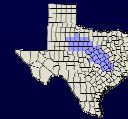


Agenda Item 6.5

Study No. 1 Updated Drought of Record Safe Yields for Reservoirs Upstream of Possum Kingdom Reservoir and Water Quality

October 29, 2008



History

- ✓ Policy Recommendations in the 2001 Brazos G Regional Water Plan include:
 - “Recommend that ‘safe yield’ as opposed to ‘firm yield’ be used in the development of available water supply estimates for reservoirs, as appropriate”
- ✓ 2004
 - HDR presented draft water supply/demand comparisons based on firm yield estimates
 - Brazos G RWPG directed HDR to estimate safe yields in addition to firm yields for reservoirs upstream of Possum Kingdom Reservoir
 - Adoption of safe yields above Possum Kingdom and updated drought analyses for use in 2006 plan
 - ✓ Hydrology through June 2004



History - Today

- ✓ August 2006 – Brazos G RWPG – approves task to evaluate the impact of on-going drought on reservoir supplies in the upper Brazos G area.
- ✓ July 2008 – Latest month where hydrologic data can be collected for the analysis.
- ✓ October 2008 – Presentation of Results
 - Impacts of Drought on Water Supply
 - ✓ Quantity – How much?
 - ✓ Quality – Treatment and Costs?

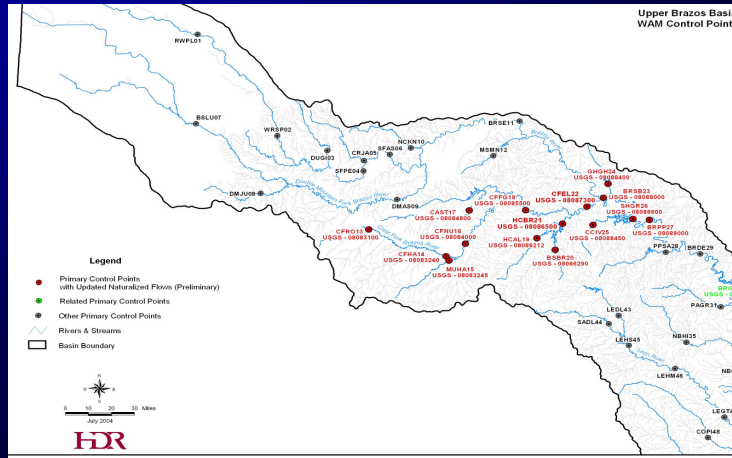
Definitions

Naturalized Flows – Theoretical flows that represent the historical flows of a river without any anthropogenic effects. Typically calculated by using gage streamflows and adjusting for diversions, return flows, and reservoir operations.

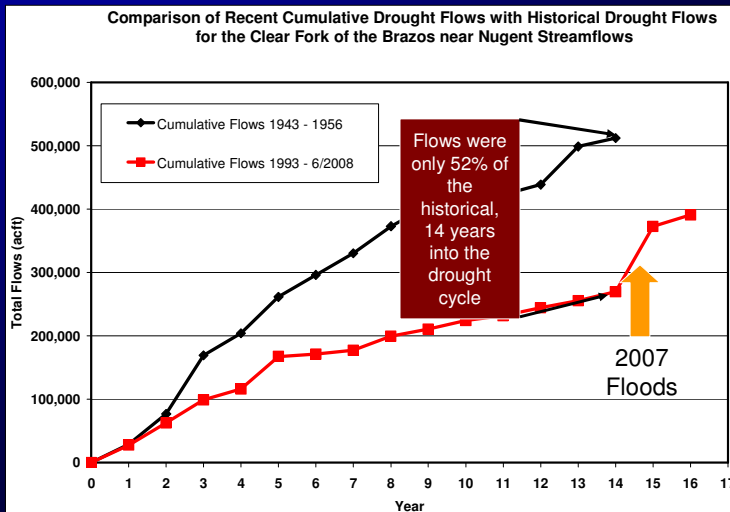
Drought of Record – Period of maximum drawdown (minimum storage) for a reservoir during the historically simulated time frame of the model.

Safe Yield – Maximum annual quantity that can be withdrawn from a reservoir such that a given volume remains in storage (usually equal to the safe yield) during the critical period of the drought of record.

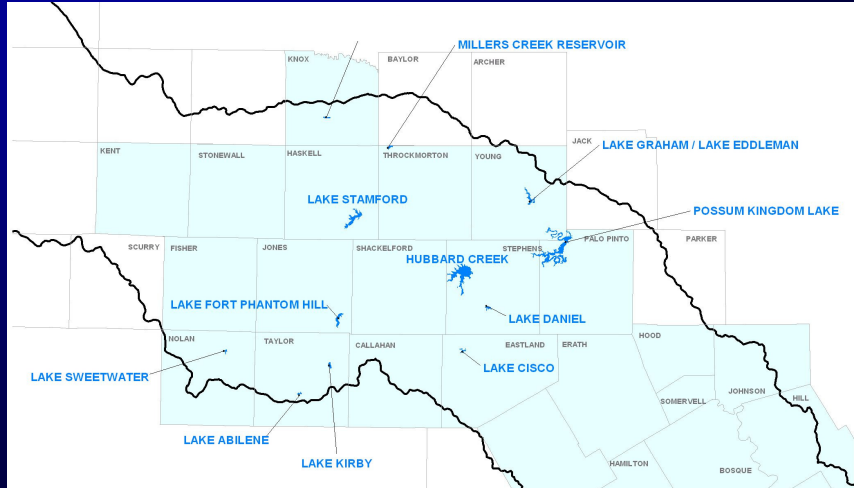
Brazos WAM Updated Control Points



Drought Inflow Comparison Gaged Flows - Clear Fork near Nugent



Reservoirs Potentially Affected



Comparison of Safe Yields for Large Reservoirs Using 2006 Plan and Recent Update

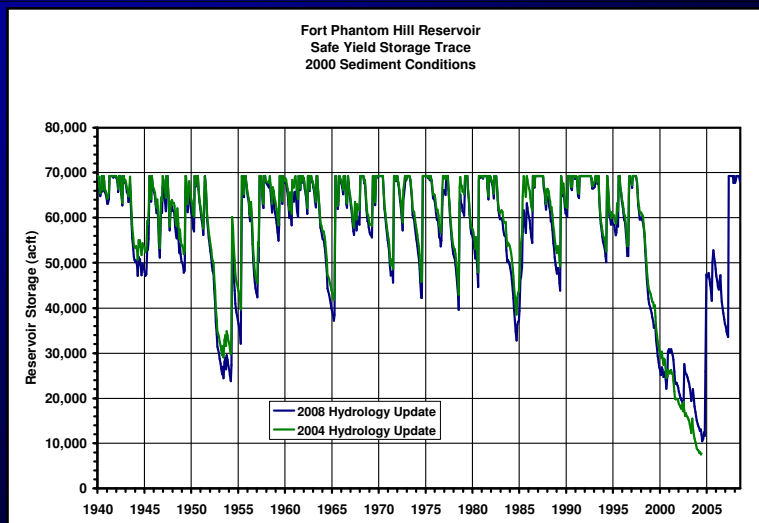
Run	Reservoir	Water Right Holder	County	Authorized Annual Diversion (acft/yr)	2006 Brazos G Safe Yields (2004 Hydrology)		2008 Brazos G Safe Yields (2008 Hydrology)		
					Year 2000 Yield (acft/yr)	Year 2060 Yield (acft/yr)	Year 2000 Yield (acft/yr)	Year 2060 Yield (acft/yr)	
1	Lake Abilene	City of Abilene	Taylor	1,675	1,200	525	1,255	570	
2	Lake Cisco	City of Cisco	Eastland	2,027	1,340	1,340	1,140	1,130	
3	Lake Daniel	City of Breckenridge	Stephens	2,100	650	550	235	205	
4a	Fort Phantom Hill	City of Abilene	Jones	33,190	7,430	6,940	10,455	10,300	
4b*	Fort Phantom Hill	City of Abilene	Jones	33,190	-	-	16,850	15,145	
5	Lake Graham/Eddleman	City of Graham	Young	20,000	4,650	3,700	3,935	3,215	
6a	Hubbard Creek Lake	West Central Texas MWD	Stephens	56,000	18,658	17,760	17,015	16,485	
6b*	Hubbard Creek Lake	West Central Texas MWD	Stephens	56,000	-	-	33,305	32,600	
7	Lake Kirby	City of Abilene	Taylor	3,880	500	320	570	350	
8	Lake Stamford	City of Stamford	Haskell	10,000	5,890	5,400	5,740	5,300	
9	Lake Sweetwater	City of Sweetwater	Nolan	3,780	1,035	980	1,055	1,030	
10a	Miller's Creek Lake	North Central Texas MWA	Baylor	5,000	900	700	90	0	
10b*	Miller's Creek Lake	North Central Texas MWA	Baylor	5,000	-	-	4,900	1,900	
* With priority calls agreement with Possum Kingdom Reservoir				Total:	132,652	52,273	45,345	69,885	61,445



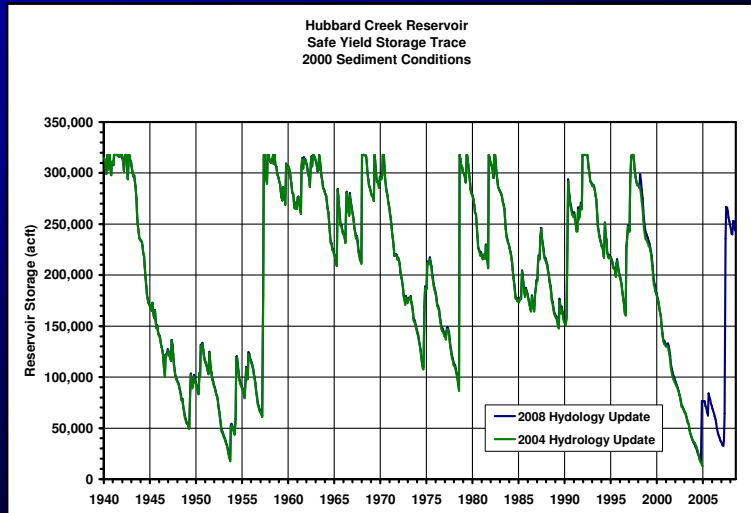
Comparison of Small Reservoirs Safe Yields Using 2006 Plan and Recent Update

Run	Reservoir	Water Right Holder	County	Authorized Annual Diversion (acft/yr)	2006 Brazos G Safe Yield (acft/yr)	Safe Yield 2008 Hydrology (acft/yr)
1	Lake Trammel	City of Sweetwater	Nolan	2,000	717	540
2	Lytle Lake	WTU	Taylor	230	230	230
3	Lake Hamlin	City of Hamlin	Jones	300	300	80
4	Anson North Lake	City of Anson	Jones	542	120	65
5	Lake Woodson	City of Woodson	Throckmorton	60	60	30
6	McCarty Lake	City of Albany	Shackelford	600	575	120
7	Baird Lake	City of Baird	Callahan	550	385	60
8	Moran City Lake	City of Moran	Shackelford	90	90	70
9	Lake Bryson	City of Bryson	Jack	90	90	40
Total:				4,462	2,507	1,235

Storage Trace – Updated Drought



Storage Trace – Updated Drought



Discussion of Model Results

- ✓ From a Yield standpoint – Current drought generally controls supply.
- ✓ The current drought is not over for some reservoirs.
- ✓ 5 Reservoirs show 1950's drought still controls.
 - ✓ Lake Abilene
 - ✓ Lake Graham
 - ✓ Lake Kirby
 - ✓ Lake Stamford
 - ✓ Lake Sweetwater

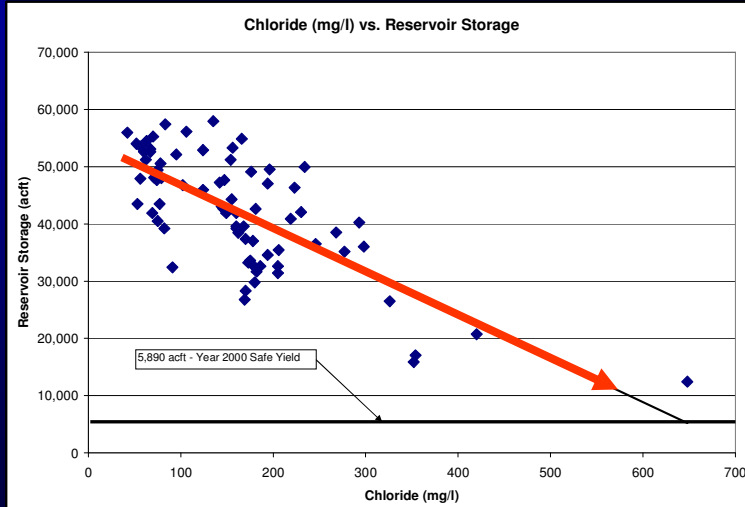
Summary

- ✓ 4 out of the 9 large reservoirs show reduced supply under new drought.
- ✓ The reduction percentage varies between 7% and 62% depending on the reservoir.
- ✓ Sizeable benefit from priority call agreements :
 - ✓ Possum Kingdom to Fort Phantom Hill Scalping
 - ✓ Possum Kingdom to Hubbard Creek Reservoir

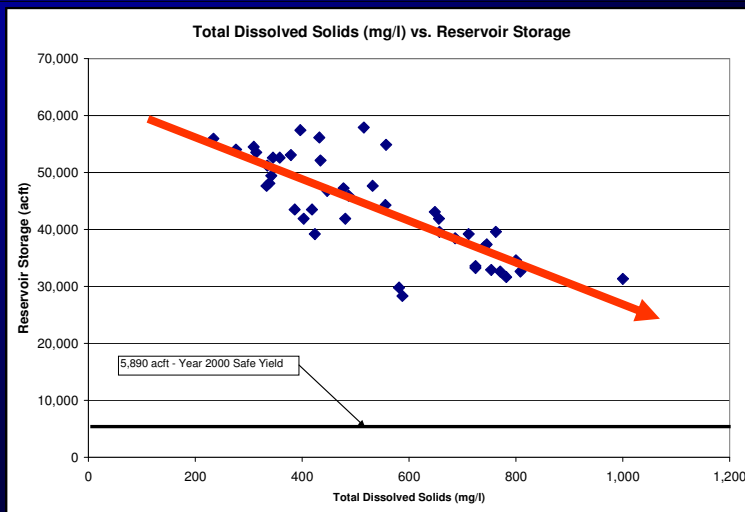
Water Quality Impacts of Droughts on Reservoir Water Quality

- ✓ 3 Reservoirs
- ✓ Relate Chlorides and TDS to Storage
- ✓ Potential Costs of Additional Treatment

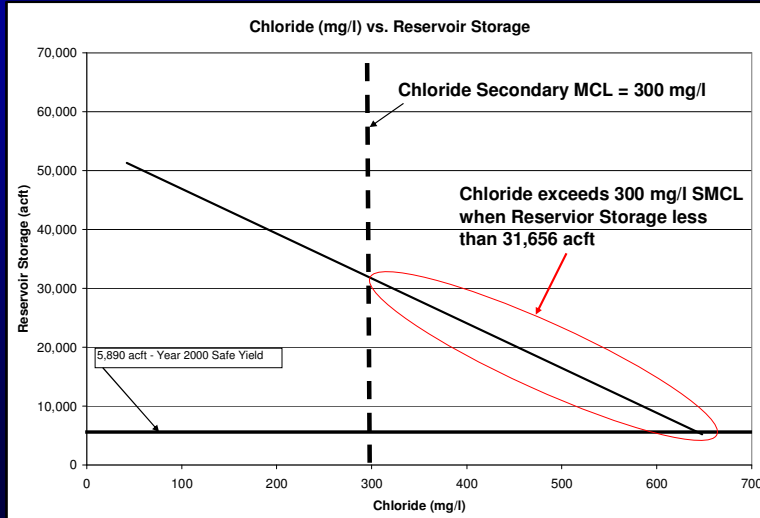
Water Quality vs. Storage Regressions Lake Stamford - Chlorides



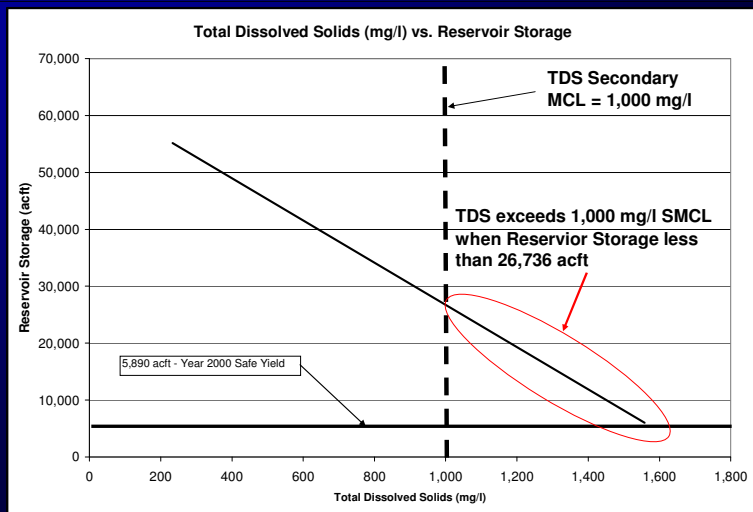
Water Quality vs. Storage Regressions Lake Stamford - TDS



Water Quality Lake Stamford - Chlorides



Water Quality Lake Stamford - TDS



Water Quality and Treatment Costs

Treatment Costs for Desalination of 1,500 mg/l	1 MGD	3 MGD	10 MGD
\$/acft	381	290	234
\$/1,000 gal	1.17	0.89	0.72

Water Quality Summary Results

- ✓ As reservoirs draw down – water quality degrades.
- ✓ Water quality for Chlorides and TDS could exceed secondary MCL requiring additional treatment.
- ✓ Unit Costs for additional treatment generally range from \$234 to \$381/acft of supply.

Discussion
