Groundwater Quality and Quantity Complications in the Upper Coastal Plain of Georgia

A Case Study from the Cretaceous Sand (Dublin-Midville) Aquifer System

Georgia Environmental Conference

August 22, 2018

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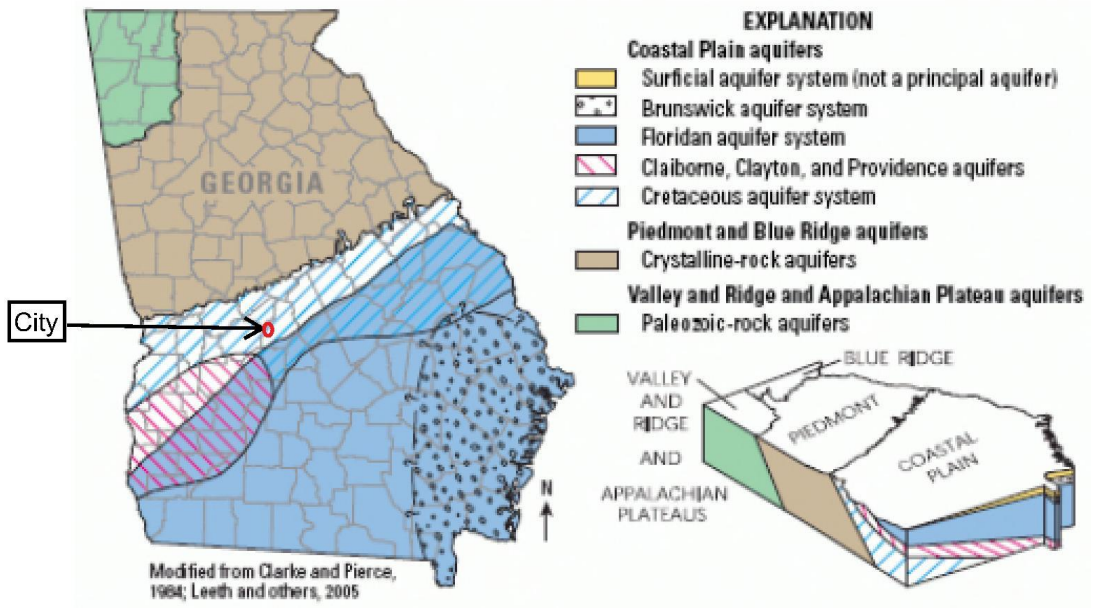
Coastal Plain Aquifer Review



Principal aquifers of Georgia. The most productive aquifers are in the Coastal Plain province where thick, permeable sedimentary deposits have formed several layers of aquifers. The surficial aquifer system is present throughout the State and is not shown on the map at left.

Source: USGS

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Coastal Plain Aquifer Review

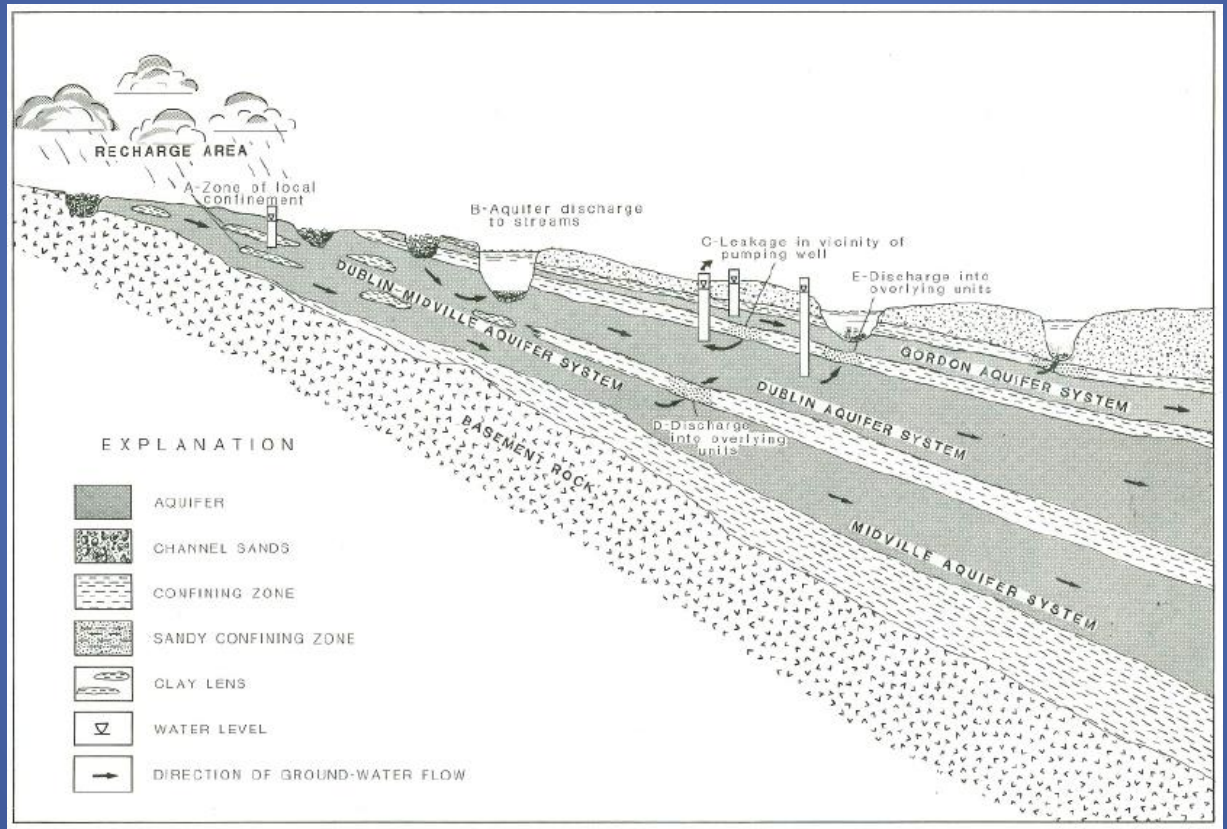

Figure 23.—Schematic diagram of recharge and discharge, and the direction of ground-water flow in the Gordon, Dublin, Midville, and Dublin-Midville aquifer systems.

Source: GGS Information Circular 74

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Background

- Cretaceous Aquifer System
  - Comprised of the Providence, Dublin, Midville, and Dublin-Midville Aquifers
  - Dublin and Midville Aquifers are not separated in updip areas and form the Dublin-Midville Aquifer
- Case Study – Municipal Groundwater Supply
  - 5 Production wells for drinking water
    - 800 to 1,500 gpm wells; 448’-665’ deep
    - Low pH groundwater (3.6 – 5.0): lower in 3 deeper wells
    - Wells installed 1965 – 1989 (53, 47, 38, 33, & 29 years old)

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Well Issues in Low pH Groundwater

- Continuous O&M issues
  - Anything not stainless steel continually being replaced due to corrosion
  - Pumps rebuilt with stainless components
  - Some carbon steel outer casings failed in less than 10 years
    - lower pH (3.6 – 4.4), deeper, & updip wells
  - Other carbon steel outer casings failed and were unnoticed until other component failure
  - One well started pumping sand (well failure)

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Acidic Groundwater (pH 4.8 – 5.0), Carbon Steel Well Casing (3/8”), and Time

1st Hole in Casing @ 80’

2nd Hole in Casing @ 115’

All images courtesy of Client

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Acidic Groundwater (pH 4.8 – 5.0), Carbon Steel Well Casing (3/8”), and Time

3rd Hole in Casing @ 180’

4th Hole in Casing @ 198-201’

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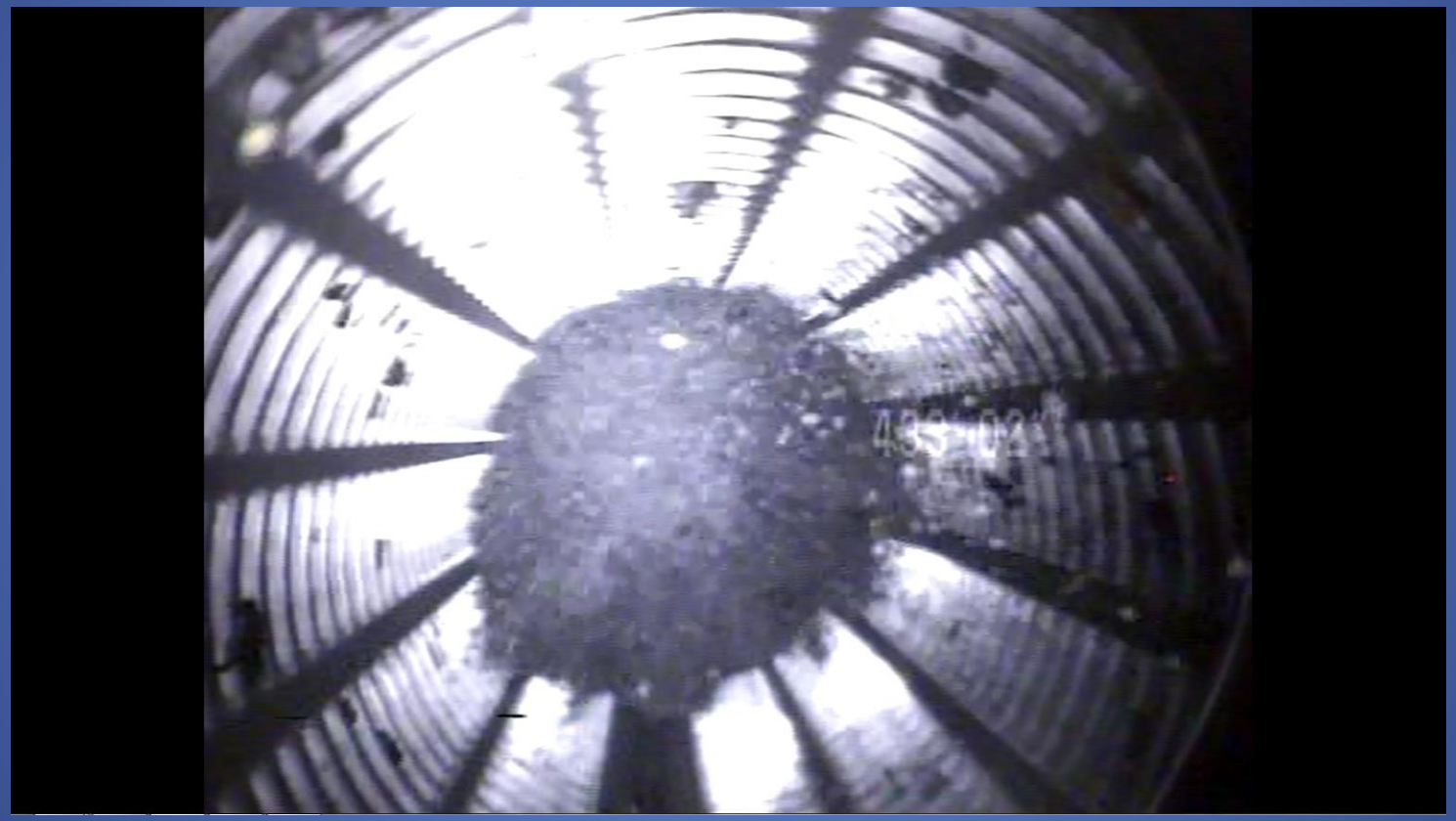
Hole at the Bottom



Sand Flowing Up a Stainless Well Screen at 443’

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“Find Us Better Water”

- Objectives:
  - Neutral pH
  - Low major ion concentrations (low iron, chloride, sulfide) to minimize treatment
  - 2 MGD (1,390 GPM)
  - High topographic location for distribution
- Obstacle:
  - This is the Upper Coastal Plain…

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Alternate Groundwater Source Review Process

- Are there shallower or deeper aquifers beneath the city?
- Are there other aquifers to the south, southwest, or southeast?
- Are multi-aquifer wells a possibility to manipulate water quality and quantity?

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Shallower, Deeper, or Multiple Aquifers?

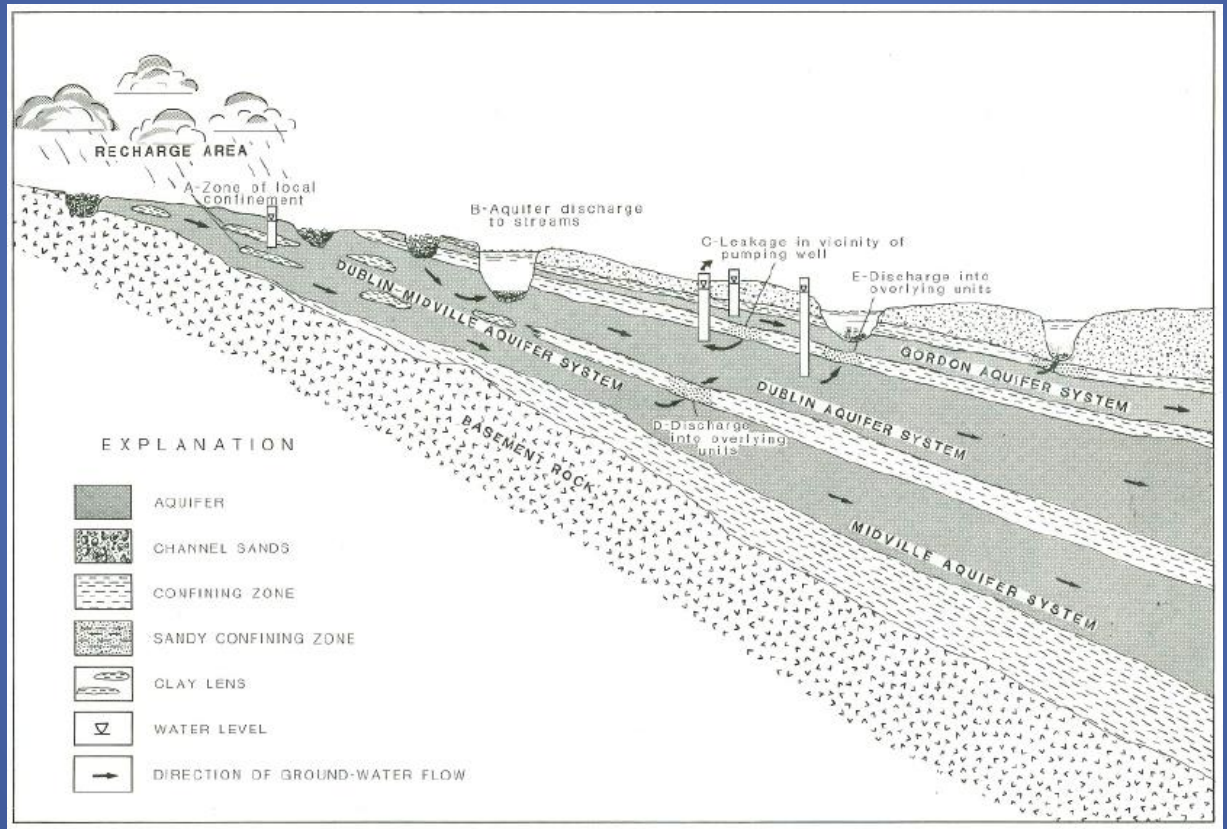

Figure 23.—Schematic diagram of recharge and discharge, and the direction of ground-water flow in the Gordon, Dublin, Midville, and Dublin-Midville aquifer systems.

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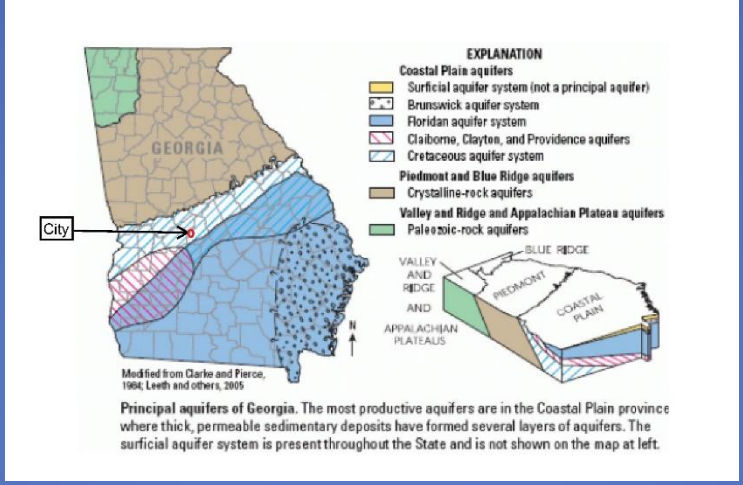
Nearby Aquifers to the South?



- No Floridan Aquifer under the city, but…
  - Temptingly close…some miles to the south
  - But just where is the Floridan in the south part of Houston County?

Source: USGS

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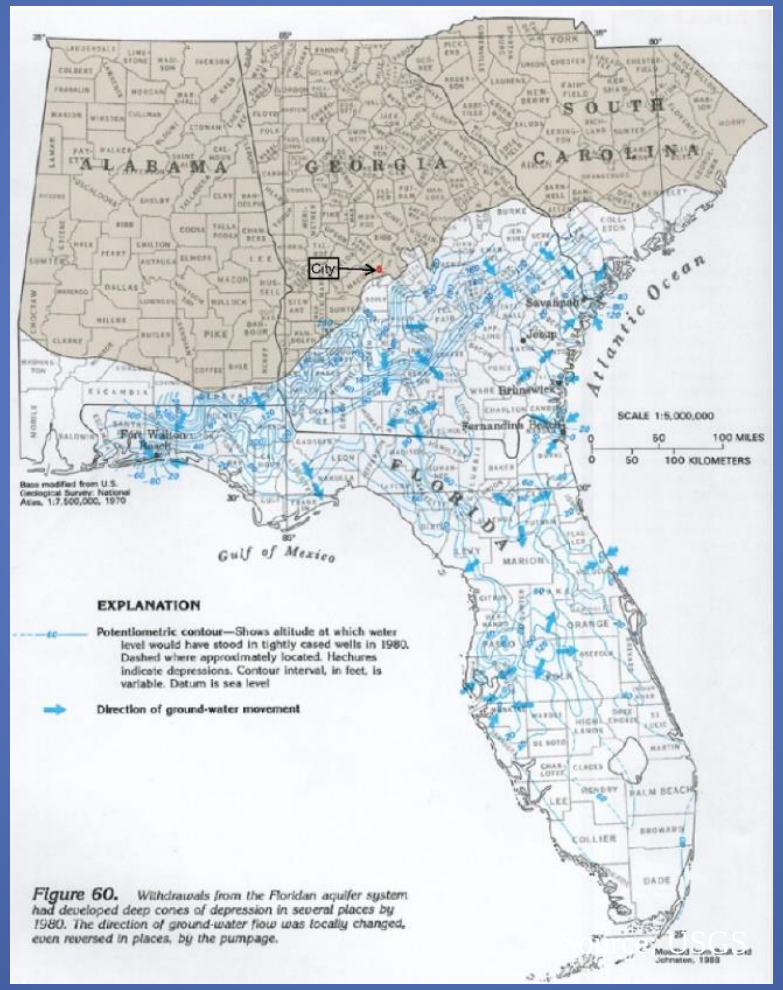
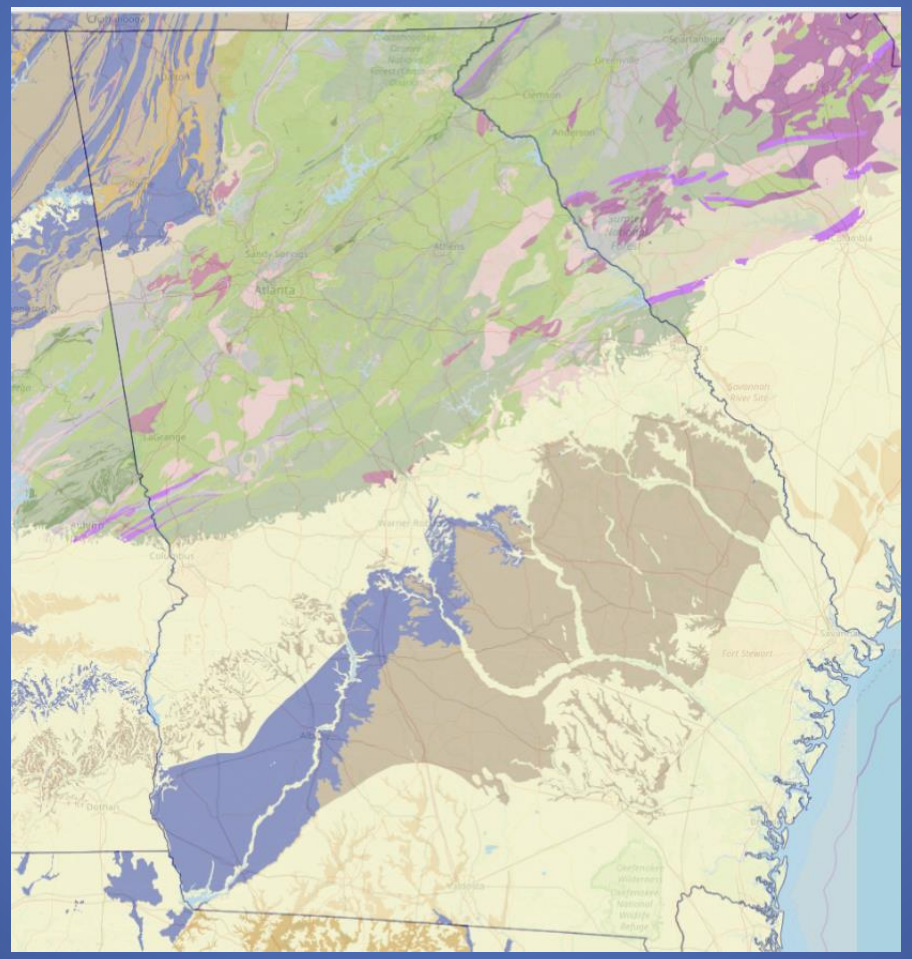
Map of Floridan Aquifer System



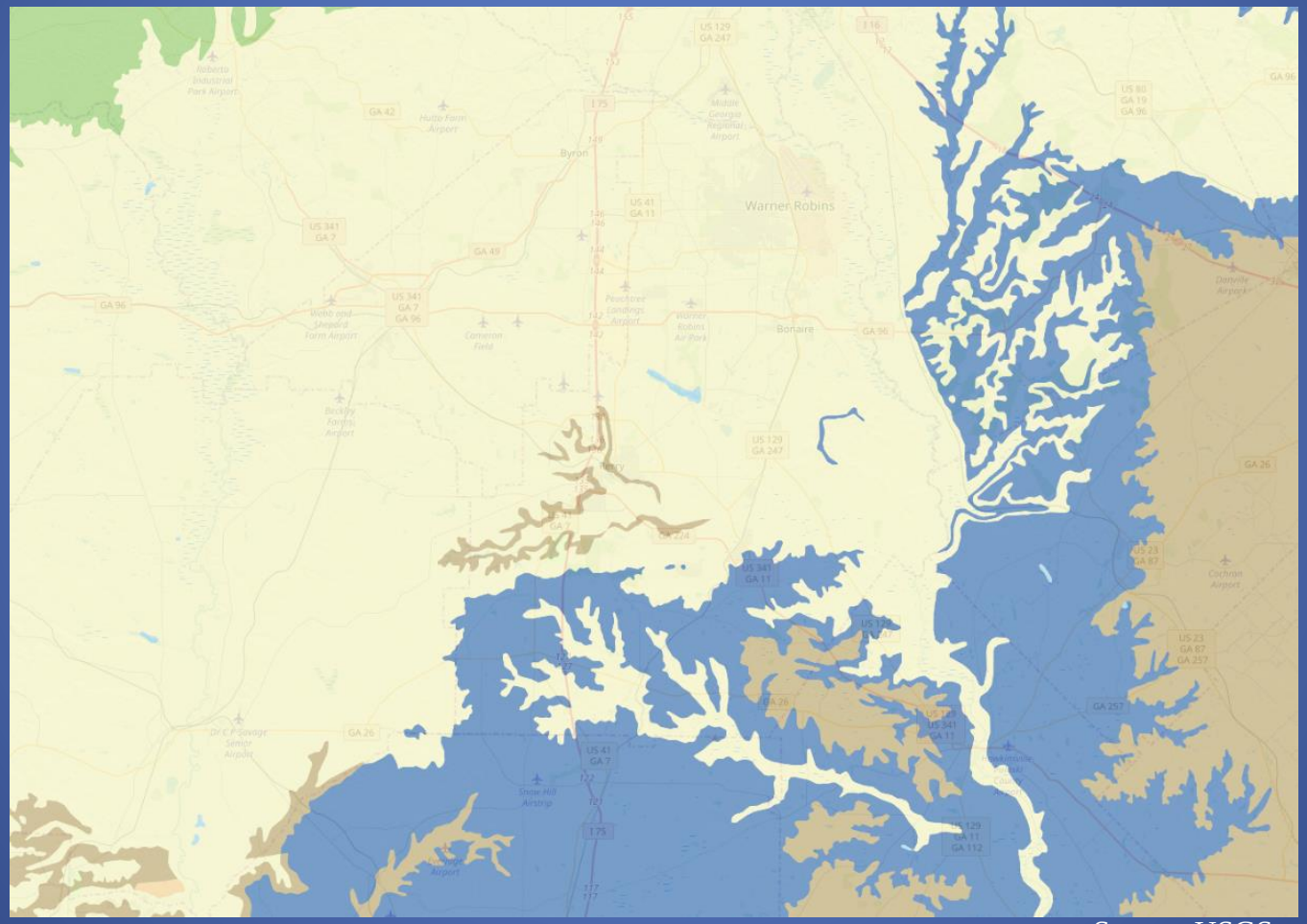
Source: USGS

Geologic Map of Georgia



Source: USGS

Geologic Map of Georgia Closeup



Source: USGS

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Alternate Groundwater Source Review

- So, can we get to the Floridan?
  - No. Suwannee Limestone is just across the creek south of town, but it is unconfined. True Floridan too far away.
- What about the shallower Gordon Aquifer, but south of the city?
  - Confined and deeper
  - pH good (7-7.6)
  - Volume too low (up to 300 gpm)

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Multi-Aquifer Wells?

- What about multi-aquifer wells?
  - Another municipality to the south has a Gordon/Dublin well yielding 700-1,000 gpm at pH 7 with low iron
  - But, it's not 1,390 gpm (2 MGD)!

- This was our recommendation:
  - Two Gordon/Dublin wells yielding 700-1,000 gpm at pH 7 and low iron at a location on a high ridge south of town
  - Shallower than Dublin-Midville wells, so some cost savings

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The Rest of the Story…

- Did they take our recommendations?
  - No, they purchased an in-town site
  - Cost analysis showed that the recommended location and wells cost 20% more in capital costs than one in-town well
  - There are always criteria other than scientific ones

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The Take Away

- If your wells have groundwater pH<5, have them inspected
  - They may be compromised with no readily discernable exterior signs
- If you are planning to install new wells, the well-drilling industry standard in the area is carbon steel outer casing.
  - Consider potential well rebuilding costs in a few years before accepting this.
- Calculate capital and O&M/rebuilding costs over time for full cost evaluation.
- If you ask for everything, it's never going to be the cheapest option.

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