Bladen County Preliminary Capacity Use Assessment

North Carolina
Division of Water Resources
Environmental Management Commission

October 2, 2002

Executive Summary

Since the 1970s ground water levels in Bladen County have responded to withdrawals by the various industrial users, agricultural irrigators and public water suppliers. In 1992, levels began declining at a much faster rate in the Upper Cape Fear aquifer than in earlier years, because of a large increase in withdrawals. Over the last ten years, the United States Geological Survey (USGS) and the North Carolina Division of Water Resources (DWR) have tracked the use of the Upper Cape Fear aquifer for water supply using a series of monitoring wells.

These wells show that the water pressure in the Upper Cape Fear aquifer has fallen in response to pumping. Maps of the pressure conditions in the aquifer over the ten-year period show dramatic changes to the size and shape of the cone of depression. Water levels have declined so that they are near the top of the Upper Cape Fear confining unit. This suggests that the pumping water levels nearby (normally deeper) are within the confining unit or near the top of the aquifer. If water levels decline below the top of the aquifer then the aquifer is being dewatered. Salt water is of concern as it is found in the Lower Cape Fear aquifer below a pumping center. Heavy pumping may cause salt water encroachment across the Lower Cape Fear confining unit and contaminate well fields.

Along with the concerns over the water level declines in the Upper Cape Fear aquifer there have been serious effects by North Carolina's current drought. Monitoring of the Surficial aquifer or unconfined aquifer in Bladen County has shown ground water level declines. The Surficial aquifer is most susceptible to drought conditions. When individual homeowner wells are shallow a drought can "dry-up" the wells. Actually, the water table drops below the base of the well. A deeper well would still have water available, but might require a different type of pump. A capacity use investigation will not help individual homeowners with a drought situation.

The Division of Water Resources recommends to the EMC Water Allocation Committee that a capacity use investigation is not needed at this time. Over the next year, staff will take the following steps:

1. Encourage the Lumber River Council of Governments (LRCOG) to continue their work within Bladen and surrounding counties to study ground water resources.
2. Coordinate with the USGS and their cooperators, the LRCOG, to continue to collect ground water level data at a series of private wells in Bladen County. Continuous water level recording using data-loggers at many of the wells are a priority. DWR is interested in deploying automatic recorders at as much of their monitoring well network as possible.
3. Through the LRCOG, meet with the large ground water users in Bladen County and nearby counties to discuss opportunities to use water more efficiently and from different sources.
4. In late 2003, the Division will re-evaluate the water level data, interpret water withdrawal trends using new 2002 Local Water Supply Plan information, and review outcomes of meetings with the large water users. If the situation has not continued to improve, we will request a meeting with the Water Allocation Committee.

The Facts about Bladen County Ground Water

Ground water level declines have been documented in the Upper Cape Fear aquifer since monitoring wells were constructed in that aquifer in the 1970s (see figures 1 and 2). However, beginning in 1992, levels began to decline in a much more dramatic fashion until about 1996. Although continuing to decline after 1996, the rate was substantially reduced. The reduced rate continued until 1999-2000. Then water levels, for the most part, equilibrated (neither rose nor fell) or began to rise. This is true except for water levels near DuPont and Smithfield Packing, where water level declines continue today.

Those water levels displayed in figure 2 and collected in 2002, together with others from the Upper Cape Fear aquifer allow creation of a potentiometric surface map of the aquifer. The color-shaded version of that map is shown in figure 3 and contour-only version in figure 4. A cone of depression centered on Smithfield Packing is clearly seen. Also in figure 4, a cross-section line (A-A') is indicated and is illustrated in figure 5.

The water levels near Tar Heel (Smithfield Packing) and DuPont lie at the top of the Upper Cape Fear confining unit (see figure 5). This is of concern because it suggests that pumping levels, at least at Smithfield Packing, have most likely dropped into the confining unit or possibly as deep as the aquifer itself. If the pumping levels are below the top of the aquifer then dewatering is taking place. DuPont's water withdrawals are almost strictly from surface water, from an intake on the Cape Fear River. DuPont only uses a small amount of ground water for potable needs (see table 1).

Salt water is in the Lower Cape Fear aquifer, which lies directly below the Upper Cape Fear aquifer. Salty water exists beneath the Elizabethtown well field (see figure 5). Pumping may eventually cause migration of salt water toward a pumping center.

Water withdrawal information for the region is summarized in table 1. Although Smithfield Packing did not submit a 1999 Water Withdrawal Registration form, their withdrawal data from the Division of Environmental Health combined with all other users totaled about six million gallons per day in 1997–1999. This withdrawal data allows a better understanding of the hydrographs in figure 2. For example, all the wells are responding to the obvious cut back in withdrawal by Alamac Knit Fabrics, from 1.840 million gallons per day to zero, which is clearly shown by the Alamac Knit Fabrics well (in 2000, 2001 and 2002). We know this is because Alamac Knit Fabrics has gone out of business. All the wells except the Smithfield Packing and DuPont wells respond to this change in withdrawal. The Smithfield Packing and DuPont wells continue to decline, albeit at lesser rates.

There are significant gaps in the water level, fresh water-salt water interface, and hydrogeologic framework information. Filling these gaps is a priority in the near future so as to understand this situation fully. Water level control for the Upper Cape Fear aquifer is especially lacking in Cumberland County. There is also limited data on the hydrogeologic framework in Cumberland County and northeast, west and southeast Bladen County (the black dots on figure 4). We lack monitoring well stations (where we can monitor all the major aquifers from a series

of wells) in Cumberland County and central and northern Bladen County (the black dots on figure 1).

Recommendations

Although the Upper Cape Fear aquifer shows signs of stress similar to those seen in the central coastal plain, there are significant differences. The central coastal plain is a large area with hundreds of large water users. Relatively few large water users seem to be involved in this situation. Whereas no central planning organization existed in the central coastal plain, the LRCOG exists and is very interested in understanding their ground water resources and participating in planning for the greater Bladen County region.

Beginning in August, DWR began regulating the central coastal plain through the CCPCUA rules that the EMC adopted in May 2001. The Division of Water Resources' role in the permitting process is critical to the success of the CCPCUA. Entering into a capacity use investigation at this time in Bladen County will divert key resources needed to administer the CCPCUA.

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Definitions

Cone of Depression: A cone of depression is produced as a well withdraws water from a well. Nearby water pressures are reduced less and less as one moves further from the pumped well, so a cone of depression is deepest nearest the pumped well and shallowest at some distance. The cone of depression's shape is also influenced as more wells are pumped, so that as many users pump their wells, each cone of depression from individual wells coalesces with a neighboring well and forms a larger, irregularly shaped cone of depression.

Salt Water Encroachment: Salty ground water is drawn toward and into a well field as pumping reduces the ground water pressures in the fresh portion of an aquifer. If a well field has caused this then treatment of the higher chloride-rich water is more expensive.

Surficial aquifer or unconfined aquifer: Also known as the water-table aquifer, this aquifer is the shallowest subsurface material that will yield water to a well. In the Coastal Plain it is usually composed of sandy material.

Dewatering: Ground water levels have declined below the top of a confined aquifer. Unconfined conditions now exist in the aquifer. Air is allowed into the aquifer. The capacity of the aquifer to produce water is lessened. In the central coastal plain, conditions like this have occurred over a widespread area and there are signs that the aquifer's ability to yield water is greatly diminished. The evidence occurs as air entrained in the withdrawn water and greatly reduced yields and longer pump run-times.

Potentiometric Surface Map: A map of the surface formed by linking many ground water levels collected for a particular confined aquifer. Levels are all related to a datum, or in this case, mean sea level.

Figure 1. Water Level Network with Highlighted Bladen County Wells

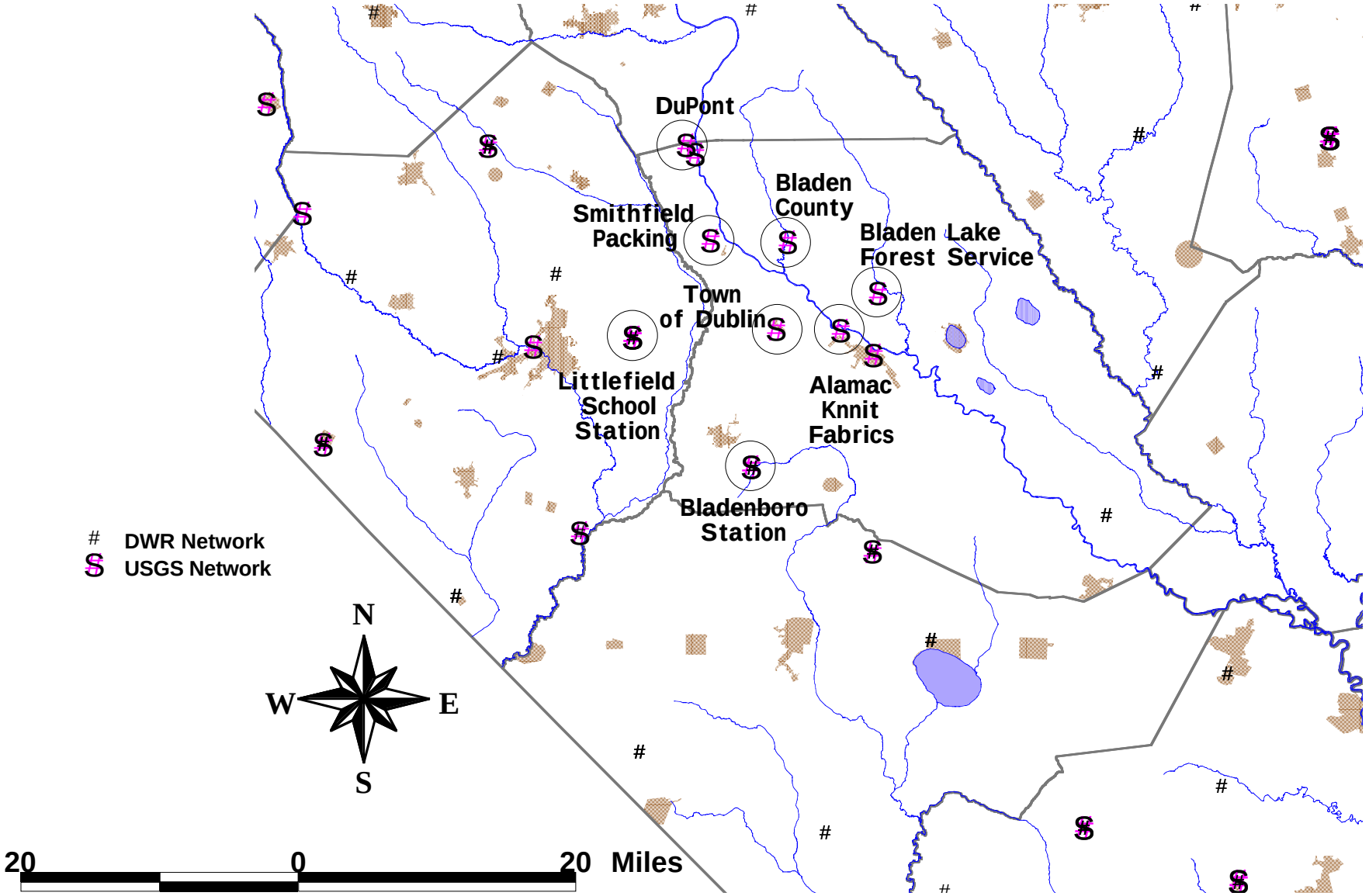

Figure 2. Bladen County Water Levels

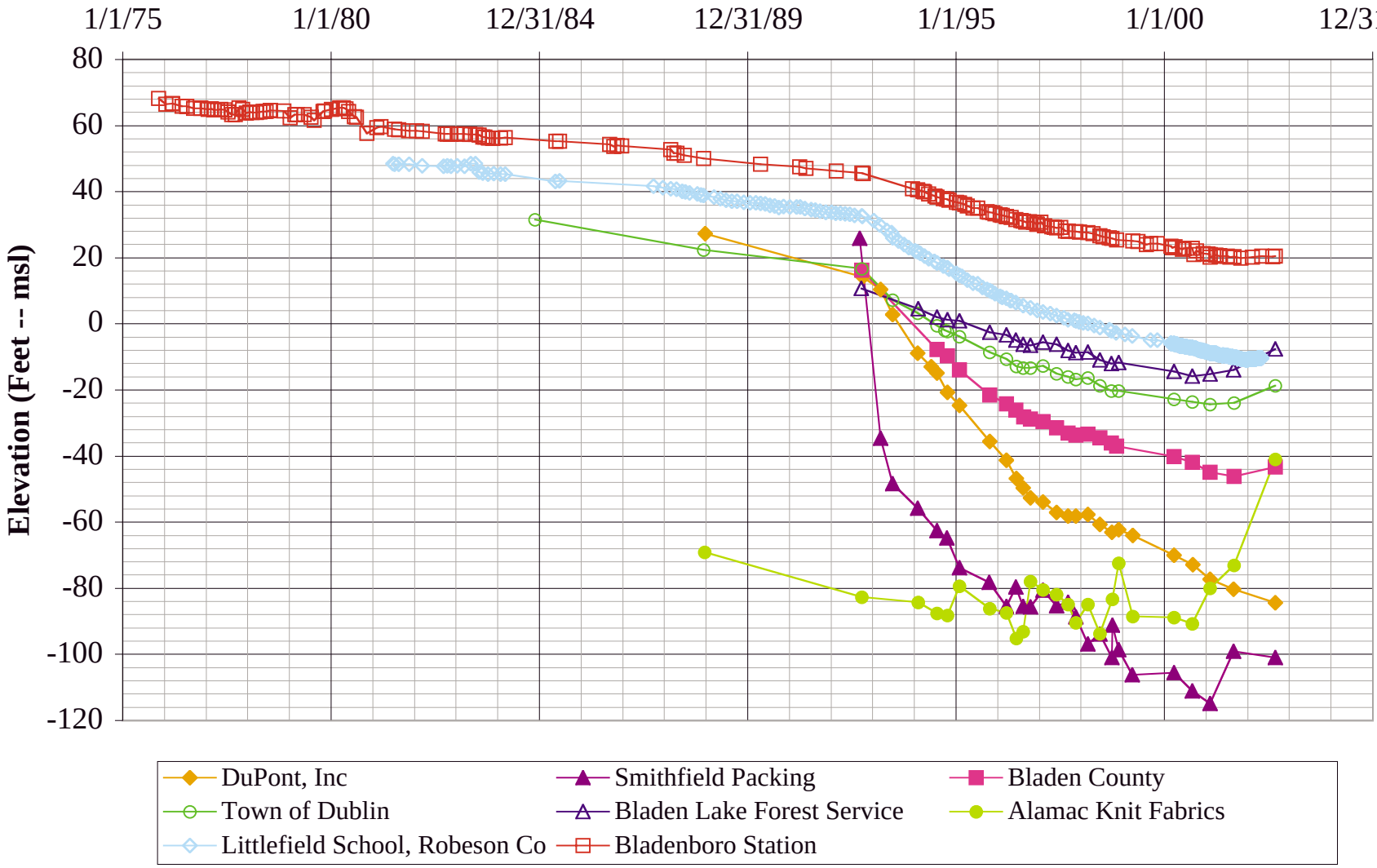

Figure 3. Upper Cape Fear Potentiometric Surface Map for 2002

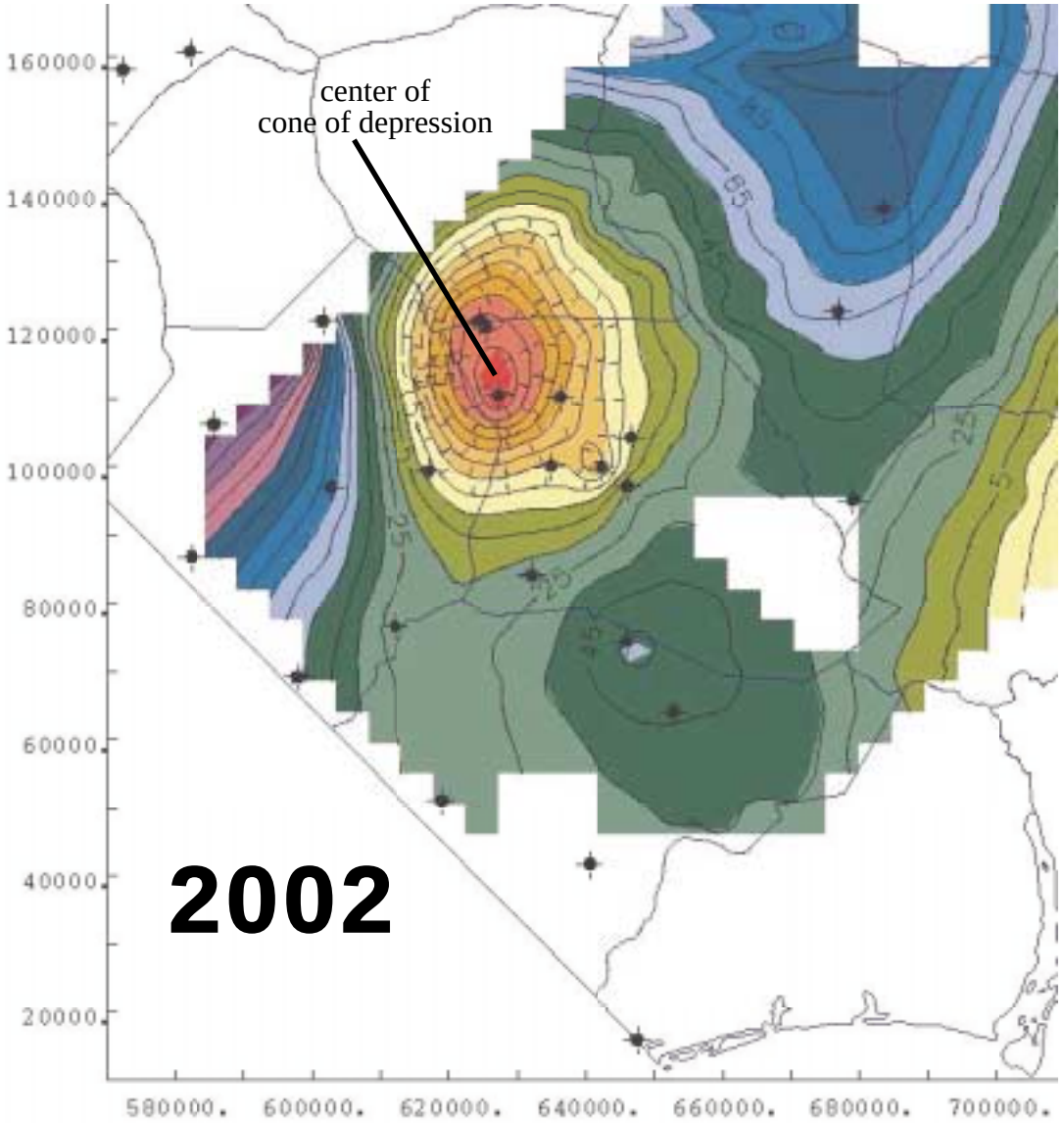

Figure 4. Upper Cape Fear Potentiometric Surface Map with Hydrogeologic Framework Boreholes

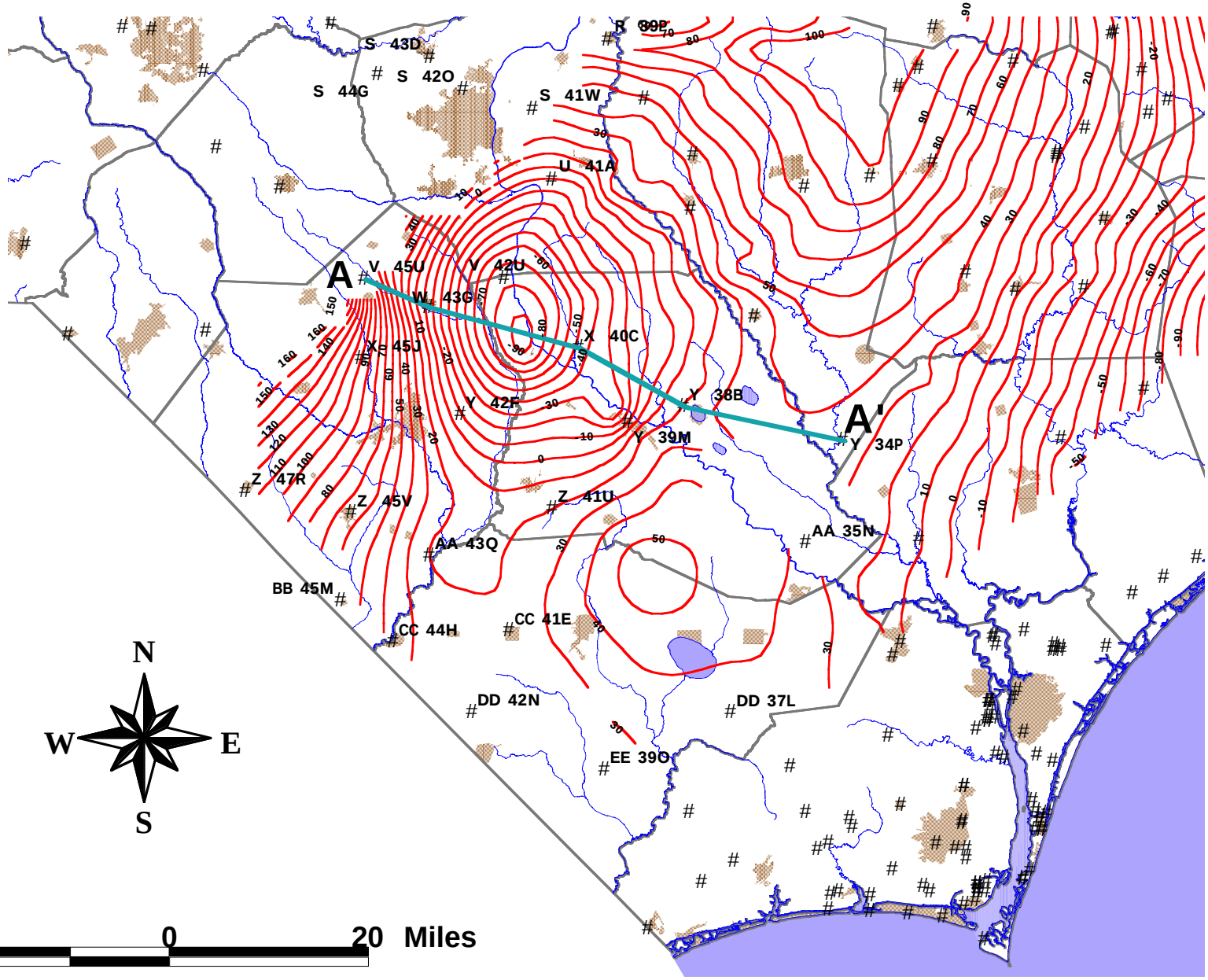

Figure 5. Hydrogeologic Cross Section through Bladen County along A–A'

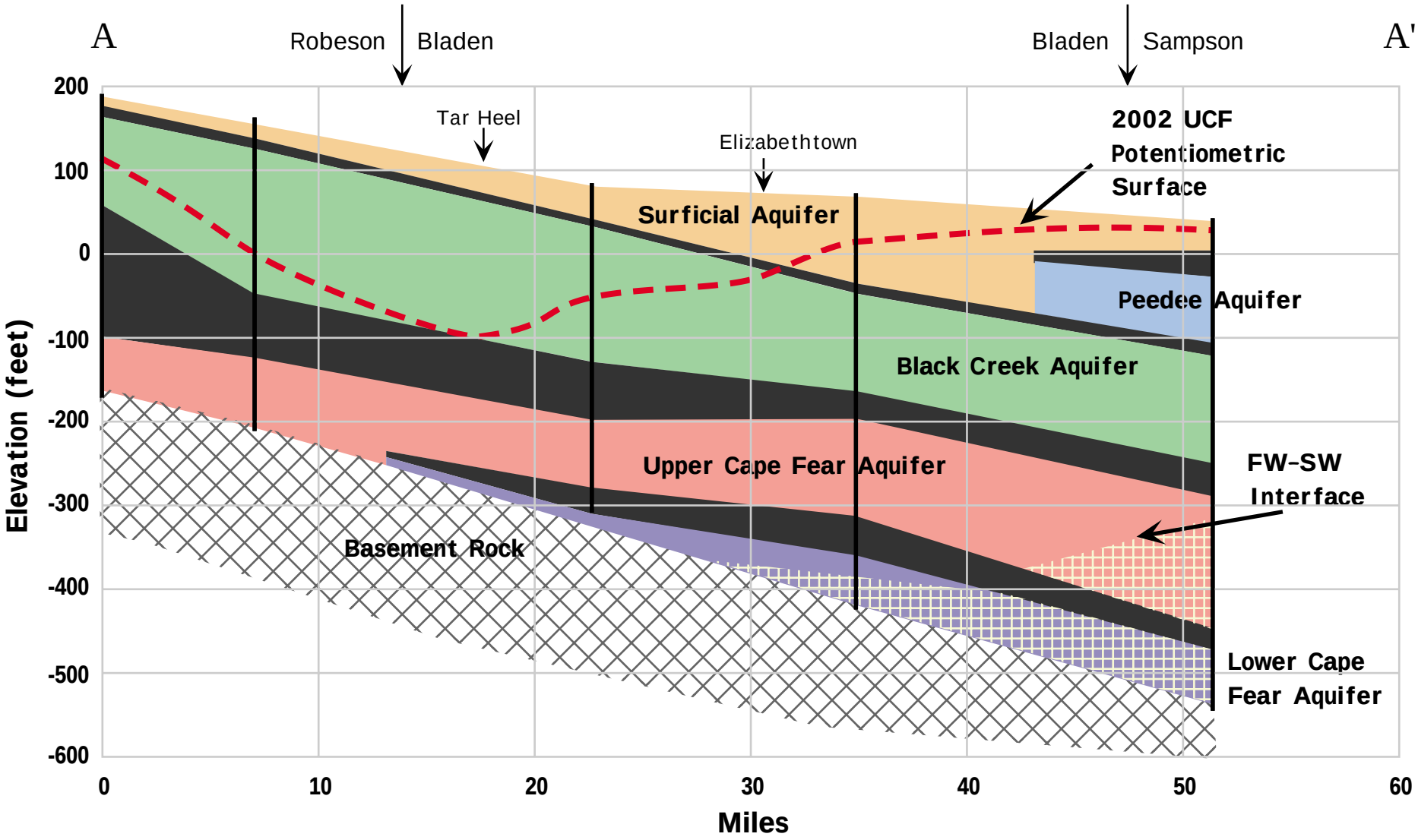

Table 1

Upper Cape Fear Aquifer Water User Name	Amount Withdrawn (mgd)	Source of Data (either Water Withdrawal Registration – 1999 or Local Water Supply Plan - 1997)
Smithfield Packing	1.974	DEH Public Water Supply Forms 1999
Alamac Knit Fabrics*	1.840	WWR
Elizabethtown	0.881	LWSP
Bladen County Water District – West Bladen	0.351	LWSP
White Lake	0.276	LWSP
Bladenboro	0.208	LWSP
Clarkton	0.130	LWSP
South Bladen	0.069	LWSP
Bladen County Water District – 701N	0.067	LWSP
Bladen County Water District – White Oak	0.063	LWSP
Dublin	0.050	LWSP
Bladen County Water District – East Arcadia	0.050	LWSP
Tarheel	0.027	LWSP
DuPont	0.006	WWR
Total	**5.992**	

* At some point after 1999, Alamac Knit Fabrics went out of business and their withdrawals stopped.