Groundwater Availability Evaluation Methods and Considerations

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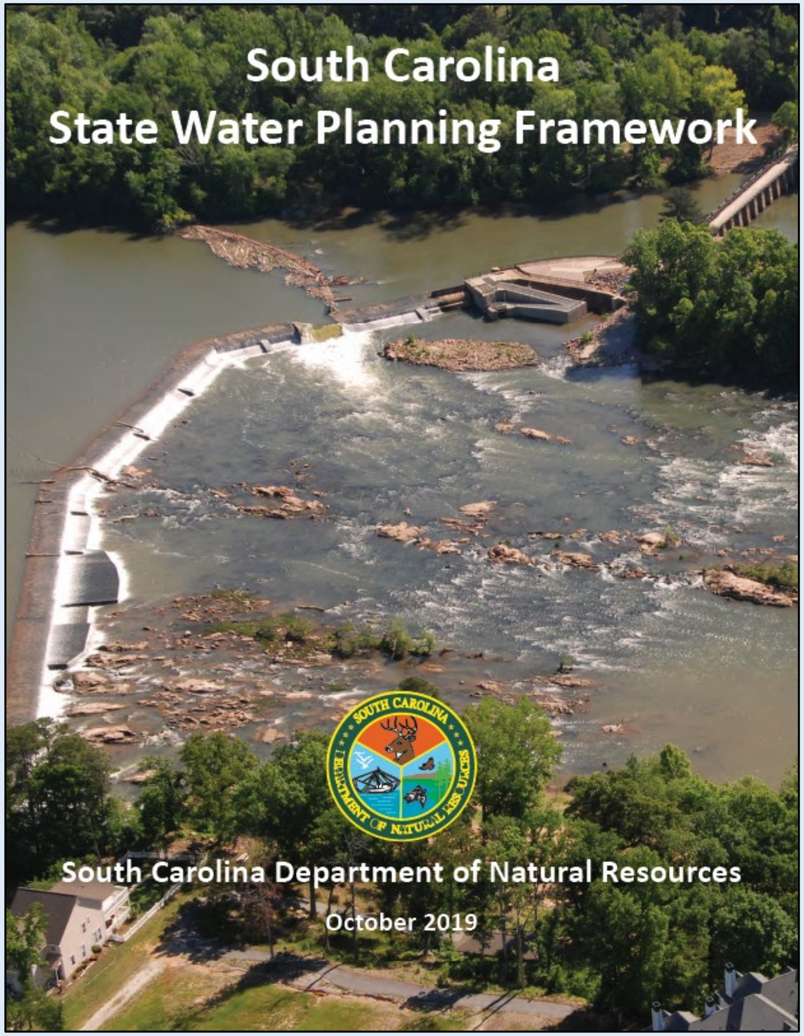
Groundwater Planning Approach



- Groundwater Areas of Concern
- Groundwater Conditions
- Groundwater Supply
- Groundwater Shortages

(Section 4.4.1 on pages 56-57 of the Planning Framework)

http://hydrology.dnr.sc.gov/state-and-river-basin-planning.html.

Groundwater Model Scenarios

Predevelopment Groundwater Use Simulation
(groundwater levels before development, 1900)

- Current Groundwater Use Scenario
  (groundwater levels after 50 years of pumping at current rates)

- Permitted Groundwater Use Scenario
  (groundwater levels after 50 years of pumping at permitted rates)

- Business-as-Usual Water-Demand Projection Scenario
  (groundwater levels after 50 years with modest increases in pumping)

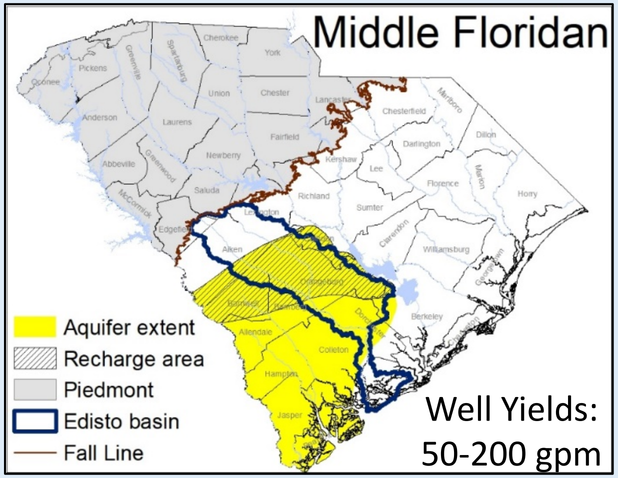
- High Water-Demand Projection Scenario
  (groundwater levels after 50 years with major increases in pumping)

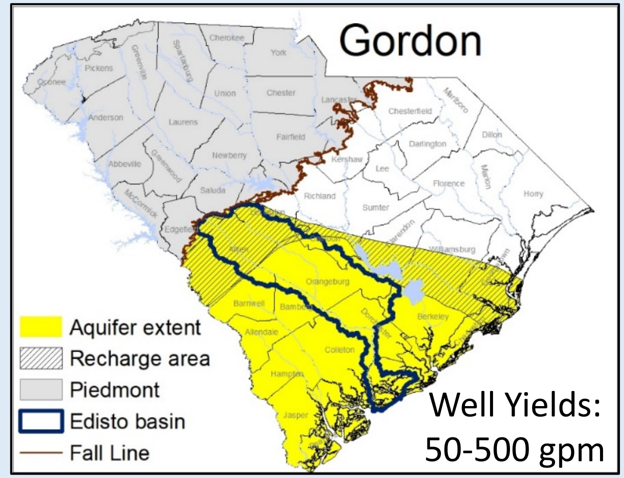
Hydrogeologic Framework

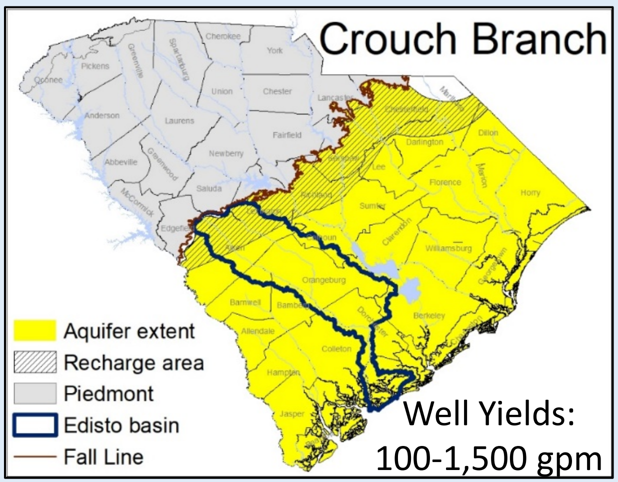
A review of the hydrogeologic framework

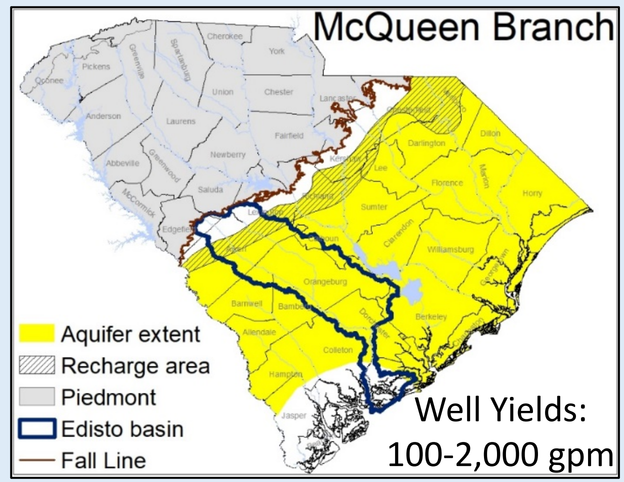
confining unit	
Middle Floridan aquifer	Limestone and sand aquifer; 0-100 ft thick; domestic; 50-200 gpm.
confining unit	
Gordon aquifer	Limestone and sand aquifer; 0-200 ft thick; domestic, irrigation, small public supply; 50-500 gpm.
confining unit	
Crouch Branch aquifer	Sand aquifer; 0-350 ft thick; irrigation, public supply, energy; 100-1,500 gpm.
confining unit	
McQueen Branch aquifer	Sand aquifer; 0-300 ft thick, irrigation, public supply, energy; 100-2,000 gpm.
confining unit	
Piedmont rocks (bedrock)	

Distribution of aquifers and recharge areas



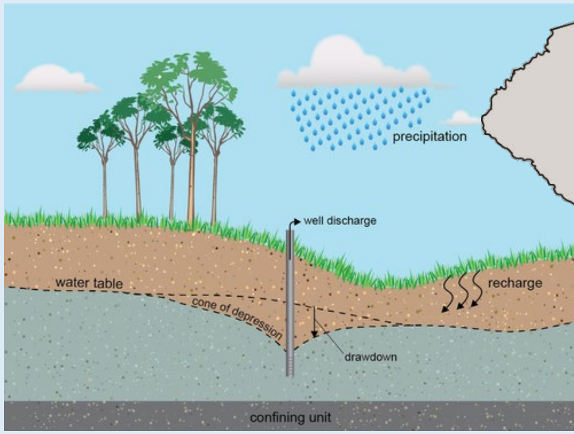




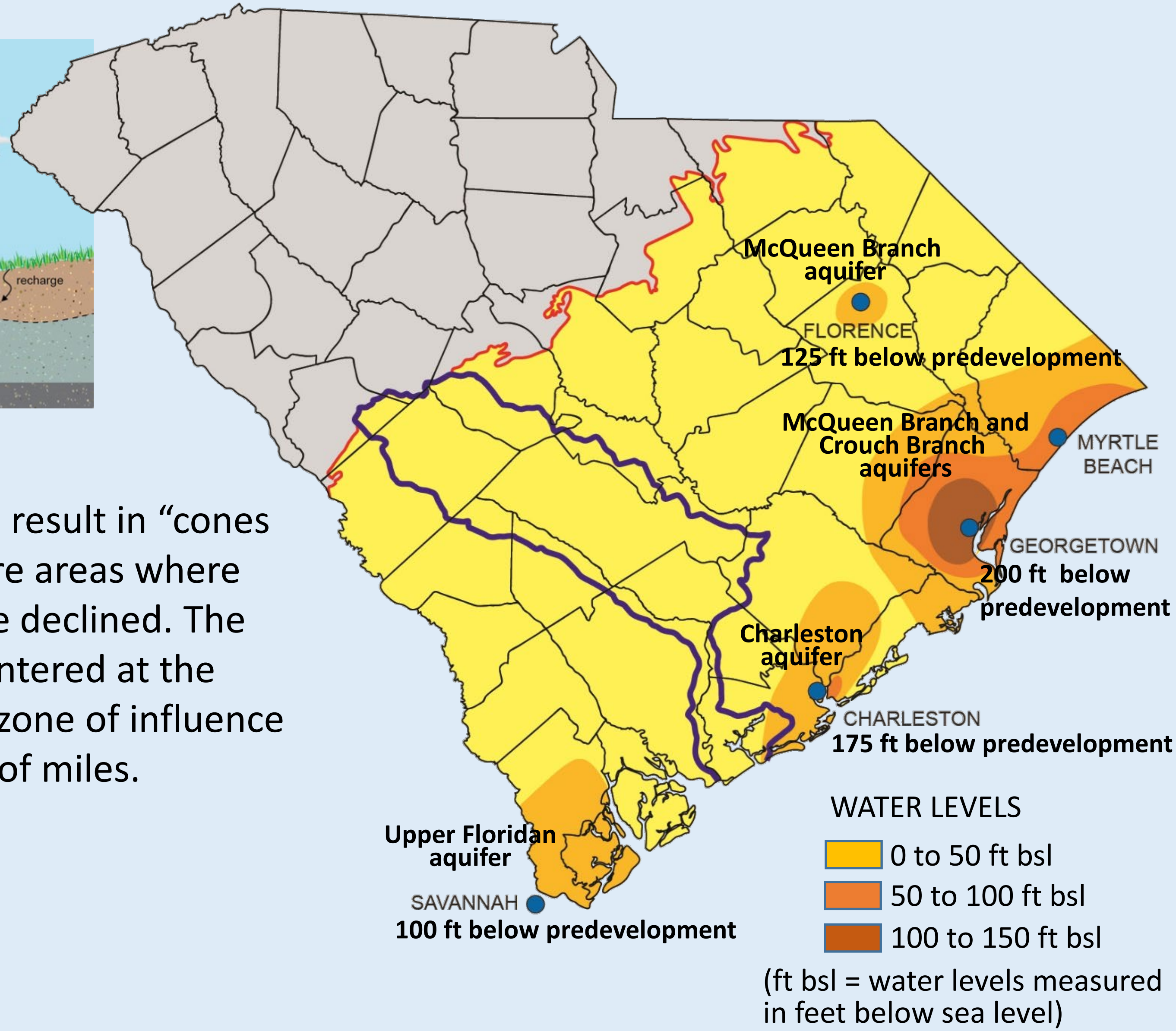


Recharge occurs mostly in the upper reaches of the basin where aquifers are unconfined. In the middle and lower reaches of the basin, aquifers are bounded above and below by clay layers and are called confined aquifers. In confined aquifers, water is under pressure. Water pumped from confined aquifers reduces water pressure.

Major Cones of Depression in the State



Long-term pumping can result in “cones of depression”, which are areas where groundwater levels have declined. The greatest declines are centered at the pumping wells, but the zone of influence can spread out for tens of miles.



Impacts of Lowering Groundwater Levels

Lowering groundwater levels (reduction in water pressure) can have negative impacts, including:

- Reductions in yields of nearby wells
- Saltwater intrusion along the coast
- Degradation of water quality inland
- Reductions in discharge to lakes, streams and wetlands
- Land subsidence and development of sinkholes
- Permanent damage to the aquifer

Great uncertainty associated with the amount of groundwater that can be withdrawn before negative impacts occur.

Groundwater Areas of Concern

Groundwater flow models can be used to predict future groundwater levels but they can not be used to predict if or when these negative impacts will occur.

Therefore, the effects that pumping have on the resource, environment, and on other users must be monitored so groundwater can be managed to prevent such side effects from permanently damaging the resource and from posing a threat to the public's health and well-being.

Results from the model scenarios, however, may be used to designate "**Groundwater Areas of Concern**" in the basin.

Groundwater Areas of Concern

Definition (from the State Water Planning Framework):

Groundwater Area of Concern – an area where current or future groundwater withdrawals from an aquifer are causing or are expected to cause unacceptable impacts to the resource or to the public health and well-being.

The RBC can recommend that certain aquifers in certain areas of the basin be designated as **Groundwater Areas of Concern** and can propose increased monitoring of the aquifer in those areas and/or technical studies be done to determine if further action needs to be taken.

If further action is needed, the RBC can propose that a **Groundwater Condition** be applied.

Groundwater Conditions

Definition (from the State Water Planning Framework):

Groundwater Condition – a physical limitation on the amount of groundwater that can be withdrawn from an aquifer.

The RBC can propose that **Groundwater Conditions** be applied to aquifers in certain areas of the basin if data and/or models indicate that an aquifer is currently being overpumped or is predicted to be overpumped in the future.

Groundwater Supply

If **Groundwater Conditions** are defined in the basin, then an estimate of **Groundwater Supply** can be made using the groundwater flow model.

Definition (from the State Water Planning Framework):

> **Groundwater Supply** – the volume of water that can be withdrawn annually from an aquifer in a chosen area without violating any Groundwater Conditions.

Texas Water Planning

Texas Water Planning example…

Texas has been developing water plans since 1961. They currently develop water plans for 16 regional water planning areas in the State using a stakeholder-driven approach. Regional water plans are updated every 5 years culminating in a State Water Plan.

Groundwater Planning Approach in Texas

A key part of groundwater planning in Texas is determining a groundwater "Desired Future Condition" for each aquifer.

A Desired Future Condition is a long-term management goal for each aquifer. Some examples include:

1) Limiting drawdowns in the Ogallala aquifer to an average of 20 feet in Randall County for the period 2012-2062.
2) Causing no more than 30 feet of average declines in the Dockum aquifer in Carson County for the period 2012-2062.
3) Retaining at least 50% of the remaining storage in the Ogallala and Rita Blanca aquifers in Hansford County for the period 2012-2062.

Modeled Available Groundwater in Texas

Once the Desired Future Condition has been determined for each aquifer, the State, using groundwater models, determines the amount of groundwater that can be pumped that will achieve the Desired Future Condition. This is called the "Modeled Available Groundwater".

Permits are issued so that the total volume of permitted groundwater will achieve the Desired Future Condition.

Groundwater Shortage

The estimated **Groundwater Supply** may not be enough to meet future demands. In this case, a **Groundwater Shortage** may occur, and Water Management Strategies will have to be developed to meet demands.

Definition (from the State Water Planning Framework):

Groundwater Shortage – occurs when current or future groundwater withdrawals from a specified aquifer are violating or are expected to violate a Groundwater Condition applied on that aquifer.

Groundwater Shortages in Texas

In order to meet the Future Desired Condition, withdrawals from the Ogallala aquifer are reduced over the 50-year planning period. Alternative sources of supply must be developed, or demand must be reduced.

COUNTY	AQUIFER	2020	2030	2040	2050	2060	2062
Armstrong	Ogallala	1,286	1,048	866	723	610	591
Potter	Ogallala	225	225	225	223	221	221
Randall	Ogallala	39,084	37,987	32,477	28,334	25,018	24,459

Units are in acre-feet per year

Some examples of Water Management Strategies used in S.C.

Conjunctive Water Use: Combined use of surface and groundwater sources.

- **City of Florence**: supplements groundwater with water from the Pee Dee River.
- **Grand Strand Water and Sewer Authority**: supplements groundwater with water from Bull Creek and the Atlantic Intracoastal Waterway.

Aquifer Storage and Recovery: Injection of treated water into an aquifer for future use.

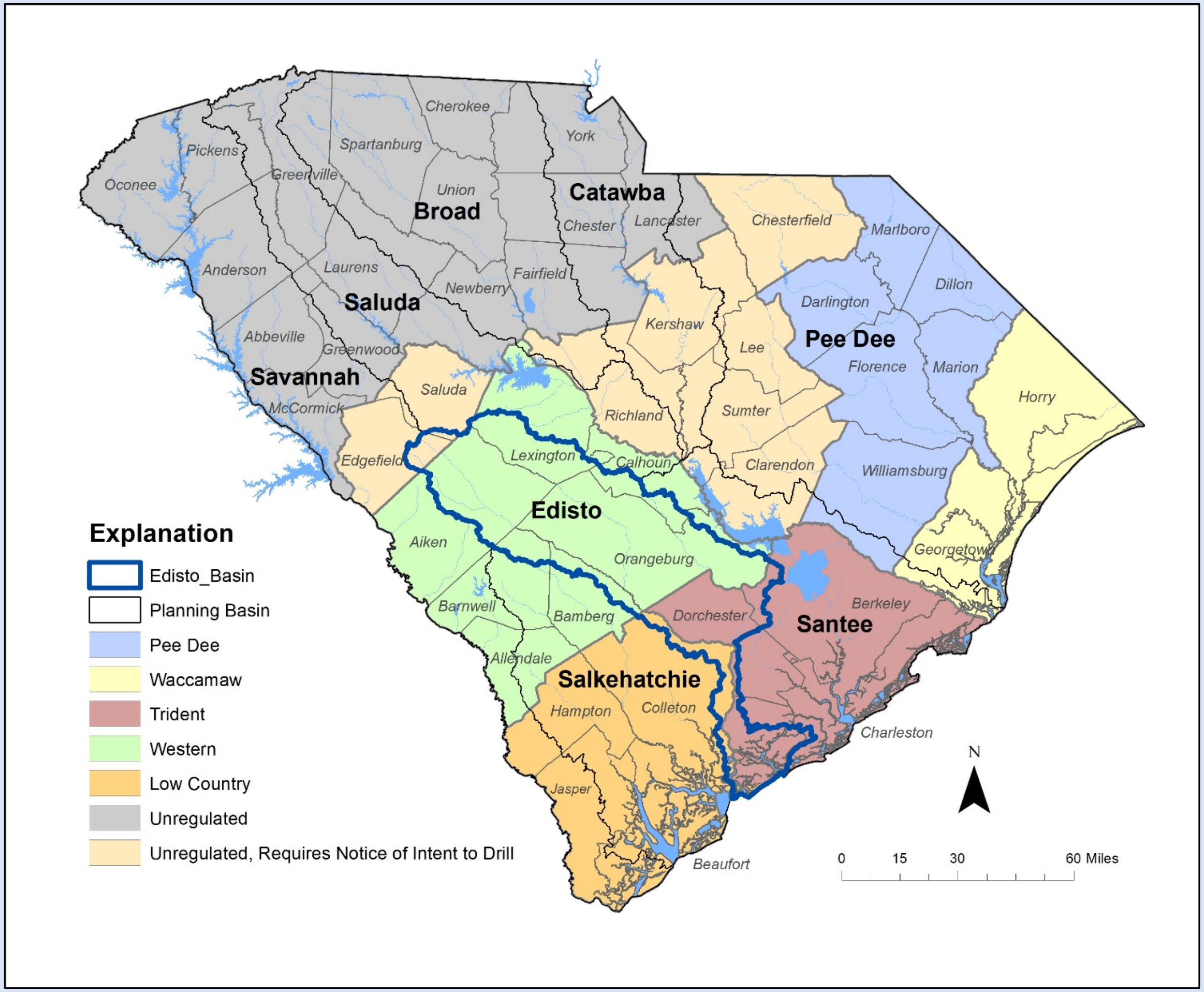
- **Grand Strand Water and Sewer Authority**: treated surface water is pumped into the Crouch Branch aquifer for use during peak demands.
- **Beaufort-Jasper Water and Sewer Authority**: treated surface water is pumped into the Upper Floridan aquifer for use during dry months or drought.

Reverse Osmosis: A process that uses a membrane to remove salts and other dissolved solids from water.

- **Hilton Head Public Service District**: groundwater from the Middle Floridan aquifer is treated to remove salt.

Capacity Use Areas in the Edisto Basin

Any groundwater recommendations made by the Council should be vetted by the Capacity Use Area stakeholder group, if one exists, and approved by DHEC.



Edisto basin covers portions of 3 designated Capacity Use Areas: Western (2018); Trident (2002), and Low Country (1981)