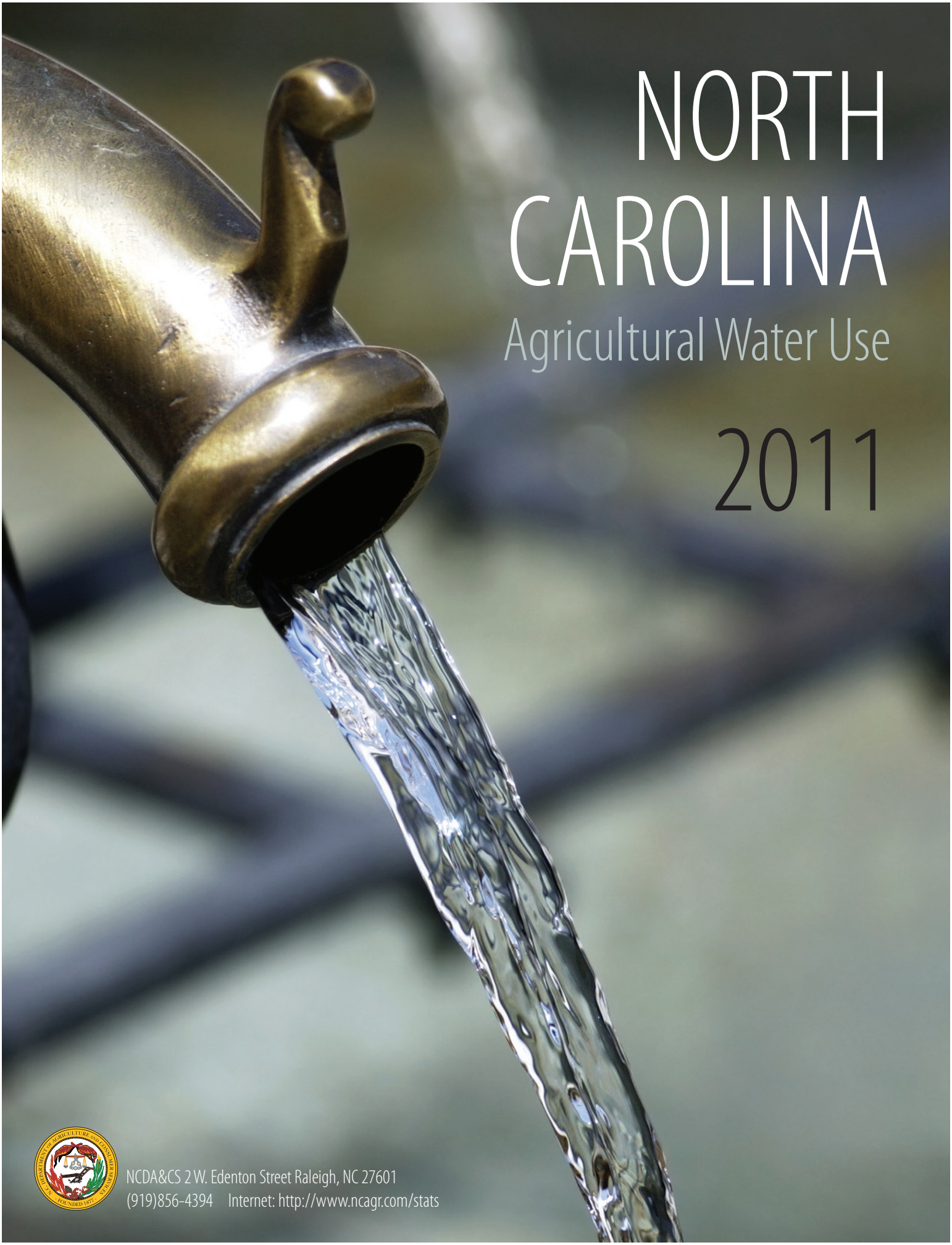

NORTH CAROLINA

Agricultural Water Use

2011

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(919)856-4394 Internet: http://www.ncagr.com/stats

NORTH CAROLINA
2011 Agricultural Water Use Survey

The fourth statewide survey was conducted to document water use for the agricultural sector during 2011. 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 Environment and Natural Resources (DENR). DENR's report can be found on ***http://www.ncwater.org/Permits_and_Registration/Water_Withdrawal_and_Transfer_Registration/report.***

When looking at agricultural water use from a total volume withdrawn perspective, table 1 on page 3 is most representative of total water use.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 365 days of the year is most representative of relative volumes used. On average, farm operations that use irrigation will withdraw water about 19 days each month. Field crop operations use water even less often, primarily 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 Table 2 on page 6 displays "demand" use, which is calculated by dividing the total water withdrawn for the month by the days applied.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. The definition of a consumptive use varies depending on the source. Most experts in agricultural sciences consider consumptive use to be the amount of water that is either taken up by plants, or evaporated. According to an Economic Research Service (USDA) report, irrigation consumptive use on farms is about 61 percent of total withdrawals nationally. This can vary greatly between regions depending on the type of system used and efficiency of the irrigation equipment.

Of the farms surveyed in the state, 1,308 withdrew over 10,000 gallons of water in any one day. The year began with most of the state experiencing abnormally dry to severe drought conditions. In March, conditions improved in the mountains but declined at the coast deteriorating to extreme drought by July. August found the mountain counties falling into abnormally dry conditions, but the rest of the state began recovering with enough rain to restore the northeastern counties to normal. Conditions gradually improved in much of the state through October. Abnormally dry and moderate drought conditions continued to be found in the center and southwestern portions of the state. July was the largest water use month in 2011, averaging 173.4 million gallons daily, with a maximum daily withdrawal of 379.5 million gallons. The annual average daily water use for 2011 was 70.3 million gallons. The daily withdrawal capacity for the 1,308 operations totaled 1,036.2 million gallons in 2011.

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. Data was not disclosed if there were less than three operations in any category or if one report comprised 60 percent or more of the total.

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

Table 1: Total & Average Daily Water Withdrawn [1]
2011 North Carolina Water Use by Month

Month	# Operations	Monthly Total-Ground	Monthly Total-Surface	Average Across All Days-Ground	Average Across All Days-Surface
	Count	*Gallons*	*Gallons*	*Gallons*	*Gallons*
January	785	352,687,278	498,522,071	11,377,009	16,081,357
February	801	318,380,816	456,926,165	11,370,743	16,318,792
March	860	623,806,091	715,862,896	20,122,777	23,092,351
April	932	696,159,305	902,539,489	23,205,310	30,084,650
May	995	958,841,319	1,471,826,232	30,930,365	47,478,266
June	1126	1,414,309,167	2,928,587,753	47,143,639	97,619,592
July	1207	1,569,713,341	3,805,700,350	50,635,914	122,764,527
August	1108	1,389,295,715	2,652,539,265	44,815,991	85,565,783
September	921	658,868,409	1,349,455,033	21,962,280	44,981,834
October	842	412,527,178	850,730,658	13,307,328	27,442,924
November	791	365,215,345	534,005,466	12,173,845	17,800,182
December	761	332,384,109	513,012,552	10,722,068	16,548,792
Annual Average				**24,813,939**	**45,481,588**

Operations:

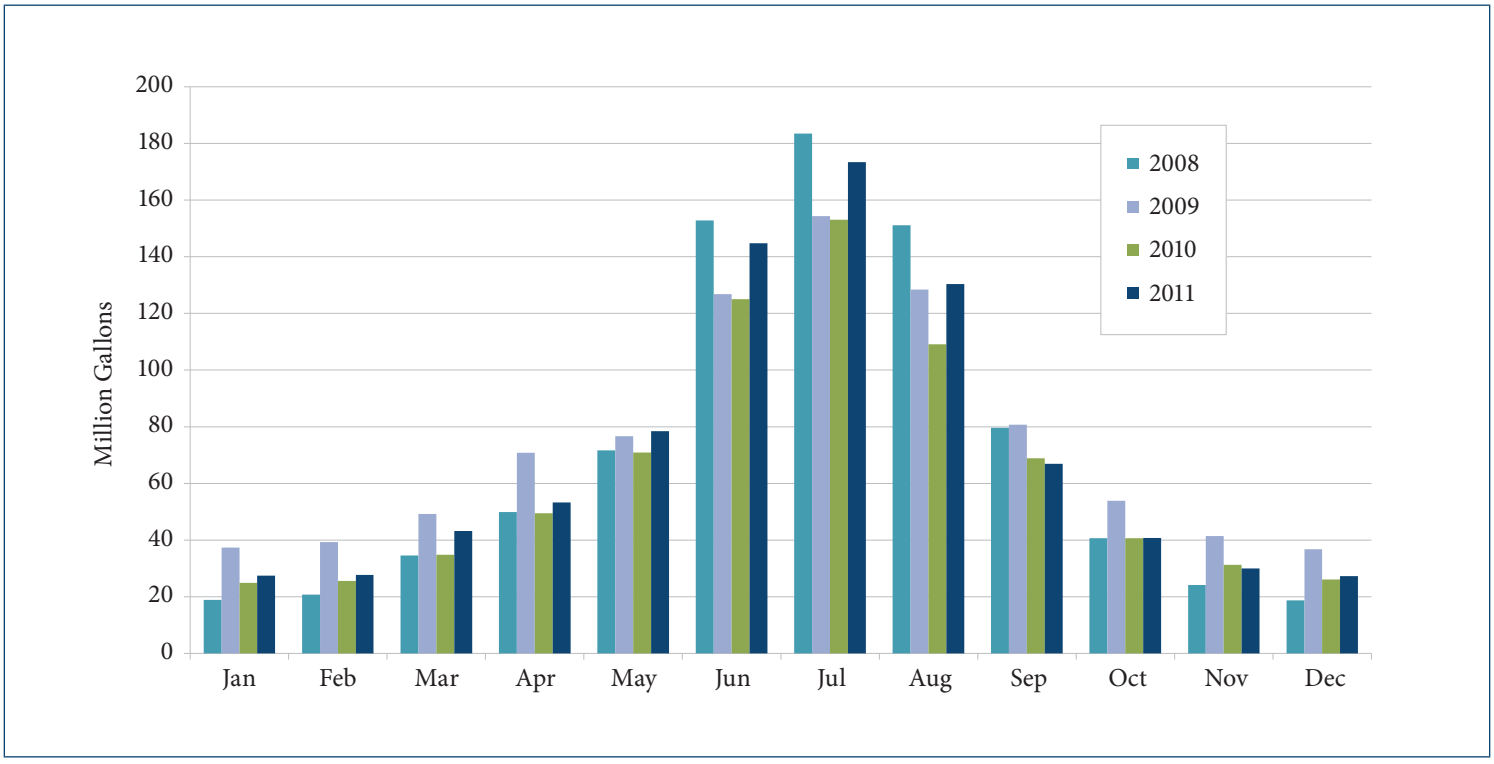
1308 *Total Operations*

Daily Withdrawal Capacity (incl. ground & surface):

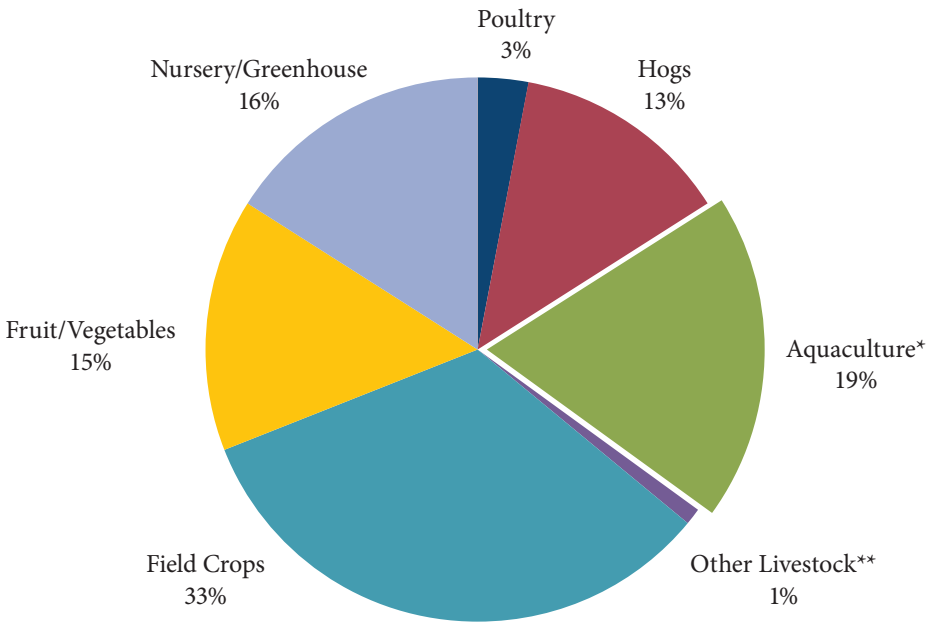
1,036,242,866 *Gallons*

[1] 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 DENR by May 21, 2012 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
2008–2011

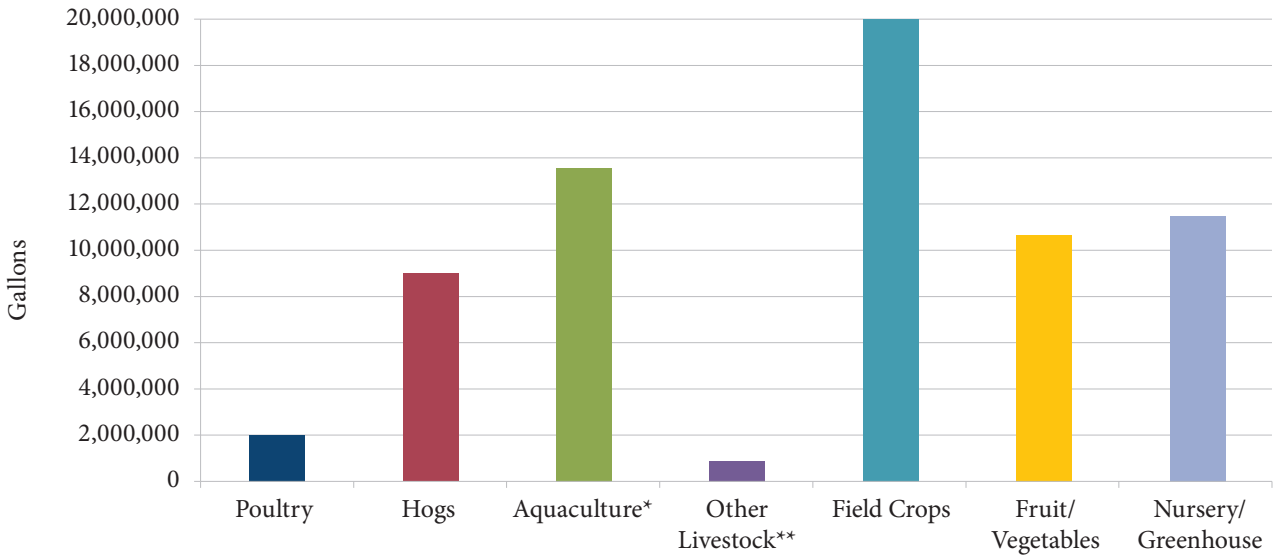


Annual Water Withdrawals by Percent



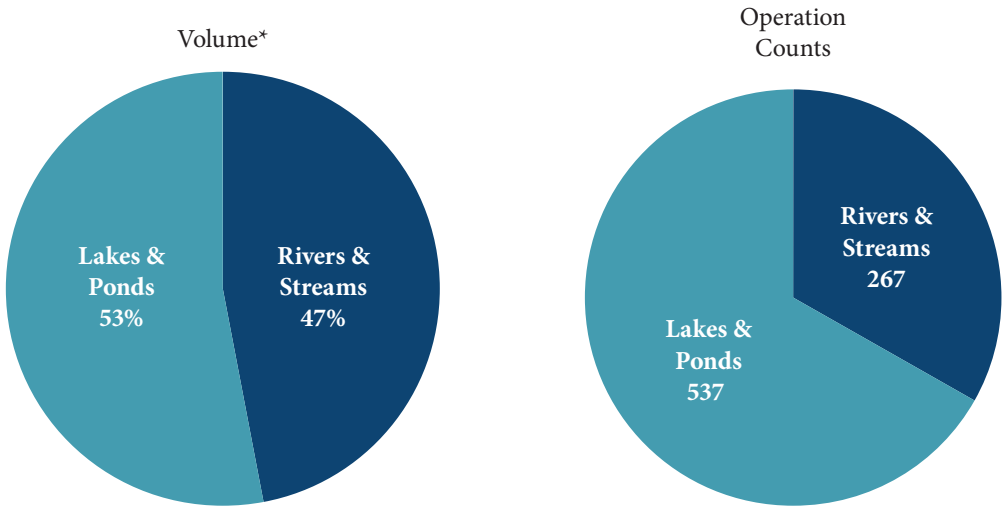
** 97% of aquaculture water withdrawals occur in western counties from rivers and streams and are typically flow through/non-consumptive.*
*** Other Livestock includes cattle, horses, goats, sheep, etc.*

Average Daily Water Withdrawals



** 97% of aquaculture water withdrawals occur in western counties from rivers and streams and are typically flow through/non-consumptive.*
*** Other Livestock includes cattle, horses, goats, sheep, etc.*

Annual Surface Water Withdrawals



** 33% of River & Stream Withdrawals are made by aquaculture operations from the western portion of the state and are typically flow through/ non-consumptive.*

Table 2: Demand Use for Days Applied [1]
2011 North Carolina Water Use by Month

Month	Average Days Applied Ground	Average Days Applied Surface	Total Avg. Daily-Ground	Total Avg. Daily-Surface	Total Max Daily-Ground	Total Max Daily-Surface
	Days	*Days*	*Gallons*	*Gallons*	*Gallons*	*Gallons*
January	29	19	13,511,831	20,970,898	15,700,053	21,169,862
February	26	16	14,825,898	21,275,176	18,587,530	21,424,929
March	28	16	30,658,407	42,807,394	45,057,360	43,254,213
April	27	16	33,863,468	70,002,519	44,604,293	74,095,311
May	28	17	54,429,810	103,659,799	76,903,706	111,666,341
June	27	16	76,628,955	202,469,805	99,747,690	218,852,971
July	28	17	80,565,957	235,551,535	99,295,823	280,157,078
August	28	17	75,689,509	182,563,448	96,635,104	199,381,737
September	27	17	31,998,788	84,601,106	40,662,219	91,996,586
October	29	17	17,867,742	38,725,959	24,029,911	40,271,668
November	27	17	15,750,682	24,425,312	21,460,929	24,766,579
December	28	19	13,569,630	21,040,612	16,829,981	21,168,542
Annual Average			**38,280,056**	**87,341,130**		

[1] 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 DENR by May 21, 2012 have been excluded.

2011 North Carolina Water Use
County Summary

County	Unique Operations [1]	Annual Average Daily [2] Ground	Annual Average Daily [2] Surface	Daily Withdrawal Capacity [3]
	Count	*Gallons*	*Gallons*	*Gallons*
Alexander	3	13,875	*	92,000
Anson	10	116,760	*	2,141,572
Bertie	13	125,530	1,145,503	37,229,800
Bladen	77	1,425,622	1,594,838	101,957,431
Buncombe	7	*	154,167	2,632,480
Burke	4	*	122,987	8,048,000
Cabarrus	7	45,108	*	4,235,960
Caswell	19	*	316,699	14,527,800
Catawba	8	*	1,122,346	9,163,800
Chatham	7	30,198	*	671,540
Chowan	10	*	1,146,576	16,788,600
Cleveland	6	*	15,108	2,063,080
Columbus	19	1,281,878	193,624	9,198,129
Duplin	131	2,302,780	222,526	22,574,819
Edgecombe	16	104,524	1,731,828	29,315,384
Franklin	16	28,932	443,943	12,506,360
Gaston	3	*	54,246	1,170,880
Granville	19	*	313,589	26,919,740
Greene	26	*	247,008	37,117,112
Guilford	14	*	347,216	9,105,800
Halifax	9	*	776,462	7,637,368
Harnett	22	135,182	186,803	8,505,614
Hertford	10	54,921	1,296,607	27,328,391
Iredell	8	50,315	94,878	7,968,400
Johnston	39	571,861	2,122,301	30,075,080
Jones	19	182,281	*	5,371,289
Lee	11	25,814	181,702	9,943,080
Lenoir	22	220,874	535,729	10,333,800
Montgomery	16	50,425	691,053	11,068,520
Moore	25	58,366	271,293	15,286,200
Nash	28	124,135	1,869,417	31,556,400
Northampton	10	271,059	131,485	7,968,310
Onslow	12	114,443	*	2,050,800
Orange	10	35,890	62,080	3,967,480
Pender	29	477,494	679,238	47,367,324
Person	14	10,966	509,334	14,803,390
Pitt	17	361,228	141,810	10,389,816
Randolph	21	118,663	385,411	9,824,680
Richmond	15	181,716	*	9,517,797
Robeson	52	3,785,756	*	83,748,749
Rockingham	25	*	615,365	29,815,952
Rowan	11	*	936,730	13,637,200
Sampson	134	*	941,072	57,206,510
Scotland	23	589,576	*	9,374,996
Stanly	3	20,852	*	366,800
Surry	14	88,547	*	10,800,400
Union	28	230,425	*	14,010,210
Vance	8	*	274,063	9,823,000
Wake	33	105,163	1,000,294	26,076,368
Warren	15	74,090	299,653	8,835,010
Washington	9	148,466	*	3,049,327
Wayne	35	599,070	194,071	9,737,573
Wilkes	11	66,818	*	2,745,760
Yadkin	6	78,464	*	5,205,600
Other Counties [4]	149	10,505,870	22,112,534	133,385,385
State	**1,308**	**24,813,939**	**45,481,588**	**1,036,242,866**

** Disclosure - one operation is greater than 60% of total or less than 3 operations. [1] Represents the unique # of operations which withdrew surface and or ground water. [2] Represents the average across all 365 days of the year 3 includes ground and surface. [4] Includes non-disclosed data from the table above and all data for Alamance, Alleghany, Ashe, Avery, Beaufort, Brunswick, Caldwell, Camden, Carteret, Cherokee, Clay, Craven, Cumberland, Currituck, Dare, Davidson, Davie, Durham, Forsyth, Gates, Graham, Haywood, Henderson, Hoke, Hyde, Jackson, Lincoln, McDowell, Macon, Madison, Martin, Mecklenburg, Mitchell, New Hanover, Pamlico, Pasquotank, Perquimans, Polk, Rutherford, Stokes, Swain, Transylvania, Tyrrell, Watauga, Wilson, Yancey, as well as non-disclosed data from the published counties.*

2011 North Carolina Water Use - Hydrologic Unit Code Summary

Hydrologic Unit Code	Unique Operations [1]	Annual Average Daily [2] Ground	Annual Average Daily [2] Surface	Daily Withdrawal Capacity [3]
	Count	*Gallons*	*Gallons*	*Gallons*
03010103	21	*	374,878	12,549,472
03010104	24	*	615,125	23,147,690
03010107	23	402,633	1,415,269	36,391,733
03010203	21	154,471	2,745,289	51,114,991
03010205	17	133,066	246,405	9,294,127
03020101	55	106,989	1,995,147	70,028,300
03020102	18	87,668	918,958	12,859,152
03020103	29	362,069	1,615,341	29,673,749
03020201	86	601,944	3,045,665	73,033,273
03020202	43	508,187	618,264	22,021,584
03020203	53	579,804	969,666	56,092,380
03020204	17	165,135	*	2,654,298
03020301	5	35,464	*	458,000
03020302	11	131,488	*	2,015,400
03030002	50	128,990	967,952	45,965,008
03030003	46	171,896	699,744	26,690,340
03030004	42	396,877	1,272,226	24,536,253
03030006	180	*	2,297,381	135,592,029
03030007	181	3,066,502	1,199,361	67,225,712
03040101	39	200,730	1,690,429	23,507,760
03040102	13	98,920	*	10,911,600
03040103	16	89,666	939,582	16,351,040
03040104	16	93,974	70,444	3,580,052
03040105	42	737,470	*	33,177,870
03040203	68	1,869,079	751,517	40,416,692
03040204	42	3,044,186	*	71,146,879
03040206	27	1,285,008	*	6,083,429
03050101	16	35,470	*	17,312,800
03050102	10	87,459	1,238,974	8,566,600
03050105	12	*	182,043	4,407,880
06010105	13	178,670	363,502	11,485,360
Other Counties [4]	72	10,060,121	19,248,425	87,951,414
State	**1,308**	**24,813,939**	**45,481,588**	**1,036,242,866**

** Disclosure - one operation is greater than 60% of total or less than 3 operations. [1] Represents the unique # of operations which withdrew surface and/or ground water. [2] Represents the average across all 365 days of the year. [3] Includes ground and surface. [4] Includes non-disclosed data from the table above and all data for 3010102,03010204,03020104, 03020105,03030005, 03040201,03050103, 05050001,06010103, 06010106, 06010108, 06010202, 06010203, 06020002.*

2011 Central Coastal Plain Total Water Use by Month [1]

Month	# Operations	Average Across All Days-Ground	Average Across All Days-Surface	Total Max Daily-Ground	Total Max Daily-Surface
	Count	*Gallons*	*Gallons*	*Gallons*	*Gallons*
January	241	4,111,036	261,409	5,050,066	266,040
February	245	4,002,939	262,563	5,196,360	266,072
March	253	4,503,722	763,507	7,869,553	1,420,689
April	263	4,699,161	1,239,860	8,956,349	4,871,316
May	270	5,088,040	4,019,576	9,956,049	9,567,873
June	294	6,586,825	11,795,068	13,007,480	36,991,414
July	295	6,801,484	14,439,703	13,271,340	56,317,457
August	261	5,643,488	5,361,156	10,193,282	13,316,534
September	245	4,841,729	1,919,404	7,870,013	2,941,013
October	239	4,174,434	937,241	5,672,650	1,434,435
November	231	3,991,847	490,862	4,864,616	594,362
December	230	3,729,082	261,543	4,714,144	265,090
Annual Average		**4,847,816**	**3,479,324**		

Operations:

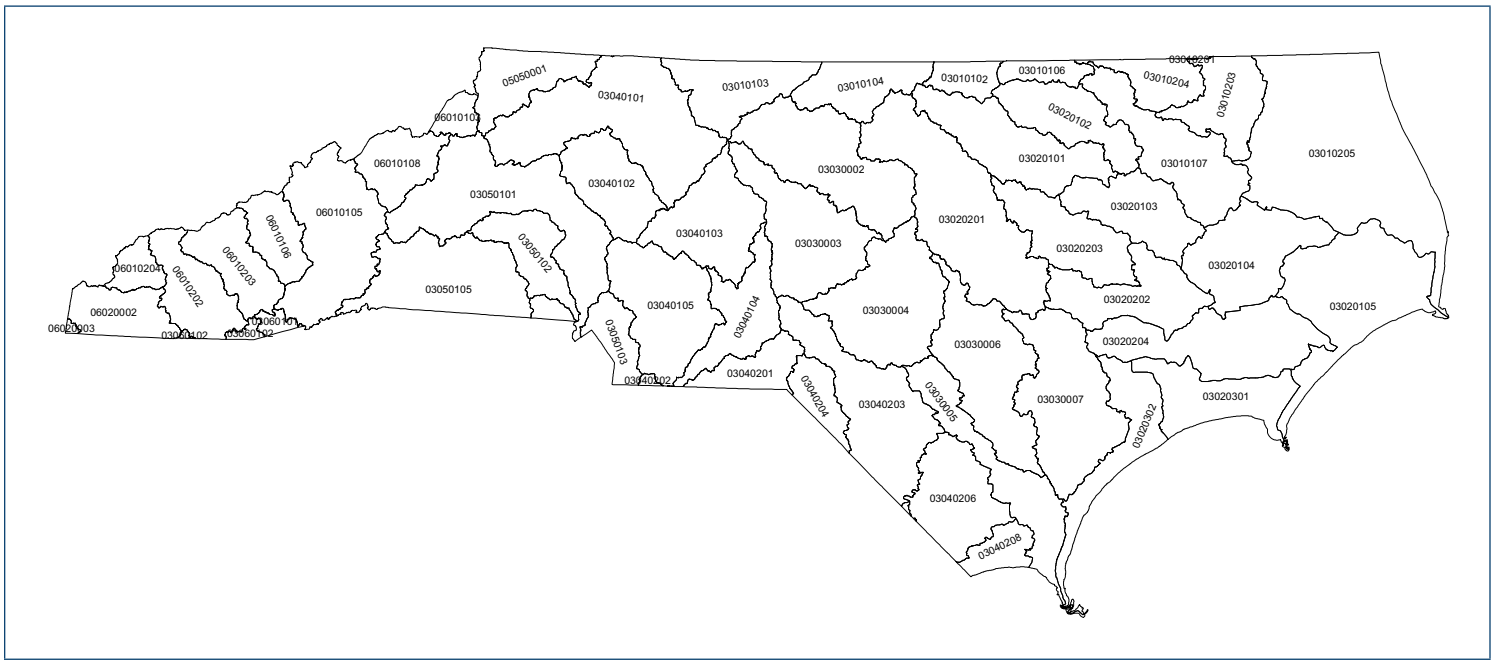
320 *Total Operations*

Daily Withdrawal Capacity (incl. ground & surface):

155,541,607 *Gallons*

[1] 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. Does not include farms that have reported their withdrawals directly to DENR by May 21, 2012. The 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. More than 3,500 such operations were contacted and included farms with a history of withdrawing more than 10,000 gallons on any one day. 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 89% 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.

Taking the above steps, including conducting a census of all known farm operations that use 10,000 gallons of water on any one day, results in zero sampling error around the estimates and **minimal** non-sampling and coverage error. 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.