

Water Risk Assessment Summary for the Cambrian-Ordovician Aquifer

Assessment completed Q1 2026

Summary of Results

| Table 1. Depletion and Scarcity KPIs | | | | |
|--|-------------------|---------------------|------------------------|-----------------------|
| Water Source | Chronic Depletion | Curtailement Events | Current Water Scarcity | Future Water Scarcity |
| Cambrian-Ordovician Aquifer ¹ | 0.02 Low Risk | None Low Risk | 0.80 High Risk | 0.81 High Risk |

Depletion and Scarcity Results

Chronic Depletion

- **Definition:** Quantifies the current state of water level decline in a water source
- **Calculation:** $Chronic\ Depletion = \frac{baseline\ water\ level - current\ water\ level}{baseline\ water\ level - minimum\ water\ level}$
 - Baseline: Average water level or flow over the history of the water source
 - Current: Average water level or flow over the past 5 years
 - Minimum: Minimum allowable water level or flow of the water source.
 - For this analysis, we used the well bottom elevations as a proxy for minimum groundwater levels.
- Baseline: Mean of annual average water level elevation for a monitoring well in the Cambrian-Ordovician Aquifer from 1996 through 2025 (524.83 ft NAVD88) ([Source](#)). Figure 1 below depicts the daily depth to groundwater level during this period, which remains relatively constant and therefore indicates no depletion of the Cambrian-Ordovician Aquifer.
 - Land surface elevation = 876.25 ft NAVD88
 - Average depth to water level from 1996 to 2025 = 351.42 ft
 - Mean of annual average water elevation = (876.25 ft - 351.42 ft) = 524.83 ft NAVD88

¹ The Cambrian-Ordovician Aquifer and Mississippian Aquifer both overlay this region. However, there is limited data available for the Mississippian Aquifer to evaluate this source, and additional hydrogeologic studies would be needed to complete that evaluation.

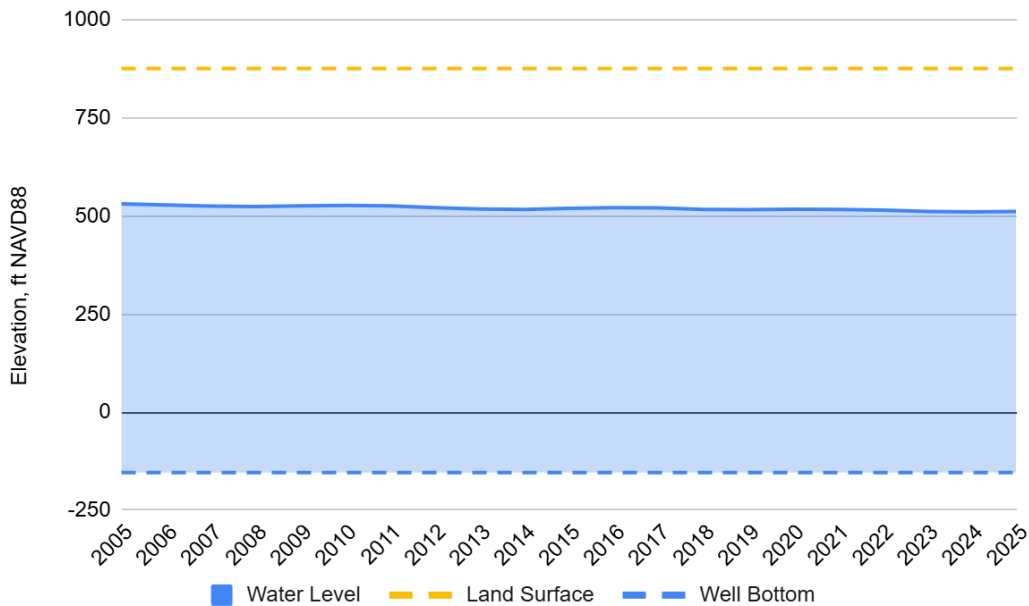


Figure 1: Graph of historic water level relative to land surface and well bottom for a monitoring well in the Cambrian-Ordovician Aquifer in New Florence, MO ([Source](#)).

- Current: Mean of annual average water level elevation for a monitoring well in the Cambrian-Ordovician Aquifer from 2021 through 2025 (513.2 ft NAVD88) ([Source](#)).
 - Five-year average of depth to water level = 363.05 ft
 - Mean of annual average water level elevation = (876.25 ft - 363.05 ft) = 513.2 ft NAVD88

- Minimum: Well bottom elevation for monitoring well in the Cambrian-Ordovician Aquifer (-153.75 ft NAVD88) ([Source](#)).
 - Well Depth = 1,030 ft
 - Well bottom elevation = (876.25 ft - 1,030 ft) = -153.75 ft

- Chronic Depletion = $\frac{524.83 \text{ ft} - 513.2 \text{ ft}}{524.83 \text{ ft} - -153.75 \text{ ft}} = 0.02$, which is **low risk**.

Curtailment Events

- **Definition:** Quantifies how many times the water source has been curtailed or ceased operation due to scarcity in the last 5 years.
- **Result:** No curtailment events have occurred for the Cambrian-Ordovician Aquifer, which is **low risk**.

Water Scarcity

- **Definition:** Measures long-term deficit/surplus of sustainable water available from specific water supply.
- **Calculation:** $Water\ Scarcity = \frac{total\ demand}{total\ sustainable\ supply}$
- Current Total Demand = 641 MGD
 - 2025 Demand = (2017 Total Demand) (1+ population increase)²⁰²⁵⁻²⁰¹⁷
 - 2017 Total Demand = 631 MGD ([USGS 2017](#))
 - Midwest annual population growth of 0.2% ([US Census Bureau 2023](#))
- Future Total Demand = 661 MGD
 - 2040 Demand = (2017 Total Demand) (1+population increase)²⁰⁴⁰⁻²⁰¹⁷
- Typically for groundwater sources, a sustainable aquifer yield (SAY) value is used to determine sufficient aquifer supply to meet total demands.
- However, in the absence of an SAY, a [USGS simulation](#) of groundwater flow in the Cambrian-Ordovician was used as a data source.
 - The USGS study revealed that aquifer recharge is linked to sustained pumping within the Cambrian-Ordovician Aquifer, impacting both the amount recharged and the direction of flow (i.e., increased pumpage results in increased recharge to the Cambrian-Ordovician).
 - Pre-development (0 mgd pumping / 369 mgd recharge, [USGS p. 104](#)) and post-development scenarios were simulated (781 mgd pumping / 903 mgd recharge, [USGS p. 104](#)).
 - Recharge (or supply) values for the current and future demand (i.e. pumping) scenarios were extrapolated linearly using the pre-development and post-development trendline.
 - For the current total demand of 641 MGD, the extrapolated SAY is 805 MGD, resulting in a current water scarcity of 0.8. For the future total demand of 661 MGD, the extrapolated SAY is 818 MGD, resulting in a future water scarcity of 0.81. These water scarcity ratios are considered to be **high risk**.
- Further, the USGS simulation also indicated that less than 1.5% of precipitation recharges to the Cambrian-Ordovician Aquifer. Most precipitation was lost through either evapotranspiration or flow to surface water ([USGS p.11](#)).
- The Cambrian-Ordovician Aquifer is a deep, prehistoric water source. Groundwater simulation revealed that although increased sustained pumping would increase recharge to the aquifer, recharge would not occur at a rate sufficient to replenish the amount of water extracted.

Climate Impact Results

Precipitation Trend

- **Definition:** Quantifies observed precipitation trend (relative change per decade) over a historic period of 50 years or longer for the source watershed(s).
- **Data Source:** NOAA's [Climate at a Glance](#) website provides national time series for the U.S. by county
- **Result:** +0.56 in/decade for Northeast Prairie division of Missouri. Annual precipitation has increased over the last 50 years, indicating a **low risk**.

Average Precipitation Prediction

- **Definition:** Describes the predicted precipitation trend as reported by the Intergovernmental Panel on Climate Change (IPCC). This KPI identifies as a high risk any sites with a high confidence of decreasing mean precipitation.
- **Data Source:** Mean Precipitation from IPCC's [WGI Interactive Atlas](#), which assigns both a direction of predicted trend and a confidence level of the trend prediction.
- **Result:** Midwestern U.S. shows a “low confidence in direction of change”, indicating a **low risk** for decreased precipitation.

Intense Precipitation Prediction

- **Definition:** Describes the predicted precipitation trend as reported by the IPCC. This KPI identifies as a high risk any sites with a high confidence level of increase in intense precipitation events and flash flooding.
- **Data Source:** Heavy Precipitation and Pluvial Flood from IPCC's [WGI Interactive Atlas](#), which assigns both a direction of predicted trend and a confidence level of the trend prediction.
- **Result:** Midwestern U.S. shows a “high confidence of increase”, indicating that the region is at **high risk** for more intense precipitation events. Taken into consideration with the increased precipitation trend, there may be more precipitation than existing infrastructure can accommodate, which could cause flooding.

Drought Frequency

- **Definition:** Quantifies the probability of droughts based on precipitation and temperature data.
- **Data Source:** Drought Frequency Probability from WWF's [Water Risk Filter](#)
- **Result:** East Central Missouri shows a **low risk**.

Drought Prediction

- **Definition:** Describes the predicted precipitation trend as reported by the IPCC. This KPI identifies as high risk regions with high confidence of increase in drought.

- **Data Source:** Hydrological Drought from IPCC's [WGI Interactive Atlas](#), which assigns both a direction of predicted trend and a confidence level of the trend prediction.
- **Result:** Region shows a “medium confidence of increase” indicating a **medium risk** of increased agricultural and ecological drought.