

# NORTH CAROLINA

## Agricultural Water Use

# 2022



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## 2022 Agricultural Water Use Survey

The tenth statewide survey was conducted to document water use for the agricultural sector during 2022. As directed in legislation enacted in 2008 (SL2008-0143), the North Carolina Department of Agriculture and Consumer Services, Agricultural Statistics Division, is required to collect annual information from farmers who withdraw 10,000 gallons or more in any one day. Individual responses remain confidential and are only used in combination with other reports to produce totals.

Farmers who use over 1,000,000 gallons in any one day are required to report their water usage directly to the Department of Environmental Quality (DEQ). DEQ's report can be found on <https://www.ncwater.org/WUDC/app/WWATR/report>.

When looking at agricultural water use from a total volume withdrawn perspective, table 1 on page 4 is most representative of total water use. Because farms that withdraw the largest amounts of water do not make those withdrawals every day, the average daily use across all days of the year is most representative of relative volumes used. On average, farm operations that use irrigation will withdraw water about 17 days each month. Field crop operations use water even less often, primarily due to supplement rainfall. While there are other agricultural users of water, including livestock and poultry producers, aquaculture farms, and others, the largest volume of water use is from irrigators. The average North Carolina farm that uses water does so infrequently and in relatively small amounts. Table 2 on page 6 displays "demand" use, which is calculated by dividing the total water withdrawn for the month by the days applied.

The results of this survey reflect water withdrawals from ground and surface sources. Many comparisons across sectors will incorporate an estimate of consumptive use of withdrawals. According to a 1990 USDA Economic Research Service Report, consumptive use is a measure of water lost to the immediate water environment through evaporation, plant transpiration, incorporation in products or crops, or consumption by humans, livestock and, in agriculture, is primarily crop evapotranspiration, which is heavily influenced by climate, crops, irrigated, and yield. Past USDA ERS irrigation consumptive use on farms estimates are around 60 percent of total withdrawals nationally.

Of the farms surveyed, 785 withdrew over 10,000 gallons of water in any one day. Soil conditions were considered normal

throughout most of the state for the entire year. July was the largest water use month in 2022, averaging 75.8 million gallons daily, with a maximum daily withdrawal of 185.6 million gallons. The annual average daily water usage for 2022 was 45.5 million gallons. The daily withdrawal capacity for the 785 operations totaled 1 billion gallons in 2022.

A questionnaire was mailed to operations which had potential for large water usage. Operations that did not respond were contacted by telephone follow-up. In addition, livestock and poultry contractors in the state were contacted by email, phone, or mail.

The unique number of operations, the annual average daily ground and surface usage, as well as the capacity is published by county and by hydrologic unit codes (HUC). The capacity is the potential amount of ground and/or surface water that could be withdrawn in a 24-hour period. The published capacity represents the sum of capacities for all reporting operations in that county or HUC. In nearly all cases, this capacity was never met.

One survey instrument was used to gather data for the state as well as for the Central Coastal Plain Capacity Use Area (CCPCUA). Results for the CCPCUA were summarized and published in a separate table.

**Table 1: Total & Average Daily Water Withdrawn <sup>1</sup>  
2022 North Carolina Water Use by Month**

Month	Operations	Monthly Total Ground	Monthly Total Surface	Average Across All Days-Ground	Average Across All Days-Surface
	<i>Number</i>	<i>Gallons</i>	<i>Gallons</i>	<i>Gallons</i>	<i>Gallons</i>
January	538	247,670,167	837,664,451	7,989,360	27,021,434
February	547	234,291,034	860,795,256	8,079,001	29,682,595
March	593	280,917,030	1,034,640,520	9,061,840	33,375,501
April	633	397,542,428	935,604,697	13,251,414	31,186,823
May	652	561,921,569	1,131,351,102	18,126,502	36,495,197
June	693	685,086,463	1,258,071,335	22,836,215	41,935,711
July	725	764,580,380	1,584,998,689	24,663,883	51,128,990
August	670	610,156,579	1,149,491,606	19,682,470	37,080,374
September	613	504,533,544	784,232,722	16,817,785	26,141,091
October	582	307,218,710	727,844,970	9,910,281	23,478,870
November	544	270,611,507	622,644,001	9,020,384	20,754,800
December	519	259,561,048	600,319,829	8,372,937	19,365,156
<b>Annual Average</b>				<b>13,984,339</b>	<b>31,470,545</b>

**Operations :**

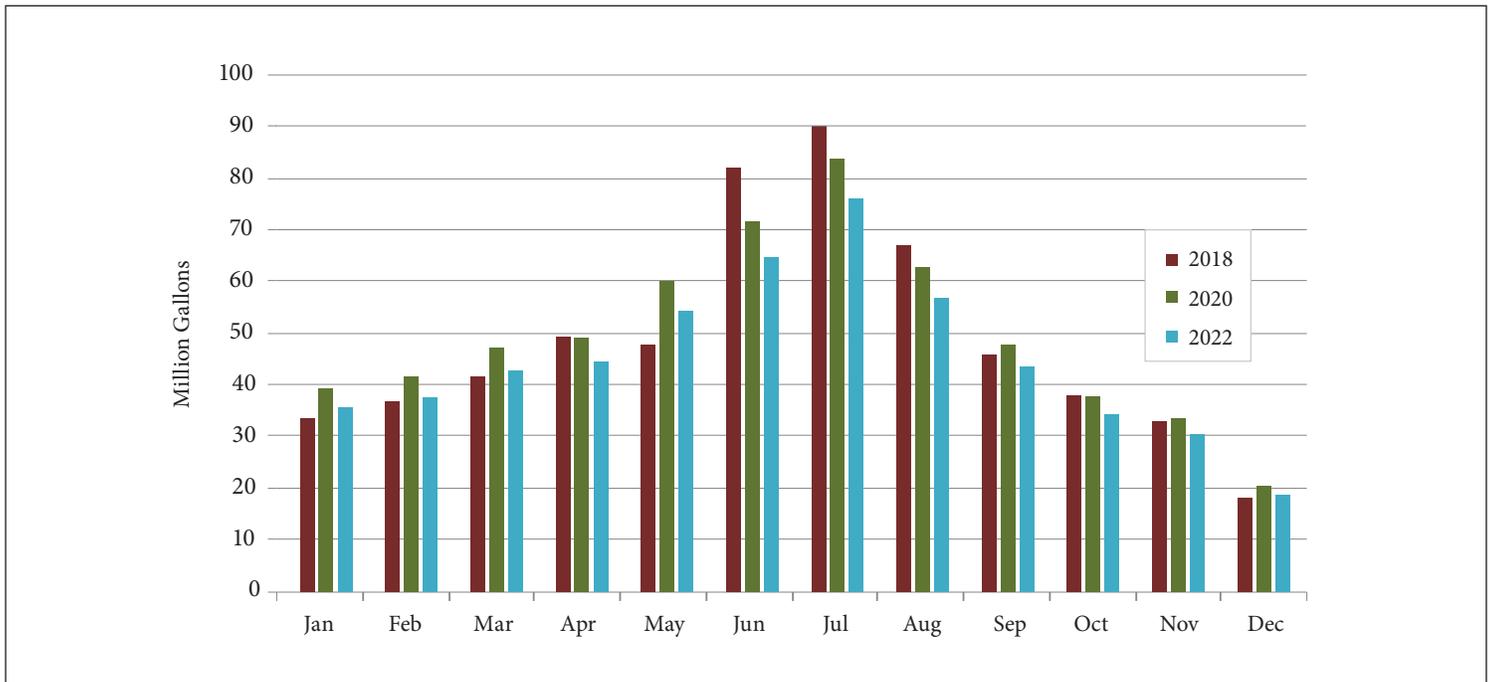
**785 Total Operations**

**Daily Withdrawal Capacity (incl. ground & surface):**

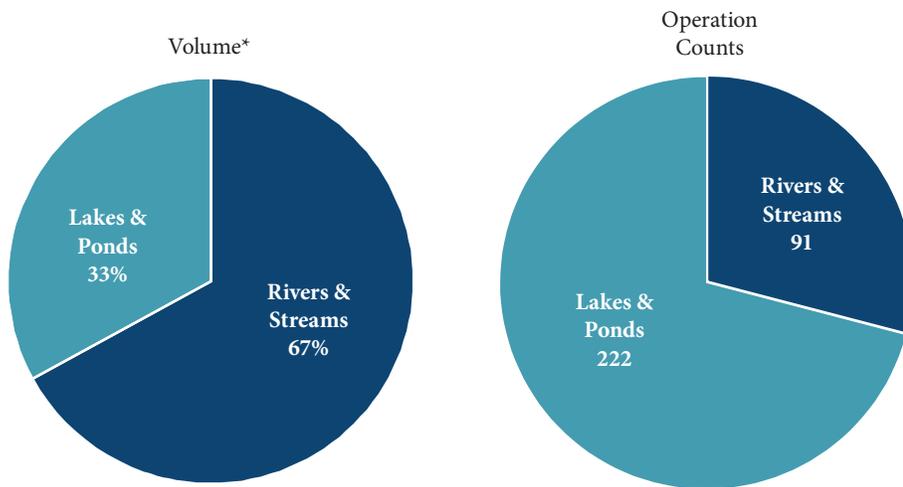
**1,043,550,381 Gallons**

<sup>1</sup> Users of 10,000 gallons or more per day. Averages reported in this table reflect the average water withdrawn across all days of the month. Farms that reported their withdrawals directly to DEQ by August 1, 2023 have been excluded. The monthly number of operations will not add to the total. Some operations reported both surface and ground water withdrawals, which are counted twice in the monthly number of operations. However, the total number of operations represents operations that withdrew water at any time during the year, regardless if withdrawn from multiple sources.

**Average Across All Days  
Ground & Surface Water Withdrawals  
2018–2022**



## 2022 Annual Surface Water Withdrawals



\* Includes flow through/non-consumptive withdrawals.



**Table 2: Demand Use for Days Applied <sup>1</sup>**  
**2022 North Carolina Water Use by Month**

Month	Average Days Applied Ground	Average Days Applied Surface	Total Average Daily-Ground	Total Average Daily-Surface	Total Max Daily-Ground	Total Max Daily-Surface
	<i>Days</i>	<i>Days</i>	<i>Gallons</i>	<i>Gallons</i>	<i>Gallons</i>	<i>Gallons</i>
January	26	13	8,523,100	28,478,285	9,470,650	28,527,791
February	24	11	8,840,478	59,962,222	10,919,622	60,896,659
March	24	12	13,366,657	79,197,011	18,026,416	87,628,946
April	24	14	16,963,739	62,396,863	19,687,970	66,982,543
May	24	17	26,164,233	55,229,196	35,322,310	59,576,760
June	24	16	38,932,723	72,113,189	48,052,779	95,401,491
July	24	16	42,119,565	116,824,161	51,453,767	134,166,340
August	25	17	34,299,670	59,255,955	42,195,137	74,899,480
September	25	17	26,043,011	55,807,306	30,124,763	59,237,205
October	25	16	11,871,914	27,069,203	13,697,192	29,914,055
November	26	13	9,996,298	22,599,188	11,719,092	22,849,932
December	25	12	9,444,165	20,719,738	11,093,255	20,761,660
<b>Annual Average</b>			<b>20,547,129</b>	<b>54,971,026</b>		

<sup>1</sup> Users of 10,000 gallons or more per day. Averages reported in this table reflect the average water withdrawn during the days of application. Farms that reported their withdrawals directly to DEQ by August 1, 2023 have been excluded.



## 2022 North Carolina Water Use County Summary

County	Unique Operations <sup>1</sup>	Annual Average Daily <sup>2</sup> Ground	Annual Average Daily <sup>2</sup> Surface	Daily Withdrawal Capacity <sup>3</sup>
	<i>Number</i>	<i>Gallons</i>	<i>Gallons</i>	<i>Gallons</i>
Alamance	6	15,420	*	*
Alexander	5	41,752	*	732,018
Anson	9	65,149	*	*
Bertie	8	99,679	*	*
Bladen	64	999,703	*	154,449,525
Chatham	7	27,815	*	*
Columbus	8	118,614	*	2,063,075
Cumberland	5	25,434	*	5,878,958
Duplin	85	1,763,879	*	32,189,142
Edgecombe	10	70,535	*	14,912,273
Greene	10	102,727	*	*
Harnett	14	87,489	*	10,150,772
Haywood	3	*	54,089	2,109,420
Hertford	10	131,371	*	*
Johnston	20	90,517	410,564	*
Lee	8	11,360	*	5,046,065
Montgomery	7	33,776	*	1,898,432
Nash	10	179,287	454,022	5,778,544
Northampton	18	275,721	*	19,387,701
Onslow	5	44,201	*	962,771
Pender	17	372,969	*	127,598,623
Pitt	12	165,299	*	8,414,525
Richmond	9	115,700	*	2,342,638
Robeson	45	2,825,382	*	74,966,032
Rockingham	9	*	71,497	6,093,241
Rowan	6	17,392	*	*
Sampson	80	1,749,802	*	35,610,982
Scotland	15	209,827	*	731,366

County	Unique Operations <sup>1</sup>	Annual Average Daily <sup>2</sup> Ground	Annual Average Daily <sup>2</sup> Surface	Daily Withdrawal Capacity <sup>3</sup>
	<i>Number</i>	<i>Gallons</i>	<i>Gallons</i>	<i>Gallons</i>
Surry	9	65,425	*	*
Union	15	166,999	*	7,933,033
Vance	3	*	97,111	*
Wake	8	*	53,019	5,364,043
Wayne	15	242,699	*	4,500,271
Wilkes	16	87,371	*	2,166,747
Other Counties <sup>4</sup>	214	3,781,046	30,330,244	512,270,182
<b>State</b>	<b>785</b>	<b>13,984,339</b>	<b>31,470,545</b>	<b>1,043,550,381</b>

*\*not published to avoid disclosure of individual reports <sup>1</sup> represents the unique # of operations which withdrew surface and or ground water <sup>2</sup> represents the average across all days of the year <sup>3</sup> includes ground and surface <sup>4</sup> includes nondisclosed data from the table above and all data for counties not listed in the above table.*

## 2022 North Carolina Water Use - Hydrologic Unit Code Summary

Hydrologic Unit Code	Unique Operations <sup>1</sup>	Annual Average Daily <sup>2</sup> Ground	Annual Average Daily <sup>2</sup> Surface	Daily Withdrawal Capacity <sup>3</sup>
	<i>Number</i>	<i>Gallons</i>	<i>Gallons</i>	<i>Gallons</i>
03010104	9	*	39,222	6,336,325
03010203	20	275,058	*	22,901,623
03020102	11	82,242	379,397	7,281,453
03020201	36	183,860	673,538	47,226,238
3020202	20	265,586	70,578	16,554,074
03020203	26	257,928	226,525	27,544,745
03020302	6	137,220	*	1,235,238
03030002	29	*	1,174,604	26,112,008
03030004	20	162,693	*	10,295,723
03030006	101	1,736,405	418,547	61,394,258
03030007	112	2,246,275	*	142,566,331
03040101	31	168,523	*	12,332,286
03040103	53	549,833	1,233,345	140,112,904
03040105	20	*	76,872	19,170,264
3040203	42	2,541,109	*	41,433,030
03040206	10	225,382	*	3,761,175
03050105	9	124,335	*	1,300,390
06010106	3	*	54,089	2,109,420
<b>Other Hucs<sup>4</sup></b>	<b>224</b>	<b>5,027,891</b>	<b>27,123,828</b>	<b>453,882,896</b>
<b>State</b>	<b>785</b>	<b>13,984,339</b>	<b>31,470,545</b>	<b>1,043,550,381</b>

\* not published to avoid disclosure of individual reports <sup>1</sup> represents the unique # of operations which withdrew surface and or ground water <sup>2</sup> represents the average across all days of the year <sup>3</sup> includes ground and surface <sup>4</sup> includes nondisclosed data from the table above and all data for HUCS not listed in the above table.

## 2022 Central Coastal Plain Total Water Use by Month <sup>1</sup>

Month	Operations	Average Across All Days-Ground	Average Across All Days-Surface	Total Max Daily-Ground	Total Max Daily-Surface
	Number	Gallons	Gallons	Gallons	Gallons
January	145	2,389,632	1,236,204	2,583,665	1,250,215
February	144	2,394,579	1,673,530	3,928,672	12,343,660
March	156	2,583,483	2,209,214	4,156,642	10,552,908
April	160	3,039,358	2,392,090	3,652,842	8,839,431
May	164	2,644,289	2,681,967	3,284,820	4,570,182
June	168	3,067,944	4,547,286	4,358,629	10,656,558
July	165	3,878,442	4,699,268	5,394,329	13,515,517
August	159	3,202,563	3,947,779	4,176,998	7,144,047
September	151	3,270,762	2,975,091	3,737,308	8,709,255
October	149	2,719,109	2,149,215	3,205,748	2,364,371
November	144	2,436,506	1,460,198	2,675,602	1,590,948
December	140	2,490,228	1,121,184	2,755,429	1,121,184
<b>Annual Average</b>		<b>2,843,075</b>	<b>2,591,086</b>		

**Operations:**

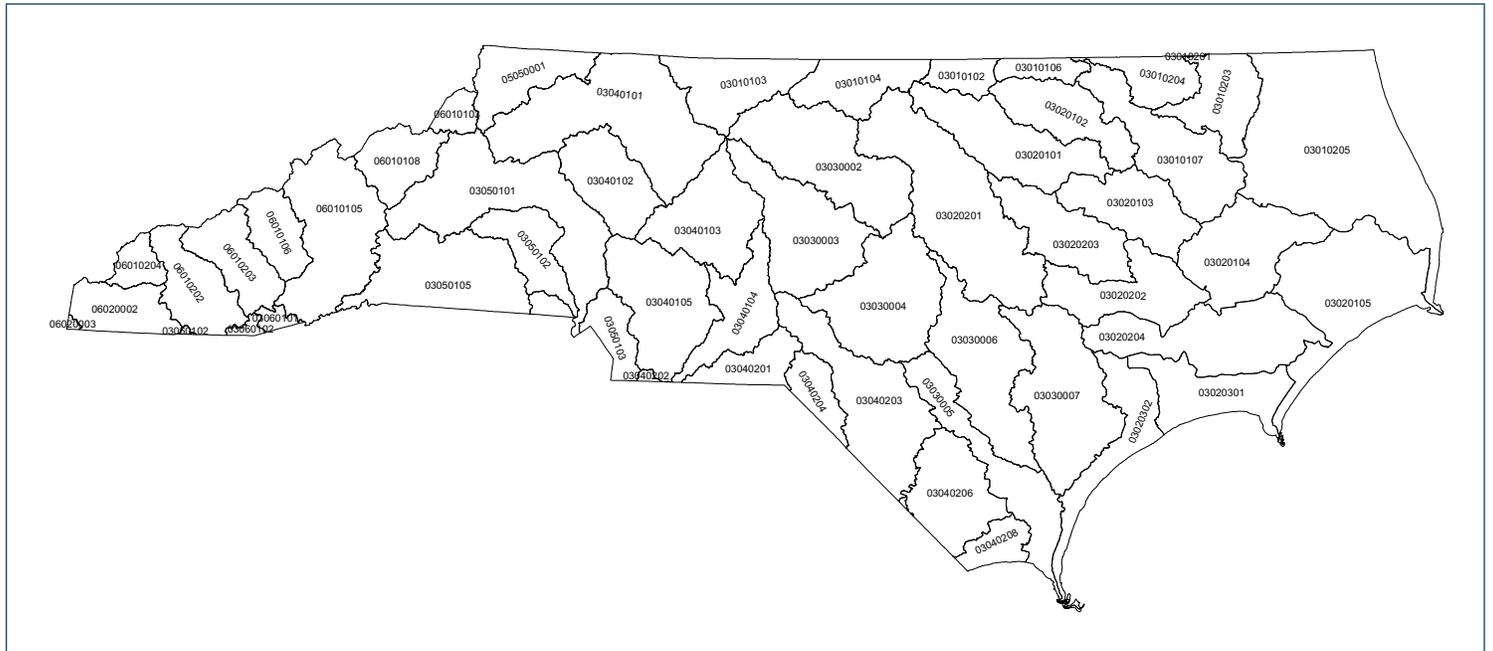
**178 Total Operations**

**Daily Withdrawal Capacity (incl. ground & surface):**

**188,867,473 Gallons**

<sup>1</sup> Users of 10,000 gallons or more per day. Averages reported in this table reflect the average water withdrawn across all days of the month. Farms that reported their withdrawals directly to DEQ by July 25, 2021 have been excluded. The total number of operations represents operations that withdrew water at any time during the year. Central Coastal Plain Counties include Beaufort, Carteret, Craven, Duplin, Edgecombe, Greene, Jones, Lenoir, Martin, Onslow, Pamlico, Pitt, Washington, Wayne, and Wilson

### Hydrologic Unit Codes (HUC)



## Statistical Defensibility

The North Carolina Department of Agriculture and Consumer Services' Agricultural Statistics Division conducted a census of all known farm operations in North Carolina which had farming types that could potentially use more than 10,000 gallons of water in one day. Approximately, 3,300 such operations were contacted and included farms with a history of withdrawing more than 10,000 gallons on any one day from surface or ground sources. Also included were operations with large numbers of poultry, hogs, cattle, aquaculture, fruits, vegetables, nursery/ greenhouse crops, tobacco, or other field crops which are often irrigated. An 81% response rate was attained via mail, phone, or electronically via the web or email. Historical data for all respondents was reviewed to insure comparability with previous surveys. Operations were offered work sheets which assisted them, if necessary, in reporting their withdrawals.

The Census of Agriculture List, the most comprehensive source of farms, was used as the basis for this survey. Although no under-coverage estimator has been applied, the list of NC farmers is expanded on a daily basis as new operations are discovered through routine list building activities. Since agricultural operations that withdraw at least 10,000 gallons of water per day tend to be larger, more intensive farms, under-coverage for this survey is minimal based on historic surveys with similar operations. When reasonable, non-respondents' usage was estimated based on their own historical reports.

Taking the above steps, including conducting a census of all known farm operations that use at least 10,000 gallons of water on any one day, results in zero sampling error around the estimates and minimal non-sampling and coverage error. A nonresponse adjustment expansion factor was applied. It was derived by dividing the universe count by the count of records with usable data.

Prior to the 2008 NC Agricultural Water Use Survey, there was no official statistically defensible data set to represent agricultural water use in North Carolina.

