

Groundwater Availability Assessment  
Technical Advisory Committee Meeting  
October 1, 2018  
1:00-3:00  
S.C. Geological Survey  
5 Geology Road  
Columbia, SC 29212

AGENDA

1. Introductory Remarks and Roll Call

In attendance or on the call: Adem Ali, Alex Butler, Andrea Hughes, Michael Yip, Ray Gagnon, Clay Duffie, Lance Tully, Andy Wachob, Bill Clendenin, Brooke Czwartacki, Joe Gellici, Joshua Williams, Kelley Ferda, Bruce Campbell

Joe Gellici noted the importance of input data that are used to develop the groundwater model and the importance of maintaining and expanding these datasets and programs in the future. These include water use data, pumping tests, potentiometric maps, the groundwater monitoring network, baseflow information from streamflow gages, geophysical logs to improve the hydrogeologic framework, and the recharge model.

2. Status Report on the Hydrogeologic Framework – Joe Gellici (DNR)

Joe Gellici gave a brief report on the status of the hydrogeologic framework (see presentation).

a. Structure contour maps

- i. Elevation contour maps of each aquifer have been produced and created in GIS.
- ii. Thickness contour maps of each aquifer and confining unit have been produced can created in GIS.
- iii. These maps are currently under final review by Joe Gellici

b. Potentiometric mapping

- i. Water levels in the Upper and Middle Floridan aquifers track closely with one another and are typically 1-2 feet apart. Significant head differences, however, occur between water levels in the Middle Floridan and the Gordon aquifer (across the Gordon confining unit).

- ii. At the Savannah River Site (SRS), head differences as great as 40 ft occur across the Gordon confining unit, with higher heads in the Floridan in upland areas and with higher heads in the Gordon along major floodplains.
- iii. Owing to these differences, DNR plans to produce two potentiometric maps this year – one of the Gordon aquifer and one of the Floridan aquifer (combining water levels from the Upper and Middle Floridan aquifers). Water levels will be recorded in November and December 2018 and the maps will be available Spring 2019

c. Questions

- i. Bill Clendenin: Do any aquifers contain minor producing units?  
Joe Gellici: Yes, the Crouch Branch aquifer in Florence and Dillon counties. The Crouch Branch splits into three separate aquifers. For now, they will be combined due to lack of supportive data.

3. Status Report on the Groundwater Recharge Model – Bruce Campbell (USGS)

Bruce Campbell gave a report on the status of the recharge model (see presentation).

- a. Model inputs include land use/land cover, climate data, hydrologic soil group, soil water capacity, and flow direction derived from DEMs.
- b. Recharge results are compared to baseflow calculations as a verification exercise.
- c. Questions

- i. Clay Duffie: What are the units for recharge values?  
Bruce Campbell: Inches/year
- ii. Clay Duffie: Are you using precipitation rates as model input to factor the recharge rates?  
Alex Butler: The model uses a climate dataset produced by the University of Idaho called gridMET (cited as METDATA). Combines gridded climate data with radar data.

4. Status Report on the Groundwater Flow Model – Bruce Campbell (USGS)

Bruce Campbell gave a report on the status of the groundwater flow model.

- a. Calibration results are still being reviewed. Joe Gellici and Andrea Hughes have reviewed and made some comments as well.

- b. Anyone who would like to view historic calibration results in detail, contact Bruce Campbell.
  - c. Joe Gellici wants to review all hydraulic conductivity values for some possible tweaking of the model to improve calibration. Joe would like to see a map showing the distribution of horizontal hydraulic conductivity values used in the model for each aquifer.
  - d. Questions and comments
    - i. Adem Ali: Which parameter is most sensitive in the groundwater flow model?  
Bruce Campbell: Hydraulic conductivity is the most sensitive. Storage terms are set extremely low in order for simulation of drawdowns.
    - ii. Adem Ali: Are the calculated hydraulic conductivity values typical values one would produce from a pumping test?  
Bruce Campbell: Yes, and calibration results will be reviewed to see how well they match to pumping test data provided by SCDNR.
    - iii. Clay Duffie: Suggested for next meeting that an example be provided of what the model outputs will look like, preferably regional. Discuss predictions of future drawdowns and restrictions groundwater producers will be facing in the future. How will the assessment of scenarios be utilized in state water plan.
    - iv. Kelley Ferda: Will regulatory recommendations be included?  
Joe Gellici: No, this will come up during the regional water planning process.
5. Discussion – Campbell, B.G., and Coes, A.L., eds., 2010, [Groundwater availability in the Atlantic Coastal Plain of North and South Carolina](#): U.S. Geological Survey Professional Paper 1773, 241 p., 7 pls.

The committee was asked to review this report for discussion at the next TAC meeting. What do you like? What do you dislike? Any recommendations for upcoming report? As of now, the plan is to revise mainly Chapter 3.

- a. Questions and comments
  - i. Clay Duffie: Mostly interested in water budgets and presenting these results in a “digestible” manner for the common person to understand. What is the best way to breakdown and present results for each aquifer and/or region?
  - ii. Joe Gellici: Recommends for the next meeting going through an example of one of the water-budget analyses from the 2010 report.

## 6. Discussion – Model Scenarios

Once the model is completed, what needs to be simulated?

### a. Questions and comments

- i. Bruce Campbell: Climate is built in to the recharge model. We also have future water-use scenarios. The water-use projections that we've done have everything except agricultural use. We don't have large irrigation users in our future water-use projections.
- ii. Clay Duffie: Six scenarios were suggested at a previous meeting.
  1. Current water demand
  2. Permitted water demand
  3. Future water demand
  4. Effect of future development
  5. Climate change
  6. Extreme and severe drought
- iii. Clay Duffie: Can these be looked at on a per aquifer basis?  
Bruce Campbell: The outputs for these scenarios will be in the form of potentiometric maps and water budgets. Just like previous 2010 report. Every aquifer will include inputs, outputs, and flows. This information will give an idea of what is going on but hard to get big picture. The model will have to be utilized in order for more detailed questions to be answered in the future.
- iv. Clay Duffie: Suggest showing budgets as bar graphs in regions. Graphical displays make it easier to understand data.
- v. Kelley Ferda: Agrees with Clay and would like to gain some concrete planning tools out of the report. What's available and what's not available over the next 10, 20, 30...50 years on a per aquifer basis.
- vi. Joe Gellici: This will be included in our water demand forecast. It is a 50-year forecast broken down in 10-year intervals. This will show how levels will change over next 10, 20, 30.... 50 years. Different scenarios can then be simulated and the results compared. For example, simulate withdrawals from two aquifers rather than one to see if we can minimize the impact that future pumping will have.
- vii. Alex Butler: It will be hard to come up with a single number for a single aquifer. Many factors affect water production from aquifers such as how you pump it, when you pump it, what the recharge

rates are, etc. More importantly, we should be asking, “what are the potential negative impacts?”

7. Update on the Planning Process Advisory Committee – Joe Gellici (DNR)

Joe Gellici commented on the Planning Process Advisory Committee (see presentation).

- a. The Planning Process Advisory Committee (PPAC) formed in March of this year (2018).
- b. 18 members make up the PPAC from all major stakeholder groups. They meet face to face, once a month.
- c. The purpose of this committee is to develop a guidance document for the regional water plans. Regional water plans for surface water and groundwater are being developed for each of the eight river basins. River basin advisory councils are made up of 10-20 members.
- d. Clemson maintains webpage <https://www.clemson.edu/public/water-assessment/>

8. Potentiometric Mapping in Georgetown County and Future Mapping – Brooke Czwartacki (DNR)

Brooke Czwartacki gave a report on the potentiometric mapping programs at DNR (see presentation).

- a. The purpose of potentiometric maps is to assess changes in groundwater storage and determine regional flow directions from hydraulic gradients of the major aquifer systems. (McQueen Branch/Charleston, Crouch Branch, Floridan)
- b. Comparison of yearly potentiometric maps can reveal long-term changes in aquifer storage. Analyses of drought, salt water intrusion, subsidence and well interference can be made by tracking changes over time.
- c. These maps assist in state-level planning and groundwater use management. Useful for planning and development.
- d. Challenges faced when producing maps include:
  - i. Inconsistent well availability and accessibility
  - ii. Spatial resolution
  - iii. Wells are often screened in multiple aquifers
- e. The ultimate goal of program is to have enough wells to define and track changes on a variable time scale.

- f. Area of concern – Georgetown County – Crouch Branch aquifer cone of depression:
  - i. Mapping cone of depression since 1995
  - ii. Originally mapped and displayed over the Town of Andrews (west of Georgetown) but started to notice the development of a potentiometric low near Georgetown in 2001
  - iii. When comparing the most recent maps from 2012, 2015, and 2016 the trend observed is that the cone is spreading and deepening
  - iv. The average decline in all wells ranges from 1.5 - 2.6 ft/year
  - v. Still noticing ~2 ft decline when comparing seasonal differences. Maps are typically produced in the Fall when groundwater levels have not yet recharged from summer usage. Georgetown County was reproduced this summer for comparison purposes.
- g. Future plans
  - i. New Crouch Branch monitoring well going in at 8 Oaks County Park in Georgetown County. Hope to use this well to better define cone of depression in area. More continuous data are available on mainland and edge of island to better track this cone.
  - ii. Measuring the Floridan system this Fall (Gordon, Upper Floridan, and Middle Floridan). Hoping to produce 2 maps – one of the Gordon and one of Floridan; however, afraid data will be lacking in the low country for the Gordon aquifer. Gordon is not used in Beaufort because it is typically 900-1000 ft below land surface. Looking for wells in Gordon aquifer...maybe a few wells owned by Labeco Farms? Just need a few to help define the area.
- h. Alex Butler: Proposed the idea of going back to historic maps and re-creating with updated aquifer designations since this seems to change often

## 9. Groundwater Management in Texas – Joe Gellici (DNR)

Joe Gellici gave an overview of how groundwater is managed in Texas (see presentation).

- a. In South Carolina, river basin councils will eventually be formed to develop a 50-year regional surface and groundwater plan for each river basin. The planning units for these water plans are the eight major river basins. At the same time, DHEC is establishing technical advisory committees for each capacity use area to develop groundwater management plans. So far,

the Trident capacity use area (Berkeley, Charleston, and Dorchester Counties) is the only one with a TAC.

- b. Boundaries of the capacity use areas do not coincide with boundaries of the basins. How are these two groups, the river basin councils and the groundwater TACs, going to work together?
- c. Texas has a similar problem. Regional water planning groups develop long-term (50-year) water plans, and groundwater management groups oversee the management of groundwater. Joint water planning between the two groups is now statutorily required in Texas. The groundwater management groups determine what is an acceptable future (50 years) condition of an aquifer. This is called the “desired future condition”. For example, the group may decide that in 50 years the Edwards aquifers should still have 50% of its storage remaining. Or, the group may decide that in 50 years water levels must be within 50 ft of land surface; or that the total dissolved solids is less than 1,000 mg/L, etc. Once the desired future condition of an aquifer is determined, the State of Texas runs a groundwater quantity model to determine how much water can be withdrawn from a particular aquifer in order to meet that desired future condition. Essentially, a groundwater availability number for each aquifer is determined by the State on the basis of the desired future condition. This groundwater availability number, which is called the “modeled available groundwater”, is provided by the State to the regional water planning groups so that these planning groups know how much groundwater is available for future use.
- d. Joint Water Planning – committees and councils working together
  - i. Determine desired future conditions (DFC) for each aquifer. This is a long term management goal.
  - ii. Try to put groundwater availability number on each aquifer for each district.
  - iii. If multiple DFCs exist within a single groundwater management area they must be compatible with one another
  - iv. Determine caps and breakdown over 50 year plan to reach end goal
- e. Joe Gellici also indicated that the boundaries of the aquifers do not coincide with the boundaries of the river basins or the boundaries of the capacity use areas. A river basin is the natural hydrologic planning unit for surface water because water within the basin is hydrologically connected but is isolated from water in adjacent basins. An aquifer is analogous to a river basin in the sense that water in an aquifer is hydrologically connected but is more-or-less isolated from water in adjacent aquifers. Should

aquifers be considered as planning units for groundwater? If so, then the groundwater TACs in each capacity use area must plan jointly.

- f. Joe Gellici and Clay Duffie recommended a white paper be presented to PPAC on undesirable consequences of over pumping and on how the various groups should plan jointly.