GEORGIA *Water* PLANNING & POLICY CENTER

USDA-CSREES National Water Conference:

Research, Extension and Education for Water Quality and Quantity

January 28-February 1, 2007
Savannah, Georgia

The Feasibility of Using Aquifer Storage and Recovery to Manage Water Supplies in Georgia

By
Doug Wilson
Georgia Water Planning and Policy Center
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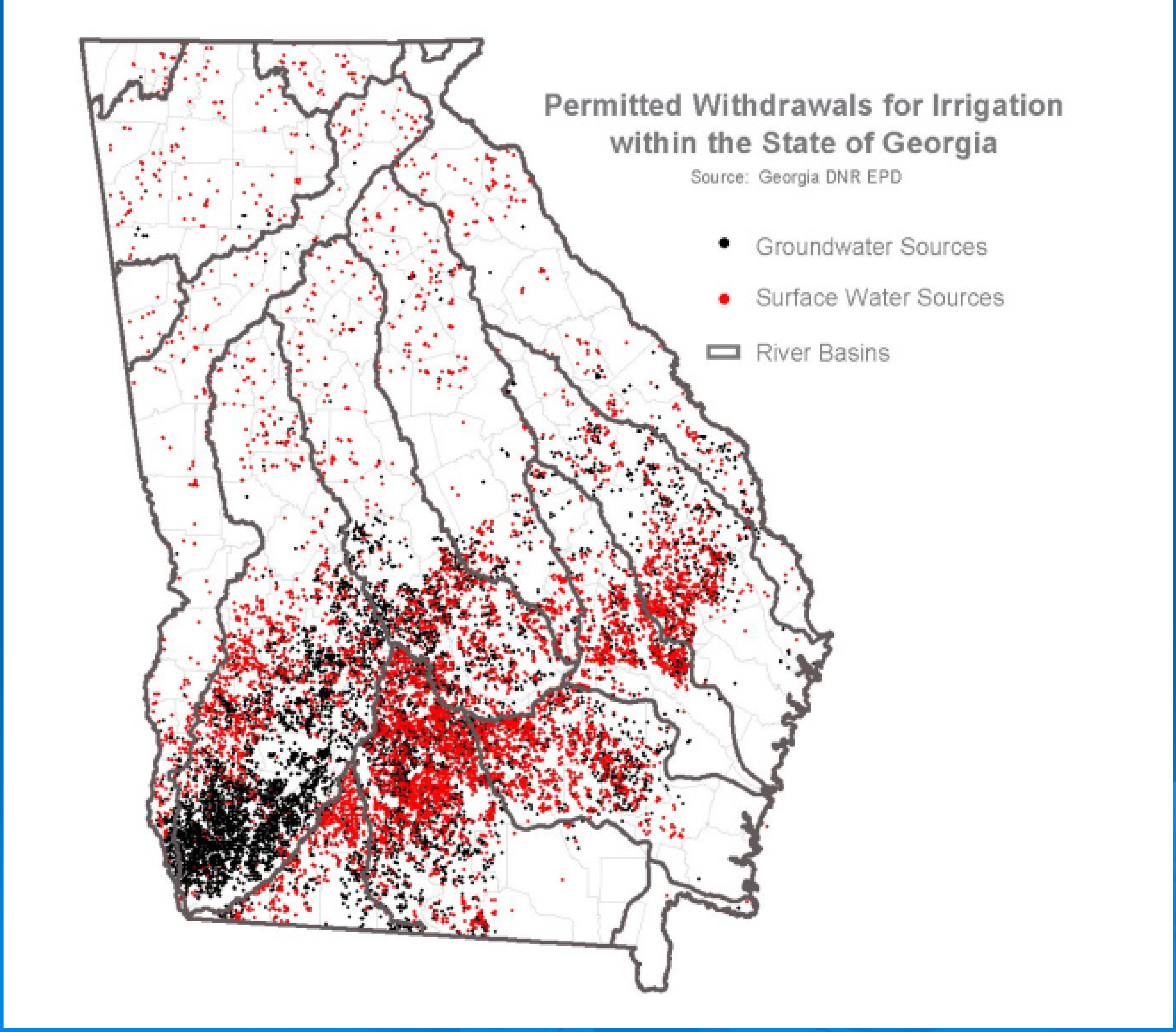
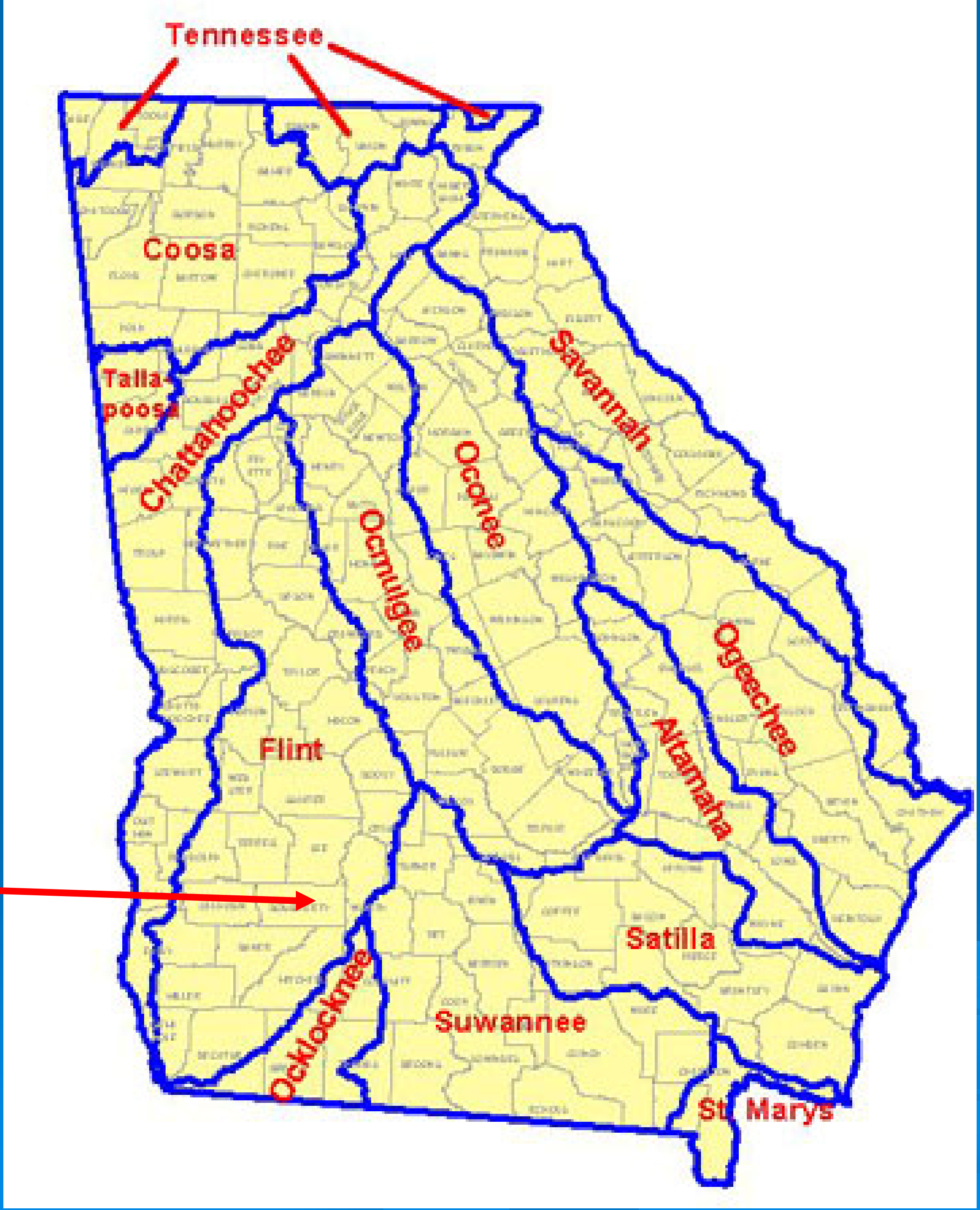
1] Presented at the USDA-CSREES National Water Conference, Savannah, Georgia 1/28-2/07
The author gratefully acknowledges support for this work received from the U.S.D.A..

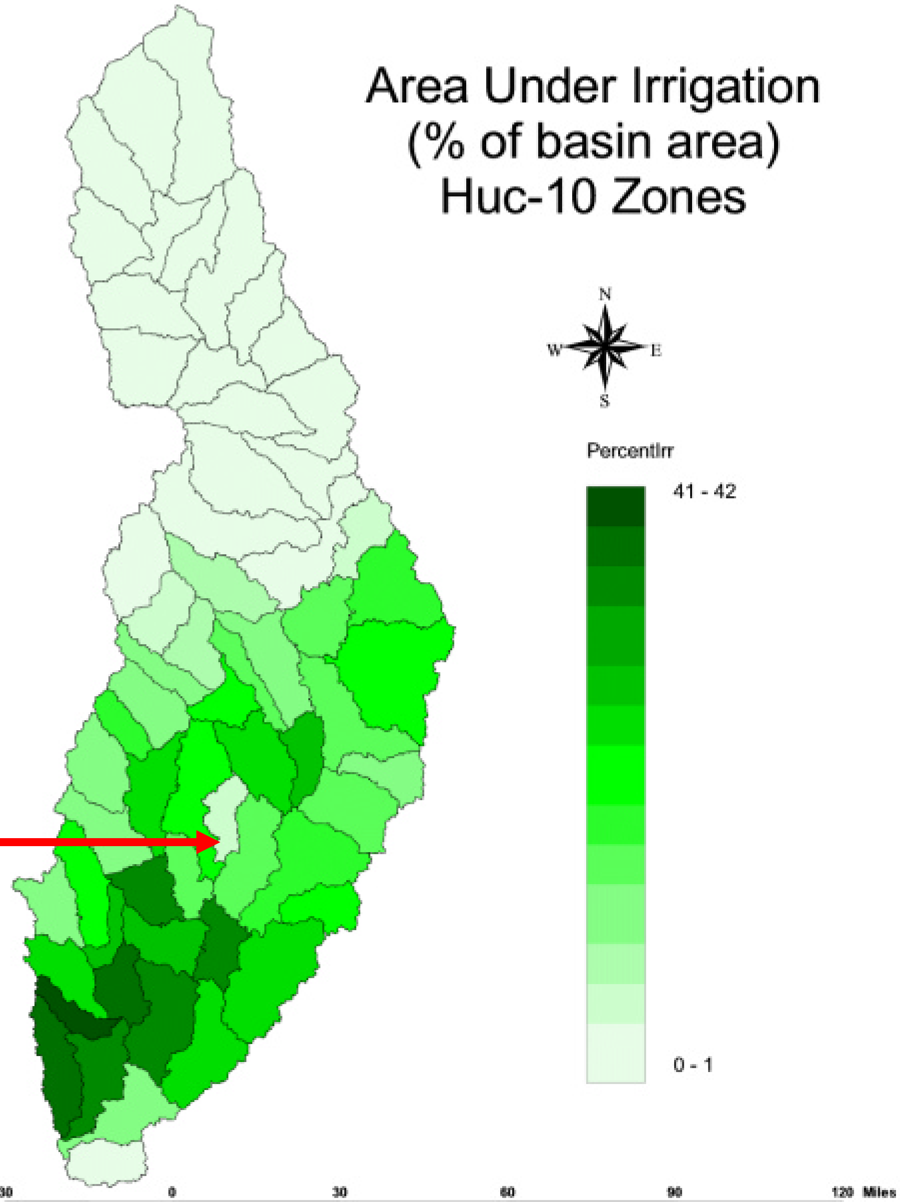
Agricultural Water Permits



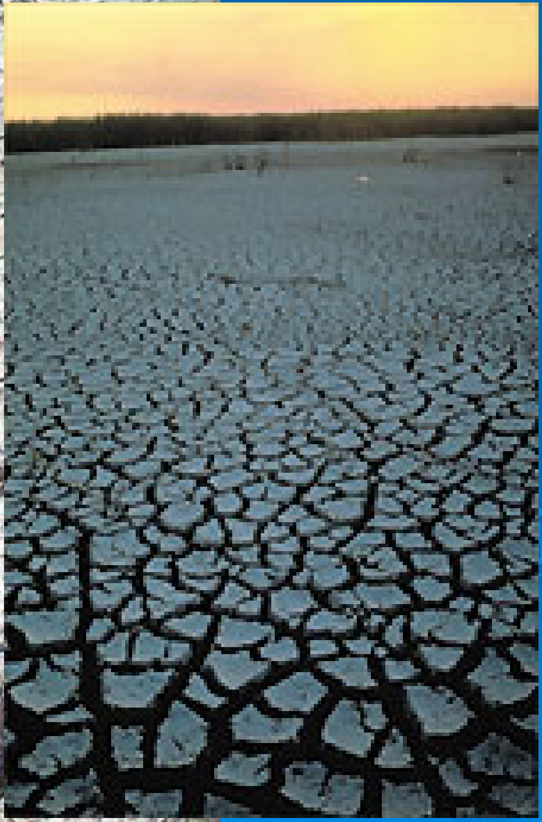


Tennessee
Coosa
Talla-
poosa
Chattahoochee
Savannah
Oconee
Ocmulgee
Ogeechee
Altamaha
Flint
Satilla
Ocklocknee
Suwannee
St. Marys
Albany

Albany


Area Under Irrigation
(% of basin area)
Huc-10 Zones
N
W
E
S
PercentIrr
41 - 42
0 - 1
30
0
30
60
90
120 Miles

1998 - 2002



State Response to Drought

- 2000-Passed the Flint River Drought Protection Act
- 2001-Retired 33,101acres from irrigation at a cost of $4.5 million
- 2002-Retired 40,894 acres from irrigation at a cost of $5.2m million
- The State's actions would indicate the basin's water resources are fully allocated….so what to do?

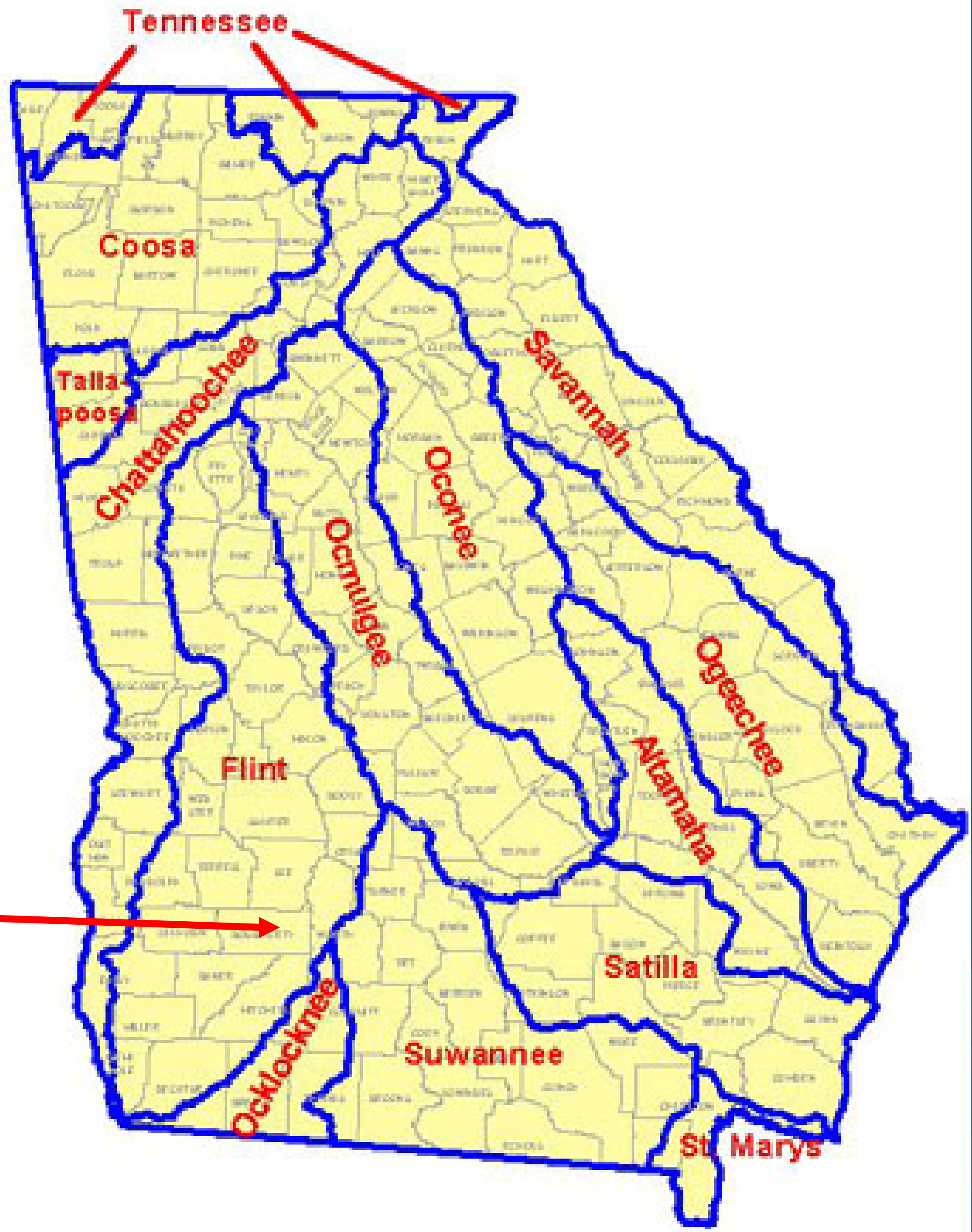
PERMIT TRADING

AQUIFER STORAGE & RECOVERY

Until very recently Georgia has had a law prohibiting ASR but now is at least considering it as a means of augmenting supply.

So we began looking for a suitable location

- We knew the situation in the Flint Basin described above
- We looked at basin geohydrology
  - Multiple aquifers
  - One under moratorium due to local over pumping
- We looked at non-ag users in the basin
  - A number of industrial concerns with water demands that could be met with ASR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Flint
Satilla
Ocklockneee
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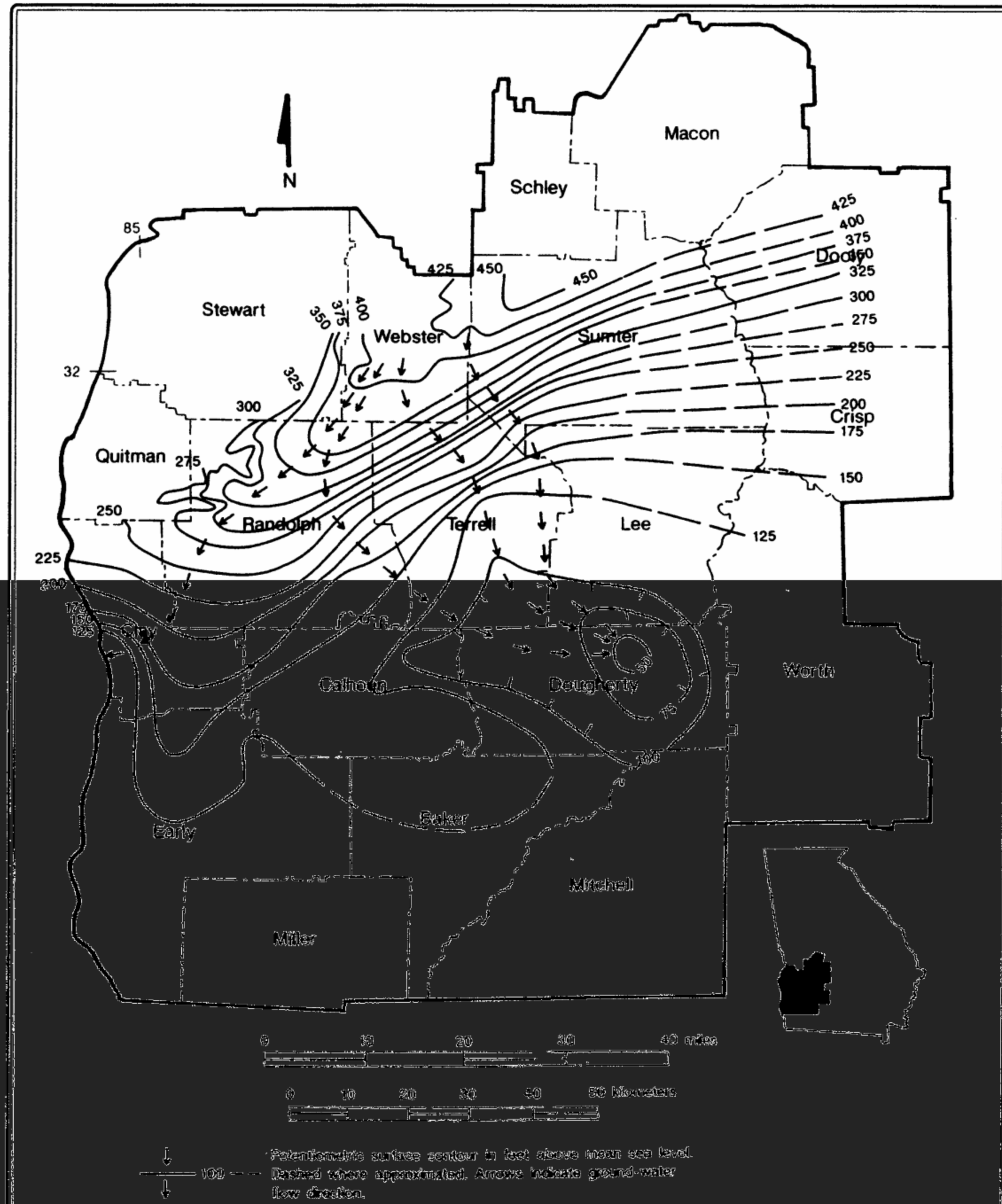
St. Marys

Albany

ERATHEM	SYSTEM	SERIES	THICKNESS (feet)	AQUIFER OR CONFINING UNIT	LITHOLOGY	REMARKS
Cenozoic	Quaternary	Holocene Pleistocene	20–80	*Surficial aquifer/* upper semiconfining unit	Sand and clay	Not a primary source of water, but has been used for domestic purposes.
	Tertiary	Pliocene Miocene Oligocene			Weathered limestone	
		Eocene – Upper	[illegible]	Upper Floridan aquifer: Upper water-bearing zone; Middle unit; Lower water-bearing zone	Sandy limestone	Major source of water for irrigation and domestic use.
		Eocene – Middle	10–100	Lisbon confining unit	Glauconitic limestone	
		Eocene – Middle / Lower	0–270	Claiborne aquifer	Sand Fossiliferous limestone Sand Glauconitic limestone	Major source of water for public supply.
		Paleocene	0–260	Wilcox confining unit	Sand Glauconitic sand Clay	In some areas, sand and limestone layers in the Hatchetigbee Formation, Tuscahoma Formation, Nanafalia Formation, and upper Clayton Formation provide ample supplies for domestic use.
		Paleocene	0–265	Clayton aquifer	Limestone	Major source of water for irrigation, industrial, and public-supply use. In the carbonate area, the aquifer consists primarily of limestone and provides ample water for municipal, agricultural, and industrial supply.
Mesozoic	Cretaceous	Upper Cretaceous	0–390	Providence aquifer	Sand	
			0–300	Providence–Ripley confining unit	Silty sand	Where absent, the Providence Sand, Ripley Formation, and upper Cusseta Sand form a single aquifer
			0–150	Cusseta aquifer	Sand	Forms a single aquifer with the Providence Sand and Ripley Formation downdip and eastward
			0–700	Blufftown aquifer	Glauconitic sand Clay and marl	
			200–1,200	Eutaw and Tuscaloosa Formations	Sand and clay	

Modified from Clarke and others, 1984 (lower Eocene and deeper); and Hicks and others, 1987 (middle Eocene and upper)



N
Macon
Schley
Dooly
Stewart
Webster
Sumter
Quitman
Randolph
Terrell
Lee
Crisp
Calhoun
Dougherty
Worth
Baker
Early
Miller
Mitchell
85
32
425
400
375
350
325
300
275
250
225
200
175
150
125
0 10 20 30 40 miles
0 10 20 30 40 50 kilometers
100
Potentiometric surface contour in feet above mean sea level. Dashed where approximated. Arrows indicate ground-water flow direction.

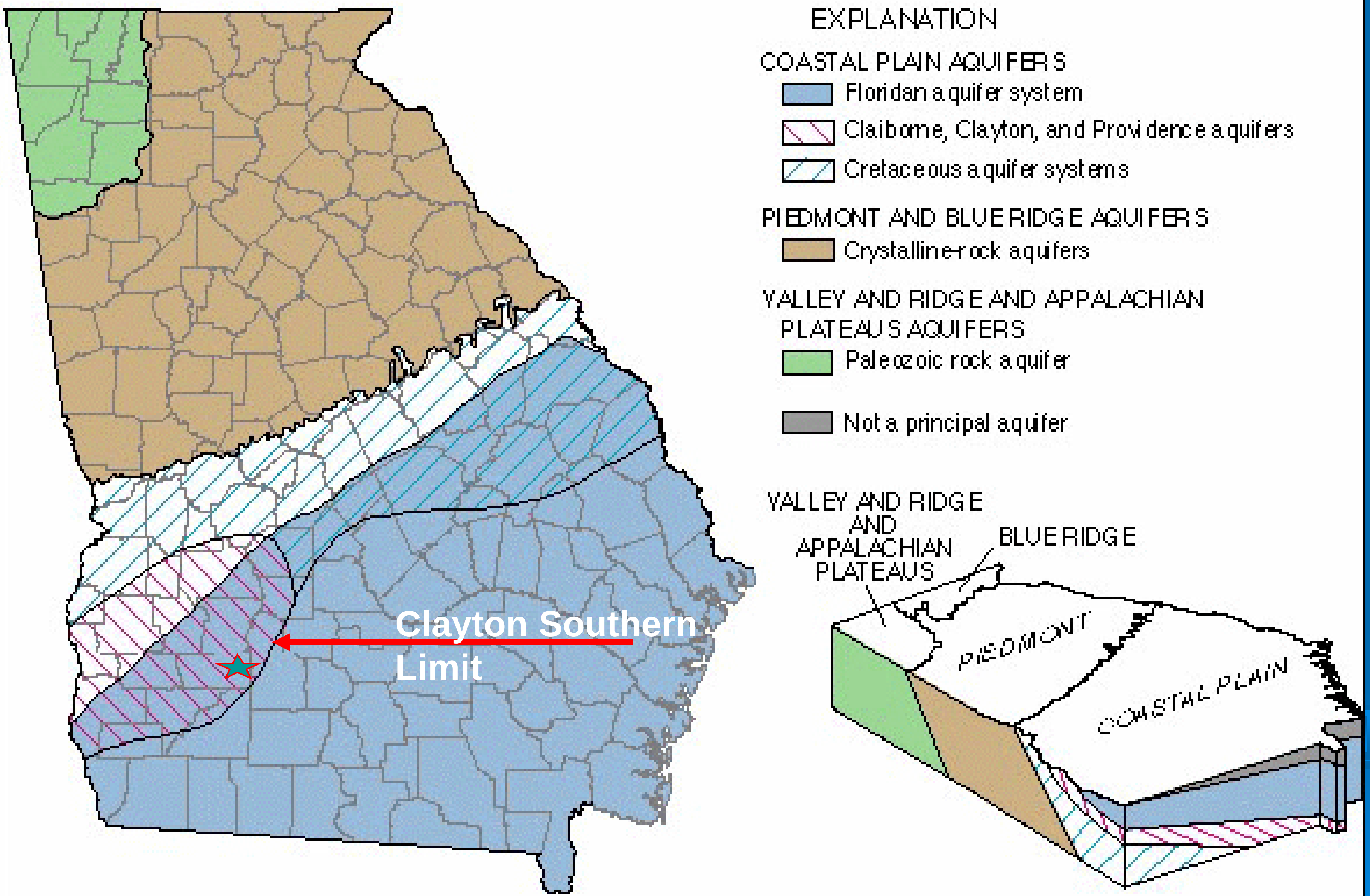
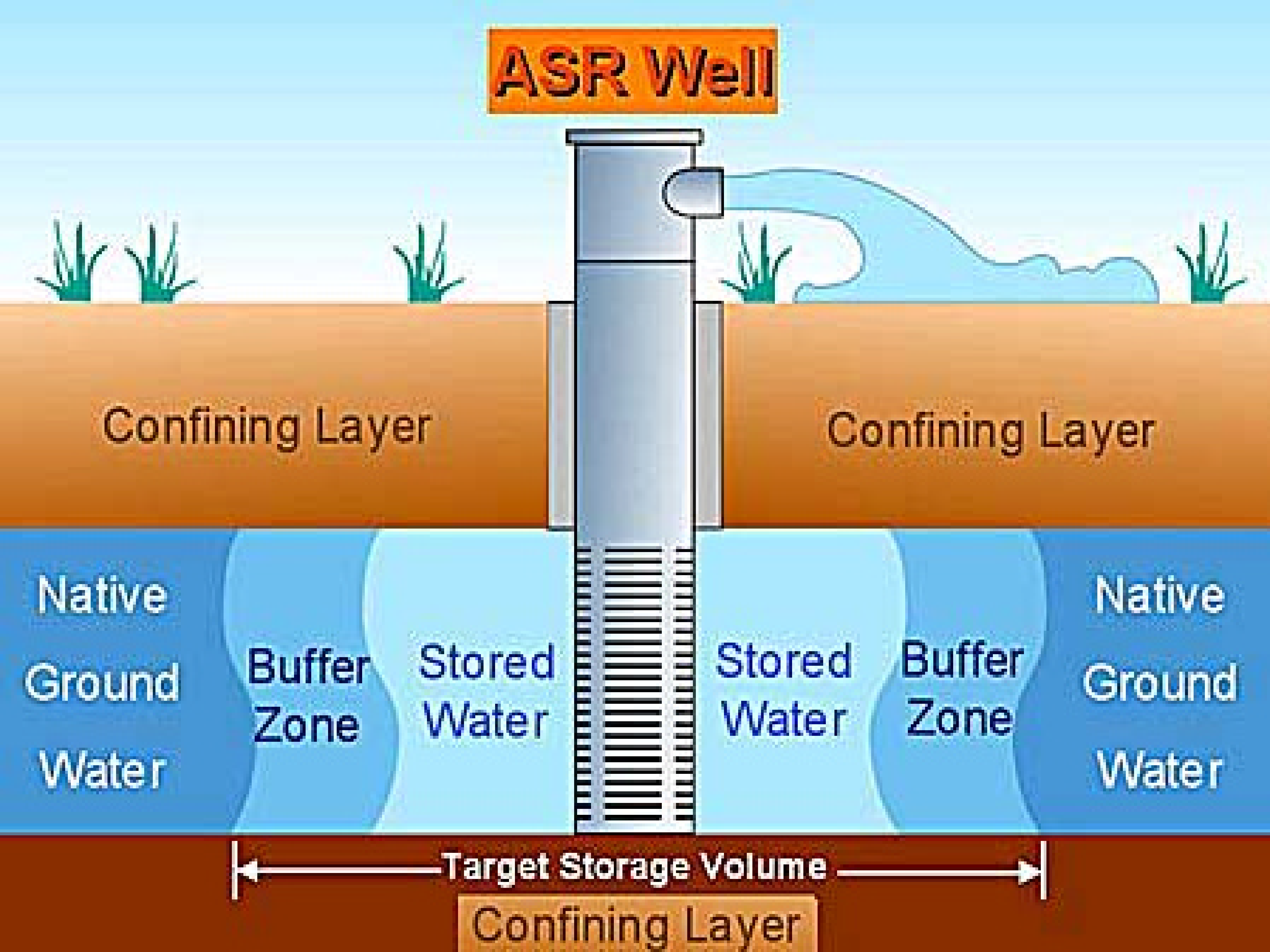


Figure 1. Area of use of principal aquifers and generalized diagram showing aquifers and physiographic provinces in Georgia.



ASR Well
Confining Layer
Confining Layer
Native Ground Water
Buffer Zone
Stored Water
Stored Water
Buffer Zone
Native Ground Water
Target Storage Volume
Confining Layer

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Cenozoic	Quaternary; Tertiary	Holocene; Pleistocene; Pliocene; Miocene; Oligocene	20–80	*Surficial aquifer/* upper semiconfining unit	Sand and clay; Weathered limestone	Not a primary source of water, but has been used for domestic purposes.
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During Times of Abundance

- When flows in the Flint are high; water could be treated and injected into the Clayton Limestone…..or
- When groundwater levels in the Floridan are high water from the Floridan could be pumped directly into the Clayton Limestone

In the Event of Drought

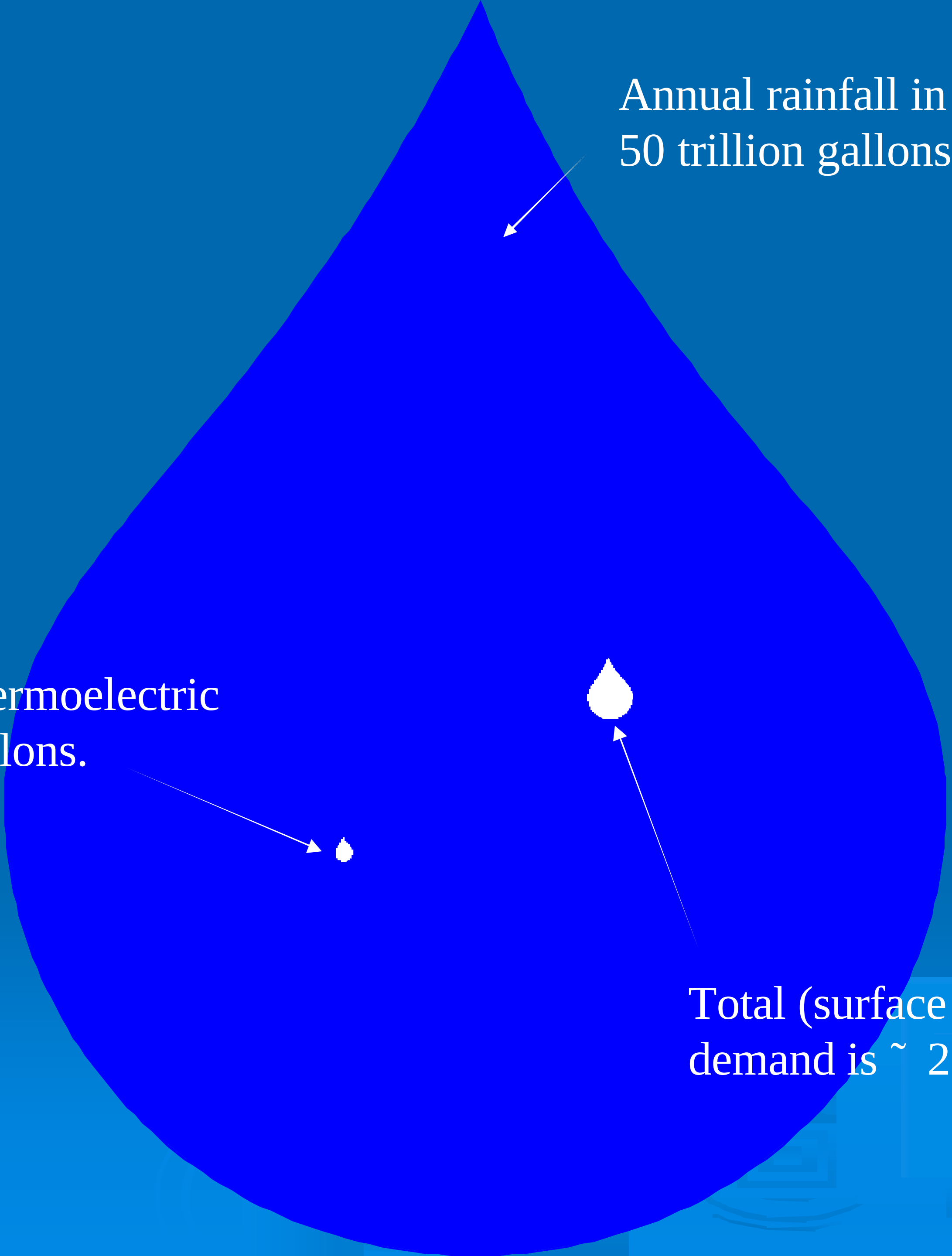
- The water stored in the Clayton Limestone could be recovered and pumped into the Flint to replace withdrawals from new permitted uses until flows reach some predetermined level.

Results of Two Studies

- The evidence is reasonably strong suggesting that benefits far exceed the costs that can be attributed to a full-scaled 10 mgd ASR facility.
- **Paper # 2006-005**
  Flint River Basin Near Albany, Georgia: Aquifer Storage and Recovery (ASR)
  Water Resource Solutions
- **Paper # 2006-005A**
  Lower Flint River Basin Aquifer Storage and Recovery: Economic Considerations
  Ronald Cummings, Douglas Wilson and Mark Masters
- h2opolicycenter.org

Parting Thought

Annual rainfall in Georgia is ~ 50 trillion gallons.



Demand minus thermoelectric is ~ 1.2 trillion gallons.

Total (surface & ground) water demand is ~ 2.5 trillion gallons.

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