Surface Water Resources of the Saluda River Basin

Saluda River Basin Council – Meeting #2, April 19, 2023

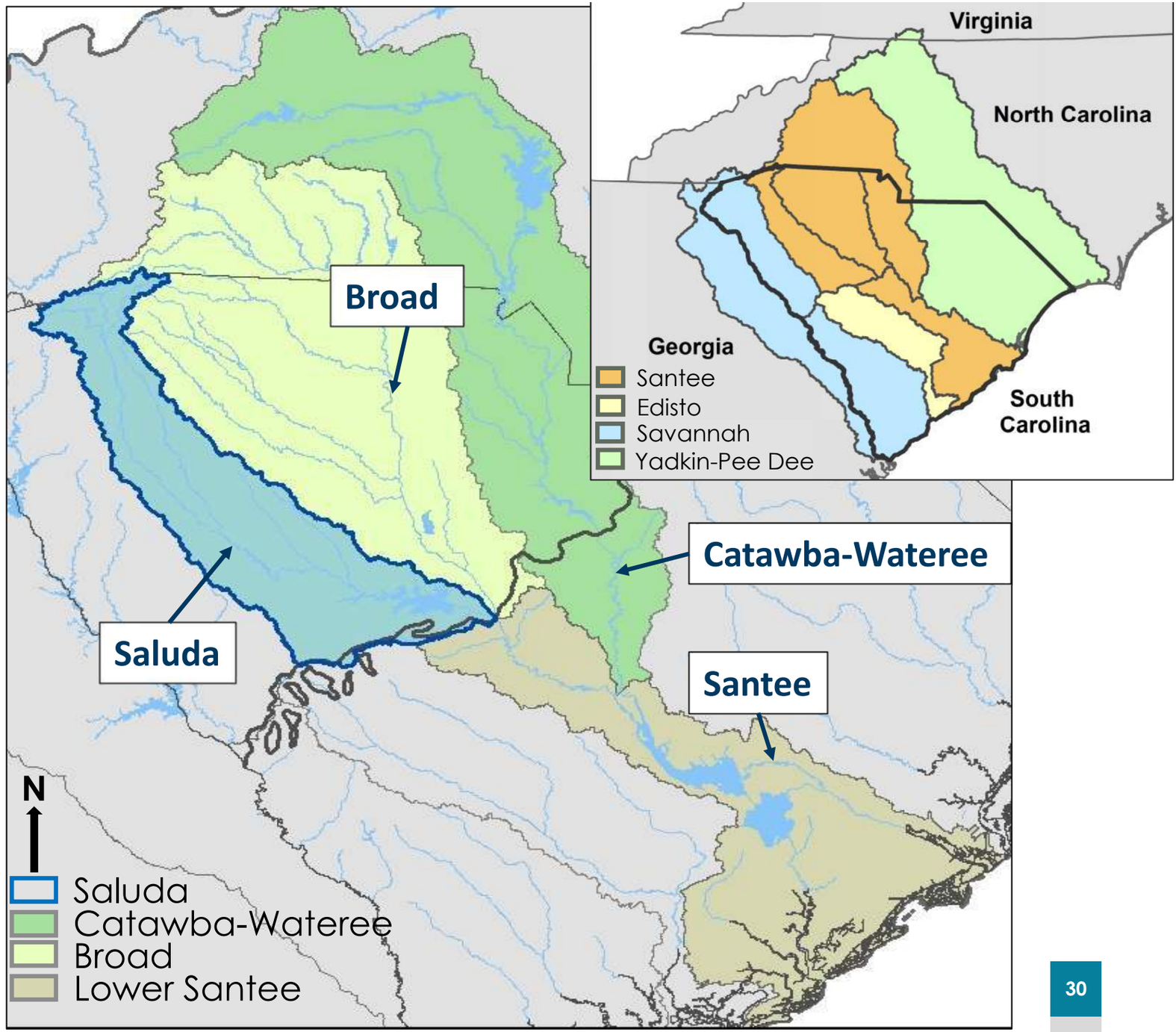
Priyanka More, Hydrologist

SC Department of Natural Resources

Agenda Item 6

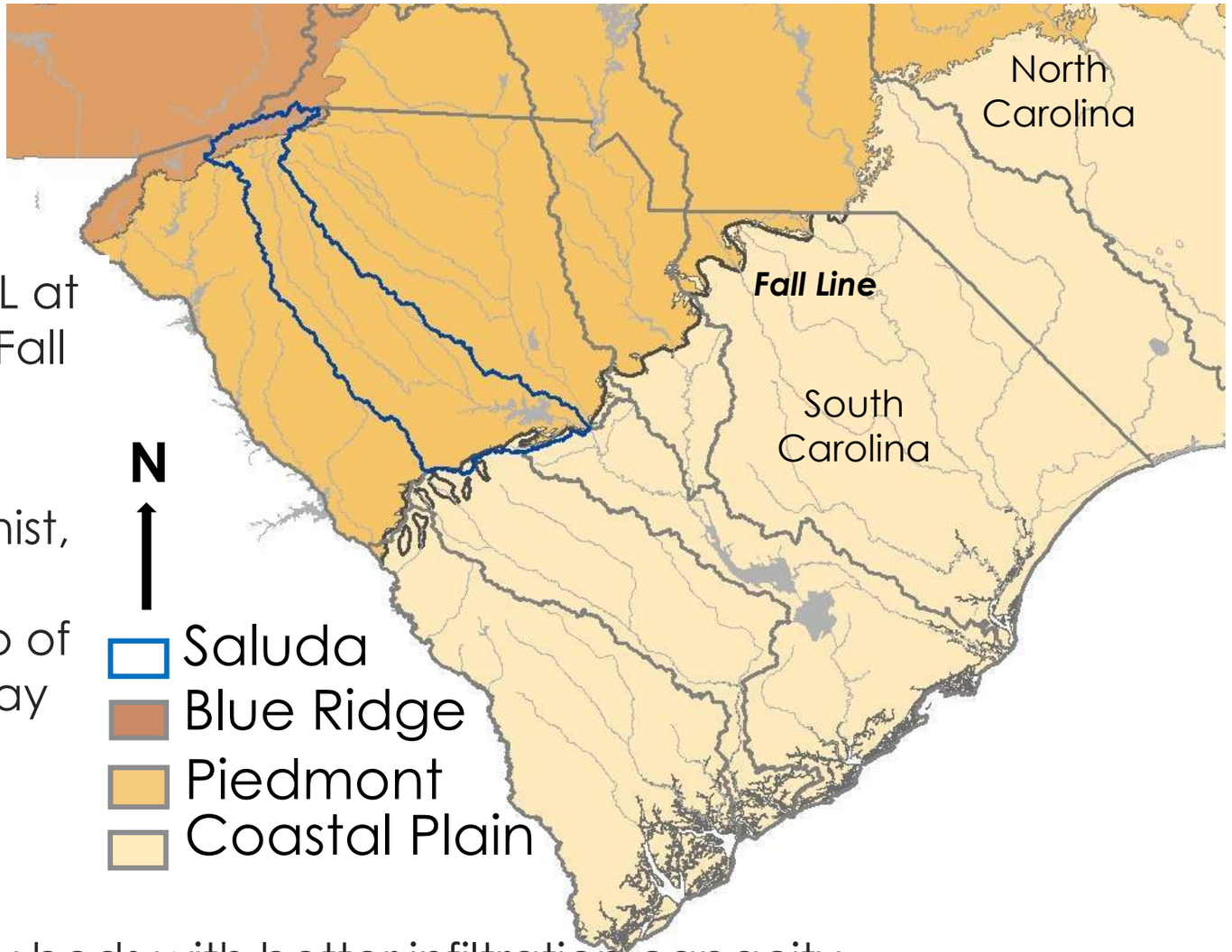
Saluda Basin Overview

- Part of the larger Santee River basin.
- Area = 2,523 sq. mi.
  - 15% of entire Santee basin.
- One of three planning basins upstream of the lower Santee planning basin.
- Basin entirely within SC.

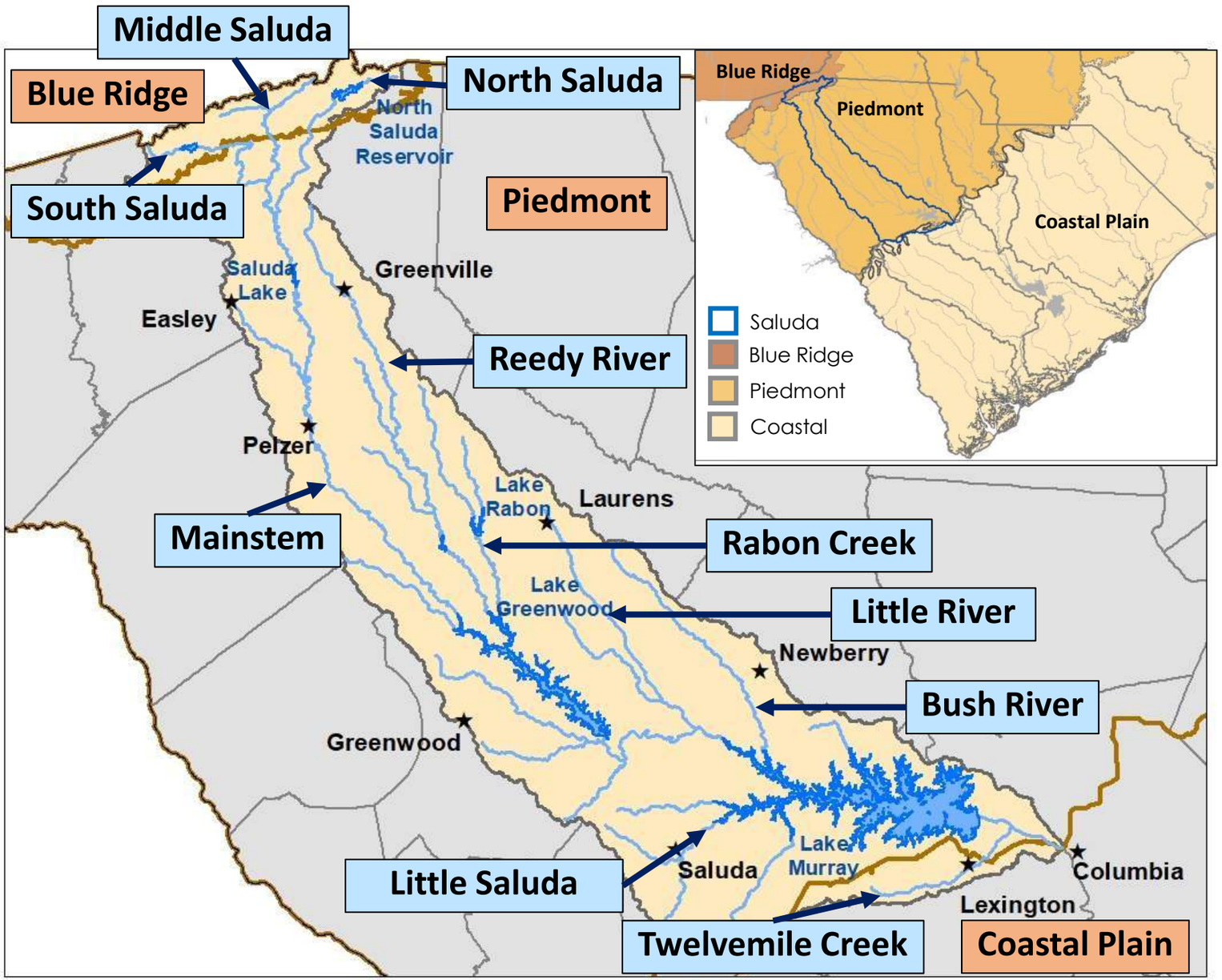


Physiographic Provinces

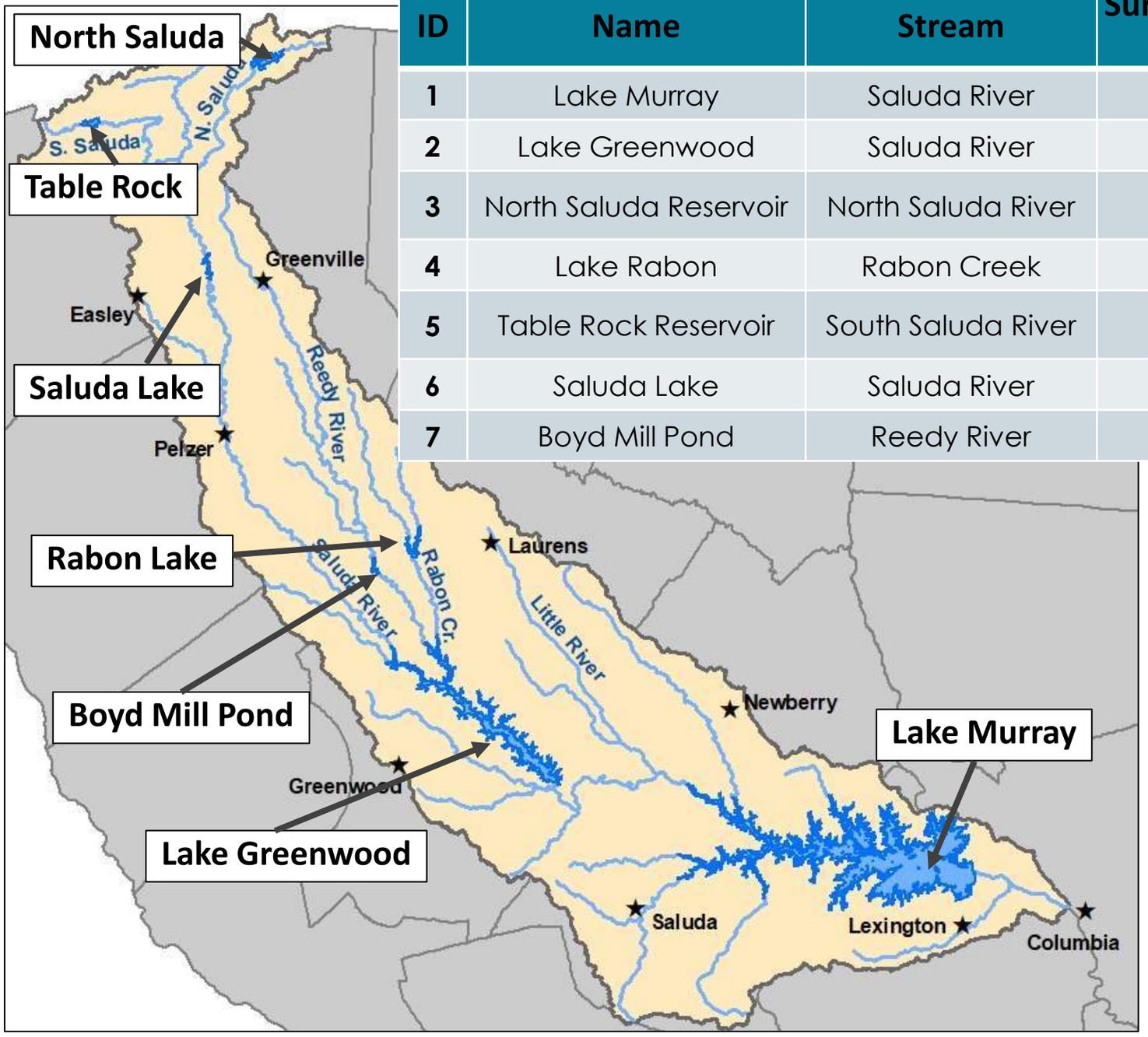
- Blue Ridge Mountains
  - Rugged terrain and streams have higher gradient.
- Piedmont
  - Elevation ranges from 1000 ft above MSL at foothills of Blue Ridge to 400 ft near the Fall Line.
  - Underlain by fractured crystalline rock, consisting of intrusive granite, gneiss, schist, and metamorphosed volcanic rock.
  - Most overlying soil (saprolite) is made up of moderately to poorly permeable silty clay loams.
- Coastal Plain
  - Topographic relief is relatively lower.
  - Composed of sand, limestone, and clay beds with better infiltration capacity.
- Most of basin within Piedmont province and small portion extends into Coastal Plain.



Saluda Basin- Surface Water Resources



- Upper Saluda Basin
  - Generally higher baseflow/more sustained flow in Blue Ridge and inner Piedmont areas.
  - Low to moderate regulation.
- Lower Saluda Basin
  - Low baseflow.
  - Heavy regulation, downstream of Lake Greenwood.

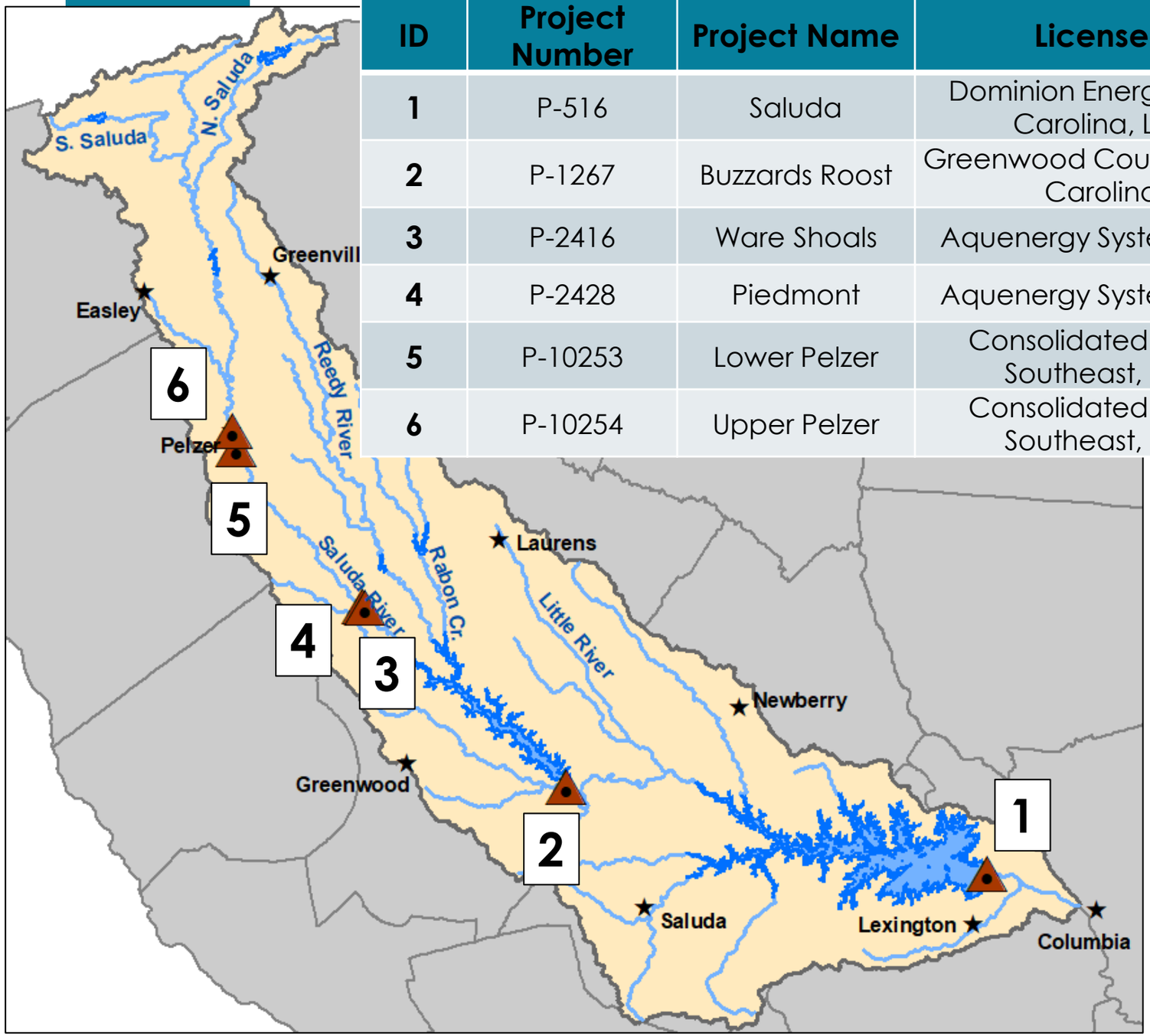


ID	Name	Stream	Surface area (acres)	Storage capacity (acre-feet)	Operator
1	Lake Murray	Saluda River	51,000	2,114,000	Dominion Energy
2	Lake Greenwood	Saluda River	11,400	270,000	Greenwood County
3	North Saluda Reservoir	North Saluda River	1,034	33,000	Greenville Water System
4	Lake Rabon	Rabon Creek	562	6,832	LCPW
5	Table Rock Reservoir	South Saluda River	485	15,000	Greenville Water System
6	Saluda Lake	Saluda River	305	7,228	City of Easley
7	Boyd Mill Pond	Reedy River	203	3,000	Laurens County

Saluda Basin Reservoirs

- 7 Reservoirs greater than 200 acres.
- Used for hydroelectric power, water supply and recreation.

ID	Project Number	Project Name	Licensee	Issue Date	Expiration Date	Capacity (MW)
1	P-516	Saluda	Dominion Energy South Carolina, LLC	06/01/1984	08/31/2010	207.3
2	P-1267	Buzzards Roost	Greenwood County, South Carolina	12/18/1995	11/30/2035	15.0
3	P-2416	Ware Shoals	Aquenergy Systems, LLC	04/04/2002	03/31/2032	6.2
4	P-2428	Piedmont	Aquenergy Systems, LLC	04/15/2020	03/31/2060	1.0
5	P-10253	Lower Pelzer	Consolidated Hydro Southeast, LLC	08/06/2020	07/30/2060	3.3
6	P-10254	Upper Pelzer	Consolidated Hydro Southeast, LLC	06/30/2020	05/31/2060	2.0

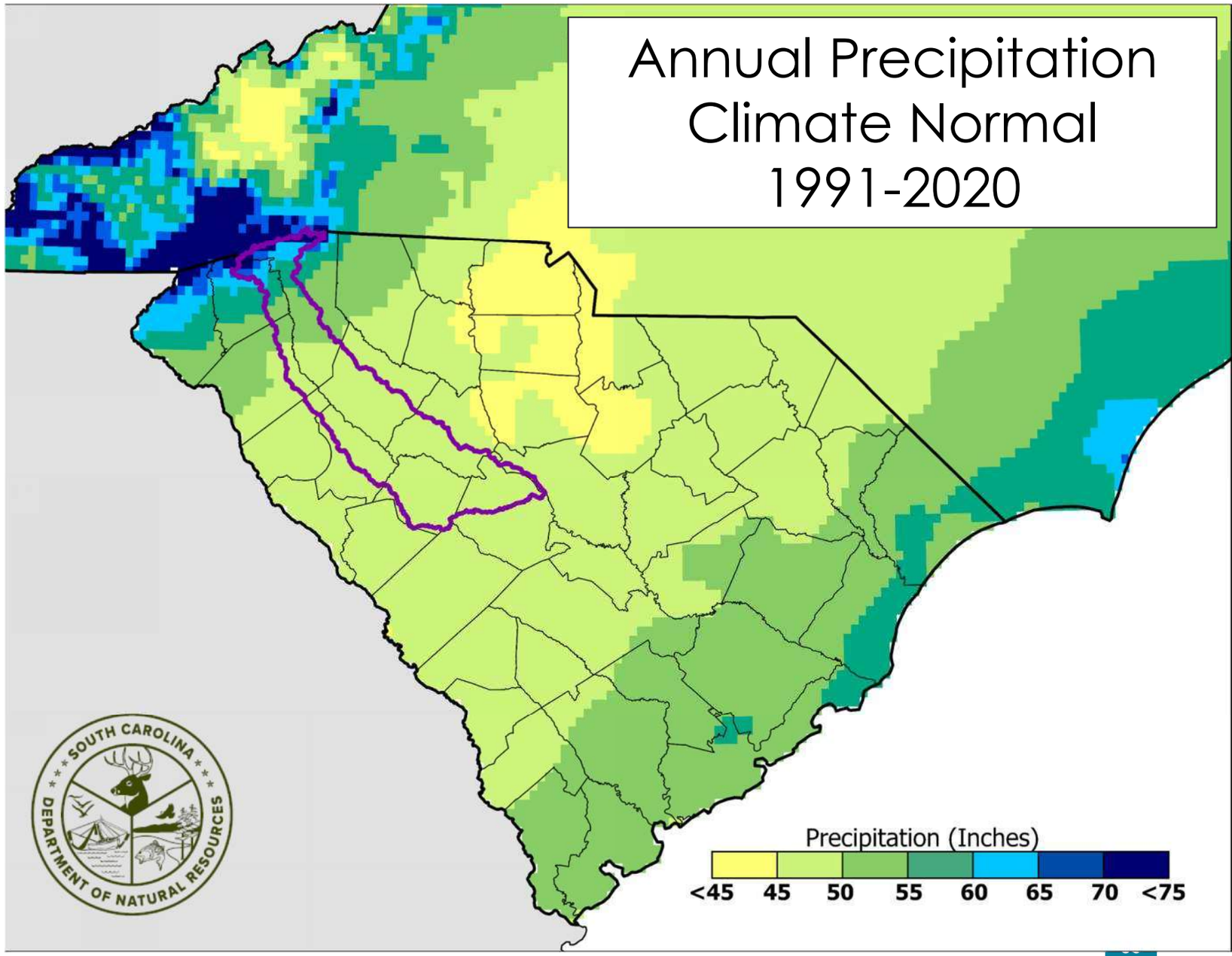


Hydroelectric Projects

- Six projects licensed by the Federal Energy Regulatory Commission (FERC).

1991-2020 Rainfall -Climate Normal

- Average annual rainfall ranges from 75” in the Blue Ridge province to 45” in the lower part of the basin.



Saluda Basin- Rainfall Patterns

Northwest Climate Division – Average Annual Rainfall
and 5-year Running Average

Wetter Periods
Drier Periods

Max: 73 in
1929

Avg: 50 in

Min: 31 in
2016

POR : 127 years

Precipitation (inches)

80.11
70.11
60.11
50.11
40.11
30.11

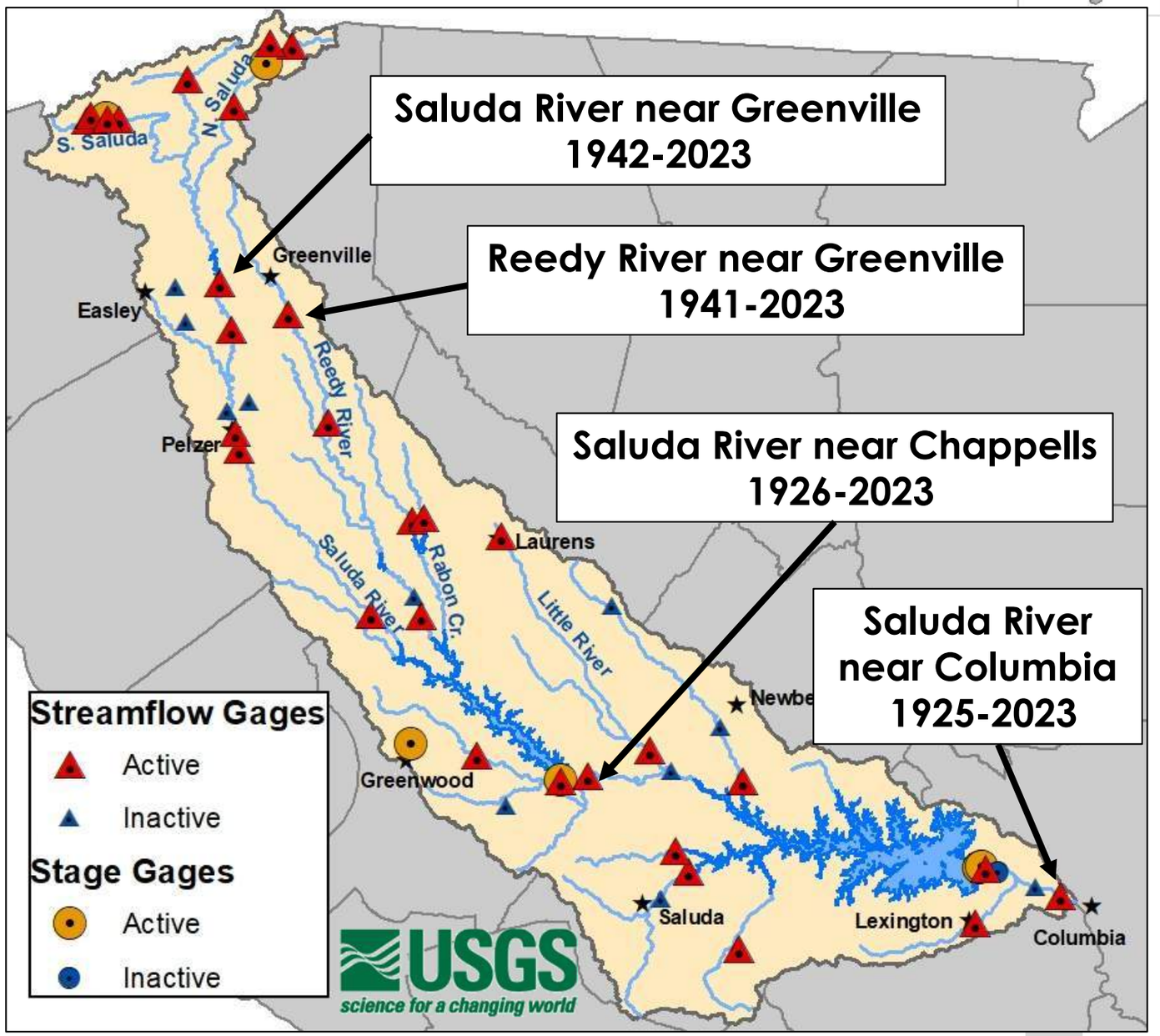
1895
1920
1950
1980
2010
2022

SCIPP (www.southernclimate.org)

Data

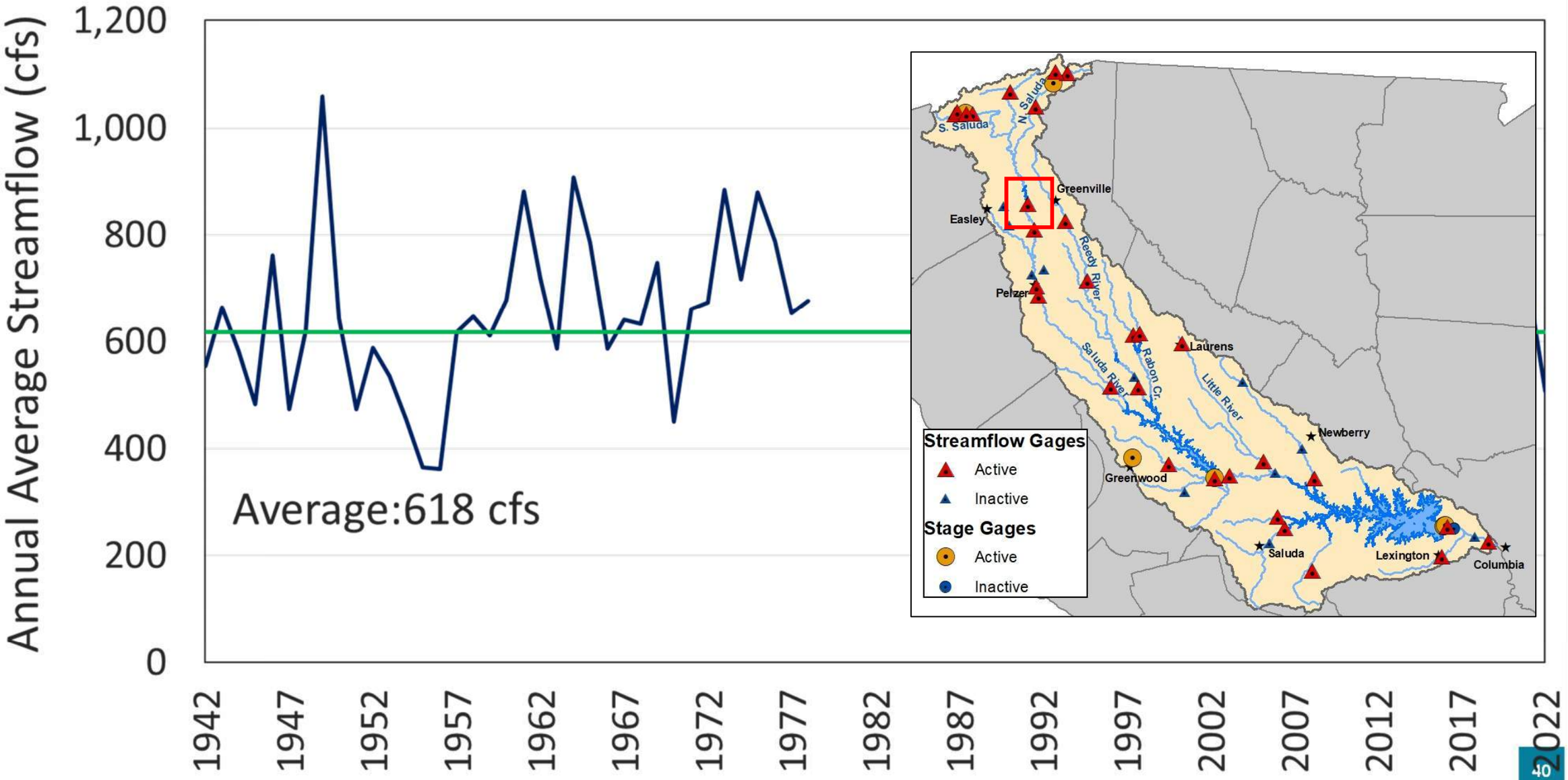
Surface Water Monitoring Network

- 30 active USGS streamflow gaging sites.
  - Periods of record extend back to the 1920s for a few sites along the mainstem Saluda.
  - Sites measure volumetric discharge(cfs – cubic feet per second)and stage.
- 6 additional USGS stage sites.

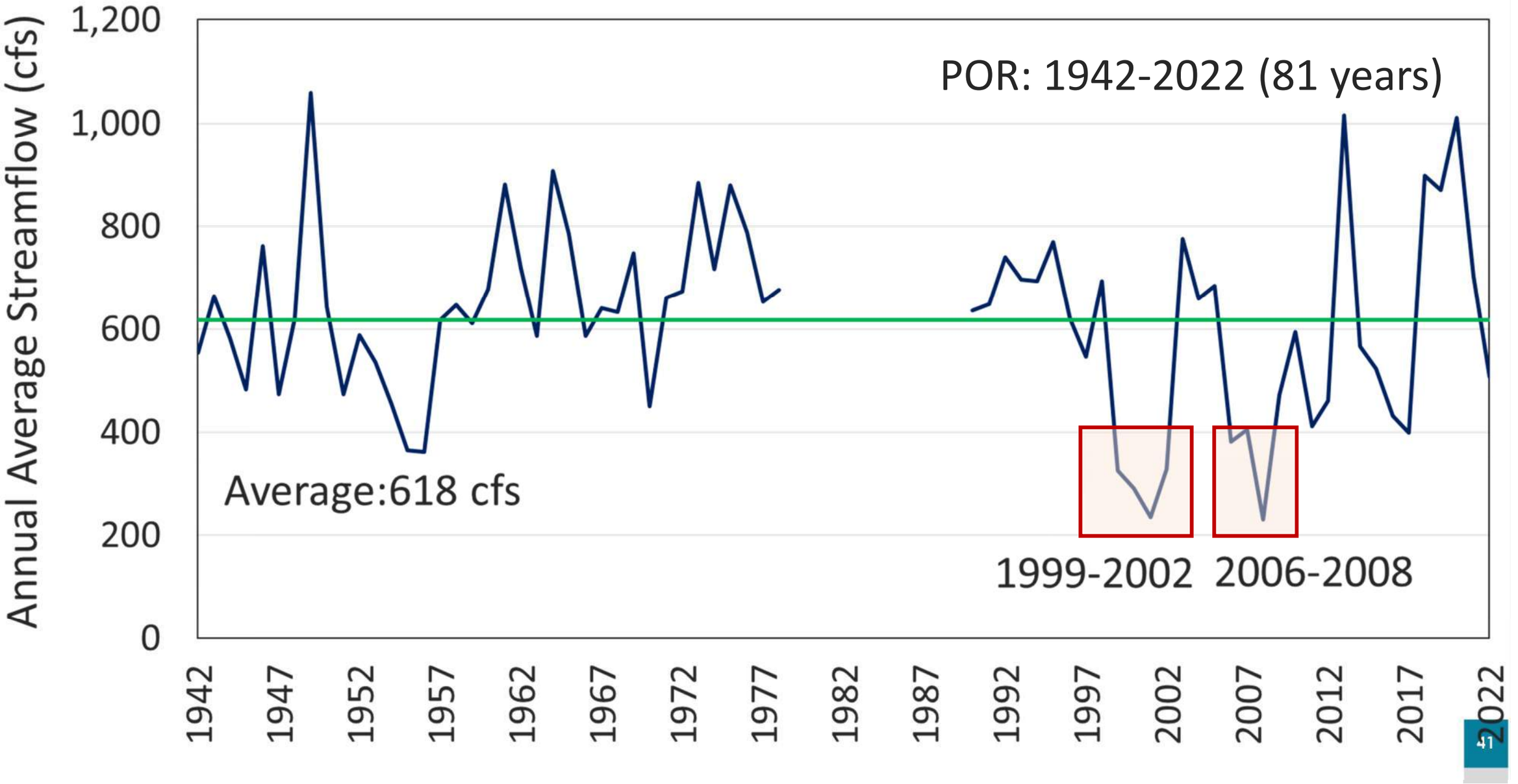


Time Travel!

Average Annual Flows-Saluda near Greenville

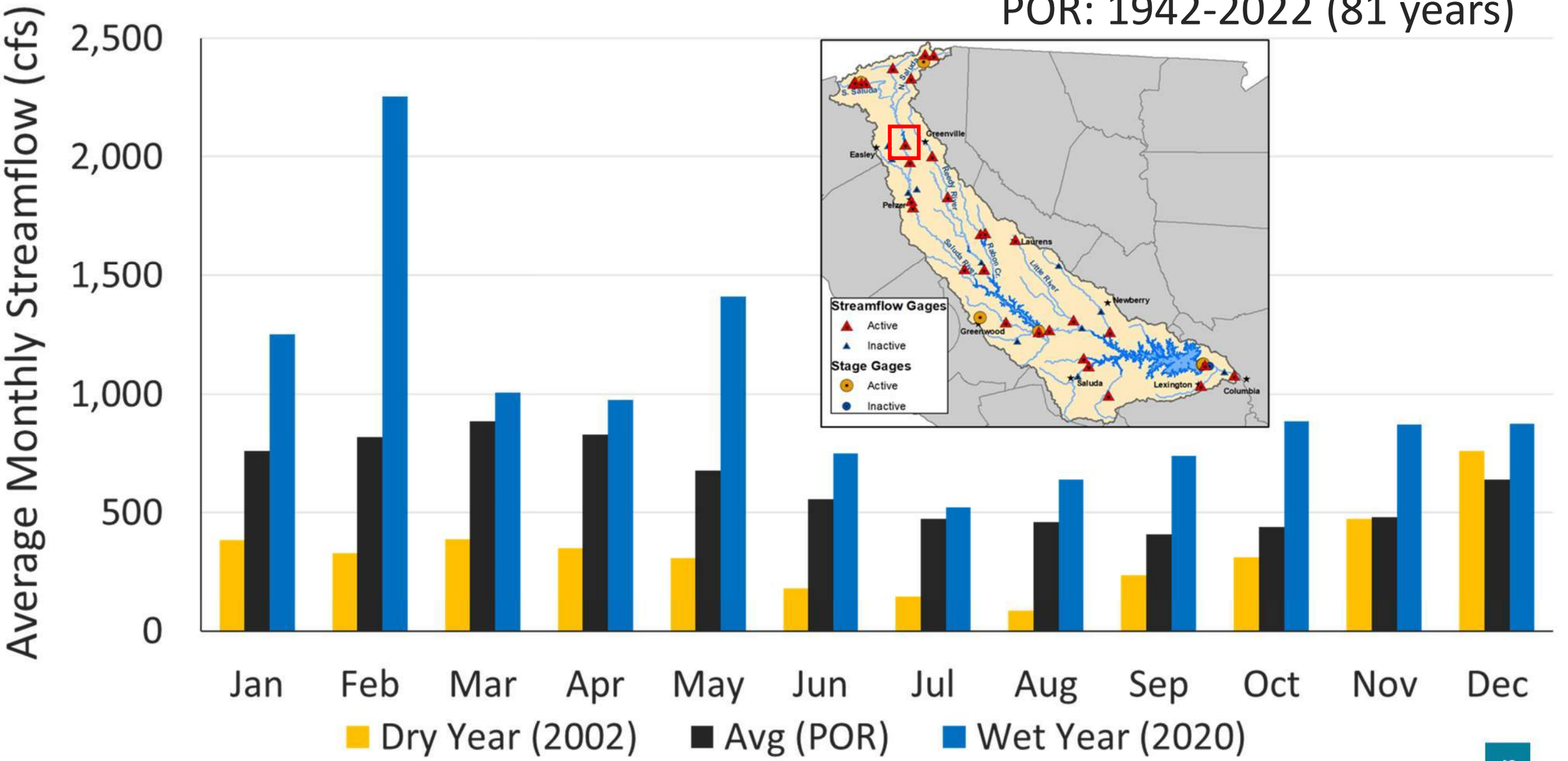


Average Annual Flows-Saluda near Greenville

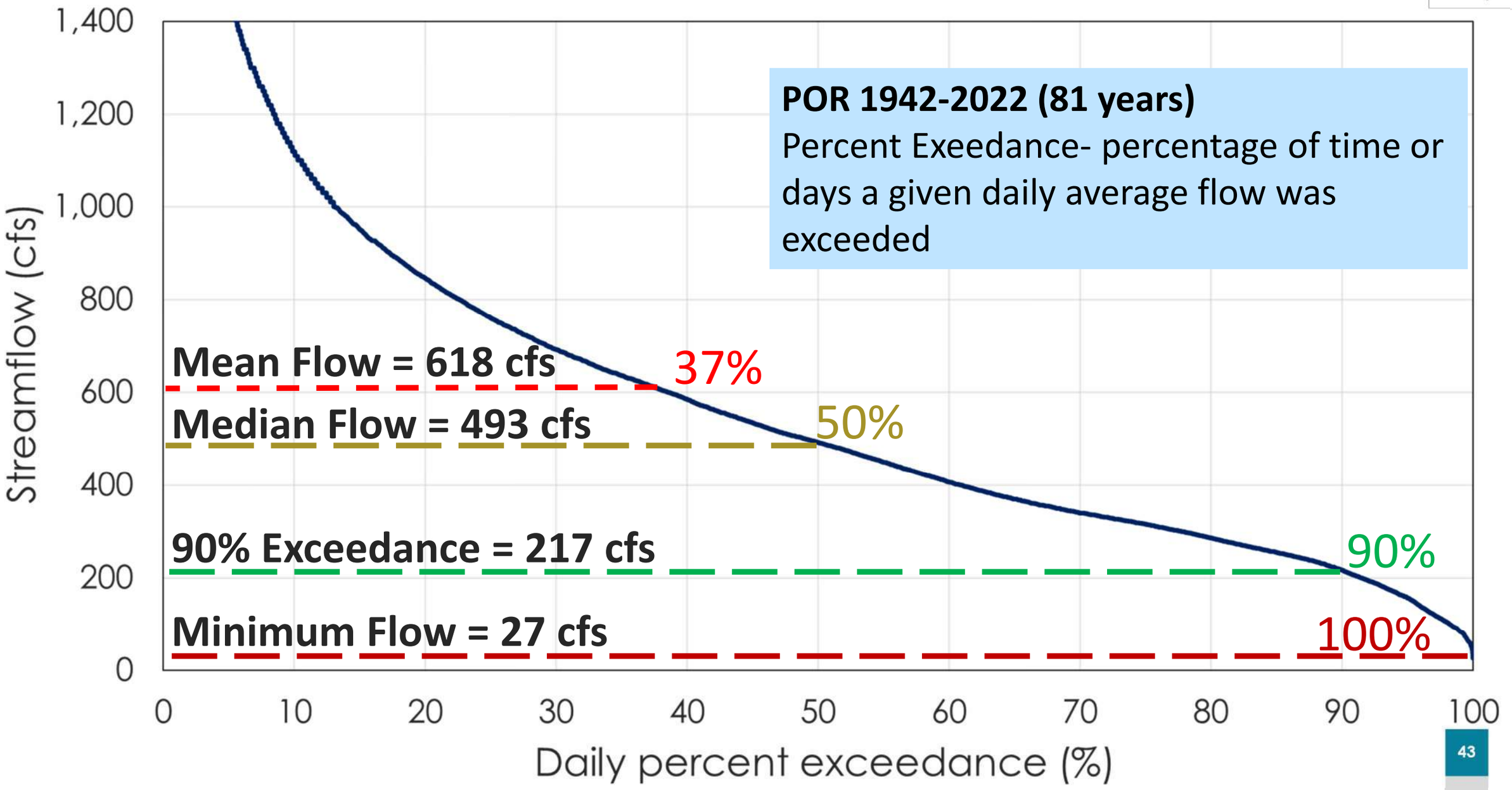


Average Monthly Flows-Saluda near Greenville

POR: 1942-2022 (81 years)

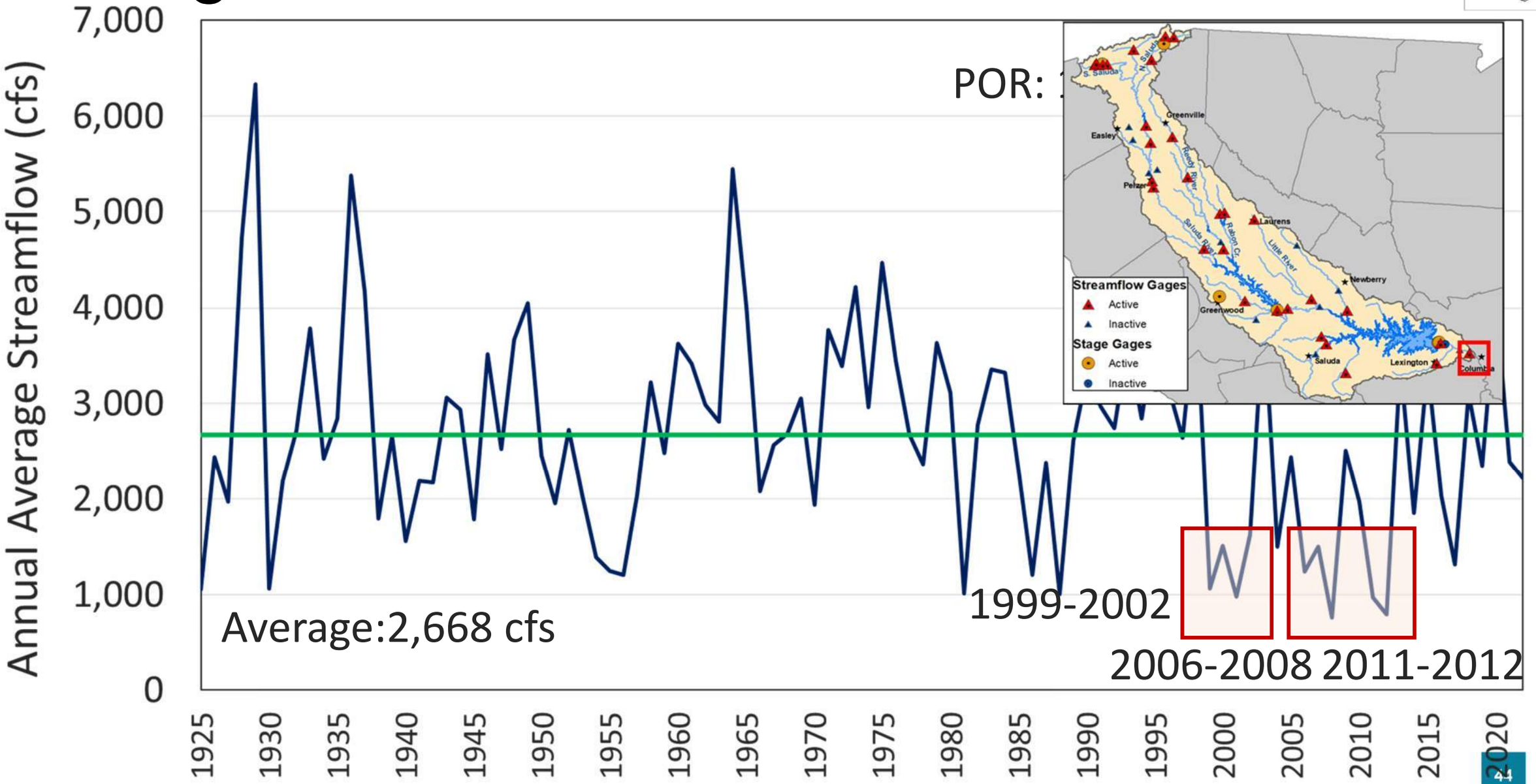


Flow Duration Curve- Saluda near Greenville

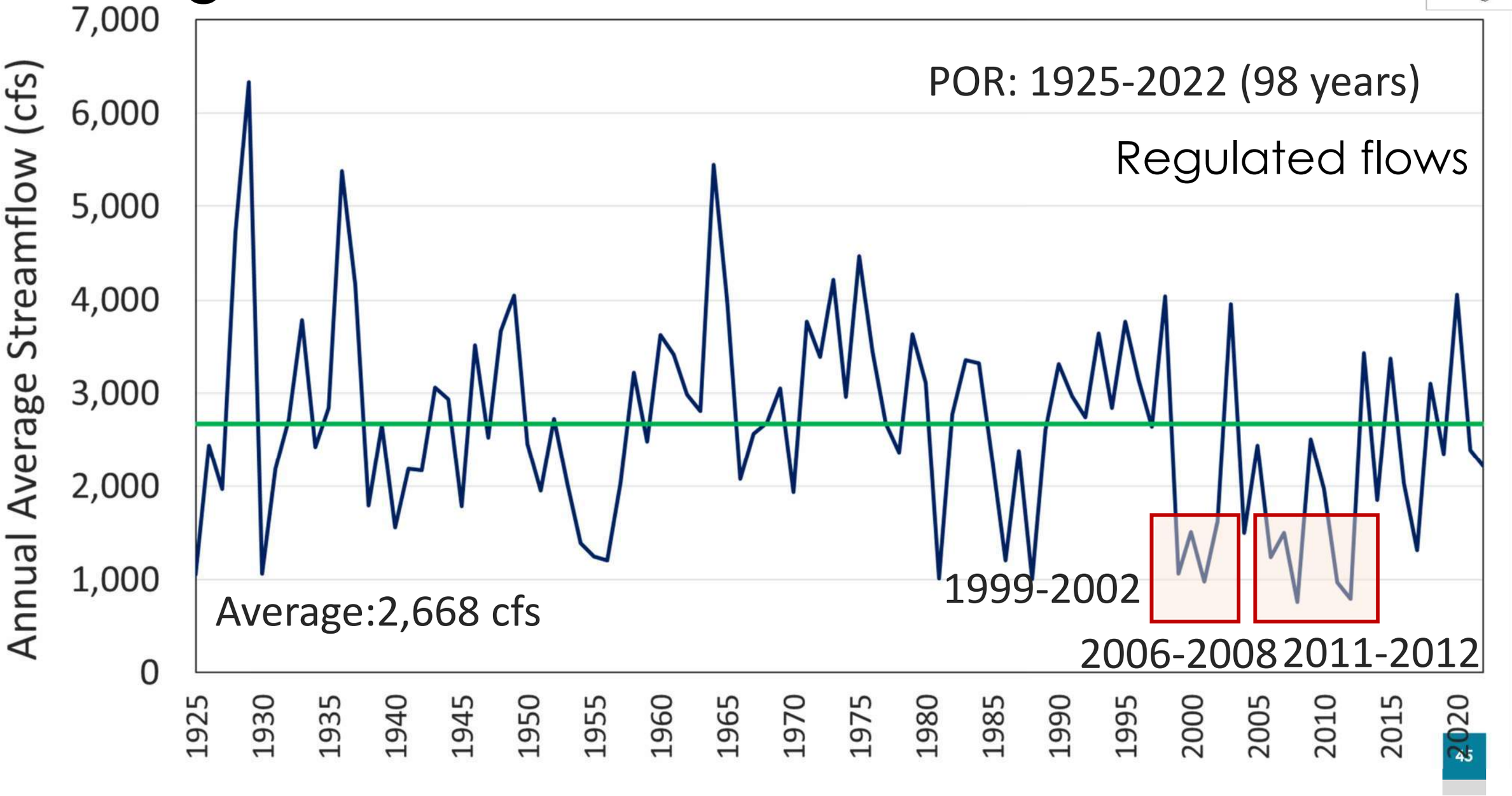


POR 1942-2022 (81 years)
Percent Exeedance- percentage of time or days a given daily average flow was exceeded

Average Annual Flows-Saluda near Columbia



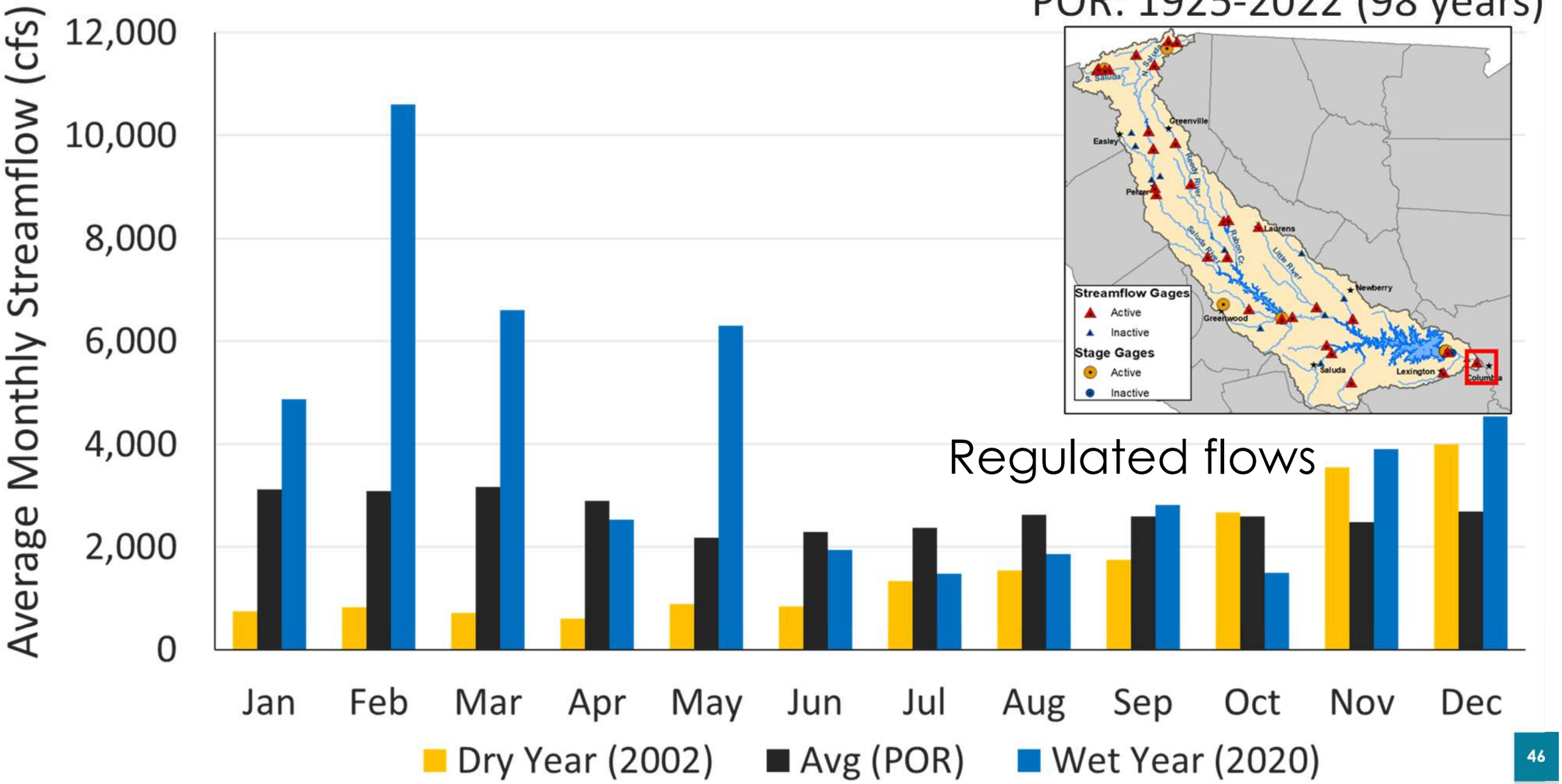
Average Annual Flows-Saluda near Columbia



Average Monthly Flows-Saluda near Columbia

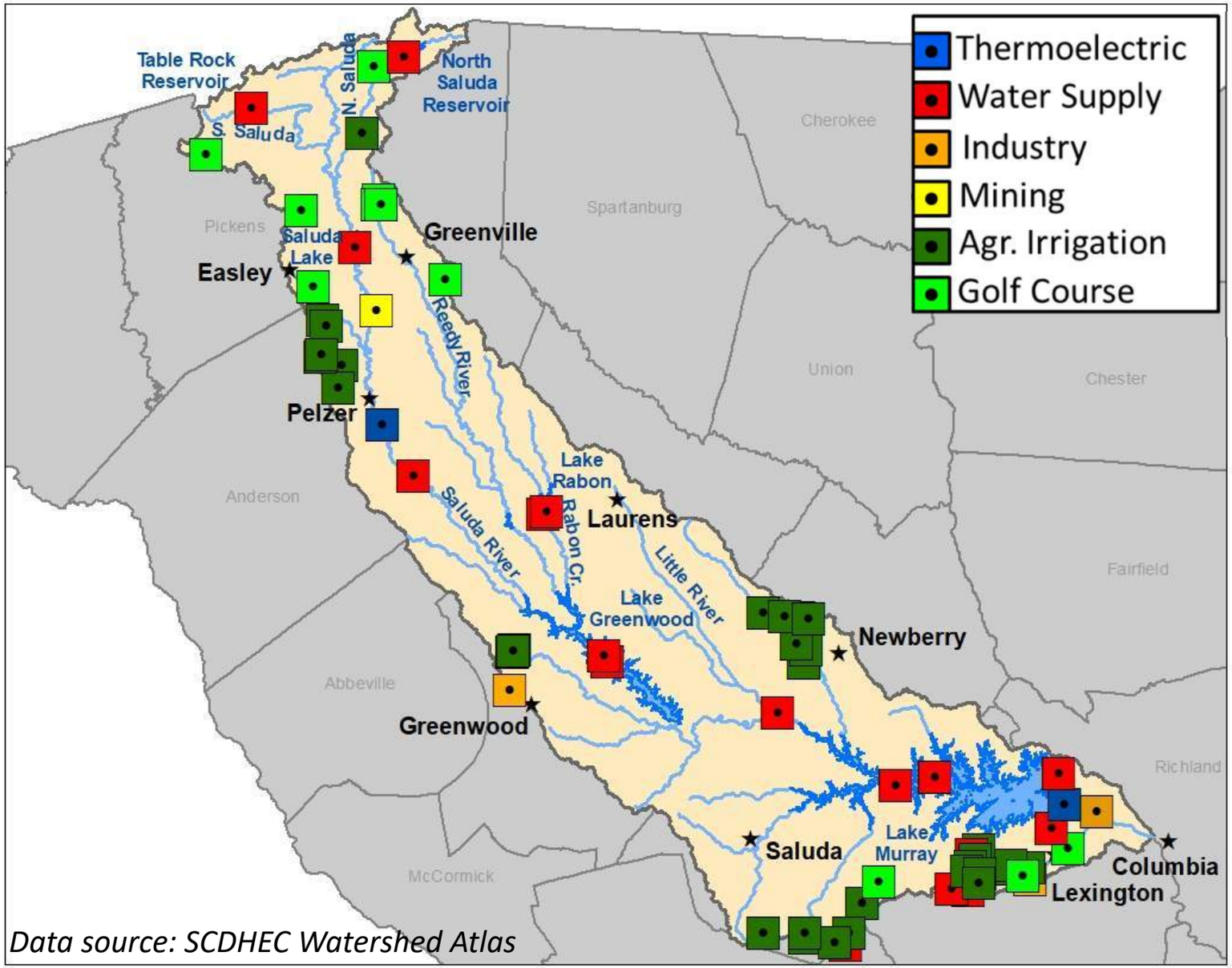
POR: 1925-2022 (98 years)

Regulated flows



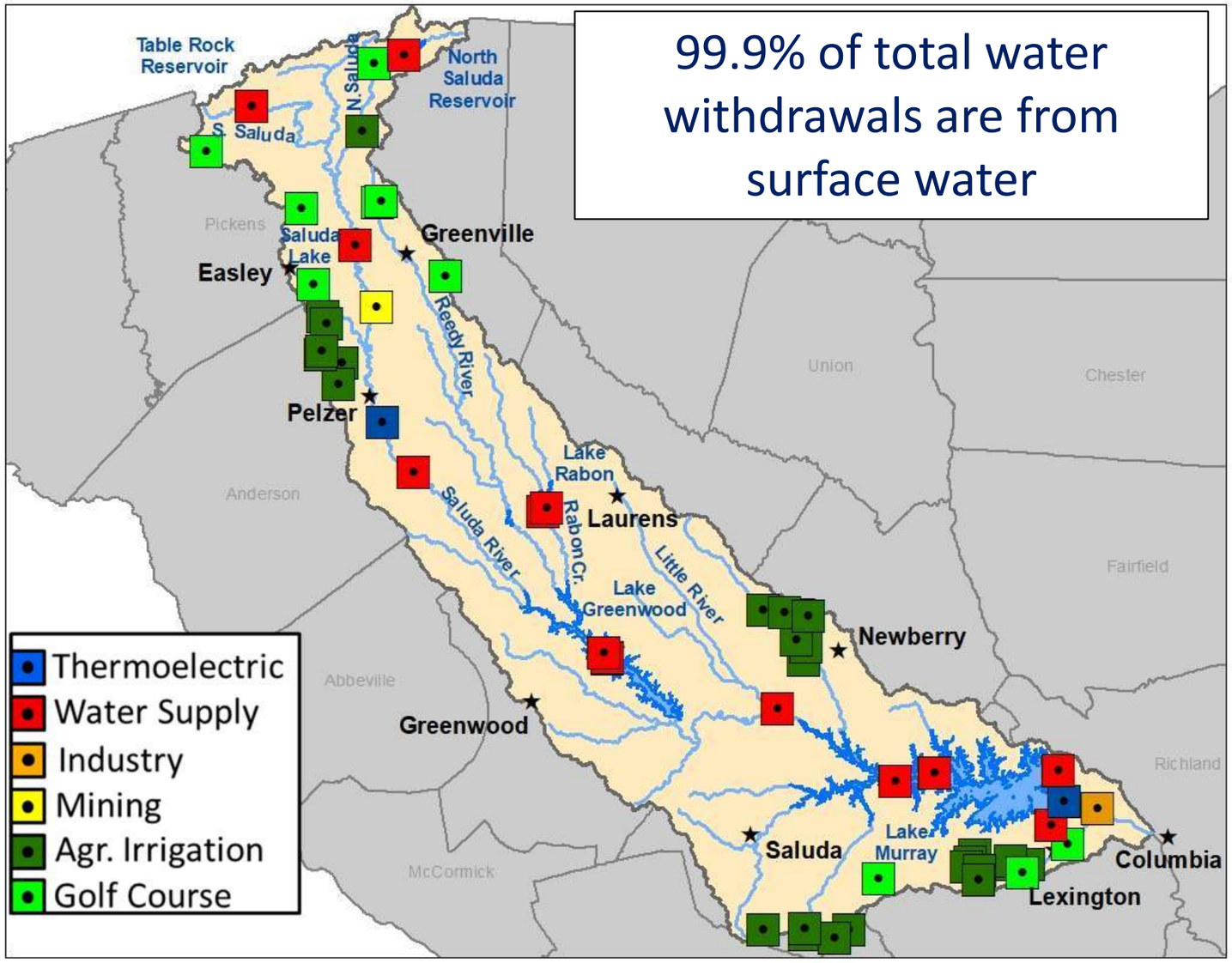
Saluda Basin Water Use

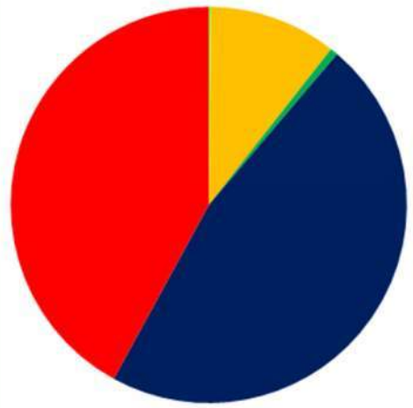
- Map shows active permits and registrations under the South Carolina Surface Water Withdrawal, Permitting, Use, and Reporting Act 2011.
- Planning will focus primarily on the basin's surface water resources (99.9% of withdrawals from surface water sources).



Data source: SCDHEC Watershed Atlas

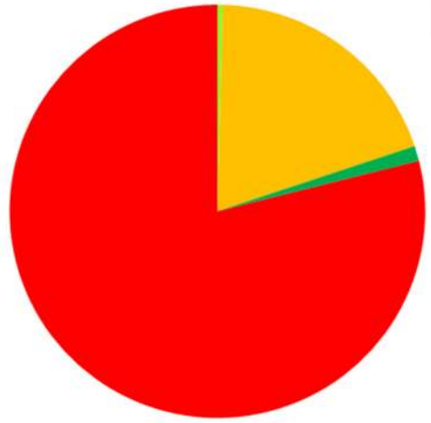
2021 Reported Surface Water Withdrawals





Including Power

- Thermoelectric (47%)
- Water Supply (42%)
- Industry (10%)
- Agr. Irrigation (< 1%)
- Golf Course (< 1%)

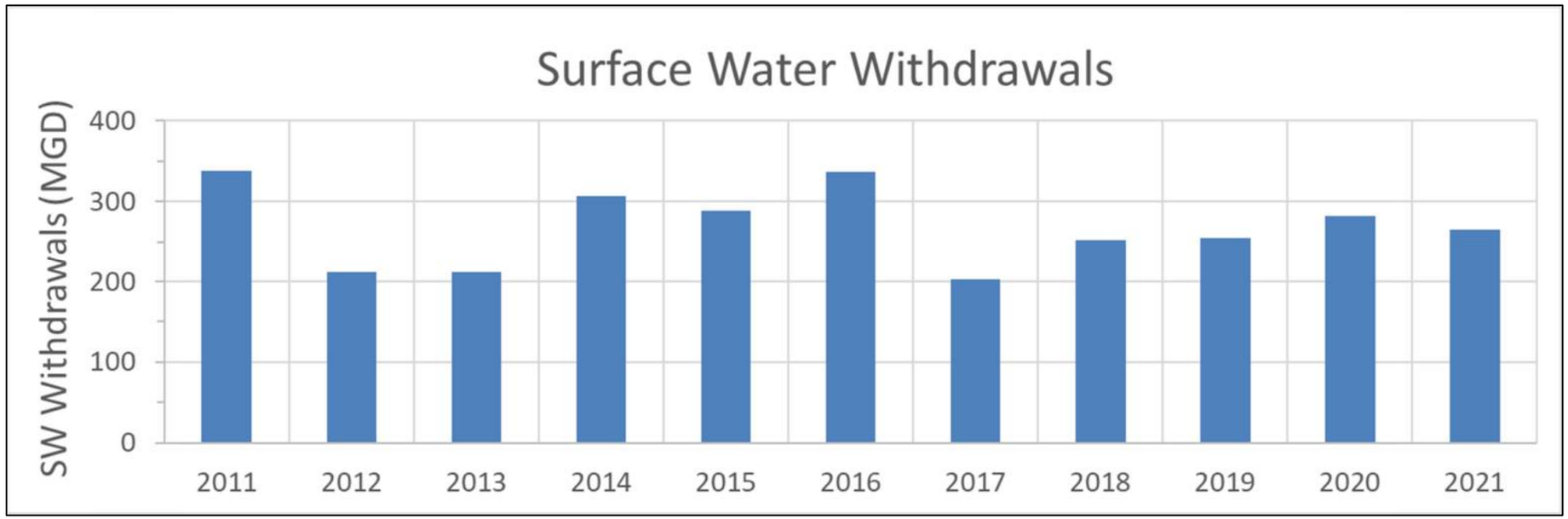


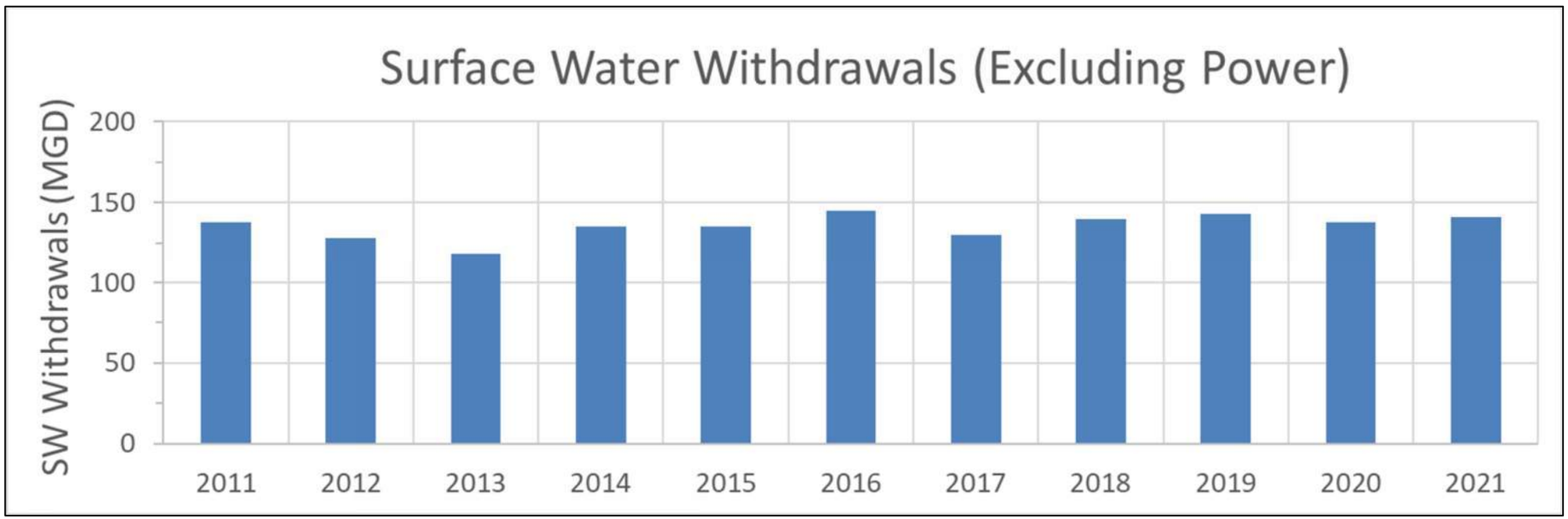
Excluding Power

- Water Supply (79%)
- Industry (19%)
- Agr. Irrigation (1%)
- Golf Course (< 1%)

Source: SCDHEC Water Use Database

Reported Surface Withdrawals (2011-2021)





Summary

- Variable rainfall throughout the basin
  - Blue Ridge province: 75 inches
  - Coastal Plain: 45 inches
- Highly variable flows in the basin
  - Upper Basin
    - High baseflow
    - Low to moderate regulation
  - Lower Basin
    - Low baseflow
    - Heavy regulation downstream of Lake Greenwood
- Planning will focus primarily on the basin's surface water resources
  - 99.9% withdrawals from surface water source

Priyanka More
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SC Department of Natural Resources

Groundwater Resources of the Saluda Basin

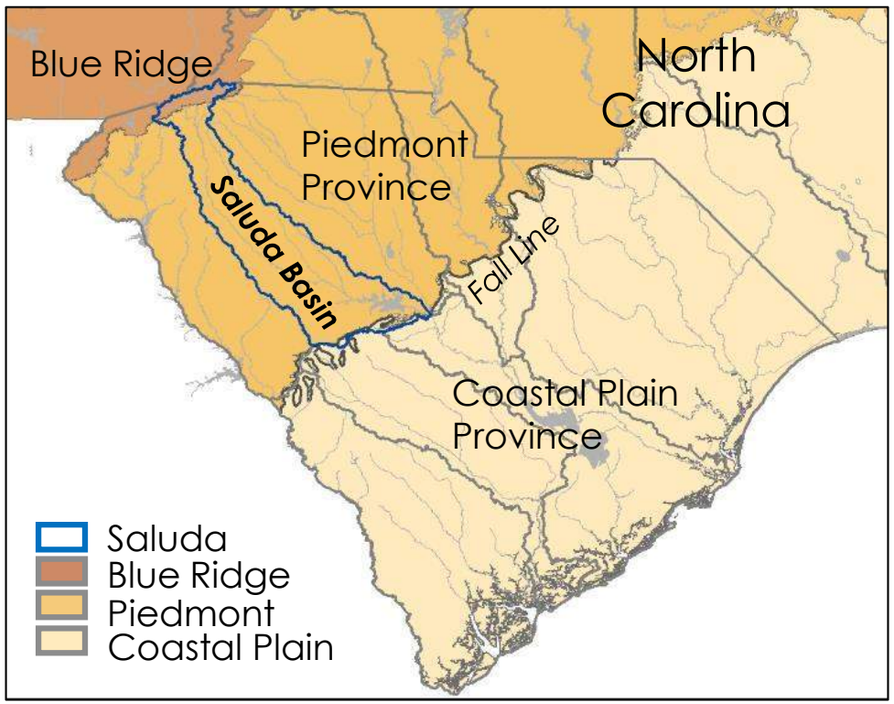
Saluda River Basin Council – Meeting #2, April 19th, 2023

Joe Gellici, Hydrogeologist

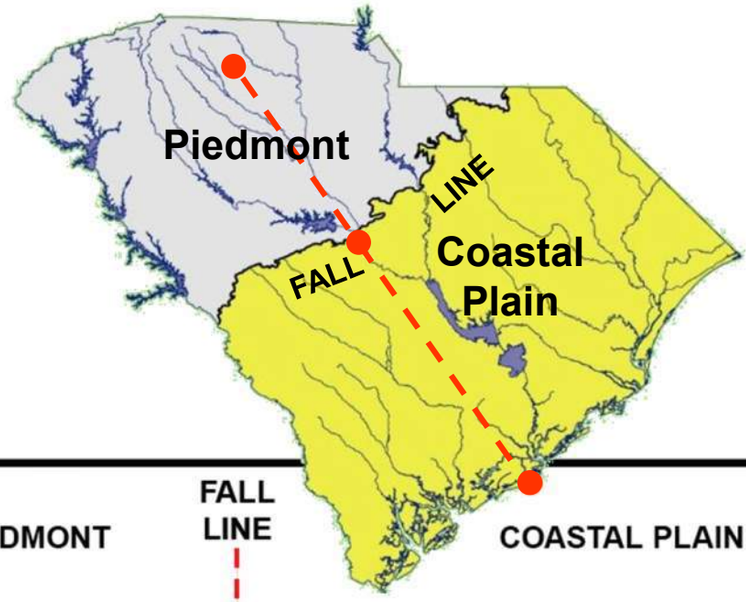
SC Department of Natural Resources

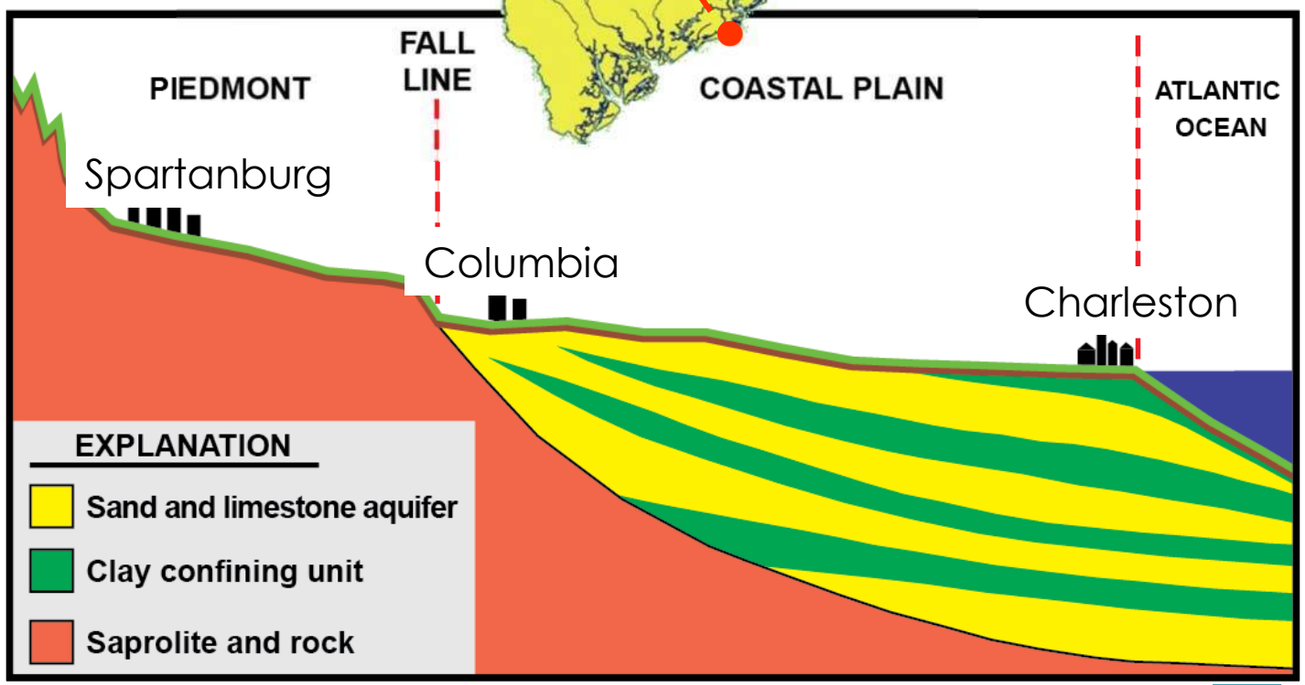
Agenda Item 6 (continued)

Generalized Hydrogeologic Section through the State

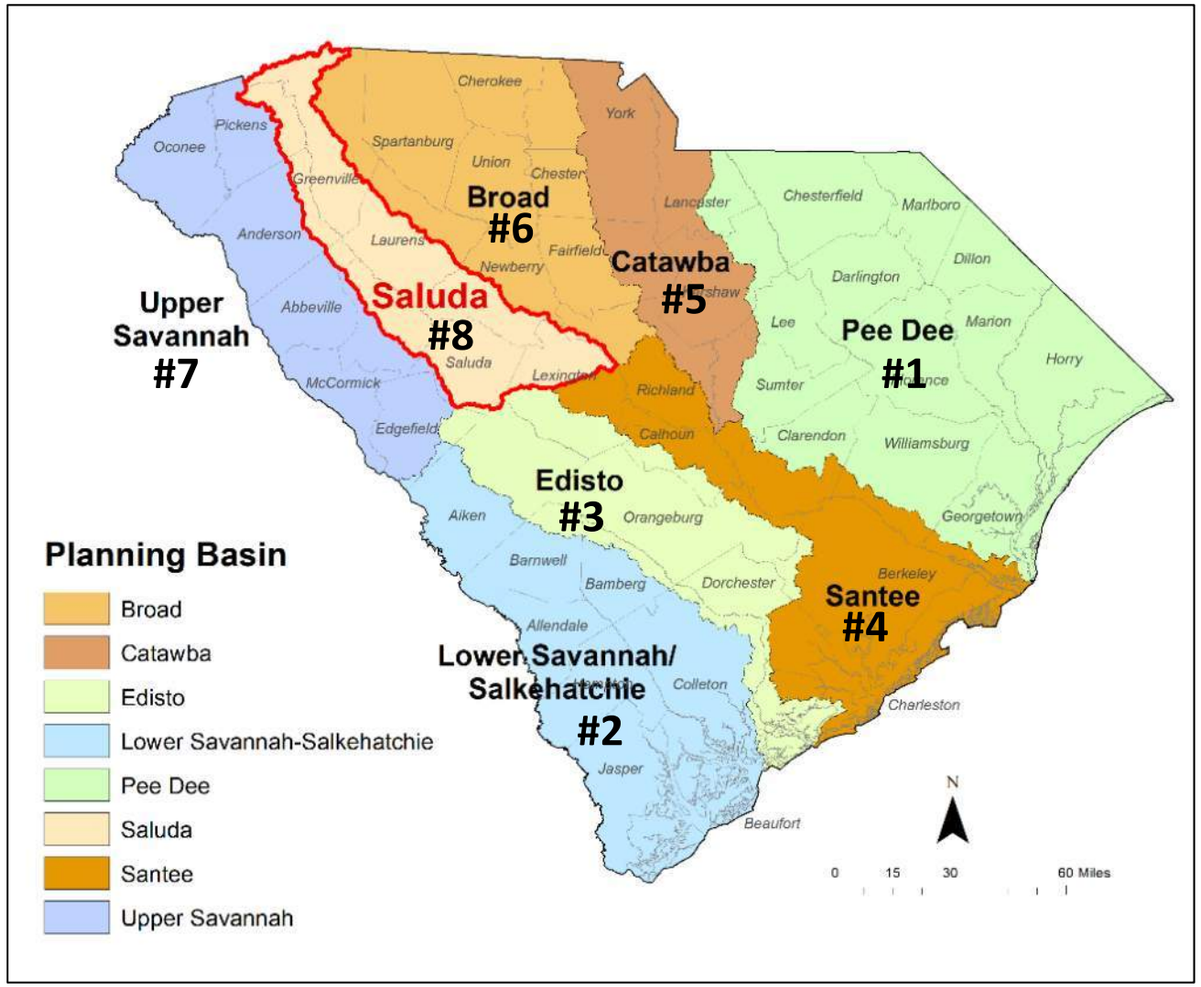


Most of our groundwater is located in the Coastal Plain Province.





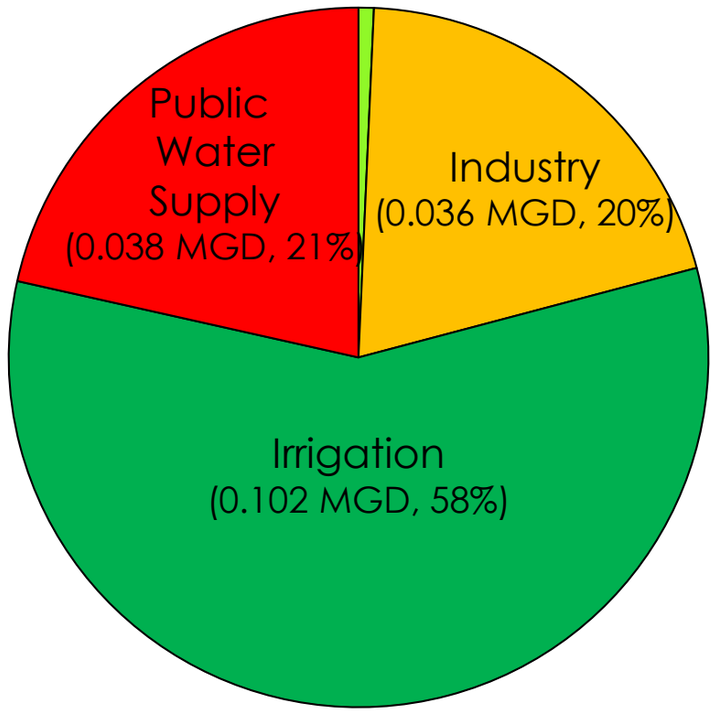
Groundwater Withdrawals in the State, 2021

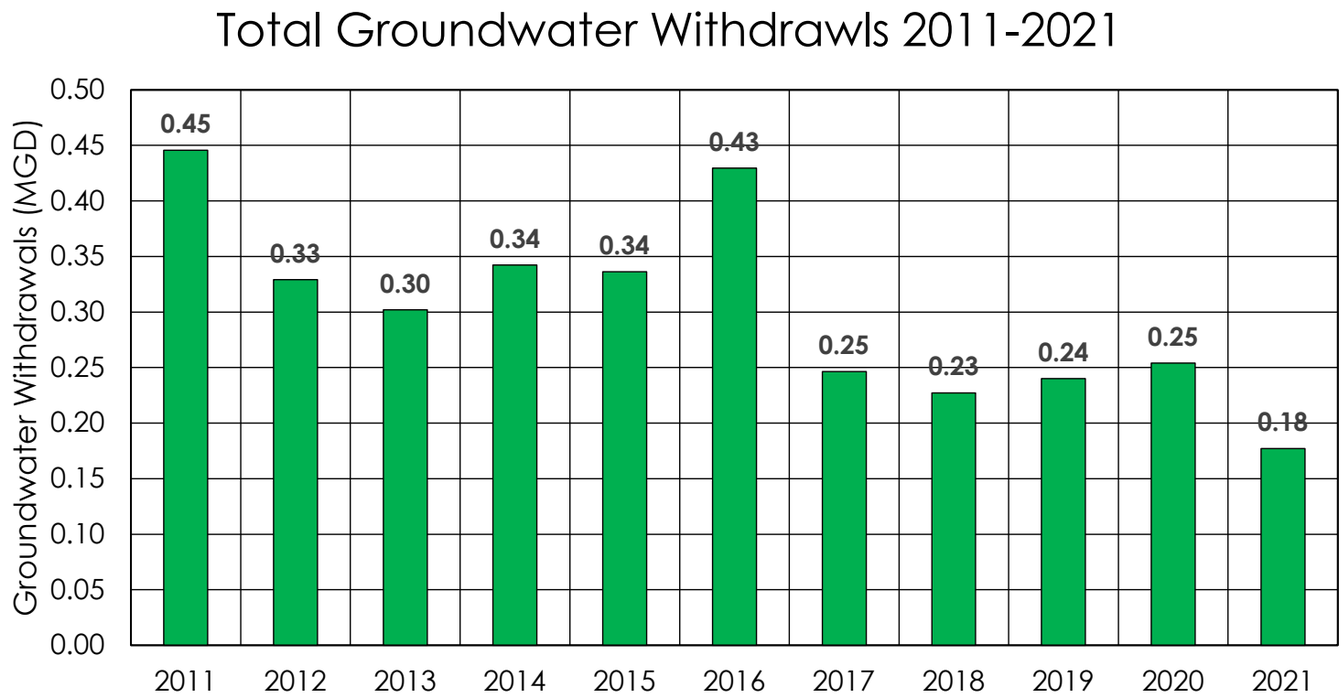


Reported groundwater withdrawals in 2021 (MGD)
1. Pee Dee 112.8 (40.5%)
2. Lower Savannah 74.4 (26.7%)
3. Edisto 60.5 (21.7%)
4. Santee 23.3 (8.4%)
5. Catawba 6.5 (2.3%)
6. Broad 0.5 (0.2%)
7. Upper Savannah 0.5 (0.2%)
8. Saluda 0.2 (0.1%)
Total 278.7

Source: SCDHEC Water Use Database

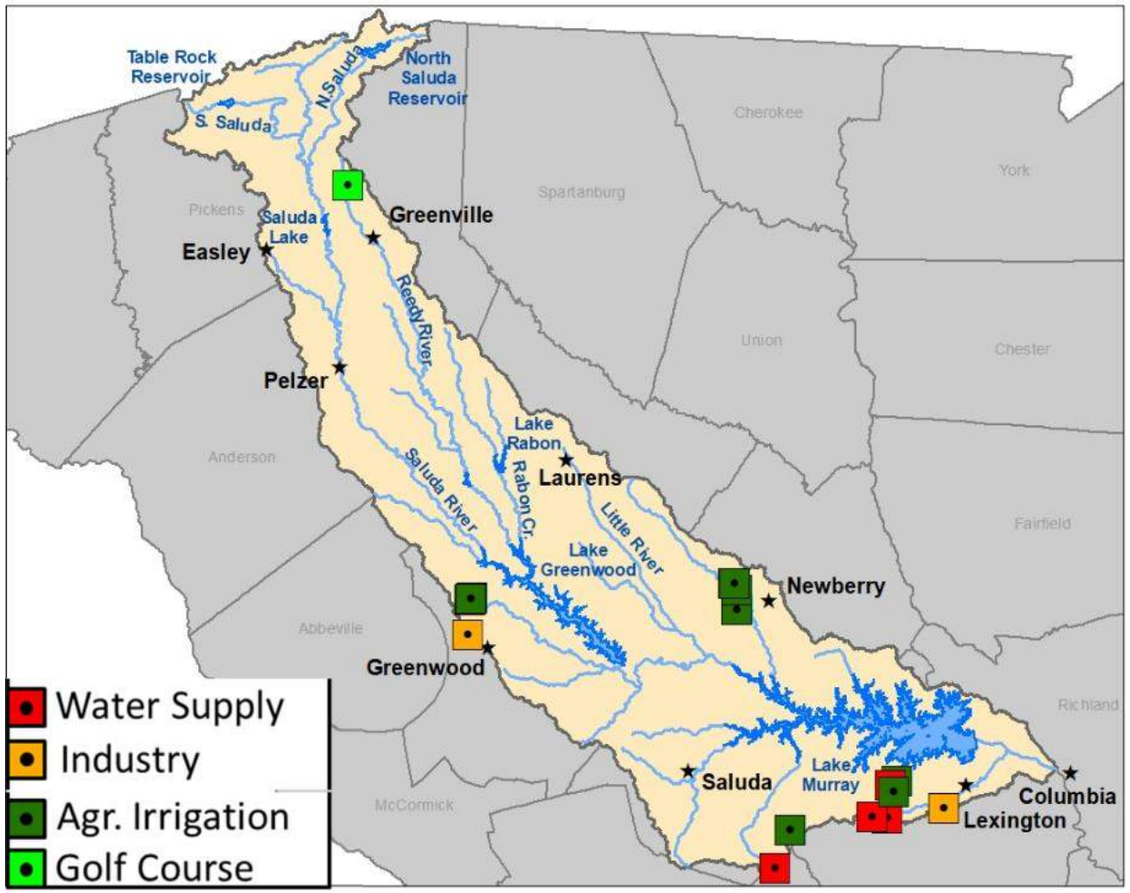
Groundwater Withdrawals and Trends





Source: SCDHEC Water Use Database

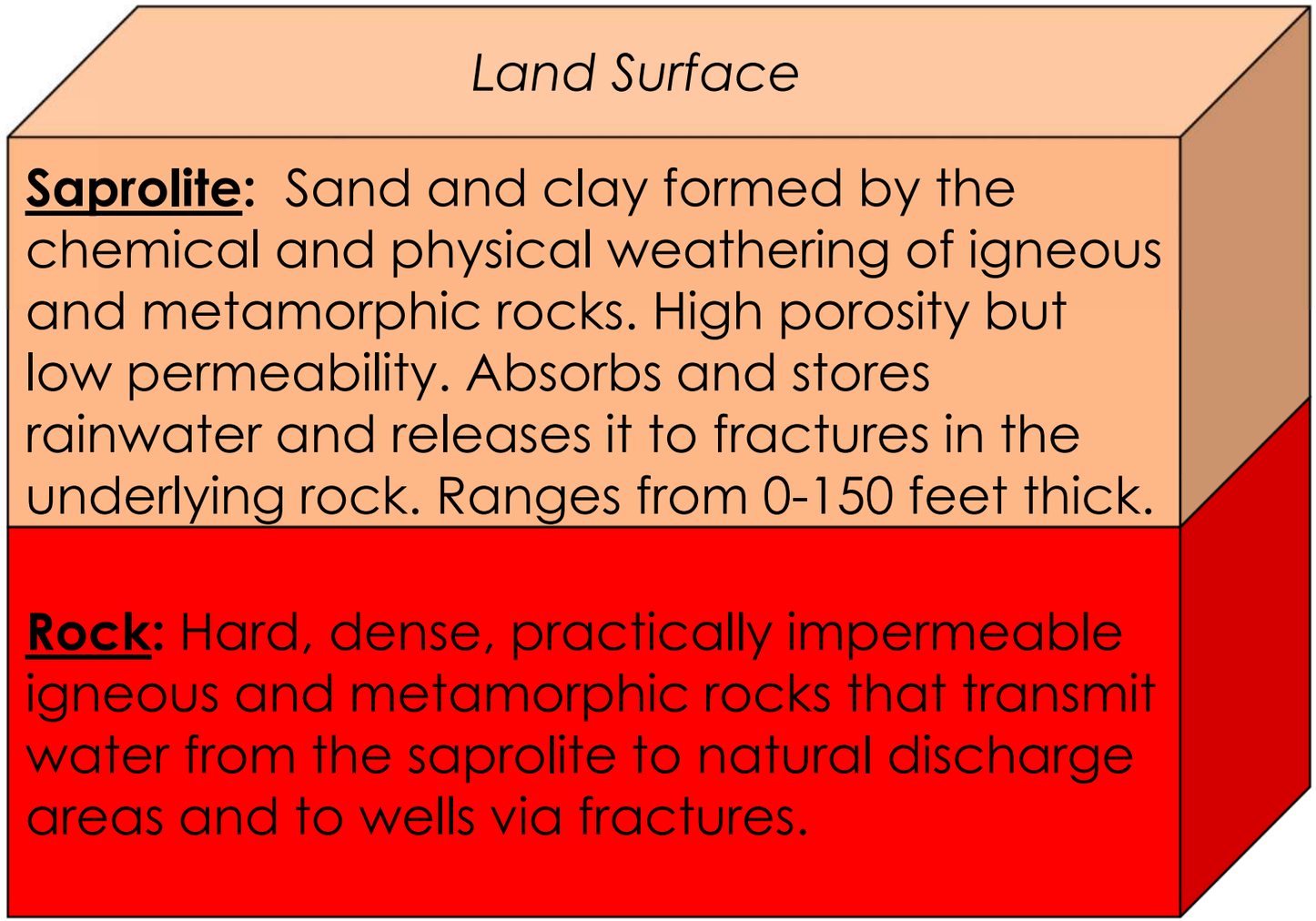
2021 Reported Groundwater Withdrawers



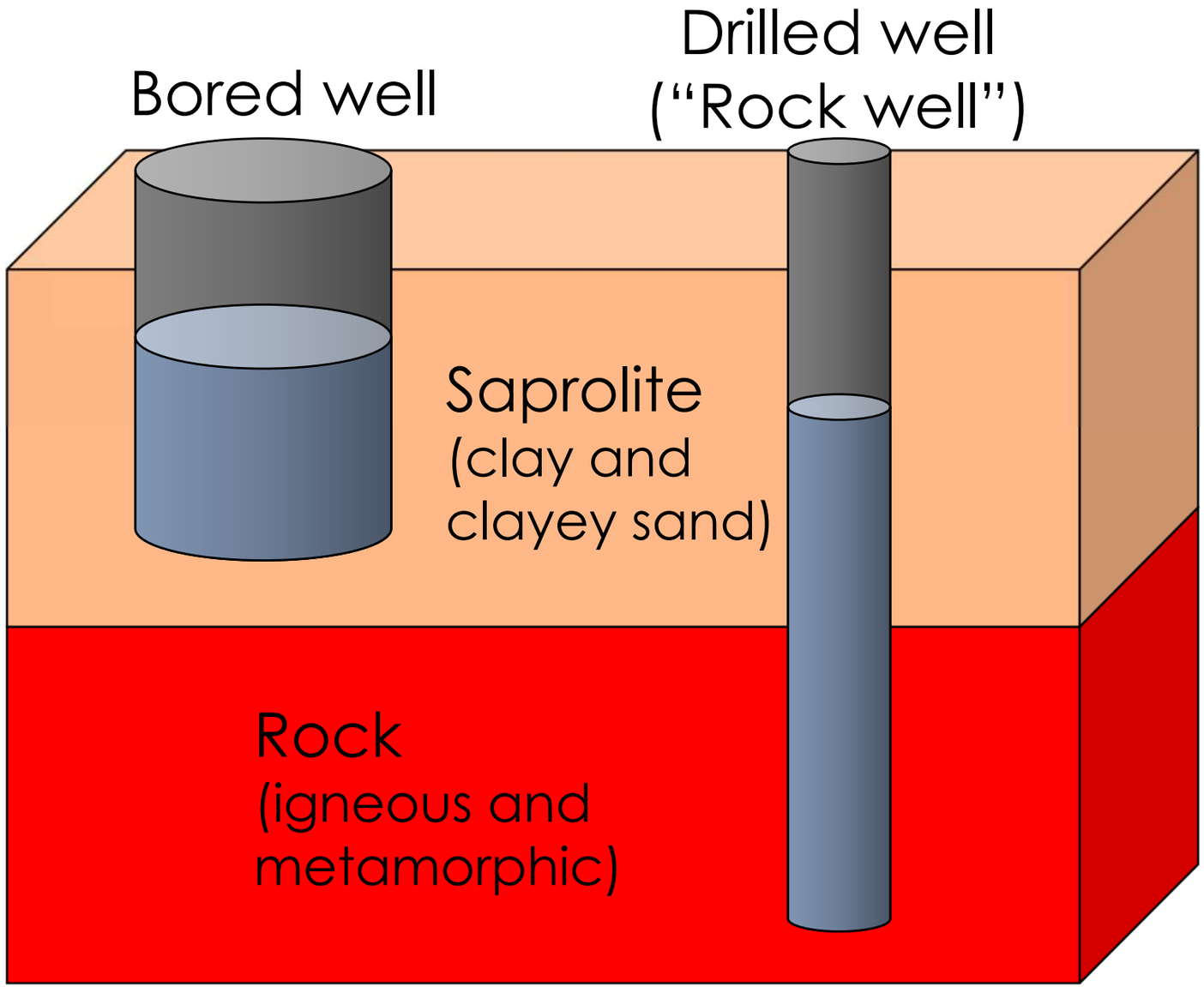
Category	Facility	# of Wells	MGD
Water Supply	Town of Monetta	1	0.0027
	Gilbert-Summit Rural Water District	3	0.0354
Irrigation	Jerrold A. Watson and Sons	3	n/a
	J & P Park Acquisitions, Inc.	5	0.0005
	James R. Sease Farms, Inc.	1	n/a
	Mayer Farm	6	0.0339
	Bush River Farms	3	0
	Walter P. Rawls and Sons, Inc.	1	0.0537
Industry	Greenwood Mills, Inc.	1	0.0187
	Michelin North America	2	0.0170
Golf Course	Furman Golf Club	1	0.0012

Source: SCDHEC Water Use Database

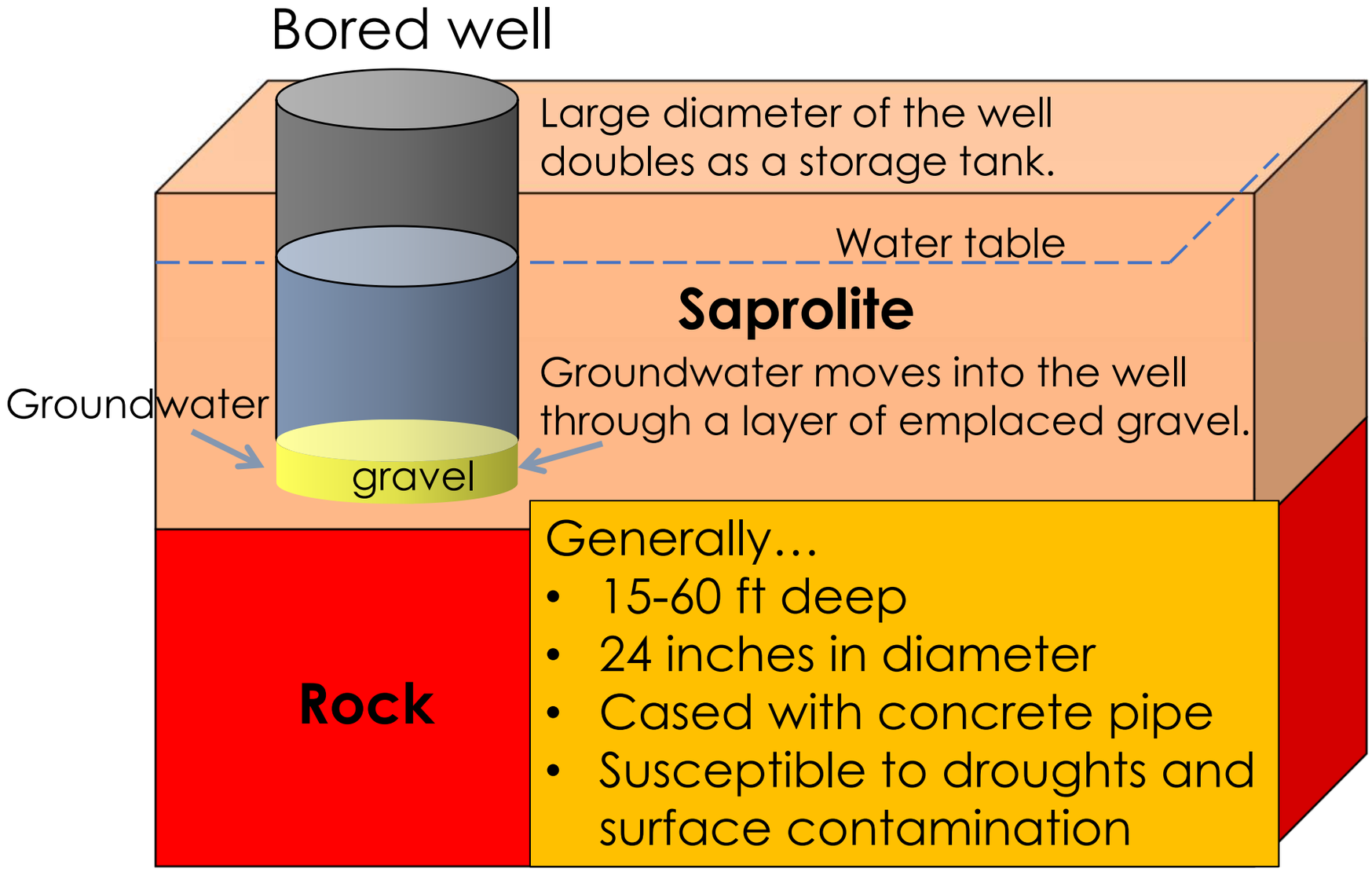
Piedmont Hydrogeologic Framework
2-Layered System



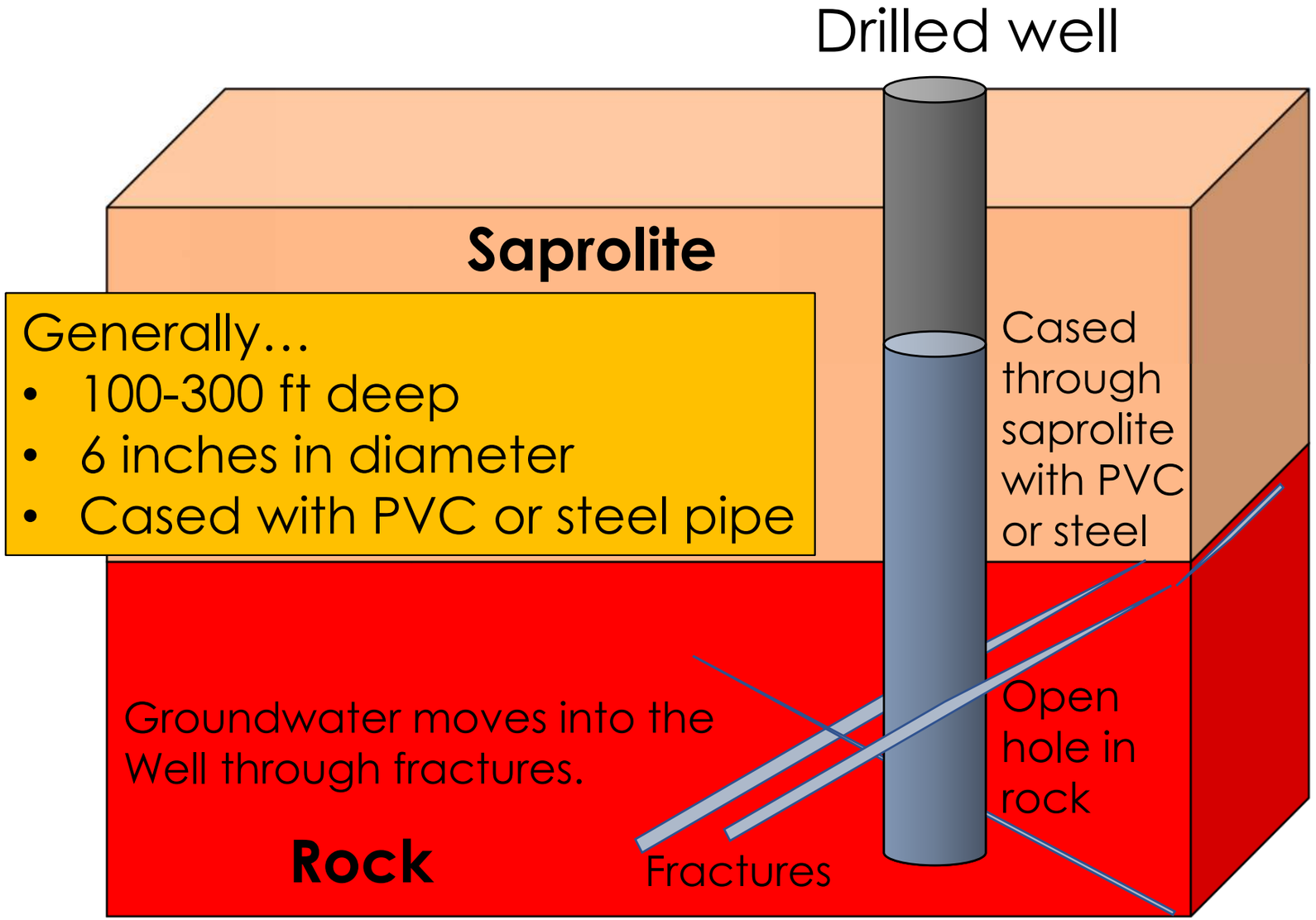
Two Types of Wells – Bored and Drilled



Bored Wells in the Piedmont



Drilled Wells in the Piedmont



Well Depths and Yields by County in the Saluda Basin

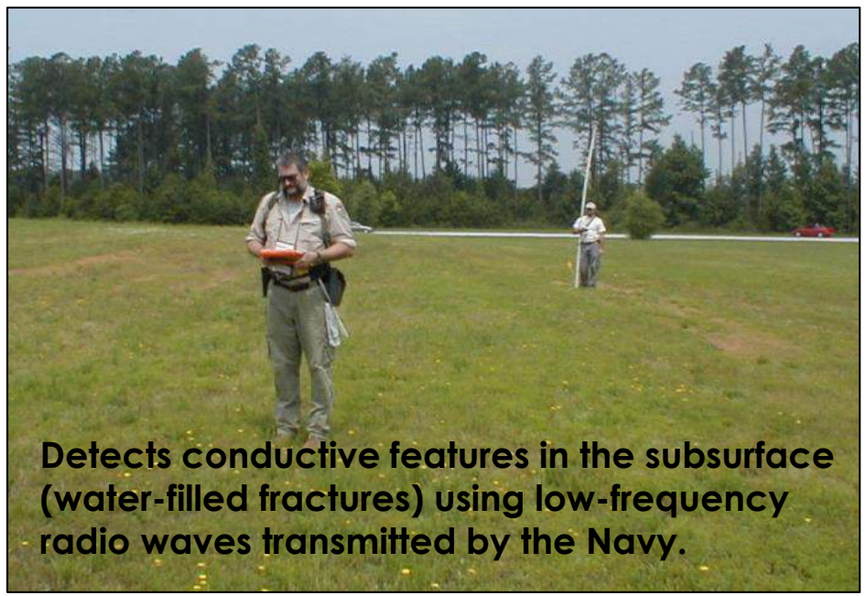
County	Well Depth (feet)		Well Yield (gpm)	
	Average	Maximum	Average	Maximum
Abbeville	237	455	8	20
Anderson	303	730	32	400
Greenville	243	1,057	18	200
Greenwood	264	642	21	150
Laurens	277	750	17	300
Lexington	194	540	15	150
Newberry	229	725	16	200
Pickens	268	705	20	200
Richland	227	400	17	40
Saluda	236	1,103	15	40
Total	250	1,103	18	400

Source: South Carolina State Water Assessment, Second Edition, 2009
gpm, gallons per minute

- The overall average well depth is 250 ft and the average well yield is 18 gallons per minute.
- Well yields are low but are high enough to support most domestic use in the basin.
- Yields are mainly a function of the number and size of fractures, and of the hydraulic connection between the fractures and saprolite.
- Higher yields are generally found:
  - in low lying areas, such as valleys and hillside ravines (draws) as opposed to hilltops and hillsides
  - where saprolite is thick
  - where wells penetrate certain geologic structures such as quartz veins, dikes, and lithologic contacts
  - in highly textured rocks, such as schists, as opposed to non-textured (massive) rocks, such as gneiss

Groundwater Yields in the Piedmont

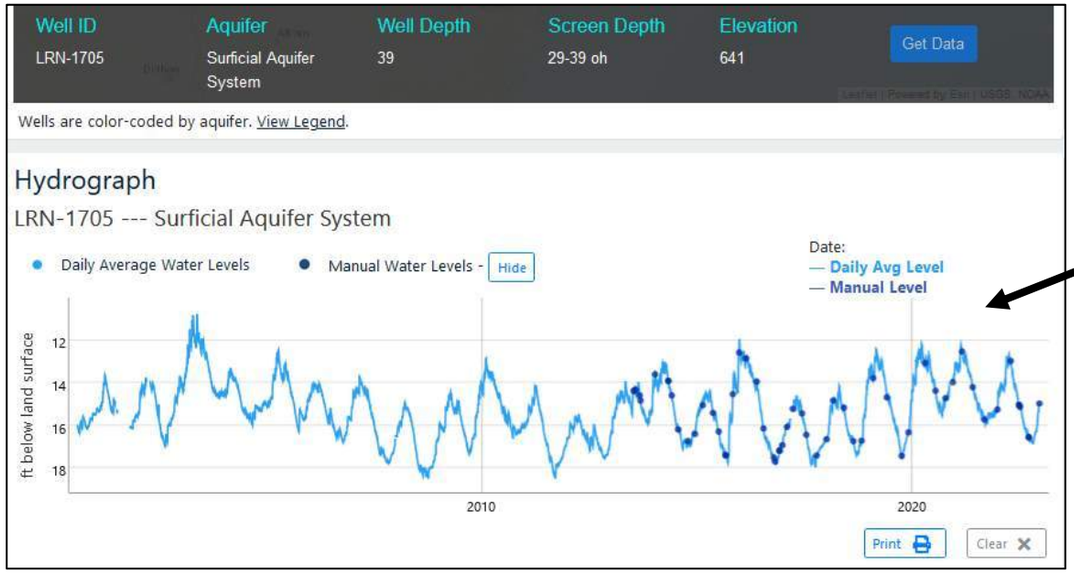
- Efforts have been made to increase yields in existing wells using dynamite (did not work at a public supply well at Caesars Head State Park) and hydrofracturing (yields went from 1 gpm to 5 gpm at a domestic well in Greenville County).
- Efforts have been made using geophysics to identify areas that can produce high-yielding wells.

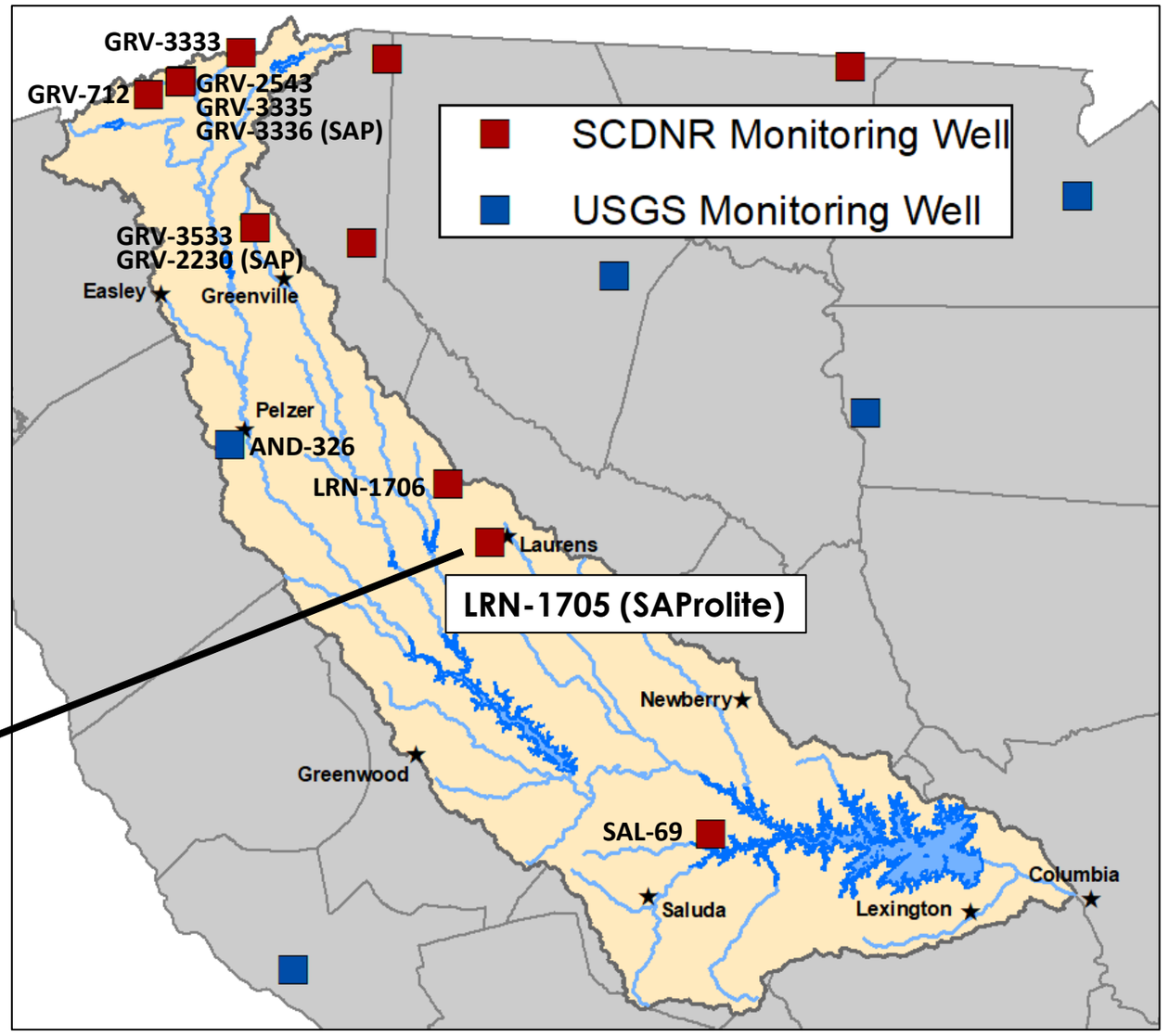


Detects conductive features in the subsurface (water-filled fractures) using low-frequency radio waves transmitted by the Navy.

WADI Instrument

Groundwater Monitoring Network





https://hydrology.dnr.sc.gov/groundwater-data/

Summary of Groundwater Availability in the Saluda Basin

- Groundwater is the principal source of water for rural homes in the basin.
- Low to moderate yields can be obtained from wells across the entire basin.
- Yields can usually satisfy the requirements of most domestic use and some small irrigation and industrial use.

References

Daniel, Charles C., III, White, Richard K., and Stone, Peter A., eds., **Ground Water in the Piedmont: Proceedings of a Conference On Ground Water in the Piedmont of the Eastern United States**, October 16-18, 1989, Charlotte, N.C., 693 p.

Mitchell, H. Lee, 1995, **Geology, Ground Water, and Wells of Greenville County, South Carolina**: South Carolina Department of Natural Resources, Water Resources Report 8, 66 p., 1 plate.