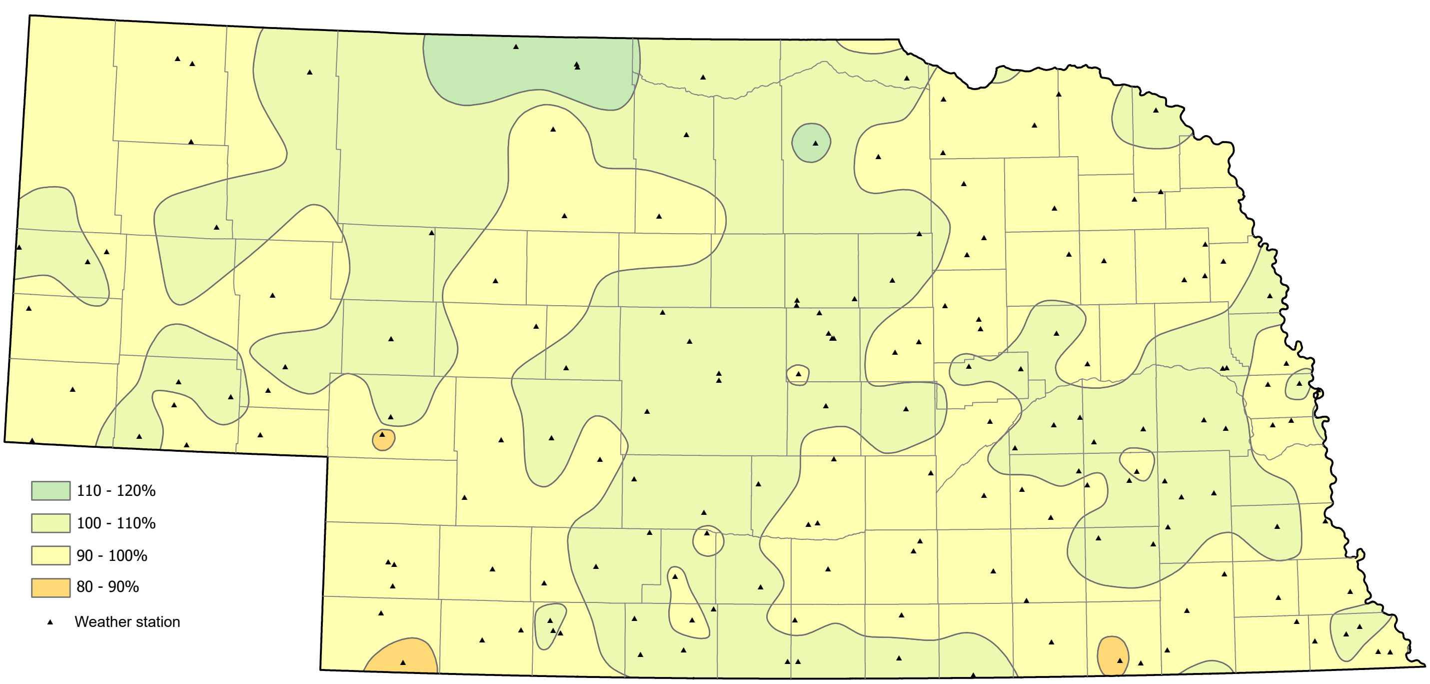
From the spring of 2015 to the spring of 2025, groundwater levels have fluctuated regionally, despite near-average precipitation statewide. The regional patterns of groundwater-level changes may have resulted from: (1) extreme regional variability in year-to-year precipitation and associated irrigation pumping rates, (2) delayed reaction time of aquifers to climate trends, (3) increased runoff during brief, high-intensity rainfall events, and (4) continued pumping of irrigation wells in areas of the state that receive minimal recharge to aquifers. Although some long-term trends can be observed at this scale, such as steadily increasing levels in the central Sand Hills, steadily rising levels in Butler, Polk, Hamilton, and York counties, and steadily decreasing levels in known problem areas such as Box Bute County, and the southwest corner of the State, groundwater levels have fluctuated from year to year due to extreme variations in yearly rainfall, recharge, and evapotranspiration over the past 10 years. Groundwater-level changes mapped in Figure 9, therefore, may exhibit the effects of short-term extremes rather than long-term trends.

Figure 9. Groundwater-Level Changes in Nebraska - Spring 2015 to Spring 2025



Sources: U.S. Geological Survey, Nebraska Water Science Center; U.S. Bureau of Reclamation, Kansas-Nebraska Area Office; Nebraska Natural Resources Districts; Central Nebraska Public Power and Irrigation District; Conservation and Survey Division, School of Natural Resources, University of Nebraska–Lincoln

Figure 10. Percent of Normal Precipitation - January 2015 to January 2025



Sources: National Climate Data Center, Asheville, North Carolina; High Plains Regional Climate Center, University of Nebraska-Lincoln

CHANGES IN GROUNDWATER LEVELS, PREDEVELOPMENT TO SPRING 2025

Long-term groundwater-level changes in Nebraska primarily reflect aquifer depletion in areas of dense irrigation development and increases in storage due to seepage from canals and reservoirs.

Spring 2025 groundwater levels indicate both long-term declines and long-term rises from predevelopment in certain areas of Nebraska (Fig. 11). Almost all the areas of significant groundwater-level declines correspond to high irrigation-well densities in aquifers that are deep and have little direct connection to surface water (Fig. 12). The greatest decline from predevelopment to 2025 is approximately 133 feet, in Box Butte County just north of the city of Alliance. Notable groundwater-level declines from predevelopment to spring 2025 have occurred in Box Butte County, and the southwestern part of the state in Chase, Perkins, and Dundy counties. A large area of smaller declines in southeast to south-central Nebraska reflects a slight depletion of the High Plains aquifer. The largest groundwater-level rises occurred in Gosper, Phelps, and Kearney counties, where there are extensive canals and surface-water irrigation systems.

The predevelopment groundwater levels used in Chase, Perkins, and Dundy counties are representative of the approximate average groundwater levels prior to 1953. A general trend of declining groundwater levels that began around 1966 correlates temporally with the intensive use of groundwater for irrigation. The approximate average groundwater levels prior to 1938 were utilized as predevelopment values for the groundwater-level change map in Box Butte County. Intensive groundwater development for irrigation since 1950 has caused groundwater levels to decline by 5 feet to more than 130 feet from predevelopment levels (Fig. 11). Records from wells in the southwestern counties indicate that rates of decline have been essentially steady, despite subsequent changes in groundwater management practices, water use allocations, and fluctuations in the amount of annual precipitation (Korus and Burbach, 2009b). Records from wells in Box Butte County indicate that rates of decline may have slowed somewhat.

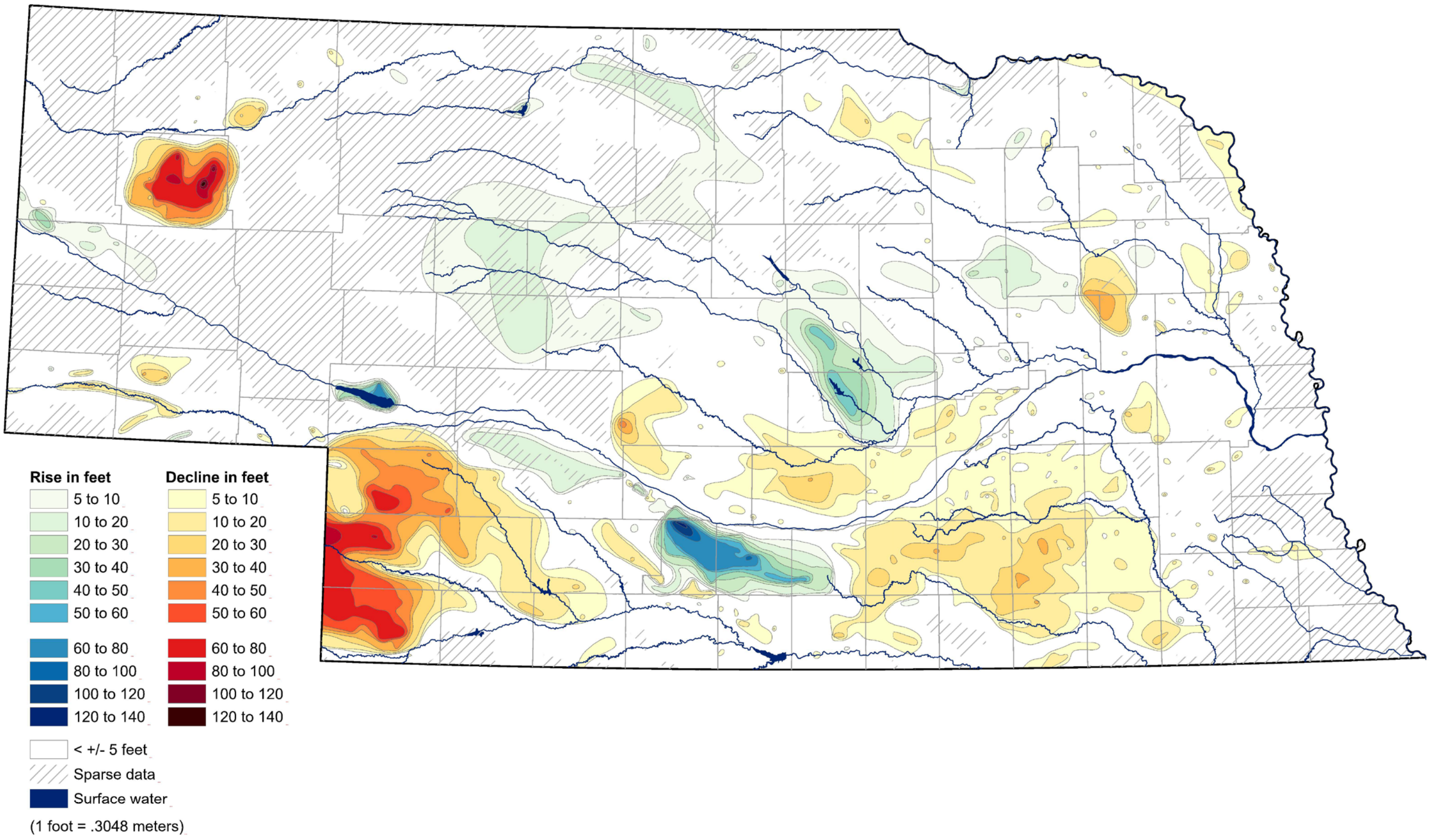
Much of southeastern to south-central Nebraska has experienced long-term groundwater-level declines since predevelopment times (Fig. 11). Predevelopment water levels in this area are generally representative of the approximate average water levels prior to 1950. Groundwater levels in large parts of this region have declined more than 10 feet, and in some areas by more than 30 feet, since predevelopment.

Groundwater-level declines also occurred in large areas between the Platte and Loup or South Loup rivers and in the Republican River Valley and the Panhandle. Irrigation-well densities are high in some, but not all, of the aforementioned areas. Aquifer characteristics, rates of recharge, and irrigation scheduling may have contributed to these declines as well. Recently, groundwater fluctuations in this region have been closely tied to fluctuations in the regional climate; however, levels seem to be stabilizing over the long term.

Groundwater-level rises from predevelopment generally occurred in areas of surface-water irrigation systems. Storage of water in Lake C. W. McConaughy began in 1941, and seepage losses caused groundwater-level rises of as much as 60 feet in nearby observation wells (Ellis and Dreeszen, 1987). Groundwater levels around the lake generally stabilized by about 1950 and since then have fluctuated in response to changes in reservoir levels and precipitation (Johnson and Pederson, 1984). Water released from storage in Lake C. W. McConaughy is subsequently diverted from the Platte River near Sutherland west of North Platte, and then flows through the Tri-County Canal and a series of reservoirs toward Dawson, Gosper, Phelps, and Kearney counties, where it has been used for irrigation since 1941. The deep percolation of water from these irrigation-distribution systems and from excess water applied to crops has gradually increased groundwater levels by more than 120 feet (Fig. 11). Groundwater levels have also risen in response to seepage from Sutherland Reservoir, Lake Maloney, and their associated canals in eastern Keith and central Lincoln counties. Similarly, there are groundwater-level rises of as much as 60 feet associated with irrigation canals in southern Sioux, Scotts Bluff, and western Morrill counties.

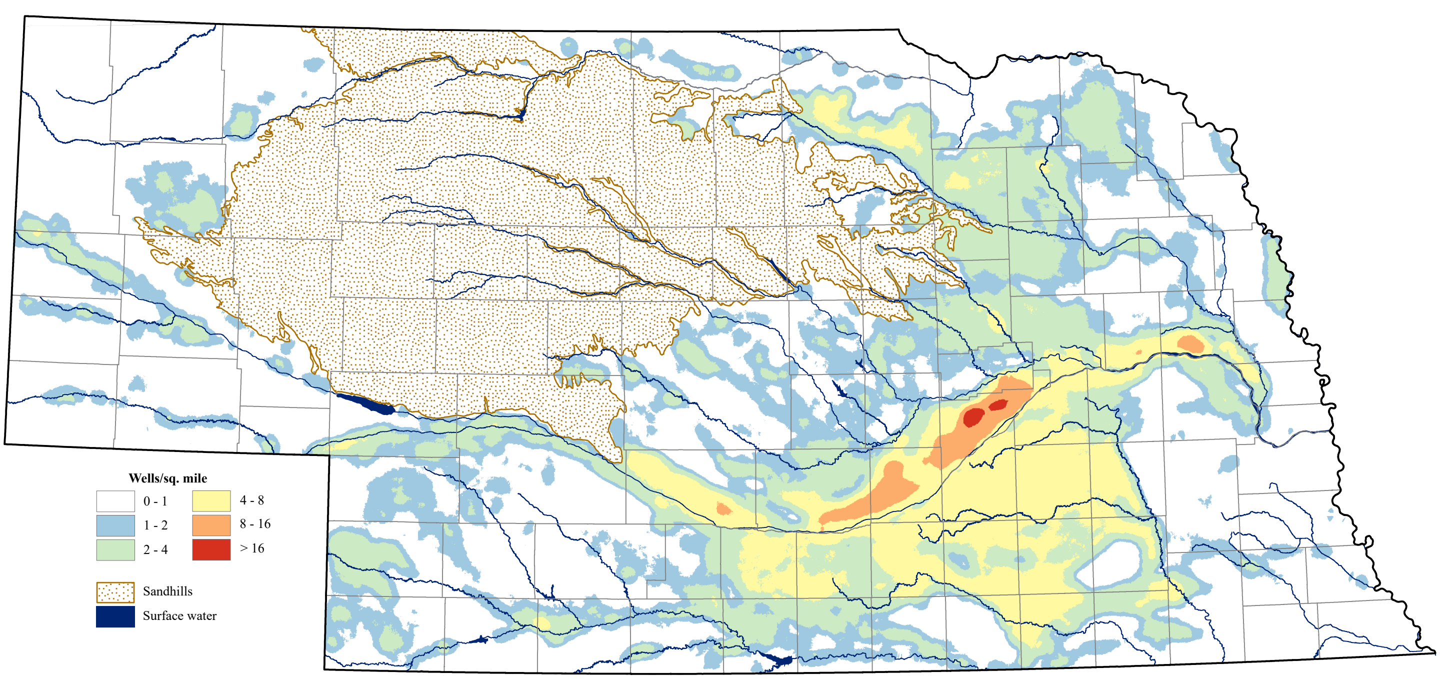
Groundwater-level rises of 10 to more than 50 feet occurred in portions of central Nebraska (Fig. 11). The highest groundwater-level rises occurred in Valley, Sherman, and Howard counties in response to sustained seepage from irrigation canals, Sherman and Davis Creek reservoirs, and the deep percolation of irrigation water applied to crops.

Figure 11. Groundwater-Level Changes in Nebraska - Predevelopment to Spring 2025



Sources: U.S. Geological Survey, Nebraska Water Science Center; U.S. Bureau of Reclamation, Kansas-Nebraska Area Office; Nebraska Natural Resources Districts; Central Nebraska Public Power and Irrigation District

Figure 12. Density of Active Registered Irrigation Wells - December 2024



Source: Nebraska Department of Natural Resources

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