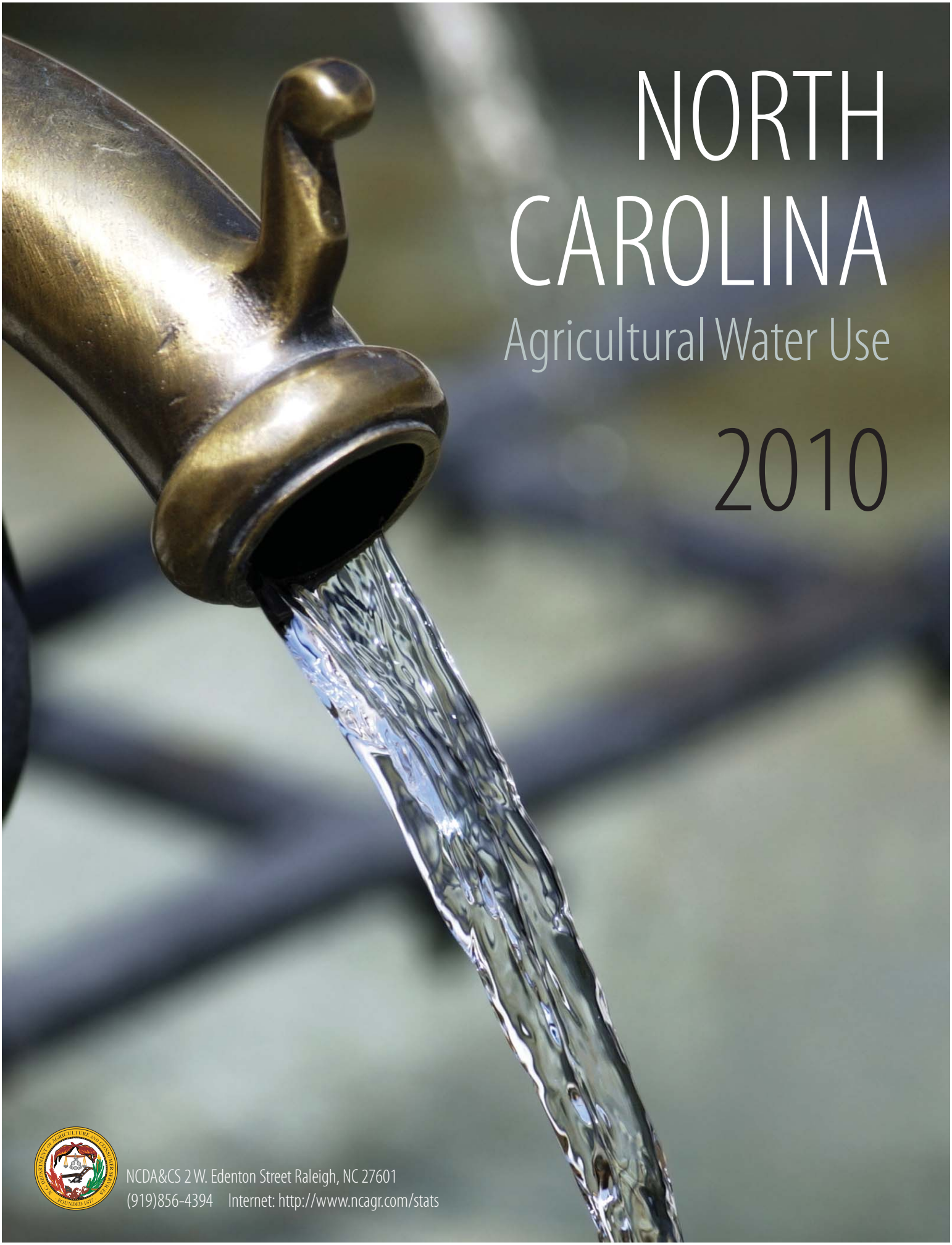


NORTH CAROLINA

Agricultural Water Use

2010

NCDA&CS 2 W. Edenton Street Raleigh, NC 27601
(919)856-4394 Internet: http://www.ncagr.com/stats

NORTH CAROLINA
2010 Agricultural Wateruse

The third statewide survey was conducted to document water use for the agricultural sector during 2010. 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/whichsystem.php .**

When looking at agricultural water use from a total volume withdrawn perspective, table 1 on page 3 is most representative of total water use.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 20 days each month. Field crop operations use water even less often, primarily to supplement rainfall. Western states rely on irrigation more frequently and in larger volumes throughout the year. To help put North Carolina water use in perspective, there were about 150,000 acres of farm land irrigated in 2008, compared to nearly 9 million total acres of land in farms. 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 Table 2 displays "demand" use, which is calculated by dividing the total water withdrawn for the month by the days applied.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, 1420 withdrew over 10,000 gallons of water in any one day. The year began with the entire state experiencing normal moisture conditions. The central & eastern portions briefly experienced abnormally dry conditions in late April but quickly recovered to normal. Abnormally dry conditions began creeping back into the state in late June from the perimeters of the state's mountain, coastal, and northern counties. These conditions spread and worsened throughout the state in July to include all but the south central piedmont. Conditions improved in many counties in August but worsened in September to wrap most of the state in abnormally dry conditions with the southern Piedmont experiencing moderate drought. October found conditions improving in the eastern counties while moderate drought and abnormally dry conditions continued in the Piedmont and Western areas of the state. July was the largest water use month in 2010, averaging 153.1 million gallons daily, with a maximum daily withdrawal of 356.9 million gallons. The annual average daily water use for 2010 was 63.3 million gallons. The daily withdrawal capacity for the 1420 operations totaled 1094.9 million gallons in 2010.

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. Caution should be used in comparing the 2010 summary with summary data prior to 2007 due to the impact of a more comprehensive source of names, primarily from the 2007 Census of Agriculture.

Table 1: Total & Average Daily Water Withdrawn[1]
2010 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	849	327,746,853	443,718,548	10,572,479	14,313,502
February	880	306,896,139	408,396,413	10,960,576	14,585,586
March	954	429,059,324	650,423,885	13,840,623	20,981,416
April	1024	587,000,892	897,557,431	19,566,696	29,918,581
May	1102	736,126,685	1,462,543,675	23,746,022	47,178,828
June	1231	957,486,641	2,794,574,636	31,916,221	93,152,488
July	1323	1,233,133,162	3,512,626,842	39,778,489	113,310,543
August	1220	911,836,657	2,470,582,043	29,414,086	79,696,195
September	1048	540,075,004	1,526,319,779	18,002,500	50,877,326
October	954	455,042,183	805,086,261	14,678,780	25,970,525
November	894	366,143,125	570,731,451	12,204,771	19,024,382
December	840	305,086,729	504,999,747	9,841,507	16,290,314
Annual Average				**19,543,563**	**43,774,974**

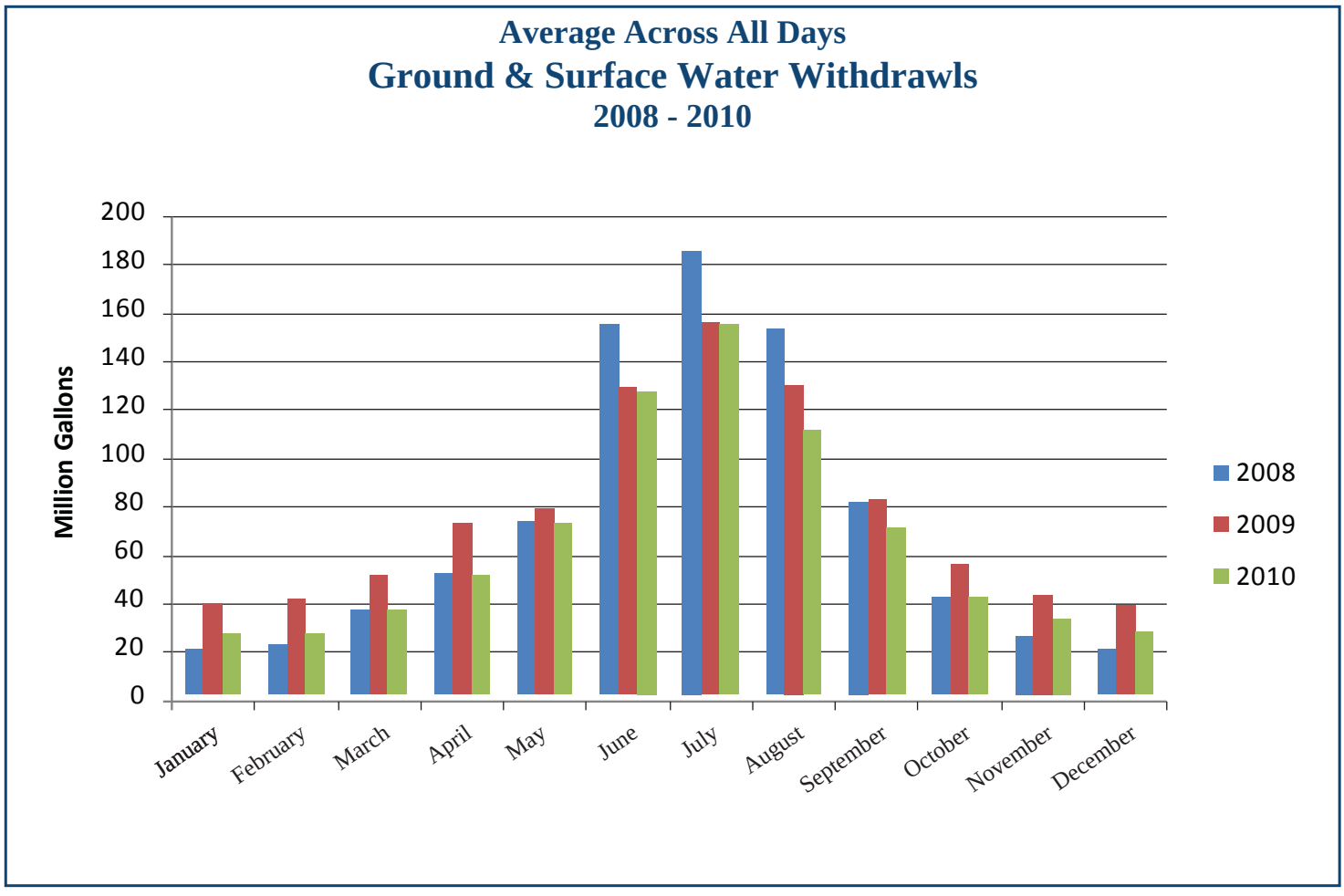
Operations[2]:

1420 Total Operations

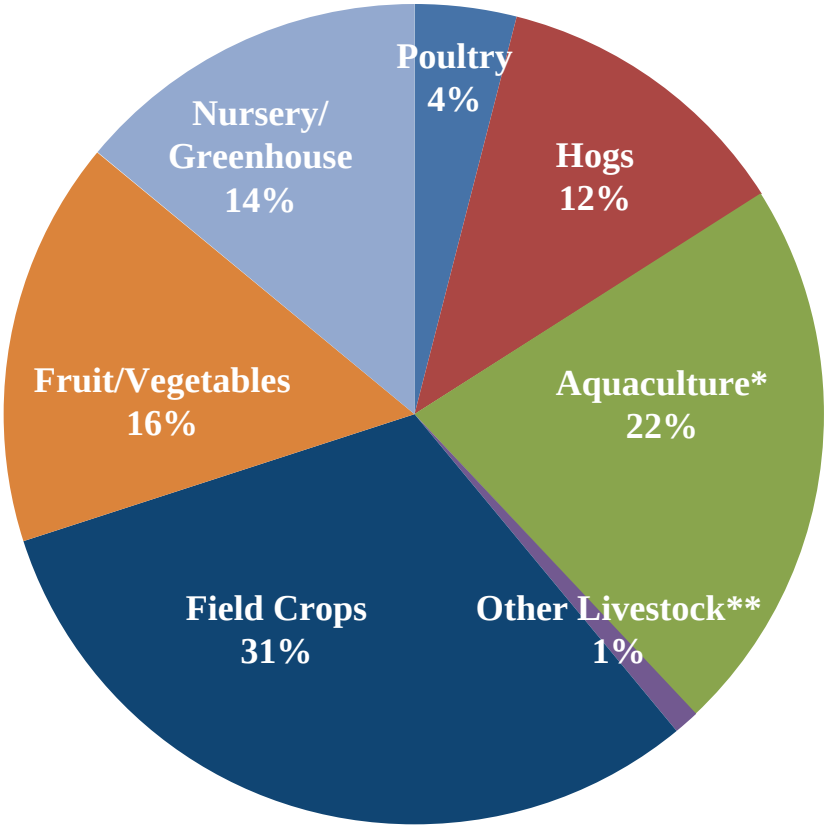
Daily Withdrawal Capacity (incl. ground & surface):

1,094,941,408 (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 July 1, 2011. The number of operations represents operations that withdrew water at any time during the year.

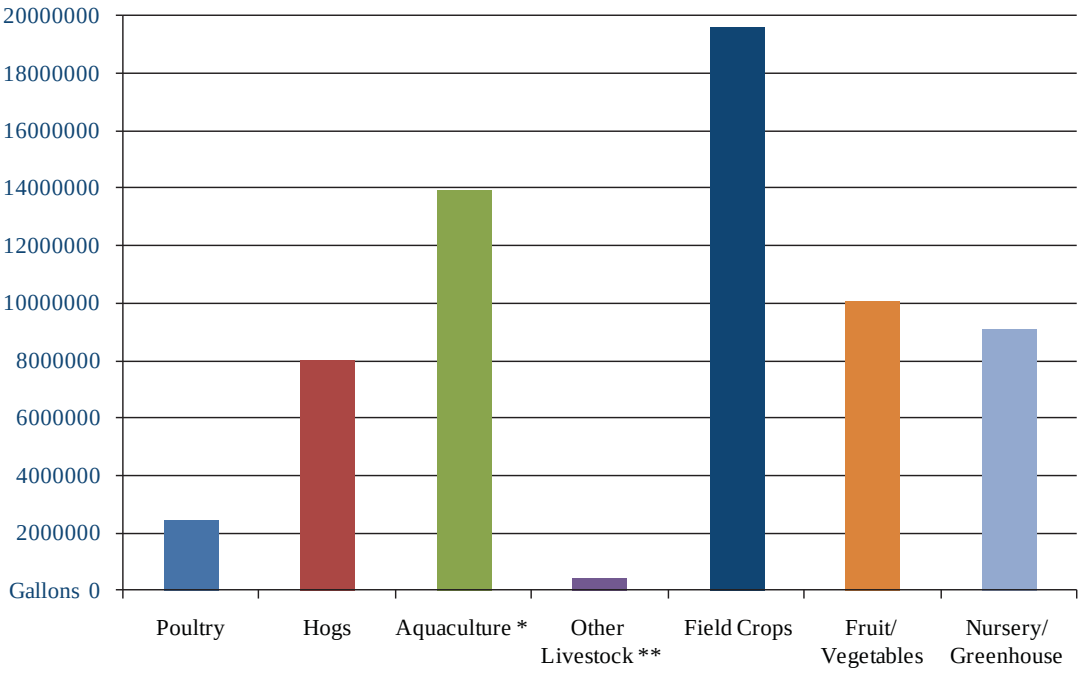


Annual Water Withdrawls by Percent Ground and Surface



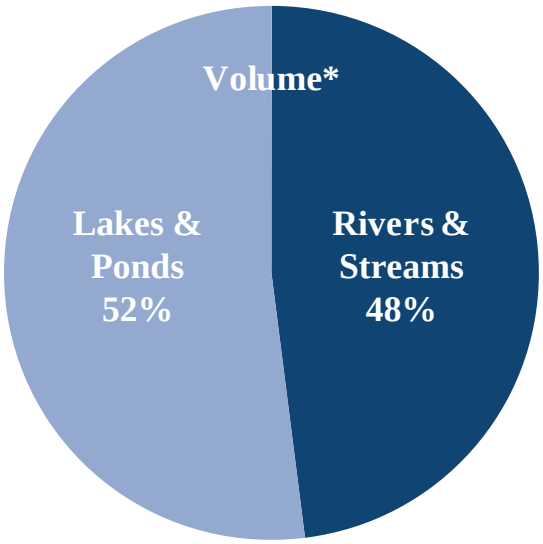
***97 % of aquaculture water withdrawls occur in western counties from rivers and streams and are typically flow through/non-cosumptive.** **Other Livestock includes cattle, horses, goats, sheep, etc.

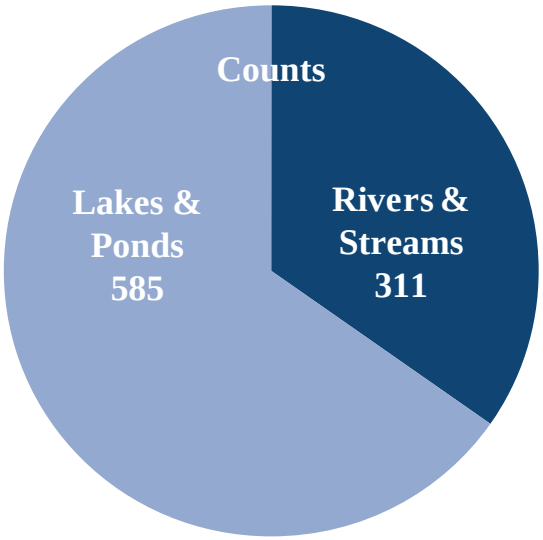
Average Daily Water Withdrawals Ground and Surface



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

Total Surface Water Withdrawn Annually





* 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]
2010 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	28	21	14,128,112	17,727,629	16,453,433	19,348,289
February	25	18	15,459,206	19,100,220	20,286,659	21,297,486
March	27	17	37,822,513	48,805,093	42,858,438	50,350,902
April	26	17	37,863,484	76,546,923	49,736,408	81,156,296
May	27	17	41,080,816	106,840,035	59,458,825	115,878,899
June	26	16	52,945,187	186,080,387	74,973,158	205,890,029
July	27	17	79,885,699	226,710,453	95,973,178	260,929,620
August	27	17	57,032,521	169,291,378	69,772,195	193,441,699
September	27	18	30,219,785	95,254,706	39,496,324	107,951,614
October	28	19	24,116,620	42,901,684	33,979,151	47,053,753
November	27	18	24,030,425	24,917,014	30,992,459	26,795,863
December	28	19	14,002,860	20,288,011	17,871,027	20,364,739
Annual Average			**35,715,602**	**86,205,294**		

Users of 10,000 gallons or more per day. Averages reported in this table reflect the average water withdrawn during the days of application. Does not include farms that have reported their withdrawals directly to DENR by July 1, 2011.

2010 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)*
Alamance	9	*	141,223	12,396,360
Alexander	7	19,578	*	1,079,600
Anson	9	73,265	*	2,103,480
Ashe	3	*	21,241	3,885,000
Bertie	18	129,548	2,082,145	32,286,400
Bladen	88	1,283,878	724,550	128,822,179
Brunswick	5	54,768	*	1,363,000
Buncombe	5	*	248,202	1,401,080
Cabarrus	7	41,187	*	1,923,520
Caldwell	8	*	125,305	5,894,700
Caswell	17	*	193,196	9,826,200
Catawba	8	*	569,551	11,435,800
Chatham	12	90,855	*	956,440
Cleveland	9	63,812	22,578	2,714,080
Craven	9	119,335	*	5,434,646
Davidson	9	21,662	*	6,158,440
Duplin	135	2,023,176	*	32,060,904
Durham	6	*	40,270	937,520
Edgecombe	16	*	1,093,956	23,296,173
Franklin	18	*	500,669	20,861,060
Granville	19	425,448	346,321	17,876,300
Greene	31	411,009	*	38,807,824
Halifax	8	*	257,348	7,132,880
Harnett	25	136,975	137,124	10,464,754
Henderson	11	*	310,796	4,370,600
Johnston	48	*	878,120	26,506,380
Jones	14	161,988	*	3,294,410
Lee	20	61,563	216,146	13,539,100
Lenoir	15	162,021	*	5,866,800
Lincoln	9	109,524	*	9,559,400
Montgomery	18	65,468	*	13,993,400
Moore	33	*	536,992	22,507,600
Nash	29	133,943	1,641,659	28,514,040
Northampton	11	279,531	*	18,726,400
Onslow	10	88,232	*	1,699,400
Orange	10	*	73,724	5,424,000
Pender	30	698,489	1,390,793	43,176,680
Person	13	12,391	364,956	13,267,440
Pitt	26	533,710	591,338	12,013,806
Randolph	30	209,627	401,890	11,265,180
Richmond	17	158,391	237,734	14,770,157
Robeson	49	2,570,340	*	29,464,829
Rockingham	32	161,705	475,787	30,064,712
Rowan	7	21,510	*	17,264,800
Sampson	134	2,451,430	617,798	49,259,842
Stanly	5	33,977	*	1,482,900
Stokes	5	*	33,166	4,927,200
Union	25	258,188	*	22,281,940
Vance	13	*	618,327	18,643,000
Wake	41	143,055	1,477,433	28,822,416
Warren	14	*	480,902	10,173,000
Washington	8	92,446	*	1,251,661
Wayne	43	521,274	*	13,472,093
Wilkes	11	117,176	*	3,242,600
Yadkin	5	28,426	*	1,943,200
Other Counties[4]	203	5,574,661	26,923,733	235,034,082
STATE	**1420**	**19,543,563**	**43,774,974**	**1,094,941,408**

** 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 Alleghany, Avery, Beaufort, Burke, Camden, Carteret, Cherokee, Chowan, Clay, Columbus, Cumberland, Currituck, Dare, Davie, Forsyth, Gaston, Gates, Graham, Guilford, Haywood, Hertford, Hoke, Hyde, Iredell, Jackson, McDowell, Macon, Madison, Martin, Mecklenburg, Mitchell, New Hanover, Pamlico, Pasquotank, Perquimans, Polk, Rutherford, Scotland, Surry, Swain, Transylvania, Tyrrell, Watauga, Wilson, Yancey, as well as non-disclosed data from the published counties.

2010 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	24	266,584	252,839	15,960,832
03010104	24	13,561	438,197	19,634,500
03010107	26	326,243	2,208,780	45,061,320
03010203	17	106,837	2,248,631	39,360,640
03010204	7	*	416,997	8,468,000
03010205	20	137,242	159,036	7,568,861
03020101	65	886,386	3,075,455	89,315,060
03020102	17	42,186	600,753	14,807,340
03020103	31	424,205	1,324,302	24,312,049
03020201	104	502,561	2,638,249	57,724,113
03020202	46	602,395	*	15,072,601
03020203	70	697,429	1,672,639	60,521,462
03020204	10	76,857	*	1,847,468
03020302	9	94,616	*	1,547,000
03030002	53	180,000	1,129,425	41,660,216
03030003	63	322,423	674,437	25,429,600
03030004	54	718,771	988,229	33,122,736
03030005	27	499,697	*	65,572,757
03030006	186	2,961,101	1,777,068	143,175,529
03030007	182	3,210,713	2,533,488	62,093,494
03040101	47	289,266	*	22,158,480
03040102	9	46,371	*	10,232,640
03040103	13	46,612	*	14,732,360
03040104	19	78,188	508,820	13,775,280
03040105	40	2,465,154	*	45,052,540
03040201	4	34,644	*	204,597
03040203	67	1,449,686	*	39,409,649
03040204	42	1,521,097	*	27,478,887
03040206	28	480,264	*	4,610,297
03050101	23	75,834	295,193	20,563,200
03050102	11	134,423	797,234	15,030,400
03050105	16	81,744	162,885	4,353,480
05050001	4	*	32,932	6,045,000
Other Counties4	62	770,475	19,839,384	99,039,020
STATE	**1420**	**19,543,563**	**43,774,974**	**1,094,941,408**

** 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 03010102, 03020104, 03020105, 03020301, 03050103, 06010103, 06010105, 06010106, 06010108, 06010202, 06010203, 06020002*

2010 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	239	3,537,598	294,256	3,887,137	294,256
February	251	3,533,106	344,938	3,953,919	1,015,012
March	263	3,626,941	1,100,661	5,715,174	8,573,743
April	279	4,645,105	3,033,573	8,934,876	18,864,568
May	283	5,873,241	8,955,717	11,087,206	24,728,485
June	312	8,396,879	12,327,650	15,349,735	33,568,911
July	315	8,157,323	12,938,152	14,595,624	44,655,400
August	292	5,704,553	7,575,963	10,642,046	19,536,103
September	269	4,505,271	4,051,830	6,868,854	8,415,543
October	256	4,068,977	1,538,254	4,825,419	2,834,434
November	245	3,501,994	869,069	3,929,687	1,383,762
December	238	3,255,490	294,256	3,634,794	294,256
Annual Average		**4,900,540**	**4,443,693**		

Operations:

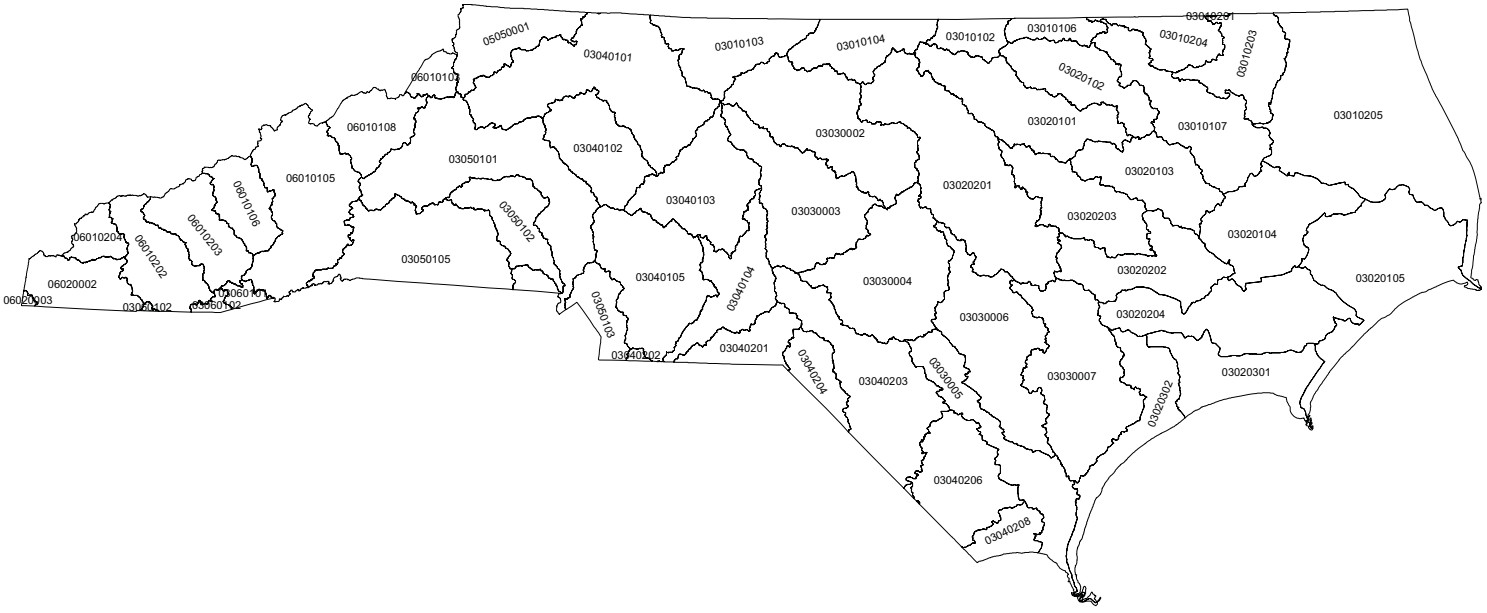
335 Total Operations

Daily Withdrawal Capacity (incl. ground & surface):

156,697,219 (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 July 1, 2011. The number of operations represents operations that withdrew water at any time during the year.

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 in one day. More than 3600 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. A 92% 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.