

North Carolina Ground Water Resources Monitoring Well Network 2012 Annual Report



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Division of Water Resources
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1.0 Introduction

The State of North Carolina (the State) relies on ground water for approximately 50 percent of its drinking (potable) water use. In addition, the State has thousands of agricultural and industrial ground water users. Since 1998, the North Carolina Department of Environment and Natural Resources (DENR), Division of Water Resources (DWR) has monitored and maintained a statewide network of monitoring wells to assess North Carolina's ground water supply. The operation of this monitoring well network is an essential part of DWR's mission to ensure that the State has an adequate water supply for its citizens. Information (data) collected quarterly from this well network include the following:

- Evaluating climatic influences on the State's ground water supply, including effects of drought and recharge-discharge relationships;
- Monitoring human-induced effects on the State's ground water supply, particularly in the regional aquifer systems of the Coastal Plain physiographic province. These effects include local and regional water level declines as well as migration of the fresh water-salt water interface within various aquifers;
- Providing supporting data for enforcement and creation of current and future ground water usage regulations, such as the Central Coastal Plain Capacity Use Area rules; and
- Providing high quality ground water data to local governments, ground water professionals, and the general public to use in making informed decisions in ground water related issues.

Data collected from the network are available to the public through DWR's Internet website, www.ncwater.org. These data include ground water levels, chloride measurements, well construction information, borehole log construction (lithological and geophysical), ground water monitoring station locations, and geophysical/lithological data collection from non-DWR well sites.

2.0 Purpose and Scope

The 2012 Annual Report summarizes field activities and conclusions derived from activities performed during the July 1, 2011 through June 30, 2012 fiscal year. These activities include water level and water quality data statistics, monitoring well installations including new installations, monitoring equipment usage and evaluations, and site surveys.

3.0 Background

The Division of Water Quality (DWQ) and its predecessor agencies initially operated the statewide Ground Water Resource Monitoring Program. DWQ installed the original network wells in the 1960s and is responsible for installation of approximately 66 per cent of the current monitoring well network. DWQ actively monitored the network through the early 1990s, collecting a portion of the ground water data currently contained within the network database. The program was transferred to DWR in 1998.

The U.S. Geological Survey (USGS) has also contributed to the monitoring of the State's ground water resources under a cooperative agreement between the State of North Carolina and the Federal government. The cooperative well network consists of 13 monitoring wells, many of which are also part of the DWR statewide network.

4.0 DWR Statewide Monitoring Well Network Overview

4.1 Description

The monitoring well network currently consists of 596 wells at 198 monitoring stations (sites), divided into five regions, comprising 61 counties (Figure 1). There are 28 wells located in the Piedmont and Mountain physiographic provinces (Piedmont and Mountain) and 568 wells located in the Coastal Plain physiographic province (Coastal Plain). The Coastal Plain relies more heavily on ground water supplies than either the Piedmont or Mountains. Subsequently, ground water monitoring and research has been more concentrated in the Coastal Plain. In the past few years, more resources have been invested in monitoring the Piedmont and Mountain ground water conditions to better understand the impact of drought cycles on ground water supplies and their contribution to surface water flow. There are 30 wells within the monitoring well network used to assess drought conditions (Figure 2).

Of the 198 monitoring stations, 61 are on State or Federal property, 51 are located on property owned by local governments, 84 are located on private property through agreements with landowners and 2 stations are located on properties where landowner indicates that the land property ownership may change. In the past, some wells have been abandoned at the landowner's request due to changes in land use or ownership. Due to the high cost of well construction combined with the fact that the wells are most valuable when they are monitored continuously over a period of decades, every attempt is made to put new stations in secure, stable locations. A scale has been developed to rank new and existing well sites for potential well abandonment due to land-use issues in the future (Table 1). It is preferred that new wells be installed at sites with a susceptibility rating of 1 or 2.



Laurel Springs Station, Alleghany County



Wilkesboro Station, Wilkes County



North Pitt High School Station, Pitt County

4.2 Monitoring

The statewide monitoring network is divided into five regions ([Figure 1](#)). One staff member is responsible for each region. Staff member responsibilities include visiting the wells quarterly to collect water level data, performing routine site maintenance, keeping automatic data recorders in working order and keeping sites accessible and esthetically pleasing. Additional site activities (i.e. recorder removal/replacement, weed/grass maintenance, video-logging, etc.) are conducted on an as needed basis.



Video-Logging at Hope Plantation, Bertie County

Depth to ground water level measurements are collected from the network in two different ways. Manual water levels are measured using electronic water level indicators. Hourly water level measurements are collected using one of two types of automatic water level recorders (shaft encoders or submersible pressure transducers, vented and unvented). Hourly water level data are extremely valuable in assessing aquifer recharge, impacts of large storms on ground water conditions, and delineation of aquifer boundaries. DWR typically publishes only the manual water level readings and daily water level data from recorders on the website. However, hourly data is available upon request for specific wells. [Table 2](#) summarizes site and recorder distribution by region.



Manual water level collection.



Electronic water level recorder (Hobo connected to Shuttle)

Triennial chloride samples are collected from select wells in the Coastal Plain. The samples are analyzed using the Quantab field method. Field results are used to monitor the migration of the fresh water-salt water interface in the Coastal Plain aquifers. Additional chloride samples are collected for field analyses when new monitoring wells are installed and as needed for special projects. The next chloride sampling event will occur September 2013. In addition, a special chloride sampling is being conducted in September 2012. Section 5.2 summarizes the 2010 chloride sampling event.

5.0 2011-2012 Well Network Statistics

5.1 Ground Water Data Collection

Depth to ground water was measured in 594 wells in the July 1, 2011 through June 30, 2012 fiscal year. The following wells were not measured for four consecutive quarters during the 2011/2012 fiscal year:

- P17E4, Whitley Farms, was dry for two consecutive quarters (August and November 2011), therefore, depth to ground water could not be measured in this well. The well was placed on the inactive list and abandoned in the spring of 2012.
- O10W1, Hydeland, was interpreted to be a hybrid well and placed on the inactive well list in 2010. However, water levels were collected from this well in February, May, and August of 2011. Monitoring well O10W1 is scheduled for replacement.
- O17I3, Bath, was interpreted to be a hybrid well and placed on the inactive list. Water levels were collected from this well in May and August of 2012.
- V26W1, Robert Black Residence, was placed on the inactive list in December 2011. Water levels were collected from well O17I3 in August and November of 2011.

- CC30P2, Wilmington Airport, was damaged in the fall of 2011. Partial electronic data was collected during the 2011/2012 fiscal year, however, DWR personnel were unable to collect manual water levels. This well was abandoned in January 2012.

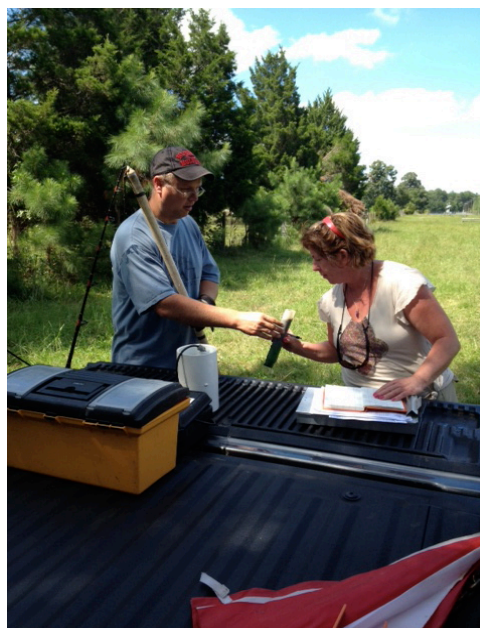
Table 3 contains DWR monitoring well network statistics from January 1, 2005 through June 30, 2012. Statistics may vary in comparison to previous years due to additional data entry in the DWR database as older field books are scanned and unrecorded data entered.

Figure 3 compares the number of wells monitored to the water level data collected from the network from 1967 to present. Hourly water level data is not included in this graph. Calendar year 2011 represents the most water level data collected in any single year since starting the monitoring well network operation. This is due to the gradual increase in the number of wells monitored and the increased use of automatic data recorders. The 2012 data was collected through June 2012.

Archived water level recorder charts obtained from DWQ with records dating from the 1960s through 1980s continue to be digitized and data recorded into DWR online database. Additional continued digitized information recorded in the database includes, but is not limited to, well construction records, well development, chloride sampling events, memorandums of agreement, and field notes.

5.2 Triennial Chloride Sampling

The triennial chloride sampling was performed in September and October 2010. Ground water from 245 wells within the network was sampled for chlorides using Quantab® chloride titrators. Field data were collected for pH, conductivity, and salinity using YSI® portable probes.



Chloride Sampling

The intention of the triennial chloride sampling is to assess the position of the fresh water-salt water interface within each of the major coastal plain aquifers. Current results are compared to results of previous sampling events to evaluate potential landward migration of the fresh water-salt water interface due to aquifer overuse. Chloride sampling results are posted in the database and the DWR website.

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North Carolina Department of Environment and Natural Resources

Division of Water Resources

Field	Data
County	Beaufort
Quad link to framework	Q 16G4
Name link to logs	Godley
Latitude	35.315752
Longitude	-76.727595
Location Accuracy	GPS
Netname <small>(link to USGS data)</small>	
USGS ID	351856076434104
Aquifer	Castle Hayne
Land Surface	10.63
NED elevation = 9.89 feet	
Date Constructed	02/23/1981
Measuring Point <small>(feet above land surface)</small>	1.20
Depth	500.00
Diameter	4.00
Yield	60.00
Exists?	y
Recorder Box?	y
Top of Screen	406.00
Bottom of Screen	500.00
Number of Water Levels <small>{date * feet below land surface * elevation}</small>	2,461
** 999.99 feet below land surface value indicates dry well	
Number of Chlorides <small>{date * chlorgpm * spcond_us/cm * salin_ppt * pH * comments}</small>	6
** -1 values equal no data ** a negative # other than -1 equals below detection limit of #	
output files are tab-delimited text National Elevation Dataset, 1/9 arc second value, -3 X 3 meter grid	

return to well table

DWR Monitoring Database Detail for Q 16G4

Show Map -- Monthly Statistics Plot -- Station Levels (may include USGS data)

Q 16G4 water levels and chloride concentrations

water levels from 10-01-2011 to 12-31-2012

slope: -13.86 feet/year over this date range

Start Date: - -

End Date: - -

Sampling results indicate that there continues to be concern for salt-water encroachment, especially near larger pumping centers located near the fresh water-salt water interface (250 parts per million (ppm) chloride is considered salt water). The September 2010 chloride field sampling results associated with wells near larger pumping centers illustrate these type of issues:

- Chloride concentrations from October 2010 in the lower Castle Hayne aquifer well Q16G4 at the Godley Station continue to indicate salt water intrusion with levels of 531 ppm which exceed the 250 ppm threshold for salt water. This station is located near PCS Phosphate Inc. at Aurora, NC in Beaufort County.
- Chloride concentrations from the Peedee aquifer well Y25Q4 at the Folkstone Station show a large decrease in chlorides from 252 ppm on September 2007 to BDL (below detection limit of 33 ppm) in September 25, 2010. This station is located near the ONWASA Dixon well field in Onslow County.

- Chloride concentrations from the Upper Cape Fear aquifer well J22P5 at the Gold Point Station decreased from 162 ppm in September 2007 to 54 ppm in September 2010. This station is located near the town of Robersonville in Martin County.
- Chloride concentrations from the Upper Cape Fear aquifer well R23X9 at the Cove City station increased from 352 ppm in October 2007 to 463 ppm in September 2010. This well is located near the town of Cove City, North Carolina.

Table 4 summarizes the chloride field analysis to date. Chloride sampling will take place again in September and October 2012.

5.3 Well Installation

From March through May 2012, the following monitoring wells were installed:

- Ivanhoe Station, Ivanhoe, Duplin County, one well, Y34P7;
- Camp Glenn Station in Morehead City, Carteret County, one well, X17J7;
- Whitley Farms in Beaufort County, one well, P17E5; and
- Farmville Marlboro Rd. Station in Farmville, Pitt County, five wells, M27U13, M27U14, M27U15, M27U16 and M27U17.

The wells were installed using 4-inch PVC riser and 10 or 20 feet of 4 to 4.5-inch stainless steel continuous wire wrap V-slot screen (wells greater than 70 feet) or 4 inch .020 slot PVC screen (wells less than 70 feet). The wells were constructed of a gravel pack extending from the bottom of the screen to a minimum of five feet, but no more than ten feet, above the screen. A minimum of ten feet of bentonite overlay the top of the gravel pack in order to provide a sufficient bentonite seal in the well. Table 5 summarizes the monitoring well construction information.



Slotted Screen with Tail Pipe



Gravel Pack Installation



Pressure grouting using bentonite grout

A pilot hole was not advanced prior to installing the wells at the Ivanhoe, Camp Glenn, and Whitley Farms stations since these stations had pilot holes advanced in previous years and geophysical logging was conducted. Pilot holes were advanced and geophysical logging conducted at the Farmville Marlboro Rd. station prior to well installation. Geophysical and lithologic log interpretation enabled the DWR staff to assess well screen intervals and the number of wells to be installed. Borehole advancement and well installation included well development and chloride measurement collection.



Samples for lithologic interpretation



Geophysical Logger

Monitoring wells at Ivanhoe (Y34P7), Camp Glenn (X17J7), and Whitley Farms (P17E5), were developed from March through June 2012 by pumping. Development removes fine-grained sediments from the vicinity of the well screen and ensures proper hydraulic connection with the aquifer. In addition, field data were collected for pH, conductivity, salinity, and temperature in thirty minute or hourly intervals. Field data exhibiting overall consistency was used to assist in the decision to stop well development.



Well Development

5.4 Well Maintenance

The well network requires continual maintenance to keep active monitoring stations usable. Many of the wells exceed 30 years in age and are constructed of materials that are susceptible to corrosion, especially in acidic or saline ground water conditions. Some older wells were constructed with outdated, less than desirable construction practices including backfilling boreholes with cuttings instead of neat cement or bentonite grout. Boreholes backfilled with cuttings form an inadequate seal and allow other aquifers to influence the water level and water quality in that well. Another outdated practice included well construction using telescoped casing. Telescoped casing uses a reducer to trim the well to a smaller diameter casing at depth apparently to save money during well construction. Telescoped wells are very susceptible to blockage at the depth of the reducer. Approximately 152 wells in the network were constructed with reducers. DWR has implemented a long-term program for replacing damaged or unsuitably constructed wells with new properly constructed wells.

In addition to replacing monitoring wells, DWR was able to repair wells in order to make them usable. The following wells were repaired between February and June 2012:

- Winsteadville Station, Beaufort County, O15N5, replaced outer casing & shale trap;
- Clark's Station, Craven County, S22J5, replaced/repared shale trap;
- Arapahoe Station, Pamlico County, S18U10, removed bent casing and replaced with new casing and;
- Cox Crossroads Station, Beaufort County, P19M4, installed shale trap and installed protective sleeve on outer casing.

The shale trap is a bell shaped piece of rubber which is clamped to the PVC casing and placed below the damaged area of the well. The inside of the shale trap is grouted from where it is attached to the casing to the surface, in order to seal the damaged area of the well and maintain the well's integrity.

Installation of new and replacement monitoring wells occupies a large portion of DWR's resources. [Table 5](#) lists the new wells installed during the 2011-2012 fiscal year. The new wells are included on [Figure 1](#).

5.5 [Automatic Water Level Recorders](#)

Automatic water level recorders play an integral role in the DWR monitoring program. They allow for economical collection of near-continuous data at remote well stations. Four primary recorders are utilized and are included [Table 6](#).



Hobo including barometer, shuttle and water level indicator



Sutron including card reader, 12-volt battery and voltage meter



Global Water WL16 including iPAQ, field book and calculator

5.6 Site Surveys

Concrete survey monuments continue to be installed at each of the 198 monitoring well stations within the network. Once installation is complete, the monuments will be surveyed using Survey Grade Global Positioning System (GPS) to calculate the most accurate horizontal and vertical location data possible. At the end of the fiscal year, 190 monuments had been installed. It is anticipated that this work will be completed by the end of the year 2012. Surveying of the monuments will take place once monument installation at each well station is complete.



Gas auger and monument



Top of monument - survey point

6.0 **Planned Activities for FY 2012-2013**

6.1 New Well Installation

Monitoring well network expansion efforts for FY 2012-2013 will be focused on Beaufort, Bladen, Chowan, Columbus, Duplin, New Hanover, Pender, Pitt, Sampson, Scotland, Washington, and Wayne Counties. In addition, some wells throughout the network that cannot be used due to bad construction, screening in multiple aquifers, etc., may be abandoned during this upcoming fiscal year. [Table 7](#) summarizes the possible upcoming expansion of the network in 2012-2013.

6.2 Well Abandonment

The following wells were abandoned during FY 2011-2012: Whitley Farms, Beaufort County, P17E4 and Wilmington Airport, New Hanover County, CC30P2.

7.0 Summary and Conclusions

The NCDENR, DWR has maintained and monitored a statewide network of ground water monitoring wells used to assess North Carolina's ground water supply since 1998.

Data collected from the network are available to the public through DWR's Internet website, www.ncwater.org. These data include, but are not limited to, ground water levels, chloride measurements, well construction information, borehole log construction (lithological and geophysical), ground water monitoring station locations, and geophysical/lithological data collected from other (non-DWR) well sites.

The well network consists of 596 monitoring wells at 198 individual stations. From July 2011 through June 2012, ground water level data were collected from 594 wells within the network. These data include manual measurements taken quarterly from wells, plus hourly water levels collected using automatic data recorders from 498 wells.

A total of eight monitor wells have been installed at four different stations. One monitoring well was installed at Ivanhoe (Duplin County), one monitoring well was installed at Camp Glenn (Carteret County), one well was installed at Whitley Farms (Beaufort County), and five monitoring wells were installed at Farmville Marlboro Rd. (Pitt County). Borehole advancement and well installation included, but was not limited to, well development and collection of chloride measurements.

A total of two wells were abandoned at two different stations: well P17E4 at Whitley Farms, Beaufort County and well CC30P2 at Wilmington Airport, New Hanover County.

Archived water level recorder charts obtained from the DWQ with records dating from the 1960s through 1980s continue to be digitized and data recorded into the DWR online database. Survey monuments continue to be installed at each of the well stations with plans to survey each monument using Survey Grade GPS.

The triennial chloride sampling was performed on 245 wells in September/October 2010. Thirteen additional samples were collected from the new well installations between in December and May 2011. One additional sample was collected from the new installation in April 2012. Sampling results indicated that there continues to be concern for saltwater encroachment especially near larger pumping centers located near the fresh-salt water interface. Chloride sampling will occur again in September 2012.

DWR has tentative plans to expand the monitoring well network by installing thirteen to twenty-six wells at seven to ten sites in fiscal year 2012/2013. In addition several wells in the network may be scheduled for abandonment, replacement, and repair.

FIGURES

Figure 1: North Carolina Division of Water Resources Monitoring Stations August 2011

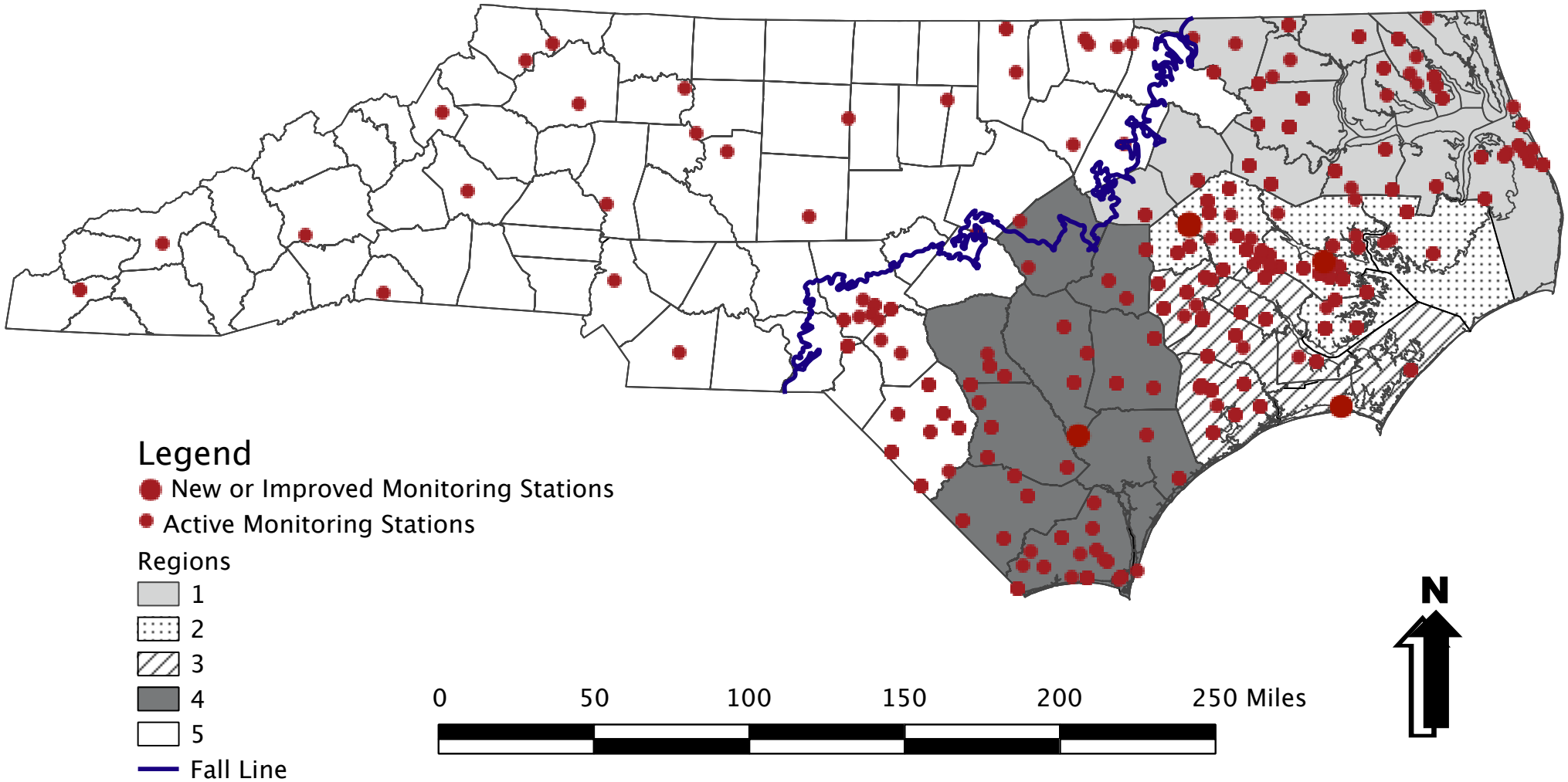


Figure 2: Drought Indicator Wells

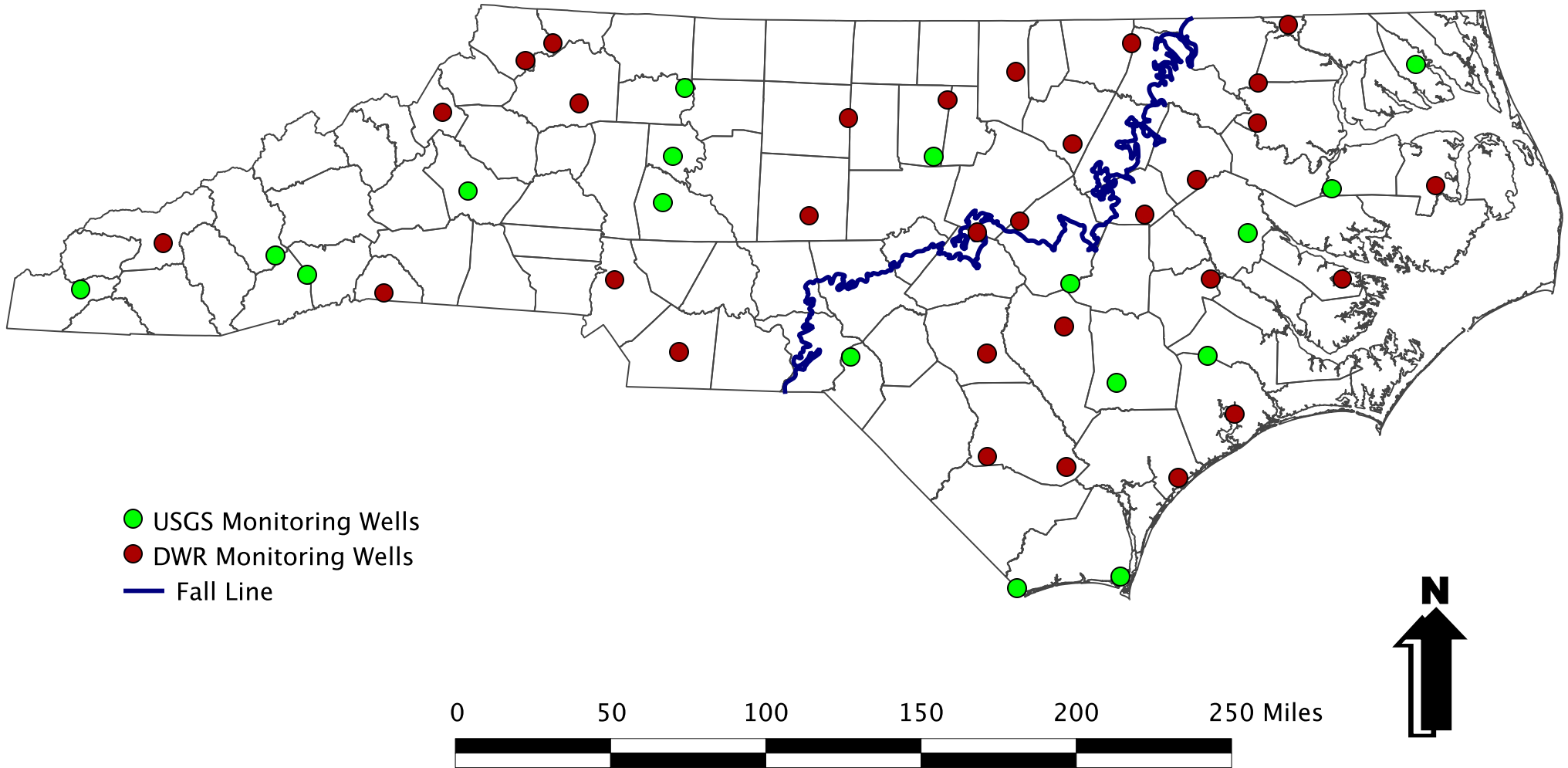
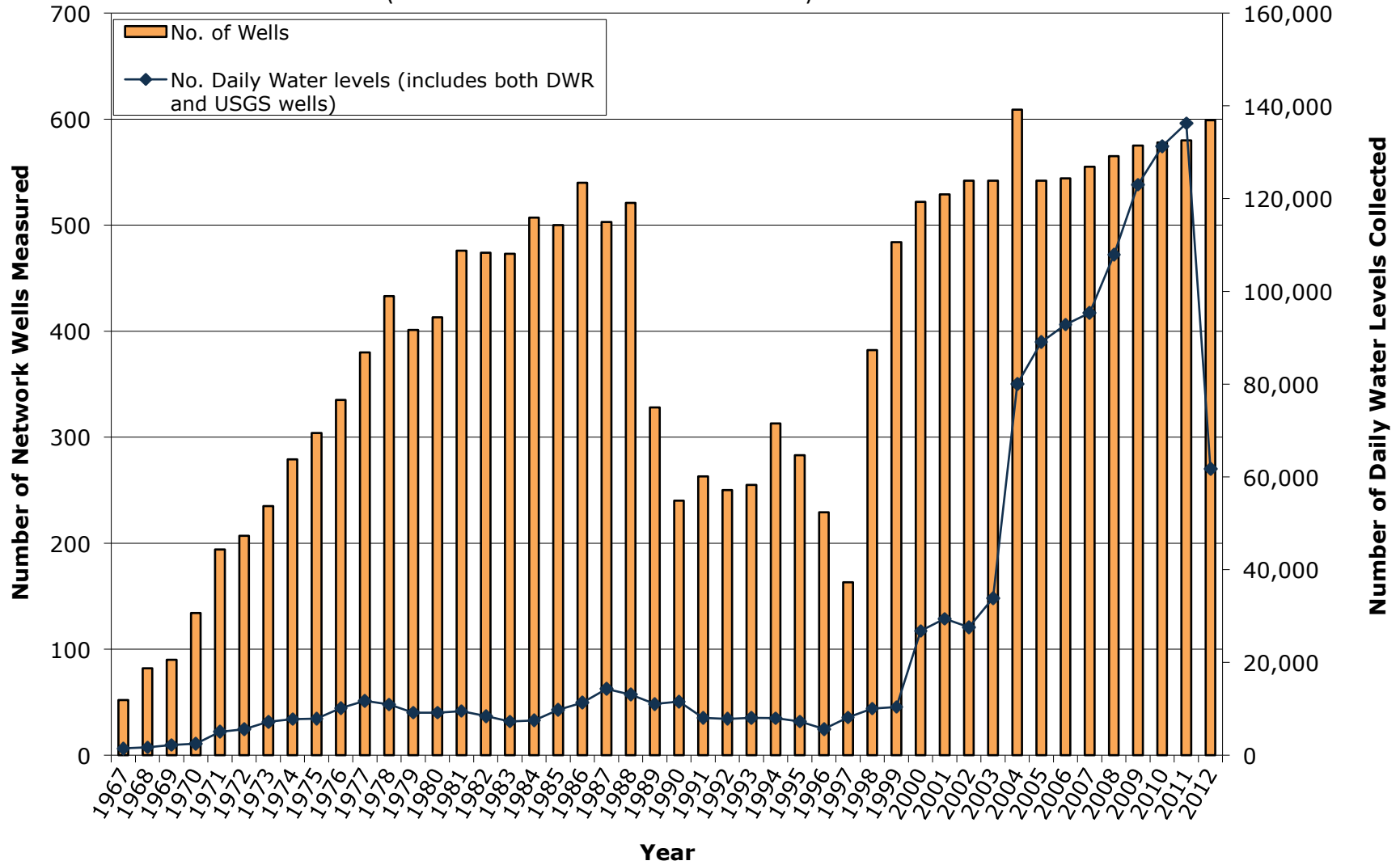


FIGURE 3

Water Level Data Collected from 1967-2012
(Plot includes both DWR and USGS Data)



TABLES

TABLE 1 Site Susceptibility Rating North Carolina Ground Water Resources Monitoring Well Network 2012 Annual Report	
Susceptibility Rating	Description
1	Secure —station is located on State or Federal government property
2	Secure —station is located on local government or school property
3	Moderately secure —station is located on private property, but landowner does not give any indication that land use or property ownership may change
4	Tenuous —station is located on public or private property and landowner is giving indications that land use or property ownership may change
5	Imminent threat —station is on public or private property and landowner desires abandonment of well station.

TABLE 2				
Site and Recorder Distribution by Region through 6/30/12				
North Carolina Division of Ground Water Resources Monitoring Well Network				
2012 Annual Report				
Region	Parameter	Number	% of Region	% of Network
	Wells	122		20.5
	Sites	41		20.7
	Sutrons	0	0.0	0.0
1	WL15s	0	0.0	0.0
	WL16s	50	41.0	8.4
	Hobos	48	39.3	8.1
	All Recorders	98	80.3	16.4
	Wells	154		25.8
	Sites	41		20.7
	Sutrons	3	1.9	0.5
2	WL15s	19	12.3	3.2
	WL16s	50	32.5	8.4
	Hobos	55	35.7	9.2
	All Recorders	127	82.5	21.3
	Wells	112		18.8
	Sites	26		13.1
	Sutrons	3	2.7	0.5
3	WL15s	4	3.6	0.7
	WL16s	42	37.5	7.0
	Hobos	25	22.3	4.2
	All Recorders	74	66.1	12.4
	Wells	131		22.0
	Sites	42		21.2
	Sutrons	0	0.0	0.0
4	WL15s	9	6.9	1.5
	WL16s	24	18.3	4.0
	Hobos	46	35.1	7.7
	All Recorders	79	60.3	13.3
	Wells	77		12.9
	Sites	46		23.2
	Sutrons	6	7.8	1.0
5	WL15s	10	13.0	1.7
	WL16s	16	20.8	2.7
	Hobos	29	37.7	4.9
	All Recorders	61	79.2	10.2

TABLE 3 DWR Monitoring Well Network Statistics (1-1-05) through (6-30-12) North Carolina Ground Water Resources Monitoring Well Network 2012 Annual Report								
Parameter	2005	2006	2007	2008	2009	2010	2011	2012
Number of monitored wells	542	544	555	565	575	579	591	594
Manual water levels (tapedowns)	2,633	2,738	2,618	2,468	2,556	2,911	2627	1394
Daily water levels (automatic recorders)	89,088	92,827	95,333	107,883	122,969	131,325	136,209	61,746
Total hourly water levels	2,141,368	2,229,355	2,294,909	2,591,483	2,961,371	3,163,229	3,276,498	1,479,961
Chloride Samples	17	22	175	12	17	251	21	1
Geophysical & lithologic logs at new stations	2	1	3	1	1	0	2	1

TABLE 4
Chloride Field Analysis to Date
Wells Q16G4, Y25Q4, J22P5 and R23X9
Ground Water Resources Monitoring Well Network
2012 Annual Report

Station	Date	Chlorides (ppm)
	10/04/2010	531
	10/01/2007	564
Godley Station	09/15/2004	137
Q16G4	10/07/1999	91
	07/14/1998	174
	02/23/1981	No Reading Available
	09/22/2010	BDL of 33
	09/25/2007	252
Folkstone Station	09/14/2004	266
Y25Q4	10/12/1999	35
	08/06/1998	11
	09/25/1982	No Reading Available
	10/04/2010	54
Gold Point Station	09/24/2007	162
J22P5	09/30/2004	BDL of 28 **
	09/15/2004	BDL of 28
	06/10/2002	10
	09/20/2010	463
Cove City Station	10/05/2007	352
R23X9	09/13/2004	309
	10/04/2000	30
Chloride Level for Salt Water		250

**Collected after well development

TABLE 5
Well Construction Information
Ivanhoe, Sampson County, Camp Glenn, Carteret County, Whitley Farms, Beaufort County and
Farmville Marlboro Rd., Pitt North Carolina
Ground Water Resources Monitoring Well Network
2012 Annual Report

Well ID	Station Name	Date Installed	Well Diameter (inches)	Well Depth (ft bls)	Screened Interval (x to y ft bls)	Measuring Pt. (MP) (ft)	Aquifer	Water Level (from MP) (ft)
								Measured - 6/26/12
Y34P7	Ivanhoe	04/13/12	4	135	110-130	2.92	Pee Dee	5.55
								Measured - 5/23/12
X17J7	Camp Glenn	03/27/12	4	17	10-15	3.00	Surficial	7.36
								Measured - 5/29/12
P17E5	Whitley Farms	04/19/12	4	35	20-30	2.79	Surficial	9.05
M27U13	Farmville Marlboro Rd.	05/15/12	4	329	314-324	2.98	To Be Determined	Not Measured
M27U14	Farmville Marlboro Rd.	05/29/12	4	245	230-240	2.82	To Be Determined	Not Measured
M27U15	Farmville Marlboro Rd.	06/06/12	4	145	130-140	2.96	To Be Determined	Not Measured
M27U16	Farmville Marlboro Rd.	05/07/12	4	55	40-50	3.13	To Be Determined	Not Measured
M27U17	Farmville Marlboro Rd.	05/03/12	4	30	15-25	2.96	Surficial	Not Measured

TABLE 6
Automatic Water Level Recorders
North Carolina Ground Water Resources Monitoring Well Network
2012 Annual Report

Recorder Type	Number in Service*
Sutron Corporation Model 8400A	12
Global Water Instrumentation, Inc. Model WL15	42
Global Water Instrumentation, Inc. Model WL16	182
HOBO U20 Water Level Logger (including separate barometer per station installed)	262 (59 barometers)

***As of June 30, 2012**

Note: Due to the large number of recorders employed by DWR, there are, at any given time, a number of units that are being serviced or replaced. These units are not reflected in the above totals.

**TABLE 7
 FY 2012-2013 Network Expansion
 North Carolina Ground Water Resources Monitoring Well Network
 2012 Annual Report**

Station Name/Quad	County	Proposed New Well Screens (ft bls)	Aquifer
		20-30	Surficial
		100-110	Yorktown
Pocosin Lake Area	Washington	200-210	Castle Hayne (upper)
		350-360	Castle Hayne (lower saltwater)
		500-510	Beaufort
		600	Pilot Hole
Ivanhoe	Sampson	440-450	Upper Cape Fear
		20-30	Surficial
Vicinity of Walnut Creek	Wayne	45-55	Black Creek or Surficial
		100-110	Black Creek
		220-230	Upper Cape Fear
		350	Pilot Hole (Top of Basement)
Burgaw	Pender	20-30	Surficial
		630-640	Upper Cape Fear
Kelly	Bladen	280-290	Surficial
		448-458	Upper Cape Fear
		20-30	Surficial
		90-100	Castle Hayne
North Central New Hanover County	New Hanover	220-230	Upper Pee Dee
		350-360	Lower Pee Dee
		450	Pilot Hole

TABLE 7 (continued) FY 2011-2012 Network Expansion North Carolina Ground Water Resources Monitoring Well Network 2012 Annual Report			
Station Name/Quad	County	Proposed New Well Screens (ft bls)	Aquifer
		20-30	Surficial
		30-40	Pee Dee
Vicinity of Faison/Warsaw	Northwestern Duplin County	140-150	Black Creek
		265-275	Upper Cape Fear
		400-410	Lower Cape Fear
		448	Pilot Hole
		20-30	Surficial
		80-90	Yorktown
Between DWR Godley and Aurora	Beaufort	250-260	Castle Hayne (upper)
		440-450	Castle Hayne (lower)
		610-620	Beaufort
		650-660	Pee Dee
		700	Pilot Hole
		20-30	Surficial
Nakina	Columbus	380-390	Black Creek
		844-854	Lower Cape Fear
		20-30	Surficial
USGS Core Hole Site at Fort Fisher/Kure Beach	New Hanover	95-105	Castle Hayne
		160-170	Pee Dee

TABLE 7 (continued) FY 2011-2012 Network Expansion North Carolina Ground Water Resources Monitoring Well Network 2012 Annual Report			
Station Name/Quad	County	Proposed New Well Screens (ft bls)	Aquifer
		20-30	Surficial
		110-120	Pee Dee
Vicinity of Moore's Creek National Park	Pender County	330-340	Black Creek
		590-600	Upper Cape Fear
		630	Pilot Hole
		20-30	Surficial
Turkey	Sampson	318-328	Upper Cape Fear
		432-442	Lower Cape Fear
		20-30	Surficial
Vicinity of Salemburg	Sampson	80-90	Black Creek
		206-216	Upper Cape Fear
		20-30	Surficial
Town of Laurinburg	Scotland	120-130	Black Creek
		332-342	Upper Black Creek
		20-30	Surficial
		80-90	Yorktown
Vicinity of Valhalla	Chowan	220-230	Castle Hayne
		320-330	Beaufort
		450-460	Upper Cape Fear
		850-860	Lower Cape Fear
		1200-1210	Lower Cretaceous
		1300	Pilot Hole

**TABLE 7 (continued)
 FY 2011-2012 Network Expansion
 North Carolina Ground Water Resources Monitoring Well Network
 2012 Annual Report**

Station Name/Quad	County	Proposed New Well Screens (ft bls)	Aquifer
		20-30	Surficial
		124-134	Yorktown
		244-254	Castle Hayne (upper)
Belhaven	Beaufort	312-322	Castle Hayne (lower)
		388-398	Beaufort
		540-550	Pee Dee
		720-730	Black Creek
		900	Pilot
		20-30	Surficial
		46-56	Yorktown
River Park North	Pitt	110-120	Pee Dee
		150-160	Upper Black Creek
		252-262	Lower Black Creek
		380-390	Upper Cape Fear