

**BEFORE THE OKLAHOMA WATER RESOURCES BOARD
STATE OF OKLAHOMA**

IN THE MATTER of an Update to the Maximum)
Annual Yield for the Alluvium and Terrace)
Deposits of the Beaver-North Canadian River)
underlying parts of Blaine, Canadian, and)
Oklahoma counties, Oklahoma, covering all or)
parts of Township 12N, Ranges 4WIM, 5WIM,)
6WIM, and 7WIM and Township 13N, Ranges)
4WIM, 5WIM, 6WIM, 7WIM, 8WIM, and 9WIM,)
and Township 14N, Ranges 8WIM, 9WIM,)
10WIM, and 11WIM, and Township 15N, Ranges)
10WIM, 11WIM, and 12WIM, and Township)
16N, Ranges 10WIM, 11WIM, and 12WIM, and)
Township 17N, Ranges 11WIM, 12WIM, and)
13WIM, and Township 18N, Ranges 12WIM and)
13WIM, and Township 19N, Ranges 12WIM and)
13WIM.)

**TENTATIVE ORDER FOR THE UPDATE OF THE MAXIMUM ANNUAL YIELD
FOR THE ALLUVIUM AND TERRACE DEPOSITS
OF THE BEAVER-NORTH CANADIAN RIVER, REACH II**

On this 15th day of July 2025, there came for consideration a proposed order to update the maximum annual yield for the alluvium and terrace deposits of the Beaver-North Canadian River Groundwater Basin (Reach II). Based on the updated hydrologic surveys and investigations, the Oklahoma Water Resources Board ("Board") makes and enters the following tentative findings, tentative conclusions of law, and order and directives.

EXISTING MAXIMUM ANNUAL YIELD

1. On April 10, 1990, the Board issued an Order establishing the maximum annual yield for the alluvium and terrace deposits of the Beaver-North Canadian River Groundwater Basin in Blaine, Canadian, and Oklahoma counties, Oklahoma, covering all or parts of Township 12N, Ranges 4WIM, 5WIM, 6WIM, and 7WIM; Township 13N, Ranges 4WIM, 5WIM, 6WIM, 7WIM, 8WIM, and 9WIM; Township 14N, Ranges 8WIM, 9WIM, 10WIM, and 11WIM; Township 15N, Ranges 10WIM, 11WIM, and 12WIM; Township 16N, Ranges 10WIM, 11WIM, and 12WIM; Township 17N, Ranges 11WIM, 12WIM, and 13WIM; Township 18N, Ranges 12WIM and 13WIM, and Township 19N, Ranges 12WIM and 13WIM.

2. In the Order, the Board determined:
 - a. The total land area overlying the basin was 211,840 acres;
 - b. The amount of water in storage as of July 1, 1973, was approximately 950,000 acre-feet;
 - c. The rate of natural recharge to the basin was 2.5 inches per year and total discharge from the basin during the 20-year simulation period was 2.83 million acre-feet;
 - d. Transmissivity of the basin sediments ranged from 0 to 2,050 feet squared per day and averaged 1,080 feet squared per day; and
 - e. Pollution to the basin from natural sources was considered negligible.
3. The Order determined the maximum annual yield, based on a 20-year basin life, to be one (1) acre-foot per year of fresh groundwater.

TENTATIVE FINDINGS

4. The Board has made or caused to be made hydrologic surveys and investigations of the Beaver-North Canadian River Alluvium and Terrace Groundwater Basin (Reach II), in parts of Blaine, Canadian, and Oklahoma counties. The study area is a long, narrow surficial aquifer that resides along an approximate 116-mile-long stretch of the North Canadian River from Canton Lake in northwestern Blaine County to Lake Overholser on the west side of Oklahoma City.

The hydrologic surveys and investigations reviewed for this order include the U.S. Geological Survey (USGS) Scientific Investigations Report 2015-5183, Hydrogeological Framework, Numerical Simulation of Groundwater Flow, and Effects of Projected Water Use and Drought for the Beaver-North Canadian River Alluvial Aquifer, Northwestern Oklahoma, by Ryter, D.W., and Correll, J.S. (2016) and U.S. Geological Survey Open-File Report 83-4076, Numerical Simulation of the Alluvium and Terrace Aquifer along the North Canadian River from Canton Lake to Lake Overholster, Central Oklahoma, by Christenson, S.C., (1983).

5. The Beaver-North Canadian River Alluvium and Terrace Groundwater Basin is composed of Quaternary- and Tertiary-age sediments (sand, silt, clay, and gravel) that unconformably overlie Permian-age bedrock units principally composed of shale and sandstone. In Canadian County, bedrock outcrops in a narrow band approximately 22 miles long that separates the alluvial deposits from the older and topographically higher terrace deposits.

6. Groundwater wells completed in the alluvium and terrace deposits typically yield 100-300 gallons per minute, with a mean of 105 gallons per minute. Individual well yields range from less than 10 gallons per minute to more than 1,000 gallons per minute in some high-capacity irrigation and municipal wells. Groundwater is predominantly used for irrigation and public supply purposes, with smaller proportions for power, industrial, and recreational uses.

7. The total land area overlying Reach II of the basin is approximately 363 square miles or 232,035 acres (excluding the area of Lake Overholster) based on updated Oklahoma Geological Survey surficial geology maps, drillers logs submitted to the OWRB, and aerial photography (see *Executive Summary Report* for details of the changes to the basin area).

8. The amount of groundwater in storage in Reach II is approximately 1.1 million acre-feet, calculated as the sum of the model cell storage values calculated by multiplying the cell area (61.8 acres), cell saturated thickness, and cell specific yield. A close approximation of the storage can be calculated by multiplying the basin area by the average specific yield (Sy) of 0.20, and the average saturated thickness of 24 feet.

9. Model calibrations for the Reach II numerical flow model yielded a mean annual recharge estimated of 60,950 acre-feet per year or about 3.1 inches per year using the 369 square mile basin area; when adjusted to the updated 362 square mile OWRB defined basin area, the mean annual recharge to the basin decreased to 59,942 acre-feet per year. Accordingly, over a 20-year period, the total amount of recharge to the groundwater basin would be approximately 1.20 million acre-feet. Mean annual recharge across the basin area is generally less than 5 inches per year. Locally recharge rates can be as much as 10.6 inches per year.

10. To calculate the total amount of discharge from Reach II of the basin attributable to groundwater withdrawals, the Board assumes full withdrawal of groundwater authorized by rights to use the groundwater established under state laws as they existed prior to July 1, 1973, with such rights being recognized in final orders determining prior rights to use groundwater. For Reach II, active prior rights authorize the withdrawal of 27,402.1 acre-feet per year. Current regular active permits in Reach II (as of June 2025) constitute a total authorized withdrawal of 32,986.0 acre-feet per year. The total anthropogenic discharge from the basin over 20 years is about 1.21 million acre-feet, assuming full withdrawal of the authorized groundwater use and no change in the status of the permits over the life of the basin. The cumulative total discharge from the basin during the 20-year model simulation was about 2.40 million acre-feet.

11. Model-calibrated horizontal hydraulic conductivity (Kh) for Reach II ranged from 4 to 279 feet per day, with a mean of 70 feet per day. Values of transmissivity from three published aquifer tests in Canadian County (all in alluvium) showed a transmissivity range of 5,347.2 to 13,100.7 feet squared per day. Christenson (1983) estimated a mean transmissivity of 1,080 feet squared per day for the modeled basin area. Model-calibrated specific yield (Sy) ranged from 0.10 to 0.25, with a mean of 0.20.

12. In general, groundwater in the basin is calcium bicarbonate type and is considered suitable for most uses. The average concentration of total dissolved solids within Reach II is about 732 milligrams per liter (mg/L). Groundwater that is sourced from the alluvium of the North Canadian River generally has a higher overall concentration of total dissolved solids than the associated terrace deposits; concentrations greater than 1,000 mg/L have been measured in this aquifer historically and were characterized as either sodium chloride or calcium sulfate types. Higher concentrations of sulfate and chloride are likely sourced from the dissolution of halite (NaCl) and gypsum (CaSO₄-2H₂O) in the underlying Permian-age bedrock. Total dissolved solids, nitrogen (as nitrate), iron, and manganese are all considered water quality concerns in Reach II; more than half of the water quality samples collected had total dissolved solid concentrations exceeding 500 milligrams per liter. High concentrations of iron and manganese in several samples suggest that dissolved oxygen is being depleted from the groundwater locally or that pumping has induced the upward migration of more mineralized groundwater. High nitrate concentrations in groundwater are associated with areas of the aquifer overlain by croplands and are likely attributed to fertilizers.

13. From the updated hydrologic investigation and based on information in Tentative Findings Nos. 7 through 11, the maximum annual yield for Reach II of the Beaver-North Canadian Alluvium and Terrace Groundwater Basin is tentatively determined to be about 120,644 acre-feet per year, (equivalent to 4.68 million acre-feet over 20 years) with an equal proportionate share of 0.5 (acre-feet/acre)/year) for the undeveloped land areas. Current active regular permits will maintain an equal proportionate share of 1.00 (acre-feet/acre)/year) based on the April 1990 final order.

TENTATIVE CONCLUSIONS

14. The Board is given authority by the Oklahoma Groundwater Law, 82 O.S. Supp. 2000, Sections 1020.4, 1020.5 and 1020.6 to make hydrologic surveys and investigations, enter orders to make tentative determinations, hold hearings on the tentative determinations and make final determinations of the maximum annual yields of each groundwater basin and subbasin. The Board is also given authority to cooperate with state and federal agencies engaged in similar surveys and investigations and may accept and use the findings of such agencies.

15. The Beaver-North Canadian Alluvium and Terrace Groundwater Basin has been designated by the Board as a "major groundwater basin" as defined by the Oklahoma Groundwater Law. See Section 1020.1(3) of Title 82 of the Oklahoma Statutes.

16. According to Section 1020.5 of Title 82 of the Oklahoma Statutes, after completing hydrologic surveys, the Board is to make a tentative determination of the maximum annual yield of groundwater to be produced from a basin or subbasin based upon the following:

- a. total land area overlying the basin or subbasin;
- b. amount of water in storage in the basin or subbasin;
- c. rate of recharge to and total discharge from the basin or subbasin;
- d. transmissibility of the basin or subbasin; and
- e. possibility of the basin or subbasin from natural sources.

The maximum annual yield is to be based on a minimum basin life of 20 years from the date of the final order determining the maximum annual yield.

17. After a tentative maximum annual yield for a basin is determined, hearings are to be called and held in centrally located places within the area of the major groundwater basin. The hydrologic survey and information relied on to make the tentative order is to be made available for all interested persons, and notice is to be provided as required by Section 1020.6 of Title 82 of the Oklahoma Statutes.

ORDER AND DIRECTIVES

IT IS THEREFORE ORDERED by the Oklahoma Water Resources Board that the updated maximum annual yield of Reach II of the Beaver-North Canadian Alluvium and Terrace Groundwater Basin as described in this Order, is 120,644 acre-feet per year and that the equal proportionate share of the yield to be allocated to each acre of undeveloped land overlying the basin is tentatively determined to be 0.5 acre-feet per acre per year. Current active regular permits will maintain an equal proportionate share of 1.00 (acre-feet/acre)/year) based on the April 1990 final order.

IT IS FURTHER ORDERED that hearings be held in a centrally located place within the area of the groundwater basin, that the hydrologic survey and information relied on to establish the tentative order be made available to interested persons, and that notice of the hearings be given as required by law. After said hearings, a proposed final order shall be prepared and submitted to the Board for consideration as required by law.

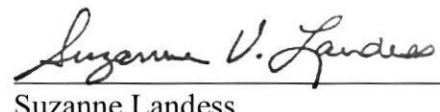
IT IS FURTHER ORDERED that in conjunction with any hearings held, staff should seek input concerning any modification of the well spacing distance set forth in the current rules of 660 feet, and staff shall consider such input in drafting a proposed rule amendment for the next permanent rulemaking proceeding.

IT IS SO ORDERED by the Oklahoma Water Resources Board in regular and open meeting this 15th day of July 2025.

OKLAHOMA WATER RESOURCES BOARD

ATTEST:


Thomas Gorman
Chairman
7/15/2025
Date


Suzanne Landess
Secretary
7/15/2025
Date

(SEAL)



Attachment 1. Updated boundary of Reach II of the Beaver-North Canadian Alluvial Groundwater Basin with permitted lands.

