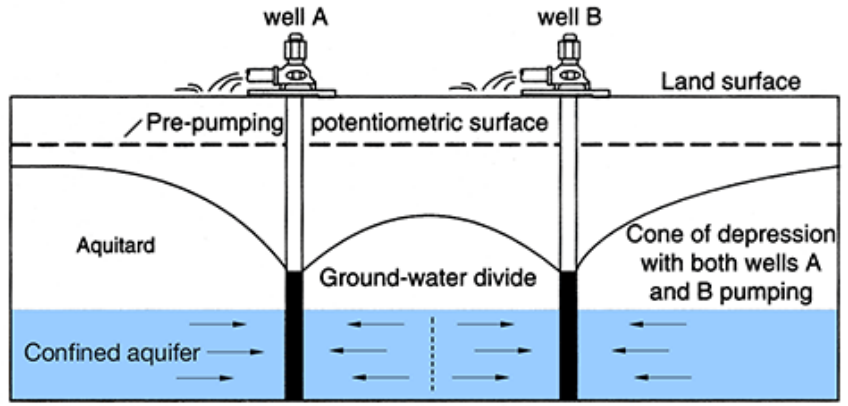
Model Then Measure:
Assessing and monitoring the potential for unreasonable impacts from a pumping well

Example from the Middle Trinity Aquifer, Hays County, Texas

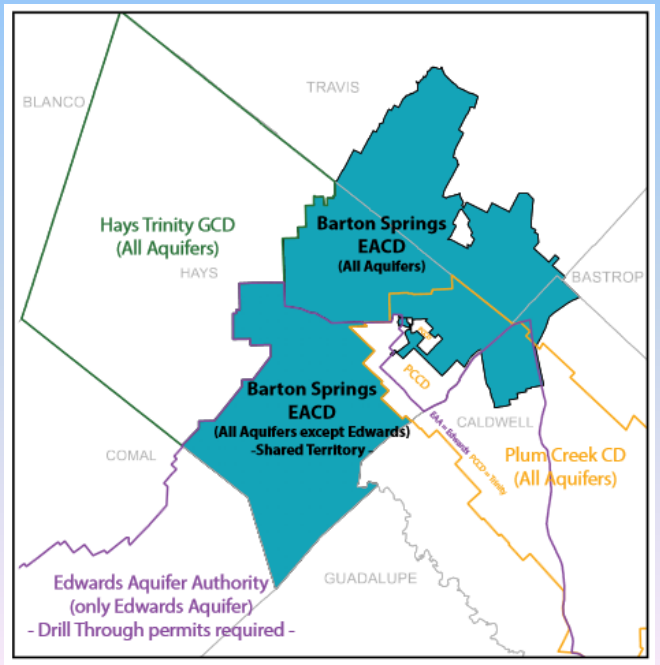


Brian B. Hunt and Brian A. Smith
Barton Springs/Edwards Aquifer Conservation District

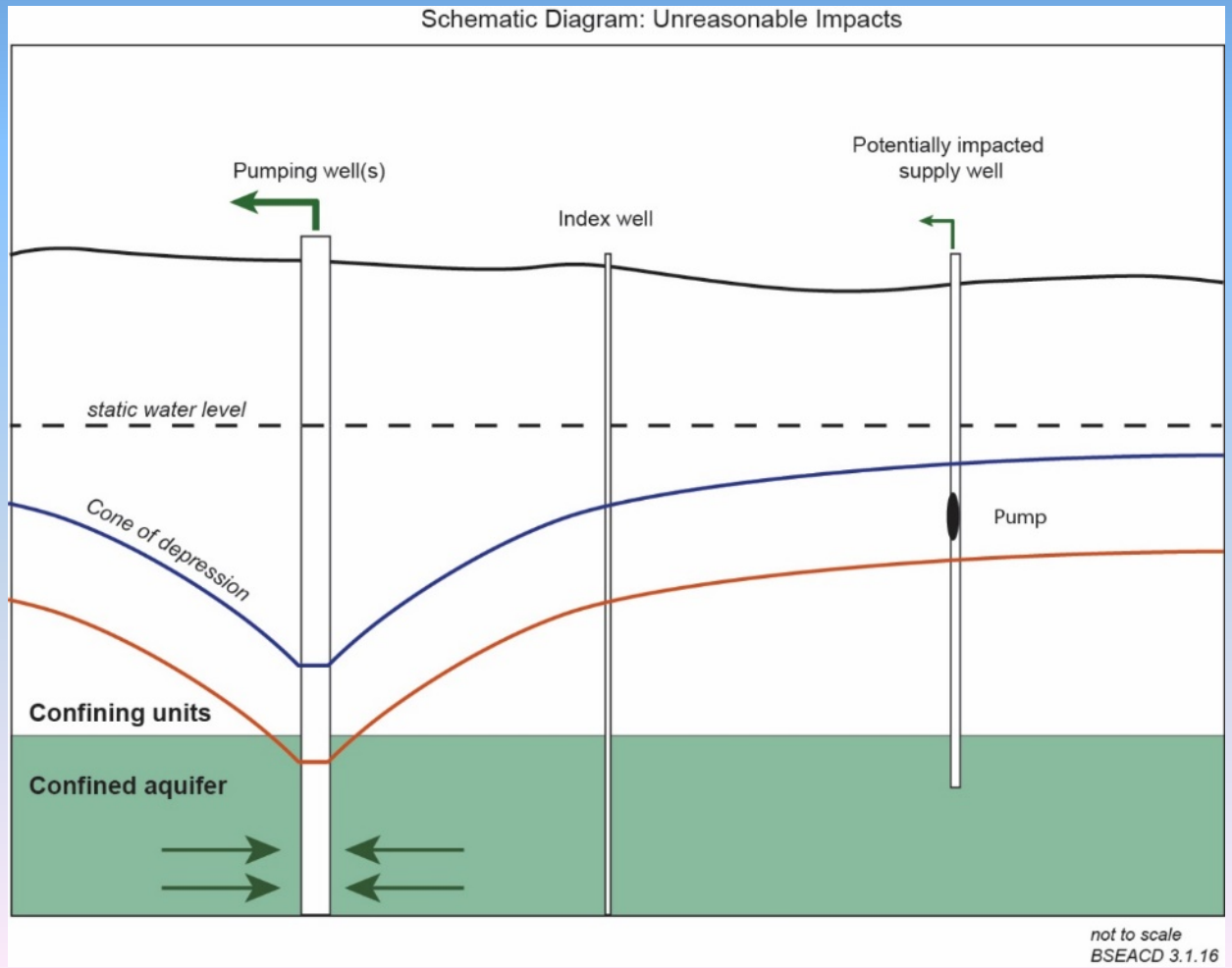
Geological Society of America
South Central Meeting
San Antonio, Texas
March 2017

District Policy

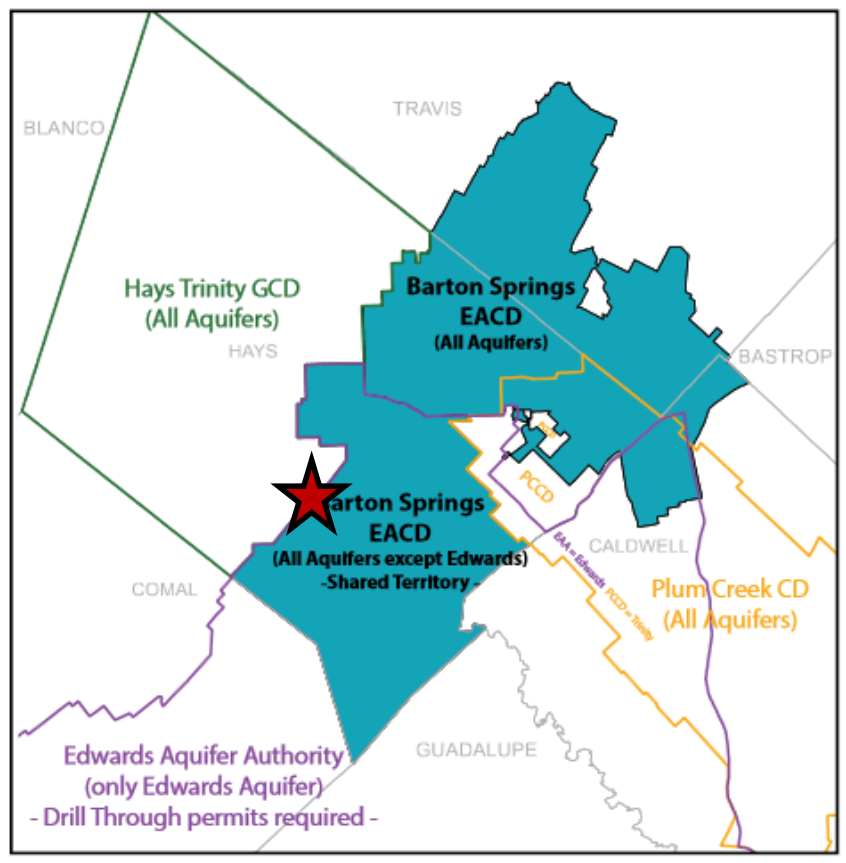
The District seeks to manage total groundwater production on a long-term basis <u>while avoiding the occurrence of unreasonable impacts</u>.



Challenge: How do we assess the potential impacts of pumping for permitting purposes?

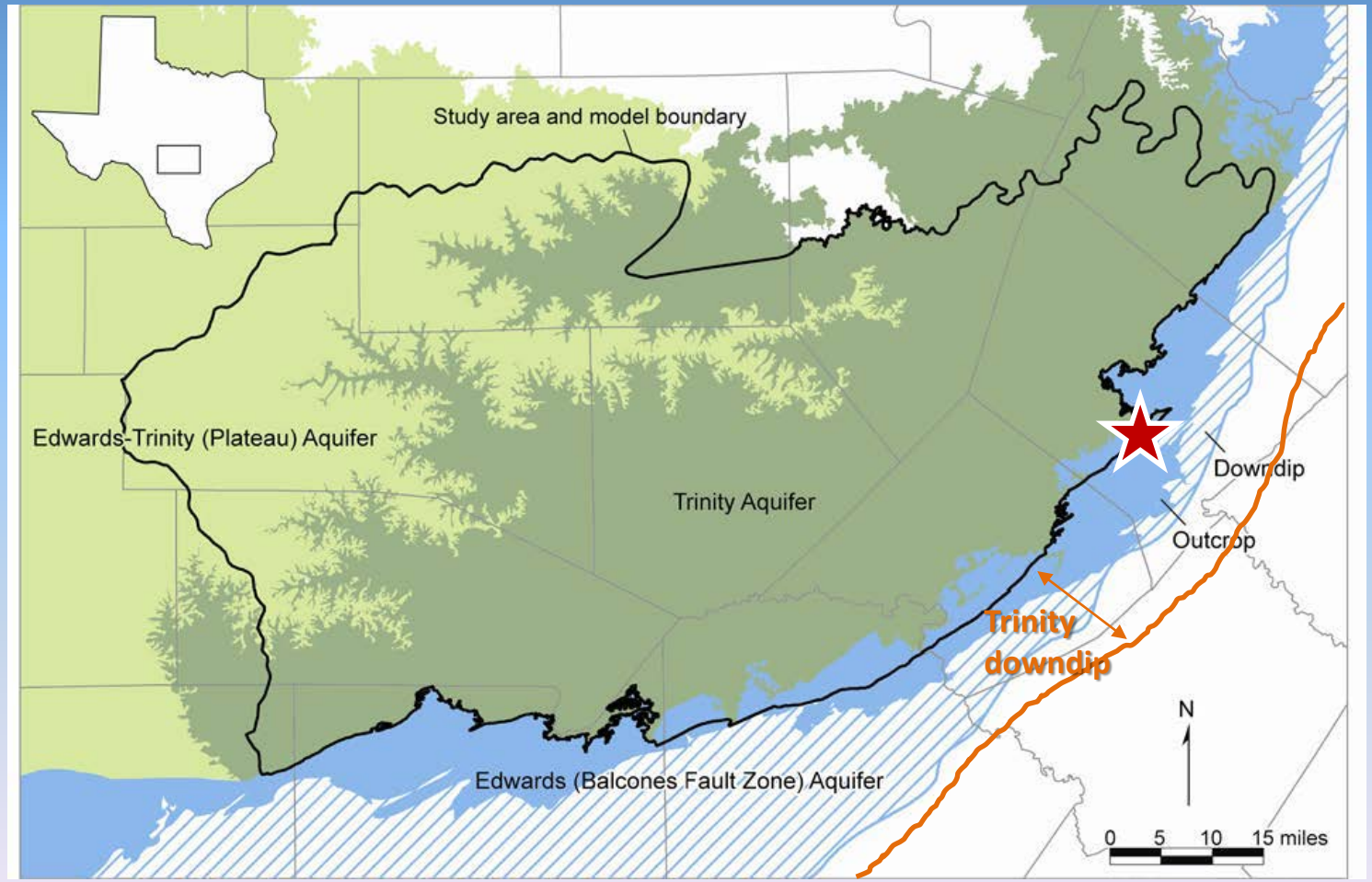


Example



- First large permit request following HB 3405 and consideration of “unreasonable impacts”
- Middle Trinity Irrigation Well
- Requesting 887 acre-feet/year (550 gpm equivalent)

Major Aquifers



TWDB Report 377,
Jones et al., 2011, modified from
Mace et al, 2000

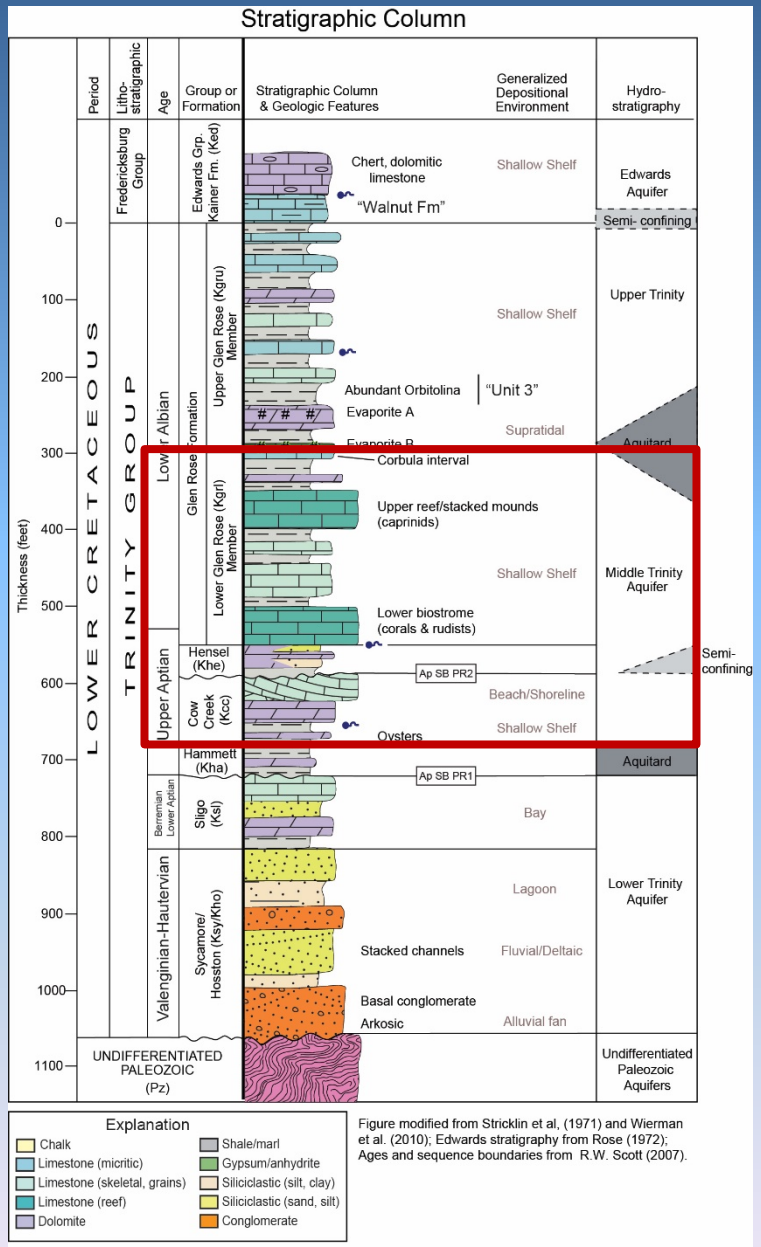


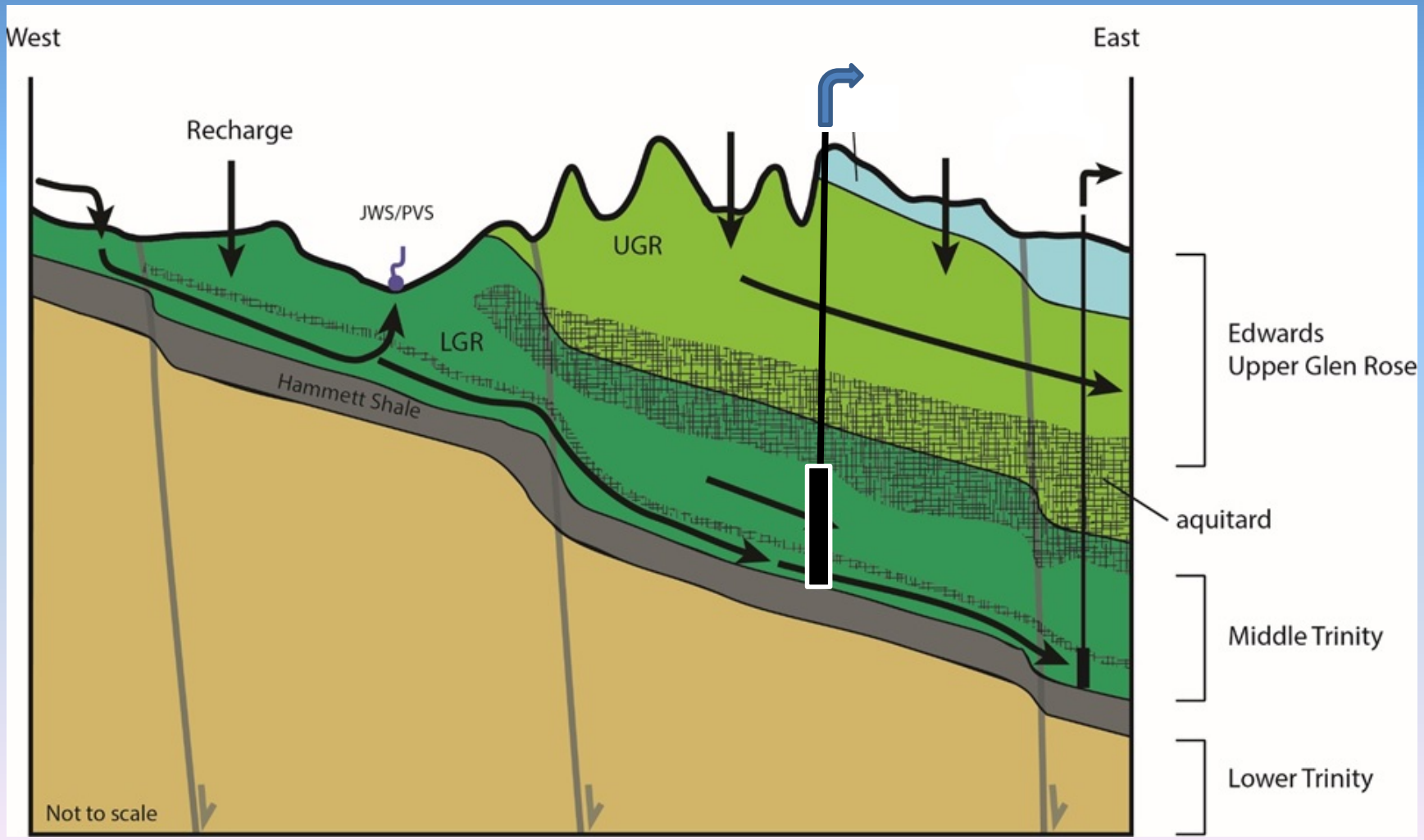
Figure modified from Stricklin et al, (1971) and Wierman et al. (2010); Edwards stratigraphy from Rose (1972); Ages and sequence boundaries from R.W. Scott (2007).

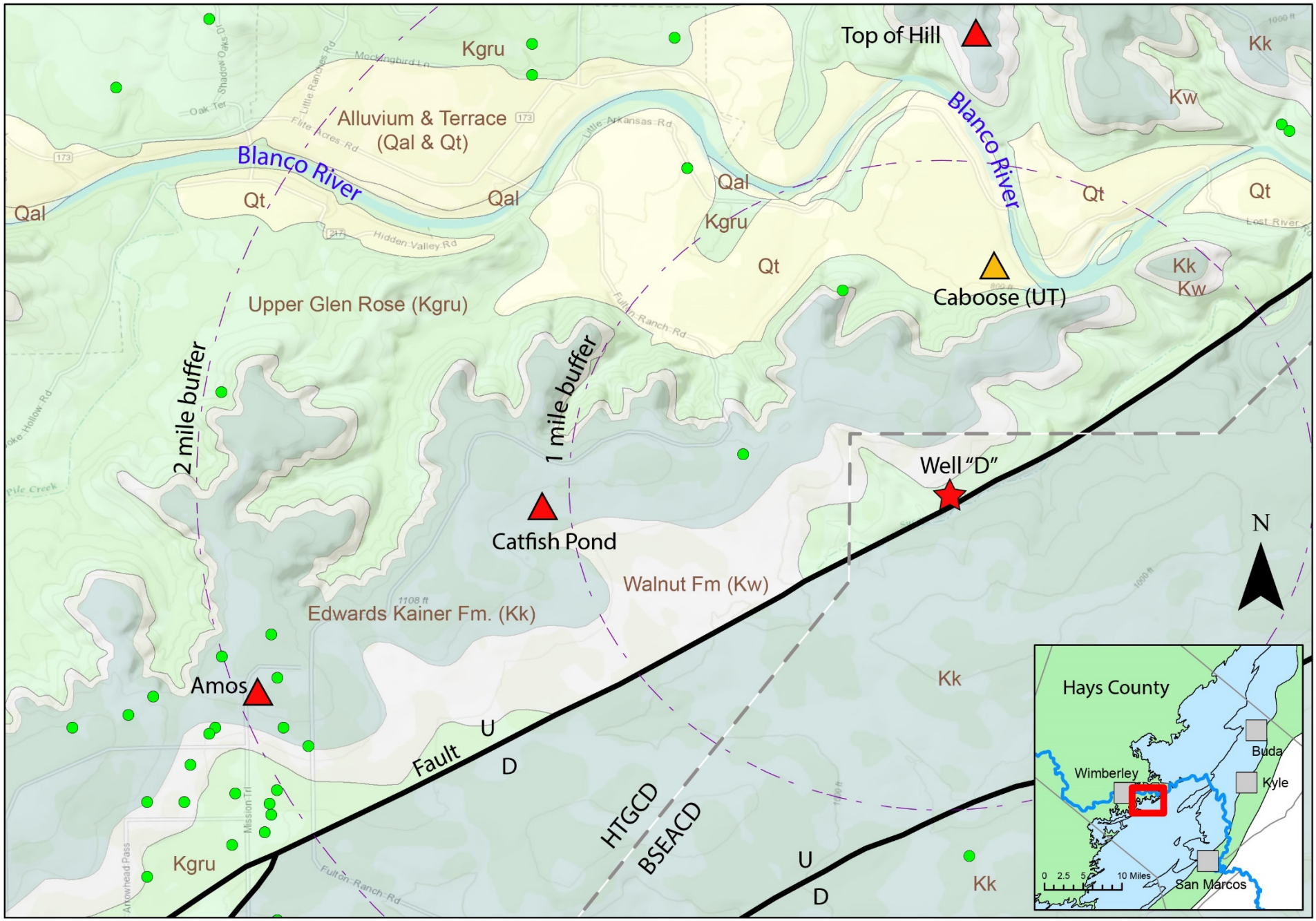
Hydrostratigraphy

Middle Trinity Aquifer

- Lower Glen Rose
- Hensel
- Cow Creek

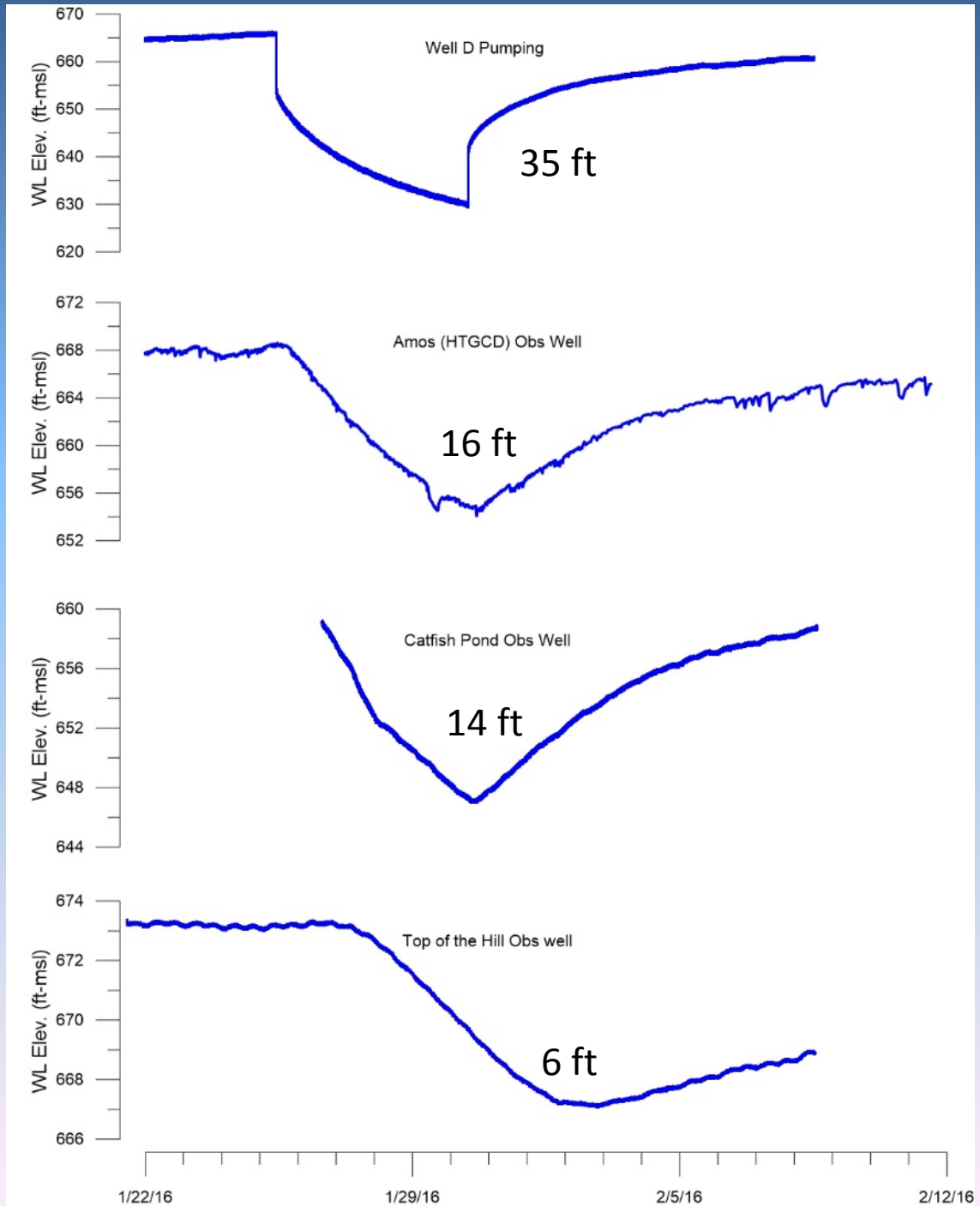
Conceptual Model




Top of Hill
Kk
Kw
Kgru
Alluvium & Terrace
(Qal & Qt)
Blanco River
Qal
Qt
Qal
Qal
Kgru
Qt
Blanco River
Qt
Qt
Caboose (UT)
Kk
Kw
Upper Glen Rose (Kgru)
2 mile buffer
1 mile buffer
Well "D"
Catfish Pond
N
Walnut Fm (Kw)
Edwards Kainer Fm. (Kk)
Amos
Kk
Fault
U
D
HTGCD
BSEACD
U
D
Kgru
Kk
Hays County
Buda
Wimberley
Kyle
San Marcos
0 2.5 5 10 Miles

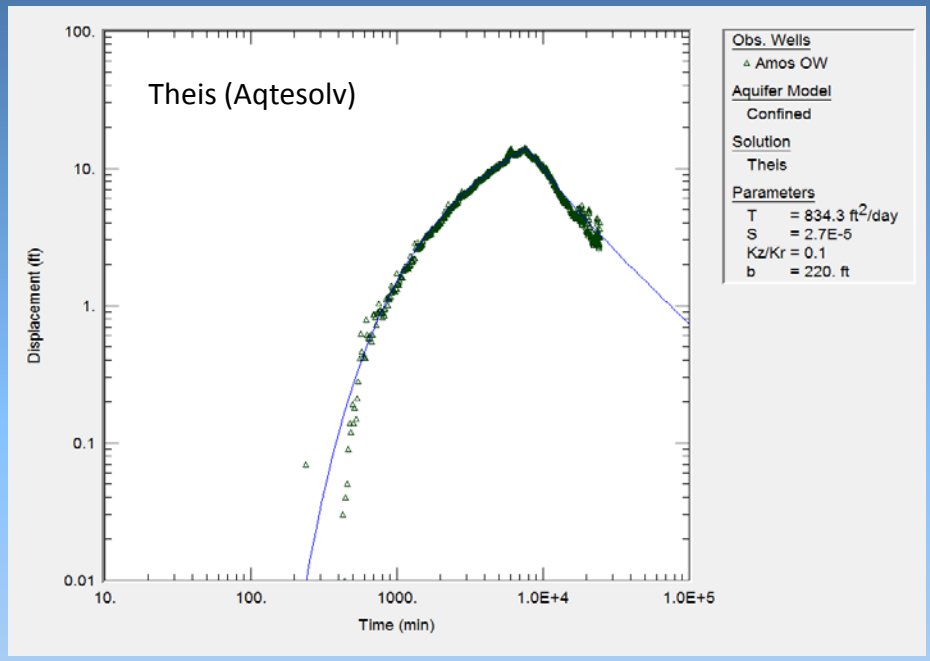
Aquifer Test

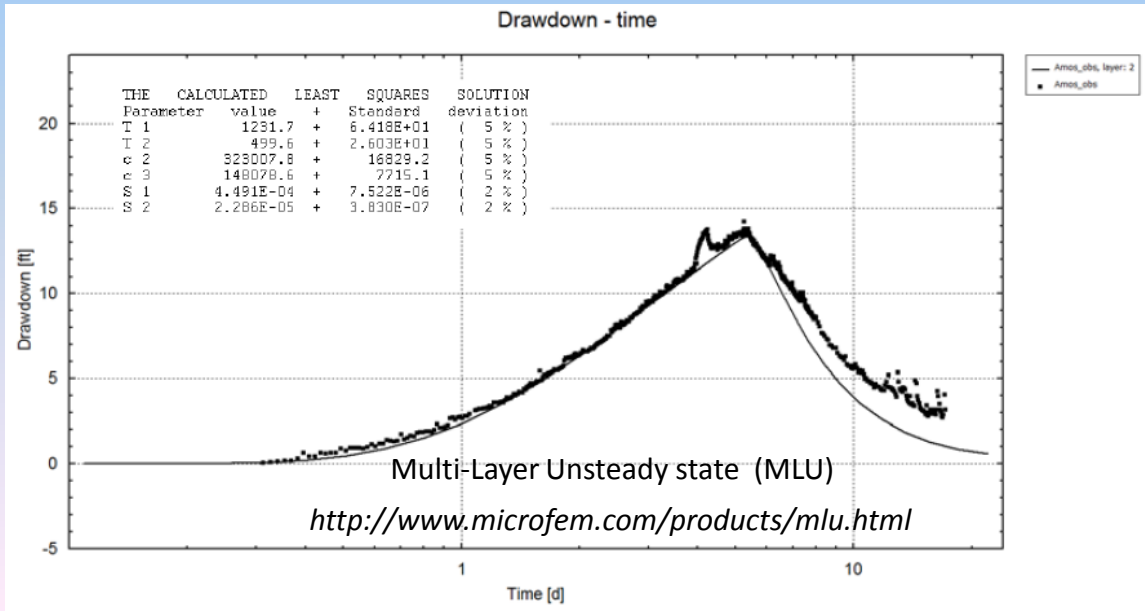
- Aquifer Test
  - Pump 540 gpm
  - 5 days
  - 3 MT obs wells
  - 1 UT obs well
  - Aquifer parameters estimated


Well D Pumping
35 ft
Amos (HTGCD) Obs Well
16 ft
Catfish Pond Obs Well
14 ft
Top of the Hill Obs well
6 ft
WL Elev. (ft-msl)
670
660
650
640
630
620
672
668
664
660
656
652
660
656
652
648
644
674
672
670
668
666
1/22/16
1/29/16
2/5/16
2/12/16

Analytical Models

Well	Average Transmissivity (ft2/d)	Storativity
Well D_PW	744	n/a
Catfish OW	826	9.14e-5
Amos OW	814	2.6e-5
Hill Top OW	786	1.6e-4
Average	793	9.25e-5





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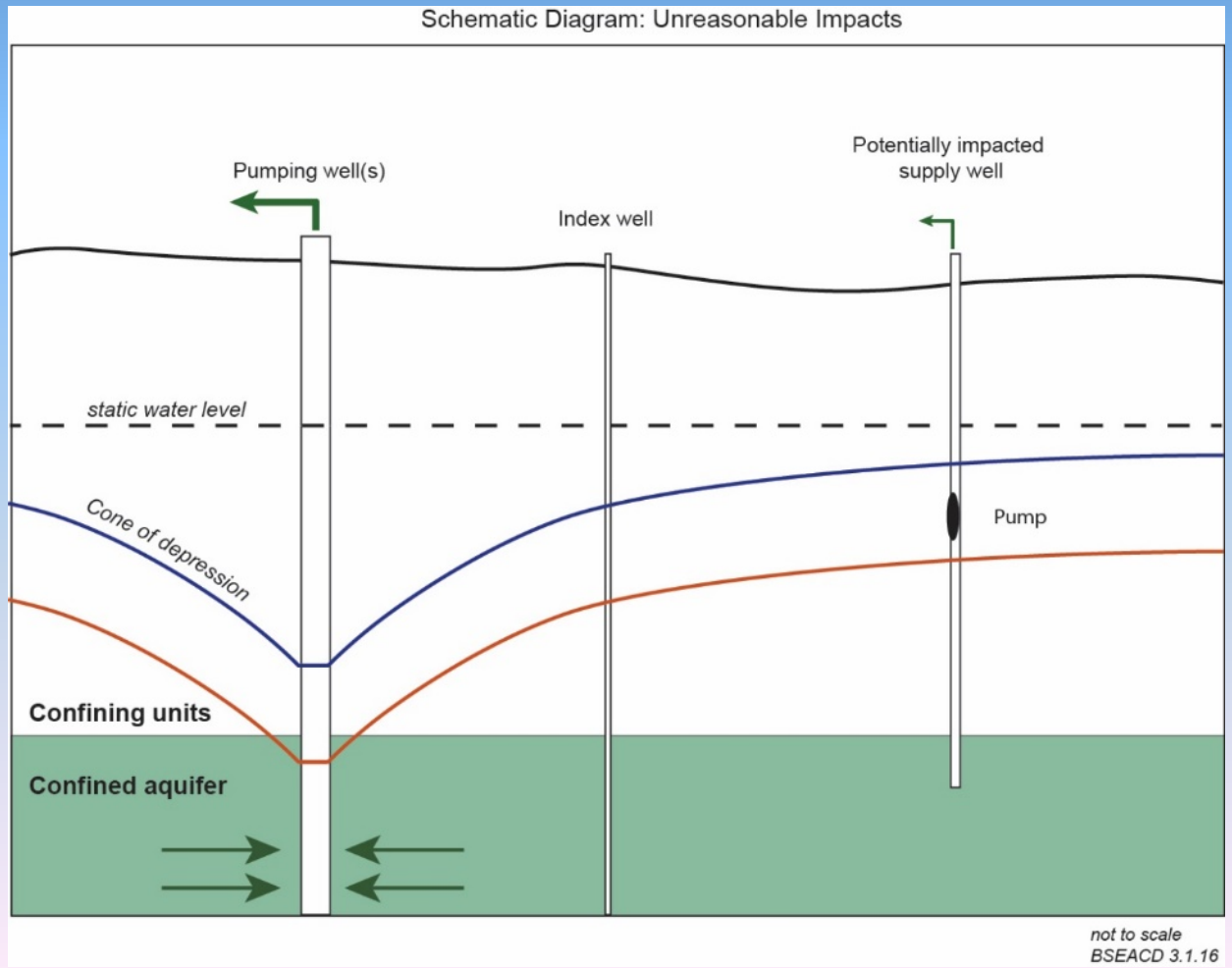

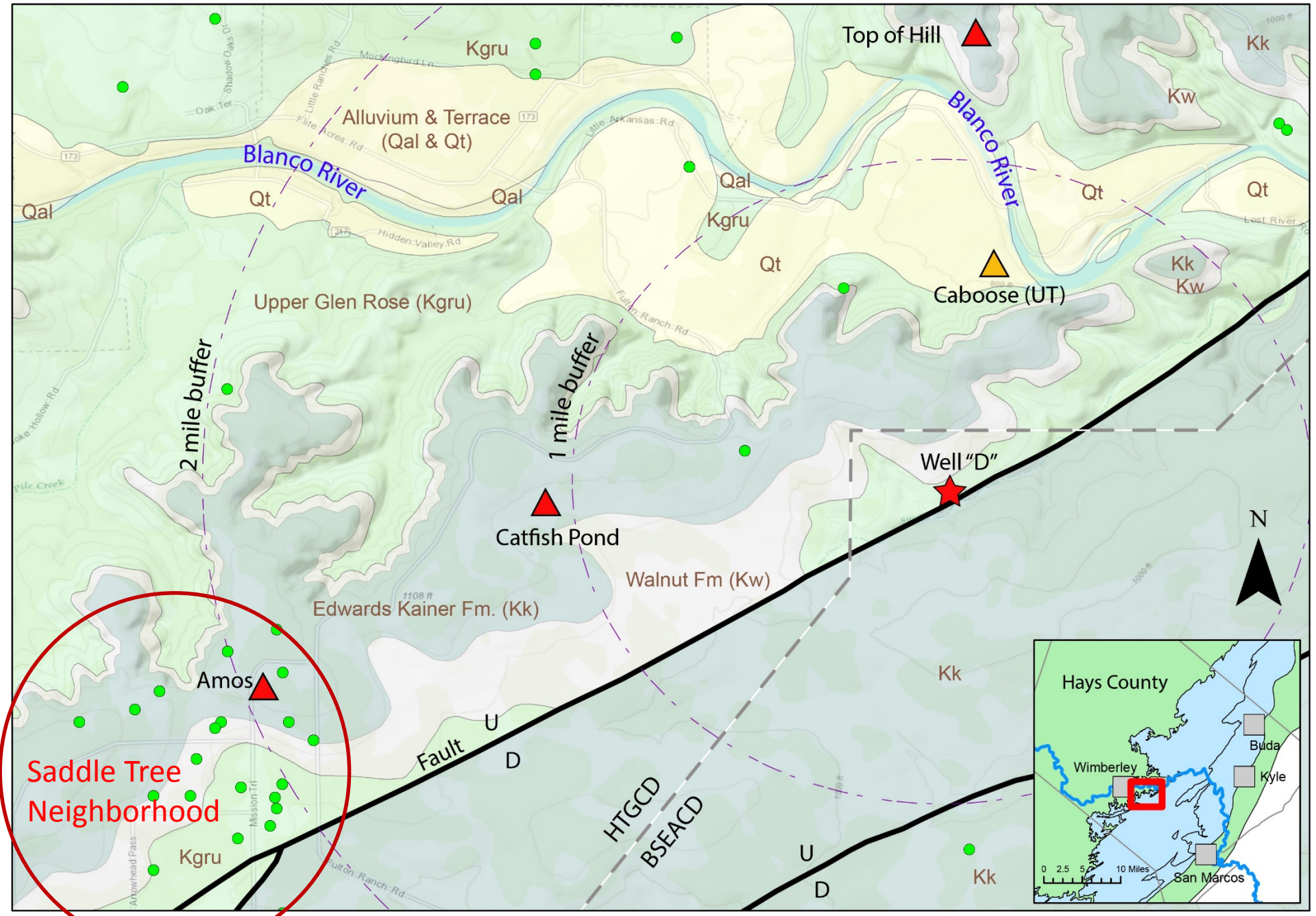
Top of Hill
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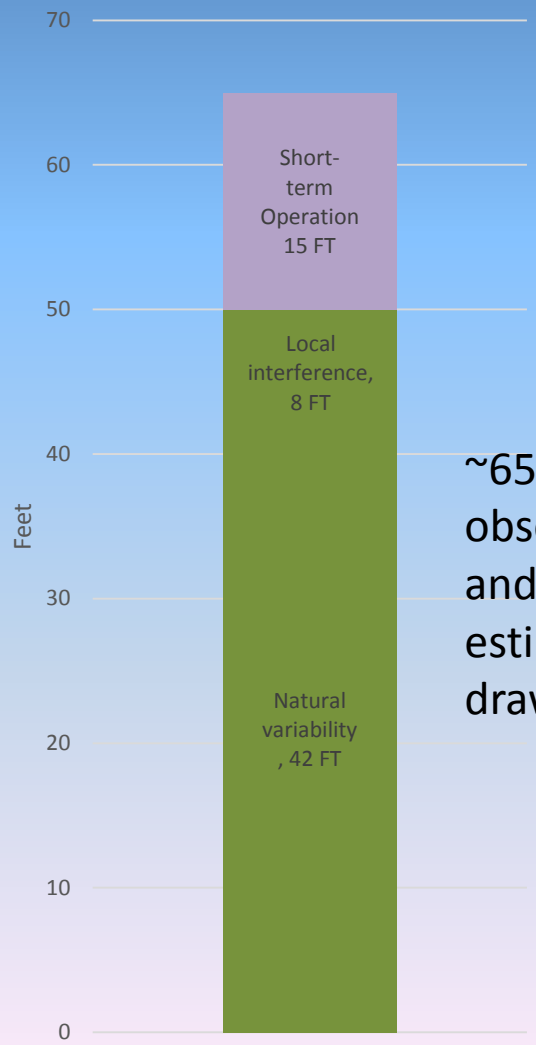
D
HTGCD
BSEACD
U
D
Kgru
Kk
Hays County
Buda
Wimberley
Kyle
San Marcos
0 2.5 5 10 Miles

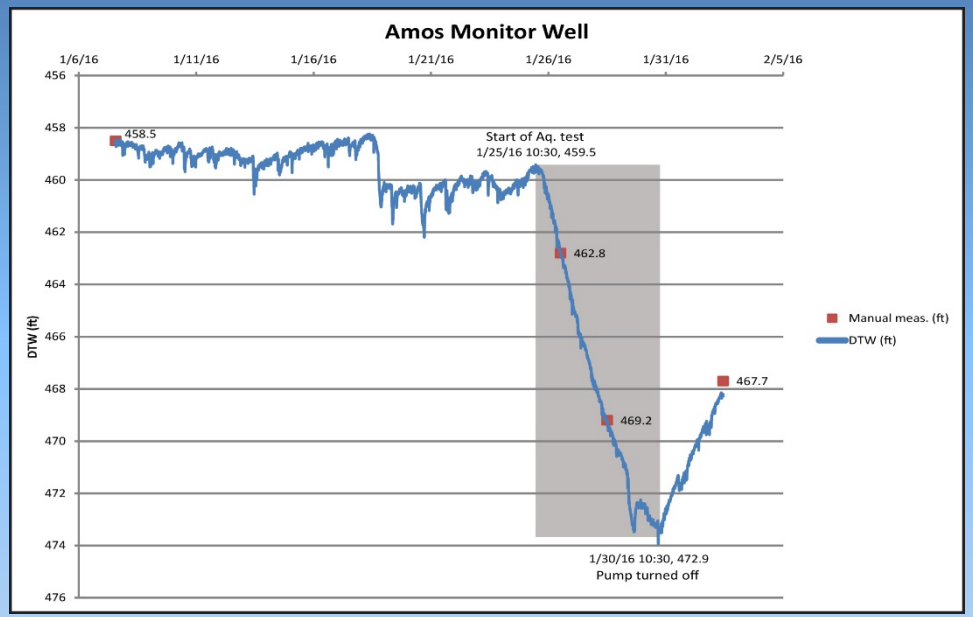
Approach: Index Well

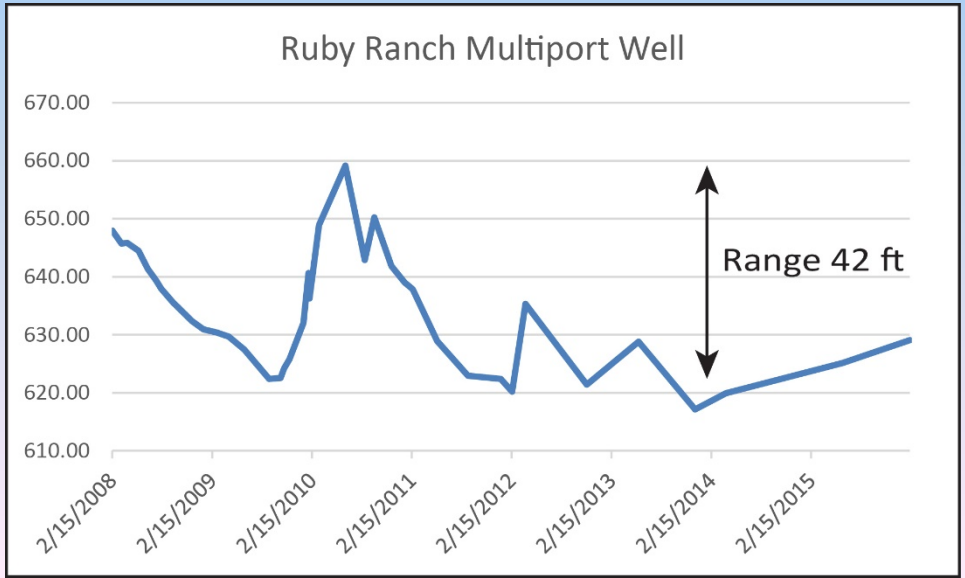
- Estimate drawdown for area of concern represented by an index well.
- Is there potential for unreasonable impact?
  - Well interference?
  - Dewatering of the Middle Trinity aquifer?
- If so, establish “compliance levels” in an index or sentinel well to avoid impacts.

Components of Drawdown



~65 ft observed and estimated drawdown





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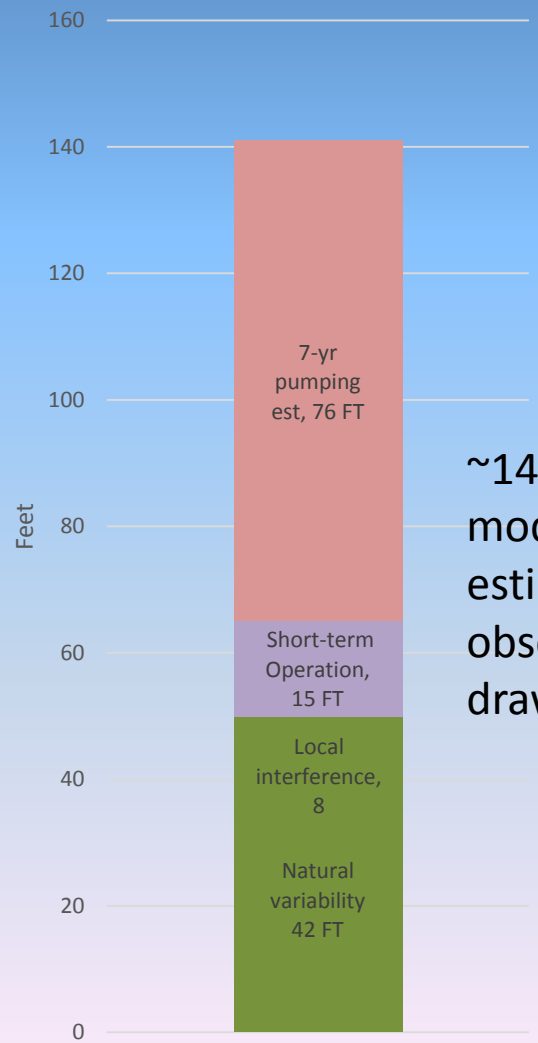
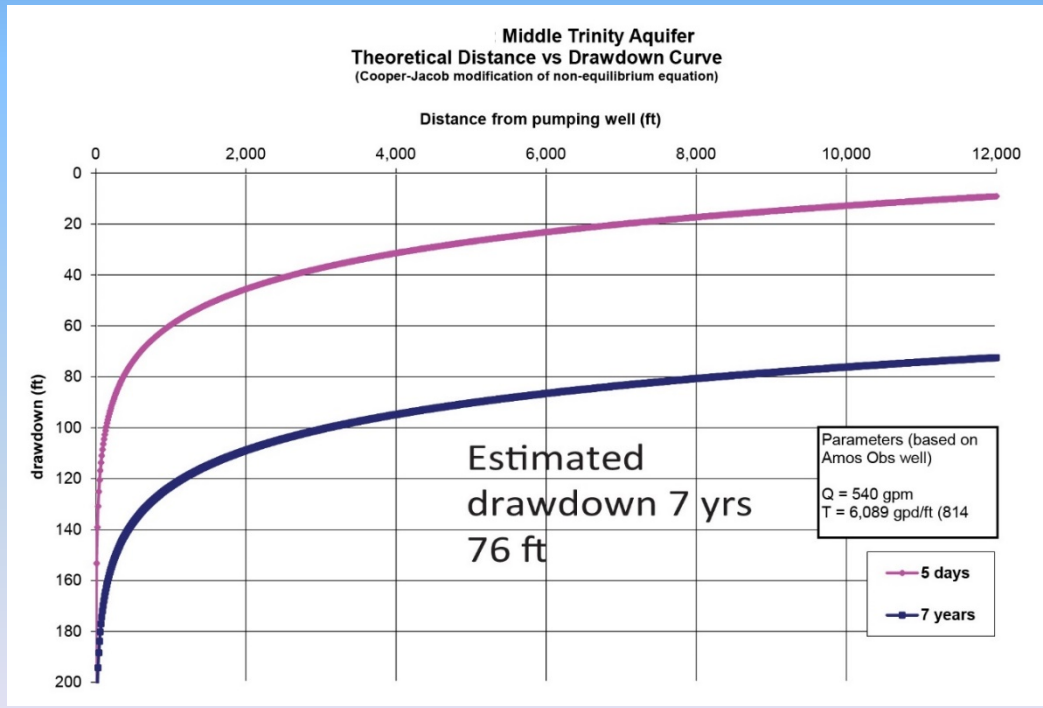
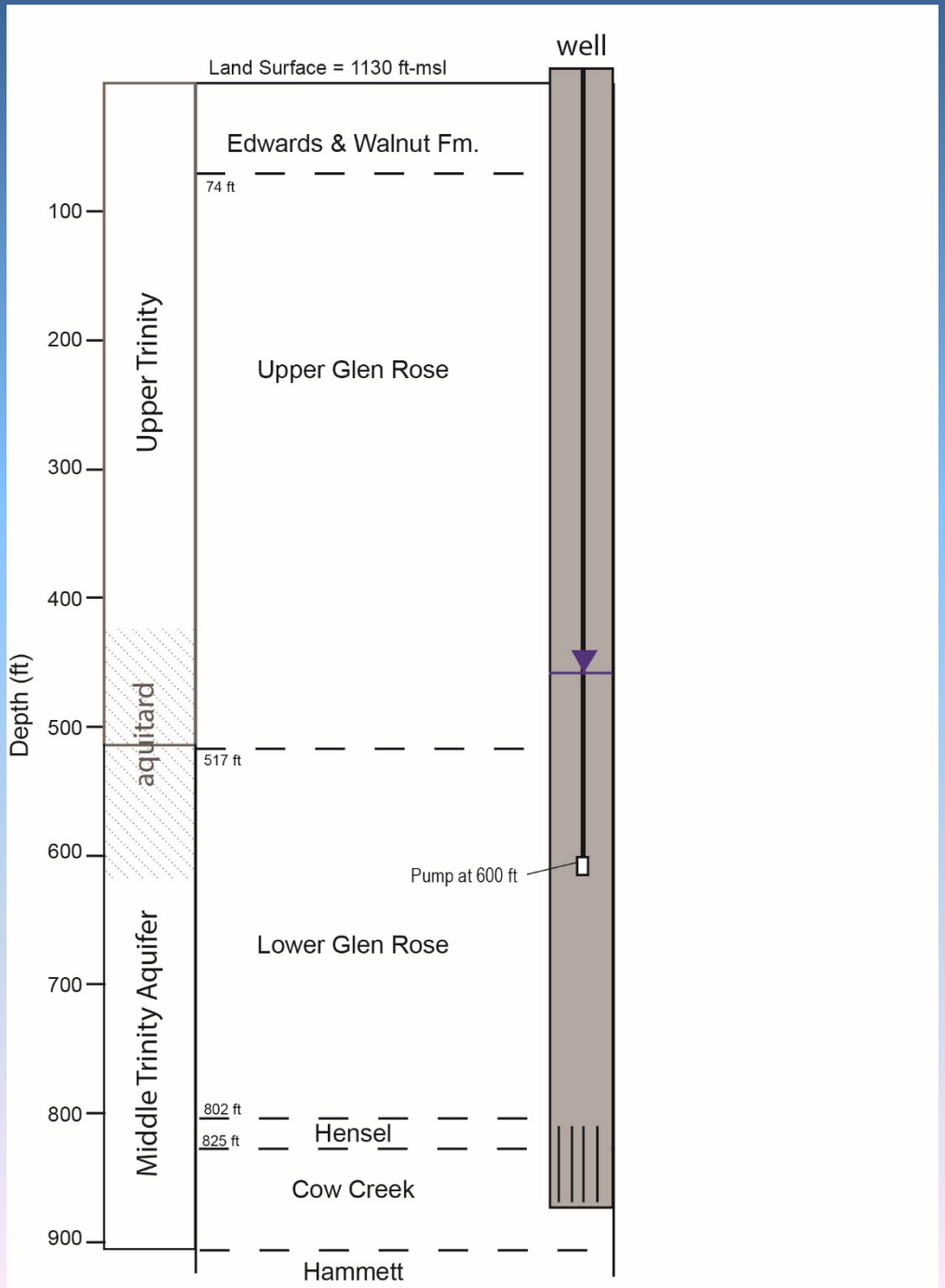


~140 ft modeled + estimated + observed drawdown

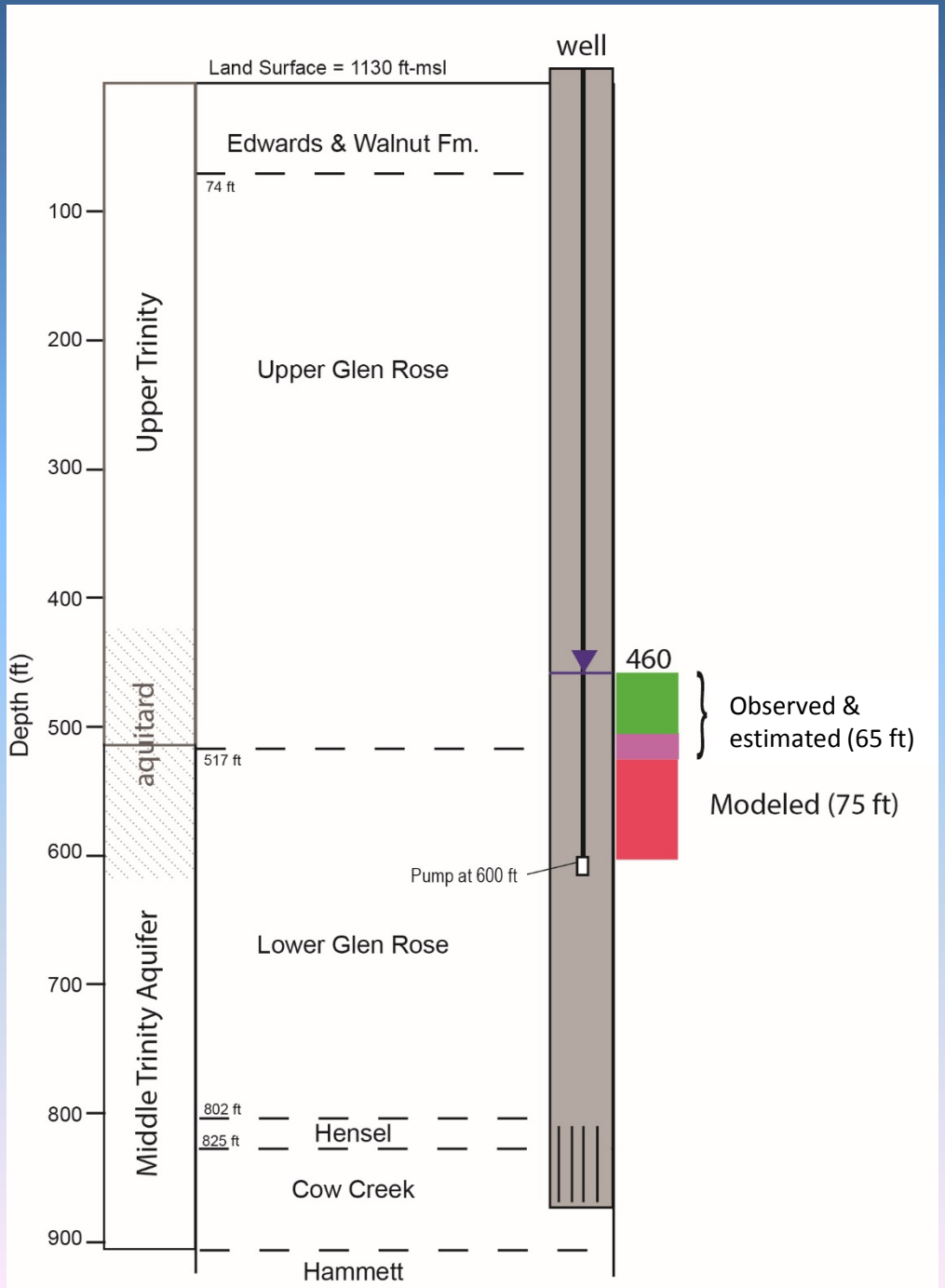




Index Well

Selected the Amos Observation well to be an index well.

Assumed to be representative of wells for the area of concern.



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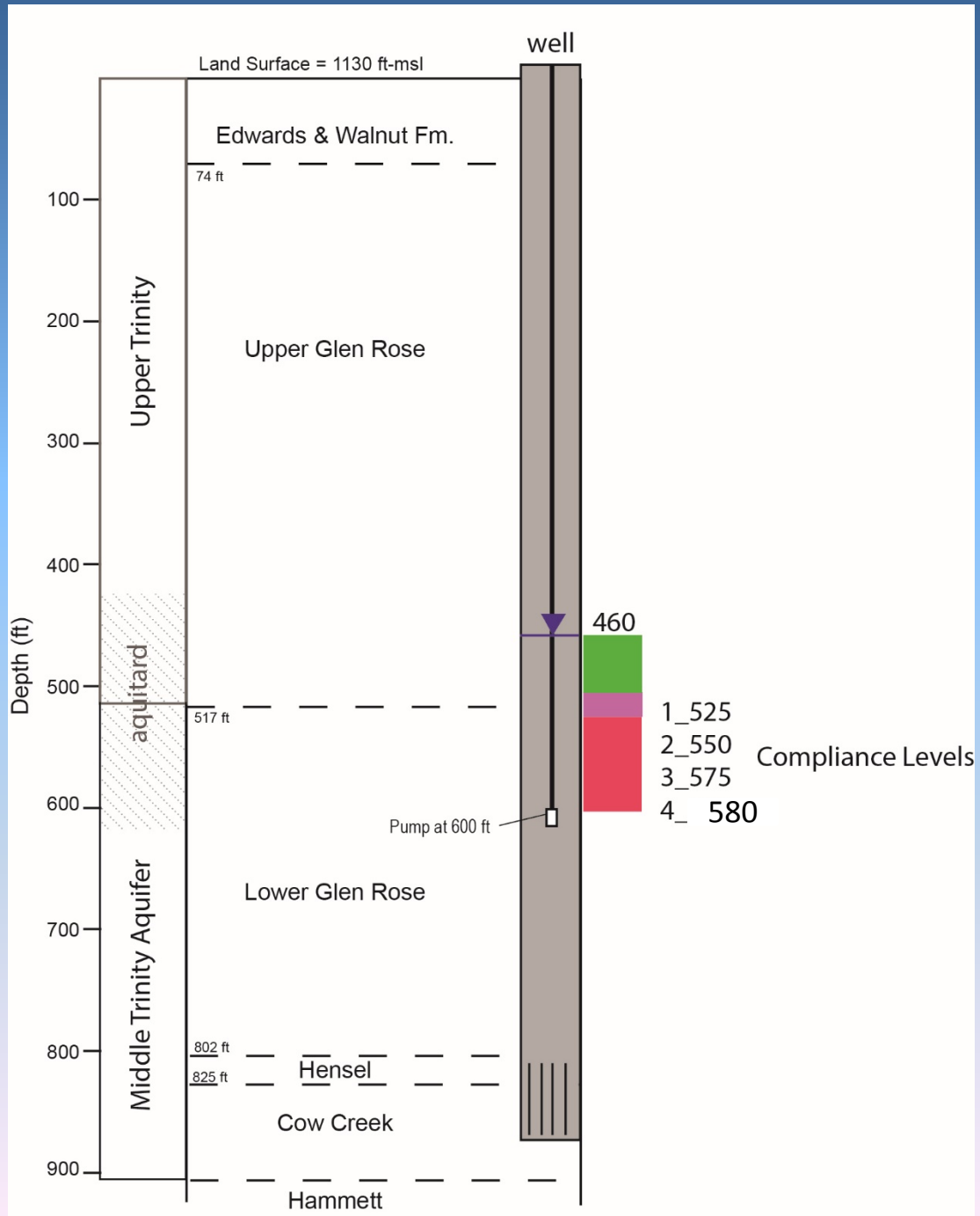


Index Well

Establish <u>compliance levels</u> in well to:

1. Maintain >20 ft water level above pumps
2. Maintain water level above main water-bearing zone of aquifer

Permitting Approach

Compliance Level	Description	depth to water (ft)	Permit Action
	Reference level	460	none
1	Evaluation	525	Evaluation of cause only
2	Avoidance Measures	550	Temporary curtailment of 20%
3	Maximum Drawdown Allowable	575	Temporary curtailment of 40%
4	Unreasonable Impact to Existing Wells	580	Temporary curtailment of 100%

Staff recommend approval to the Board with conditions.

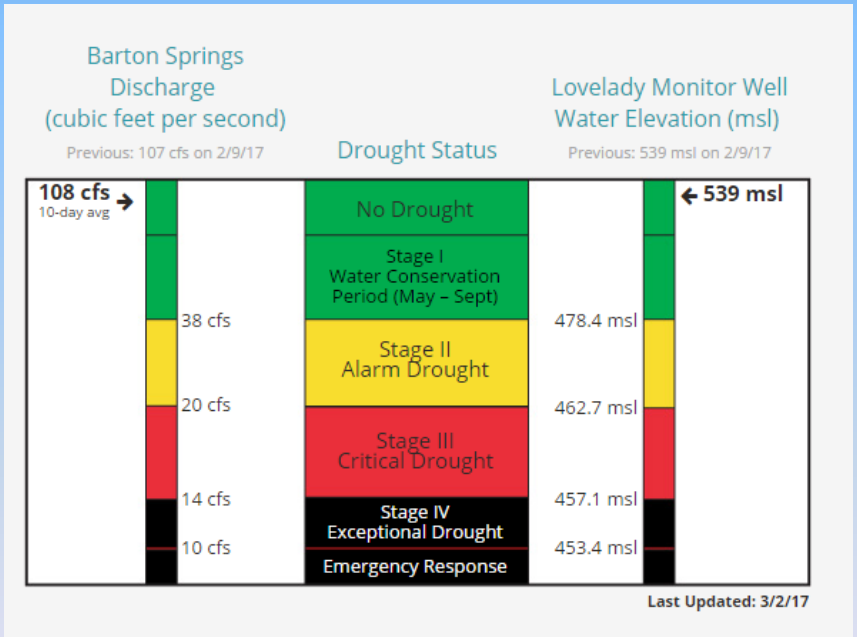
- Considers water level variability and uncertainty in forecasting
- Use data to monitor and compliance levels to trigger permit conditions

Conclusions

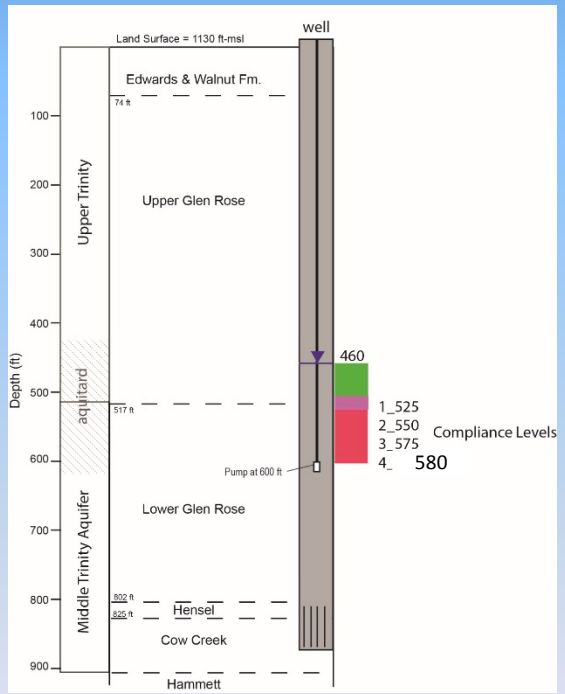
- Approach uses best available science incorporating:
  - Hydrogeology
  - Best tools available to forecast drawdown
- Approach monitors the data and actual impacts.
  - Data-driven approach addresses uncertainty.
- Permit conditions are triggered by levels in an index well to avoid unreasonable impacts.

Analogues?

Drought Trigger



Index Well



Thank You

brianh@bseacd.org

30 years 1987-2017

Barton Springs Edwards Aquifer CONSERVATION DISTRICT