

groundwater 101 for southwest travis county

Robert E. Mace, Ph.D., P.G.
The Meadows Center for Water & the Environment
Texas State University

presented to

Southwest Travis County Groundwater Conservation District
Bee Cave, Texas; August 8, 2018

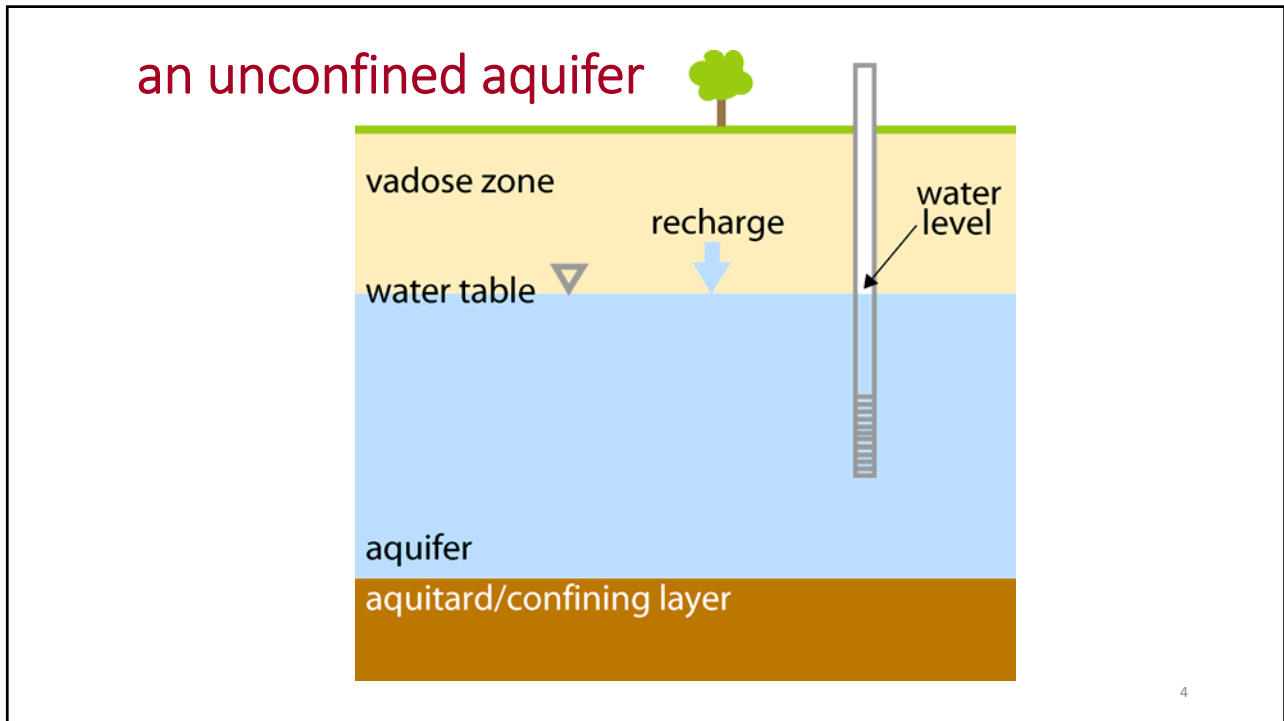
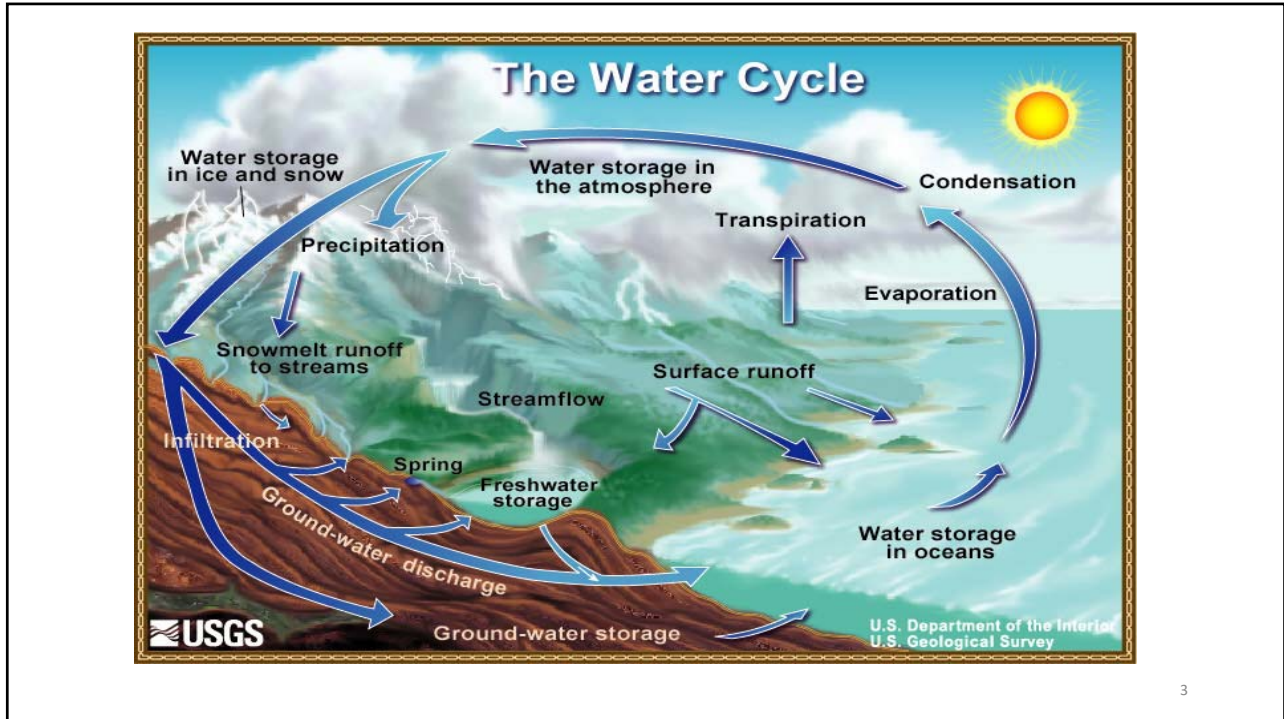


the meadows center for water & the environment

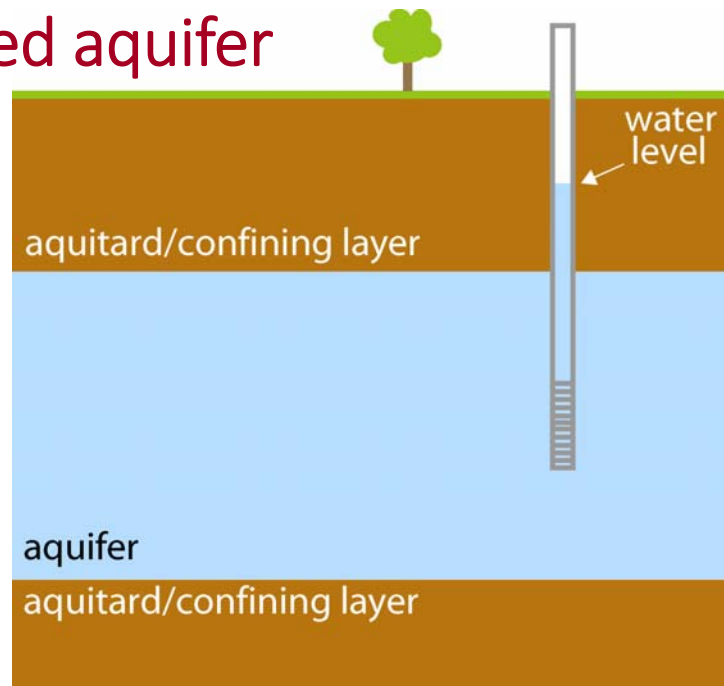
inspiring research and leadership
that ensures clean, abundant water
for the environment and all humanity

TEXAS  STATE
UNIVERSITY

The rising STAR of Texas

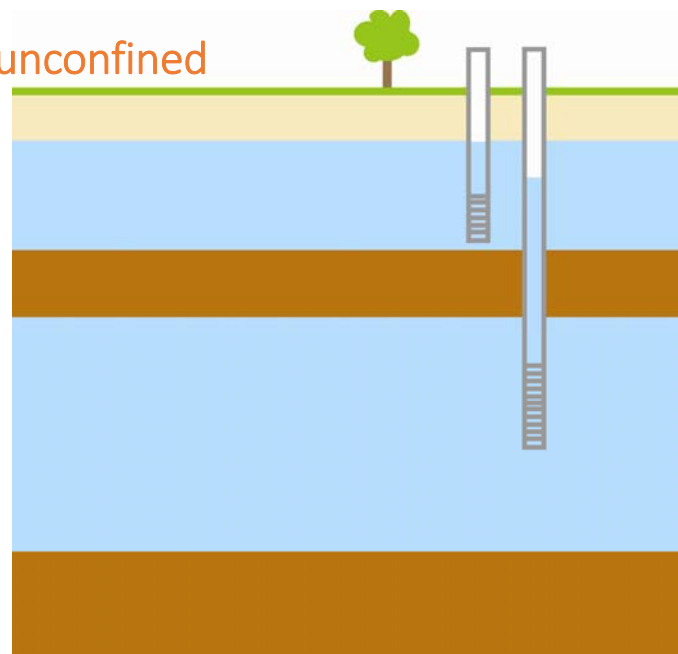


a confined aquifer



5

same location: confined and unconfined



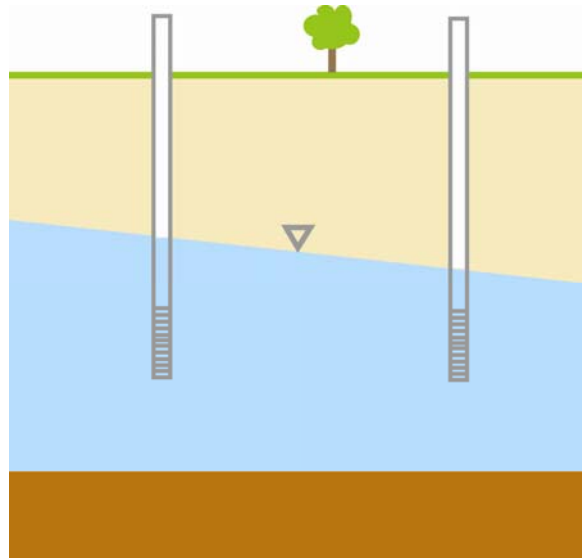
6

2 rules of groundwater flow

- **water flows downhill** (toward lower potential energy)
- **water flows uphill** (toward money)

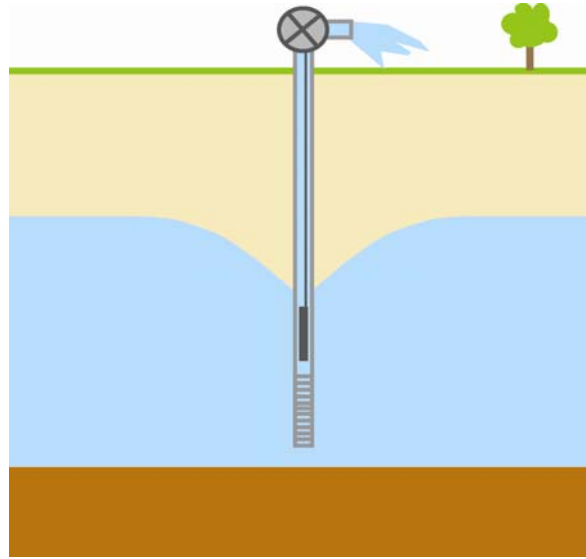
7

water flows downhill (to lower potential energy)



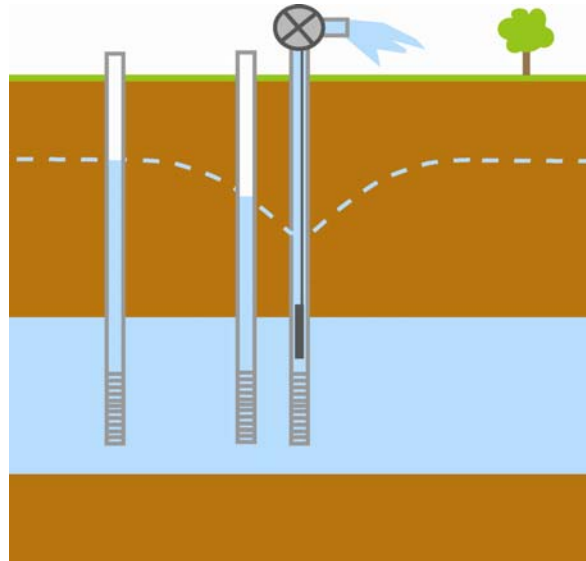
8

pumping a well: unconfined

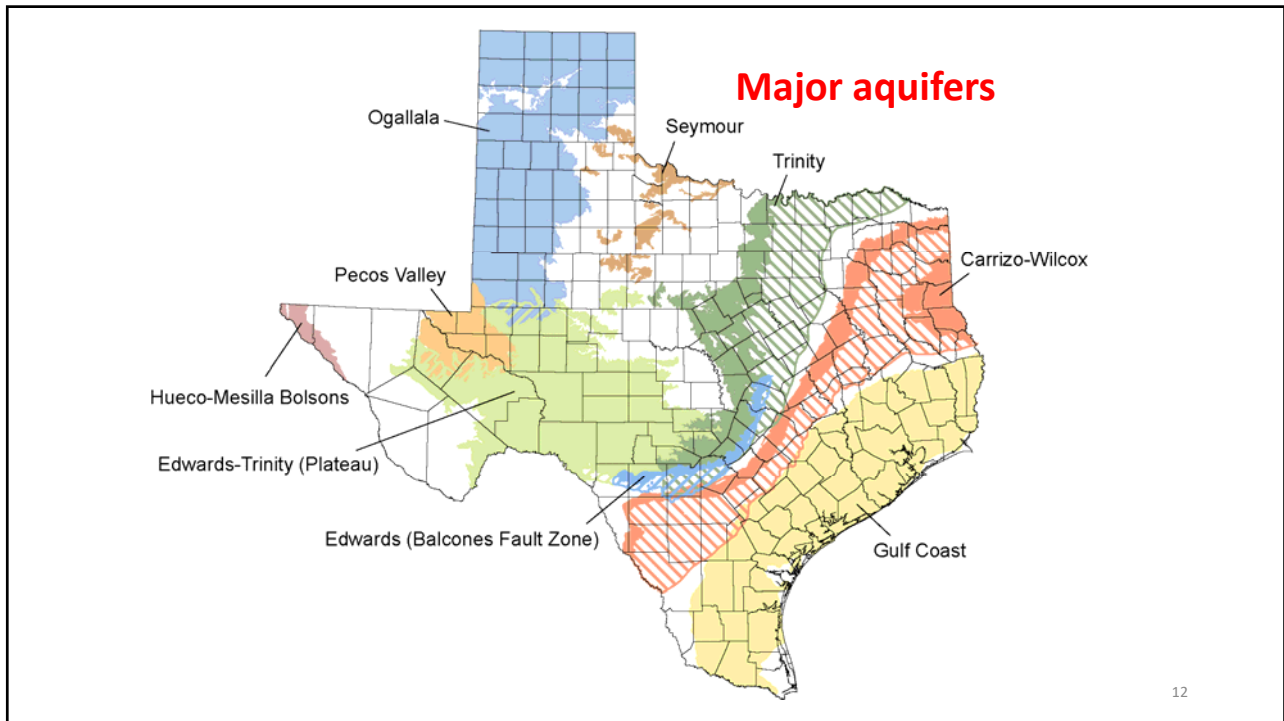
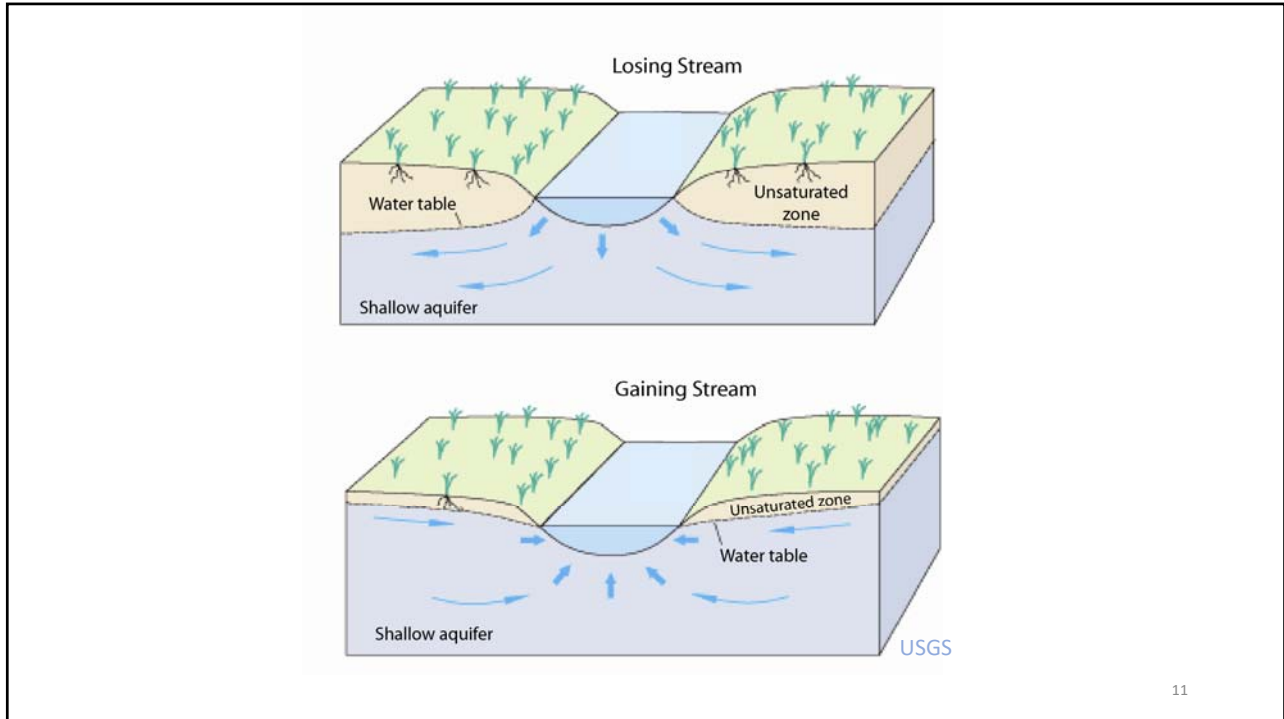


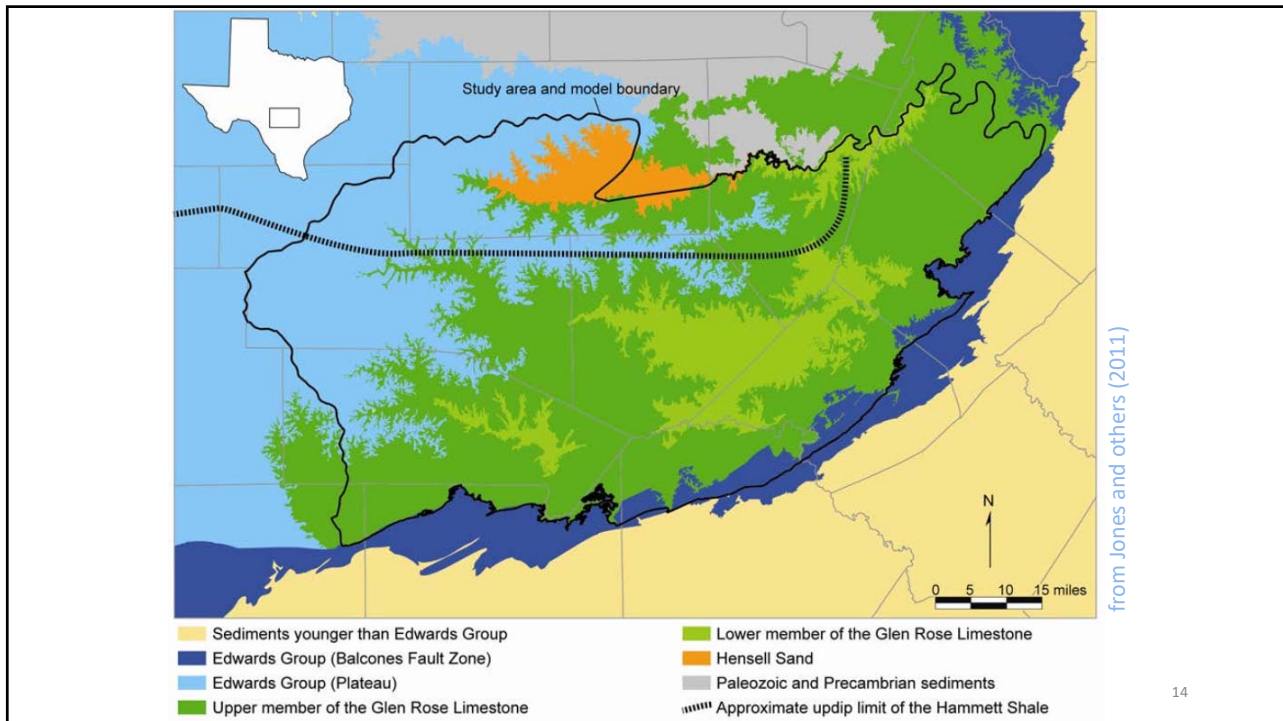
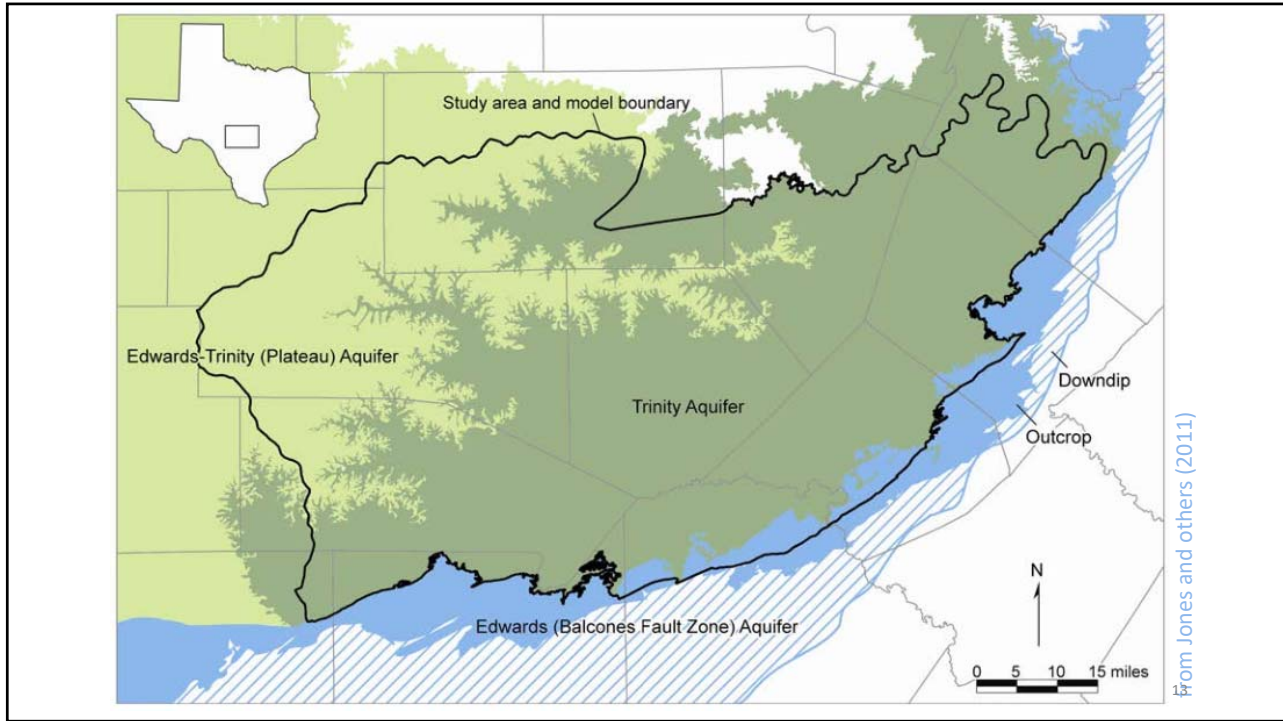
9

pumping a well: confined



10

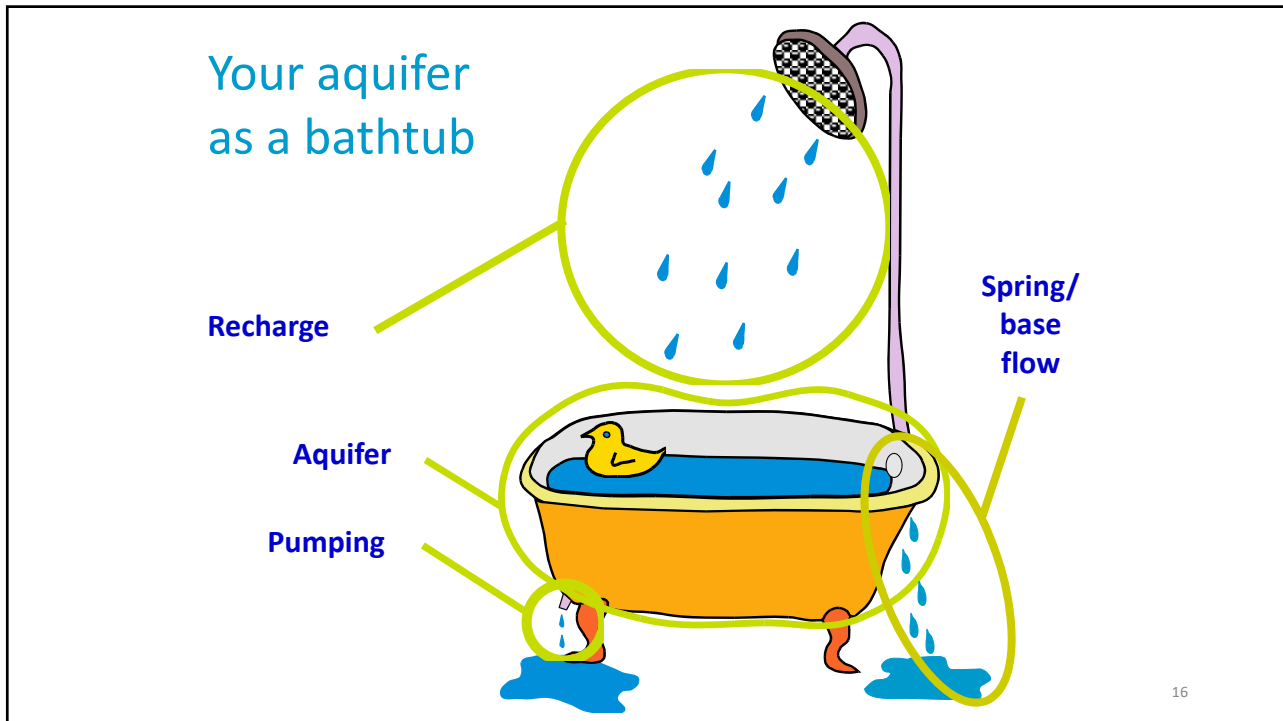




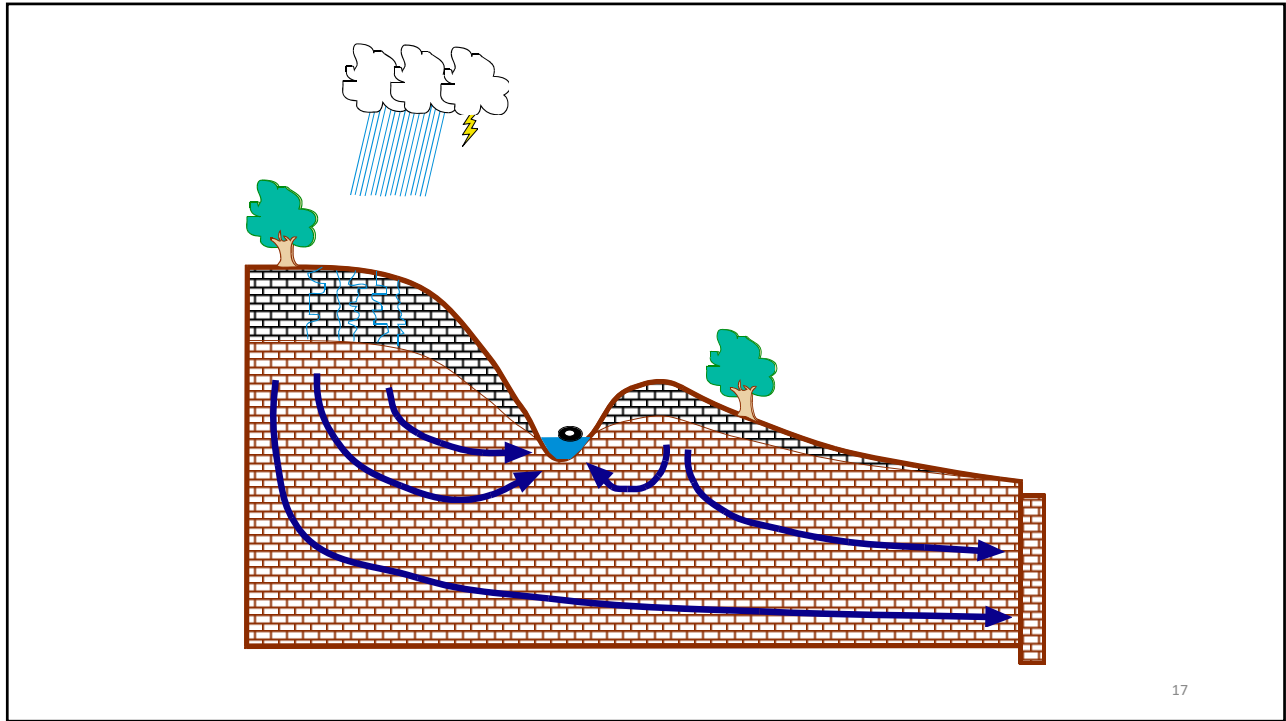
Era	System	Group	Stratigraphic unit		Hydrologic unit	
Cenozoic	Quaternary		Alluvium		Alluvium	
Mesozoic	Cretaceous	Edwards	Segovia Formation		Edwards Group	
			Fort Terrett Formation			
		Trinity	Glen Rose Limestone	Upper Member	Trinity Aquifer System	Upper Trinity
				Lower Member		Middle Trinity
			Hensell Sand/Bexar Shale			
			Cow Creek Limestone			
			Hammett Shale			Confining unit
			Sligo Formation			Lower Trinity
Sycamore Sand/Hosston Formation						
Paleozoic		Undifferentiated Pre-Cretaceous rock				

from Jones and others (2011)

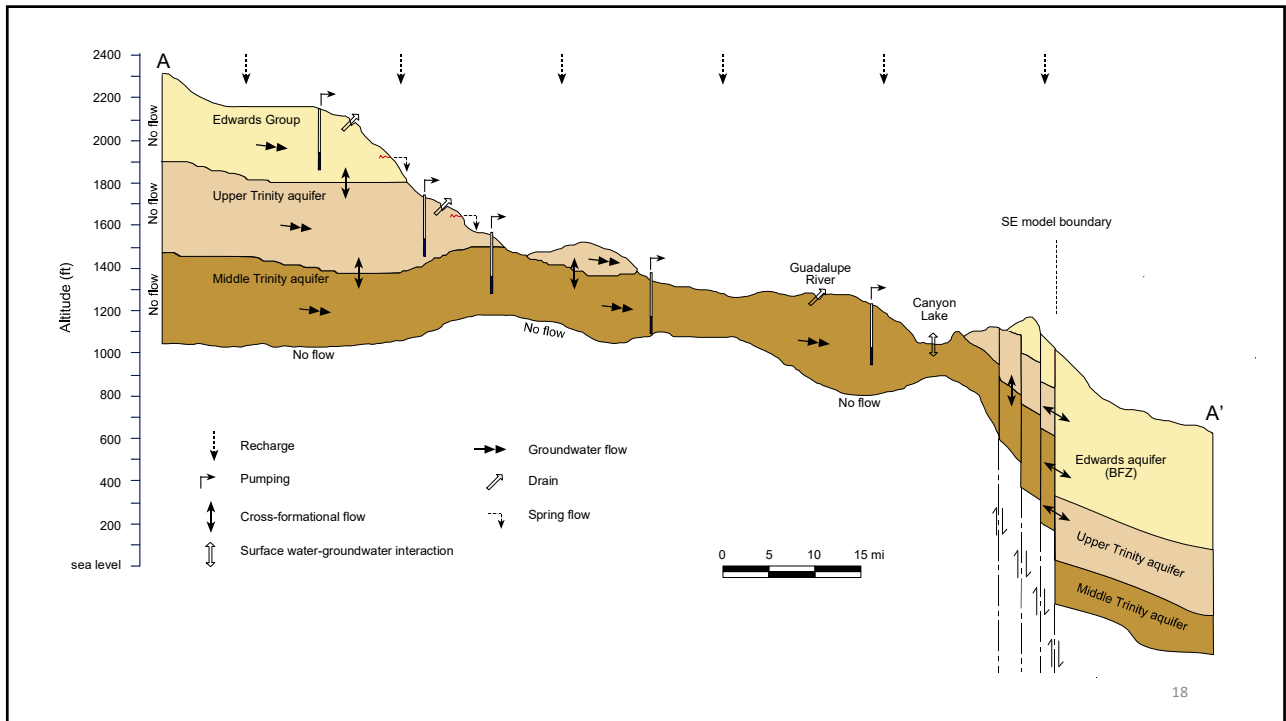
15



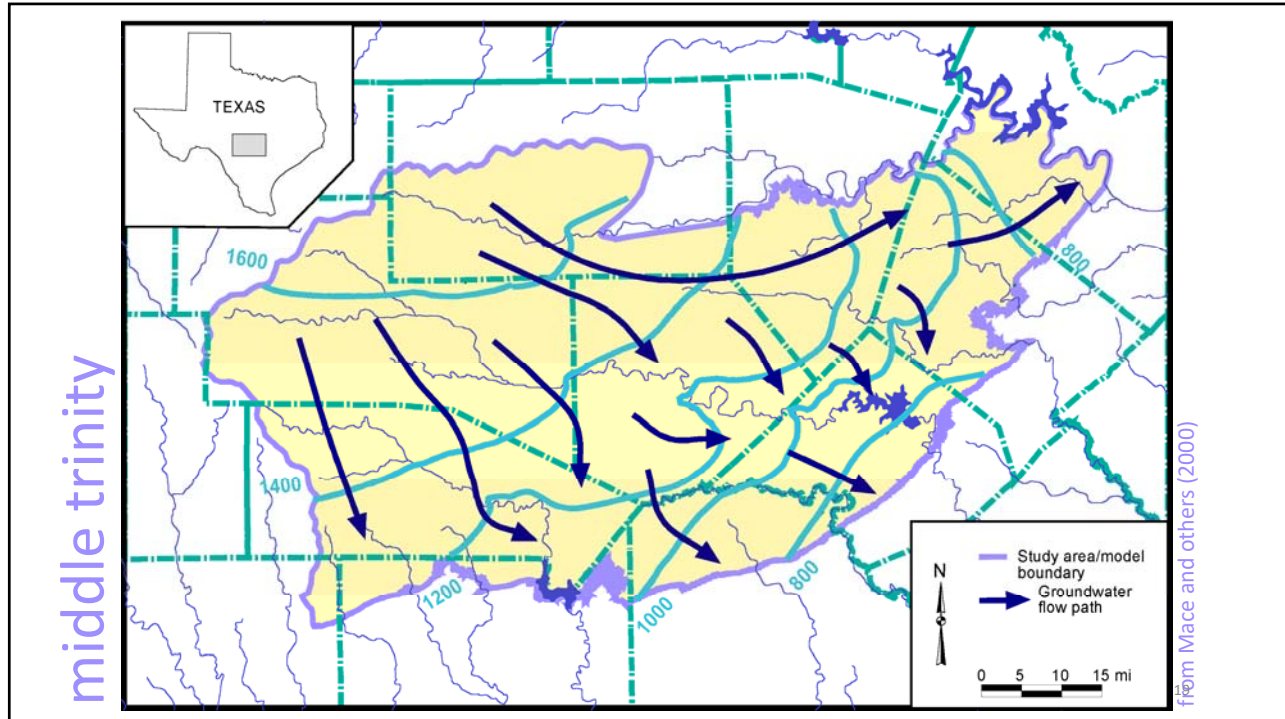
16



17



18



“pre-development” water budget for 1980

(acre-feet per year)

County	Wells	Streams and springs	Recharge	Reservoirs	Edwards (Balcones Fault Zone) Aquifer	Lateral inflow	Lateral outflow
Travis	-100	-5,200	11,900	-10,300	-2,100	6,100	-400

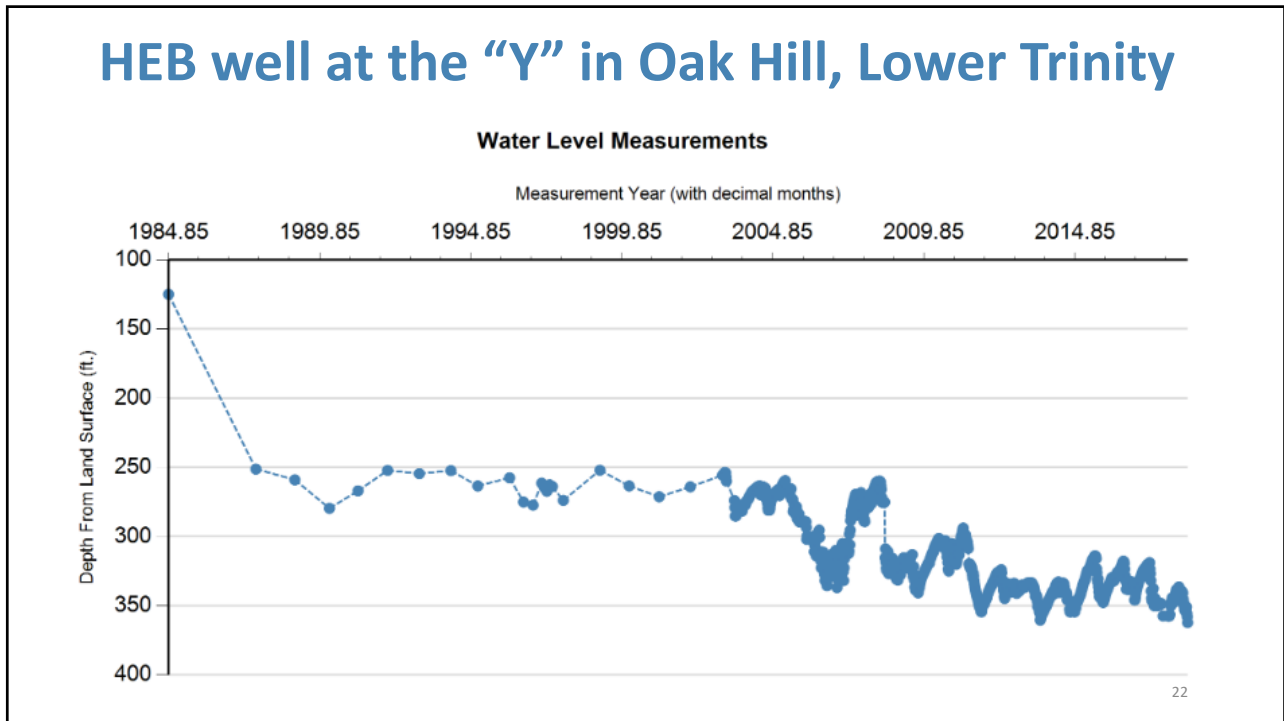
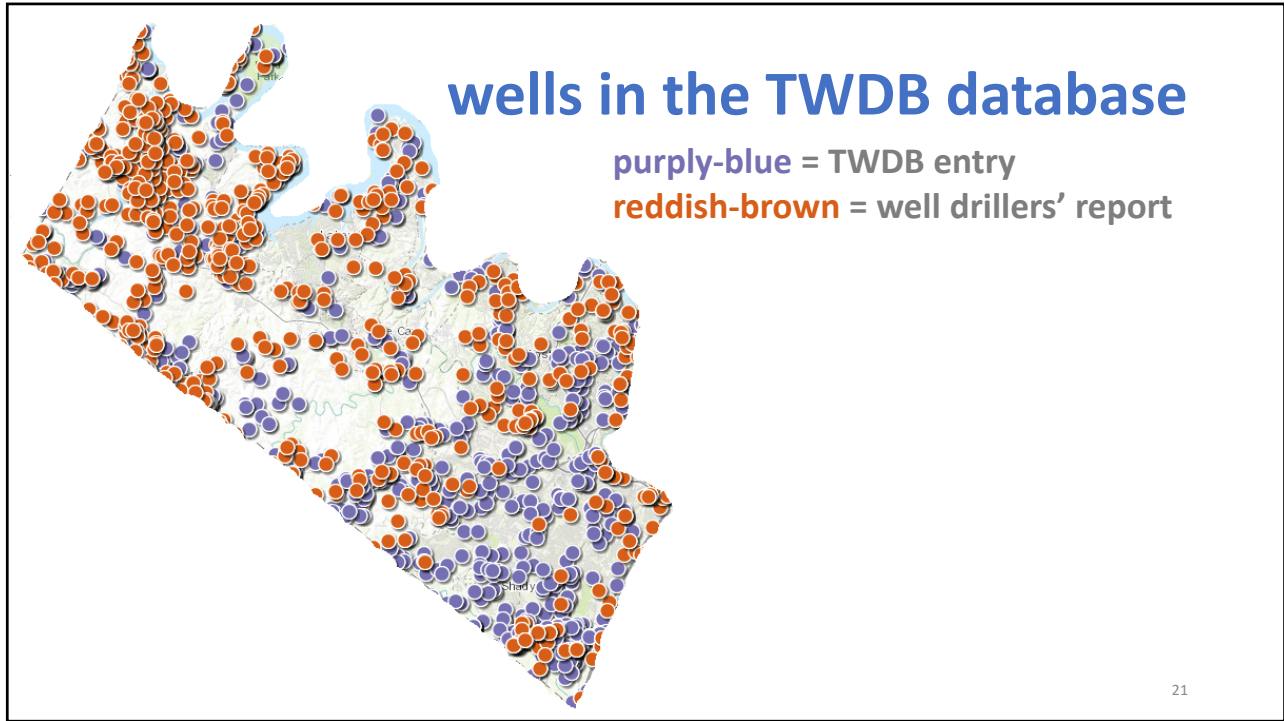
from Jones and others (2011)

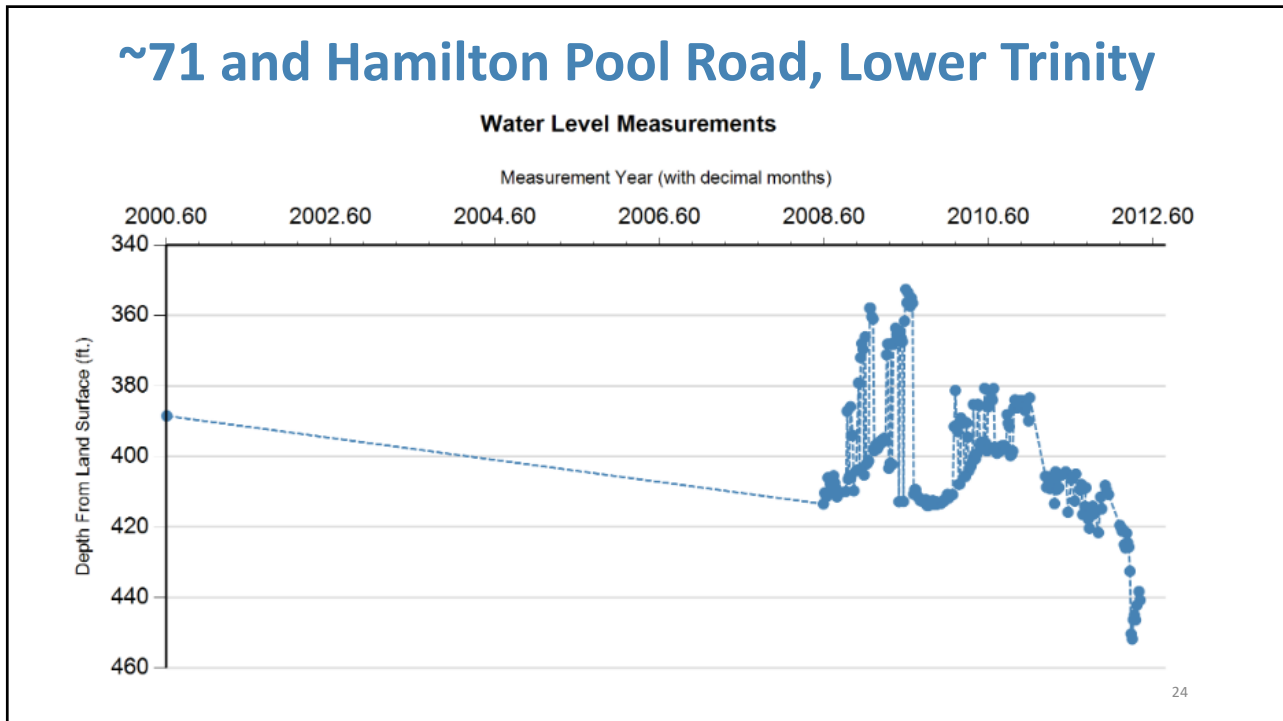
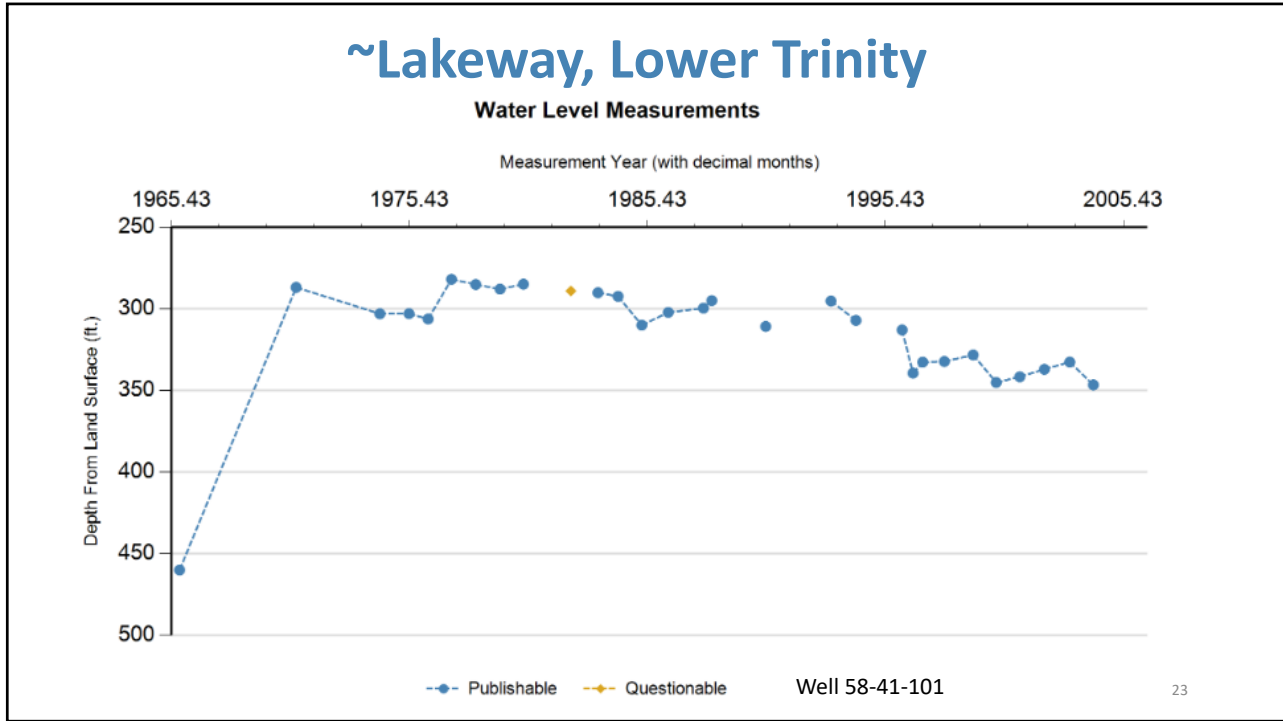
water use for 2008

County	Upper Trinity Aquifer	Middle Trinity Aquifer	Lower Trinity Aquifer	Total Pumping
Travis	551	4,967	0	5,518 ?

Jones and others (2011) report 146 for 1997...
 TWDB reports 7,360 for 2016 (but for entire county)

from GMA9JPC (2016)
 via Hutchison (2010)







How much water
is available
for use?

25

like beauty,
groundwater availability
is in the eye
of the beholder

26

0



groundwater availability...

27



groundwater
goals

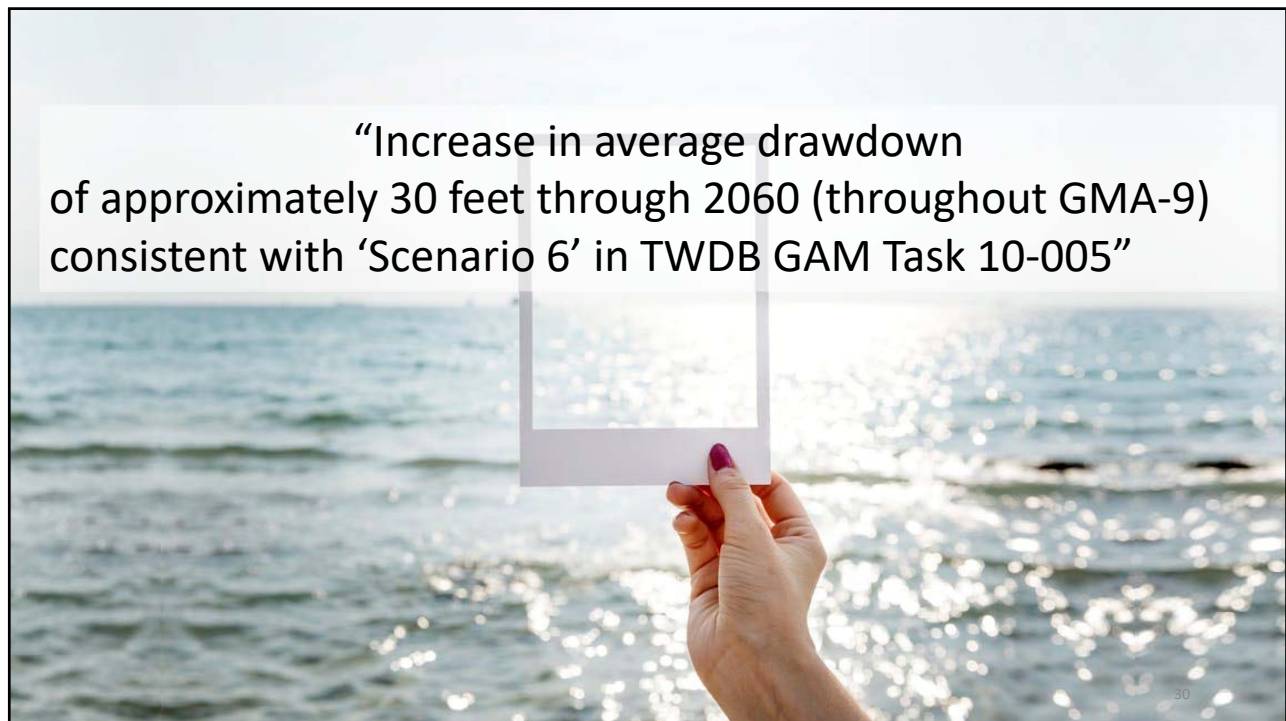


• desired future conditions



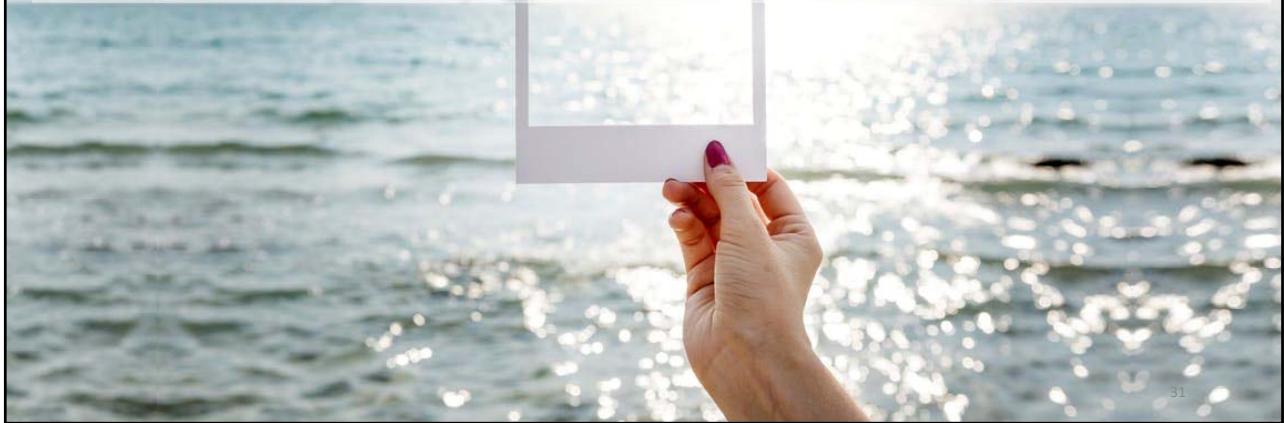
• modeled available groundwater

28



for southwest Travis County:

- ~ 56 percent increase in pumping
- ~ 30-foot decline in upper, middle, and lower Trinity
- ~ a 33 percent decrease in flow to springs, rivers, and lakes
- ~ a 70 percent decrease in flow to the Edwards



some numbers for sw travis county

modeled available groundwater: ~8,600
2008 pumping: ~5,500

all values in acre-feet per year

32



questions?

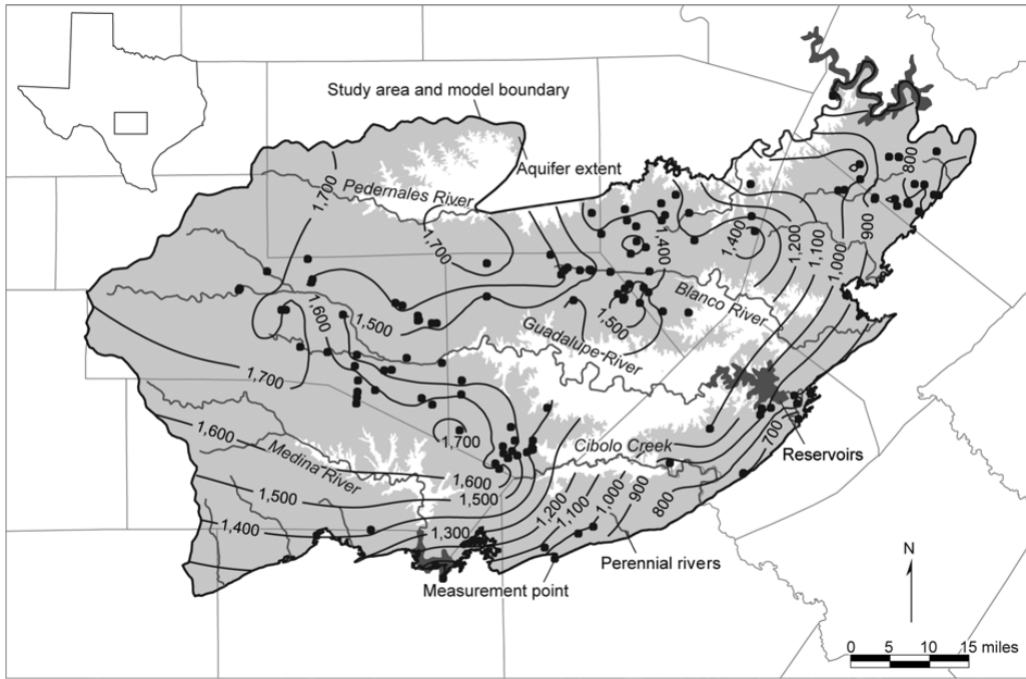
Robert E. Mace, Ph.D., P.G.
The Meadows Center for Water & the Environment
Texas State University
robertmace@txstate.edu
(512)245-6021
@MaceatMeadows

33

references:

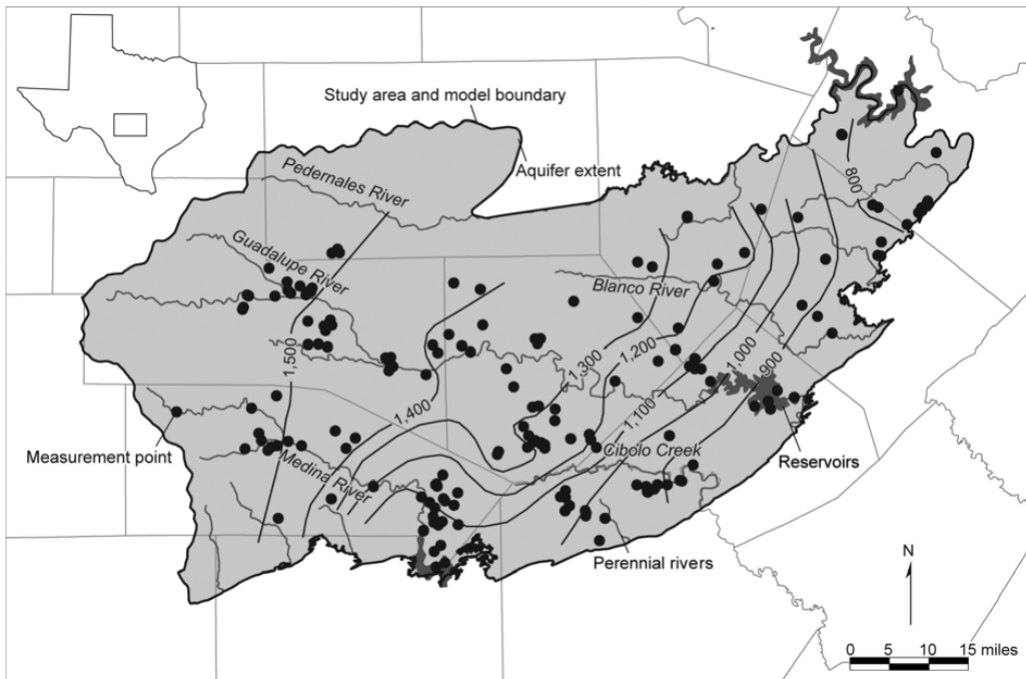
- GMA9JPC (Groundwater Management Area 9 Joint Planning Committee), 2016, Groundwater Management Area 9 explanatory report for desired future conditions major and minor aquifers: Groundwater Management Area 9 Joint Planning Committee Report, variously paginated (191 p.). [\[link\]](#)
- Hutchison, W.R., 2010, GAM Task 10-005, Texas Water Development Board. [\[link\]](#)
- Jones, I.C., Anaya, R., and Wade, S., 2011, Groundwater availability model: Hill Country portion of the Trinity Aquifer of Texas: Texas Water Development Board Report 377, 165 p. [\[link\]](#)
- Mace, R.E., Chowdhury, A.H., Anaya, R., and Way, S.-C. (T.), 2000, Groundwater availability of the Trinity Aquifer, Hill Country Area, Texas—Numerical simulations through 2050: Texas Water Development Board Report 353, 117 p. [\[link\]](#)

upper trinity water levels, 1977 thru 1985

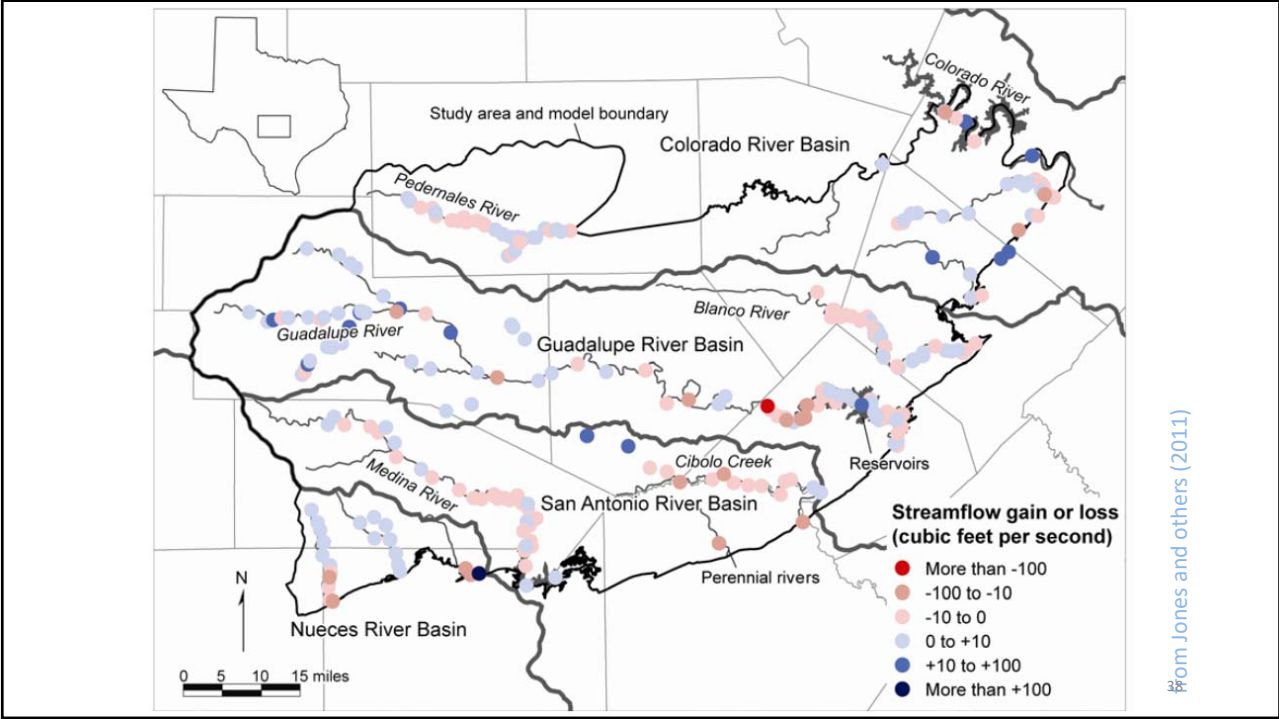
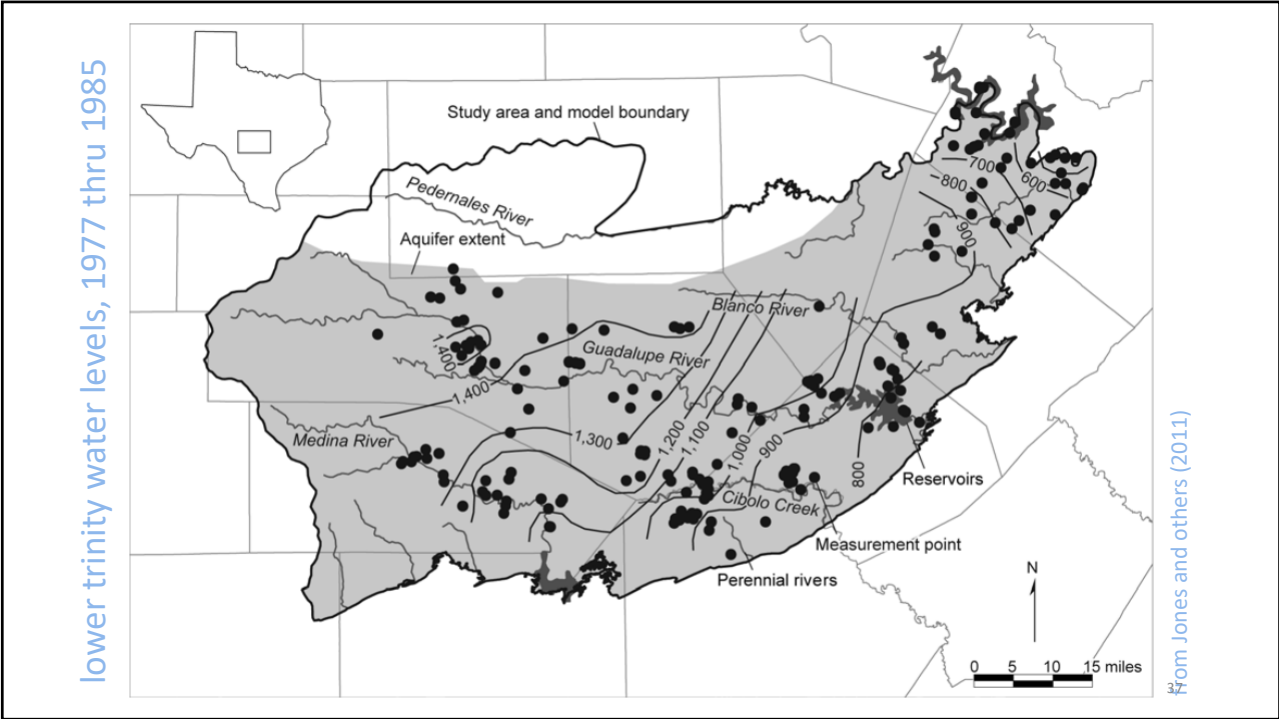


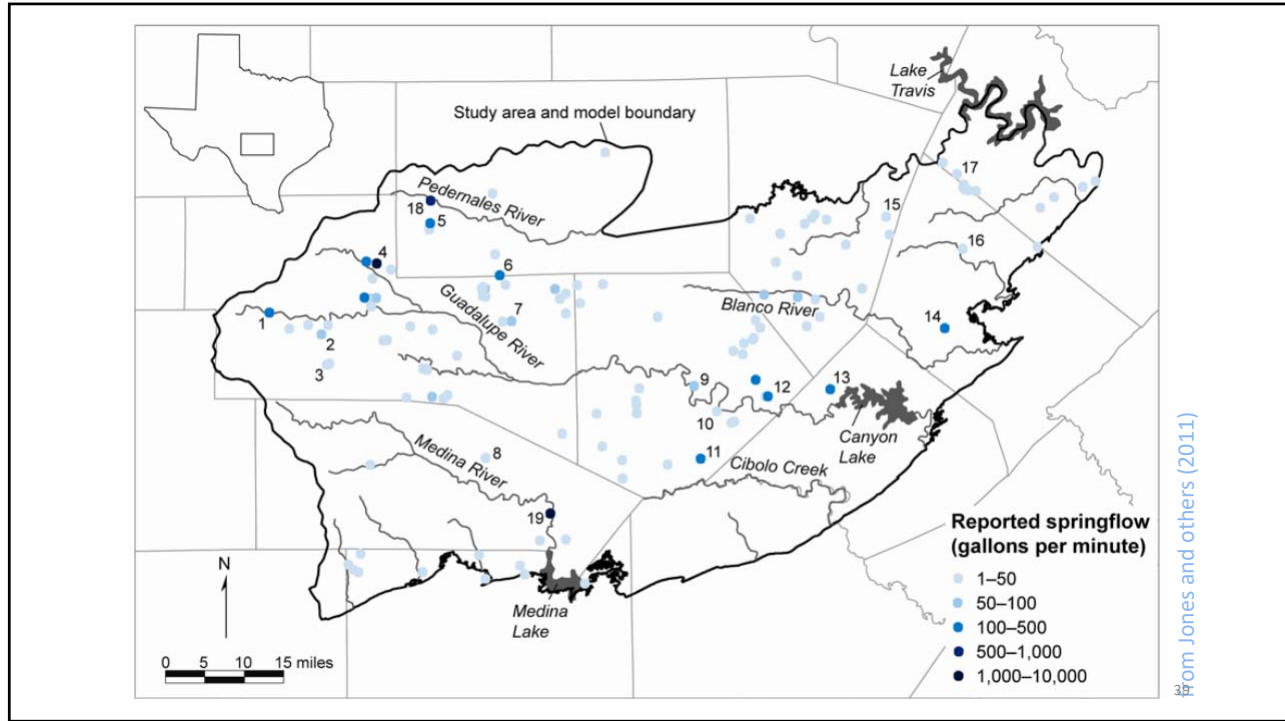
from Jones and others (2011)

middle trinity water levels, 1977 thru 1985



from Jones and others (2011)





Travis County

Component	Case	Scenario						
		1	2	3	4	5	6	7
Pumping (AF/yr)	Minimum	0	1,814	3,629	5,368	6,958	8,521	9,405
	Exceeded 95% of years	0	1,814	3,629	5,368	7,058	8,521	9,561
	Average	0	1,814	3,629	5,368	7,158	8,697	9,692
	Exceeded 5% of years	0	1,814	3,629	5,443	7,158	8,947	10,437
	Maximum	0	1,814	3,629	5,443	7,257	8,947	10,736
Spring and River Base Flow (AF/yr)	Minimum	13,039	12,019	10,762	9,511	8,171	6,895	5,915
	Exceeded 95% of years	14,452	12,938	11,495	10,032	8,540	7,343	6,337
	Average	16,216	14,699	13,180	11,666	10,197	9,050	7,959
	Exceeded 5% of years	18,024	16,480	14,936	13,469	12,022	10,687	9,792
	Maximum	18,883	17,348	15,798	14,389	13,230	12,312	11,359
Outflow Across the Balcones Fault Zone (AF/yr)	Minimum	1,565	1,377	1,132	855	521	171	-147
	Exceeded 95% of years	1,966	1,643	1,314	973	613	290	-28
	Average	2,341	2,006	1,672	1,321	980	670	341
	Exceeded 5% of years	2,717	2,377	2,034	1,700	1,384	1,057	777
	Maximum	2,914	2,571	2,226	1,917	1,695	1,510	1,324
Overall Trinity Drawdown after 50 Years (ft)	Minimum	-24.8	-18.4	-11.7	-5.1	2.9	11.1	12.5
	Exceeded 95% of years	-21.3	-14.8	-8.1	-1.0	8.9	16.6	19.1
	Average	-15.2	-8.6	-1.9	6.9	20.7	27.6	31.5
	Exceeded 5% of years	-9.0	-2.6	4.4	13.4	22.0	28.8	32.9
	Maximum	-7.1	-0.6	6.3	13.9	22.0	29.4	33.4
Edwards Group Drawdown after 50 Years (ft)	Minimum	NA	NA	NA	NA	NA	NA	NA
	Exceeded 95% of years	NA	NA	NA	NA	NA	NA	NA
	Average	NA	NA	NA	NA	NA	NA	NA
	Exceeded 5% of years	NA	NA	NA	NA	NA	NA	NA
	Maximum	NA	NA	NA	NA	NA	NA	NA
Upper Trinity Drawdown after 50 Years (ft)	Minimum	-14.2	-12.6	-11.0	-9.5	-4.3	-0.1	-3.8
	Exceeded 95% of years	-6.6	-5.0	-3.4	-1.3	4.9	8.0	6.4
	Average	-5.9	-7.4	-8.9	-14.8	28.0	28.2	29.4
	Exceeded 5% of years	18.7	20.3	21.8	28.1	29.3	29.7	31.0
	Maximum	23.5	25.1	26.7	28.3	29.6	30.8	32.9
Middle Trinity Drawdown after 50 Years (ft)	Minimum	-28.7	-20.6	-12.2	-3.8	5.7	11.3	16.1
	Exceeded 95% of years	-26.6	-18.3	-9.8	-1.1	9.7	19.8	23.3
	Average	-22.8	-14.5	-5.9	4.1	17.8	27.6	31.5
	Exceeded 5% of years	-18.9	-10.6	-1.8	8.1	19.8	29.0	33.5
	Maximum	-17.8	-9.4	-0.6	8.7	19.8	29.5	33.8
Lower Trinity Drawdown after 50 Years (ft)	Minimum	-28.9	-20.7	-12.3	-3.9	5.4	11.4	16.1
	Exceeded 95% of years	-26.8	-18.5	-9.9	-1.3	9.6	19.4	23.3
	Average	-23.0	-14.6	-5.9	4.0	17.8	27.6	32.5
	Exceeded 5% of years	-19.0	-10.6	-1.7	8.2	19.9	29.0	34.8
	Maximum	-17.9	-9.4	-0.5	8.8	19.9	29.5	35.3

from Hutchison (2010) 40