North Carolina
Division of Water Resources
Ground Water Management Branch
2019 Annual Report

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R 23X, Cove City Station, Craven County

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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. The North Carolina Department of Environmental Quality (DEQ), Division of Water Resources (DWR), and preceding agencies have operated, installed, and monitored a statewide monitoring well network from the 1960s to the present. 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 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 impacts 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;
- Periodic sampling of the monitoring well network to establish background levels for constituents (e.g. nitrates, etc.); and
- Providing high quality ground water data to local governments, ground water professionals, and the 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, *https://www.ncwater.org/GWMB*. 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 2019 Annual Report summarizes field activities and conclusions derived from activities performed or associated with the Ground Water Management Branch during the July 1, 2018 through June 30, 2019 fiscal year (2019 FY). These activities include the ground water monitoring well network water level and water quality data statistics, monitoring well installations, including new installations and acquired wells, monitoring equipment usage and evaluations, site surveys, local monitoring well network information, and a summary of the Central Coastal Plain Capacity Use Area 2019 FY activities.

3.0 Background

DWR and its predecessor agencies have operated the statewide Ground Water Resource

Monitoring Program from the 1960s to the present. The active monitoring well network has expanded by approximately forty percent (280 monitoring wells) by either installation or acquisition of new monitoring wells since 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 17 monitoring wells, many of which are also part of the DWR statewide network.

Beaver Creek Station
S 26I Jones County

4.0 DWR Statewide Monitoring Well Network Overview

4.1 Description

The monitoring well network currently consists of 672 wells at 228 monitoring stations (sites), divided into six regions, comprising 66 counties (Figure 1). There are 51 wells located in the Piedmont and Mountain physiographic provinces (Piedmont and Mountain) and 621 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. Consequently, ground water monitoring and research have 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 47 DWR wells within the monitoring well network used to assess drought conditions in the 2019 FY (Figure 2).

Of the 228 monitoring stations, 79 are on State or Federal property, 59 are located on property owned by local governments, 86 are located on private property through agreements with

Olivers Crossroad Station
T 23X, Jones County

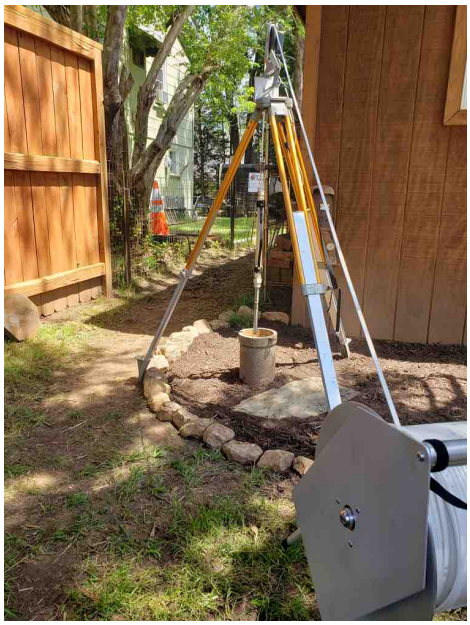
Deppe Monitoring Station, V 23X, Onslow County

landowners, and 4 stations are located on properties where the 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.

4.2 Monitoring

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

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 unvented pressure transducers. Hourly water level data are extremely valuable in assessing aquifer recharge, impacts of large storms on ground water conditions, and delineation of aquifer boundaries. Manual water level readings and daily automatic recorder water level data are typically published on the DWR website. However, hourly data is available upon request for specific wells. Table 2 summarizes site and recorder distribution by region.



Video Camera, Powell Drive Station K 40M, Wake County

In addition to the recorders mentioned above, Solinst Telemetry System (STS) recording units have been installed in sixteen wells that are included in the Drought Indicator Well network. They consist of one pressure transducer, one barometer, and are powered

Video-logging, Stillwell Building Station, Q 94J, Jackson County

by a twelve-volt battery. Data is collected by a controller unit that stores hourly readings. The readings are sent to the home station (DWR web page server) every reporting interval (currently 3 hours) via a cell phone modem apart from the Laurel Springs (C 31U1) and Como (B 20U) stations. The Laurel Springs and Como monitoring stations transmit data two to three times daily due to inconsistency in cell phone service in these areas. DWR uses the STS system on the Drought Indicator Well network to take the place of monthly visits. They are serviced every quarter or semi-annually depending on battery life. The STS data is especially helpful in keeping the Drought Indicator well water levels up to date (https://www.ncwater.org/?page=345). Table 3 summarizes STS system information.

STS Equipment
Topsail Station, BB 28J, Pender County

4.3 Chloride Sampling

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 interfaces 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 in September-October 2019 to track salt water encroachment conditions. Section 5.2 summarizes the 2017 chloride sampling event.

5.0 Well Network Statistics

5.1 Ground Water Data Collection

Depth to ground water was measured in

678 wells in the 2019 FY. Table 4 contains DWR monitoring well network statistics from January 1, 2005 through June 30, 2019. 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 2018 represents the most water level data collected in any single year since starting the monitoring well network operation. The 2019 FY data was collected from January 1 through June 30, 2019.

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

Data Collection
Cremo Station, F 19V, Bertie County

5.2 Chloride Sampling

A chloride sampling event was performed in 2017. Ground water from 322 wells within the network was sampled for chlorides using Quantab® chloride titrators from July 12, 2017 through October 5, 2017. Field data were collected for pH, conductivity, and salinity using YSI® portable probes.

The purpose of chloride sampling is to evaluate trends in water quality 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 levels were used to determine if ground water was fresh (< 250 ppm chloride) or salty (≥ 250 ppm chloride). There is a natural transition between fresh and salty ground water in each aquifer where water becomes

Hobo Datalogger
Bear Grass Station, K 21R
Martin County

salty with depth (at the fresh water-salt water interface). The transition areas are different for each aquifer. Chloride analytical results for the Cretaceous Black Creek (Kbc), Upper Cape Fear (Kucf), and Lower Cape Fear (Klcf) aquifers are shown in Figures 4, 5, and 6, respectively.

Figure 4 shows chloride levels in the Black Creek aquifer have remained below detection limits or relatively uniform for all except 4 of 27 wells since 2010. A continuous increasing trend was recognized at Lee Creek in Beaufort County (P 17I), where chlorides rose from 6,766 ppm in 2010 to 9,056 ppm in 2017. The increase at Lee Creek is potentially related to open-pit mining activities near that location.

Figure 5 shows non-detectable or low-level chloride fluctuations within the Upper Cape Fear aquifer for the majority of the 37 wells sampled. Recent chloride decreasing trends were observed at the Chicod (O 23L), Cove City (R 23X), Jones Middle School (T 24J), and Clarendon (DD 42N) wells, with a decrease at Clarendon from 202 to 100 ppm between 2012 and 2017. Recent chloride increasing trends were observed at select Gold Point (J 22P), D H Conley (N 23P), Clarks (S 22J), Comfort (U 26J), and Nakina (EE 39O) wells with an increase at Clarks from 1,735 to 2,297 ppm between 2012 and 2017. The cause for fluctuations may be attributable to local or regional pumping effects.

Figure 6 shows low to moderate chloride fluctuations within the Lower Cape Fear aquifer for the majority of the 20 wells sampled. Notable chloride level decreases were observed at the Morgans Corner (C 12W), Gold Point (J 22P), North Pitt High School (L 24B), Falkland (L 25P), and Kelly (AA 35N) wells with decreases of over 1,000 ppm per well at Morgans Corner and Kelly between 2010 and 2017. Chloride decreases in these wells are potentially attributable to CCPCUA pumping reductions.

Measuring Depth to Water Level
Bonnerton Station, P18V
Beaufort County

Chloride Sampling
WCWC Station, X 19O
Carteret County

5.3 Well Installation and Development

From March 2019 through June 2019, the following monitoring wells were installed using the mud rotary drilling method:

- Clinton Station, Sampson County, six wells (U 35I1, U 35I2, U 35I3, U 35I4, U 35I5 and U 35I6);
- Topsail Fire Tower Station, Pender County, four wells (AA 27L1, AA 27L2, AA 27L3, AA 27L4)
- Merchants Millpond Station, Gates County, two wells installed (C 16S1, C 16S2); this station will be completed and GW1s submitted when the station is added to the monitoring well network in the 2020 FY.

Drilling at the Clinton and Topsail Fire Tower Stations by AC Schultes of North Carolina from Rocky Point, NC began with pilot holes which were used to construct monitoring wells U 35I2 and AA 27L3, respectively. A pilot hole was advanced at the ongoing Merchants Millpond Station by Toano Well and Pump Service, Toano, Virginia and used to construct monitoring well C 16S1. Other well numbers will be defined once the station is complete in the 2020 FY. DWR staff collected samples of the pilot hole drill cuttings at ten-foot intervals in order to assess the borehole lithology. In addition, a borehole geophysical log was obtained by lowering a probe into the borehole once the borehole was completed. The geophysical log makes a detailed record of the geologic formations in the borehole. Geophysical and lithologic log interpretation enabled the DWR staff to assess well screen intervals and the number of wells to be installed at the newly installed and pending monitoring stations. The wells were installed using 4-inch PVC riser and 10 to 20 feet of 4 to 4.5-inch stainless steel continuous wire wrap

Casing (above) Clinton Station, U 35I Sampson County, Mudpit (below) Topsail Fire Tower Station, AA 27L Pender County

Collecting Samples from Drill Cuttings,
Merchants Millpond Station, C 16S, Gates County

V-slot screen. 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 overlays the top of the gravel pack to provide a sufficient bentonite seal in the well. Table 5 summarizes the monitoring well construction information. The 2019 FY completed monitoring station wells are included in Figure 1. Well construction records for the 2019 FY completed wells are included in Appendix A.

Identification Documentation of Drill Cuttings
Merchants Millpond Station, C 16S, Gates County

Development removes fine-grained sediments from the vicinity of the well screen and ensures proper hydraulic connection with the aquifer. During development, 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. DWR staff developed several existing monitoring well stations in the 2019 FY. Monitoring wells developed in the 2019 FY are listed in Table 6.

Well Development
Clinton Station, U 35I, Sampson County

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.

5.5 Acquired Network Wells

DWR acquired one existing well, Powell Drive Station in Wake County, during the 2019 FY. Details of the monitoring station are included in Table 5.

5.6 Automatic Water Level Recorders

Automatic water level recorders play an integral role in the DWR monitoring program. Hourly water level measurements are collected using unvented submersible pressure transducers. They allow for economical collection of near-continuous data at remote well stations. Two primary

recorders (Onset Computer's Hobo U20 series and Solinst Telemetry System or STS) were utilized in the 2019 FY and are included in Table 2. Table 7 lists the recorders present on network wells as of June 30, 2018.

5.7 Site Surveys

Concrete survey monuments have been installed at each of the 228 active monitoring well stations within the network. Five of those stations have more than one monument.

Each of the installed monuments have been surveyed using Survey Grade Global Positioning System (GPS) to calculate the most accurate horizontal and vertical location data possible with the exception of the new, Clinton and Topsail Fire Tower Stations. DWR was unable to get elevations at two monitoring stations, Beach Grove School Field (M93L and Woody Creek M93R), due to the inability to acquire a cell phone signal at the station's location. GPS surveying will be conducted again in the winter/spring of the 2020 FY to provide horizontal and vertical data on the newly installed and acquired monitoring well stations, as well as a select number of sites to obtain additional measurements.

Monument, Powell Drive Station K 40M, Wake County

R10 Survey Equipment, Troutman Station, L 67U2, Iredell County

6.0 Local Monitoring Well Network Information

6.1 Orange County Monitoring Well Cooperative Network

The creation of the Orange County Ground Water Observation Well Network, Orange Well Net (OWN), was proposed in May 2005. It was decided to utilize existing bedrock wells in lieu of installing new wells for monetary reasons. In March 2010, the OWN included six inactive bedrock wells for ground water data collection. In 2011, three regolith wells were added to the OWN as a result of a cooperative arrangement. In 2012, two bedrock wells, the Ray Road and Rocky Ridge

wells were removed from the network and replaced with two bedrock wells, well 4D in Duke Forest and a well at the former Orange County 911 Center. The wells that were most recently added to the network are the Brumley East well, as the result of an agreement with the Triangle Land Conservancy, and the Duke Forest 4S and 4I wells, with the agreement (informal) of DWR and Duke Forest. Table 8 summarizes the OWN well information. Figure 7 is a map of the OWN well locations.

Ground water data is collected periodically from the OWN. This data is collected to assess ground water availability and concerns locally in Orange County. The data is formatted and uploaded to the DWR ground water database and is available to the public. Table 9 is a summary of the OWN statistics from March 2010 through June 30, 2019. The 2011, 2012, and 2013 OWN Annual Reports are available on the DWR website. Tom Davis (Water Resources Coordinator for the Orange County Department of Environment, Agriculture, Parks and Recreation), the OWN Annual Reports, and information provided by the DWR database, are the sources for the Orange County Monitoring Well Network information provided herein.

6.2 Guilford County Monitoring Well Cooperative Network

The Guilford County ground water monitoring network was established in 2002 and includes eight monitoring well stations located on public properties owned by Guilford County or the City of Greensboro. Each well site was selected to represent an area of the county and to minimize the influence of any existing water supply wells nearby. Table 10 summarizes the Guilford County monitoring well information. In addition, NC A&T State University uses the Knox Road Station for their hydrology class and the students use the data from this station for their course project.

Water levels are collected manually on the same day of each month. Hourly data is collected using Global Water WL16 submersible transducers and are downloaded at the time of manual collection of depth to ground water levels. The data is formatted and uploaded to the DWR ground water database and is available to the public.

Table 11 summarizes the Guilford County monitoring well statistics from 2008 through June 30, 2019. Figure 8 is a site map of the Guilford County monitoring well locations. Gene Mao (Guilford County Department of Health and Human Services, Division of Environmental Health, Health, Environment, & Risk Assessment Unit), and information obtained from the DWR database, are the sources for the Guilford County Monitoring Well Network information provided herein.

6.3 Western Carolina Hydrological Research Station Cooperative Network

The Western Carolina Hydrological Research Station, (WCHRS), was established in 2010 in a partnership between Western Carolina University (WCU) and DEQ. The WCHRS is comprised of approximately 40 monitoring wells and is located within the Cullowhee Creek watershed. It was decided in 2017 that the WCHRS cooperative well network would be comprised of seventeen of these wells, including two wells acquired by DWR, Stillwell Building Station (Q 94J1) and the CC Old Well Station (Q 94I1), both active wells in the statewide monitoring well

network. According to the WCU description of the WCHRS located in the DWR database, "the well network was designed to study ground water interaction with streams in a headwaters region typical of the southern Appalachians. Most ground water levels are measured weekly by student researchers at WCU. A few wells have computer sensors so water level data are collected continuously at 15-minute intervals."

Table 12 summarizes the WCHRS cooperative network well information. Figure 9 is a map of the WCHRS cooperative network well locations.

Ground water data is collected periodically from the WCHRS. Data from select wells are formatted and uploaded to the DWR ground water database and is available to the public. Table 13 is a summary of the WCHRS statistics from 2011 through June 30, 2019. Mark Lord and David Kinner, Professors of Geology with the Department of Geosciences and Natural Resources, WCU in Cullowhee, NC, the wcu.edu website, and information provided by the DWR database are the sources for the WCHRS information provided herein.

7.0 Planned Activities

7.1 New Well Installation

Monitoring well network expansion efforts for the 2020 FY will focus mainly on Sampson, Onslow and Duplin counties. Table 14 summarizes the potential upcoming expansion of the network in the 2020 FY.

7.2 Well Abandonment/Station Removal

Some wells throughout the network that cannot be used due to poor construction, screens in multiple aquifers, unsafe locations, etc., may be abandoned during the 2020 FY.

Four stations, Calico (P 22F6 and P 22F7), Creeping Swamp (O 22V6 and O 22V7), Highway 102 (O 21Q1, O21Q2, and O 21Q3), and Onslow Quarry 15 (W 26D1) were removed from the active network due to hazardous locations.

8.0 Water Quality

The Ground Water Management Branch added some ground water quality staff members in December 2015. Among the responsibilities of these employees is to support Tasks 5 & 6 of the North Carolina 2016 FY Workplan for the Clean Water Act Section 106 Ground Water Grant (EPA).

Task 5 - Characterize the State's Ground Water Resources, and Task 6 – Ground Water Monitoring Program

The Division of Water Resources conducts an active program of ground water monitoring that advances the DWR mission by improving DWR's knowledge in the following areas:

1 Impacts of land-applied wastes, artificial infiltration practices, or other human activities, including:
   - Potential impacts of these activities on the surficial aquifer and the secondary impacts to the deeper aquifers or surface waters;
   - The occurrence of "emerging contaminants" related to these activities; and
   - Effectiveness of regulations and permits for these activities.

2 Threats to ground water quality, including:
   - The existence, nature, and scope of emerging or existing threats;
   - Assessment of the causes and factors affecting naturally-occurring contamination, agricultural contamination, or contamination resulting from activities permitted by DWR; and
   - Tracking the status of ground water quality across the state.

The goal of all characterization, monitoring, and investigation efforts is to improve DWR's understanding of the causes and extent of problems, to minimize human exposure to contaminants, and identify areas where regulations or best management practices can be improved to prevent contamination from occurring.

The state has an extensive network of ground water monitoring stations which can be utilized as an ambient ground water monitoring network. Prior to December 2015, the Piedmont-Mountain Resource Evaluation Program sampled wells annually from a well network installed and constructed for characterizing the relationship of water quality to underlying geology in the Piedmont and Mountain physiographic provinces. Less water quality monitoring occurred in the Coastal Plain in the last two decades.

Ground Water Sample Collection
Comfort, U 26J, Jones County

The Ground Water Management Branch intends to collect samples from each active well in the statewide monitoring well network. In the 2019 FY, samples were collected from 29 monitoring stations (94 wells). Typically, one team of DWR staff members purged wells to be sampled using high-capacity pumps and then a second employee team sampled the wells with low-flow pumps the same day. The samples were analyzed for the following parameters:

- Standard private well parameters – arsenic (As), barium (Ba), cadmium (Cd), chromium (Cr), copper (Cu), fluoride (F^-), lead (Pb), iron (Fe), magnesium (Mg), manganese (Mn), mercury (Hg), nitrate (NO_3), selenium (Se), silver (Ag), sodium (Na), zinc (Zn), pH, and bacterial indicators;
- Ammonium (NH^4), Total Kjeldahl Nitrogen (TKN), Nitrate+Nitrite, and Phosphate (PO_4);
- Volatile Organic Compounds (VOCs), Semi-Volatile Organic Compounds (SVOCs), and Pesticides;
- Major ions: bromide (Br), calcium (Ca), potassium (K), sulfate (SO_4), carbonate (CO_3), bicarbonate (HCO_3) and chloride (Cl^-);
- Metals
  - Dissolved (filtered in field – geochemistry applications require dissolved metals)
  - Total (drinking water standards are based on total metals)
  - Cu and Zn (in both swine permits and the standard private well suite)
  - Coal Ash Metals – (this increases our knowledge of naturally occurring contaminants of interest to the coal ash program)
    - Note, currently chromium analysis performed by the DWR lab requires more precision to satisfy coal ash program needs. Analysis for hexavalent chromium would need to be sent to a private lab at some cost.
    - Note, currently the DWR lab analyzes for total vanadium. The 2L standard for vanadium (V) is under review and will probably be based on particular species of V, not total V.
- Field parameters
  - Specific Conductivity, pH, Dissolved Oxygen (DO), Temperature (°C), Oxidation-Reduction Potential (ORP), Turbidity

In addition to the referenced ground water sampling events, five ground water stations in New Hanover County were sampled specifically for per-and polyfluoroalkyl substance (PFAS), a group of man-made chemicals that includes perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS), GenX and others. Wells were sampled using a high-density polyethylene (HDPE) Super/Skinny Sleeve. By using this method, a grab sample of ground water is collected from the screened interval (or any interval of interest) of the well with minimal disturbance and effort, thus eliminating the need for purging three well volumes.

Ground water sampling protocol is included in Appendix B. Field data information for the 2019 FY are included in Table 15. Laboratory analytical results received for the 2019 FY are available upon request. In the 2020 FY, ground water samples will continue to be collected from wells in the monitoring well network and analyzed for the parameters referenced above. Analytical data should be available to the public through the DWR website in the 2020 FY.

9.0 Central Coastal Plain Capacity Use Area

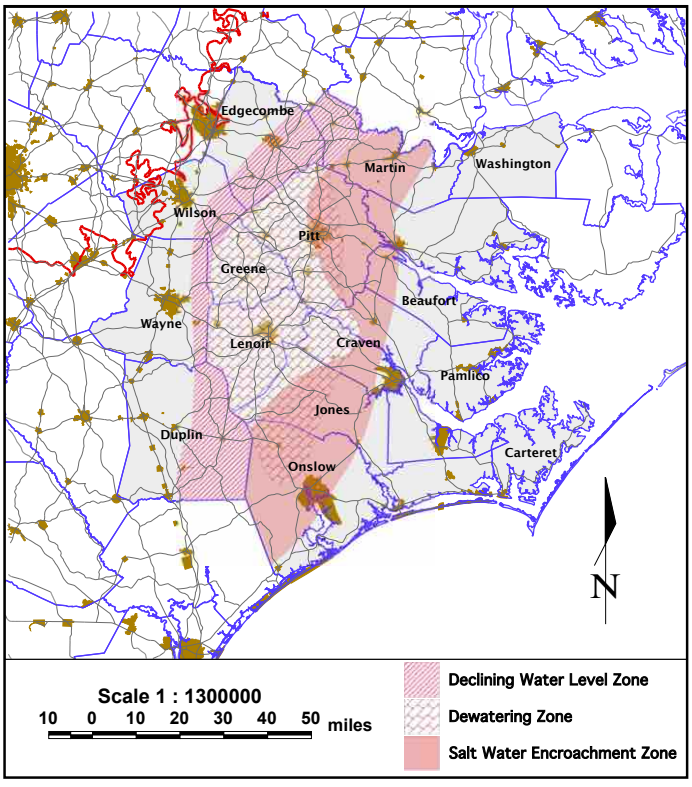
The Central Coastal Plain Capacity Use Area (CCPCUA) is a 15-county region in the coastal plain that is an example of a water overuse situation. On August 1, 2002, the CCPCUA rules came into effect because of significant ground water depletion problems. As stated in 15A NCAC 2E .0501, "the intent of this Section [the CCPCUA rules] is to protect the long term productivity of aquifers within the designated area and to allow the use of ground water for beneficial uses at rates which do not exceed the recharge rate of the aquifers…" For many years, water was withdrawn from the deep confined aquifers, which are a primary source of water in the CCPCUA, at a rate that was greater than they were naturally recharged. If this situation had been allowed to continue indefinitely, the aquifers could have been permanently damaged, impairing their ability to function as a water supply.

The goal of the DWR is to regulate water withdrawals in the Central Coastal Plain (CCP) under the authority of the Environmental Management Commission (EMC). The following summarizes how these withdrawals are regulated:

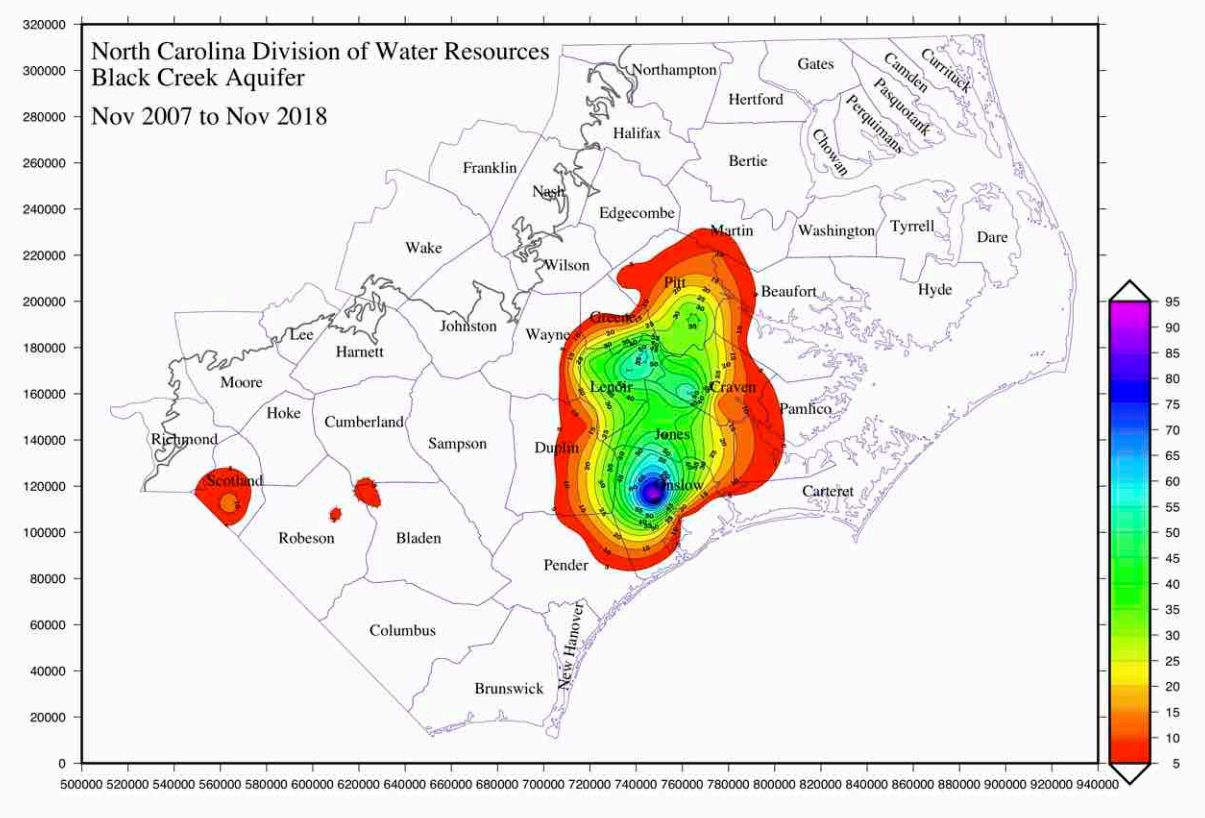
- Water withdrawal permits are required for ground water users who withdraw greater than 100,000 gallons of water per day;
- Annual registration and reporting of withdrawals is required for surface and ground water withdrawals greater than 10,000 gallons per day;
- Counties included in the CCPCUA are Beaufort, Carteret, Craven, Duplin, Edgecombe, Greene, Jones, Lenoir, Martin, Onslow, Pamlico, Pitt, Washington, Wayne, and Wilson.

DWR collects depth to water level measurements and chloride sampling event data from monitor wells within the state's well network and CCPCUA permitted wells to assess aquifer conditions. 15A NCAC 2E .0503 requires that DWR assess aquifer conditions in 2008, 2013 and 2018 to determine if CCPCUA rule changes are necessary. Through the CCPCUA permitting system, large ground water users (>100,000 gpd) in some parts of the capacity use area are required to progressively reduce withdrawals in 2008, 2013, and 2018 to allow the aquifers to recover. The managed withdrawals from these aquifers have allowed the aquifers to recover as depicted in the following recovery maps of the Upper Cape Fear Aquifer and the Black Creek Aquifer.

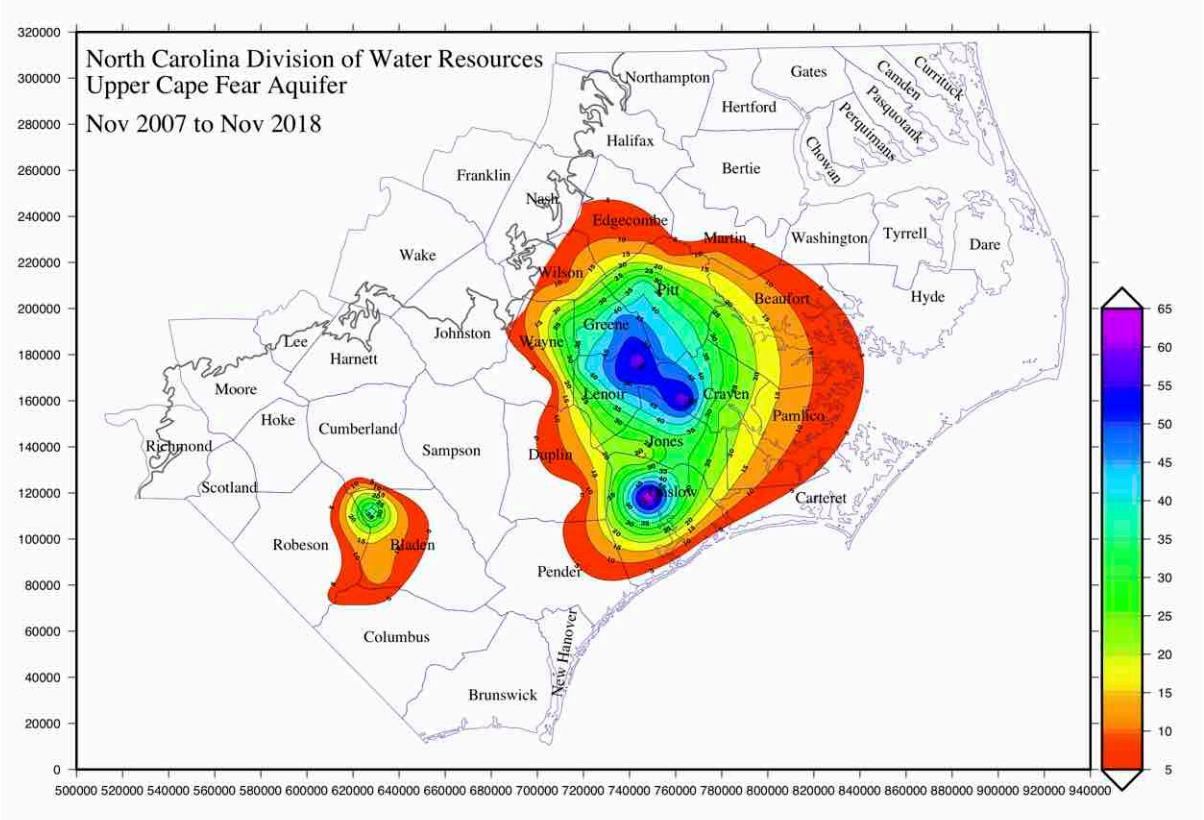
CCPCUA Cretaceous Aquifer Zones



The map of the Black Creek Aquifer shows the areas where ground water levels have risen between 5 feet (red) to more than 95 feet (purple) from November 2007 through November 2018. The largest recovery is observed in the Onslow County area where water users have made large investments in developing the Castle Hayne aquifer as an alternate water source.



The map of the Upper Cape Fear Aquifer shows the areas where ground water levels have risen between 5 feet (red) to more than 65 feet (blue) from November 2007 through November 2018. The largest recovery is observed in the Lenoir county area due to the development of a surface



water treatment plant on the Neuse River in 2008 and Craven county area which developed wells in the Castle Hayne aquifer as an alternate water source.

Based on analysis of water level and chloride concentration data gathered through January 2013 in the CCPCUA, and a thorough review of aquifer conditions, DWR concluded that no action needed to be taken by the EMC to alter either the reduction zone boundaries or rule language in 15A NCAC 2E .0503, but recommended the use of temporary permits under rule .0502. This may give certain permit holders a stable withdrawal rate which is higher than indicated by their reduction schedule and reduction zone, provided that all well construction and reporting criteria are met as specified in the 2013 CCPCUA Assessment Report, which can be viewed at https://www.ncwater.org/CCPCUA under the miscellaneous link.

DWR uses a series of criteria to judge each production well and aquifer conditions by individual permit in the permitting process. This enhanced permit application review allows the division to alter an individual permit holder's reduction requirements if the permit holder can demonstrate they are using the ground water at a sustainable rate. As of August 2019, the following nine permit holders have acquired temporary permits: Greene County Regional Water System, Town of La Grange, Belfast-Patetown Sanitary District, Northwestern Wayne Sanitary District, Southeastern Wayne Sanitary District, Fork Township Sanitary District, Chinquapin Water Association, Inc., City of New Bern, and the Town of Snow Hill, Jones County Regional Water and Craven County water.

Although the CCPCUA rules require assessments to be produced in 2008, 2013, and 2018, the DWR staff will continue to constantly track aquifer conditions so as to best serve the permit holders in the region and to provide awareness of potential ground water supply issues. The 2018 assessment concluded recently with the EMC's approval of the report on October 10, 2018. The assessment report reviewed aquifer data in a similar fashion to previous efforts in 2008 and 2013. Water levels in the Black Creek and Upper Cape Fear aquifers were found to be equilibrating to the lower rate of aquifer use as water systems continue to shift demand to other sources which include surface water and shallower aquifers. While water level data are consistent with sustainable use of the aquifer system, chloride concentrations are somewhat inconsistent. Smaller and static cones of depression have developed in the Peedee and Castle Hayne aquifers in response to new well fields and are only visible using the combined DWR and permit holder water level data. Reports referencing the CCPCUA rules can be viewed by visiting the DWR website, https://www.ncwater.org/CCPCUA.

10.0 Summary and Conclusions

DWR and its predecessor agencies have maintained and monitored a statewide network of ground water monitoring wells used to assess North Carolina's ground water supply since the 1960s.

Data collected from the monitoring well network are available to the public through DWR's Internet website, *https://www.ncwater.org/GWMB*. 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 monitoring well network consists of 672 monitoring wells at 228 individual stations. From July 2017 through June 2018, ground water level data were collected from 661 wells within the network. These data include manual measurements taken quarterly from wells and hourly water levels collected using automatic data recorders from 558 wells.

Sixteen STS units have been installed as of 2018 FY on drought monitoring network wells. The addition of the STS units replace monthly site visits, allow access to current water level data, and provide positive economic impacts.

Chloride sampling was performed on 322 wells from August through October 2017. 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 levels in the Black Creek aquifer have remained below detection limits or relatively uniform for all except 4 of 27 wells since 2010. Chloride levels in the Upper Cape Fear aquifer are non-detectable or low level chloride fluctuations for the majority of the 37 wells sampled. The Lower Cape Fear aquifer had low to moderate chloride fluctuations for the majority of the 20 wells sampled.

Six monitoring wells were installed at the Clinton monitoring station during the 2019 FY. Four monitoring wells were installed at the Topsail Fire Tower Station during the 2019 FY. Both stations were developed and sampled for chlorides.

One monitoring well station, Powell Drive Station, Wake County, was acquired and added to the monitoring well network in the 2019 FY.

No wells were abandoned or received major repair during the 2019 FY. Four stations, Calico (P 22F6 and P 22F7), Creeping Swamp (O 22V6 and O 22V7), Highway 102 (O 21Q1, O21Q2, and O 21Q3), and Onslow Quarry 15 (W 26D1) were removed from the active network due to hazardous locations.

There are three local networks whose water level data are currently being uploaded to the DWR database. The OWN in Orange County, the Guilford County network, and the WCHRS in Jackson County water level data can be viewed by the public on the DWR website.

Survey monuments have been installed at each of the well stations. Survey Grade GPS will be performed on the newly installed an acquired well stations, and select existing stations with installed monuments during the 2020 FY.

DWR has tentative plans to expand the monitoring well network by installing up to 30 wells at five sites in the 2020 FY.

Monitoring well network expansion efforts for the 2020 FY will focus mainly on Sampson, Onslow and Duplin counties.

Ground water quality staff collected ground water samples from 29 monitoring stations (94 wells) in the 2019 FY. A preliminary review of the data indicates no results of concern.

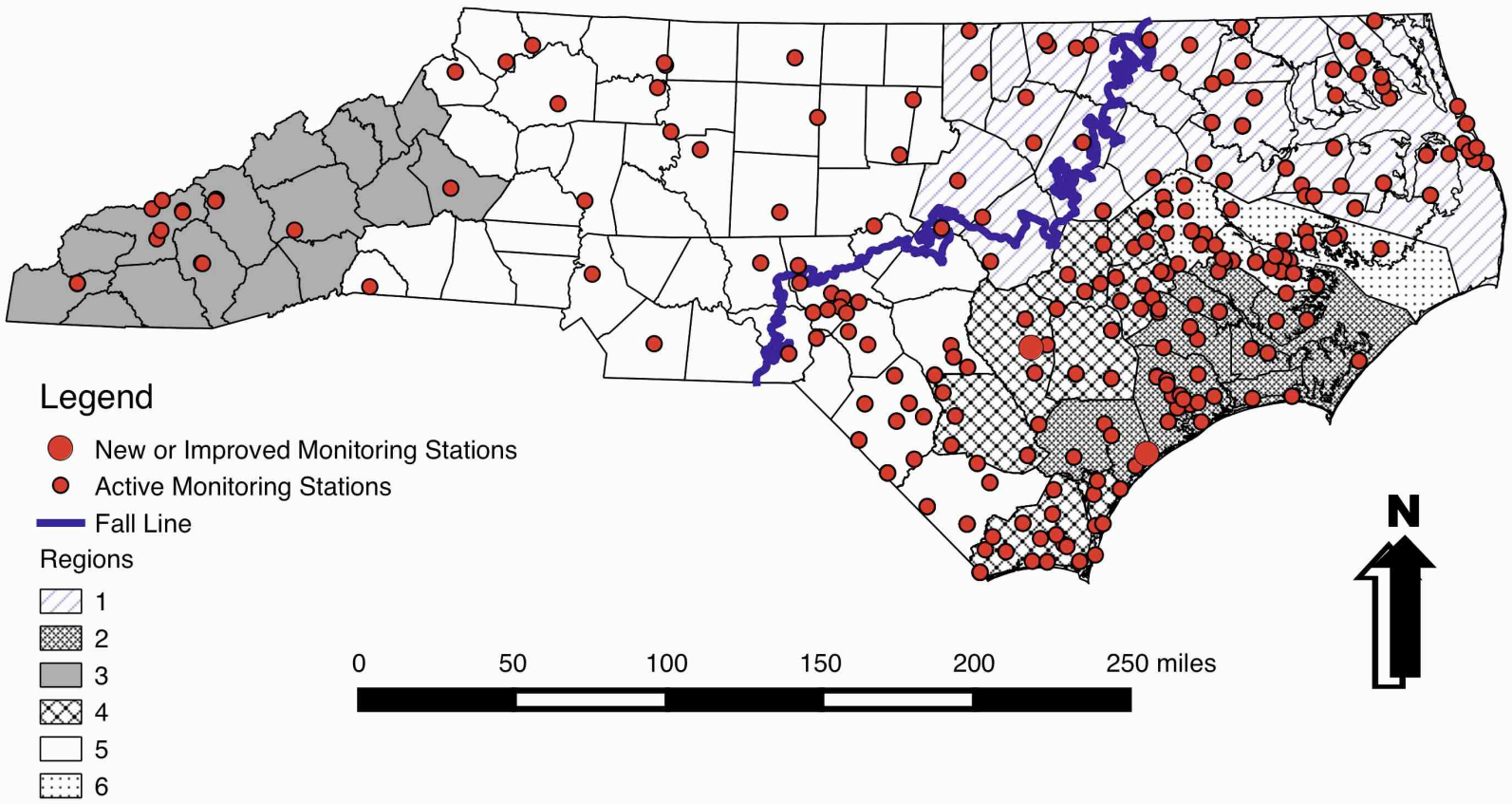
Fifteen counties in the Central Coastal Plain are governed by the Central Coastal Plain Capacity Use Area rules. Data collected from the monitoring well network is being used to assess aquifer conditions and determine whether or not changes to the rules are warranted. Based on the results of the 2018 assessment, concluding with the EMC's approval of the report on October 10, 2018, DWR will not pursue rule changes. Instead, DWR will continue issuing temporary permits under rule 15A NCAC 2E .0502 which can ease withdrawal reduction requirements for certain permit holders, but add other permit conditions.

FIGURES

Figure 1

NCDWR - Ground Water Management Branch
Monitoring Well Station Locations
2019 Annual Report

NOTE: This map is for informational purposes only. It does not authorize any party to enter onto any lands depicted herein.

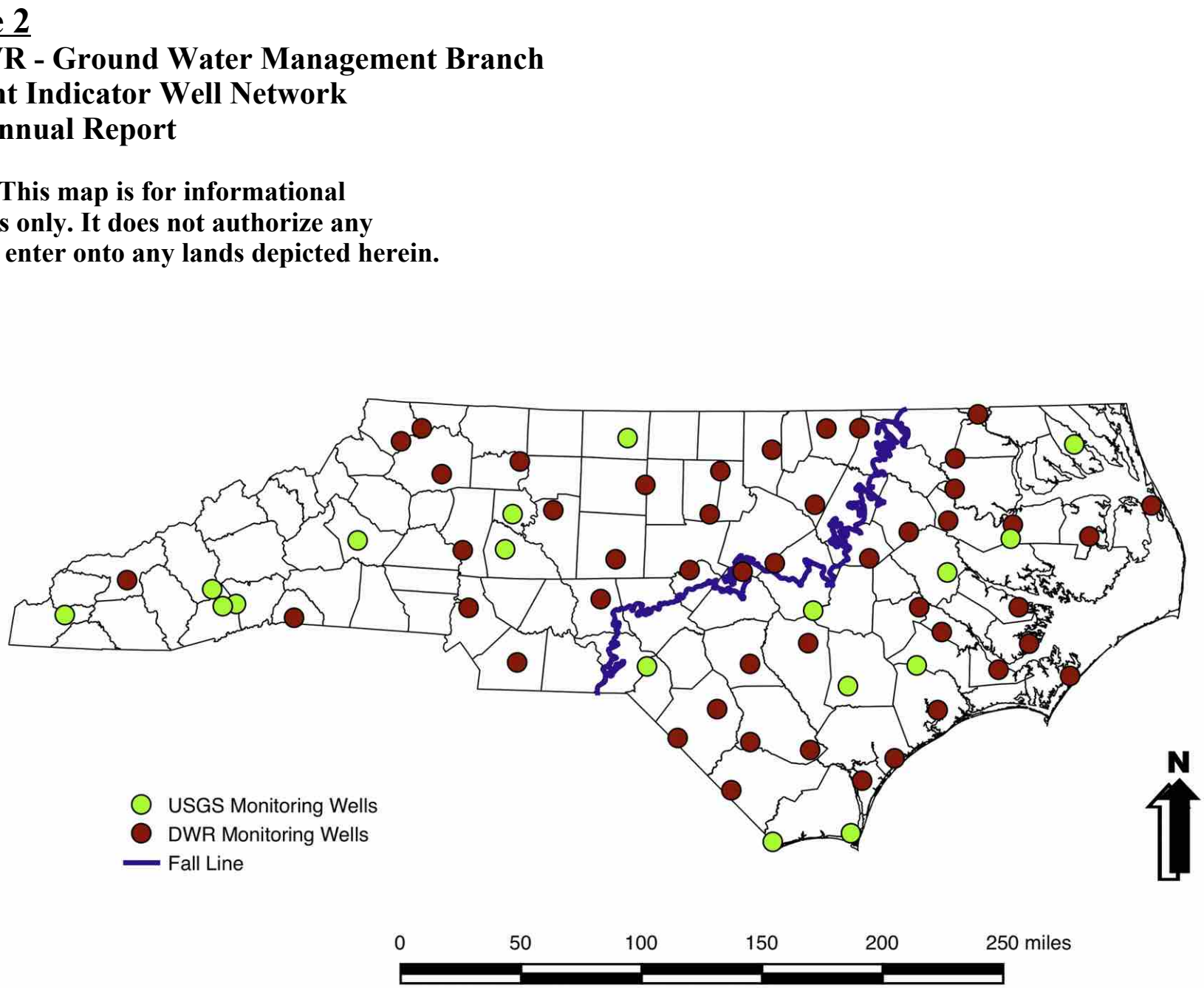


7-18-2019

Figure 2

NCDWR - Ground Water Management Branch
Drought Indicator Well Network
2019 Annual Report

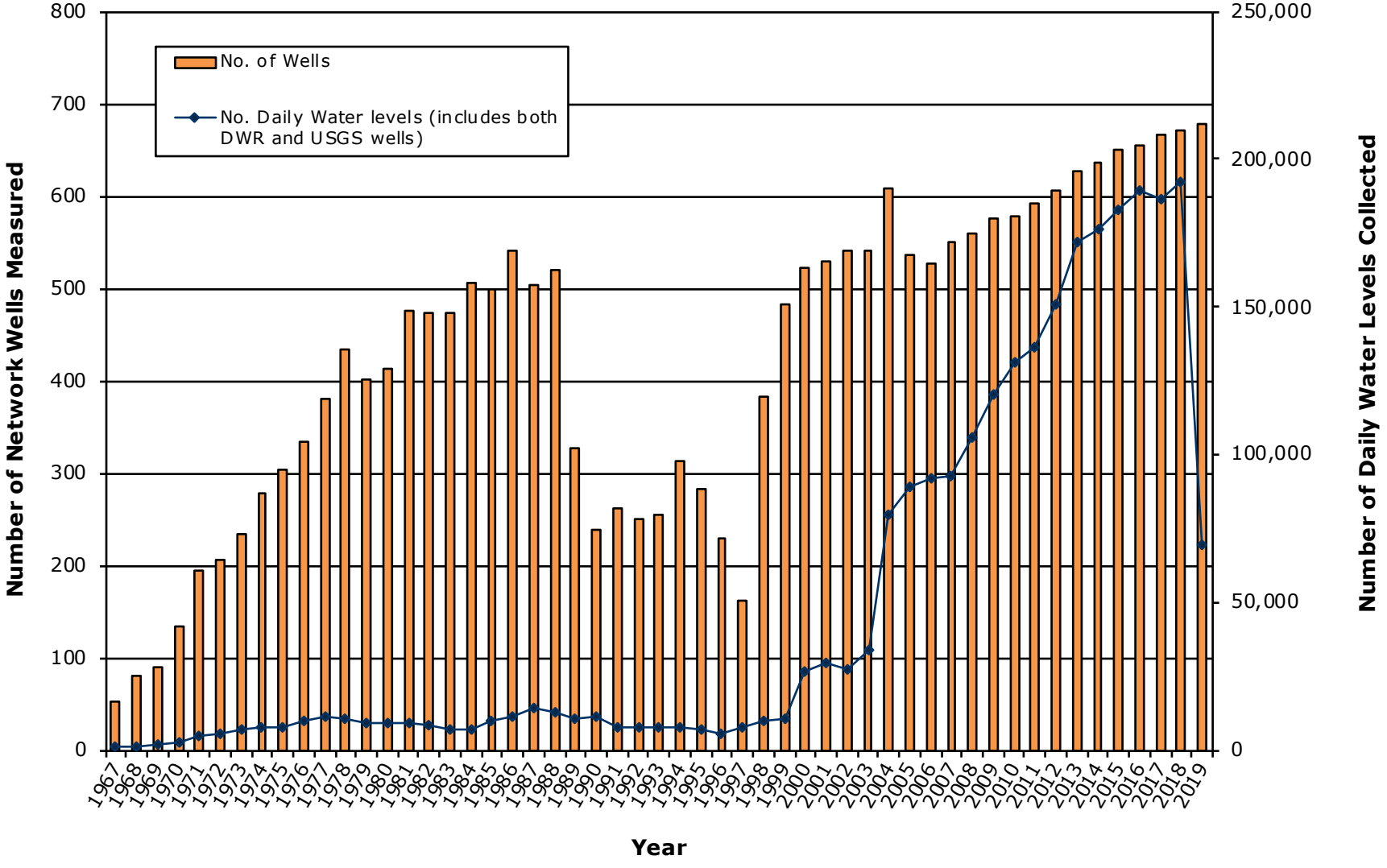
NOTE: This map is for informational purposes only. It does not authorize any party to enter onto any lands depicted herein.



10-02-2018

FIGURE 3

Water Level Data Collected from 1967-2019 (Plot includes both DWR and USGS Data)

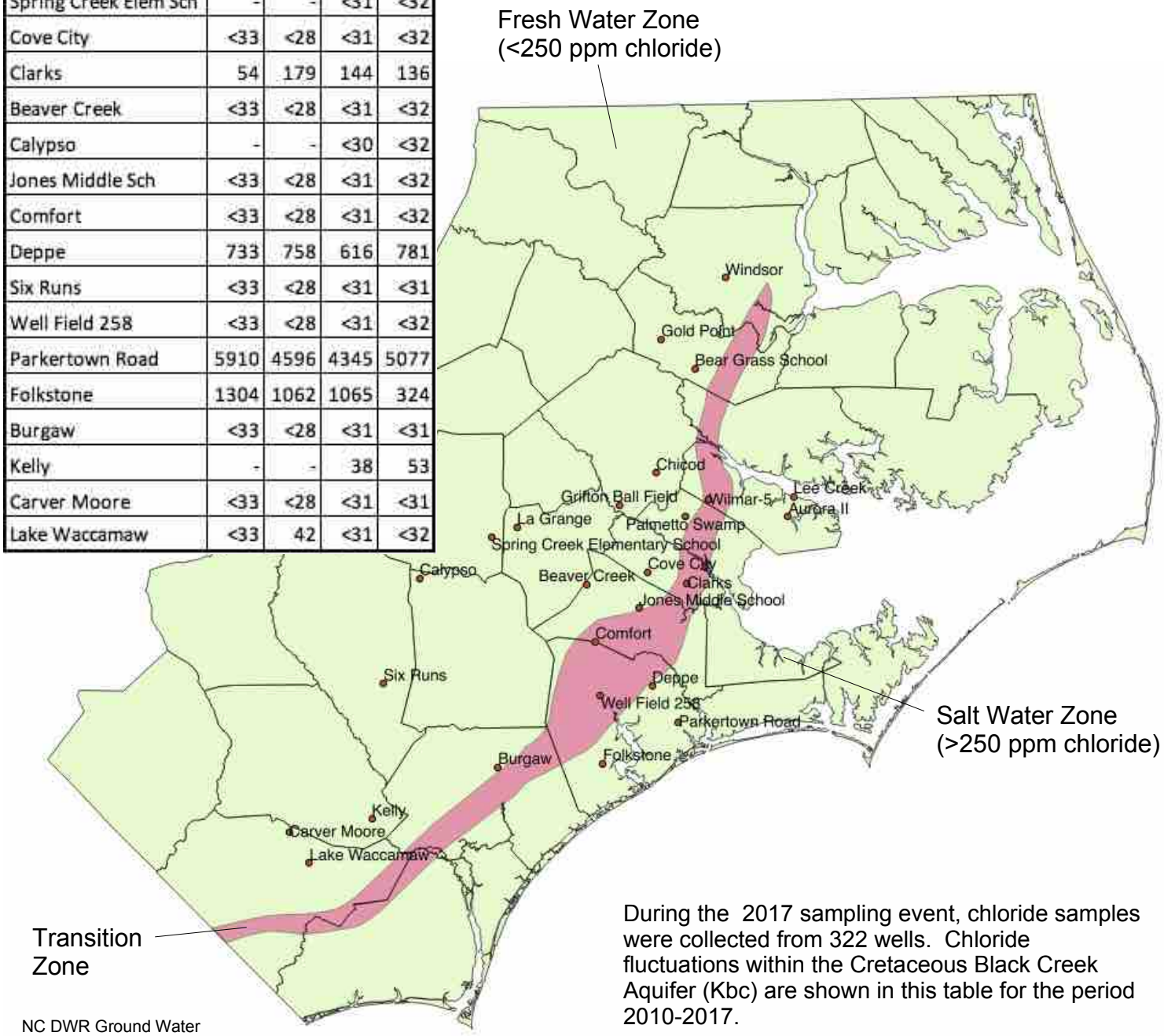


MONITORING STATION	2010	2012	2015	2017
	CHLORIDES (mg/l)			
Windsor	-	<28	<31	<26
Gold Point	<33	<28	<31	<31
Bear Grass Sch	<33	<28	<31	<26
Chicod	49	35	38	45
Lee Creek	6766	6888	7904	9056
Wilmar-5	400	434	-	496
Wilmar-9	239	194	-	188
Palmetto Swamp	49	35	38	45
Grifton Ball Field	<28	<28	<31	<32
Aurora II	6765	7562	9634	8124
La Grange	<33	<28	<31	<32
Spring Creek Elem Sch	-	-	<31	<32
Cove City	<33	<28	<31	<32
Clarks	54	179	144	136
Beaver Creek	<33	<28	<31	<32
Calypso	-	-	<30	<32
Jones Middle Sch	<33	<28	<31	<32
Comfort	<33	<28	<31	<32
Deppe	733	758	616	781
Six Runs	<33	<28	<31	<31
Well Field 258	<33	<28	<31	<32
Parkertown Road	5910	4596	4345	5077
Folkstone	1304	1062	1065	324
Burgaw	<33	<28	<31	<31
Kelly	-	-	38	53
Carver Moore	<33	<28	<31	<31
Lake Waccamaw	<33	42	<31	<32

Figure 4

NCDWR - Ground Water Management Branch
Chloride Levels in the Cretaceous Black Creek Aquifer
2018 Annual Report

NOTE: This map is for informational purposes only. It does not authorize any party to enter onto any lands depicted herein.



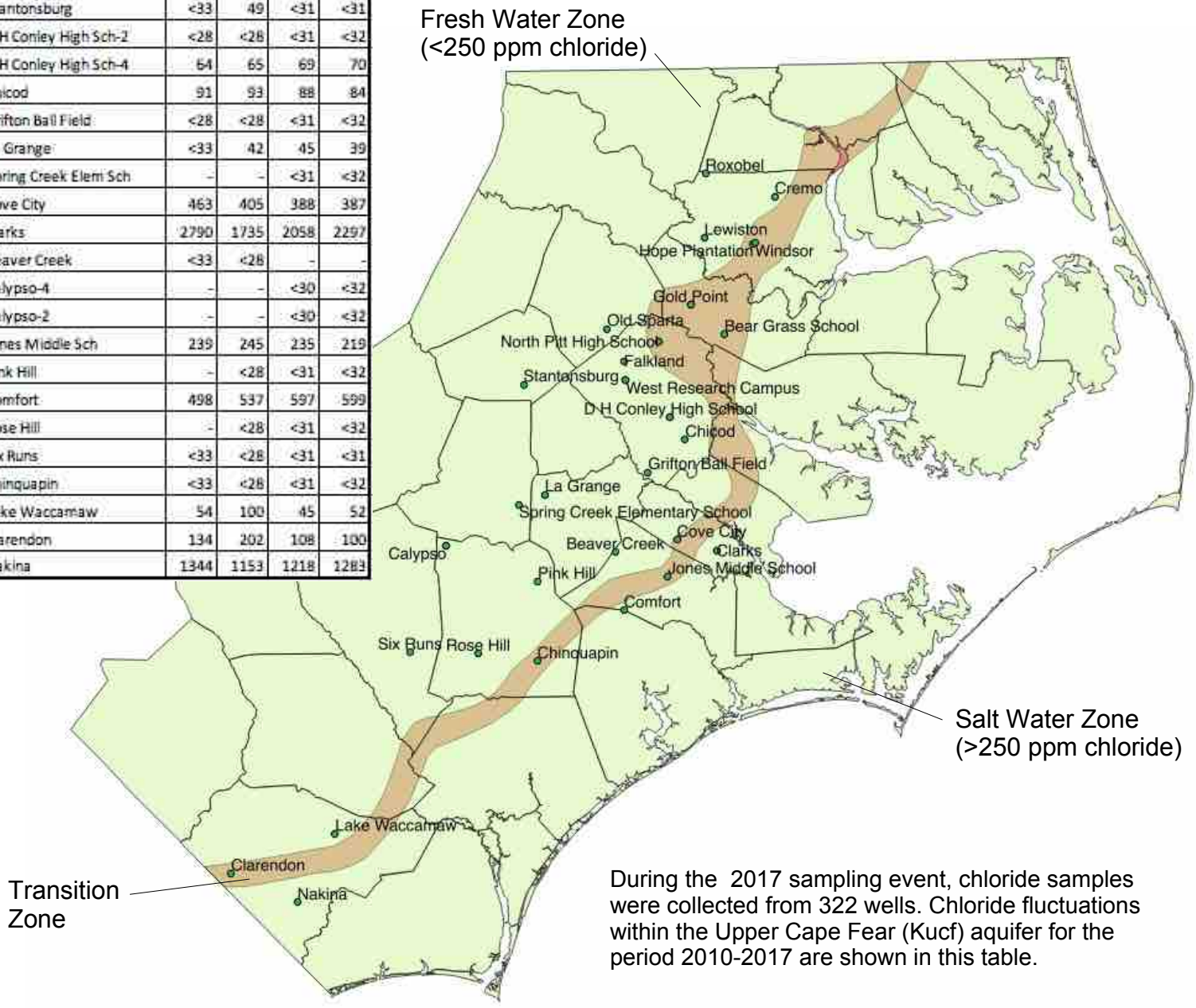
During the 2017 sampling event, chloride samples were collected from 322 wells. Chloride fluctuations within the Cretaceous Black Creek Aquifer (Kbc) are shown in this table for the period 2010-2017.

MONITORING STATION	2010	2012	2015	2017
	CHLORIDES (mg/l)			
Cremo	<33	<28	<31	<26
Roxobel	<33	<28	<31	<26
Hope Plantation	<33	35	-	-
Windsor	-	236	144	194
Lewiston	<33	<28	<31	<26
Gold Point-1	<33	<28	<31	<31
Gold Point-5	54	172	186	164
Gold Point-7	372	343	362	416
Bear Grass School	<33	111	45	50
Old Sparta	<33	56	31	41
North Pitt High Sch-4	463	284	293	314
North Pitt High Sch-5	400	327	-	337
Falkland	<33	<28	<31	<32
West Research Campus-3	<33	<28	<31	<32
West Research Campus-4	<33	<28	<31	<32
West Research Campus-5	54	57	61	59
Stantonsburg	<33	49	<31	<31
D H Conley High Sch-2	<28	<28	<31	<32
D H Conley High Sch-4	64	65	69	70
Chicod	91	93	88	84
Grifton Ball Field	<28	<28	<31	<32
La Grange	<33	42	45	39
Spring Creek Elem Sch	-	-	<31	<32
Cove City	463	405	388	387
Clarks	2790	1735	2058	2297
Beaver Creek	<33	<28	-	-
Calypso-4	-	-	<30	<32
Calypso-2	-	-	<30	<32
Jones Middle Sch	239	245	235	219
Pink Hill	-	<28	<31	<32
Comfort	498	537	597	599
Rose Hill	-	<28	<31	<32
Six Runs	<33	<28	<31	<31
Chinquapin	<33	<28	<31	<32
Lake Waccamaw	54	100	45	52
Clarendon	134	202	108	100
Nakina	1344	1153	1218	1283

Figure 5

NCDWR - Ground Water Management Branch
Chloride Levels in the Cretaceous Upper Cape Fear Aquifer
2018 Annual Report

NOTE: This map is for informational purposes only. It does not authorize any party to enter onto any lands depicted herein.



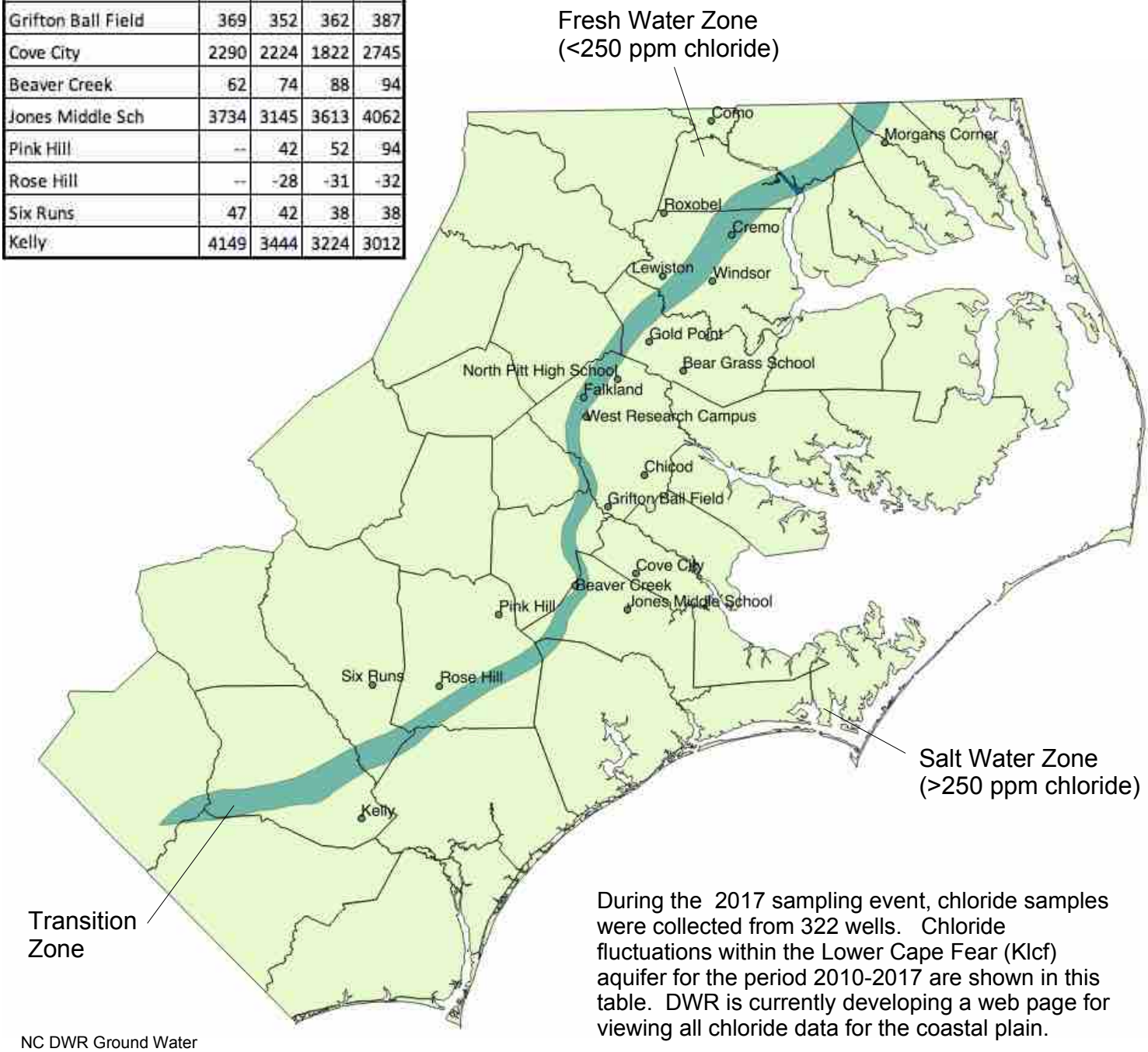
During the 2017 sampling event, chloride samples were collected from 322 wells. Chloride fluctuations within the Upper Cape Fear (Kucf) aquifer for the period 2010-2017 are shown in this table.

MONITORING STATION	2010	2012	2015	2017
	CHLORIDES (mg/l)			
Como	90	93	88	90
Morgans Corner	5096	5095	3853	3662
Roxobel	-33	28	-31	26
Cremo	174	126	132	137
Lewiston	40	35	-31	-26
Windsor	--	1220	430	449
Gold Point	868	892	791	781
Bear Grass Sch	1023	2420	655	1283
North Pitt High Sch	798	758	655	645
Falkland	239	227	201	-32
West Research Campus	463	327	144	415
Chicod	814	758	430	781
Grifton Ball Field	369	352	362	387
Cove City	2290	2224	1822	2745
Beaver Creek	62	74	88	94
Jones Middle Sch	3734	3145	3613	4062
Pink Hill	--	42	52	94
Rose Hill	--	-28	-31	-32
Six Runs	47	42	38	38
Kelly	4149	3444	3224	3012

Figure 6

NCDWR - Ground Water Management Branch
Chloride Levels in the Cretaceous Lower Cape Fear Aquifer
2018 Annual Report

<u>NOTE</u>: This map is for informational purposes only. It does not authorize any party to enter onto any lands depicted herein.



During the 2017 sampling event, chloride samples were collected from 322 wells. Chloride fluctuations within the Lower Cape Fear (Klcf) aquifer for the period 2010-2017 are shown in this table. DWR is currently developing a web page for viewing all chloride data for the coastal plain.

Figure 7

NCDWR - Ground Water Management Branch
Site Map of Orange Well Net Cooperative Monitoring Well Network, Orange Co., NC
2018 Annual Report

NOTE: This map is for informational purposes only. It does not authorize any party to enter onto any lands depicted herein.

N

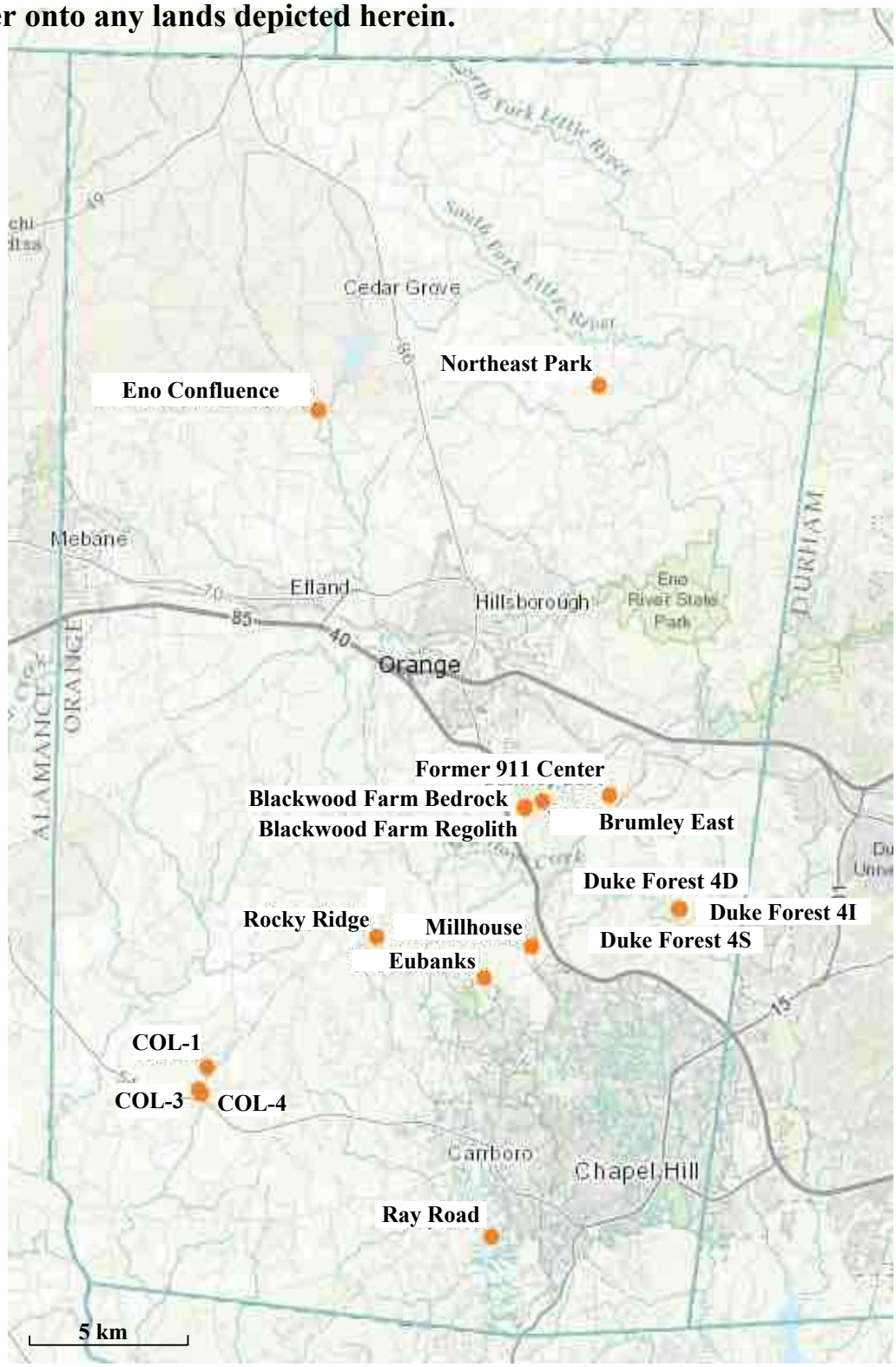


Figure 8

NCDWR - Ground Water Management Branch
Site Map of Guilford County Cooperative Monitoring Well Network, Guilford Co., NC
2018 Annual Report

<u>NOTE</u>: This map is for informational purposes only. It does not authorize any party to enter onto any lands depicted herein.

N

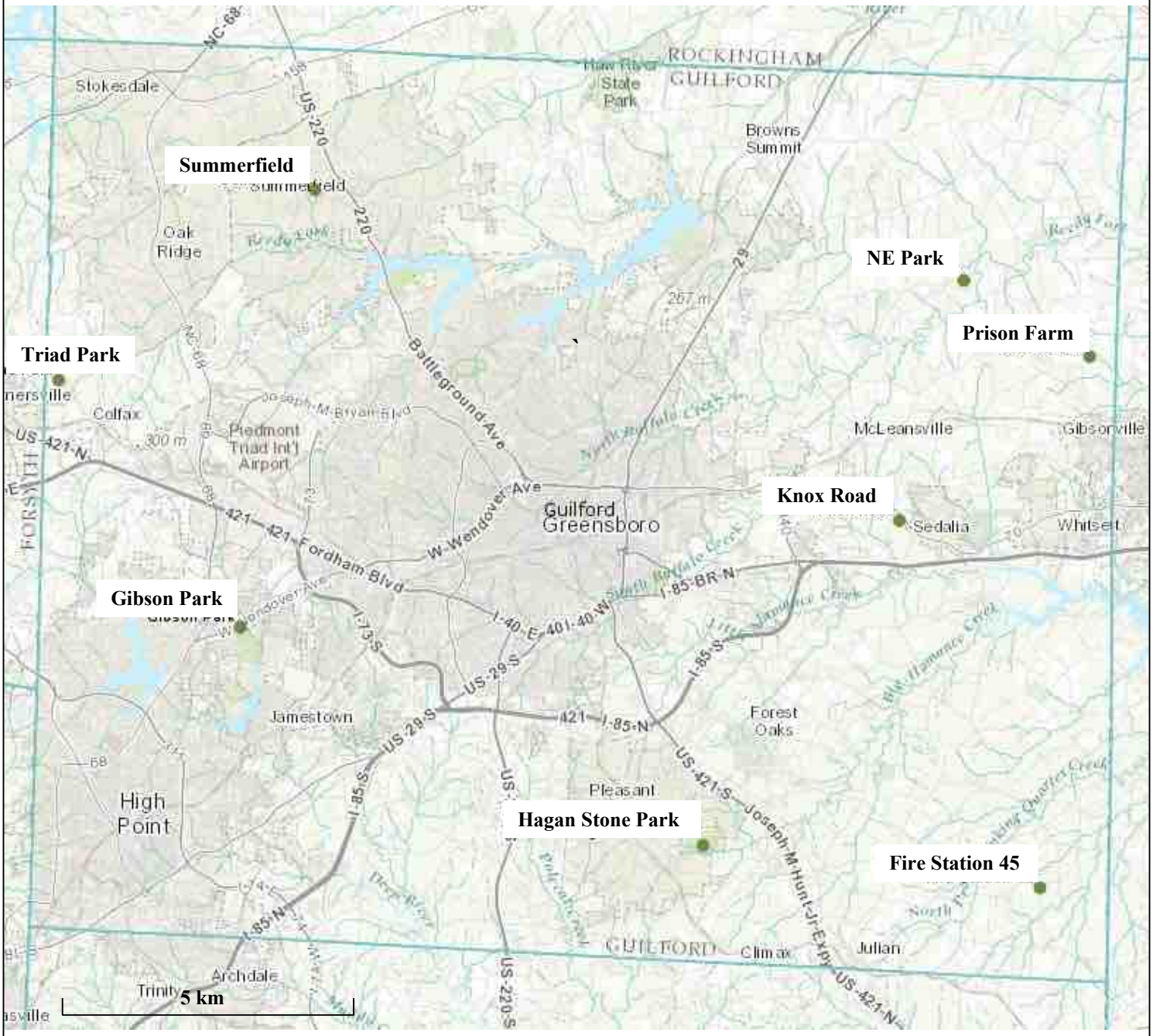
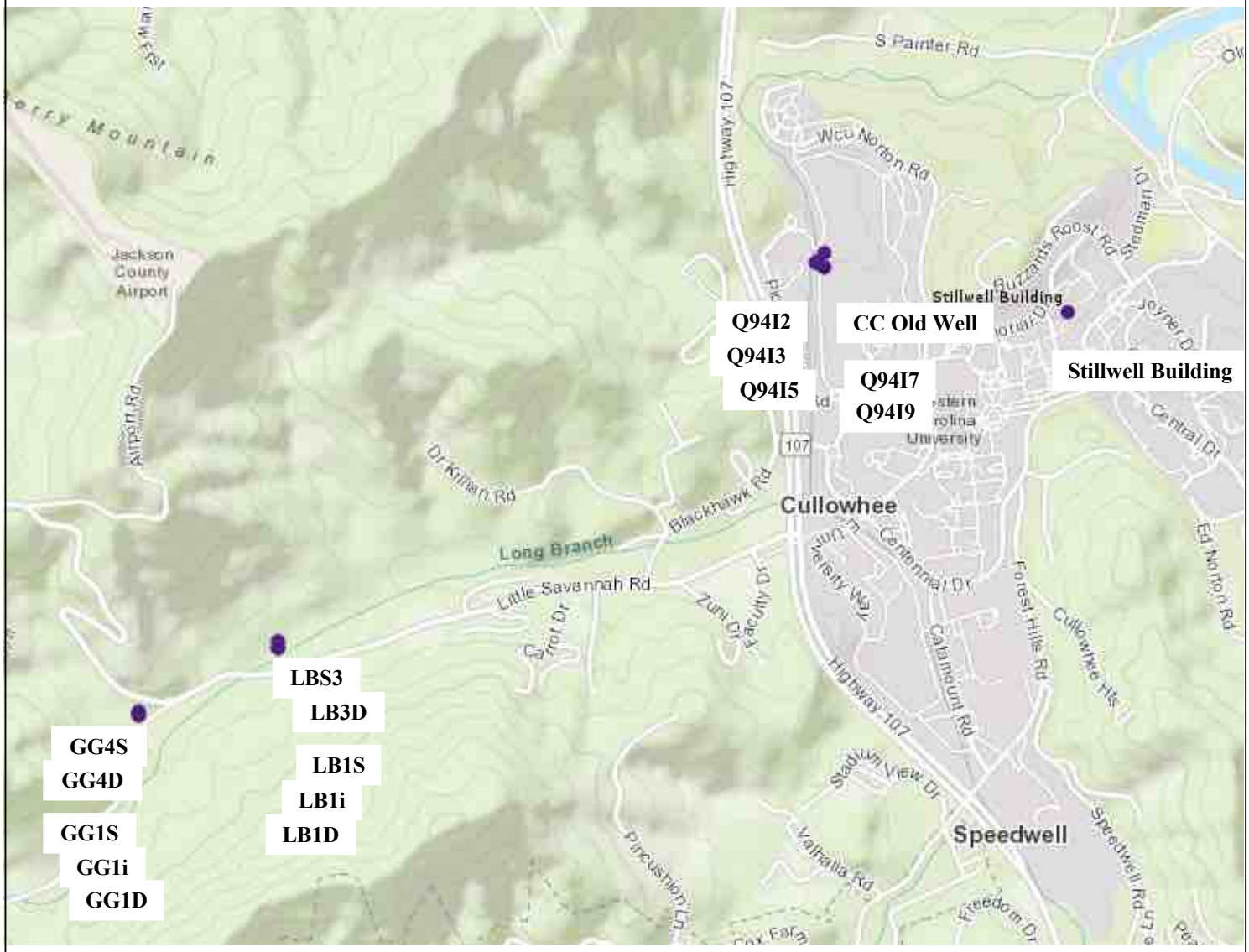


Figure 9

NCDWR - Ground Water Management Branch
Site Map of Western Carolina Hydrological Research Station Cooperative Monitoring Well Network, Jackson County, NC
2018 Annual Report

N

NOTE: This map is for informational purposes only. It does not authorize any party to enter onto any lands depicted herein.



TABLES

TABLE 1
Site Susceptibility Rating
North Carolina Division of Water Resources
Ground Water Management Branch
2019 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 as of 6/30/2019
North Carolina Division of Water Resources
Ground Water Management Branch
2019 Annual Report

Region	Parameter	Number	% of Region	% of Network
	Wells	145		21.6
1	Sites	54		23.7
	Hobo	132	91.0	19.6
	Solinst	4		
	Wells	167		24.9
2	Sites	39		17.1
	Hobo	149	89.2	22.2
	Solinst	1		
	Wells	14		2.1
3	Sites	14		6.1
	Hobo	11	78.6	1.6
	Solinst	1		
	Wells	163		24.3
4	Sites	48		24.1
	Hobo	107	65.6	15.9
	Solinst	0		
	Wells	98		14.6
5	Sites	48		21.1
	Hobo	83	84.7	12.4
	Solinst	10		
	Wells	85		12.6
6	Sites	25		11
	Hobo	74	87.1	11
	Solinst	0		

These are counts of the number of wells which have at least one recorder of the stated variety. These numbers do not 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. In addition, Solinst recorders are always installed on wells with Hobos, so the number of Solinst recorders does not increase the total number of wells with recorders.

TABLE 3
Solinst Telemetry System (STS) Distribution by Region as of 6/30/2019
North Carolina Division of Water Resources
Ground Water Management Branch
2019 Annual Report

Region	Station Name	Well Number	Date Installed
1	Como	B 20U8	10/14/2014
1	Lewiston	H 22I3	06/20/2013
1	Manteo Airport	I 4W5	06/04/2014
1	Bunn	I 35K2	10/20/2016
2	Topsail Beach	BB 28J5	06/12/2014
3	Bryson City	O 97W2	02/18/2014
5	Clarendon	DD 42N1	04/24/2014
5	Rowland	Z 47R5	04/24/2014
5	Laurel Springs	C 71U1	10/11/2016
5	Gibsonville	G 50W2	09/26/2016
5	Wilkesboro	G 69J1	11/22/2016
5	Troutman	L 67U2	8/27/2014
5	NC Zoo	M 53L1	06/19/2014
5	Hornets Nest	Q 66C1	10/07/2014
5	Columbus	R 82I1	02/19/2014
5	Monroe	U 62A1	07/02/2014

TABLE 4
Monitoring Well Network Statistics (1/1/2005 through 6/30/2019)
North Carolina Division of Water Resources
Ground Water Management Branch
2019 Annual Report

Parameter	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number of monitored wells	537	538	550	559	568	579	591	605	626	637
Manual water levels (tapedowns)	2,606	2,719	2,599	2,463	2,556	2,965	2,624	2,952	3,265	2703
Daily water levels (automatic recorders	89,088	92,038	93,145	105,708	120,694	131,317	136,208	150,912	172,111	176,111
Total hourly water levels	2,141,368	2,229,355	2,294,909	2,593,630	2,961,371	3,163,188	3,276,496	3,622,891	4,128,993	4,225,684
Chloride Samples	17	22	175	12	17	251	21	274	13	10
Geophysical & lithologic logs at new stations	2	1	3	1	1	0	2	1	1	1

TABLE 4 (continued)
Monitoring Well Network Statistics (01-01-2005 through 06-30-2019)
North Carolina Division of Water Resources
Ground Water Management Branch
2019 Annual Report

Parameter	2015	2016	2017	2018	2019
Number of monitored wells	651	655	667	671	678
Manual water levels (tapedowns)	3,141	2,996	3,477	3,890	1,887
Daily water levels (automatic recorders	182,907	189,302	185,558	192,502	69,943
Total hourly water levels	4,389,822	4,542,068	4,447,347	4,618,783	1,669,171
Chloride Samples	270	31	358	14	3
Geophysical & lithologic logs at new stations	2	2	3	1	3

TABLE 5
Well Construction Information for New Well Installation and Acquired Wells for the 2019 FY
North Carolina Division of Water Resources
Ground Water Management Branch
2019 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 Date Measured (from MP) (ft)
U 35I1		03/12/2019	4	42	30-40		NDY	14.05 (05/22/2019)
U 35I2		03/22/2019	4	483	470-480		NDY	118.20 (05/22/2019)
U 35I3	Clinton	04/04/2019	4	390	376-386		NDY	119.17 (05/22/2019)
U 35I4		04/09/2019	4	112	93-103		NDY	47.80 (05/22/2019)
U 35I5		04/16/2019	4	291	274-284		NDY	115.62 (05/22/2019)
U 35I6		04/24/2019	4	190	175-185		NDY	58.30 (05/22/2019)
AA 27L1		05/02/2019	4	50	35-45	3.50	NDY	31.70 (06/17/2019)
AA 27L2	Topsail Fire Tower	05/06/2019	4	95	81-91	3.40	NDY	36.16 (06/17/2019)
AA 27L3		05/16/2019	4	502	488-468	3.35	NDY	38.69 (06/17/2019)
AA 27L4		05/23/2019	4	258	243-253	3.02	NDY	36.70 (06/17/2019)
C 16S1		06/14/2019	4		445-455	-	-	-
C 16S2	Merchants Millpond	06/26/2019	4		235-245			
Well Construction Information for Wells Acquired in the 2019 FY								
K 40M1	Powell Drive	01/01/1952	6	133.5	97-133.5	0.80	Br	22.08 (04/25/2019)

NDY – Not Determined Yet
**Water Levels Reported from the Most Recent Date Water Level Collected (2019 FY)

TABLE 6
Well Development/Water Quality Purging Information for 2019 FY
North Carolina Division of Water Resources
Ground Water Management Branch
2019 Annual Report

Well ID	Station Name	Date Developed
P 18V3	Bonnerton	10/15/2018 - 10/16/2018
P 18V4	Bonnerton	10/15/2018 - 10/16/2018
P 18V5	Bonnerton	10/15/2018 - 10/16/2018
P 18V6	Bonnerton	10/15/2018 - 10/16/2018
P 18V7	Bonnerton	10/15/2018 - 10/17/2018
P 18V8	Bonnerton	10/15/2018 - 10/17/2018
M 12L1	New Lake	12/12/2018
M 12L3	New Lake	12/12/2018
M 12L4	New Lake	12/12/2018
M 12L5	New Lake	12/12/2018
M 12L6	New Lake	12/12/2018
Q 16G3	Godley	1/8/2016
Q 16G4	Godley	1/8/2016
Q 16G7	Godley	1/16/2019
Q 16G8	Godley	1/16/2019
P 21K3	Wilmar	1/23/2019
P 21K4	Wilmar	1/23/2019
P 21K5	Wilmar	1/23/2019
P 21K6	Wilmar	1/23/2019
P 21K7	Wilmar	1/23/2019
P 21K9	Wilmar	1/23/2019
P 17E1	Whitley Farms	3/19/2019
P17E2	Whitley Farms	3/19/2019
P 17E3	Whitley Farms	3/19/2019
P 17E5	Whitley Farms	3/19/2019

TABLE 6 (continued)
Well Development/Water Quality Purging Information for 2019 FY
North Carolina Division of Water Resources
Ground Water Management Branch
2019 Annual Report

Well ID	Station Name	Date Developed
O 10W2	Hydeland	3/28/2019
O 10W3	Hydeland	3/28/2019
Q 15U3	Hobucken	4/4/2019
Q 15U5	Hobucken	4/4/2019
Q 15U7	Hobucken	4/4/2019
U 26J1	Comfort	4/11/2019
U 26J4	Comfort	4/11/2019
U 26J5	Comfort	4/11/2019
U 26J9	Comfort	4/11/2019
U 26J10	Comfort	4/11/2019
U 35I1	Clinton	5/15/2019-5/16/2019
U 35I2	Clinton	5/15/2019-5/16/2019
U 35I3	Clinton	5/15/2019-5/16/2019
U 35I4	Clinton	5/15/2019-5/16/2019
U 35I5	Clinton	5/15/2019-5/16/2019
U 35I6	Clinton	5/15/2019-5/16/2019
AA 27L1	Topsail Fire Tower	6/11/2019-6/12/2019
AA 27L2	Topsail Fire Tower	6/11/2019-6/12/2019
AA 27L3	Topsail Fire Tower	6/11/2019-6/12/2019
AA 27L4	Topsail Fire Tower	6/11/2019-6/12/2019

TABLE 7
Automatic Water Level Recorders as of 6/30/2019
North Carolina Division of Water Resources
Ground Water Management Branch
2019 Annual Report

Recorder Type	Number in Service*
HOBO U20 Water Level Logger (including separate barometer per station installed	755 (includes 197 barometers)
Solinst Telemetry System (STS)	32 (includes 16 barologgers and 16 leveloggers)

***As of June 30, 2019**

Note: Due to the large number of recorders deployed 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 8
Orange Well Net Monitoring Well Information
Orange County, NC
North Carolina Division of Water Resources
Ground Water Management Branch
2019 Annual Report

Quad	Well Name	Total Depth (ft bgs)	Casing Depth (ft bgs)	Land Surface (ft)	Aquifer	Geology
G 44G1	Northeast Park NES	45	15	622	Bs	Epiclastics
G 45F1	Eno Confluence Property	192	37	611	Br	Felsic Tuff
H 44P1	Blackwood Farm Bedrock	302	100	556	Br	Felsic Lavas and Tuffs (Dacite)
H 44P2	Former 911 Center	400	85	581	Br	Altered Tuff
H 44P3	Blackwood Farm Regolith	45	15	556	Bs	Felsic Lavas and Tuffs (Dacite)
H 44R1	Brumley East	605	108	562.39	Br	Mafic Lavas and Tuffs
I 44B1	Duke Forest DF-4D	397.09	82.1	424.91	Br	Felsic Plutonics
I 44B2	Duke Forest DF-4S	25	15	428.81	Bs	Felsic Plutonics
I 44B3	Duke Forest DF-4I	41	26	426.77	Br	Felsic Plutonics
I 44F1	Millhouse Road	166	67	517	Br	Epiclastics
I 45G1	Rocky Ridge	Removed from network in 2012				
I 45J1	Eubanks Road	141	33	525		
I 46R1	Andrews Rd. (COL-1)	30	10	514	Bs	Felsic Tuff
I 46R2	Hwy 54 (COL-3)	40.5	25	516	Bs	Epiclastics
I 46W1	Orange Grove Rd (COL-4)	32	17	502	Bs	Epiclastics
J 45J1	Ray Road	Removed from network in 2012				

bgs – below ground surface
** Estimated Elevation

TABLE 9
Orange Well Net Network Statistics (2008 through 06-30-2019)
North Carolina Division of Water Resources
Ground Water Management Branch
2019 Annual Report

Parameter	2008	2009	2010	2011	2012	2013	2014	2015
Manual water levels (tapedowns)	3	18	49	68	59	54	52	75
Daily water levels (automatic recorders	-	-	1,612	2,783	3,095	3,281	3,468	4,286
Total hourly water levels	-	-	38,802	66,689	74,065	78,636	83,090	102,643

TABLE 9 (continued)
Orange Well Net Network Statistics (2008 through 06-30-2019)
North Carolina Division of Water Resources
Ground Water Management Branch
2019 Annual Report

Parameter	2016	2017	2018	2019
Manual water levels (tapedowns)	71	80	65	25
Daily water levels (automatic recorders	5,096	4,865	4,745	1,935
Total hourly water levels	121,985	116,515	113,560	46,262

TABLE 10
Guilford County Monitoring Well Information
North Carolina Division of Water Resources
Ground Water Management Branch
2019 Annual Report

Quad	Station Name	Date Installed	Well Diameter (inches)	Well Depth (ft)	Casing Depth (ft)	Land Surface (ft)	Aquifer	City
F 54O1	Summerfield (Jack Dent Park)	10/2/02	6.25	103	81	858.5	Br	Summerfield
G 50H1	Prison Farm	5/14/04	6.25	120	45	685	Br	Gibsonville
G 51B1	Northeast Park	6/24/15	6.125	100	77	683	Br	Gibsonville
G 56L1	Triad Park	10/9/02	6.25	140	0	925	Br	Colfax
H 51D1	Knox Road	10/9/02	-	-	39	715	Br	McLeansville
H 55L1	Gibson Park	4/15/03	6.25	205	79	813	Br	Jamestown
I 50P1	Station 45 (Humble Road)	12/15/04	6.25	180	124	679.5	Br	Liberty
I 52N1	Hagan Stone Park	05/17/03	6.125	100	52	755	Br	Pleasant Garden

TABLE 11
Guilford County Monitoring Well Network Statistics (2005 through 06-30-2019)
North Carolina Division of Water Resources
Ground Water Management Branch
2019 Annual Report

Parameter	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Manual water levels (tapedowns)	-	28	14	28	35	77	77	56	63	49
Daily water levels (automatic recorders	2,106	1,884	1,922	1,892	2,000	2,592	2,561	2,474	2,585	2,562
Total hourly water levels	-	-	-	-	-	3	-	-	-	-

TABLE 11 (continued)
Guilford County Monitoring Well Network Statistics (2005 through 06-30-2019)
North Carolina Division of Water Resources
Ground Water Management Branch
2019 Annual Report

Parameter	2015	2016	2017	2018	2019
Manual water levels (tapedowns)	69	71	72	55	32
Daily water levels (automatic recorders)	2,592	941	432	134	258
Total hourly water levels	36,415	22,636	10,379	3,216	13,349

TABLE 12
Western Carolina Hydrological Research Station Network
Monitoring Well Information
North Carolina Division of Water Resources
Ground Water Management Branch
2019 Annual Report

Quad	Station Name	Date Installed	Well Depth (meters)	Casing Depth (meters)	Screen (meters)	MP (meters above land surface)	Land Surface (NED Elevation) (meters)	Geology	Aquifer
Q 94H1	GG1S	11/30/2009	2.41	0.88	0.88-2.4	1.02	683.26	colluvium/saprolite	Bs
Q 94H2	GG1i	11/30/2009	4.42	3.81	3.81-4.42	0.99	683.26	saprolite	Bs
Q 94H3	GG1D	11/30/2009	7.56	6.95	6.95-7.56	0.97	683.26	saprolite	Bs
Q 94H11	GG4S	11/30/2009	2.83	1.31	1.31-2.83	0.89	682.93	colluvium/saprolite	Bs
Q 94H13	GG4D	11/30/1999	7.80	7.19	7.19-7.8	1.01	682.93	saprolite	Bs
Q 94H14	LB3S	11/30/1999	2.65	1.13	1.13-2.65	1.02	667.35	colluvium/saprolite	Bs
Q 94H16	LB3D	11/30/2009	5.43	4.82	4.82-5.43	1.05	667.35	saprolite	Bs
Q 94H22	LB1S	11/30/2009	2.47	0.94	0.94-2.46	1.00	667.15	colluvium/saprolite	Bs
Q 94H23	LB1i	11/30/1999	3.87	3.26	3.26-3.87	1.00	667.15	saprolite	Bs
Q 94H24	LB1D	11/30/1999	5.67	5.06	5.06-5.67	0.96	667.15	saprolite	Bs
Q 94I1	CC Old Well	11/22/2004	6.28	0.30	0.30-6.40	0.82	634.00	saprolite	Bs
Q 94I2	CC1S	11/30/2009	2.53	1.01	1.01-2.53	1.01	633.07	alluvium/saprolite	Bs
Q 94I3	CC1i	11/30/1999	3.29	2.99	2.99-3.29	1.05	633.07	saprolite	Bs
Q 94I5	CC1D	11/30/1999	5.64	5.33	5.33-5.63	1.02	633.07	saprolite	Bs
Q 94I7	CC2S	11/30/1999	2.68	1.16	1.16-2.68	0.98	634.15	alluvium/saprolite	Bs
Q 94I9	CC2D	11/30/2009	6.31	5.70	5.70-6.31	0.99	634.15	saprolite	Bs
Q 94J1	Stillwell Building	-	61.27	25.91	25.91-61.27	0.65	655.45	-	Br

Note: All monitoring wells are located in Jackson County, NC

TABLE 13
Western Carolina Hydrological Research Station Network Statistics (2011 through 06-30-2019)
North Carolina Division of Water Resources
Ground Water Management Branch
2019 Annual Report

Parameter	2011	2012	2013	2014	2015	2016	2017	2018	2019
Manual water levels (tapedowns)	238	628	661	469	422	486	662	285	-

TABLE 14
Network Expansion 2020 FY
North Carolina Division of Water Resources
Ground Water Management Branch
2019 Annual Report

Proposed Station	County	Proposed Well Screens (ft bls)	Aquifer
		20-30	Surficial
Near Intersection of		41-51	Black Creek
US Hwy 421 and US Hwy 13	Sampson	168-178	Upper Cape Fear
		347	Pilot Hole (Estimated top of basement)
		20-30	Surficial
Near	Sampson	58-68	Black Creek
Salemburg		129-139	Upper Cape Fear
		368	Pilot Hole (Top of Basement)
Wellfield 258	Onslow	720-730	Black Creek
Replacement Wells		824-834	Upper Cape Fear
		20-30	Surficial
		41-51	Castle Hayne
Chinquapin Station	Duplin	165-175	Peedee
Replacement		212-222	Black Creek
		444-454	Upper Cape Fear
		618-628	Lower Cape Fear
		785	Pilot Hole (Estimated top of basement)

Table 15
Summary of Field Parameters 2019 FY
(Measured using a YSI ProDSS meters)
North Carolina Division of Water Resources
Ground Water Management Branch
2019 Annual Report

Well	Station Name	County	Date	Temp ^{0}C	Conductivity (µS/cm)	DO (ppmv or mg/L)	pH	Salinity (ppt)
P 16O2	Southside Ferry	Beaufort	06/26/2019	24.2	955	0.22	7.56	0.47
P 16O3	Southside Ferry	Beaufort	06/26/2019	20.8	2143	0.22	7.11	1.10
P 16O4	Southside Ferry	Beaufort	06/26/2019	20.0	1000	0.34	6.97	0.50
M 30L1	Stantonsburg	Wilson	06/20/2019	21.0	162.2	0.28	5.40	0.06
M 30L3	Stantonsburg	Wilson	06/20/2019	21.7	318.8	0.23	7.01	0.15
M 30L4	Stantonsburg	Wilson	06/20/2019	23.7	443.3	1.38	7.27	0.21
AA 27L1	Topsail Fire Tower	Pender	06/13/2019	24.3	74.5	0.38	4.86	0.03
AA 27L2	Topsail Fire Tower	Pender	06/13/2019	19	417.9	0.15	6.91	0.2
AA 27L3	Topsail Fire Tower	Pender	06/13/2019	26.5	3272	0.2	7.83	1.7
AA 27L4	Topsail Fire Tower	Pender	06/13/2019	19.5	591	0.17	7.19	0.29
U 35I3	Clinton	Sampson	06/04/2019	20.3	239.6	0.23	7.35	0.11
U 35I4	Clinton	Sampson	06/04/2019	19.2	53.5	0.28	5.08	0.02
U 35I5	Clinton	Sampson	06/04/2019	20	143.6	0.24	6.82	0.07
U 35I1	Clinton	Sampson	05/29/2019	23.5	91.6	4.73	4.91	0.04
U 35I2	Clinton	Sampson	05/29/2019	25.8	422.1	0.06	7.6	0.2
U 35I6	Clinton	Sampson	05/29/2019	21.5	69.4	0.22	5.83	0.03
N 22Y1	Blackjack	Pitt	05/16/2019	17.5	354.5	0.19	7.7	0.17
N 25Q2	Winterville	Pitt	05/16/2019	17.7	361.1	0.32	7.45	0.17
P 21G1	Wilmar Fire Tower	Craven	05/08/2019	18.3	385.9	0.3	7.2	0.19
O 21Q1	Highway 102	Beaufort	05/02/2019	17.5	508	0.16	6.97	0.25
O 21Q2	Highway 102	Beaufort	05/02/2019	16.2	273.7	0.27	5.96	0.13
O 21Q3	Highway 102	Beaufort	05/02/2019	20.0	139.4	0.34	6.29	0.07

Table 15 (continued)
TABLE 15
Summary of Field Parameters 2019 FY
(Measured using a YSI ProDSS meters)
North Carolina Division of Water Resources
Ground Water Management Branch
2019 Annual Report

Well	Station Name	County	Date	Temp ^{0}C	Conductivity (µS/cm)	DO (ppmv or mg/L)	pH	Salinity (ppt)
U 26J4	Comfort	Jones	05/01/2019	20.8	505	0.12	9.16	0.24
U 26J5	Comfort	Jones	05/01/2019	23.1	472.5	0.06	7.87	0.23
O 22V6	Creeping Swamp	Pitt	04/24/2019	19.8	427.2	0.35	7.07	0.21
O 22V7	Creeping Swamp	Pitt	04/24/2019	18.9	183.5	0.2	6.51	0.09
U 26J1	Comfort	Jones	04/11/2019	18.3	361.1	0.27	7.17	0.17
U 26J3	Comfort	Jones	04/11/2019	16.7	341.8	0.27	5.57	0.16
U 26J9	Comfort	Jones	04/11/2019	19	499.7	0.25	7.21	0.24
U 26J10	Comfort	Jones	04/11/2019	21	2876	0.32	8.05	1.5
Q 15U3	Hobucken	Pamlico	04/04/2019	19.2	827	0.18	7.95	0.41
Q 15U5	Hobucken	Pamlico	04/04/2019	20.3	4660	- (issue with pump)	7.62	2.5
Q 15U6	Hobucken	Pamlico	04/04/2019	18.1	598	0.14	6.89	0.29
Q 15U7	Hobucken	Pamlico	04/04/2019	21.2	42837	0.21	6.86	27.6
Q 15U8	Hobucken	Pamlico	04/04/2019	16.3	680	0.52	6.82	0.33
L 16A1	TL Harris	Washington	04/03/2019	16.6	448.9	0.38	8.95	0.22
O 10W3	Hydeland	Hyde	03/28/2019	17.8	5351	0.24	8.98	2.9
O 10W6	Hydeland	Hyde	03/28/2019	15.9	8054	0.2	6.22	4.49
P 17E1	Whitley Farms	Beaufort	03/19/2019	17.5	467.1	0.32	7.32	0.23
P 17E2	Whitley Farms	Beaufort	03/19/2019	18.3	560	0.2	6.99	0.27
P 17E3	Whitley Farms	Beaufort	03/19/2019	15.1	89.7	0.78	8.43	0.04
P 17E5	Whitley Farms	Beaufort	03/19/2019	15.1	383.5	0.96	5	0.18
P 22F6	Calico	Pitt	03/14/2019	19.4	278.8	0.15	7.04	0.13
P 22F7	Calico	Pitt	03/14/2019	19.3	375	0.52	7.16	0.18

Table 15 (continued)
Summary of Field Parameters 2019 FY
(Measured using a YSI ProDSS meters)
North Carolina Division of Water Resources
Ground Water Management Branch
2019 Annual Report

Well	Station Name	County	Date	Temp ^{0}C	Conductivity (µS/cm)	DO (ppmv or mg/L)	pH	Salinity (ppt)
O 30J1	Saulston	Wayne	02/28/2019	17.1	86.7	0.17	5.88	0.04
O 30J2	Saulston	Wayne	02/28/2019	17.5	144.3	0.43	7.09	0.07
O 30J3	Saulston	Wayne	02/28/2019	18.3	452.9	2.94	11.13	0.22
P 21K3	Wilmar	Beaufort	01/29/2019	15.4	132.4	0.22	5.89	0.06
P 21K9	Wilmar	Beaufort	01/29/2019	17.9	1884	0.04	9.01	0.96
P 21K5	Wilmar	Beaufort	01/23/2019	19.7	2300	0.17	8.4	1.18
P 21K6	Wilmar	Beaufort	01/23/2019	16.8	399	0.41	7.16	0.19
P 21K7	Wilmar	Beaufort	01/23/2019	17.5	621	0.3	7.29	0.3
Q 16G8	Godley	Beaufort	01/16/2019	18.9	746	0.2	7.32	0.37
Q 16G3	Godley	Beaufort	01/08/2019	18.7	615	0.26	7.23	0.3
Q 16G4	Godley	Beaufort	01/08/2019	19.3	1538	0.22	7.38	0.78
Q 16G5	Godley	Beaufort	01/08/2019	17.4	654	0.19	6.83	0.32
Q 16G6	Godley	Beaufort	01/08/2019	16	822	0.31	7.39	0.41
K 21R2	Bear Grass School	Martin	12/19/2018	18.8	356.7	0.42	7.55	0.17

Table 15 (continued)
Summary of Field Parameters 2019 FY
(Measured using a YSI ProDSS meters)
North Carolina Division of Water Resources
Ground Water Management Branch
2019 Annual Report

Well	Station Name	County	Date	Temp ^{0}C	Conductivity (µS/cm)	DO (ppmv or mg/L)	pH	Salinity (ppt)
M 12L3	New Lake	Hyde	12/18/2018	18.9	37166	0.18	7.48	23.6
M 12L6	New Lake	Hyde	12/18/2018	16.2	754	0.04	7.7	0.37
M 12L1	New Lake	Hyde	12/12/2018	17.9	2956	0.14	7.67	1.55
M 12L2	New Lake	Hyde	12/12/2018	13.2	133.9	0.18	3.75	0.06
M 12L4	New Lake	Hyde	12/12/2018	18.4	16884	0.34	7.38	9.96
M 12L5	New Lake	Hyde	12/12/2018	17	724	0.07	7.01	0.36
O 23L4	Chicod	Pitt	12/05/2018	17.8	584	0.8	8.2	0.28
O 23L5	Chicod	Pitt	12/05/2018	16.6	553	0.34	8.07	0.27
O 23L3	Chicod	Pitt	12/04/2018	18.7	814	0.11	8.2	0.4
O 23L8	Chicod	Pitt	12/04/2018	20.9	3895	0.05	7.92	2.07
M 25F4	Western Research Campus	Pitt	11/09/2018	18.4	365.8	0.12	7.66	0.18
P 19M2	Cox Crossroads	Beaufort	10/24/2018	17.3	376.9	0.46	5.84	0.18
P 19M4	Cox Crossroads	Beaufort	10/24/2018	17.5	273.9	0.22	9.41	0.13
P 18V7	Bonnerton	Beaufort	10/24/2018	18.6	18747	0.29	7.67	11.16
P 18V8	Bonnerton	Beaufort	10/17/2018	17.9	1480	0.16	7.07	0.75
P 18V3	Bonnerton	Beaufort	10/16/2018	22.1	59.9	0.46	5.91	0.03
P 18V4	Bonnerton	Beaufort	10/16/2018	19.2	831	0.08	6.90	0.41
P 18V5	Bonnerton	Beaufort	10/16/2018	18.5	650	0.05	6.78	0.32
P 18V6	Bonnerton	Beaufort	10/16/2018	19.8	1886	0.21	6.83	0.96

Table 15 (continued)
Summary of Field Parameters 2019 FY
(Measured using a YSI ProDSS meters)
North Carolina Division of Water Resources
Ground Water Management Branch
2019 Annual Report

Well	Station Name	County	Date	Temp ^{0}C	Conductivity (µS/cm)	DO (ppmv or mg/L)	pH	Salinity (ppt)
O 23L2	Chicod	Pitt	10/10/2018	24.4	321.8	0.15	6.18	0.15
O 23L6	Chicod	Pitt	10/10/2018	19.8	390.8	0.14	7.41	0.19
O 23L7	Chicod	Pitt	10/10/2018	18.2	404.5	0.28	7.94	0.19
M 27U7	Farmville	Pitt	10/04/2018	22.8	161.5	0.21	6.26	0.08
M 27U8	Farmville	Pitt	10/04/2018	18.7	278.6	0.1	7.05	0.13
O 28K3	Snow Hill	Greene	09/11/2018	19.8	677	0.25	7.84	0.33
O 28K4	Snow Hill	Greene	09/11/2018	18.7	125.4	0.17	7.03	0.06
O 28K5	Snow Hill	Greene	09/05/2018	19	100.3	0.25	6.6	0.05
O 28K6	Snow Hill	Greene	09/05/2018	23.1	281.9	0.19	6.13	0.13
M 38Q1	Cleveland	Johnston	08/22/2018	20.4	164.7	1.24	5.81	0.08
L 25P4	Falkland	Pitt	08/16/2018	18.6	323.8	0.17	6.98	0.15
L 25P5	Falkland	Pitt	08/16/2018	23.1	92.8	1.9	4.77	0.04
L 25P1	Falkland	Pitt	08/15/2018	19.1	2045	0.04	8.07	1.05
L 25P2	Falkland	Pitt	08/15/2018	17.3	288.4	0.3	6.79	0.14
L 25P3	Falkland	Pitt	08/15/2018	17.2	343.8	0.22	7.39	0.17
K 26M3	Old Sparta	Edgecombe	07/18/2018	21.9	30.4	3.16	4.9	0.01
K 26M1	Old Sparta	Edgecombe	07/17/2018	20	594	0.09	7.5	0.29
K 26M2	Old Sparta	Edgecombe	07/17/2018	18.4	237.7	0.14	6.9	0.11

APPENDICES

APPENDIX A

WELL CONSTRUCTION RECORDS

CLINTON MONITORING STATION
U 35I1, U 35I2, U 35I3, U 35I4, U 35I5, U 35I6

Print Form

WELL CONSTRUCTION RECORD (GW-1)

For Internal Use Only:

1. Well Contractor Information:

Jeovanny Bautista
Well Contractor Name

4125 A
NC Well Contractor Certification Number

AC Schultes of Carolina, Inc.
Company Name

2. Well Construction Permit #: _____
List all applicable well construction permits (i.e. UIC, County, State, Variance, etc.)

3. Well Use (check well use):

Water Supply Well:
- ☐ Agricultural
- ☐ Geothermal (Heating/Cooling Supply)
- ☐ Industrial/Commercial
- ☐ Irrigation
- ☐ Municipal/Public
- ☐ Residential Water Supply (single)
- ☐ Residential Water Supply (shared)

Non-Water Supply Well:
- ☑ Monitoring
- ☐ Recovery

Injection Well:
- ☐ Aquifer Recharge
- ☐ Aquifer Storage and Recovery
- ☐ Aquifer Test
- ☐ Experimental Technology
- ☐ Geothermal (Closed Loop)
- ☐ Geothermal (Heating/Cooling Return)
- ☐ Groundwater Remediation
- ☐ Salinity Barrier
- ☐ Stormwater Drainage
- ☐ Subsidence Control
- ☐ Tracer
- ☐ Other (explain under #21 Remarks)

4. Date Well(s) Completed: 3/12/19 **Well ID#** U35I1

5a. Well Location:

NCDEQ — Facility/Owner Name
Clinton City WTP — Facility ID# (if applicable)
900 Clive Jacobs Rd Clinton, NC — Physical Address, City, and Zip
Sampson — County
12050020001 — Parcel Identification No. (PIN)

5b. Latitude and longitude in degrees/minutes/seconds or decimal degrees:
(if well field, one lat/long is sufficient)
34.981452 N -78.281327 W

6. Is(are) the well(s): ☑ **Permanent** or ☐ **Temporary**

7. Is this a repair to an existing well: ☐ **Yes** or ☑ **No**
If this is a repair, fill out known well construction information and explain the nature of the repair under #21 remarks section or on the back of this form.

8. For Geoprobe/DPT or Closed-Loop Geothermal Wells having the same construction, only 1 GW-1 is needed. Indicate TOTAL NUMBER of wells drilled: _____

9. Total well depth below land surface: 42 (ft.)
For multiple wells list all depths if different (example- 3@200' and 2@100')

10. Static water level below top of casing: 12.15 (ft.)
If water level is above casing, use "-"

11. Borehole diameter: 9 7/8 (in.)

12. Well construction method: Mud Rotary
(i.e. auger, rotary, cable, direct push, etc.)

FOR WATER SUPPLY WELLS ONLY:

13a. Yield (gpm) _____ **Method of test:** _____

13b. Disinfection type: _____ **Amount:** _____

14. WATER ZONES

FROM	TO	DESCRIPTION
30 ft.	40 ft.	sand
ft.	ft.	

15. OUTER CASING (for multi-cased wells) OR LINER (if applicable)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
ft.	ft.	in.		

16. INNER CASING OR TUBING (geothermal closed-loop)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
+3 ft.	30 ft.	4 in.	SDR 17	PVC
40 ft.	42 ft.	4 in.	SCH80	PVC

17. SCREEN

FROM	TO	DIAMETER	SLOT SIZE	THICKNESS	MATERIAL
30 ft.	40 ft.	4 in.	.020		SS
ft.	ft.	in.			

18. GROUT

FROM	TO	MATERIAL	EMPLACEMENT METHOD & AMOUNT
0 ft.	18 ft.	Bentonite	poured
ft.	ft.		
ft.	ft.		

19. SAND/GRAVEL PACK (if applicable)

FROM	TO	MATERIAL	EMPLACEMENT METHOD
42 ft.	18 ft.	#2 gravel	poured
ft.	ft.		

20. DRILLING LOG (attach additional sheets if necessary)

FROM	TO	DESCRIPTION (color, hardness, soil/rock type, grain size, etc.)
0 ft.	20 ft.	reddish sandy clay
20 ft.	42 ft.	reddish sand
ft.	ft.	
ft.	ft.	
ft.	ft.	
ft.	ft.	
ft.	ft.	

21. REMARKS

22. Certification:

Jeovanny Bautista — Signature of Certified Well Contractor
04/30/19 — Date

By signing this form, I hereby certify that the well(s) was (were) constructed in accordance with 15A NCAC 02C .0100 or 15A NCAC 02C .0200 Well Construction Standards and that a copy of this record has been provided to the well owner.

23. Site diagram or additional well details:
You may use the back of this page to provide additional well site details or well construction details. You may also attach additional pages if necessary.

SUBMITTAL INSTRUCTIONS

24a. For All Wells: Submit this form within 30 days of completion of well construction to the following:

Division of Water Resources, Information Processing Unit,
1617 Mail Service Center, Raleigh, NC 27699-1617

24b. For Injection Wells: In addition to sending the form to the address in 24a above, also submit one copy of this form within 30 days of completion of well construction to the following:

Division of Water Resources, Underground Injection Control Program,
1636 Mail Service Center, Raleigh, NC 27699-1636

24c. For Water Supply & Injection Wells: In addition to sending the form to the address(es) above, also submit one copy of this form within 30 days of completion of well construction to the county health department of the county where constructed.

Print Form

WELL CONSTRUCTION RECORD (GW-1)

For Internal Use Only:

1. Well Contractor Information:

Jeovanny Bautista
Well Contractor Name

4125 A
NC Well Contractor Certification Number

AC Schultes of Carolina, Inc.
Company Name

2. Well Construction Permit #: _____
List all applicable well construction permits (i.e. UIC, County, State, Variance, etc.)

3. Well Use (check well use):

Water Supply Well:
- ☐ Agricultural
- ☐ Geothermal (Heating/Cooling Supply)
- ☐ Industrial/Commercial
- ☐ Irrigation
- ☐ Municipal/Public
- ☐ Residential Water Supply (single)
- ☐ Residential Water Supply (shared)

Non-Water Supply Well:
- ☑ Monitoring
- ☐ Recovery

Injection Well:
- ☐ Aquifer Recharge
- ☐ Aquifer Storage and Recovery
- ☐ Aquifer Test
- ☐ Experimental Technology
- ☐ Geothermal (Closed Loop)
- ☐ Geothermal (Heating/Cooling Return)
- ☐ Groundwater Remediation
- ☐ Salinity Barrier
- ☐ Stormwater Drainage
- ☐ Subsidence Control
- ☐ Tracer
- ☐ Other (explain under #21 Remarks)

4. Date Well(s) Completed: 3/22/19 **Well ID#** U35I2

5a. Well Location:

NCDEQ — Facility/Owner Name
Clinton City WTP — Facility ID# (if applicable)
900 Clive Jacobs Rd Clinton, NC — Physical Address, City, and Zip
Sampson — County
12050020001 — Parcel Identification No. (PIN)

5b. Latitude and longitude in degrees/minutes/seconds or decimal degrees:
(if well field, one lat/long is sufficient)
34.981452 N -78.281327 W

6. Is(are) the well(s): ☑ Permanent or ☐ Temporary

7. Is this a repair to an existing well: ☐ Yes or ☑ No
If this is a repair, fill out known well construction information and explain the nature of the repair under #21 remarks section or on the back of this form.

8. For Geoprobe/DPT or Closed-Loop Geothermal Wells having the same construction, only 1 GW-1 is needed. Indicate TOTAL NUMBER of wells drilled: _____

9. Total well depth below land surface: 483 (ft.)
For multiple wells list all depths if different (example- 3 @ 200' and 2 @ 100')

10. Static water level below top of casing: 118.15 (ft.)
If water level is above casing, use "+"

11. Borehole diameter: 9 7/8 (in.)

12. Well construction method: Mud Rotary -Pilot Hole
(i.e. auger, rotary, cable, direct push, etc.)

FOR WATER SUPPLY WELLS ONLY:

13a. Yield (gpm) _____ **Method of test:** _____

13b. Disinfection type: _____ **Amount:** _____

14. WATER ZONES

FROM	TO	DESCRIPTION
470 ft.	480 ft.	sand
ft.	ft.	

15. OUTER CASING (for multi-cased wells) OR LINER (if applicable)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
0 ft.	46 ft.	10 in.	SCH 80	PVC

16. INNER CASING OR TUBING (geothermal closed-loop)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
+3 ft.	470 ft.	4 in.	SDR 17	PVC
480 ft.	481 ft.	4 in.	SCH80	PVC

17. SCREEN

FROM	TO	DIAMETER	SLOT SIZE	THICKNESS	MATERIAL
47(ft.	480 ft.	4 in.	.020		SS
ft.	ft.	in.			

18. GROUT

FROM	TO	MATERIAL	EMPLACEMENT METHOD & AMOUNT
0 ft.	455 ft.	Bentonite	pumped
455 ft.	457 ft.	Bentonite	poured
ft.	ft.		

19. SAND/GRAVEL PACK (if applicable)

FROM	TO	MATERIAL	EMPLACEMENT METHOD
457 ft.	483 ft.	#2 gravel	poured
ft.	ft.		

20. DRILLING LOG (attach additional sheets if necessary)

FROM	TO	DESCRIPTION (color, hardness, soil/rock type, grain size, etc.)
0 ft.	42 ft.	reddish sandy clay
42 ft.	82 ft.	clay
82 ft.	252 ft.	silty sand
252 ft.	272 ft.	clay
272 ft.	342 ft.	silty sand
342 ft.	362 ft.	clay
362 ft.	483 ft.	silty sand

21. REMARKS

22. Certification:

Jeovanny Bautista — Signature of Certified Well Contractor
04/30/19 — Date

By signing this form, I hereby certify that the well(s) was (were) constructed in accordance with 15A NCAC 02C .0100 or 15A NCAC 02C .0200 Well Construction Standards and that a copy of this record has been provided to the well owner.

23. Site diagram or additional well details:
You may use the back of this page to provide additional well site details or well construction details. You may also attach additional pages if necessary.

SUBMITTAL INSTRUCTIONS

24a. For All Wells: Submit this form within 30 days of completion of well construction to the following:

Division of Water Resources, Information Processing Unit,
1617 Mail Service Center, Raleigh, NC 27699-1617

24b. For Injection Wells: In addition to sending the form to the address in 24a above, also submit one copy of this form within 30 days of completion of well construction to the following:

Division of Water Resources, Underground Injection Control Program,
1636 Mail Service Center, Raleigh, NC 27699-1636

24c. For Water Supply & Injection Wells: In addition to sending the form to the address(es) above, also submit one copy of this form within 30 days of completion of well construction to the county health department of the county where constructed.

Print Form

WELL CONSTRUCTION RECORD (GW-1)

For Internal Use Only:

1. Well Contractor Information:

Jeovanny Bautista
Well Contractor Name

4125 A
NC Well Contractor Certification Number

AC Schultes of Carolina, Inc.
Company Name

2. Well Construction Permit #: _____
List all applicable well construction permits (i.e. UIC, County, State, Variance, etc.)

3. Well Use (check well use):

Water Supply Well:
- ☐ Agricultural
- ☐ Geothermal (Heating/Cooling Supply)
- ☐ Industrial/Commercial
- ☐ Irrigation
- ☐ Municipal/Public
- ☐ Residential Water Supply (single)
- ☐ Residential Water Supply (shared)

Non-Water Supply Well:
- ☑ Monitoring
- ☐ Recovery

Injection Well:
- ☐ Aquifer Recharge
- ☐ Aquifer Storage and Recovery
- ☐ Aquifer Test
- ☐ Experimental Technology
- ☐ Geothermal (Closed Loop)
- ☐ Geothermal (Heating/Cooling Return)
- ☐ Groundwater Remediation
- ☐ Salinity Barrier
- ☐ Stormwater Drainage
- ☐ Subsidence Control
- ☐ Tracer
- ☐ Other (explain under #21 Remarks)

4. Date Well(s) Completed: 4/4/19 **Well ID#** U35I3

5a. Well Location:

NCDEQ — Facility/Owner Name
Clinton City WTP — Facility ID# (if applicable)
900 Clive Jacobs Rd Clinton, NC — Physical Address, City, and Zip
Sampson — County
12050020001 — Parcel Identification No. (PIN)

5b. Latitude and longitude in degrees/minutes/seconds or decimal degrees:
(if well field, one lat/long is sufficient)
34.981452 N -78.281327 W

6. Is(are) the well(s): ☑ Permanent or ☐ Temporary

7. Is this a repair to an existing well: ☐ Yes or ☑ No
If this is a repair, fill out known well construction information and explain the nature of the repair under #21 remarks section or on the back of this form.

8. For Geoprobe/DPT or Closed-Loop Geothermal Wells having the same construction, only 1 GW-1 is needed. Indicate TOTAL NUMBER of wells drilled: _____

9. Total well depth below land surface: 390 (ft.)
For multiple wells list all depths if different (example- 3 a 200' and 2 a 100')

10. Static water level below top of casing: 118.85 (ft.)
If water level is above casing, use "-"

11. Borehole diameter: 9 7/8 (in.)

12. Well construction method: Mud Rotary
(i.e. auger, rotary, cable, direct push, etc.)

FOR WATER SUPPLY WELLS ONLY:

13a. Yield (gpm) _____ **Method of test:** _____

13b. Disinfection type: _____ **Amount:** _____

14. WATER ZONES

FROM	TO	DESCRIPTION
376 ft.	386 ft.	sand
ft.	ft.	

15. OUTER CASING (for multi-cased wells) OR LINER (if applicable)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
0 ft.	46 ft.	10 in.	SCH 80	PVC

16. INNER CASING OR TUBING (geothermal closed-loop)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
+3 ft.	376 ft.	4 in.	SDR 17	PVC
ft.	ft.	in.		

17. SCREEN

FROM	TO	DIAMETER	SLOT SIZE	THICKNESS	MATERIAL
376 ft.	386 ft.	4 in.	.020		SS
ft.	ft.	in.			

18. GROUT

FROM	TO	MATERIAL	EMPLACEMENT METHOD & AMOUNT
0 ft.	364 ft.	Bentonite	pumped
364 ft.	366 ft.	Bentonite	poured
ft.	ft.		

19. SAND/GRAVEL PACK (if applicable)

FROM	TO	MATERIAL	EMPLACEMENT METHOD
366 ft.	390 ft.	#2 gravel	poured
ft.	ft.		

20. DRILLING LOG (attach additional sheets if necessary)

FROM	TO	DESCRIPTION (color, hardness, soil/rock type, grain size, etc.)
0 ft.	42 ft.	reddish sandy clay
42 ft.	82 ft.	clay
82 ft.	252 ft.	silty sand
252 ft.	272 ft.	clay
272 ft.	342 ft.	silty sand
342 ft.	362 ft.	clay
362 ft.	390 ft.	silty sand

21. REMARKS

22. Certification:

Jeovanny Gutierrez Bautista — Signature of Certified Well Contractor
04/30/19 — Date

By signing this form, I hereby certify that the well(s) was (were) constructed in accordance with 15A NCAC 02C .0100 or 15A NCAC 02C .0200 Well Construction Standards and that a copy of this record has been provided to the well owner.

23. Site diagram or additional well details:
You may use the back of this page to provide additional well site details or well construction details. You may also attach additional pages if necessary.

SUBMITTAL INSTRUCTIONS

24a. For All Wells: Submit this form within 30 days of completion of well construction to the following:

Division of Water Resources, Information Processing Unit,
1617 Mail Service Center, Raleigh, NC 27699-1617

24b. For Injection Wells: In addition to sending the form to the address in 24a above, also submit one copy of this form within 30 days of completion of well construction to the following:

Division of Water Resources, Underground Injection Control Program,
1636 Mail Service Center, Raleigh, NC 27699-1636

24c. For Water Supply & Injection Wells: In addition to sending the form to the address(es) above, also submit one copy of this form within 30 days of completion of well construction to the county health department of the county where constructed.

Print Form

WELL CONSTRUCTION RECORD (GW-1)

For Internal Use Only:

1. Well Contractor Information:

Jeovanny Bautista
Well Contractor Name

4125 A
NC Well Contractor Certification Number

AC Schultes of Carolina, Inc.
Company Name

2. Well Construction Permit #: _____
List all applicable well construction permits (i.e. UIC, County, State, Variance, etc.)

3. Well Use (check well use):

Water Supply Well:
- ☐ Agricultural
- ☐ Geothermal (Heating/Cooling Supply)
- ☐ Industrial/Commercial
- ☐ Irrigation
- ☐ Municipal/Public
- ☐ Residential Water Supply (single)
- ☐ Residential Water Supply (shared)

Non-Water Supply Well:
- ☑ Monitoring
- ☐ Recovery

Injection Well:
- ☐ Aquifer Recharge
- ☐ Aquifer Storage and Recovery
- ☐ Aquifer Test
- ☐ Experimental Technology
- ☐ Geothermal (Closed Loop)
- ☐ Geothermal (Heating/Cooling Return)
- ☐ Groundwater Remediation
- ☐ Salinity Barrier
- ☐ Stormwater Drainage
- ☐ Subsidence Control
- ☐ Tracer
- ☐ Other (explain under #21 Remarks)

4. Date Well(s) Completed: 4/9/19 **Well ID#** U35I4

5a. Well Location:

NCDEQ — Facility/Owner Name
Clinton City WTP — Facility ID# (if applicable)
900 Clive Jacobs Rd Clinton, NC — Physical Address, City, and Zip
Sampson — County
12050020001 — Parcel Identification No. (PIN)

5b. Latitude and longitude in degrees/minutes/seconds or decimal degrees:
(if well field, one lat/long is sufficient)
34.981452 N -78.281327 W

6. Is(are) the well(s): ☑ Permanent or ☐ Temporary

7. Is this a repair to an existing well: ☐ Yes or ☑ No
If this is a repair, fill out known well construction information and explain the nature of the repair under #21 remarks section or on the back of this form.

8. For Geoprobe/DPT or Closed-Loop Geothermal Wells having the same construction, only 1 GW-1 is needed. Indicate TOTAL NUMBER of wells drilled: _____

9. Total well depth below land surface: 112 (ft.)
For multiple wells list all depths if different (example- 3 a 200' and 2 a 100')

10. Static water level below top of casing: 45.80 (ft.)
If water level is above casing, use "-"

11. Borehole diameter: 9 7/8 (in.)

12. Well construction method: Mud Rotary
(i.e. auger, rotary, cable, direct push, etc.)

FOR WATER SUPPLY WELLS ONLY:

13a. Yield (gpm) _____ **Method of test:** _____

13b. Disinfection type: _____ **Amount:** _____

14. WATER ZONES

FROM	TO	DESCRIPTION
93 ft.	103 ft.	sand
ft.	ft.	

15. OUTER CASING (for multi-cased wells) OR LINER (if applicable)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
ft.	ft.	in.		

16. INNER CASING OR TUBING (geothermal closed-loop)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
+3 ft.	93 ft.	4 in.	SDR 17	PVC
103 ft.	108 ft.	4 in.	SCH 80	PVC

17. SCREEN

FROM	TO	DIAMETER	SLOT SIZE	THICKNESS	MATERIAL
93 ft.	103 ft.	4 in.	.020		SS
ft.	ft.	in.			

18. GROUT

FROM	TO	MATERIAL	EMPLACEMENT METHOD & AMOUNT
0 ft.	79 ft.	Bentonite	pumped
79 ft.	81 ft.	Bentonite	poured
ft.	ft.		

19. SAND/GRAVEL PACK (if applicable)

FROM	TO	MATERIAL	EMPLACEMENT METHOD
81 ft.	112 ft.	#2 gravel	poured
ft.	ft.		

20. DRILLING LOG (attach additional sheets if necessary)

FROM	TO	DESCRIPTION (color, hardness, soil/rock type, grain size, etc.)
0 ft.	42 ft.	reddish sandy clay
42 ft.	82 ft.	clay
82 ft.	112 ft.	silty sand
ft.	ft.	
ft.	ft.	
ft.	ft.	
ft.	ft.	

21. REMARKS

22. Certification:

Jeovanny Bautista — Signature of Certified Well Contractor
04/30/19 — Date

By signing this form, I hereby certify that the well(s) was (were) constructed in accordance with 15A NCAC 02C .0100 or 15A NCAC 02C .0200 Well Construction Standards and that a copy of this record has been provided to the well owner.

23. Site diagram or additional well details:
You may use the back of this page to provide additional well site details or well construction details. You may also attach additional pages if necessary.

SUBMITTAL INSTRUCTIONS

24a. For All Wells: Submit this form within 30 days of completion of well construction to the following:

Division of Water Resources, Information Processing Unit,
1617 Mail Service Center, Raleigh, NC 27699-1617

24b. For Injection Wells: In addition to sending the form to the address in 24a above, also submit one copy of this form within 30 days of completion of well construction to the following:

Division of Water Resources, Underground Injection Control Program,
1636 Mail Service Center, Raleigh, NC 27699-1636

24c. For Water Supply & Injection Wells: In addition to sending the form to the address(es) above, also submit one copy of this form within 30 days of completion of well construction to the county health department of the county where constructed.

Print Form

WELL CONSTRUCTION RECORD (GW-1)

For Internal Use Only:

1. Well Contractor Information:

Jeovanny Bautista
Well Contractor Name

4125 A
NC Well Contractor Certification Number

AC Schultes of Carolina, Inc.
Company Name

2. Well Construction Permit #: _____
List all applicable well construction permits (i.e. UIC, County, State, Variance, etc.)

3. Well Use (check well use):

Water Supply Well:
☐ Agricultural ☐ Municipal/Public
☐ Geothermal (Heating/Cooling Supply) ☐ Residential Water Supply (single)
☐ Industrial/Commercial ☐ Residential Water Supply (shared)
☐ Irrigation

Non-Water Supply Well:
☑ Monitoring ☐ Recovery

Injection Well:
☐ Aquifer Recharge ☐ Groundwater Remediation
☐ Aquifer Storage and Recovery ☐ Salinity Barrier
☐ Aquifer Test ☐ Stormwater Drainage
☐ Experimental Technology ☐ Subsidence Control
☐ Geothermal (Closed Loop) ☐ Tracer
☐ Geothermal (Heating/Cooling Return) ☐ Other (explain under #21 Remarks)

4. Date Well(s) Completed: 4/16/19 **Well ID#** U3515

5a. Well Location:

NCDEQ — Facility/Owner Name
Clinton City WTP — Facility ID# (if applicable)
900 Clive Jacobs Rd Clinton, NC — Physical Address, City, and Zip
Sampson — County
12050020001 — Parcel Identification No. (PIN)

5b. Latitude and longitude in degrees/minutes/seconds or decimal degrees:
(if well field, one lat/long is sufficient)
34.981452 N -78.281327 W

6. Is(are) the well(s) ☑ **Permanent** or ☐ **Temporary**

7. Is this a repair to an existing well: ☐ **Yes** or ☑ **No**
If this is a repair, fill out known well construction information and explain the nature of the repair under #21 remarks section or on the back of this form.

8. For Geoprobe/DPT or Closed-Loop Geothermal Wells having the same construction, only 1 GW-1 is needed. Indicate TOTAL NUMBER of wells drilled: _____

9. Total well depth below land surface: 291 (ft.)
For multiple wells list all depths if different (example- 3 @ 200' and 2 @ 100')

10. Static water level below top of casing: 116.5 (ft.)
If water level is above casing, use "-"

11. Borehole diameter: 9 7/8 (in.)

12. Well construction method: Mud Rotary
(i.e. auger, rotary, cable, direct push, etc.)

FOR WATER SUPPLY WELLS ONLY:

13a. Yield (gpm) _____ **Method of test:** _____

13b. Disinfection type: _____ **Amount:** _____

14. WATER ZONES

FROM	TO	DESCRIPTION
274 ft.	284 ft.	sand
ft.	ft.	

15. OUTER CASING (for multi-cased wells) OR LINER (if applicable)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
0 ft.	46 ft.	10 in.	SCH 80	PVC

16. INNER CASING OR TUBING (geothermal closed-loop)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
+3 ft.	274 ft.	4 in.	SDR 17	PVC
284 ft.	286 ft.	4 in.	SCH 80	PVC

17. SCREEN

FROM	TO	DIAMETER	SLOT SIZE	THICKNESS	MATERIAL
274 ft.	284 ft.	4 in.	.020		SS
ft.	ft.	in.			

18. GROUT

FROM	TO	MATERIAL	EMPLACEMENT METHOD & AMOUNT
0 ft.	261 ft.	Bentonite	pumped
261 ft.	263 ft.	Bentonite	poured
ft.	ft.		

19. SAND/GRAVEL PACK (if applicable)

FROM	TO	MATERIAL	EMPLACEMENT METHOD
263 ft.	291 ft.	#2 gravel	poured
ft.	ft.		

20. DRILLING LOG (attach additional sheets if necessary)

FROM	TO	DESCRIPTION (color, hardness, soil/rock type, grain size, etc.)
0 ft.	42 ft.	reddish sandy clay
42 ft.	82 ft.	clay
82 ft.	252 ft.	silty sand
252 ft.	272 ft.	clay
272 ft.	291 ft.	silty sand
ft.	ft.	
ft.	ft.	

21. REMARKS

22. Certification:

Jeovanny Gutierrez Bautista — Signature of Certified Well Contractor
04/30/19 — Date

By signing this form, I hereby certify that the well(s) was (were) constructed in accordance with 15A NCAC 02C .0100 or 15A NCAC 02C .0200 Well Construction Standards and that a copy of this record has been provided to the well owner.

23. Site diagram or additional well details:
You may use the back of this page to provide additional well site details or well construction details. You may also attach additional pages if necessary.

SUBMITTAL INSTRUCTIONS

24a. For All Wells: Submit this form within 30 days of completion of well construction to the following:

Division of Water Resources, Information Processing Unit,
1617 Mail Service Center, Raleigh, NC 27699-1617

24b. For Injection Wells: In addition to sending the form to the address in 24a above, also submit one copy of this form within 30 days of completion of well construction to the following:

Division of Water Resources, Underground Injection Control Program,
1636 Mail Service Center, Raleigh, NC 27699-1636

24c. For Water Supply & Injection Wells: In addition to sending the form to the address(es) above, also submit one copy of this form within 30 days of completion of well construction to the county health department of the county where constructed.

Print Form

WELL CONSTRUCTION RECORD (GW-1)

For Internal Use Only:

1. Well Contractor Information:

Jeovanny Bautista
Well Contractor Name

4125 A
NC Well Contractor Certification Number

AC Schultes of Carolina, Inc.
Company Name

2. Well Construction Permit #: _____
List all applicable well construction permits (i.e. UIC, County, State, Variance, etc.)

3. Well Use (check well use):

Water Supply Well:
- ☐ Agricultural
- ☐ Geothermal (Heating/Cooling Supply)
- ☐ Industrial/Commercial
- ☐ Irrigation
- ☐ Municipal/Public
- ☐ Residential Water Supply (single)
- ☐ Residential Water Supply (shared)

Non-Water Supply Well:
- ☑ Monitoring
- ☐ Recovery

Injection Well:
- ☐ Aquifer Recharge
- ☐ Aquifer Storage and Recovery
- ☐ Aquifer Test
- ☐ Experimental Technology
- ☐ Geothermal (Closed Loop)
- ☐ Geothermal (Heating/Cooling Return)
- ☐ Groundwater Remediation
- ☐ Salinity Barrier
- ☐ Stormwater Drainage
- ☐ Subsidence Control
- ☐ Tracer
- ☐ Other (explain under #21 Remarks)

4. Date Well(s) Completed: 4/24/19 **Well ID#** U3516

5a. Well Location:

NCDEQ — Facility/Owner Name
Clinton City WTP — Facility ID# (if applicable)
900 Clive Jacobs Rd Clinton, NC — Physical Address, City, and Zip
Sampson — County
12050020001 — Parcel Identification No. (PIN)

5b. Latitude and longitude in degrees/minutes/seconds or decimal degrees:
(if well field, one lat/long is sufficient)
34.981452 N -78.281327 W

6. Is(are) the well(s) ☑ **Permanent** or ☐ **Temporary**

7. Is this a repair to an existing well: ☐ Yes or ☑ No
If this is a repair, fill out known well construction information and explain the nature of the repair under #21 remarks section or on the back of this form.

8. **For Geoprobe/DPT or Closed-Loop Geothermal Wells** having the same construction, only 1 GW-1 is needed. Indicate TOTAL NUMBER of wells drilled: _____

9. Total well depth below land surface: 190 (ft.)
For multiple wells list all depths if different (example- 3 a 200' and 2 a 100')

10. Static water level below top of casing: 57.3 (ft.)
If water level is above casing, use "-"

11. Borehole diameter: 9 7/8 (in.)

12. Well construction method: Mud Rotary
(i.e. auger, rotary, cable, direct push, etc.)

FOR WATER SUPPLY WELLS ONLY:

13a. Yield (gpm) _____ **Method of test:** _____

13b. Disinfection type: _____ **Amount:** _____

14. WATER ZONES

FROM	TO	DESCRIPTION
175 ft.	185 ft.	sand
ft.	ft.	

15. OUTER CASING (for multi-cased wells) OR LINER (if applicable)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
0 ft.	46 ft.	10 in.	SCH 80	PVC

16. INNER CASING OR TUBING (geothermal closed-loop)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
+3 ft.	175 ft.	4 in.	SDR 17	PVC
185 ft.	190 ft.	4 in.	SCH 80	PVC

17. SCREEN

FROM	TO	DIAMETER	SLOT SIZE	THICKNESS	MATERIAL
175 ft.	185 ft.	4 in.	.020		SS
ft.	ft.	in.			

18. GROUT

FROM	TO	MATERIAL	EMPLACEMENT METHOD & AMOUNT
0 ft.	166 ft.	Bentonite	pumped
166 ft.	168 ft.	Bentonite	poured
ft.	ft.		

19. SAND/GRAVEL PACK (if applicable)

FROM	TO	MATERIAL	EMPLACEMENT METHOD
168 ft.	190 ft.	#2 gravel	poured
ft.	ft.		

20. DRILLING LOG (attach additional sheets if necessary)

FROM	TO	DESCRIPTION (color, hardness, soil/rock type, grain size, etc.)
0 ft.	42 ft.	reddish sandy clay
42 ft.	82 ft.	clay
82 ft.	190 ft.	silty sand
ft.	ft.	
ft.	ft.	
ft.	ft.	
ft.	ft.	

21. REMARKS

22. Certification:

Jeovanny Gutierrez Bautista — Signature of Certified Well Contractor
04/30/19 — Date

By signing this form, I hereby certify that the well(s) was (were) constructed in accordance with 15A NCAC 02C .0100 or 15A NCAC 02C .0200 Well Construction Standards and that a copy of this record has been provided to the well owner.

23. Site diagram or additional well details:
You may use the back of this page to provide additional well site details or well construction details. You may also attach additional pages if necessary.

SUBMITTAL INSTRUCTIONS

24a. For All Wells: Submit this form within 30 days of completion of well construction to the following:

Division of Water Resources, Information Processing Unit,
1617 Mail Service Center, Raleigh, NC 27699-1617

24b. For Injection Wells: In addition to sending the form to the address in 24a above, also submit one copy of this form within 30 days of completion of well construction to the following:

Division of Water Resources, Underground Injection Control Program,
1636 Mail Service Center, Raleigh, NC 27699-1636

24c. For Water Supply & Injection Wells: In addition to sending the form to the address(es) above, also submit one copy of this form within 30 days of completion of well construction to the county health department of the county where constructed.

TOPSAIL FIRE TOWER MONITORING STATION
AA 27L1, AA 27L2, AA 27L3, AA 27L4

Print Form

WELL CONSTRUCTION RECORD (GW-1)

For Internal Use Only:

1. Well Contractor Information:

Jeovanny Bautista
Well Contractor Name

4125 A
NC Well Contractor Certification Number

AC Schultes of Carolina, Inc.
Company Name

2. Well Construction Permit #: _____
List all applicable well construction permits (i.e. UIC, County, State, Variance, etc.)

3. Well Use (check well use):

Water Supply Well:
- ☐ Agricultural
- ☐ Municipal/Public
- ☐ Geothermal (Heating/Cooling Supply)
- ☐ Residential Water Supply (single)
- ☐ Industrial/Commercial
- ☐ Residential Water Supply (shared)
- ☐ Irrigation

Non-Water Supply Well:
- ☒ Monitoring
- ☐ Recovery

Injection Well:
- ☐ Aquifer Recharge
- ☐ Groundwater Remediation
- ☐ Aquifer Storage and Recovery
- ☐ Salinity Barrier
- ☐ Aquifer Test
- ☐ Stormwater Drainage
- ☐ Experimental Technology
- ☐ Subsidence Control
- ☐ Geothermal (Closed Loop)
- ☐ Tracer
- ☐ Geothermal (Heating/Cooling Return)
- ☐ Other (explain under #21 Remarks)

4. Date Well(s) Completed: 05/02/19 **Well ID#** AA27L1

5a. Well Location:

NCDEQ — Facility/Owner Name
Topsail Fire Tower — Facility ID# (if applicable)
NCFS 22695 US17 Hampstead, NC 28443
Physical Address, City, and Zip
Pender — County
4215-78-4329 — Parcel Identification No. (PIN)

5b. Latitude and longitude in degrees/minutes/seconds or decimal degrees:
(if well field, one lat/long is sufficient)

34.452033 N -77.615114 W

6. Is(are) the well(s): ☒ Permanent or ☐ Temporary

7. Is this a repair to an existing well: ☐ Yes or ☒ No
If this is a repair, fill out known well construction information and explain the nature of the repair under #21 remarks section or on the back of this form.

8. For Geoprobe/DPT or Closed-Loop Geothermal Wells having the same construction, only 1 GW-1 is needed. Indicate TOTAL NUMBER of wells drilled: _____

9. Total well depth below land surface: 50 (ft.)
For multiple wells list all depths if different (example- 3@200' and 2@100')

10. Static water level below top of casing: 26.20 (ft.)
If water level is above casing, use " - "

11. Borehole diameter: 9 7/8 (in.)

12. Well construction method: Mud Rotary
(i.e. auger, rotary, cable, direct push, etc.)

FOR WATER SUPPLY WELLS ONLY:

13a. Yield (gpm) _____ **Method of test:** _____

13b. Disinfection type: _____ **Amount:** _____

14. WATER ZONES

FROM	TO	DESCRIPTION
35 ft.	45 ft.	sand
ft.	ft.	

15. OUTER CASING (for multi-cased wells) OR LINER (if applicable)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
ft.	ft.	in.		

16. INNER CASING OR TUBING (geothermal closed-loop)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
+3 ft.	35 ft.	4 in.	SDR 17	PVC
45 ft.	50 ft.	4 in.	SCH 80	PVC

17. SCREEN

FROM	TO	DIAMETER	SLOT SIZE	THICKNESS	MATERIAL
35 ft.	45 ft.	4 in.	.020		SS
ft.	ft.	in.			

18. GROUT

FROM	TO	MATERIAL	EMPLACEMENT METHOD & AMOUNT
0 ft.	21 ft.	Bentonite	poured
ft.	ft.		
ft.	ft.		

19. SAND/GRAVEL PACK (if applicable)

FROM	TO	MATERIAL	EMPLACEMENT METHOD
50 ft.	21 ft.	#2 gravel	poured
ft.	ft.		

20. DRILLING LOG (attach additional sheets if necessary)

FROM	TO	DESCRIPTION (color, hardness, soil/rock type, grain size, etc.)
0 ft.	50 ft.	sand
ft.	ft.	
ft.	ft.	
ft.	ft.	
ft.	ft.	
ft.	ft.	
ft.	ft.	

21. REMARKS

22. Certification:

Jeovanny Bautista — Signature of Certified Well Contractor
5/31/19 — Date

By signing this form, I hereby certify that the well(s) was (were) constructed in accordance with 15A NCAC 02C .0100 or 15A NCAC 02C .0200 Well Construction Standards and that a copy of this record has been provided to the well owner.

23. Site diagram or additional well details:
You may use the back of this page to provide additional well site details or well construction details. You may also attach additional pages if necessary.

SUBMITTAL INSTRUCTIONS

24a. For All Wells: Submit this form within 30 days of completion of well construction to the following:

Division of Water Resources, Information Processing Unit,
1617 Mail Service Center, Raleigh, NC 27699-1617

24b. For Injection Wells: In addition to sending the form to the address in 24a above, also submit one copy of this form within 30 days of completion of well construction to the following:

Division of Water Resources, Underground Injection Control Program,
1636 Mail Service Center, Raleigh, NC 27699-1636

24c. For Water Supply & Injection Wells: In addition to sending the form to the address(es) above, also submit one copy of this form within 30 days of completion of well construction to the county health department of the county where constructed.

Print Form

WELL CONSTRUCTION RECORD (GW-1)

For Internal Use Only:

1. Well Contractor Information:

Jeovanny Bautista
Well Contractor Name

4125 A
NC Well Contractor Certification Number

AC Schultes of Carolina, Inc.
Company Name

2. Well Construction Permit #: _____
List all applicable well construction permits (i.e. UIC, County, State, Variance, etc.)

3. Well Use (check well use):

Water Supply Well:
- ☐ Agricultural
- ☐ Municipal/Public
- ☐ Geothermal (Heating/Cooling Supply)
- ☐ Residential Water Supply (single)
- ☐ Industrial/Commercial
- ☐ Residential Water Supply (shared)
- ☐ Irrigation

Non-Water Supply Well:
- ☒ Monitoring
- ☐ Recovery

Injection Well:
- ☐ Aquifer Recharge
- ☐ Groundwater Remediation
- ☐ Aquifer Storage and Recovery
- ☐ Salinity Barrier
- ☐ Aquifer Test
- ☐ Stormwater Drainage
- ☐ Experimental Technology
- ☐ Subsidence Control
- ☐ Geothermal (Closed Loop)
- ☐ Tracer
- ☐ Geothermal (Heating/Cooling Return)
- ☐ Other (explain under #21 Remarks)

4. Date Well(s) Completed: 05/06/19 **Well ID#** AA27L2

5a. Well Location:

NCDEQ — Facility/Owner Name
Topsail Fire Tower — Facility ID# (if applicable)
NCFS 22695 US17 Hampstead, NC 28443 — Physical Address, City, and Zip
Pender — County
4215-78-4329 — Parcel Identification No. (PIN)

5b. Latitude and longitude in degrees/minutes/seconds or decimal degrees:
(if well field, one lat/long is sufficient)
34.452033 N -77.615114 W

6. Is(are) the well(s): ☒ **Permanent** or ☐ **Temporary**

7. Is this a repair to an existing well: ☐ **Yes** or ☒ **No**
If this is a repair, fill out known well construction information and explain the nature of the repair under #21 remarks section or on the back of this form.

8. For Geoprobe/DPT or Closed-Loop Geothermal Wells having the same construction, only 1 GW-1 is needed. Indicate TOTAL NUMBER of wells drilled: _____

9. Total well depth below land surface: 95 (ft.)
For multiple wells list all depths if different (example- 3@200' and 2@100')

10. Static water level below top of casing: 37 (ft.)
If water level is above casing, use "+"

11. Borehole diameter: 9 7/8 (in.)

12. Well construction method: Mud Rotary
(i.e. auger, rotary, cable, direct push, etc.)

FOR WATER SUPPLY WELLS ONLY:

13a. Yield (gpm) _____ **Method of test:** _____

13b. Disinfection type: _____ **Amount:** _____

14. WATER ZONES

FROM	TO	DESCRIPTION
81 ft.	91 ft.	sand
ft.	ft.	

15. OUTER CASING (for multi-cased wells) OR LINER (if applicable)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
ft.	ft.	in.		

16. INNER CASING OR TUBING (geothermal closed-loop)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
+3 ft.	81 ft.	4 in.	SDR 17	PVC
ft.	ft.	in.		

17. SCREEN

FROM	TO	DIAMETER	SLOT SIZE	THICKNESS	MATERIAL
81 ft.	91 ft.	4 in.	.020		SS
ft.	ft.	in.			

18. GROUT

FROM	TO	MATERIAL	EMPLACEMENT METHOD & AMOUNT
0 ft.	71 ft.	Bentonite	pumped
71 ft.	73 ft.	Bentonite	poured
ft.	ft.		

19. SAND/GRAVEL PACK (if applicable)

FROM	TO	MATERIAL	EMPLACEMENT METHOD
95 ft.	73 ft.	#2 gravel	poured
ft.	ft.		

20. DRILLING LOG (attach additional sheets if necessary)

FROM	TO	DESCRIPTION (color, hardness, soil/rock type, grain size, etc.)
0 ft.	50 ft.	sand
50 ft.	72 ft.	clay sand
72 ft.	95 ft.	limestone, sand
ft.	ft.	
ft.	ft.	
ft.	ft.	
ft.	ft.	

21. REMARKS

22. Certification:

Jeovanny Gustavo Bautista — Signature of Certified Well Contractor
5/31/19 — Date

By signing this form, I hereby certify that the well(s) was (were) constructed in accordance with 15A NCAC 02C .0100 or 15A NCAC 02C .0200 Well Construction Standards and that a copy of this record has been provided to the well owner.

23. Site diagram or additional well details:
You may use the back of this page to provide additional well site details or well construction details. You may also attach additional pages if necessary.

SUBMITTAL INSTRUCTIONS

24a. For All Wells: Submit this form within 30 days of completion of well construction to the following:

Division of Water Resources, Information Processing Unit,
1617 Mail Service Center, Raleigh, NC 27699-1617

24b. For Injection Wells: In addition to sending the form to the address in 24a above, also submit one copy of this form within 30 days of completion of well construction to the following:

Division of Water Resources, Underground Injection Control Program,
1636 Mail Service Center, Raleigh, NC 27699-1636

24c. For Water Supply & Injection Wells: In addition to sending the form to the address(es) above, also submit one copy of this form within 30 days of completion of well construction to the county health department of the county where constructed.

Print Form

WELL CONSTRUCTION RECORD (GW-1)

For Internal Use Only:

1. Well Contractor Information:

Jeovanny Bautista
Well Contractor Name

4125 A
NC Well Contractor Certification Number

AC Schultes of Carolina, Inc.
Company Name

2. Well Construction Permit #: _____
List all applicable well construction permits (i.e. UIC, County, State, Variance, etc.)

3. Well Use (check well use):

Water Supply Well:
- ☐ Agricultural
- ☐ Municipal/Public
- ☐ Geothermal (Heating/Cooling Supply)
- ☐ Residential Water Supply (single)
- ☐ Industrial/Commercial
- ☐ Residential Water Supply (shared)
- ☐ Irrigation

Non-Water Supply Well:
- ☒ Monitoring
- ☐ Recovery

Injection Well:
- ☐ Aquifer Recharge
- ☐ Groundwater Remediation
- ☐ Aquifer Storage and Recovery
- ☐ Salinity Barrier
- ☐ Aquifer Test
- ☐ Stormwater Drainage
- ☐ Experimental Technology
- ☐ Subsidence Control
- ☐ Geothermal (Closed Loop)
- ☐ Tracer
- ☐ Geothermal (Heating/Cooling Return)
- ☐ Other (explain under #21 Remarks)

4. Date Well(s) Completed: 05/16/19 **Well ID#** AA27L3

5a. Well Location:

NCDEQ — Facility/Owner Name
Topsail Fire Tower — Facility ID# (if applicable)

NCFS 22695 US17 Hampstead, NC 28443
Physical Address, City, and Zip

Pender — County
4215-78-4329 — Parcel Identification No. (PIN)

5b. Latitude and longitude in degrees/minutes/seconds or decimal degrees:
(if well field, one lat/long is sufficient)

34.452033 N -77.615114 W

6. Is(are) the well(s): ☒ Permanent or ☐ Temporary

7. Is this a repair to an existing well: ☐ Yes or ☒ No
If this is a repair, fill out known well construction information and explain the nature of the repair under #21 remarks section or on the back of this form.

8. For Geoprobe/DPT or Closed-Loop Geothermal Wells having the same construction, only 1 GW-1 is needed. Indicate TOTAL NUMBER of wells drilled: _____

9. Total well depth below land surface: 502 (ft.)
For multiple wells list all depths if different (example- 3@200' and 2@100')

10. Static water level below top of casing: 48 (ft.)
If water level is above casing, use "+"

11. Borehole diameter: 9 7/8 (in.)

12. Well construction method: Mud Rotary - Pilot Hole
(i.e. auger, rotary, cable, direct push, etc.)

FOR WATER SUPPLY WELLS ONLY:

13a. Yield (gpm) _____ **Method of test:** _____

13b. Disinfection type: _____ **Amount:** _____

14. WATER ZONES

FROM	TO	DESCRIPTION
468 ft.	488 ft.	silty sand
ft.	ft.	

15. OUTER CASING (for multi-cased wells) OR LINER (if applicable)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
0 ft.	80 ft.	10 in.	SCH 80	PVC

16. INNER CASING OR TUBING (geothermal closed-loop)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
+3 ft.	468 ft.	4 in.	SDR 17	PVC
488 ft.	493 ft.	4 in.	SCH 80	PVC

17. SCREEN

FROM	TO	DIAMETER	SLOT SIZE	THICKNESS	MATERIAL
468 ft.	488 ft.	4 in.	.020		SS
ft.	ft.	in.			

18. GROUT

FROM	TO	MATERIAL	EMPLACEMENT METHOD & AMOUNT
0 ft.	445 ft.	Bentonite	pumped
445 ft.	447 ft.	Bentonite	poured
ft.	ft.		

19. SAND/GRAVEL PACK (if applicable)

FROM	TO	MATERIAL	EMPLACEMENT METHOD
502 ft.	448 ft.	#2 gravel	poured
ft.	ft.		

20. DRILLING LOG (attach additional sheets if necessary)

FROM	TO	DESCRIPTION (color, hardness, soil/rock type, grain size, etc.)
0 ft.	50 ft.	sand
50 ft.	72 ft.	clay sand
72 ft.	176 ft.	limestone, sand
176 ft.	256 ft.	clay, limestone
256 ft.	276 ft.	sand, limestone
376 ft.	448 ft.	clay, silt, sand
448 ft.	506 ft.	silt, sand, clay

21. REMARKS

22. Certification:

Signature of Certified Well Contractor — Date: 5/31/19

By signing this form, I hereby certify that the well(s) was (were) constructed in accordance with 15A NCAC 02C .0100 or 15A NCAC 02C .0200 Well Construction Standards and that a copy of this record has been provided to the well owner.

23. Site diagram or additional well details:
You may use the back of this page to provide additional well site details or well construction details. You may also attach additional pages if necessary.

SUBMITTAL INSTRUCTIONS

24a. For All Wells: Submit this form within 30 days of completion of well construction to the following:

Division of Water Resources, Information Processing Unit,
1617 Mail Service Center, Raleigh, NC 27699-1617

24b. For Injection Wells: In addition to sending the form to the address in 24a above, also submit one copy of this form within 30 days of completion of well construction to the following:

Division of Water Resources, Underground Injection Control Program,
1636 Mail Service Center, Raleigh, NC 27699-1636

24c. For Water Supply & Injection Wells: In addition to sending the form to the address(es) above, also submit one copy of this form within 30 days of completion of well construction to the county health department of the county where constructed.

Print Form

WELL CONSTRUCTION RECORD (GW-1)

For Internal Use Only:

1. Well Contractor Information:

Jeovanny Bautista
Well Contractor Name

4125 A
NC Well Contractor Certification Number

AC Schultes of Carolina, Inc.
Company Name

2. Well Construction Permit #: _____
List all applicable well construction permits (i.e. UIC, County, State, Variance, etc.)

3. Well Use (check well use):

Water Supply Well:
- ☐ Agricultural
- ☐ Geothermal (Heating/Cooling Supply)
- ☐ Industrial/Commercial
- ☐ Irrigation
- ☐ Municipal/Public
- ☐ Residential Water Supply (single)
- ☐ Residential Water Supply (shared)

Non-Water Supply Well:
- ☒ Monitoring
- ☐ Recovery

Injection Well:
- ☐ Aquifer Recharge
- ☐ Aquifer Storage and Recovery
- ☐ Aquifer Test
- ☐ Experimental Technology
- ☐ Geothermal (Closed Loop)
- ☐ Geothermal (Heating/Cooling Return)
- ☐ Groundwater Remediation
- ☐ Salinity Barrier
- ☐ Stormwater Drainage
- ☐ Subsidence Control
- ☐ Tracer
- ☐ Other (explain under #21 Remarks)

4. Date Well(s) Completed: 05/23/19 **Well ID#** AA27L4

5a. Well Location:

NCDEQ — Facility/Owner Name
Topsail Fire Tower — Facility ID# (if applicable)
NCFS 22695 US17 Hampstead, NC 28443 — Physical Address, City, and Zip
Pender — County
4215-78-4329 — Parcel Identification No. (PIN)

5b. Latitude and longitude in degrees/minutes/seconds or decimal degrees:
(if well field, one lat/long is sufficient)
34.452033 N -77.615114 W

6. Is(are) the well(s): ☒ Permanent or ☐ Temporary

7. Is this a repair to an existing well: ☐ Yes or ☒ No
If this is a repair, fill out known well construction information and explain the nature of the repair under #21 remarks section or on the back of this form.

8. For Geoprobe/DPT or Closed-Loop Geothermal Wells having the same construction, only 1 GW-1 is needed. Indicate TOTAL NUMBER of wells drilled: _____

9. Total well depth below land surface: 258 (ft.)
For multiple wells list all depths if different (example- 3@200' and 2@100')

10. Static water level below top of casing: 36.3 (ft.)
If water level is above casing, use "-"

11. Borehole diameter: 9 7/8 (in.)

12. Well construction method: Mud Rotary
(i.e. auger, rotary, cable, direct push, etc.)

FOR WATER SUPPLY WELLS ONLY:

13a. Yield (gpm) _____ **Method of test:** _____

13b. Disinfection type: _____ **Amount:** _____

14. WATER ZONES

FROM	TO	DESCRIPTION
243 ft.	253 ft.	sand
ft.	ft.	

15. OUTER CASING (for multi-cased wells) OR LINER (if applicable)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
0 ft.	80 ft.	10 in.	SCH 80	PVC

16. INNER CASING OR TUBING (geothermal closed-loop)

FROM	TO	DIAMETER	THICKNESS	MATERIAL
+3 ft.	243 ft.	4 in.	SDR 17	PVC
253 ft.	255 ft.	4 in.	SCH 80	PVC

17. SCREEN

FROM	TO	DIAMETER	SLOT SIZE	THICKNESS	MATERIAL
246 ft.	253 ft.	4 in.	.020		SS
ft.	ft.	in.			

18. GROUT

FROM	TO	MATERIAL	EMPLACEMENT METHOD & AMOUNT
0 ft.	236 ft.	Bentonite	pumped
236 ft.	238 ft.	Bentonite	poured
ft.	ft.		

19. SAND/GRAVEL PACK (if applicable)

FROM	TO	MATERIAL	EMPLACEMENT METHOD
258 ft.	238 ft.	#2 gravel	poured
ft.	ft.		

20. DRILLING LOG (attach additional sheets if necessary)

FROM	TO	DESCRIPTION (color, hardness, soil/rock type, grain size, etc.)
0 ft.	50 ft.	sand
50 ft.	72 ft.	clay sand
72 ft.	176 ft.	limestone, sand
176 ft.	256 ft.	clay, limestone
256 ft.	258 ft.	sand, limestone
ft.	ft.	
ft.	ft.	

21. REMARKS

22. Certification:

Jeovany Gustavo Bautista — Signature of Certified Well Contractor
5/31/19 — Date

By signing this form, I hereby certify that the well(s) was (were) constructed in accordance with 15A NCAC 02C .0100 or 15A NCAC 02C .0200 Well Construction Standards and that a copy of this record has been provided to the well owner.

23. Site diagram or additional well details:
You may use the back of this page to provide additional well site details or well construction details. You may also attach additional pages if necessary.

SUBMITTAL INSTRUCTIONS

24a. For All Wells: Submit this form within 30 days of completion of well construction to the following:

Division of Water Resources, Information Processing Unit,
1617 Mail Service Center, Raleigh, NC 27699-1617

24b. For Injection Wells: In addition to sending the form to the address in 24a above, also submit one copy of this form within 30 days of completion of well construction to the following:

Division of Water Resources, Underground Injection Control Program,
1636 Mail Service Center, Raleigh, NC 27699-1636

24c. For Water Supply & Injection Wells: In addition to sending the form to the address(es) above, also submit one copy of this form within 30 days of completion of well construction to the county health department of the county where constructed.

APPENDIX B

GROUND WATER SAMPLING PROTOCOL

Ground Water Sampling Protocol

Samples for the ambient monitoring program were collected in accordance with DWR procedures outlines in NCDWQ/APS 2006 to ensure that high quality, defensible data was collected. To ensure that only newly recharged ground water was being sampled, wells were pumped until three well volumes had been removed. Where a well's total volume was too high to feasibly pump out three volumes, wells were purged until water quality parameters (temperature, pH, specific conductance, and dissolved oxygen) of purge water stabilized. Both submersible and peristaltic pumps were used in the field at the sampler's discretion depending on the total depth of the well and the hydraulic head difference to be overcome when pumping from the water table to the surface. To prevent contamination introduced while sampling, nitrile gloves were worn during all sampling events. Pumps were decontaminated after each use. In addition, blanks and duplicate samples were collected to provide quality control information. Trip blanks were taken on each sampling trip, and equipment blanks were run through sampling equipment then analyzed. Field duplicates were taken to compromise approximately 10% of total samples collected.

The ground water was analyzed for a broad suite of water quality and water chemistry parameters (see table below). Data from the ambient monitoring program may be used to characterize ground water throughout the state as well as to address concerns of other programs and projects. Within DWR these concerns include, for example, saltwater intrusion due to over-pumping, the source of organic nitrogen found in surface water bodies, the impact of concentrated farming activities on drinking water supplies, and the levels of naturally occurring contaminants such as metals. Since most of these wells are somewhat geographically isolated from human activities, the water collected is more likely to represent ambient conditions and not contamination.

Table of Sampling Parameters

Parameter Group	Parameters
Private Well Analytes (15A NCAC 18A .3803)	arsenic, barium, cadmium, chromium, copper, fluoride, lead, iron, magnesium, manganese, mercury, nitrate, nitrite, selenium, silver, sodium, zinc, pH
Nutrients*	Ammonia, total kjeldahl nitrogen, organic nitrogen, phosphorus
Metals (Dissolved and Total)*	Aluminum, antimony, beryllium, boron, calcium, cobalt, lithium, molybdenum, nickel, potassium, strontium, thallium, tin, titanium, vanadium
Major Ions	Bromide, chloride, fluoride, sulfate, carbonate, bicarbonate
Field Parameters	Specific conductivity, pH, dissolved oxygen (DO), oxidation-reduction potential (ORP), temperature
Organic Compounds	Volatile organic compounds, Semi-volatile organic compounds, Pesticides
Other	Alkalinity, total organic carbon, turbidity, total dissolved solids, silica, sulfide

*In addition to those required by 15A NCAC 18A .3803

References:

DCDWQ/APS, 2006, Quality Assurance/Quality Control and Standard Operating Procedures Manual for Sample Collection, December 2006

15a NCAC 18a Section .3800 - Private Drinking Water Well Sampling, .3803 - Sample Analysis