Status Report on the Hydrogeologic Framework

Groundwater TAC Meeting
Columbia, S.C.
October 1, 2018

Joe Gellici - Hydrologist
Land, Water and Conservation Division
S.C. Department of Natural Resources

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
2. Status Report on the Hydrogeologic Framework – Joe Gellici (DNR)
3. Status Report on the Groundwater Recharge Model – Bruce Campbell (USGS)
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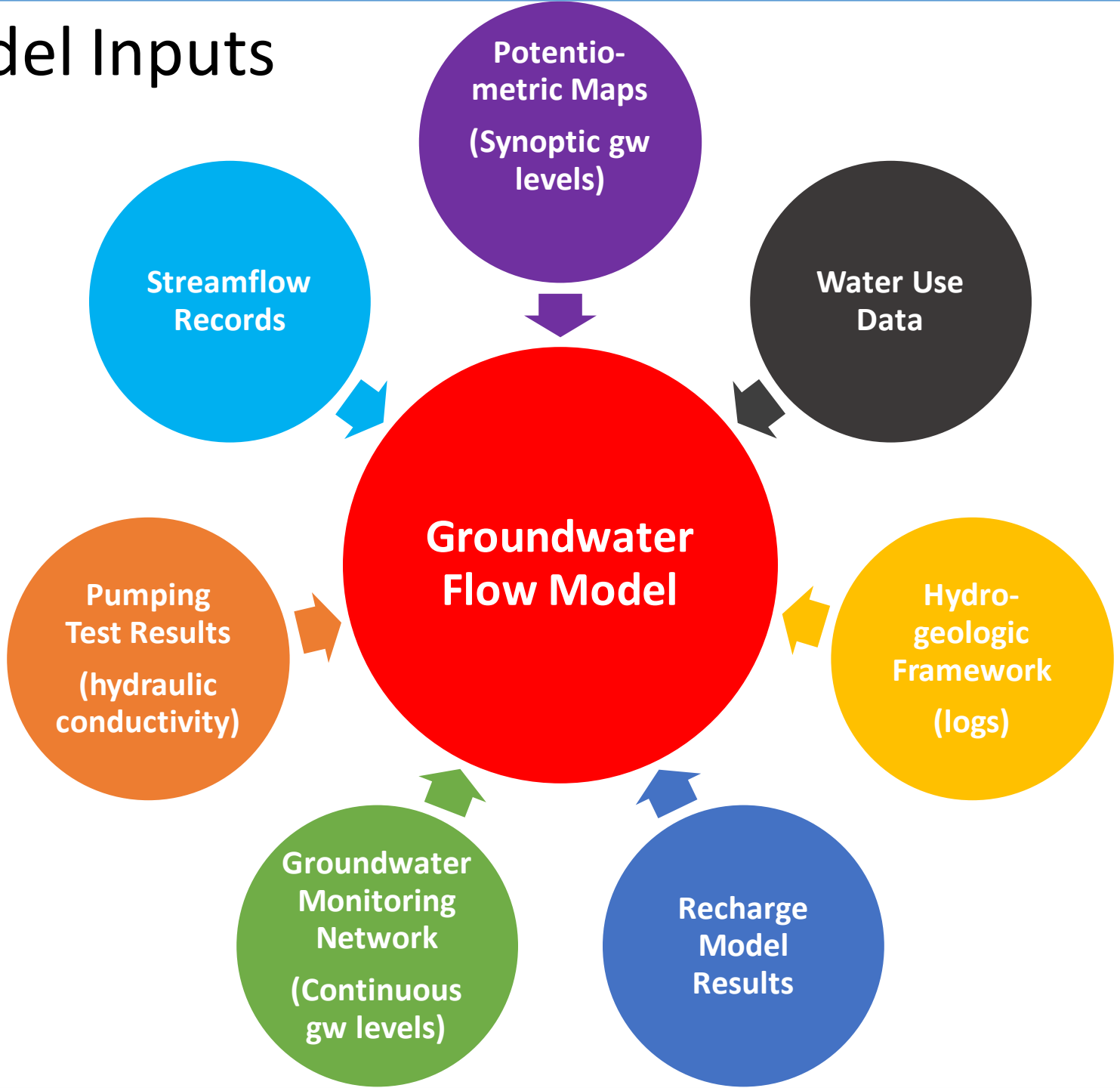
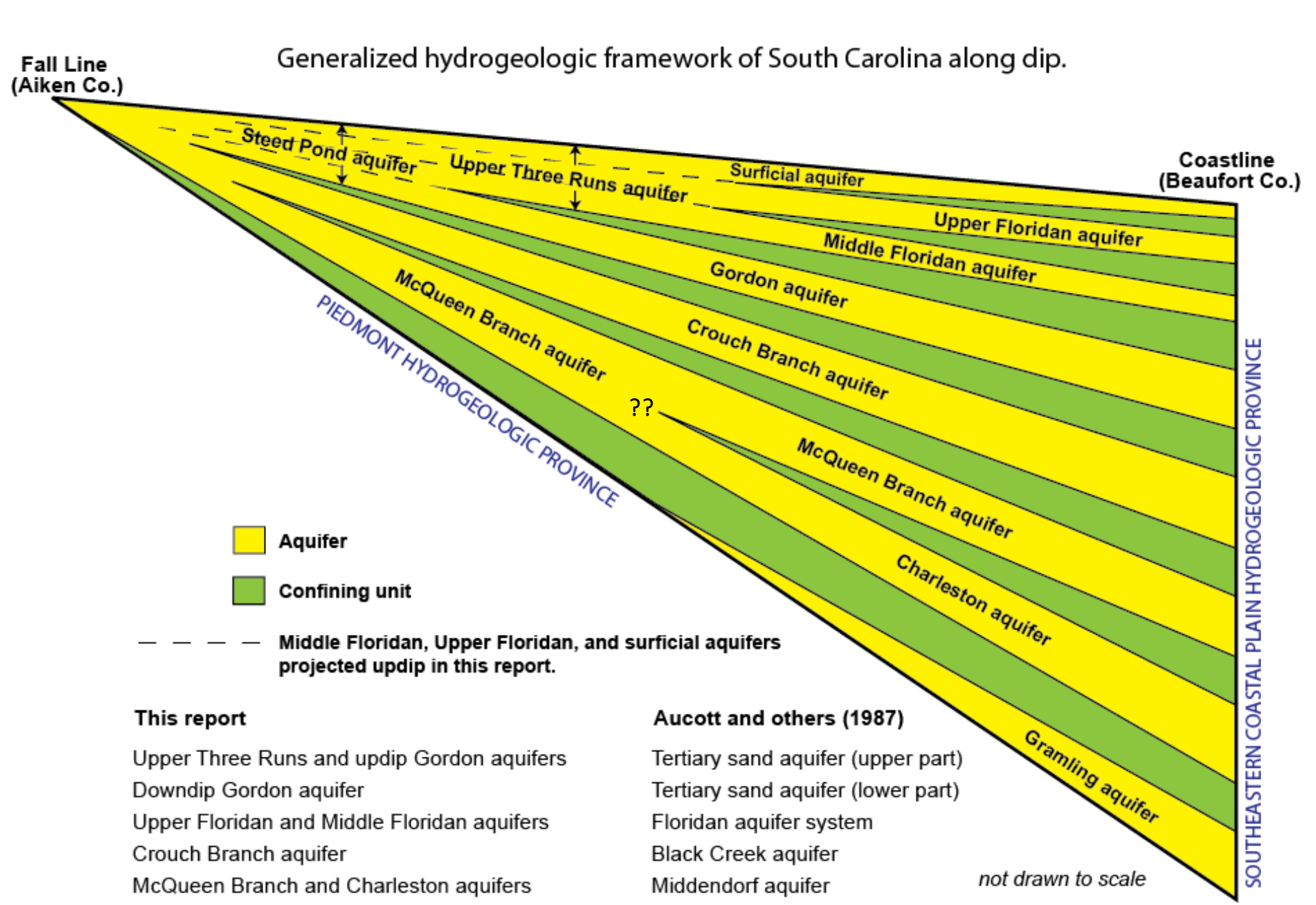
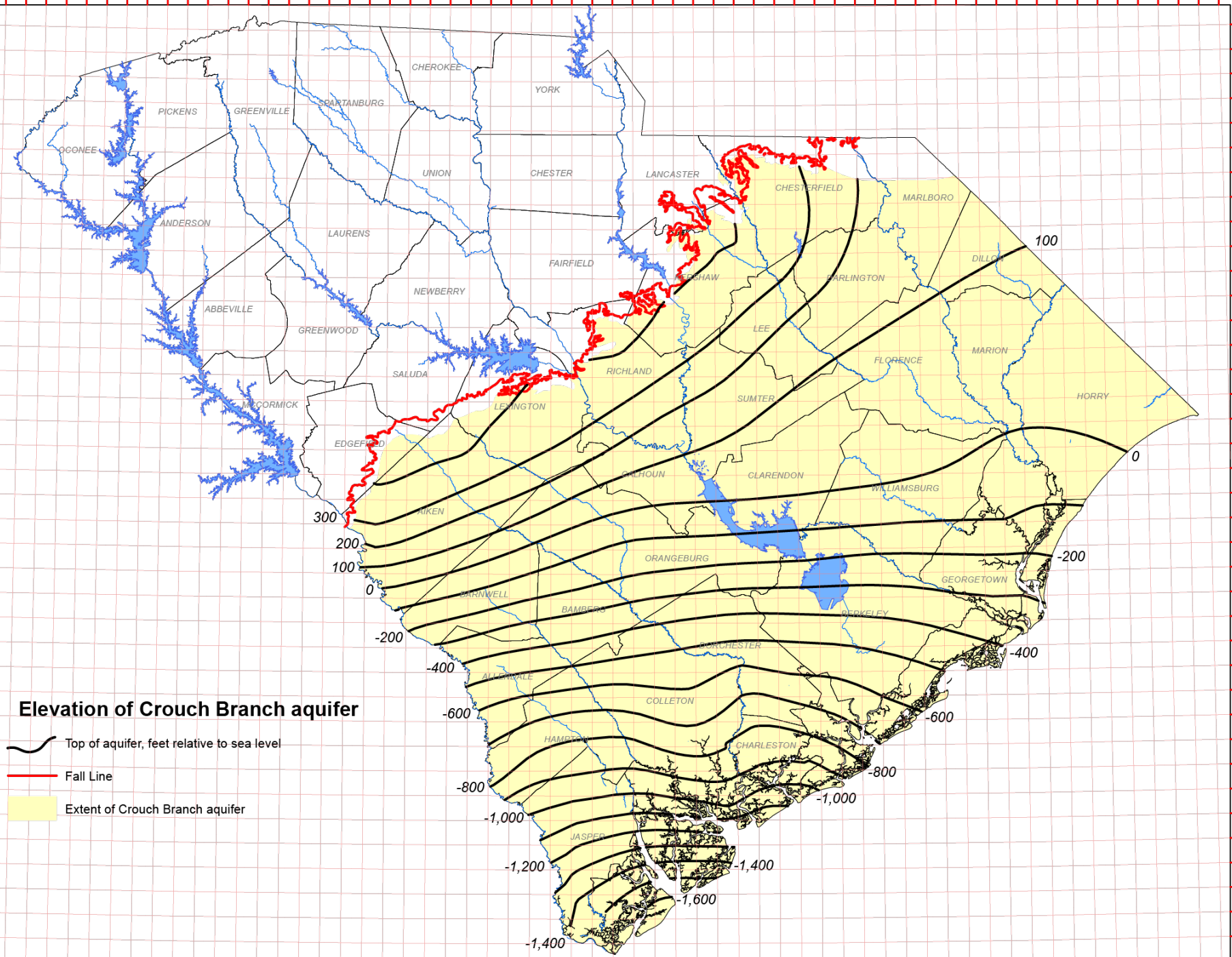
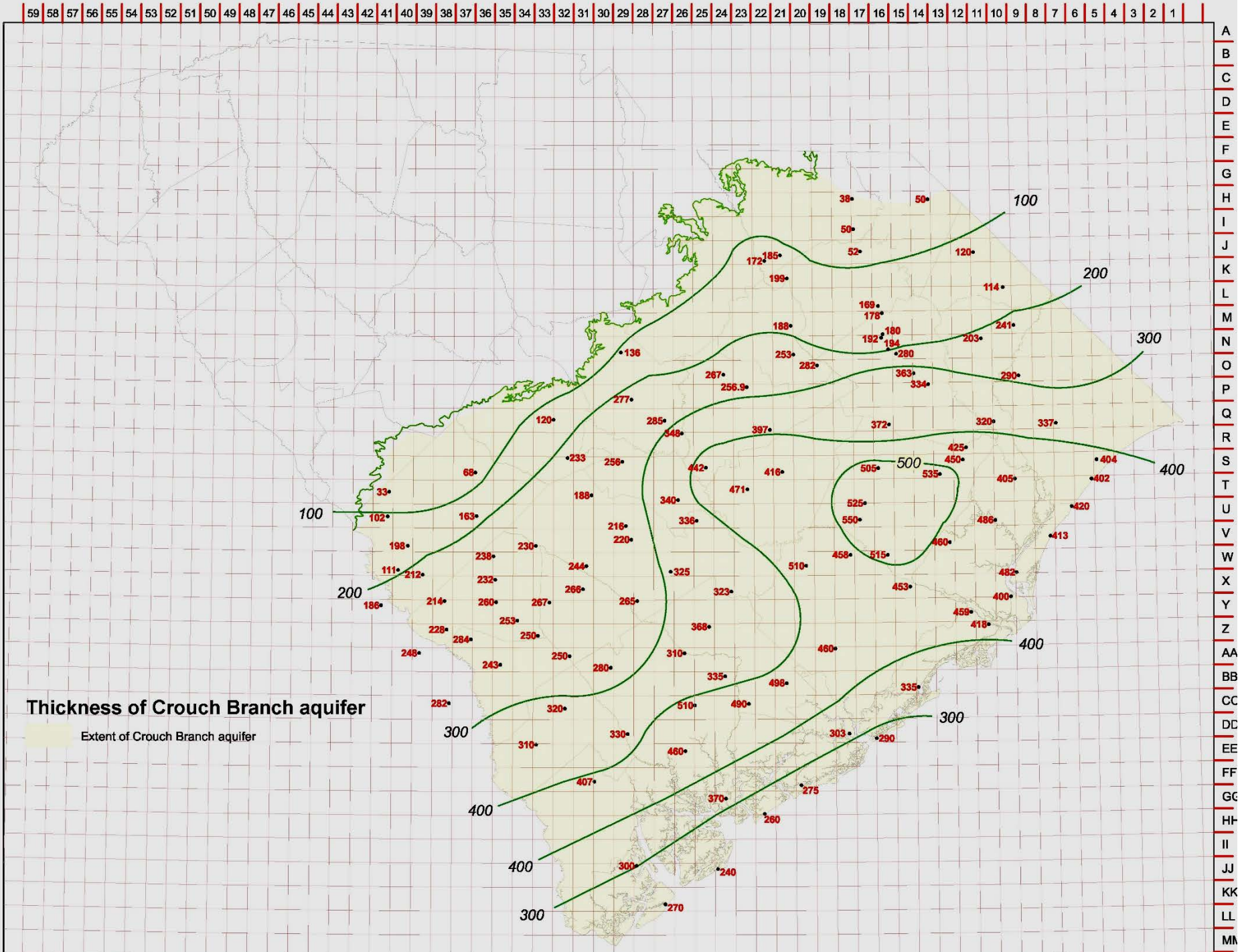
6. Discussion – Model Scenarios
7. Update on the Planning Process Advisory Committee – Joe Gellici (DNR)
8. Potentiometric Mapping in Georgetown County and Future Mapping – Brooke Czwartacki (DNR)
9. Groundwater Management in Texas – Joe Gellici (DNR)

Model Inputs




Generalized hydrogeologic framework of South Carolina along dip.
Fall Line
(Aiken Co.)
Coastline
(Beaufort Co.)
Steed Pond aquifer
Upper Three Runs aquifer
Surficial aquifer
Upper Floridan aquifer
Middle Floridan aquifer
Gordon aquifer
Crouch Branch aquifer
McQueen Branch aquifer
??
McQueen Branch aquifer
Charleston aquifer
Gramling aquifer
PIEDMONT HYDROGEOLOGIC PROVINCE
SOUTHEASTERN COASTAL PLAIN HYDROGEOLOGIC PROVINCE
Aquifer
Confining unit
Middle Floridan, Upper Floridan, and surficial aquifers projected updip in this report.
This report
Upper Three Runs and updip Gordon aquifers
Downdip Gordon aquifer
Upper Floridan and Middle Floridan aquifers
Crouch Branch aquifer
McQueen Branch and Charleston aquifers
Gramling aquifer
Aucott and others (1987)
Tertiary sand aquifer (upper part)
Tertiary sand aquifer (lower part)
Floridan aquifer system
Black Creek aquifer
Middendorf aquifer
Cape Fear aquifer
not drawn to scale


Elevation of Crouch Branch aquifer
Top of aquifer, feet relative to sea level
Fall Line
Extent of Crouch Branch aquifer
CHEROKEE
YORK
PICKENS
GREENVILLE
SPARTANBURG
OCONEE
UNION
CHESTER
LANCASTER
CHESTERFIELD
MARLBORO
ANDERSON
LAURENS
FAIRFIELD
DILLON
KERSHAW
DARLINGTON
NEWBERRY
ABBEVILLE
GREENWOOD
LEE
MARION
FLORENCE
SALUDA
RICHLAND
HORRY
SUMTER
MCCORMICK
LEXINGTON
EDGEFIELD
CALHOUN
CLARENDON
WILLIAMSBURG
AIKEN
ORANGEBURG
GEORGETOWN
BARNWELL
BAMBERG
BERKELEY
DORCHESTER
ALLENDALE
COLLETON
HAMPTON
CHARLESTON
JASPER
100
0
-200
300
200
100
0
-200
-400
-600
-800
-1,000
-1,200
-1,400
-1,600
-1,400


Thickness of Crouch Branch aquifer
Extent of Crouch Branch aquifer
100
200
300
400
500

Potentiometric Surface of the Upper Floridan, Middle Floridan, and Gordon Aquifers in South Carolina, November–December 2016

EXPLANATION

- 20 — Potentiometric contour for the Tertiary aquifers, in feet relative to sea level; dashed where inferred
- HAM-175 ● 70 — Measured well, with county well number and potentiometric elevation
- Approximate updip limit of Gordon aquifer
- Approximate updip limit of Middle Floridan aquifer
- Approximate updip limit of Upper Floridan aquifer

Extents Gordon

Extents Middle Floridan

Extents Upper Floridan

SALUDA
EDGEFIELD
FALL LINE
LEXINGTON
RICHLAND
SUMTER
FLORENCE
MARION
HORRY
CLARENDON
WILLIAMSBURG
GEORGETOWN
AIKEN
CALHOUN
ORANGEBURG
BARNWELL
BAMBERG
ALLENDALE
COLLETON
DORCHESTER
BERKELEY
CHARLESTON
HAMPTON
JASPER
BEAUFORT

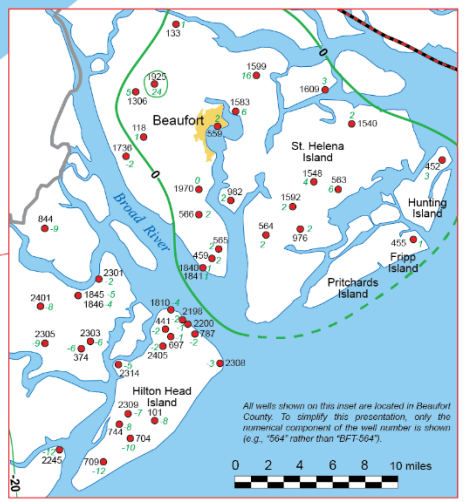
Lake Marion
Lake Moultrie
North Fork Edisto River
South Fork Edisto River
Edisto River
Salkehatchie River
Combahee River
Coosawhatchie River
Savannah River
Black River
Santee River

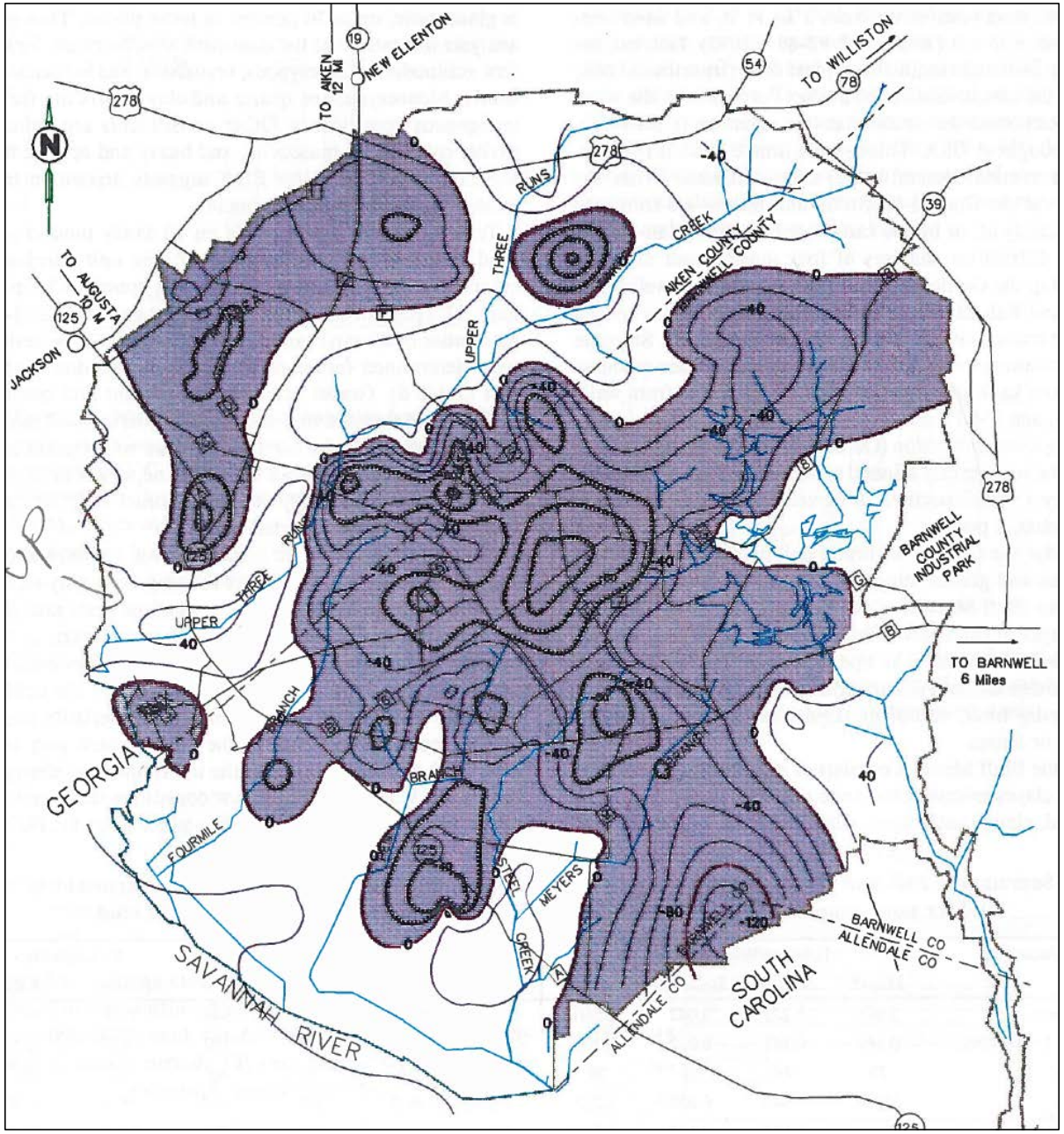
Aiken
Orangeburg
Walterboro
Summerville
Moncks Corner
Mt Pleasant
Charleston
Isle of Palms
Sullivans Island
Kiawah Island
Seabrook Island
Beaufort
Hilton Head Island

DNR

N

10 0 10 20 30 40 miles





Head difference across the Gordon confining unit at the Savannah River Site.

Denotes a downward gradient between the Upper Three Runs aquifer (water-table aquifer) and the underlying Gordon aquifer (water levels in the UTR aquifer are higher than in the Gordon).

Source: Aadland, Gellici, and Thayer, 1995

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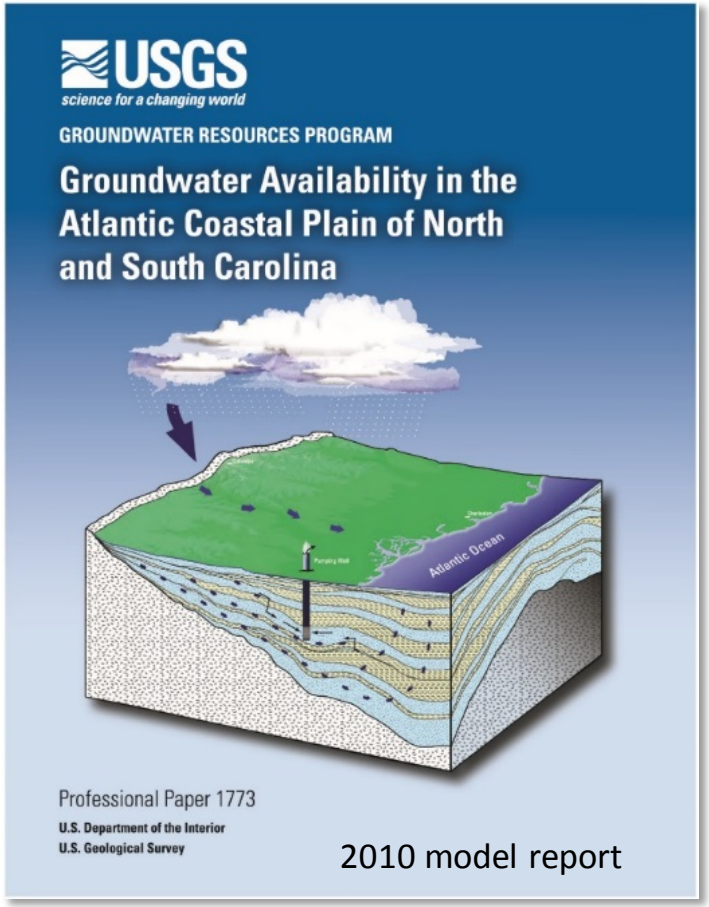

2010 model report

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.

Chapter

1. Groundwater Availability in the Atlantic Coastal Plain of North and South Carolina

2. Hydrogeologic Framework of the Atlantic Coastal Plain, North and South Carolina

3. Simulation of Groundwater Flow in the Atlantic Coastal Plain, North and South Carolina and Parts of Eastern Georgia and Southern Virginia, Predevelopment to 2004

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Planning Process Advisory Committee (PPAC)

Develop a guidance document for the regional water plans. Some of the subject matters addressed in the document will include:

- Vision and goals
- Process of designating members to the Basin Advisory Councils
- Roles and responsibilities of the Basin Advisory Councils
- Roles and responsibilities of the State agencies
- Council bylaws/operating charter for Basin Advisory Councils
- Regional water plan format and contents
- Public and stakeholder participation
- Financing of regional water plans
- Implementation of regional water plans
- Outline how the regional water plans fit into the State Water Plan
- Administrative rules

PPAC is meeting on a monthly basis
(First meeting held in March, 2018)

PPAC Committee Members

1. Jeffery Allen - **Clemson University, South Carolina Water Resources Center**
2. David Baize - **WEASC/SCAWWA**
3. Gary Spires – **South Carolina Farm Bureau**
4. David Bereskin - **Greenville Water**
5. Jesse Cannon - **Santee Cooper**
6. Fred Castles, III - **Catawba-Wateree Management Group**
7. Clay Duffie - **Mount Pleasant Waterworks**
8. J.J. Jowers, Jr - **Edisto Engineers and Surveyors, Inc., Citizen**
9. Eric Krueger - **The Nature Conservancy**
10. Jeff Lineberger - **Duke Energy**
11. Jill Miller - **South Carolina Rural Water Association**
12. Dean Moss, Jr – **Citizen, Formerly of Beaufort-Jasper Water and Sewer Authority**
13. Heather Nix - **Upstate Forever**
14. Myra Reece - **SCDHEC**
15. Ken Rentiers - **SCDNR**
16. Bill Stangler - **Congaree Riverkeeper**
17. Scott Willett - **Anderson Regional Joint Water System**
18. Charles Wingard - **Walter P. Rawl & Sons, Inc. (Agriculture)**

https://www.clemson.edu/public/water-assessment/State_Water_Planning_Process_Advisory_Committee.html

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- Saluda River Basin
- Santee River Basin
- Savannah River Basin
- Groundwater
- State Water Planning Process Advisory Committee
- Water Demand Projections
- Resources
- News and Videos
- Contacts

State Water Planning Process Advisory Committee (PPAC)

The State Water Planning Process Advisory Committee (PPAC) is comprised of stakeholders with diverse interests in South Carolina's water resources.

PPAC Members

PPAC Charter

PPAC Meeting Minutes

PPAC Meeting Agendas

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Next Meeting

Water Planning Process

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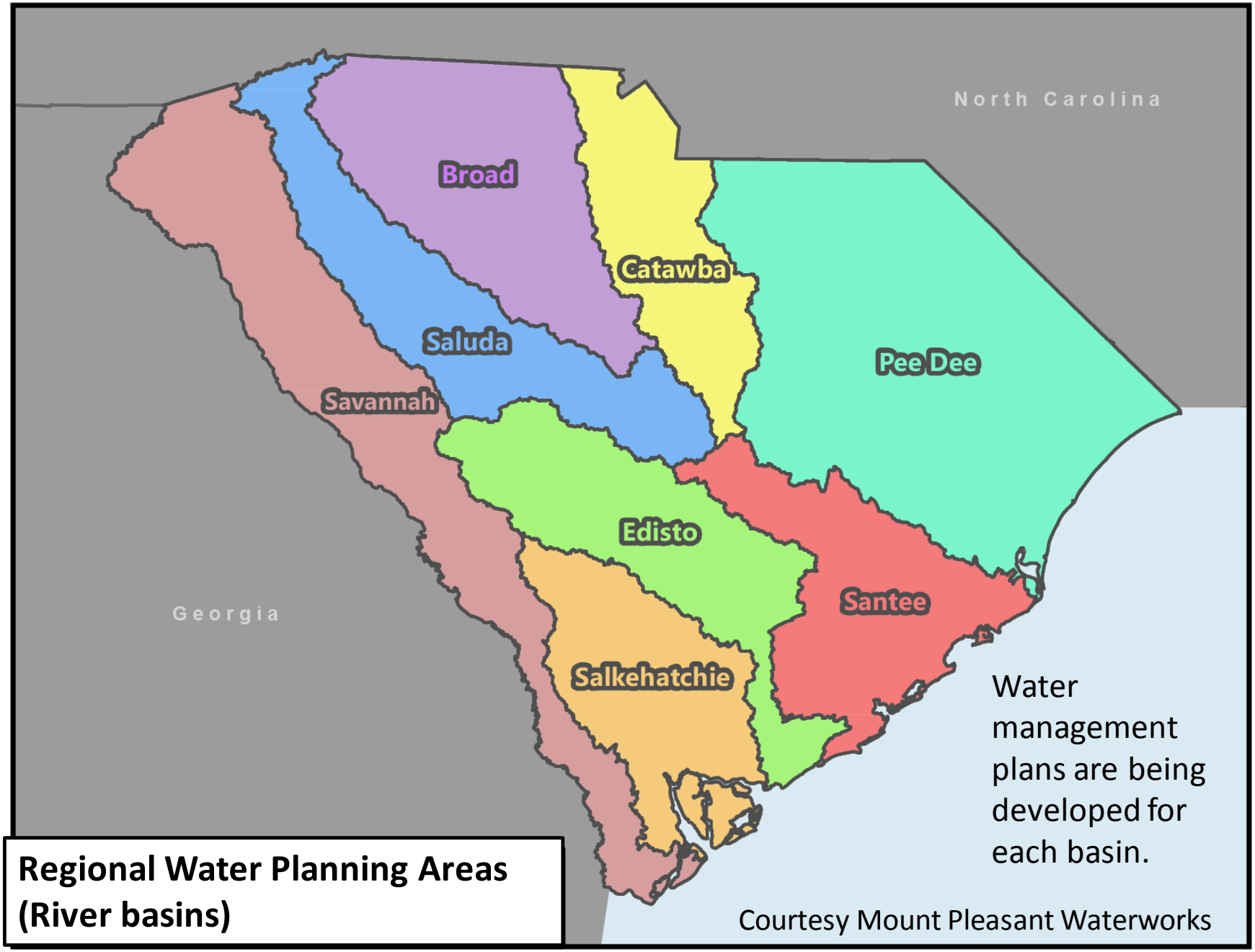
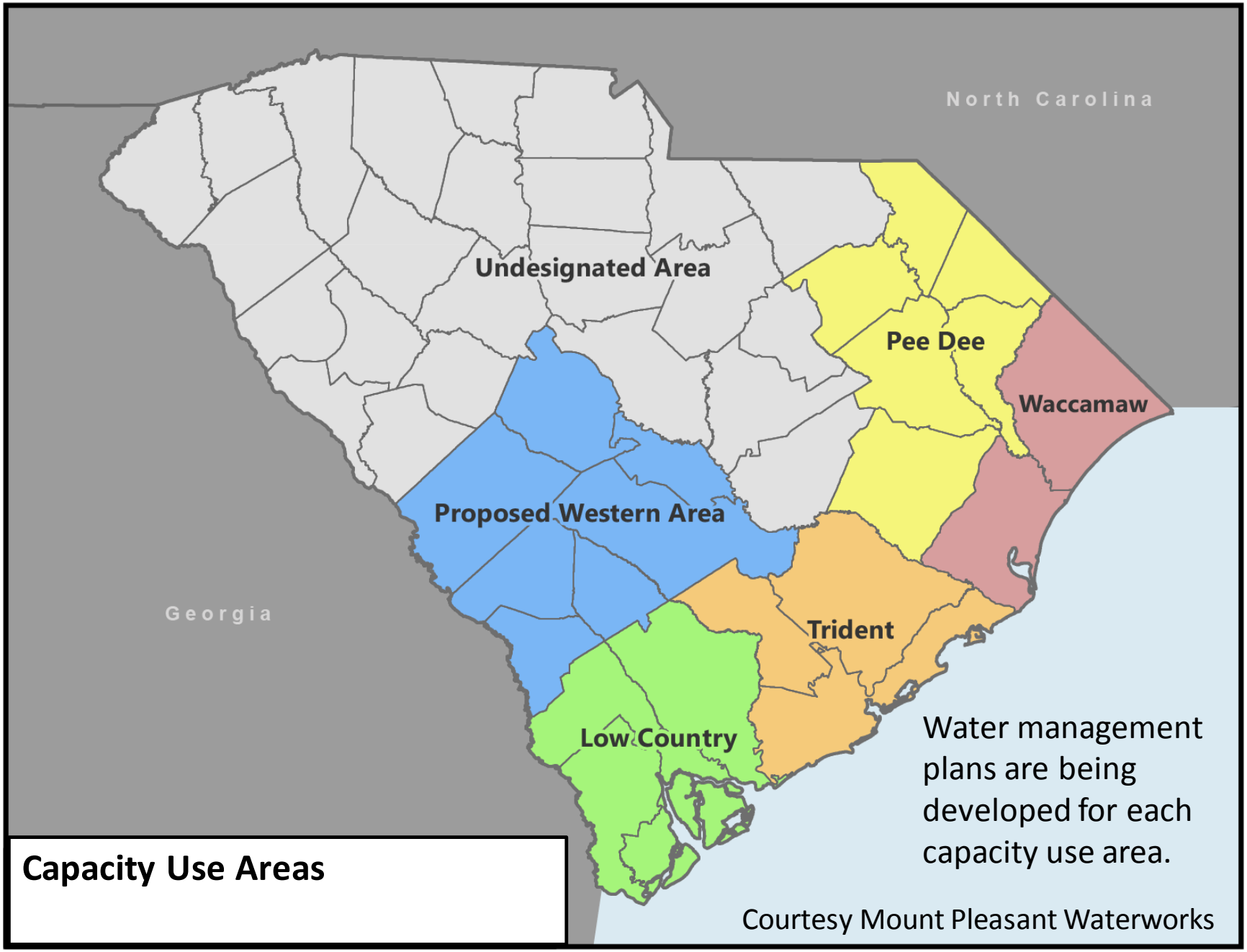
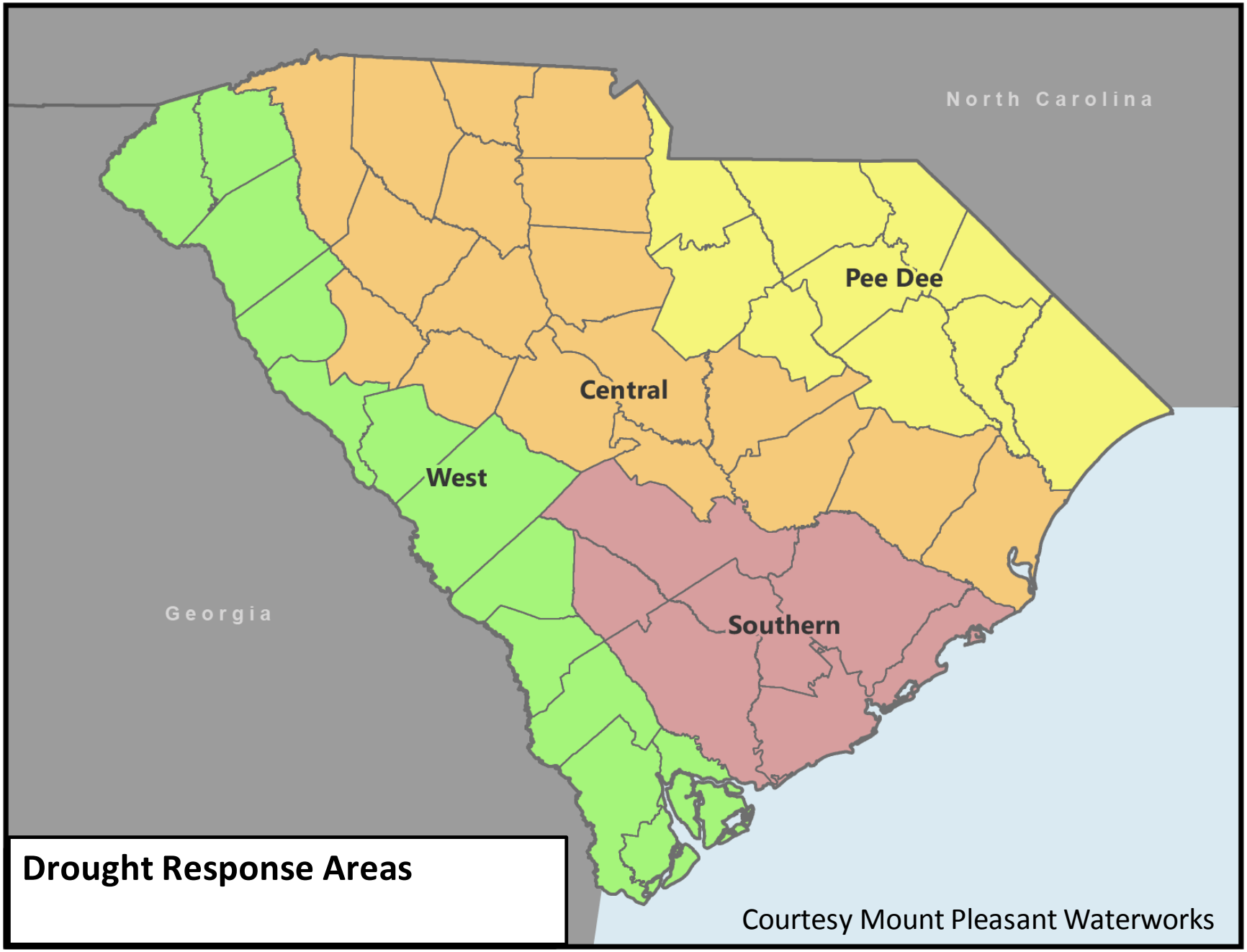
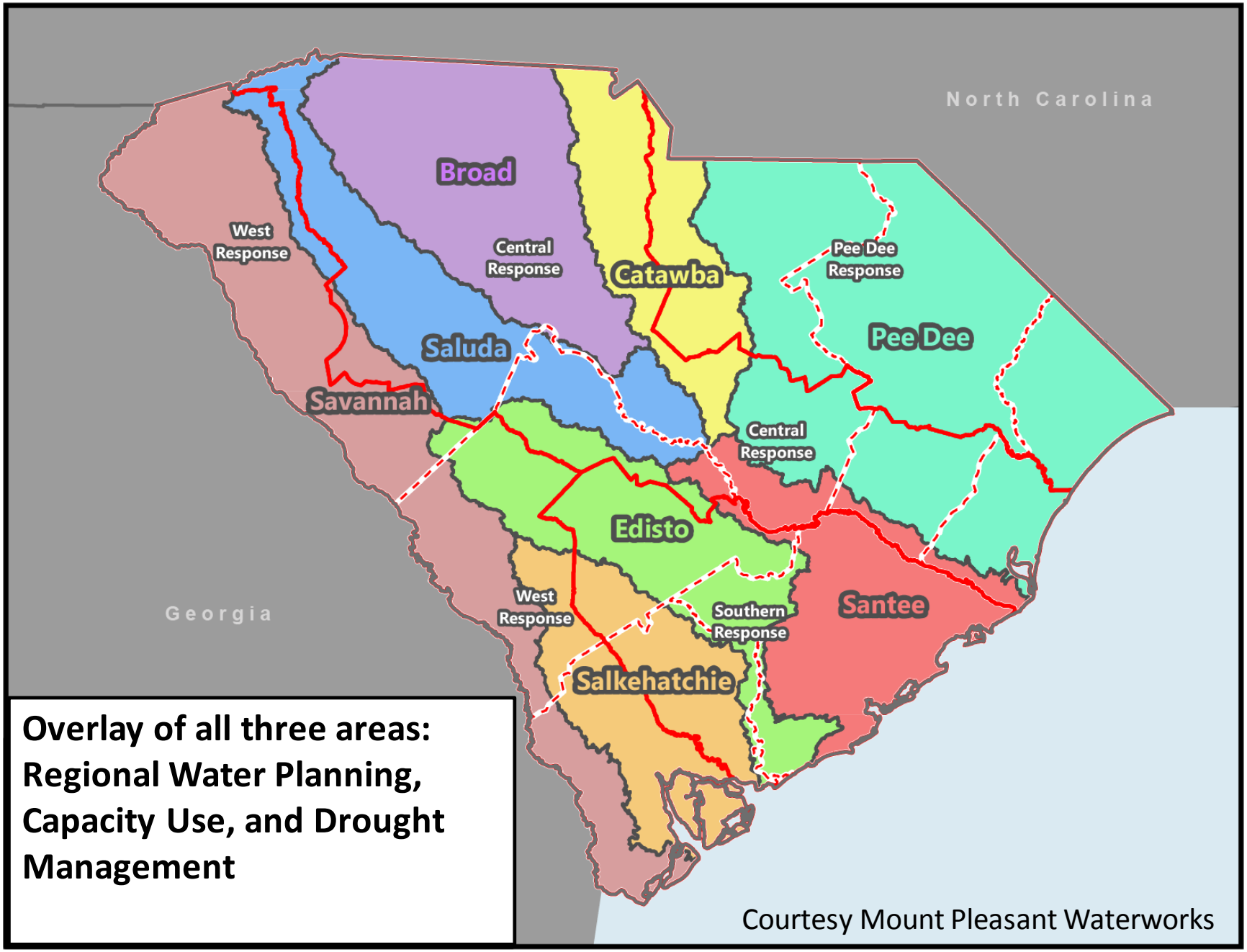
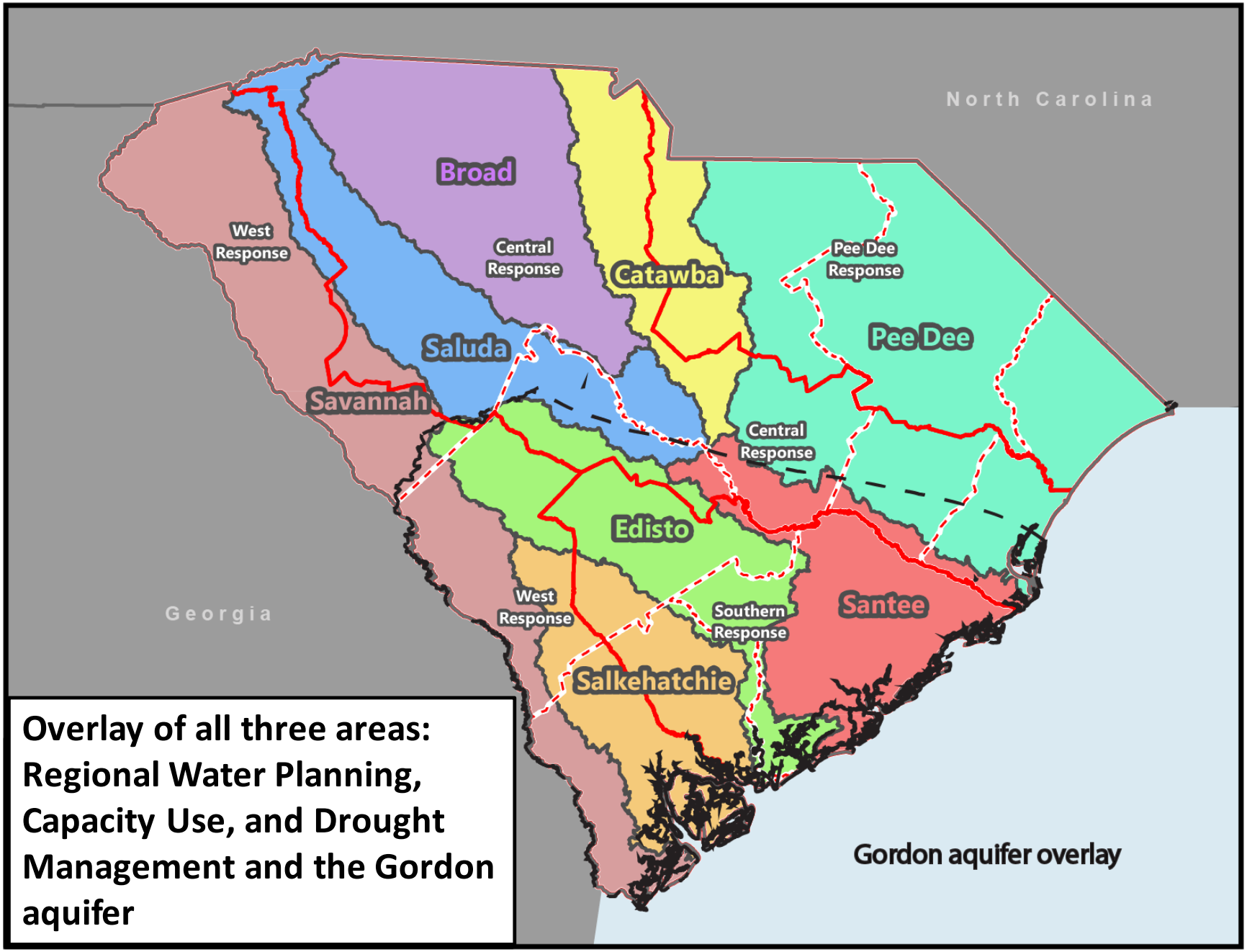

North Carolina
Broad
Catawba
Saluda
Pee Dee
Savannah
Edisto
Santee
Georgia
Salkehatchie
Water management plans are being developed for each basin.
Regional Water Planning Areas (River basins)
Courtesy Mount Pleasant Waterworks

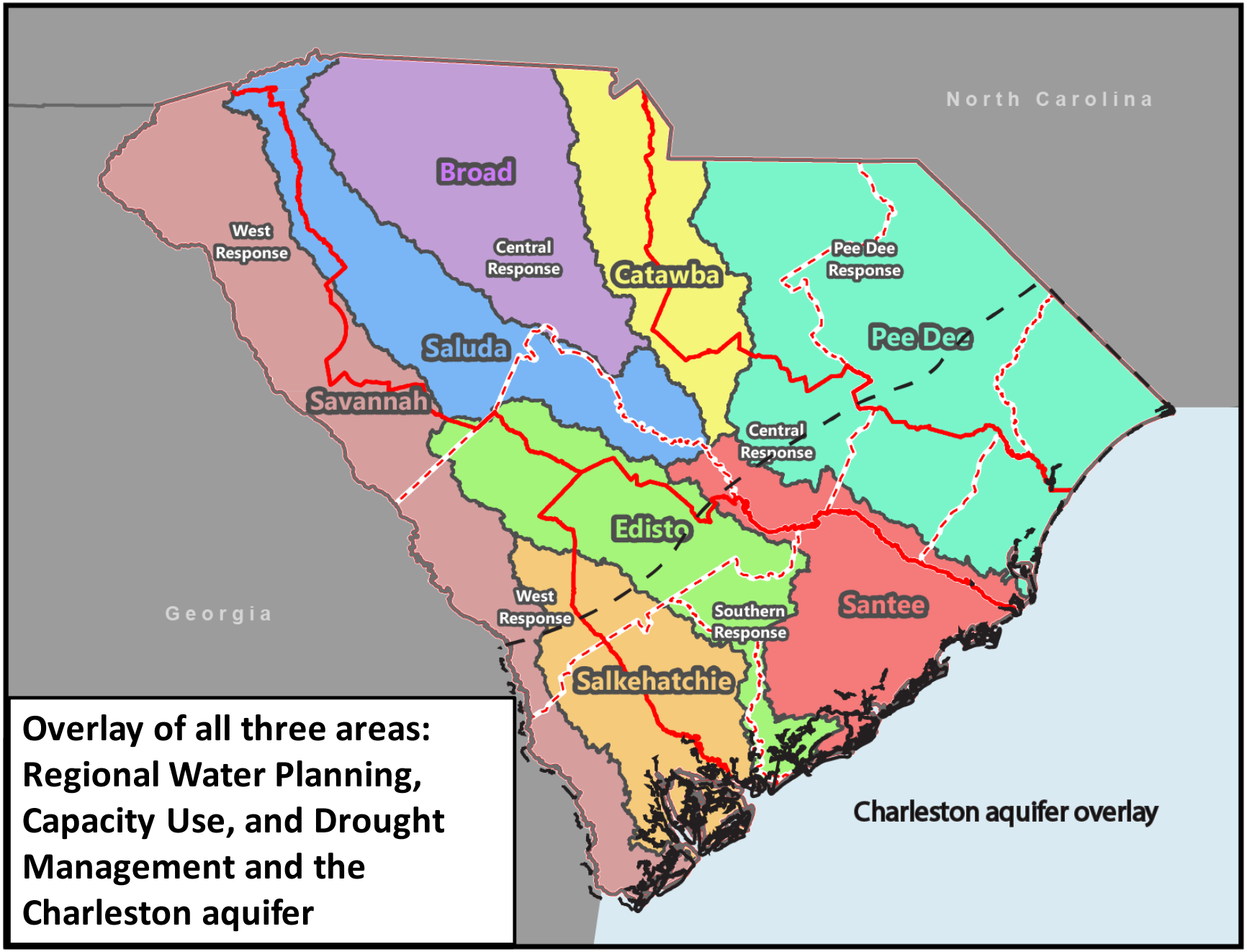


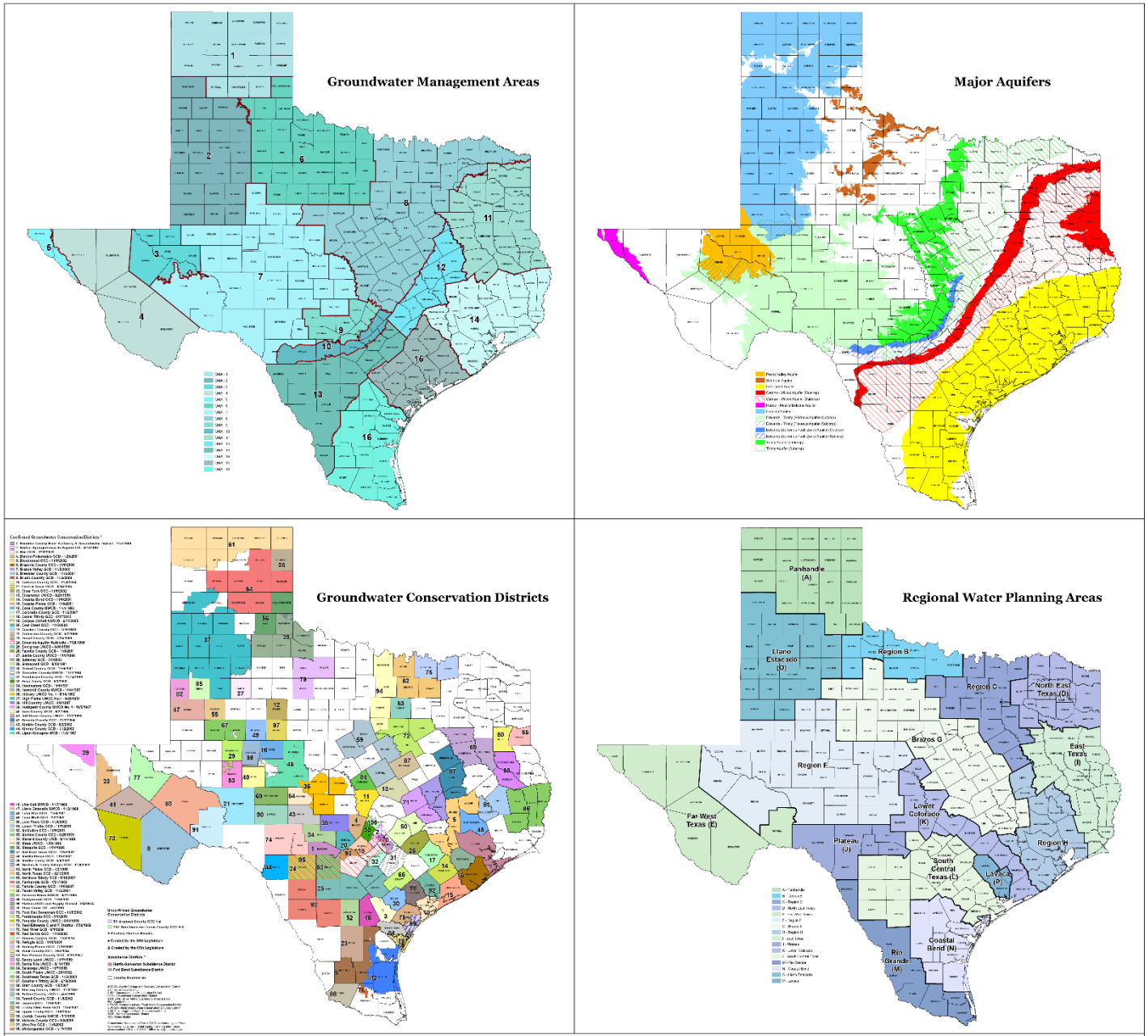
Capacity Use Areas


North Carolina
Pee Dee
Central
West
Georgia
Southern
Drought Response Areas
Courtesy Mount Pleasant Waterworks


North Carolina
Georgia
Broad
Catawba
Saluda
Savannah
Edisto
Salkehatchie
Santee
Pee Dee
West Response
Central Response
Pee Dee Response
Central Response
West Response
Southern Response
Overlay of all three areas: Regional Water Planning, Capacity Use, and Drought Management
Courtesy Mount Pleasant Waterworks

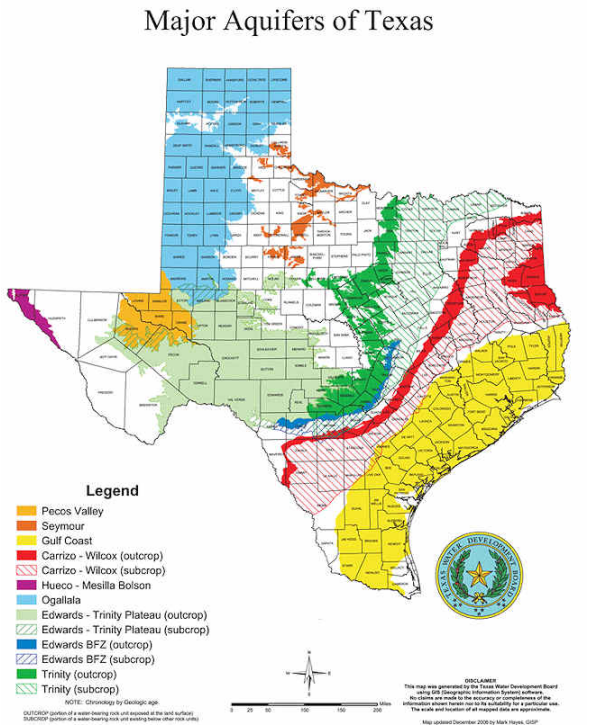

North Carolina
Georgia
Broad
Catawba
Pee Dee
Saluda
Savannah
Edisto
Santee
Salkehatchie
West Response
Central Response
Pee Dee Response
Central Response
West Response
Southern Response
Overlay of all three areas: Regional Water Planning, Capacity Use, and Drought Management and the Gordon aquifer
Gordon aquifer overlay


North Carolina
Broad
West Response
Central Response
Catawba
Pee Dee Response
Pee Dee
Saluda
Savannah
Central Response
Edisto
West Response
Southern Response
Santee
Salkehatchie
Georgia
Overlay of all three areas: Regional Water Planning, Capacity Use, and Drought Management and the Charleston aquifer
Charleston aquifer overlay

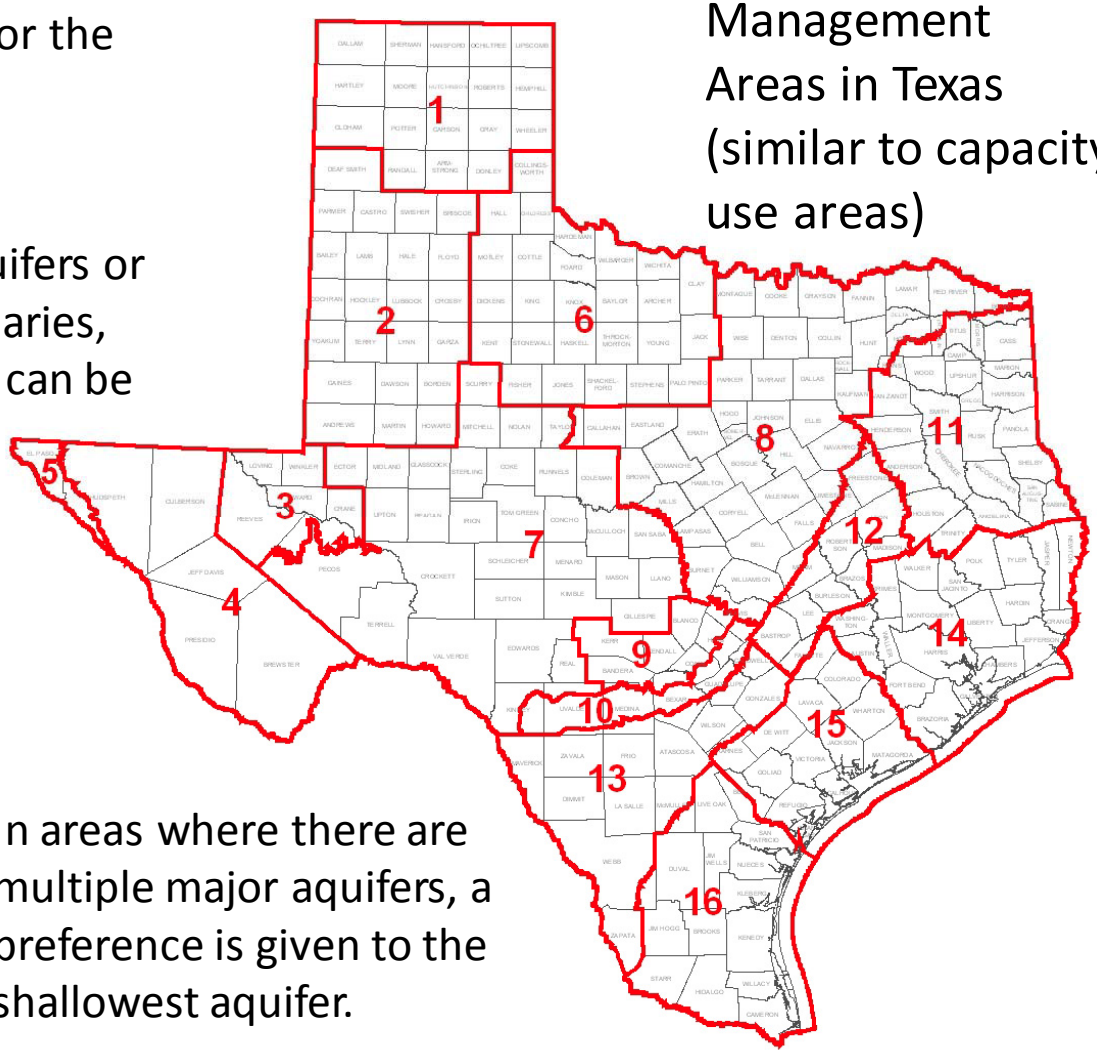

Groundwater Management Areas
Major Aquifers
Groundwater Conservation Districts
Regional Water Planning Areas
Panhandle (A)
Region B
Llano Estacado (O)
Region C
North East Texas (D)
Brazos G
Region F
East Texas (I)
Lower Colorado (K)
Far West Texas (E)
Plateau (J)
Region H
South Central Texas (L)
Lavaca (P)
Coastal Bend (N)
Rio Grande (M)
Groundwater Management Areas - Major Aquifers - Groundwater Conservation Districts - Regional Water Planning Areas
Texas Water Development Board
TNRIS

Groundwater Management Areas - Defined as an area "suitable for the management of groundwater resources".

Uses boundaries of major aquifers or subdivisions of aquifer boundaries, although political boundaries can be considered.
areas.



Groundwater Management Areas in Texas (similar to capacity use areas)



In areas where there are multiple major aquifers, a preference is given to the shallowest aquifer.

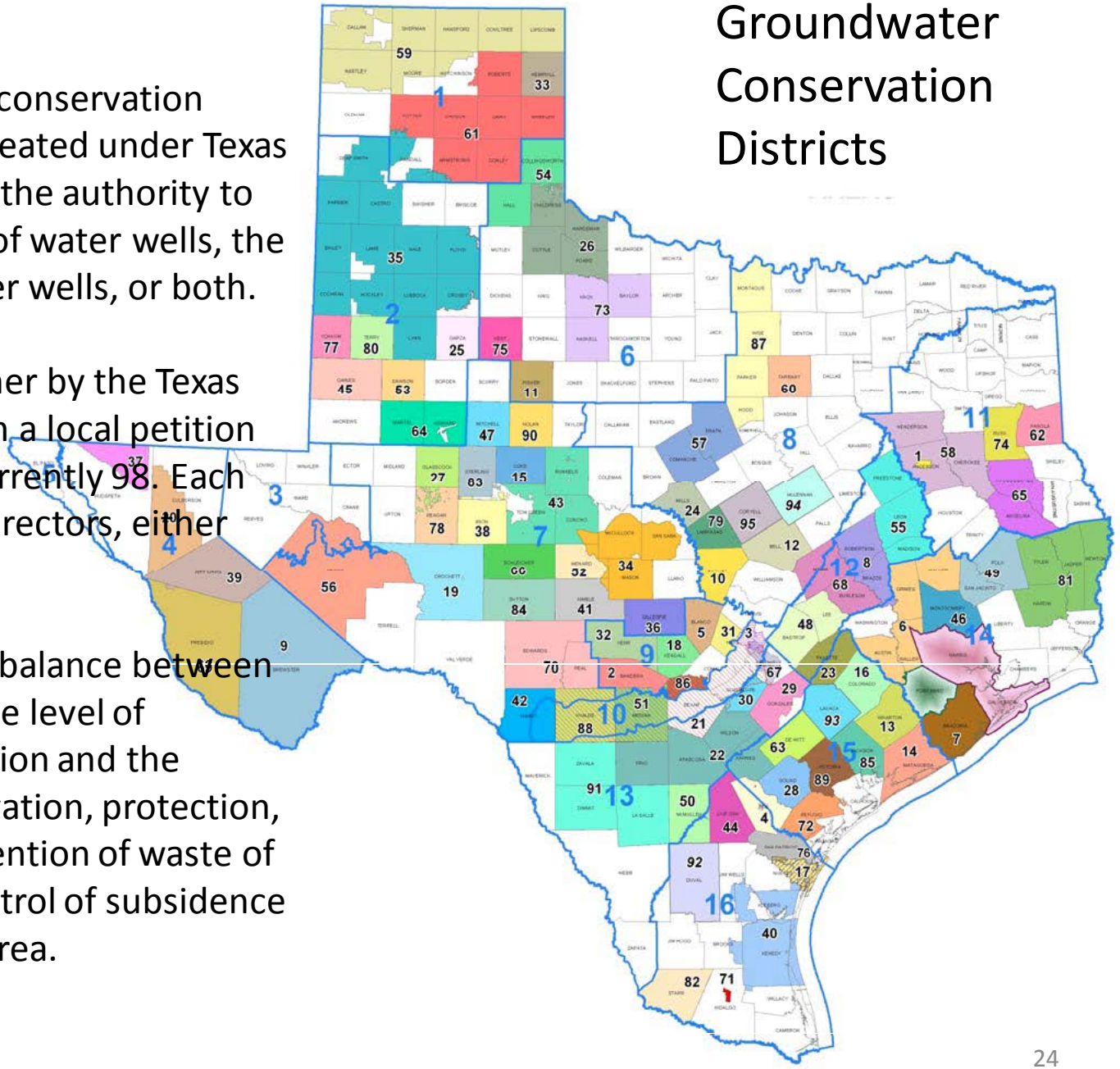
Several of the major aquifers occur in multiple groundwater management areas.

Groundwater Conservation Districts

A GCD (groundwater conservation district) is a district created under Texas Constitution that has the authority to regulate the spacing of water wells, the production from water wells, or both.

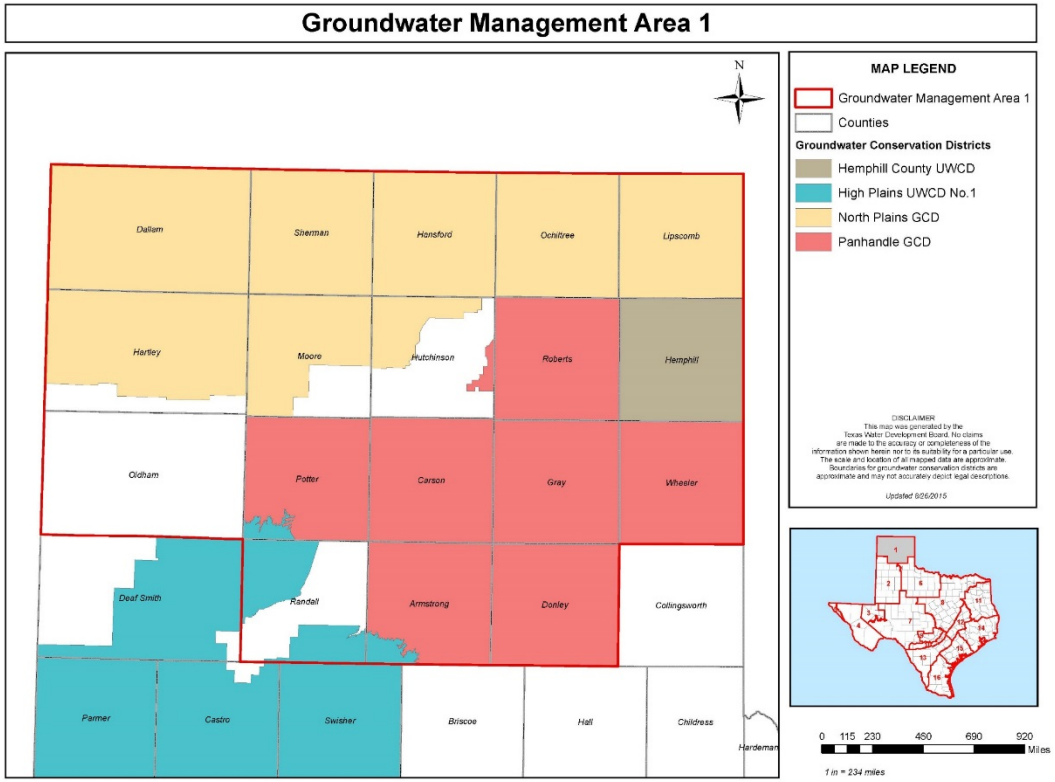
GCDs are created either by the Texas Legislature or through a local petition process. There are currently 98. Each GCD has a board of directors, either appointed or elected.

GCDs must provide a balance between the highest practicable level of groundwater production and the conservation, preservation, protection, recharging, and prevention of waste of groundwater and control of subsidence in the management area.



Each groundwater conservation district (GCD) develops a groundwater management plan.

By law, the GCDs must share their plans with each other within a management area. The joint planning process must be conducted by all groundwater conservation districts within each groundwater management area.



A key part of joint planning is determining a “desired future condition” (DFC) for each aquifer.

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

1) Water levels in the Edwards aquifer will not decline more than 100 ft in 50 years
2) Water quality in the Ogallala aquifer will not be degraded below 1000 mg/l
3) 50% of the water storage in the North Plains aquifer will be available in 50 years

Districts can establish different desired future conditions (DFCs) for each aquifer and for different geographic areas overlying an aquifer.

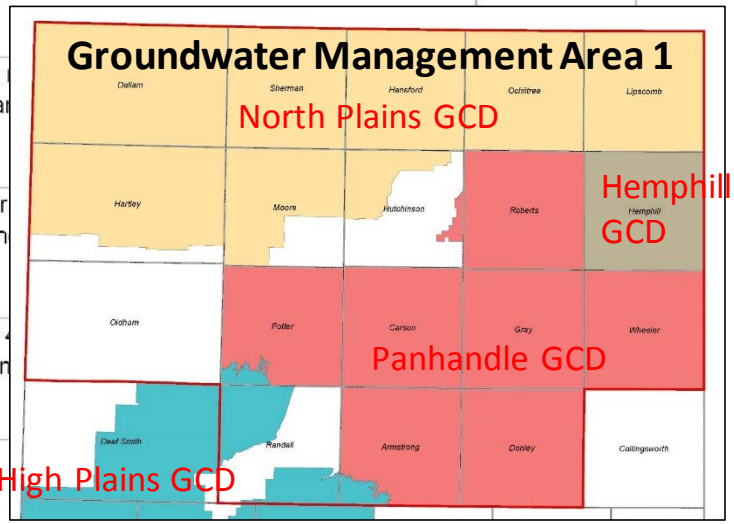
If there are multiple DFCs for the same aquifer within a groundwater management area, they need to be somewhat compatible.

The DFCs must be approved by members of their respective groundwater management area (GMA).

Once approved by the GMA, the DFCs are sent to the Texas Water Development Board (TWDB) for review and approval.

Groundwater Management Area 1 – Desired Future Conditions

County	Aquifer	Desired Future Condition (DFC)	Date DFC Adopted
Dallam Hartley Moore Sherman (North Plains GCD)	Ogallala and Rita Blanca	At least 40 percent of volume in storage remaining in 50 years, for the period 2012-2062 collectively in Dallam, Hartley, Moore, and Sherman counties.	11/2/2016
Hansford Lipscomb Ochiltree Hutchinson (partial) (North Plains GCD)	Ogallala and Rita Blanca	At least 50 percent of volume in storage remaining in 50 years, for the period 2012-2062 collectively in Hansford, Lipscomb, and Ochiltree counties and that portion of Hutchinson County within North Plains GCD.	11/2/2016
Carson Donley Gray Hutchinson Oldham Roberts Wheeler Armstrong (partial) Potter (partial) (Panhandle GCD)	Ogallala and Rita Blanca	At least 50 percent of volume in storage remaining in 50 years, for the period 2012-2062 in Carson, Donley, Gray, Hutchinson, Oldham, Roberts, and Wheeler counties; and portions of Armstrong and Potter counties within the Panhandle GCD.	11/2/2016
Hemphill (Hemphill GCD)	Ogallala and Rita Blanca	At least 80 percent of volume in storage remaining in 50 years for the period 2012-2062, within the Hemphill County.	11/2/2016
Randall Armstrong (partial) Potter (partial) (High Plains GCD)	Ogallala and Rita Blanca	Approximately 20 feet of total average drawdown in 50 years for the period 2012-2062, collectively in Randall County and in Armstrong and Potter counties within the High Plains UWCD.	11/2/2016
Dallam Hartley Moore Sherman	Dockum	At least 40 percent of the available drawdown 2062 collectively for Dallam, Hartley, Moore, a	
Carson Oldham Armstrong (partial) Potter (partial)	Dockum	No more than 30 feet average decline in water collectively in Carson and Oldham counties an the Panhandle GCD.	
Randall Armstrong (partial) Potter (partial)	Dockum	The total average drawdown is approximately 2062, collectively in Randall county, and in Arm Plains UWCD.	



Once the DFC has been determined for each aquifer in the district, the Texas Water Development Board determines the "modeled available groundwater" (MAG) based on the desired future condition.

MAG is defined as the amount of groundwater that can be pumped, on an average annual basis, that will achieve a desired future condition.

GCDs must issue permits up to the point that the total volume of exempt and permitted groundwater will achieve the DFC, using the MAG as one factor in deciding permit applications.

As such, groundwater conservation districts, working collectively within each groundwater management area, define groundwater availability for the regional water planning process.

Regional water planning must be consistent with the DFCs adopted by the GCDs. Regional water planning groups must use MAG volumes for groundwater availability when developing water plans.

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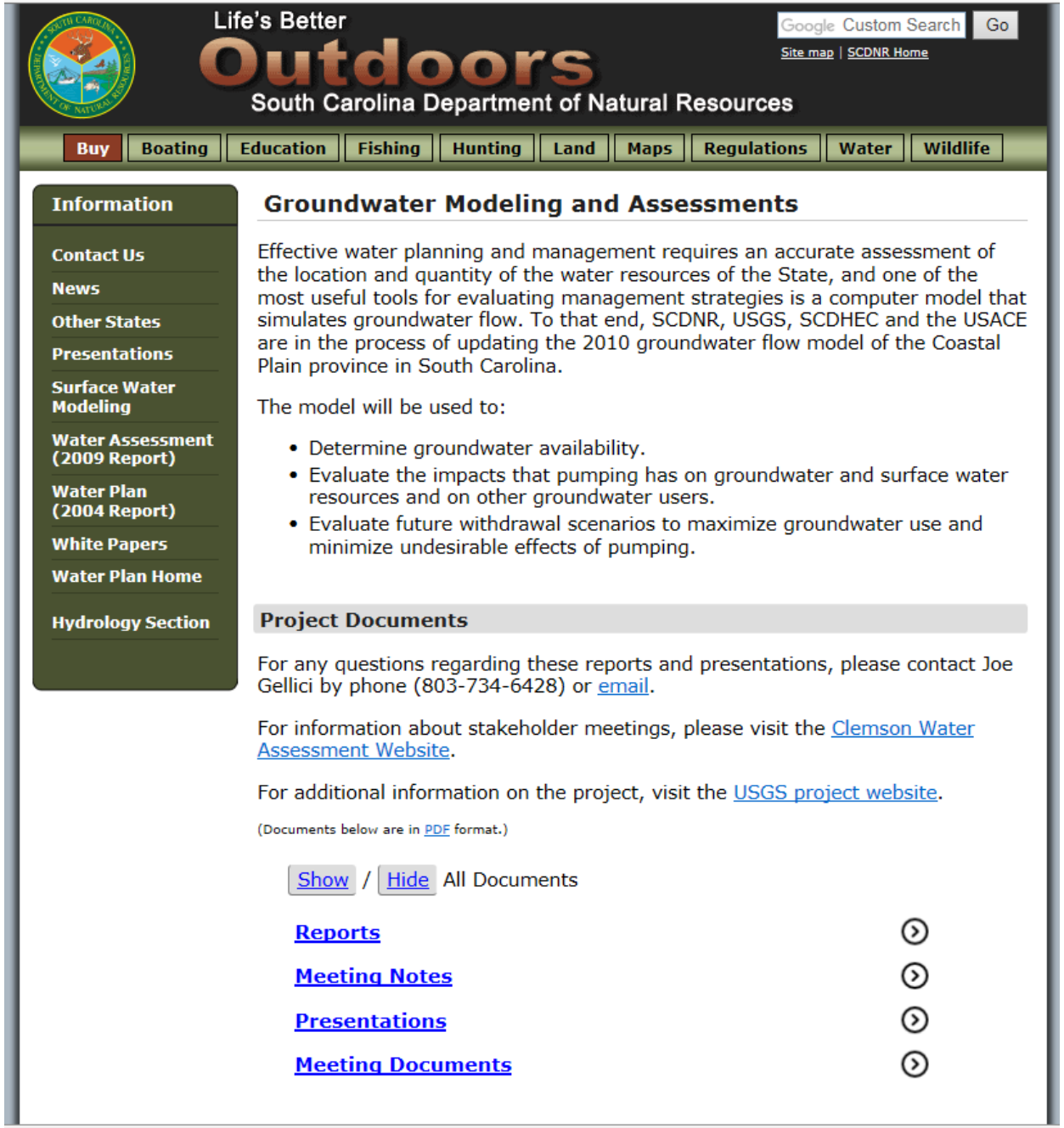
Groundwater Management Area 1 – Modeled Available Groundwater

Groundwater Conservation District	County	Aquifer	Modeled Available Groundwater						TWDB Report
			2020	2030	2040	2050	2060	2062	
High Plains UWCD No. 1	Armstrong	Ogallala	1,286	1,048	866	723	610	591	GR16-029 MAG
High Plains UWCD No. 1	Potter	Ogallala	225	225	225	223	221	221	GR16-029 MAG
High Plains UWCD No. 1	Randall	Ogallala	39,084	37,987	32,477	28,334	25,018	24,459	GR16-029 MAG
Hemphill County UWCD	Hemphill	Ogallala	52,196	52,218	52,267	52,305	52,336	52,341	GR16-029 MAG
North Plains GCD	Dallam	Ogallala/Rita Blanca	387,471	287,205	225,573	166,890	112,864	103,258	GR16-029 MAG
North Plains GCD	Hansford	Ogallala	275,016	272,656	271,226	270,281	269,589	269,479	GR16-029 MAG
North Plains GCD	Hartley	Ogallala	397,585	271,523	212,321	154,433	100,407	90,842	GR16-029 MAG
North Plains GCD	Hutchinson	Ogallala	62,803	64,522	65,652	66,075	66,027	65,956	GR16-029 MAG
North Plains GCD	Lipscomb	Ogallala	266,809	266,710	266,640	266,591	266,559	266,557	GR16-029 MAG
North Plains GCD	Moore	Ogallala	214,853	172,621	139,322	105,016	73,384	67,650	GR16-029 MAG
North Plains GCD	Ochiltree	Ogallala	243,778	243,932	244,002	244,051	244,082	244,085	GR16-029 MAG
North Plains GCD	Sherman	Ogallala	398,056	348,895	281,690	212,744	148,552	136,776	GR16-029 MAG
Panhandle GCD	Armstrong	Ogallala	57,984	53,414	48,170	43,462	38,860	38,080	GR16-029 MAG
Panhandle GCD	Carson	Ogallala	192,135	184,263	169,931	153,767	137,215	134,055	GR16-029 MAG
Panhandle GCD	Donley	Ogallala	74,808	76,289	72,962	67,873	62,058	60,901	GR16-029 MAG
Panhandle GCD	Gray	Ogallala	181,105	175,267	162,653	148,713	134,431	131,744	GR16-029 MAG
Panhandle GCD	Hutchinson	Ogallala	15,734	16,740	15,156	13,324	11,742	11,455	GR16-029 MAG
Panhandle GCD	Potter	Ogallala	16,969	15,820	14,442	13,162	11,836	11,609	GR16-029 MAG
Panhandle GCD	Roberts	Ogallala	430,618	455,129	427,218	390,247	350,459	342,748	GR16-029 MAG
Panhandle GCD	Wheeler	Ogallala	130,425	138,810	137,385	132,312	124,778	123,309	GR16-029 MAG
No District-County	Hartley	Ogallala	19,528	17,639	14,527	11,147	8,016	7,458	GR16-029 MAG
No District-County	Moore	Ogallala	8,932	8,598	7,592	6,186	4,788	4,532	GR16-029 MAG
No District-County	Oldham	Ogallala	44,599	40,203	33,423	26,207	19,590	18,617	GR16-029 MAG
No District-County	Randall	Ogallala	24,826	23,945	21,864	19,471	17,012	16,541	GR16-029 MAG
No District-County	Hutchinson	Ogallala	16,448	14,432	13,353	12,973	13,089	13,170	GR16-029 MAG
High Plains UWCD No. 1	Armstrong	Dockum	96	0	0	0	0	0	GR16-029 MAG
High Plains UWCD No. 1	Potter	Dockum	21	0	0	0	0	0	GR16-029 MAG



http://www.dnr.sc.gov/water/waterplan/groundwater.html