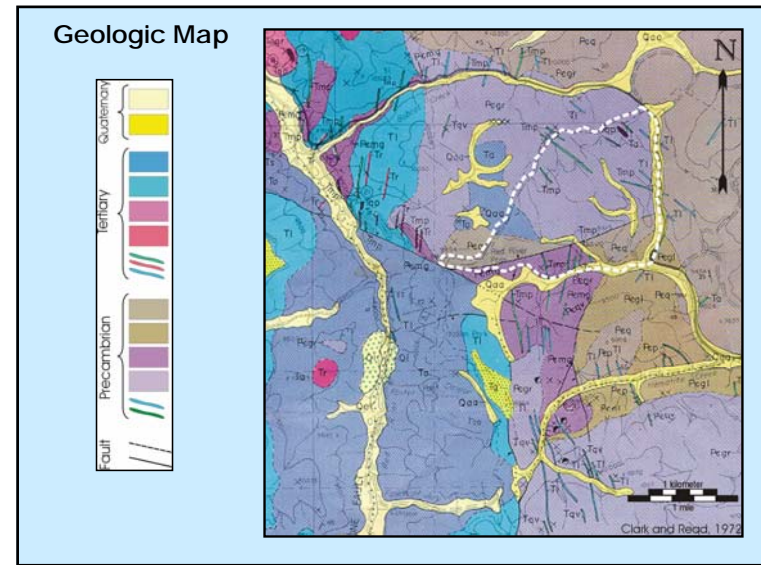
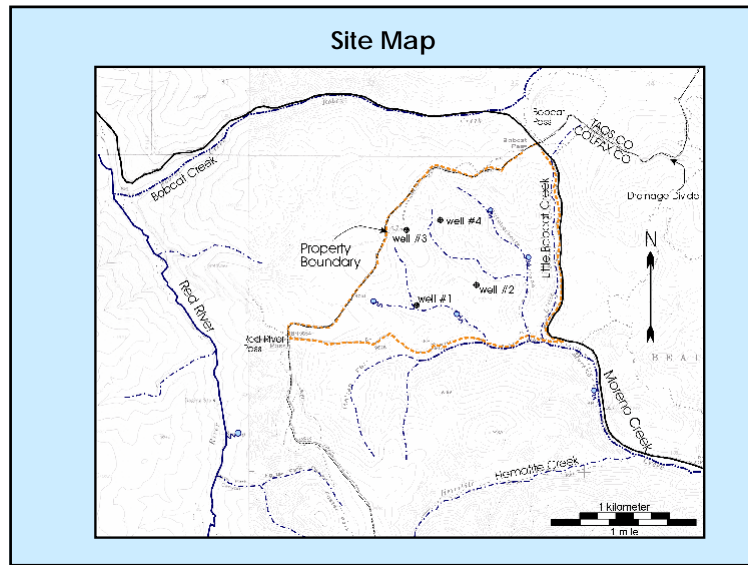
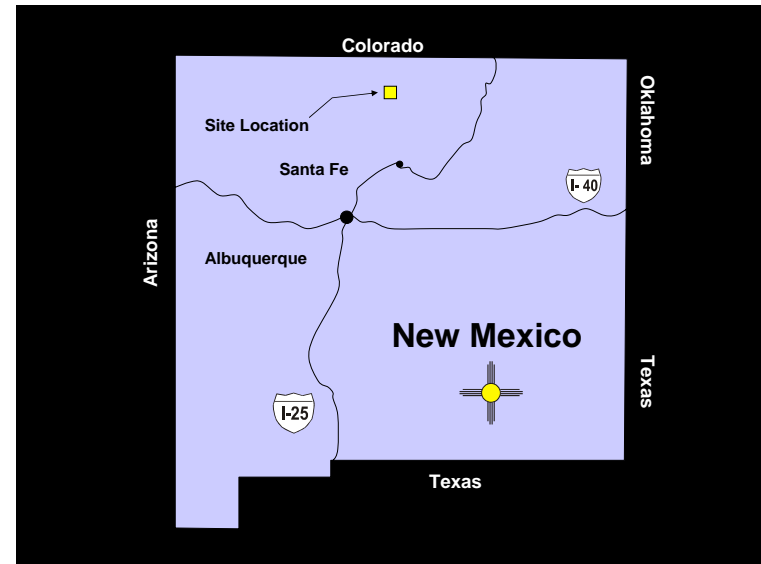


Groundwater – surface water communication in fractured crystalline bedrock aquifer near Red River Pass, Colfax County, New Mexico



Meghan Hodgins, Jay Lazarus, and Mustafa Chudnoff



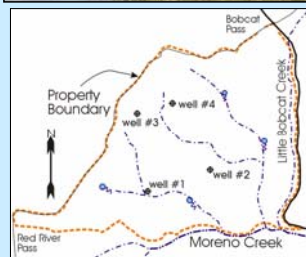
Fault and Fracture Patterns



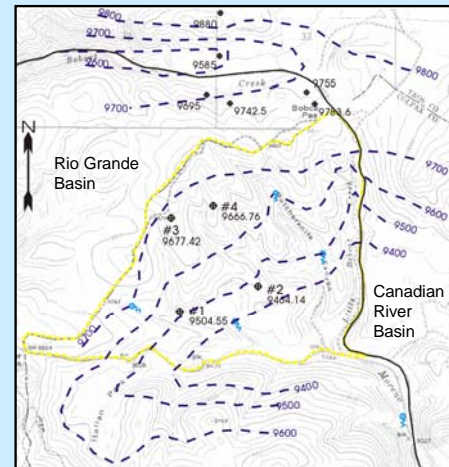
Increasing fracture density



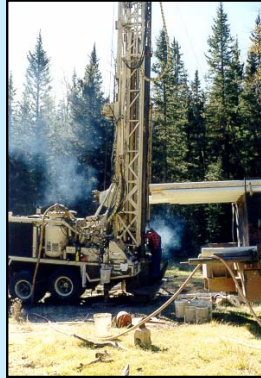
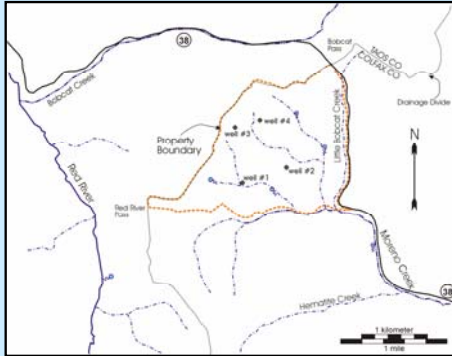
On-site Springs



Groundwater Elevation Contour Map



Well Sites and Drilling

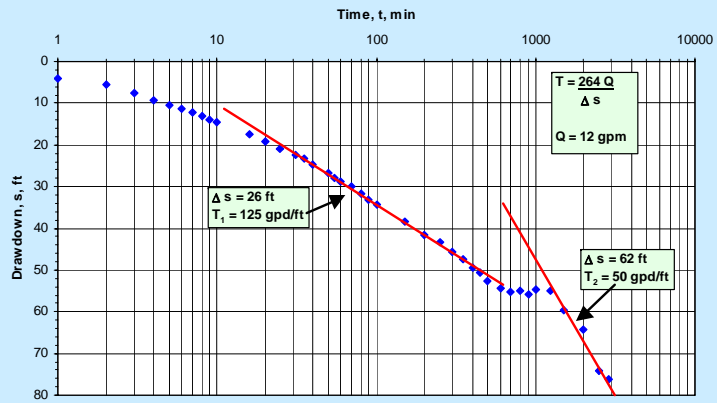


Pumping Tests

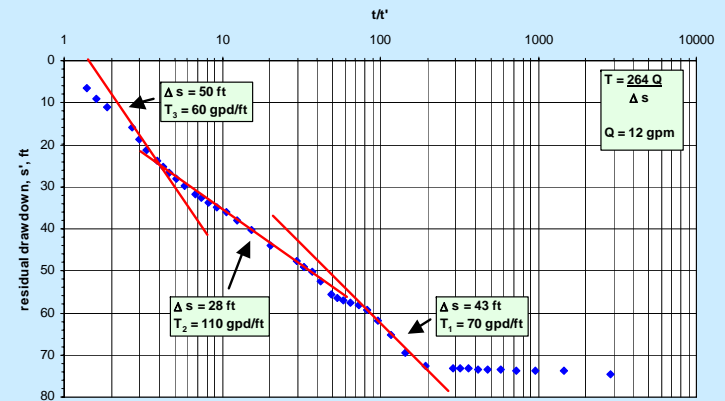
Well #	Depth to water	Total Depth	Test Duration	Test Q, gpm	Late T _r , gpd/ft	S (Theis calc.)
1	15.45	183	48-hr	12	60	0.04
2	125.86	353	68-hr	43	600	0.05
3	172.58	443	7-day	55	800	0.1
4	153.24	408	none	-	-	-



Well #1 48-hour Pumping Test Drawdown

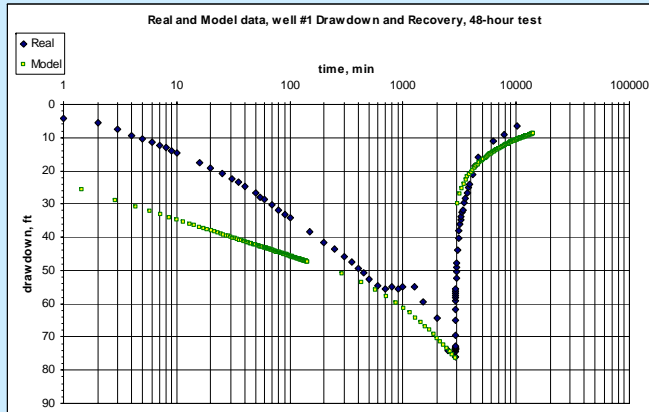


Well #1 48-hour Pumping Test Recovery

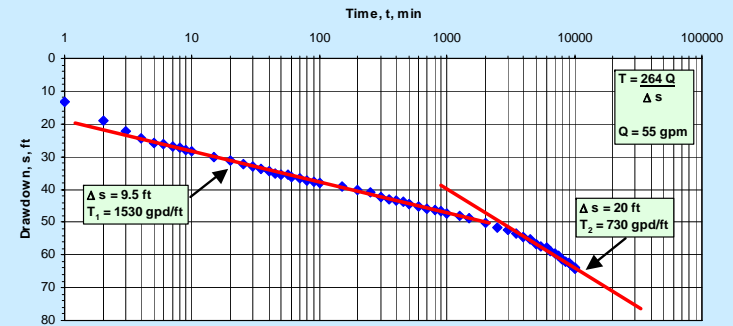


Theis Pumping Test Reconstruction for Well #1

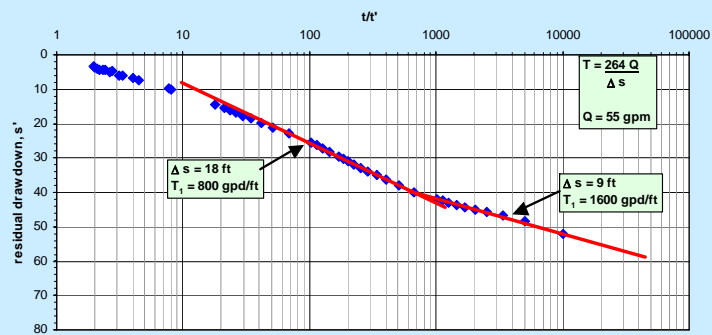
S = 0.04, two no-flow boundaries at a distance of 20 feet from well



Well #3 1-Week Pumping Test Drawdown

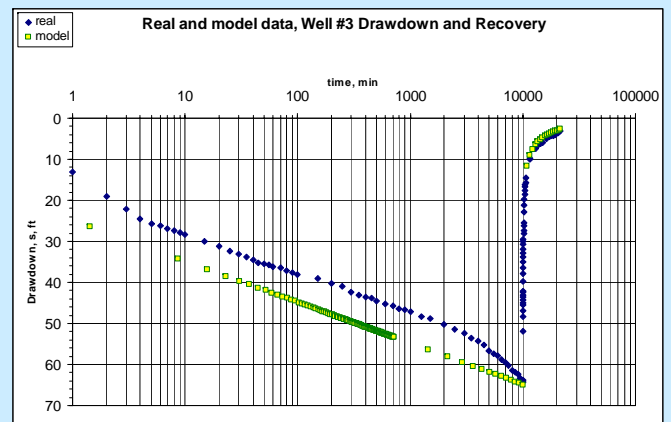


Well #3 1-Week Pumping Test Recovery



Theis Pumping Test Reconstruction for Well #3

S = 0.1, no boundaries included

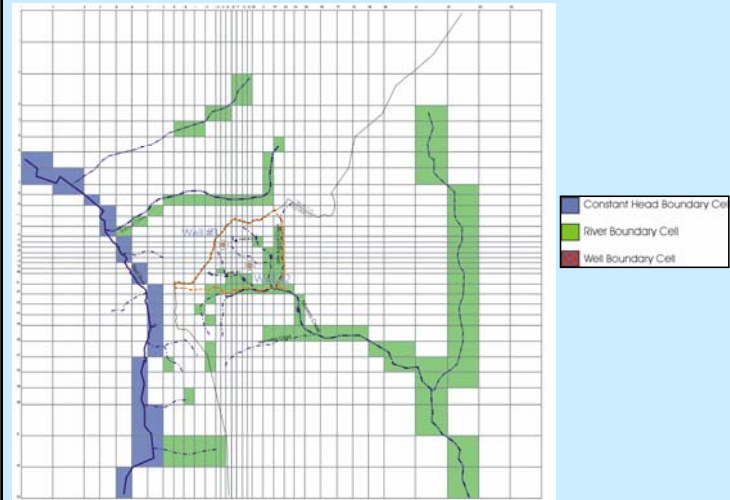


Pumping Tests

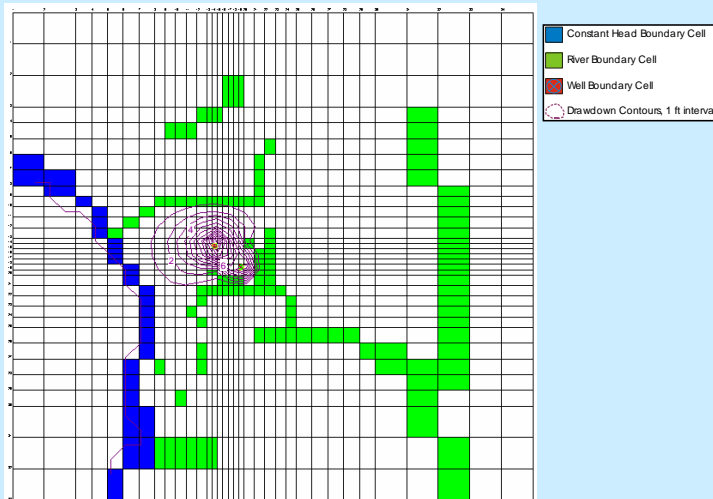
Well #	Depth to water	Total Depth	Test Duration	Test Q, gpm	Late T, gpd/ft	S (Theis calc.)
1	15.45	183	48-hr	12	60	0.04
2	125.86	353	68-hr	43	600	0.05
3	172.58	443	7-day	55	800	0.1
4	153.24	408	none	-	-	-



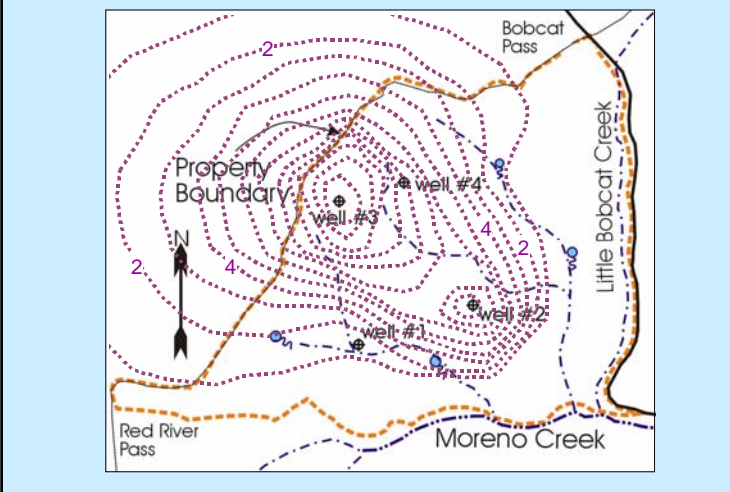
Model Grid



Predicted Groundwater Drawdown after 40 years



Groundwater Drawdown at location of On-site Springs



40-year Predicted Stream Depletions

Total Diversion = 68.1 acre-ft/year

Rio Grande Basin	Canadian River Basin	Groundwater Storage
Red River System	Moreno Creek System	
1138 ft ³ /day	4632 ft ³ /day	2357 ft ³ /day
9.5 acre-ft/year	38.8 acre-ft/year	19.7 acre-ft/year
14%	57%	29%



Pumping Test and Model Conclusions

- Fractured bedrock aquifer capable of producing sufficient water for 68.1 afa development for at least 40 years
- Groundwater – surface water communication supported by equipotential lines connecting well heads and spring elevations
- Groundwater pumping will have to be offset by surface water rights from both Rio Grande and Canadian River Basins
- Significant decrease in on-site spring discharge predicted, possibly dewatering springs

Land Use Implications

- Land use regulations should include calculations for effects on surface and groundwater for at least 100 years, if not longer
- Water rights to offset stream depletions may be required in more than one administrative basin
- The behavior of fractured rock aquifers is less well understood and may include permanent dewatering of fractures and long-term delayed effects

