FINAL TECHNICAL REPORT

Cooperative Agreement G16AC00021

Period 1/1/2016 - 12/31/2016

Award 12039661

NCDWR's Role as a New Data Provider to the NGWMN

Prepared by

N C Department of Environmental Quality
Division of Water Resources
Ground Water Management Branch
512 N. Salisbury St
Raleigh, NC 27604

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Nat Wilson, Program Manager
nat.wilson@ncdenr.gov
(919) 707-9032

Mark Durway, Hydrogeologist
mark.durway@ncdenr.gov
(919) 707-9018

Overview of Work

During 2016, the North Carolina Division of Water Resources (NCDWR) became a new data provider and added 85 wells to the National Ground-Water Monitoring Network (NGWMN). These wells were in addition to 31 NC wells added to the network by the USGS in 2009. A map and list of the wells added under this project are provided in Figures 1 and 2 of the appendix.

Completion of this project was accomplished through a cooperative agreement (G16AC00021) between the United States Geological Survey (USGS) and the NC Department of Environmental Quality. NCDWR completed this project using guidelines and recommendations contained in the Framework document, A National Framework for Ground Water Monitoring in the United States. During this project, NCDWR completed the following tasks:

1) Evaluated and selected 85 monitoring wells for the NGWMN
2) Classified wells into subnetworks and monitoring categories
3) Populated the NGWMN Well Registry
4) Set up web services to allow connection to NCDWR databases
5) Mapped fields in web services to the NGWMN Data Portal
6) Documented data collection and management procedures
7) Produced a final technical report

Description and Objectives of NCDWR's Water Level and Water Quality Networks

The NCDWR ground water monitoring network consists of 225 monitoring stations and 651 active wells. The state began creating the network in the mid-1960s and currently has well coverage in 66 of 100 counties. A map of NCDWR's well network is provided in Figure 3 and network statistics are provided in Figure 4 of the appendix. The objectives of the NCDWR ground water monitoring network are to:

- Acquire, store, and provide publicly-accessible ground water level and ambient ground water quality data
- Evaluate the effects of recharge, discharge and drought on water supply
- Monitor the effects of pumping on ground water levels
- Manage and regulate the 15-county Central Coastal Plain Capacity Use Area
- Support permit and planning decisions
- Track the Coastal Plain freshwater-saltwater interface to identify saltwater intrusion

There are 8 federally-defined principal aquifers in North Carolina. These aquifers and the number of wells in each which NCDWR serves to the NGWMN are as follows:

Principal Aquifer	Wells
Surficial aquifer system	10
Castle Hayne aquifer	7
Northern Atlantic Coastal Plain aquifer system	43
Lower Cretaceous aquifers	1
Early Mesozoic basin aquifers	0
Piedmont and Blue Ridge carbonate-rock aquifers	0
Piedmont and Blue Ridge crystalline-rock aquifers	24
Valley and Ridge aquifers	0
Total	85

Water level and water quality data from NCDWR's network is available at http://www.ncwater.org/?page=20. In addition, this website provides public access to an interactive ground water map interface, potentiometric surface maps, well construction records, lithologic and geophysical well logs, hydrogeologic tools and calculators, over 200 online publications, annual reports, and other information. NGWMN sites may be accessed directly through the NGWMN Data Portal at https://cida.usgs.gov/ngwmn/index.jsp, which provides a well summary, well logs, water level data, and water quality data.

Description of Site Selection Criteria and Process

The selection of monitoring well stations for the NGWMN took into consideration three primary factors: spatial distribution and density, length of service and reliability of data, and completeness of aquifer coverage. Typically, one well station was selected per county, which provided for a spatial density of approximately one well per 1000 square miles. Selected well stations were required to have a minimum of 5 years of consistent data with no known or apparent problems related to construction, screen setting, blockages, etc. Additionally, hydrographs from selected wells had to be effective in identifying short- and long-term trends and events (such as seasonal and long-term response to climate conditions, recharge and discharge, mining operations, irrigation, increased or decreased local and regional groundwater usage, pumping effects, change in chloride levels, etc). The final criterion for selection was that each station have wells in all principal aquifers present at that location, when possible.

Description of Process Used to Assign Subnetworks and Monitoring Categories

Selected wells were assigned to one of three Subnetworks: Background, Suspected Changes, or Documented Changes. Wells assigned to the Background Subnetwork showed no evidence of anthropogenic impact to water level or water quality. Wells assigned to two other networks showed either suspected or clearly-defined water level or water quality changes which could be reasonably related to anthropogenic impact, the most common being the effect of pumping. Of the 85 wells added in 2016, subnetwork distribution is as follows: Background (59), Suspected

Changes (8), Documented Changes (18). All wells were assigned to the Trend monitoring category.

Field Techniques for Water Level Measurement and Water Quality Sample Collection

Water levels are recorded hourly by NCDWR using dedicated Onset Hobo dataloggers. Field technicians download data from the recorders quarterly, make manual water level tape downs, and calibrate the recorders when necessary.

Water quality data are collected from discrete depth intervals within the aquifer upon well completion and on a two to three year cycle thereafter. Water quality sampling is preceded by purging three well volumes or until field parameters stabilize using a YSI meter. Water quality data consist primarily of pH, salinity, specific conductance, and temperature using a YSI meter, and chloride using Quantab test kits.

Description of Data Quality and Quality Assurance Processes

Prior to uploading water level and water quality data into NCDWR's portal, data are reviewed by key staff and approved by the Ground Water Monitoring Branch Program Manager. Data meeting quality standards are then uploaded to the appropriate database.

Security requirements are set by the Ground Water Monitoring Branch Program Manager and key staff are assigned varying levels of access to input or modify data or services based on program needs and other factors.

A Data Management Plan (DMP) for the project is provided in the appendix.

List of Minimum Data Elements and How They Are Provided to the Data Portal via the Well Registry or Web Services

The minimum required data elements, as listed in the Framework document, were keyed directly into the Well Registry for each of the 85 new wells. Data element input fields are: agency, display site?, site number (quad), site name, state, county, latitude, longitude, horizontal datum, lat/long method, lat/long accuracy, altitude, altitude units, altitude datum, altitude method, altitude accuracy, well depth, well depth units, national aquifer, local aquifer name, site type, aquifer type, in WL sub-network?, WL network name, WL baseline? WL well type, WL well characteristics, WL well purpose, WL well purpose notes, in QW sub-network?, QW network name, QW baseline?, QW well type, QW well characteristics, QW well purpose, QW well purpose notes, link. The form automatically populates the following fields: date record created, insert user, date last updated, last update user. A sample data entry form from the Well Registry website is provided in Figure 5 of the appendix.

Data and data elements for well logs, well construction, water levels, and water quality are stored in NCDWR databases and served directly to the NGWMN through web services.

Notes on Any Sites that have Missing Required Data Elements

There are no known missing required data elements for any sites. However, as of the publication date for this report, NCDWR water level data for flowing artesian wells are not displaying on the NGWMN website.

Note Any Sites that Do Not Meet Requirements in Table 4.5.1.1 and/or 4.5.2.1 of the Framework Document

Framework Table 4.5.1.1 recommends water level trend sampling be conducted daily to quarterly, depending on aquifer type, recharge or hydraulic conductivity rate, and withdrawal rate. NCDWR sites served to the NGWMN are measured hourly, and therefore, meet the Framework recommendation for water level sampling frequency.

Framework Table 4.5.2.1 recommends water quality trend sampling be conducted annually. NCDWR sites served to the NGWMN are sampled for chlorides every two to three years, and therefore, do not meet the Framework recommendation for water quality sampling frequency.

Description of the Web Services Used or Installed for this Project

The NCDWR ground water monitoring network uses Oracle MySQL Enterprise Edition for database management and Apache web server for its website located at http://www.ncwater.org/?page=20.

Web services are provided at http://www.ncwater.org/webservices/ngwmn.php. A PHP script handles the request and requires the passing of two parameters, namely site_no and ws (which is the type of request). A request for water levels from a typical NCDWR station well would look like the following:

http://www.ncwater.org/webservices/ngwmn.php?site_no=NCDWR:C12W2&ws=wl.

Options for the ws parameter include wl for water levels, wq for water quality, l for lithology, and c for construction. SiteNo values in Figure 2 can either be prefixed with 'NCDWR:' or used as listed. Either parameter can be a mixture of upper and lowercase characters.

Analyte List Used for Sampling Networks

The Framework document categorizes analytes into three primary categories: standard, extended, and supplemental (optional). Standard analytes consist of: ground water level, temperature, pH, and specific or electrical conductance. For water quality sampling NCDWR uses the standard analyte list. For water quality sampling, NCDWR also includes chloride from the extended analyte list.

List of Laboratories and their Accreditation for Analyzing Properties and Constituents Included in the Monitoring Program

Water quality analysis for chloride is performed in the field using a Quantab test kit. Periodically, NCDWR samples wells for expanded analysis, in which case analysis is performed by the agency's analytical laboratory in Raleigh, NC.

References

1) Subcommittee on Ground Water of the Advisory Committee on Water Information, 2009 (revised 2013), A national framework for ground water monitoring in the United States: Advisory Committee on Water Information, accessed January 2017, at https://acwi.gov/sogw/ngwmn_framework_report_july2013.pdf.
2) https://cida.usgs.gov/ngwmn/
3) G16AC00021 Cooperative Agreement Application, NCDWR, 9/21/15.
4) http://www.ncwater.org/?page=20

APPENDIX

Data Management Plan

Project: NCDWR-NGWMN New Data Provider and Persistent Data Service
Cooperative Agreement G16AC00021
Period 1/1/2016 - 12/31/2016
Award 12039661

Contacts: USGS
Daryll Pope, Tel (609) 771-3933, dpope@usgs.gov
Jessica Lucido, Tel (608) 821-3841, jlucido@usgs.gov
NCDWR
Nat Wilson, Tel (919) 707-9032, nat.wilson@ncdenr.gov
Mark Durway, Tel (919) 707-9018, mark.durway@ncdenr.gov

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Types of Data

Three primary data types are of concern in this project. These consist of ground water levels, ground water quality analyses, and locational data. At this time, NCDWR provides persistent data to the NGWMN from 85 wells located at 40 state-wide monitoring stations. Principal aquifers monitored by these wells consist of the Surficial aquifer system, Castle Hayne aquifer, Northern Atlantic Coastal Plain aquifer system, Lower Cretaceous aquifers, and Piedmont and Blue Ridge crystalline-rock aquifers.

Water levels are recorded hourly using dedicated Onset Hobo dataloggers. Field technicians download data from the recorders quarterly, make manual water level tape downs, and calibrate the recorders, if necessary.

Water quality data are collected from discrete depth intervals within the aquifer upon well completion and on a two to three year cycle thereafter. Water quality sampling is preceded by purging three well volumes or until field parameters stabilize using a YSI meter. Water quality data consist primarily of pH, salinity, specific conductance, and temperature using a YSI meter, and chloride using Quantab test kits.

Prior to uploading water level and water quality data into NCDWR's portal, data are reviewed. Data meeting NCDWR quality standards are then uploaded to the appropriate database.

Security requirements are set by the Ground Water Monitoring Branch Program Manager and key staff are assigned varying levels of access to input or modify data or services based on program needs and other factors.

Accuracy of locational data will be accomplished using survey grade GPS equipment to determine latitude, longitude, and altitude. Accuracy and geodetic reference systems used by NCDWR are: state plane coordinates and latitude/longitude, <0.05 ft; altitude, <0.1 ft; horizontal datum, NAD83; altitude datum, NAVD88.

Data and Metadata Standards

Data are entered into NCDWR databases or the NGWMN Well Registry. NCDWR enters and stores data in the following databases:

Data Type	Database Tables
Ground Water Levels	gwb.dwr, gwb.dwrwatlev, gwb.dwrwatlevhourly
Ground Water Quality	gwb.dwrchloride
Well Logs	gwb.logs, gwb.logdata, gwb.resstafr
Well Location (Lat/Long/Altitude)	gwb.dwr

The NCDWR ground water monitoring network uses Oracle MySQL Enterprise Edition for database management. Internal database tables are used to maintain database quality control and allow for editing. Water level data meeting NCDWR standards are uploaded to public tables listed above.

Policies for Access and Sharing

All data collected for the project is available through the NGWMN Data Portal without restriction.

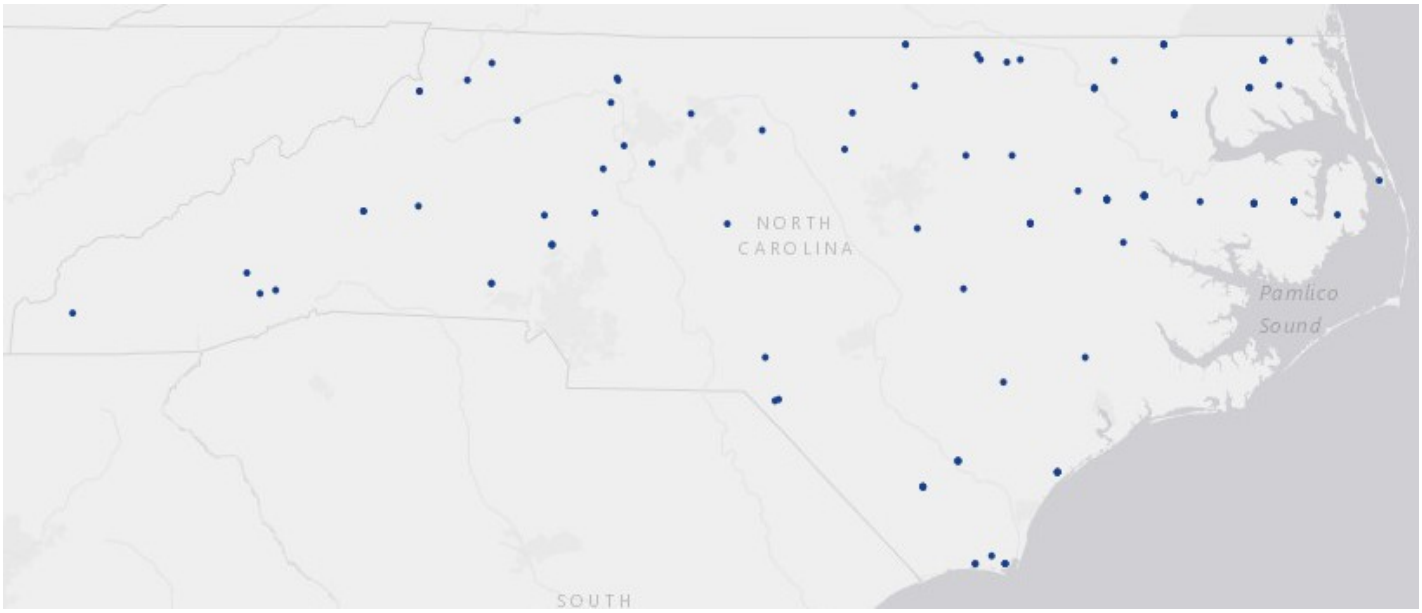
Policies and Provisions for Re-Use and Re-Distribution

There is restriction on the use of the data through the portal. Any data obtained through the portal and redistributed is expected to cite the original source of the data as NCDWR through USGS/NGWMN Cooperative Agreement G16AC00021.

Plans for Archiving and Preservation of Access

Paper copies of field forms used to collect data are scanned and stored by NCDWR. These data are included in regular system backups. These data and all databases are backed up at least weekly.

Figure 1. NGWMN Well Locations



As of December 31, 2016, there were a total of 116 North Carolina wells in the NGWMN. Of these, 31 were added by the USGS in 2009, and 85 were added by NCDWR in 2016 when it became a NGWMN Data Provider.

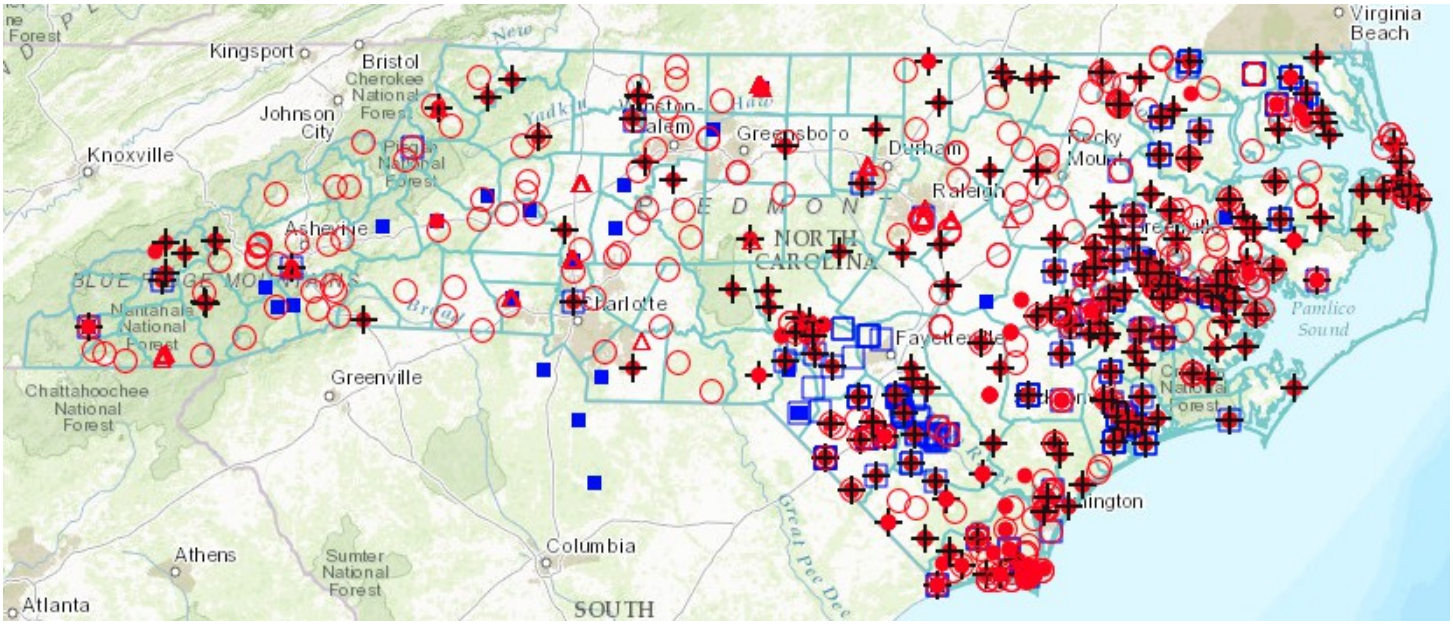
Figure 2. Wells added to the NGWMN in 2016

SiteNo	SiteName	Depth (ft)	NatAqfrDesc	LocalAquiferName	CountyNm	WlWellCharsDesc	Type	AquiferType
I35K2	Bunn	345	Piedmont and Blue Ridge crystalline-rock aquifers	Bedrock	Franklin	Background	Trend	UNCONFINED
I58Y2	Welcome	293	Piedmont and Blue Ridge crystalline-rock aquifers	Bedrock	Davidson	Background	Trend	UNCONFINED
J3X13	Wanchese Community Ctr	183	Northern Atlantic Coastal Plain aquifer system	Yorktown	Dare	Background	Trend	CONFINED
K21R1	Bear Grass School	45	Surficial aquifer system	Surficial	Martin	Suspected/AC	Trend	UNCONFINED
K21R2	Bear Grass School	112	Northern Atlantic Coastal Plain aquifer system	Beaufort	Martin	Background	Trend	CONFINED
K21R4	Bear Grass School	267	Northern Atlantic Coastal Plain aquifer system	Black Creek	Martin	Background	Trend	CONFINED
K21R5	Bear Grass School	935	Northern Atlantic Coastal Plain aquifer system	Lower Cretaceous	Martin	Background	Trend	CONFINED
K21R6	Bear Grass School	744	Northern Atlantic Coastal Plain aquifer system	Lower Cape Fear	Martin	Background	Trend	CONFINED
K26M2	Old Sparta	100	Northern Atlantic Coastal Plain aquifer system	Upper Cape Fear	Edgecombe	Suspected/AC	Trend	CONFINED
L6Y2	Stumpy Point	300	Northern Atlantic Coastal Plain aquifer system	Yorktown	Dare	Background	Trend	CONFINED
L10A2	Gum Neck	85	Northern Atlantic Coastal Plain aquifer system	Yorktown	Tyrrell	Background	Trend	CONFINED
L10A3	Gum Neck	701	Castle Hayne aquifer	Castle Hayne	Tyrrell	Background	Trend	CONFINED
L10A5	Gum Neck	920	Castle Hayne aquifer	Castle Hayne	Tyrrell	Background	Trend	CONFINED
L13I1	Lake Phelps	510	Castle Hayne aquifer	Castle Hayne	Washington	Background	Trend	CONFINED
L13I2	Lake Phelps	130	Northern Atlantic Coastal Plain aquifer system	Yorktown	Washington	Background	Trend	CONFINED
L13I3	Lake Phelps	224	Northern Atlantic Coastal Plain aquifer system	Yorktown	Washington	Background	Trend	CONFINED
L13I4	Lake Phelps	14	Surficial aquifer system	Surficial	Washington	Suspected/AC	Trend	UNCONFINED
L13I5	Lake Phelps	580	Castle Hayne aquifer	Castle Hayne	Washington	Background	Trend	CONFINED
L24B2	North Pitt High School	108	Northern Atlantic Coastal Plain aquifer system	Black Creek, Upper	Pitt	Background	Trend	CONFINED
L24B3	North Pitt High School	560	Northern Atlantic Coastal Plain aquifer system	Lower Cape Fear	Pitt	Known Changes	Trend	CONFINED
L24B4	North Pitt High School	370	Northern Atlantic Coastal Plain aquifer system	Upper Cape Fear	Pitt	Known Changes	Trend	CONFINED
L24B5	North Pitt High School	390	Northern Atlantic Coastal Plain aquifer system	Upper Cape Fear	Pitt	Known Changes	Trend	CONFINED
L24B6	North Pitt High School	213	Northern Atlantic Coastal Plain aquifer system	Black Creek	Pitt	Known Changes	Trend	CONFINED
L24B7	North Pitt High School	22	Northern Atlantic Coastal Plain aquifer system	Surficial	Pitt	Background	Trend	UNCONFINED
L67U2	Troutman	354	Piedmont and Blue Ridge crystalline-rock aquifers	Bedrock	Iredell	Background	Trend	UNCONFINED
M30L1	Stantonsburg	28	Surficial aquifer system	Surficial	Wilson	Background	Trend	UNCONFINED
M30L2	Stantonsburg	60	Northern Atlantic Coastal Plain aquifer system	Yorktown	Wilson	Known Changes	Trend	CONFINED
M30L3	Stantonsburg	115	Northern Atlantic Coastal Plain aquifer system	Upper Cape Fear	Wilson	Known Changes	Trend	CONFINED
M30L4	Stantonsburg	85	Lower Cretaceous aquifers	Upper Cape Fear	Wilson	Known Changes	Trend	CONFINED
M38Q1	Cleveland	407	Piedmont and Blue Ridge crystalline-rock aquifers	Bedrock	Johnston	Background	Trend	UNCONFINED
M53L1	NC Zoo	100	Piedmont and Blue Ridge crystalline-rock aquifers	Bedrock	Randolph	Known Changes	Trend	UNCONFINED
AA35N1	Kelly	14	Surficial aquifer system	Surficial	Bladen	Background	Trend	UNCONFINED
AA35N2	Kelly	620	Northern Atlantic Coastal Plain aquifer system	Lower Cape Fear	Bladen	Background	Trend	CONFINED
AA35N3	Kelly	84	Northern Atlantic Coastal Plain aquifer system	Peedee	Bladen	Background	Trend	CONFINED
AA35N4	Kelly	39	Surficial aquifer system	Surficial	Bladen	Background	Trend	UNCONFINED
B10R1	Moyock	840	Northern Atlantic Coastal Plain aquifer system	Upper Cape Fear	Currituck	Known Changes	Trend	CONFINED
B20U5	Como	26	Northern Atlantic Coastal Plain aquifer system	Upper Cape Fear	Hertford	Known Changes	Trend	CONFINED
B20U6	Como	575	Northern Atlantic Coastal Plain aquifer system	Lower Cape Fear	Hertford	Known Changes	Trend	CONFINED
B20U7	Como	500	Northern Atlantic Coastal Plain aquifer system	Lower Cape Fear	Hertford	Known Changes	Trend	CONFINED
B20U8	Como	33	Surficial aquifer system	Surficial	Hertford	Background	Trend	UNCONFINED
B39X1	Wallace Vaughan	146	Piedmont and Blue Ridge crystalline-rock aquifers	Bedrock	Granville	Background	Trend	UNCONFINED
B39X2	Wallace Vaughan	21	Piedmont and Blue Ridge crystalline-rock aquifers	Surficial	Granville	Background	Trend	UNCONFINED
BB28J2	Topsail Beach	493	Northern Atlantic Coastal Plain aquifer system	Peedee	Pender	Background	Trend	CONFINED
BB28J3	Topsail Beach	612	Northern Atlantic Coastal Plain aquifer system	Black Creek	Pender	Background	Trend	CONFINED
BB28J4	Topsail Beach	160	Castle Hayne aquifer	Castle Hayne	Pender	Background	Trend	CONFINED
BB28J5	Topsail Beach	15	Surficial aquifer system	Surficial	Pender	Background	Trend	UNCONFINED
C12W2	Morgans Corner	40	Northern Atlantic Coastal Plain aquifer system	Yorktown	Pasquotank	Suspected/AC	Trend	UNCONFINED
C12W4	Morgans Corner	428	Castle Hayne aquifer	Castle Hayne	Pasquotank	Background	Trend	CONFINED
C12W5	Morgans Corner	1308	Northern Atlantic Coastal Plain aquifer system	Lower Cape Fear	Pasquotank	Known Changes	Trend	CONFINED
C12W6	Morgans Corner	648	Northern Atlantic Coastal Plain aquifer system	Upper Cape Fear	Pasquotank	Background	Trend	CONFINED
C12W7	Morgans Corner	37	Northern Atlantic Coastal Plain aquifer system	Yorktown	Pasquotank	Background	Trend	CONFINED
C23Y1	Northampton East Hi Sch	25.15	Surficial aquifer system	Surficial	Northampton	Background	Trend	CONFINED
C30P1	Littleton	500	Piedmont and Blue Ridge crystalline-rock aquifers	Bedrock	Halifax	Background	Trend	UNCONFINED
C31Y1	Vaughan Elementary Sch	276	Piedmont and Blue Ridge crystalline-rock aquifers	Bedrock	Warren	Background	Trend	UNCONFINED
C33Y1	Warren County High Sch	28	Piedmont and Blue Ridge crystalline-rock aquifers	Saprolite	Warren	Background	Trend	UNCONFINED
C71U1	Laurel Springs	74	Piedmont and Blue Ridge crystalline-rock aquifers	Bedrock	Alleghany	Background	Trend	UNCONFINED
CC34L1	Northside Elementary	304	Piedmont and Blue Ridge crystalline-rock aquifers	Bedrock	Warren	Background	Trend	UNCONFINED
CC38B5	Lake Waccamaw	51	Surficial aquifer system	Surficial	Columbus	Background	Trend	UNCONFINED
CC38B6	Lake Waccamaw	122	Northern Atlantic Coastal Plain aquifer system	Peedee	Columbus	Suspected/AC	Trend	UNCONFINED
CC38B7	Lake Waccamaw	678	Northern Atlantic Coastal Plain aquifer system	Lower Cape Fear	Columbus	Suspected/AC	Trend	CONFINED
CC38B8	Lake Waccamaw	386	Northern Atlantic Coastal Plain aquifer system	Black Creek	Columbus	Suspected/AC	Trend	CONFINED
CC38B9	Lake Waccamaw	514	Northern Atlantic Coastal Plain aquifer system	Upper Cape Fear	Columbus	Suspected/AC	Trend	CONFINED
D61X1	Pilot Mtn. Well #2	297	Piedmont and Blue Ridge crystalline-rock aquifers	Bedrock	Surry	Background	Trend	CONFINED
D72Y1	Beaver Creek	270	Piedmont and Blue Ridge crystalline-rock aquifers	Bedrock	Ashe	Background	Trend	UNCONFINED
E13M1	Four Mile Desert	49	Northern Atlantic Coastal Plain aquifer system	Yorktown	Perquimans	Background	Trend	UNCONFINED
E13M2	Four Mile Desert	1019	Northern Atlantic Coastal Plain aquifer system	Lower Cape Fear	Perquimans	Background	Trend	CONFINED
E13M3	Four Mile Desert	351	Castle Hayne aquifer	Castle Hayne	Perquimans	Known Changes	Trend	CONFINED
E25L1	Caledonia Prison Farm	278	Northern Atlantic Coastal Plain aquifer system	Lower Cape Fear	Halifax	Background	Trend	CONFINED
E25L2	Caledonia Prison Farm	85	Northern Atlantic Coastal Plain aquifer system	Upper Cape Fear	Halifax	Background	Trend	CONFINED
E25L3	Caledonia Prison Farm	35	Surficial aquifer system	Surficial	Halifax	Background	Trend	CONFINED
E38F1	Oxford	496	Piedmont and Blue Ridge crystalline-rock aquifers	Bedrock	Granville	Background	Trend	UNCONFINED
E61C1	Grassy Ridge Well	183	Piedmont and Blue Ridge crystalline-rock aquifers	Bedrock	Surry	Background	Trend	UNCONFINED
E76Q1	Tater Hill	350	Piedmont and Blue Ridge crystalline-rock aquifers	Bedrock	Watauga	Background	Trend	UNCONFINED
E76Q2	Tater Hill	40	Piedmont and Blue Ridge crystalline-rock aquifers	Saprolite	Watauga	Background	Trend	UNCONFINED
F19V2	Cremo	80	Northern Atlantic Coastal Plain aquifer system	Yorktown	Bertie	Background	Trend	UNCONFINED

Figure 2. Wells added to the NGWMN in 2016

F19V3	Cremo	225	Northern Atlantic Coastal Plain aquifer system	Upper Cape Fear	Bertie	Known Changes	Trend	CONFINED
F19V4	Cremo	1038	Northern Atlantic Coastal Plain aquifer system	Lower Cretaceous	Bertie	Known Changes	Trend	CONFINED
F19V5	Cremo	600	Northern Atlantic Coastal Plain aquifer system	Lower Cape Fear	Bertie	Known Changes	Trend	CONFINED
F19V6	Cremo	431	Northern Atlantic Coastal Plain aquifer system	Upper Cape Fear	Bertie	Known Changes	Trend	CONFINED
F43X1	Caldwell	83	Piedmont and Blue Ridge crystalline-rock aquifers	Bedrock	Orange	Background	Trend	CONFINED
F62J1	East Bend VFD	603	Piedmont and Blue Ridge crystalline-rock aquifers	Bedrock	Yadkin	Background	Trend	UNCONFINED
G50W2	Gibsonville	493	Piedmont and Blue Ridge crystalline-rock aquifers	Bedrock	Guilford	Background	Trend	UNCONFINED
G69J1	Wilkesboro	260	Piedmont and Blue Ridge crystalline-rock aquifers	Bedrock	Wilkes	Background	Trend	UNCONFINED
H61U1	Clemmons	400	Piedmont and Blue Ridge crystalline-rock aquifers	Bedrock	Davie	Background	Trend	UNCONFINED
I31M1	Nash Co. Well 3 Nashville	533	Piedmont and Blue Ridge crystalline-rock aquifers	Bedrock	Nash	Background	Trend	UNCONFINED

Figure 3. NCDWR Well Network



As of November 28, 2016, the NCDWR Ground Water Monitoring Well Network was comprised of 651 wells located at 225 stations throughout the state. NCDWR began providing persistent data to the NGWMN from 85 of these wells in 2016.

Figure 4. Network Statistics
Monitoring Well Network Statistics for the NCDWR Ground Water Monitoring Branch (updated 11.28.16).

Monitoring Well Network Statistics

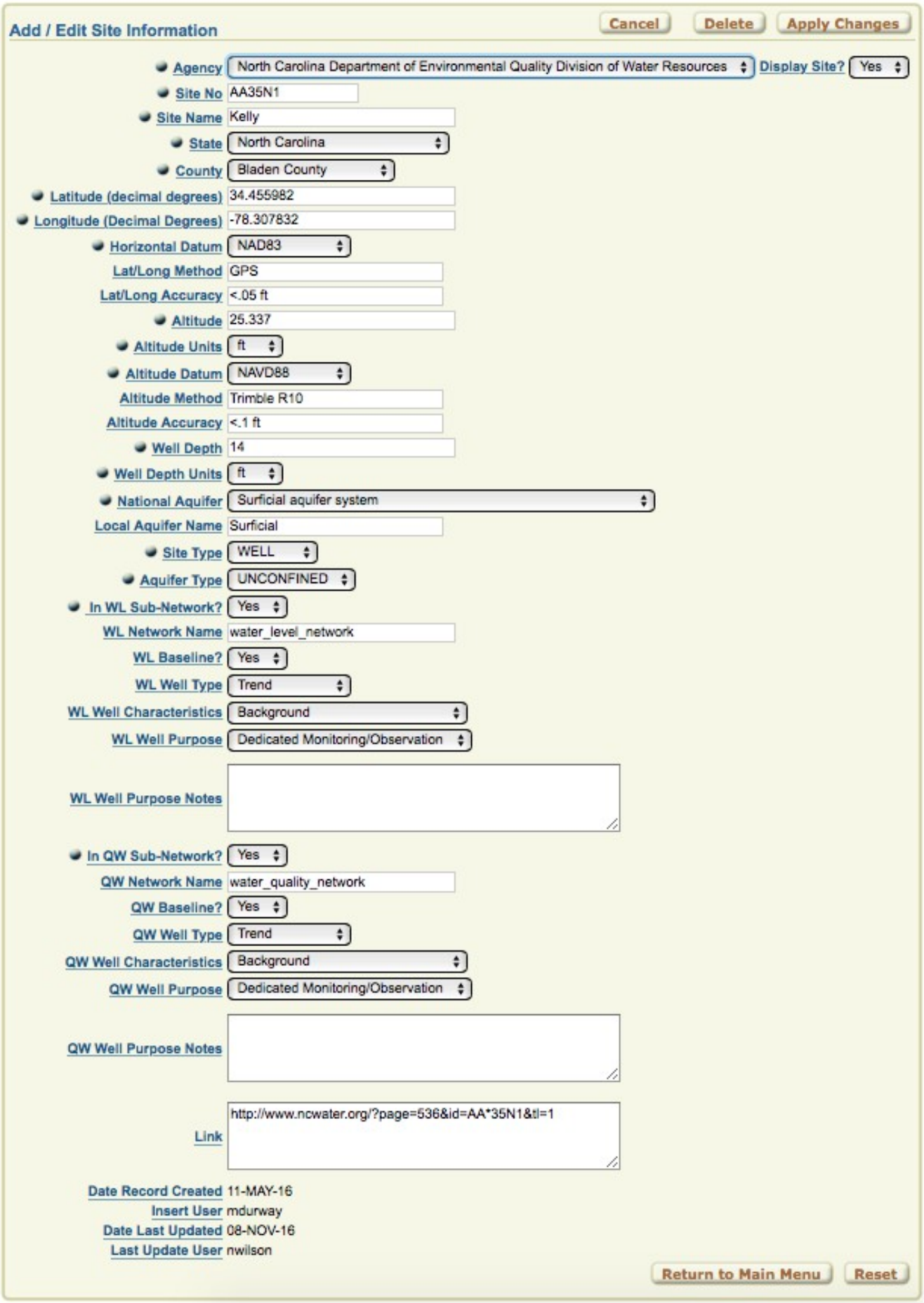
Parameter	Number	% of Network
Active Wells	651	
Sites	225	2.9 wells per site
Counties	66	66% of State
WL-15s deployed	0	0.0
WL-16s deployed	0	0.0
Sutrons deployed	0	0.0
Hobos deployed (includes 193 barometers, hobo30 = 7 and hobo13 = 186)	735	112.9
Solinst deployed	16	
Wells with Recorders (total of active recorders minus barometers)	542	83.3
Wells needing Recorders (109 minus 99 wells that can't be recorded)	10	1.5
Total Recorders (usable: on wells or in offices -- doesn't include 0 recorders on wells but not operating)	769	118.1
Hobo recorders we need to buy (two per recordable well -- recorder and barometer), negative number means we have extra. We have 2 unused Hobos. There are also 0 WL15/16s and 0 Sutrons which are likely non-working.	-14	-2.2
GPSed (Missing GPS)	635	97.5
Painted (Missing Paint)	581	89.2
DWR Recorder Boxes Installed	394	60.5
Total Boxes includes DWR (394), USGS (51), and Other Methods (15) of Recorder Installation (Missing Box or Other)	460	70.7
Wells with Reducers	147	22.6
Wells with Signs (Missing Signs)	566	86.9
Replacement Wells	21	3.2
New Wells or newly acquired wells (as of 1999-01-01) -- 212 constructed wells.	268	41.2
Owner Records	225	100.0% of sites
Monuments Installed (Sites missing Monuments)	225	100.0% of sites
Drought Wells	41	6.3
Time field recorded (total # of tapedowns = 53,073)	37,376	70.42% of total
Field Book Pages Uploaded (largest = 429,452 bytes) in wlfieldnotes	11,166	
Susceptibility (total of 225)	1: 81; 2: 55; 3: 85; 4: 4; 5:	
Internal Water Levels	1,973,766	
Public Water Levels	1,972,349	
Public Chlorides	3,732	
Hourly Water Levels	40,687,384	
Borehole Interpretations	837	
Geophysical Logs	3,420	
Log Curve Points	18,569,968	
GS Active (includes other cooperators)	45	
GS Coop Network wells	12	
GS Coop Network sites	12	
GS Coop Network counties	11	
GS Coop Network counties outside of DWR counties	3	
GS Coop Network at non-DWR sites	8	

Links are to maps of item described.

Parameter	Number	% of Region	% of Network	Region
Wells	138		21.2	1
Sites	48		21.3	
Hobo	126	91.3	19.4	
Solinst	4	2.9	0.6	
All Recorders	126	91.3	19.4	
Wells	142		21.8	2
Sites	31		13.8	
Hobo	134	94.4	20.6	
Solinst	0	0.0	0.0	
All Recorders	134	94.4	20.6	
Wells	94		14.4	3
Sites	28		12.4	
Hobo	81	86.2	12.4	
Solinst	0	0.0	0.0	
All Recorders	81	86.2	12.4	
Wells	139		21.4	4
Sites	40		17.8	
Hobo	85	61.2	13.1	
Solinst	2	1.4	0.3	
All Recorders	85	61.2	13.1	
Wells	98		15.1	5
Sites	63		28.0	
Hobo	82	83.7	12.6	
Solinst	10	10.2	1.5	
All Recorders	82	83.7	12.6	
Wells	40		6.1	6
Sites	15		6.7	
Hobo	34	85.0	5.2	
Solinst	0	0.0	0.0	
All Recorders	34	85.0	5.2	

These are counts of the number of wells which have at least one recorder of the stated variety. These numbers don't indicate the total number of recorders deployed. For example, there are always two Solinst recorders on a well and only one is counted per well. Also, Solinst recorders are always installed on wells with Hobos, so the number Solinst recorders does not increase the total number of wells with recorders.

Figure 5. Well Registry Form



Add / Edit Site Information

Cancel | Delete | Apply Changes

Agency	North Carolina Department of Environmental Quality Division of Water Resources
Display Site?	Yes
Site No	AA35N1
Site Name	Kelly
State	North Carolina
County	Bladen County
Latitude (decimal degrees)	34.455982
Longitude (Decimal Degrees)	-78.307832
Horizontal Datum	NAD83
Lat/Long Method	GPS
Lat/Long Accuracy	<.05 ft
Altitude	25.337
Altitude Units	ft
Altitude Datum	NAVD88
Altitude Method	Trimble R10
Altitude Accuracy	<.1 ft
Well Depth	14
Well Depth Units	ft
National Aquifer	Surficial aquifer system
Local Aquifer Name	Surficial
Site Type	WELL
Aquifer Type	UNCONFINED
In WL Sub-Network?	Yes
WL Network Name	water_level_network
WL Baseline?	Yes
WL Well Type	Trend
WL Well Characteristics	Background
WL Well Purpose	Dedicated Monitoring/Observation
WL Well Purpose Notes	
In QW Sub-Network?	Yes
QW Network Name	water_quality_network
QW Baseline?	Yes
QW Well Type	Trend
QW Well Characteristics	Background
QW Well Purpose	Dedicated Monitoring/Observation
QW Well Purpose Notes	
Link	http://www.ncwater.org/?page=536&id=AA*35N1&tl=1
Date Record Created	11-MAY-16
Insert User	mdurway
Date Last Updated	08-NOV-16
Last Update User	nwilson

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