PLANNING BOARD SUBCOMMITTEE: WELLS

SUBCOMMITTEE COMPOSITION AND ADDITIONAL RESOURCES

- **Subcommittee Members:** Caroline Siverson (Subcommittee Chair), Emily Moose, Clyde Frazier
- **Agriculture Advisory Board Participants:** Ben Shields, Bobby Tucker, Sharon Day
- **County Staff (Direct):** Jason Sullivan (Planning Dir.), Hunter Glenn (Planner I), Kimberly Tyson (Planner II)
- **Other County Agencies that may participate:** Anne Lowry (Environmental Health), Ginger Cunningham (Cooperative Extension), Susannah Goldston (Soil & Water Conservation District), Larry Bridges (Utilities)
- **Development Community Participant(s):** Mark Ashness, PE, LEED AP, CE Group
- **State Agency Assistance:** Phil Bradley (Asst. Section Chief/Senior Piedmont Geologist, NC Geologic Survey), Rick Bolich (Chief, Groundwater Resources Section, NCDEQ Div. of Water Resources)

MEETINGS AND PRESENTATIONS

- October 14th, 2020- **Introductions and Objectives**
- October 28th, 2020- Rick Bolich, Chief, Groundwater Resources Section, NCDEQ Div. of Water Resources, ***Basic Hydrogeology of Chatham County***
- November 13th, 2020- Phil Bradley, Asst. Section Chief/Senior Piedmont Geologist, NC Geologic Survey ***Chatham County Groundwater Features***
- November 25th, 2020- Phil Bradley and Rick Bolich answer questions
- December 9th, 2020- Craig Caldwell,
- January 6th, 2021- Anne Lowry, Environmental Health Director, ***Wells in Chatham County***
- February 3rd, 2021- Larry Bridges, County Utilities Director, ***Future Water Supply Planning***
- February 17th, 2021- Susannah Goldston, Environmental Specialist and District Director of the Chatham Soil and Water Conservation District and Ginger Cunningham, County Cooperative Extension Director, ***Chatham County Agricultural Operations and Water Use***
- March 17th, 2021- Jason Sullivan, Land-Use Regulations in Chatham County, ***Planning Presentation***
- March 31st, 2021- Billy Yow, President and CEO of D&Y Well Drilling
- April 14th, 2021- Bob Hagemann, County Attorney

REPORT SUMMARY AND RECOMMENDATIONS

In late summer of 2020, the Planning Board established a Wells Subcommittee to determine whether Chatham County needed to take steps to protect groundwater and to prevent conflict between residential and agricultural groundwater use.

Two events led to this action: A major subdivision, The Conservancy at Jordan Lake, originally proposed using County water but will ultimately depend on 45 individual wells. In addition, the Agricultural Advisory Board requested that the Planning Board consider limiting residential well use when an agricultural well went dry after a subdivision was built nearby. Additionally, Plan Chatham recommends that the County ensure long term access to water supplies for the agricultural community and that it establish policies that reduce potential conflicts over groundwater.

The Subcommittee had representatives from the Planning Board, the Agricultural Advisory Board the Planning staff and the development community. It heard presentations from State geologists, the Directors of County Departments of Environmental Health, Utilities and Planning, the Directors of the Soil and Water Conservation District and Cooperative Extension, the County Attorney and a well drilling contractor.

The primary conclusion reached by the Subcommittee was that we currently know almost nothing about sustainable groundwater use and we need to know more. We know that dry wells occur regularly, but we don't know to what extent they are caused by unsustainable demands on groundwater. We don't know the extent to which withdrawals from one well affect neighboring wells. And most significantly, we have no idea of the recharge rate for our aquifers which determines the sustainable level of groundwater withdrawal.

We need to know more because groundwater is crucial to our current and future prosperity. The county has experienced strong residential growth and that growth is expected to continue. A significant proportion of that development depends on groundwater. There are approximately 15,000 private wells in the county and 15 community water systems dependent on wells. Each year the county permits 180 to 200 new residential wells and 5 agricultural wells. As development moves toward the western part of the County, the absence of county water means that reliance on groundwater will inevitably increase and conflicts with agriculture will multiply. We are currently flying blind into this future.

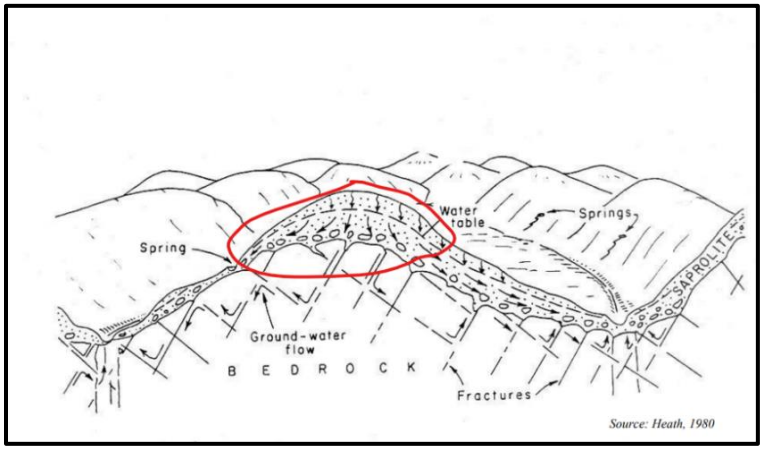
The Subcommittee makes the following recommendations:

1. That the County partner with the USGS to fund a study to determine the sustainable level of groundwater use in different areas of the county. (We have had a preliminary meeting with officials from the local USGS office and they should have a specific proposal ready for consideration late in the summer.)

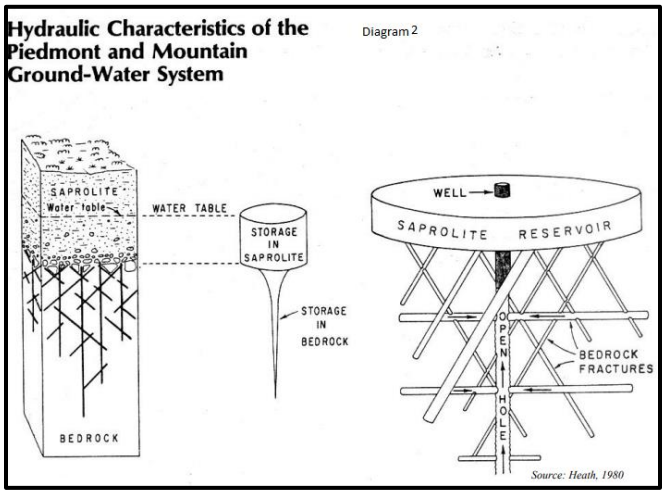
2. That the county utilize the upcoming UDO process to explore the feasibility of creating Conservation/Agricultural subdivisions and/or Agricultural Zoning Districts as recommended by the Comprehensive Plan to ensure that future residential development does not conflict with continued agricultural production.

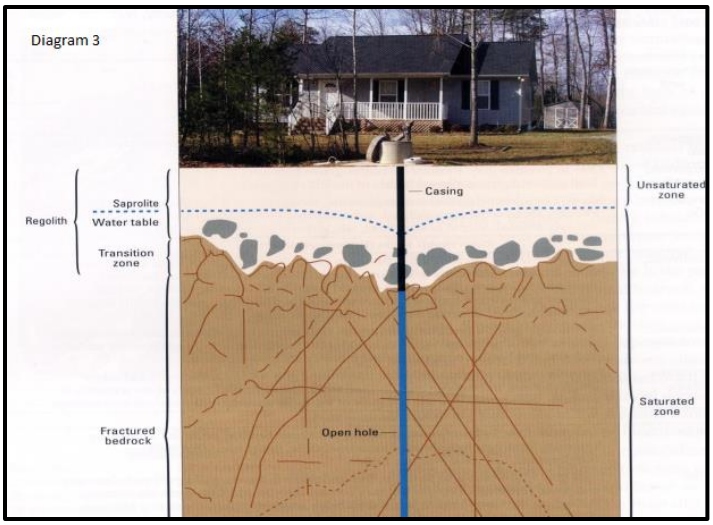
BASIC HYDROGEOLOGY IN CHATHAM COUNTY

Rick Bolich from the North Carolina Department of Environmental Quality – Division of Water Resources was invited by the subcommittee to give a presentation of the Basic Hydrogeology of Chatham County. A link to this presentation is available in the appendix. Chatham County is a very unique hydrogeologic area. Mr. Bolich said a hydrogeologists entire career could be spent in Chatham because of the diverse conditions. The west and northwestern part of the county is primarily made up of metamorphosed crystalline rock. This ancient volcanic rock is different from the Triassic basin rocks found in the southeastern portion of the county around Moncure. These Triassic basin rocks are more suitable for fracking which is why the natural gas industry has been interested in that area of Chatham and Lee counties.



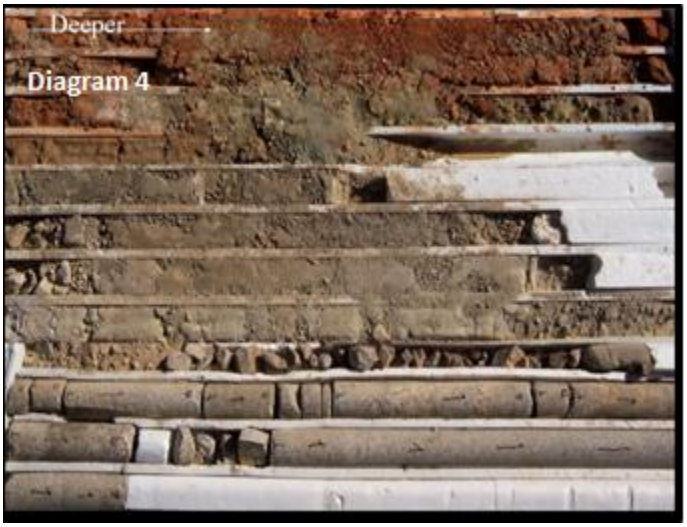
The diagram shows the basic features, and the key terms to describe the hydrogeology of the piedmont region of North Carolina. The area encircled in red depicts the soils and the saprolite and groundwater flows within them. Precipitation settles first in the saprolite and then finds its way into the underlying bedrock. The precipitation finds pathways in the form of fractures in the rock. These fractures in the bedrock of the piedmont are sources of groundwater for wells and water systems. Diagram 2 shows the relative capability of groundwater storage in the piedmont. There is much more groundwater storage in the saprolite versus the bedrock. The diagram shows the basic ability for wells to access groundwater via bedrock fractures. The natural saprolite systems of the North Carolina Piedmont with its characteristic red clay do not transmit water very well, but the particles have microscopic voids that enable water to be stored in the silt and clay of the saprolite. The saprolite is where water will be stored, especially in times of drought. The bedrock fractures transmit water easily. They are the conduit of groundwater, but they do not store water. The average depth of the saprolite in Chatham County, which can vary widely, is about 30 feet. Below that you find the transition zones and then the bedrock. Diagram 3 illustrates the different levels of hydrogeology in the piedmont and how they interact with a standard residential well. The basic goal of any household well is to hit as many of the bedrock fractures as possible. The portion of the well drilled through the saprolite and the transition zones is cased in PVC or Steel to keep out potentially contaminated groundwater. The water in the bedrock fractures is less likely to pose a water quality risk. It is important for wells to be cased until they reach the top portion of bedrock. When the well reaches bedrock, it is sealed and grouted. In Chatham, residential well users sometimes face challenges if their casing depth is not deep enough. The diagram also illustrates just how disparate well yields can be,





even when located in close proximity. It is difficult to pre-determine how many fractures a well will encounter as it is drilled.

Understanding the piedmont aquifer conditions is important to understanding groundwater availability in Chatham County. Mr. Bolich described core samples from a similarly situated location on NC State's campus. While not exactly located in Chatham, the soil conditions are similar. Diagram 4 shows the core samples from

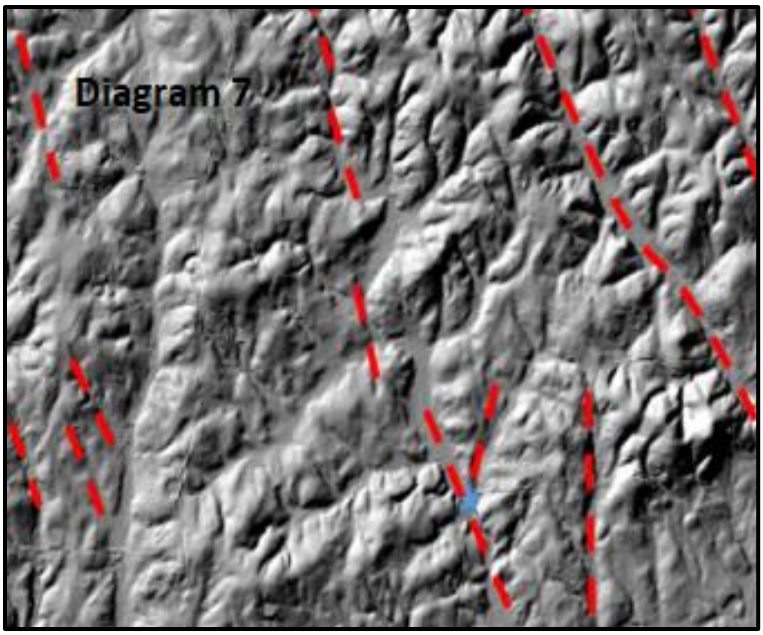


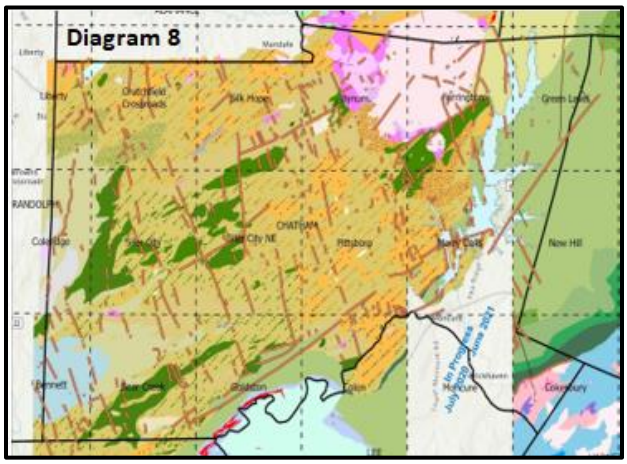
the surface to about 150 feet down. The retrieved samples show the soil, saprolite, transition zone and bedrock. The middle rows in diagram 4 show the porous transition zone, in this case at about 30 feet down. The shallow depth of the transition zone opens it up to contaminants, but the porosity transmits water well. Diagram 5 shows a detailed section of the transition zone materials, mostly made up of quartz and quartz like materials that in this case are almost like sandstone. This rock is porous, and it soaks up and stores groundwater like a sponge. However, it will also soak up and store contaminants. Mr. Bolich used the example of a leaking petroleum tank. The petroleum or water laced with petroleum will be stored in the transition zone rock and then leach into the groundwater, making effective remediation of contaminated groundwater almost impossible. Diagram 6 shows a textbook example of a bedrock fracture which would produce a high-yield groundwater well.

Mr. Bolich discussed prominate patterns in the topography of Chatham County which show the fractures of the bedrock below. Hydrogeologists look for features in the topography that show such fractures, like the sharp curves in the orientation of the rocky river and its tending to flow toward the southeast. When considering where to locate wells one would look at intersections in the regional tectonic features.

GROUNDWATER FEATURES OF CHATHAM COUNTY, NCGS

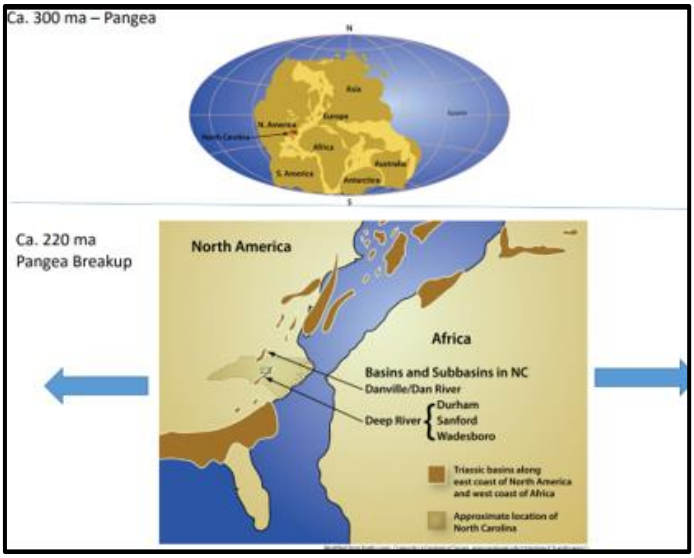
Phil Bradley, Assistant Section Chief/Senior Piedmont Geologist with the NCGS gave a detailed overview of the groundwater features in Chatham County. The most recent groundwater data from the North Carolina Geologic Survey is obtained through the use of LiDAR, which stands for Light Detection and Ranging. LiDAR gives really accurate elevation information and accurate visualization of potential groundwater features. In Diagram 7 the red dotted lines show the pronounced valleys that have a distinct orientation. When the valleys interesect you find natural springs indicated by the blue star in the diagram. Mr. Bradley disucssed the prominate patterns in the topography of Chatham County which show the fracture patterns of the rock below. Hydrogeoligists look for features in the topography that would indicate certain bedrock fractures, such as when the Rocky River is diverted to the southeast by bedrock fractures that are oriented in that direction.





There are three main geologic features in Chatham County that are indicated in diagram 8, the geologic features map. The three features are Diabase Dikes, Lineaments, and Faults. Chatham's two prominent types of bedrock are ancient, metamorphosed rock known as Carolina Terrane, and the Triassic Basin consisting of ancient sedimentary rock. A fault is a planar fracture in the rocks of the earth's crust which can range from a few centimeters to hundreds of miles long. Dikes, also called geological dikes are tabular or sheetlike igneous bodies of rock that are often oriented vertically or steeply inclined to the bedding of prehistoric intruded rock. A lineament is a topographic feature that reveals a subsurface characteristic in the bedrock. As you can see in diagram 8, Chatham County has a lot of groundwater features.

Mr. Bradley explained why Chatham County has so many unique groundwater features. North Carolina sat almost in the middle of the ancient super continent, Pangea. When Pangea started to break up 220 million years ago the Atlantic Ocean was formed by the largest fault the Atlantic ridge. The Atlantic ridge continues to grow a couple of inches each year. As the ocean was forming and Pangea was separating, multiple faults were formed that were raising land, which would then erode and create sedimentary basins. The area of Jordon Lake is a perfect example of a sedimentary basin, forming a significant portion of the Triassic basin in Chatham County. Sedimentary basins such as Jordon Lake and the Triassic basin were part of the focal point of the breakup of the continent, and these break up zones inevitably cause faults. Chatham's location in the state and its relative location within the breaking up of Pangea are why it has many more



faults, and consequently more groundwater features than other surrounding counties. Over millions of years the faults, such as dikes and lineaments, were subject to erosion which cause linear depressions in the topography which are easily identified with LiDAR mapping. In general, the reason one wants to understand the groundwater features of Chatham County, is to better understand the drastic differences in individual well yield within close proximity.

In general, a well at the top of a hill may not interact with many features, which would cause a low yield. Whereas a well in a valley or depression may intersect with more features creating a larger yield. Also, in a valley you might be closer to a stream or river, which would indicate a highly cracked-up zone with more groundwater features.

WELLS IN CHATHAM COUNTY

Anne Lowry attended the meeting to answer questions and give a presentation on the public and private wells in Chatham County. She explained the public and private water supplies in Chatham County. A public water supply is a system which provides piped drinking water to at least 15 connections or 25 people for 60 or more days per year. There are two types of public water supplies, Community and Non-Community. A community water supply serves at least 15 connections or 25 year-round residents, such as a municipal water system. Non-Community supplies are primarily sourced from wells and can be transient, such as campgrounds and gas stations or non-transient, such as churches, daycares, and schools. Public Water Supply Wells are permitted by NCDEQ and have annual sampling requirements, with all oversight coming from the state. Private wells are permitted by the local health department with a one-time sampling requirement and oversight of the well is provided by the owner.

Chatham County has 23 community water systems with 15 wells primarily serving subdivisions. There are roughly 40,000 people in Chatham County being served by a public water system with about 1900 people served by public well water systems. There are an estimated 15,000 wells in private use with an unknown number of users. Chatham County has 28 non-community transient wells in use primarily for gas stations and campgrounds, and a few churches. The Environmental Health Department permits about 180-200 wells per year with approximately 5 per year for agricultural irrigation purposes.

Ms. Lowry made sure to emphasize that just because a well goes dry does not mean the water table is getting lower. Shallow wells are more susceptible to drought events and ebb and flow from year to year depending on the weather. In drought years the county will see more well permits, but records are not kept for the number of wells that go dry every year or where they are located. There are certain areas of the county that because of geology will have more dry and failing wells, but there is no geographical data specifically related to failing wells. There is also no data for failing and underperforming agricultural wells, one reason for which might be that agricultural users do not report such instances. GIS data does show a good amount of the wells in Chatham with data such as depth and yield included. However, there is no data showing any type of pattern to dry or failing wells.

WATER SYSTEMS AND FUTURE WATER SUPPLY PLANNING

One potential problem with limiting the use of individual wells for residential use is the limited availability of acquiring water through any other means. Larry Bridges gave a presentation on the water distribution systems in the county and the effectiveness of such systems to serve all areas of the county.

Chatham County is served by three water supply systems. The North Water Distribution System is supplied by the Chatham County Water Treatment Plant and is capable producing 3 million gallons per day. The raw water comes from Jordon Lake and is purchased from the Town of Cary. This water system also has access to up to another 4 million gallons per day from the Durham Interconnection. There are approximately 240 miles of water main and over 1000 fire hydrants served by this system. This system supplies about 85 % of county water system customers. The rest of the county water comes from two other water distribution systems known as purchase systems, as the water is purchased from another municipal water system. The Southwest Water Distribution System is supplied by

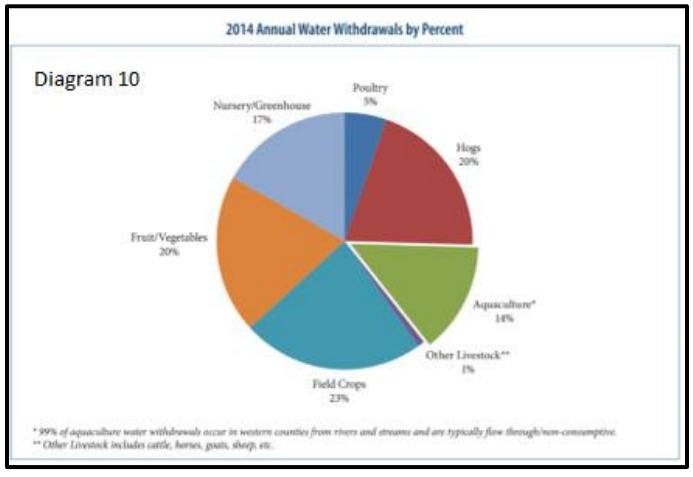
the Town of Siler City and the Asbury Water System comes from Sanford. From these two sources, with the raw water coming from the Rocky and Cape Fear rivers, the county receives approximately 8.7 million gallons per month with 115 miles of water main and more than 250 fire hydrants. Mr. Bridges also explained how the water from Jordon Lake is allocated to the surrounding jurisdictions it was designed to serve. As of the most recent allocation, Chatham County is eligible for 13% of the 100 million gallons per day storage pool. The largest users of Jordon Lake water are Wake County and the Municipalities of Cary, Apex and Morrisville. There are a variety of issues facing the future water availability for customers receiving water from Jordon Lake.

The two purchase systems providing water to the southwestern portions of the county have more than enough water than is currently needed. However, that is not where most of the development is occurring. A majority of customers are served by systems getting water from Jordon Lake, and in the summer months the water supply is overly taxed. The Durham interconnection helps with these problems, but the continual growth in development in the northeastern part of the county could pose a problem to water availability in the future. There is also a downside to not having enough users on a water system. The southwest and Asbury systems could use more customers because limited use causes the age of the water to become a water-quality problem and the lines require more maintenance. Regarding wells that are failing, they are typically in areas of the county that, in theory, could be served by the Southwest and Asbury systems if there were the resources to build the infrastructure. Mr. Bridges was not aware of any plans to expand infrastructure in these areas but advises residences to make their voices heard. The cost of extending water lines is prohibitive to residents or groups of residences; it must be borne by the local government or the development community, or a combination thereof. Currently, developers of major subdivisions are required to tie into county water utilities if the development is within 500 feet of a water line or 100 feet per lot.

AGRICULTURAL OPERATIONS AND WATER USE

One overarching concern for the subcommittee is how agricultural users are affected by dry, failing, or underperforming wells, and what effects residential growth has on agriculture, if any. Susannah Goldston and Ginger Cunningham gave a presentation on agricultural operations and water use in the county, and the resources their respective organizations provide to the agricultural community. As of the 2017 USDA Census of Agriculture, there were a little over 105 thousand acres of farmland in Chatham County, with 29% being cropland, 36% pastureland, 27% woodland and 8% other. Only about 300 acres of farmland was irrigated. In 2017 the market value of the products sold from agriculture operations was over 171 million dollars.

While there are diverse agricultural operations in Chatham County from large scale poultry houses, to livestock, to strawberries and hemp, it is important to note that agriculture in Chatham does not use nearly the amount of water of similarly situated counties in the eastern part of the state. Diagram 10 shows the annual water withdrawals for agricultural operations across the state. Many counties similar to Chatham use much more water because of Hog operations and extensive row crops such as corn and soybeans, whereas Chatham has a far greater percentage of poultry operations which use far less water. Poultry houses use water for cooling in the summer, but many of those operations are on municipal utilities. It is also important to remember that a little over a quarter of agricultural land in Chatham is classified as timberland and those tracts are not watered and do not require any type of water infrastructure. There are few agricultural operations in Chatham utilizing irrigation from wells. What little irrigation is used comes from surface water i.e., ponds and rivers. The subcommittee asked if Ms. Goldston was aware of agricultural wells going dry. She explained that there was anecdotal evidence of dewatered



agricultural wells in Chatham County; a fact that contributes to the growing concern within the agriculture community regarding the link between new residential growth and groundwater supply.

Well Drilling

As has been mentioned throughout this report, the overall concern of the subcommittee is determining the influence, if any, residential wells have on agriculture wells in Chatham County. In order to learn more about the well drilling process and some best practices for the well drilling industry, the subcommittee met with Billy Yow who owns a well drilling company in Guilford County but has drilled wells in Chatham. He provided valuable insight regarding the relationship between neighboring wells, and what causes wells to fail, drawing on his over 35 years of experience in the industry. The most important takeaway from his talk was that he was unaware of ever seeing an agricultural well fail due to a neighboring residential well or wells.

Mr. Yow went over the basic principles of well drilling and how the rules and regulations have evolved to protect the quality and quantity of water. He also gave some useful information regarding municipal and community wells as an alternative for developers in Chatham County to consider. As an example, Mr. Yow mentioned a 200-home subdivision he was contracting with in Randolph County that would be utilizing 6 community wells to supply water to the houses. When a community well is permitted, there are certain regulations that must be met. One is a pump test. A 24-hour pump test is designed to put such a strain on a well that if the well passes the test, it should not fail in the future. One reason that some wells fail is when they are overtaxed. When too much water is pumped out of a well, the static water level decreases which can cause a cone of depression, extending up to 1800 feet. The cone of depression from the overuse of a well is what could potentially harm a neighboring well. Mr. Yow said in his experience the amount of usage to cause a cone of depression is usually associated with irrigation of golf courses or agricultural operations. Mr. Yow could not think of a scenario when a residential well, being used by an average sized family, could be depleted enough to create a cone of depression affecting a neighboring well. Another common reason for wells to fail is the age and construction of the well.

As has been mentioned in previous discussions, state rules regarding well drilling have evolved over time, and most counties have their own rules and regulations that are based on the minimum state standards. However, there was not always regulations in place to protect the consumer from a failing well. Older wells have both water quality and quantity problems. One example of an older well issue is the casing depth. Before state regulations, a well driller would drill until they found water and not install a proper seal or casing. If the seal is not deep enough into consolidated rock that causes quality issues.

It was obvious from his presentation that he is used to being tasked with repairing failing wells that might be old or improperly constructed, not wells that have been affected by a neighbor. We also must remember that often, as was mentioned by Larry Bridges, well water is the only water source for many areas in the county, which is not necessarily a bad thing. Mr. Yow believed increased well usage was better than expanded growth on already burdened reservoirs.

County Attorney Opinion

The County Attorney informed the subcommittee that several legal principles cause him to question the legality of requiring subdivisions with more than a specified number of lots to connect to a public water supply (publicly or privately owned) system. These include:

1) The general proposition that property owners are legally entitled to make reasonable use of groundwater beneath their property. This is a property right.

2) G.S. 87-97(e) states: “Notwithstanding any other provision of law, no permit for a well that is in compliance with this Article and the rules adopted pursuant to this Article shall be denied on the basis of a local government policy that discourages or prohibits the drilling of new wells.”

3) While G.S. 153A-284 authorizes counties to require properties “located so as to be served by a [county] water line” to connect to the system, G.S. 87-97.1(a) provides that “a property owner may apply for, and be

issued, a permit for an irrigation water well, whether the property is connected to, or served by, a public water system."

4) Substantive due process under the constitution protects against laws that are unreasonable, arbitrary, or capricious. It also demands that laws be substantially related to the valid object sought to be obtained. Stated another way, the test is whether the law bears some reasonable relation to the legitimate objectives of the police power.

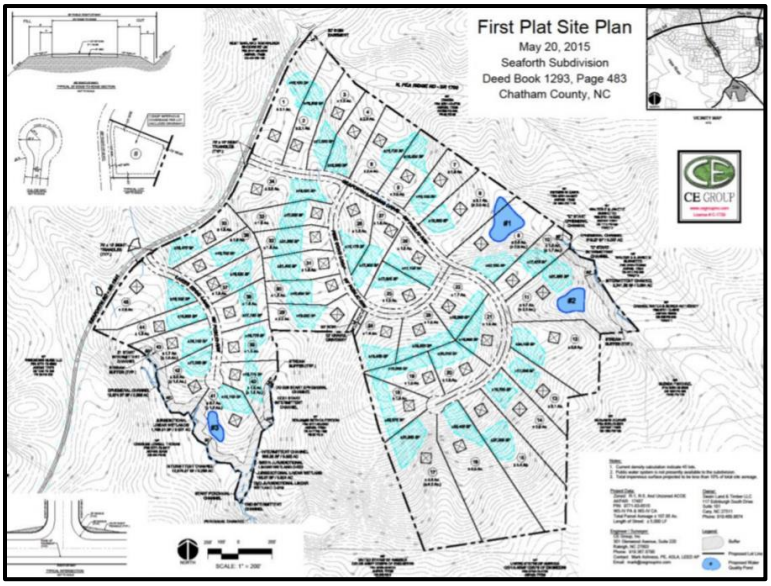
The attorney stated that, taken together, these statutes and legal principles suggest that counties face significant obstacles in trying to prohibit the drilling of wells and use of well water. Specifically, he questioned whether a subdivision ordinance requirement that would prohibit subdivisions with more than a specified number of lots from being served by ground water could pass constitutional muster. That is because: (i) given the statutory provisions, it is questionable whether restricting wells is a valid objective; and (ii) the number of lots do not necessarily correlate to the impact on ground water. He illustrated this latter point by asking the subcommittee members to consider the effect of a ten-lot limit on a 100-acre tract versus a 20-acre tract.

County Land Use Regulations and the Comprehensive Plan

The goal of this subcommittee is to make recommendations to the Planning Board regarding residential well usage in Major Subdivisions. The Planning Board will submit these recommendations to the Board of Commissioners. When recommending a local regulation be amended it is important to understand how the regulation is interpreted and enforced, and also the governing body's ability to amend the document.

Jason Sullivan gave a presentation on the Chatham County Subdivision Regulations and the Comprehensive Plan. The County has the authority to regulate the subdivision of land within its planning and development regulation jurisdiction granted by Article 8 of Chapter 160D of the NC General Statutes. In Chatham County the subdivision process is administrative/ministerial meaning there is a pre-determined set of rules and regulations to be met, and if a developer meets them there is an expectation, they will receive approval. Minor subdivisions, which are subdivisions of five lots or less are approved by staff. Major Subdivisions are reviewed by the Planning Board and final decisions are made by the Board of Commissioners.

When Planning Staff is reviewing a major subdivision, they must consider not only the subdivision regulations, but also the Zoning Ordinance and the Watershed Protection Ordinance and apply the most restrictive rule from either. For instance, minimum lot size is defined as 1-5 acres in the Zoning and Watershed ordinance, but as 40 thousand square feet or 1.5 acres for well and septic lots in the subdivision regulations. It is also important to note that Chatham's regulations already limit the number of wells in a subdivision by mandating the minimum lot size. The diagram shows the major subdivision of Seaforth Landing and illustrates how a subdivision utilizing individual wells would be oriented. The average lot size for this development was 2.29 acres, with the minimum required to be at least 1.5 acres. This project went through the major subdivision process and was approved. When thinking about how Well use could be regulated in the future it is important to remember how the comprehensive plan can be utilized.



From a zoning standpoint the comprehensive plan holds more weight than the county subdivision regulations. Through the legislative and quasi-judicial processes, the planning board and board of commissioners

can use the language in the comprehensive plan to deny a project or a rezoning, and that decision would be legally defensible. For example, if the comprehensive plan defined a certain node as agriculture and a developer wanted to rezone it light industrial, the comprehensive place could be used to guide the advisory board and commissioner's decision. As the subdivision process is administrative, the comprehensive plan can be used as an evaluative tool, but it cannot be used to deny a subdivision. If the planning board or board of commissioners does not like how subdivisions are fitting into the landscape of certain areas of the county designated for conservation or agriculture, those are concerns that can be addressed during the upcoming UDO process. Furthermore, due to ever increasing pressures in rural parts of the county the Planning Board and BOC may see fit to proceed with ordinance amendments to address inadequacies in the subdivision ordinance.

Appendix

- Presentation by Rick Bolich of NCDEQ, Division of Water Resources

https://www.chathamcountync.gov/home/showpublisheddocument/52950/637417196931470000

- Presentation by Phil Bradley of NCDEQ, North Carolina Geological Survey

https://www.chathamcountync.gov/home/showpublisheddocument/52952/637417199972600000

- Presentation by Anne Lowry, Chatham County Environmental Health Director

https://www.chathamcountync.gov/home/showpublisheddocument/54934/637527914095370000

- Presentation by Larry Bridges, Chatham County Utilities Director

https://www.chathamcountync.gov/home/showpublisheddocument/54201/637479619748430000

- Presentation by Susannah Goldston, Environmental Specialist and District Director of Chatham Soil and Water Conservation District

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- Presentation by Jason Sullivan, Chatham County Planning Director

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