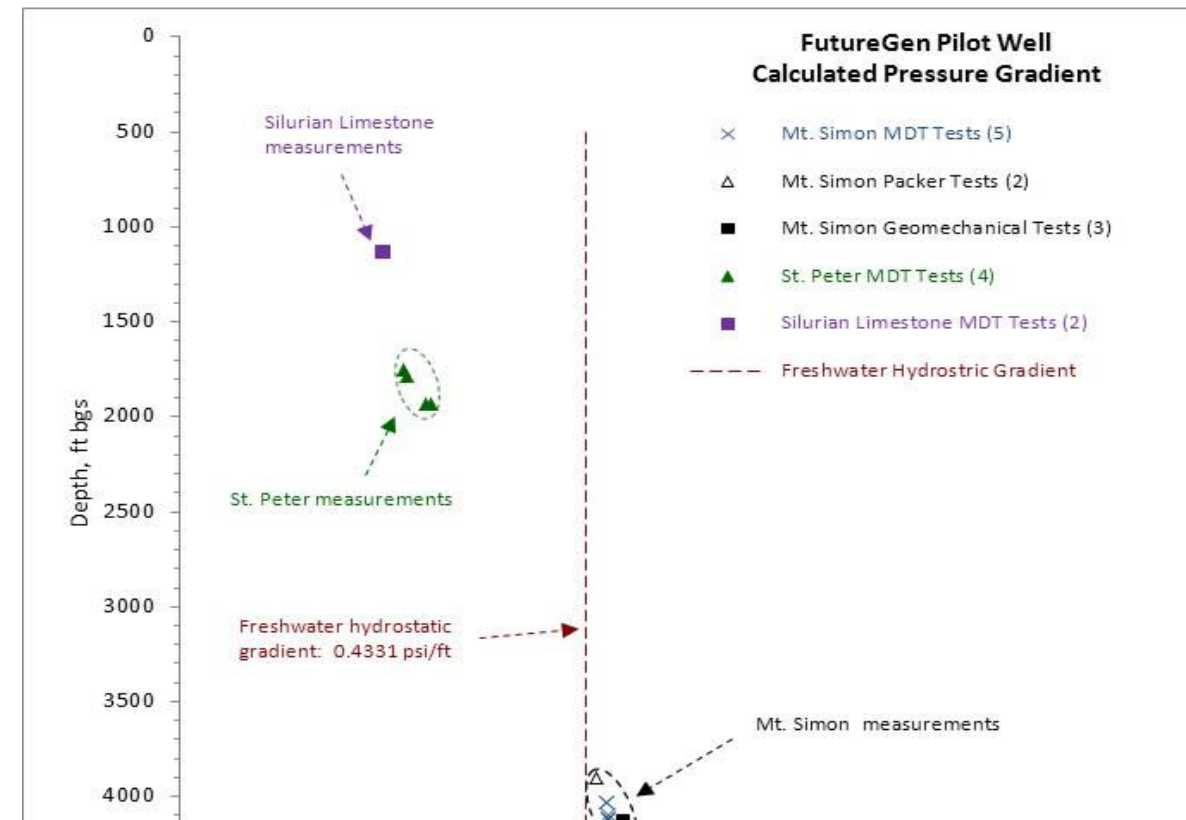
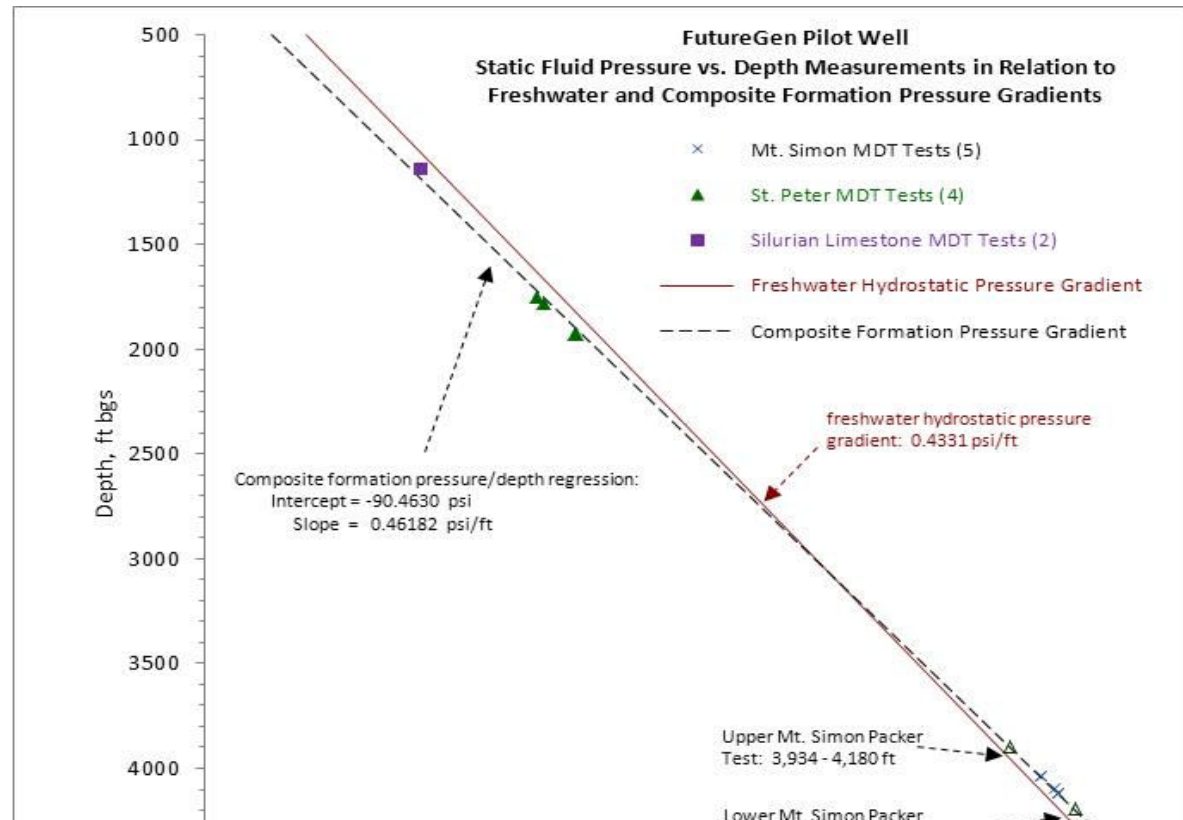
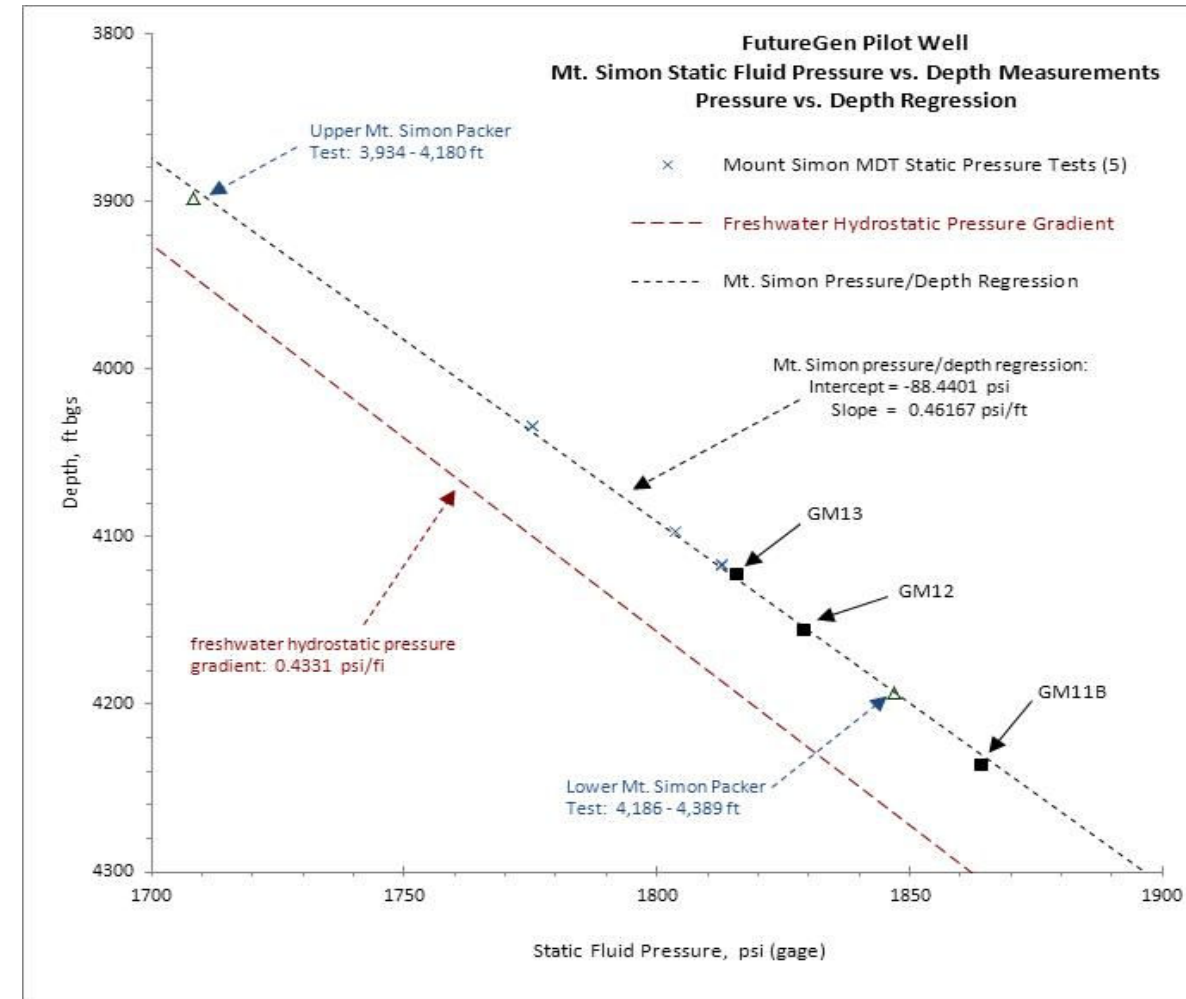
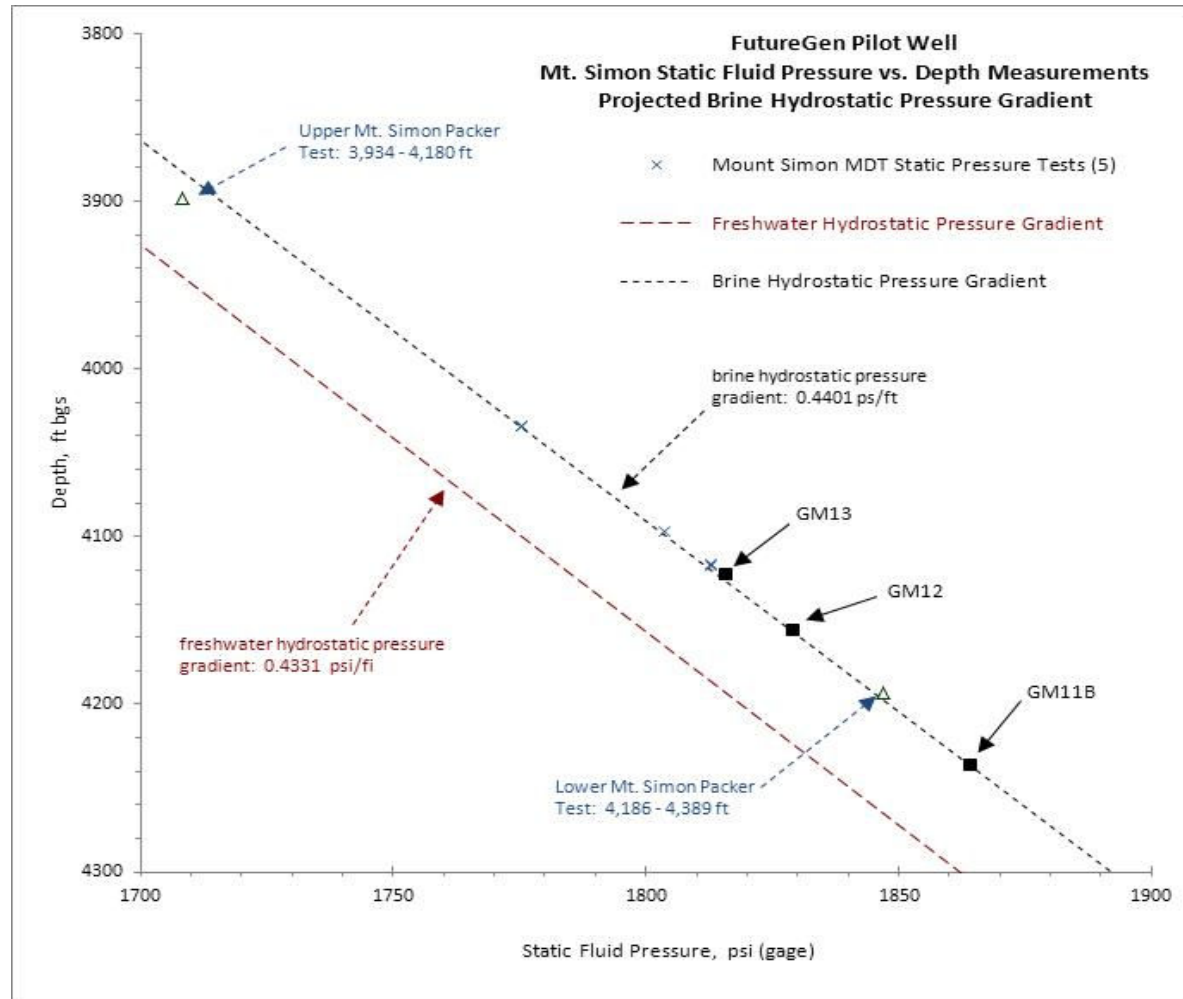
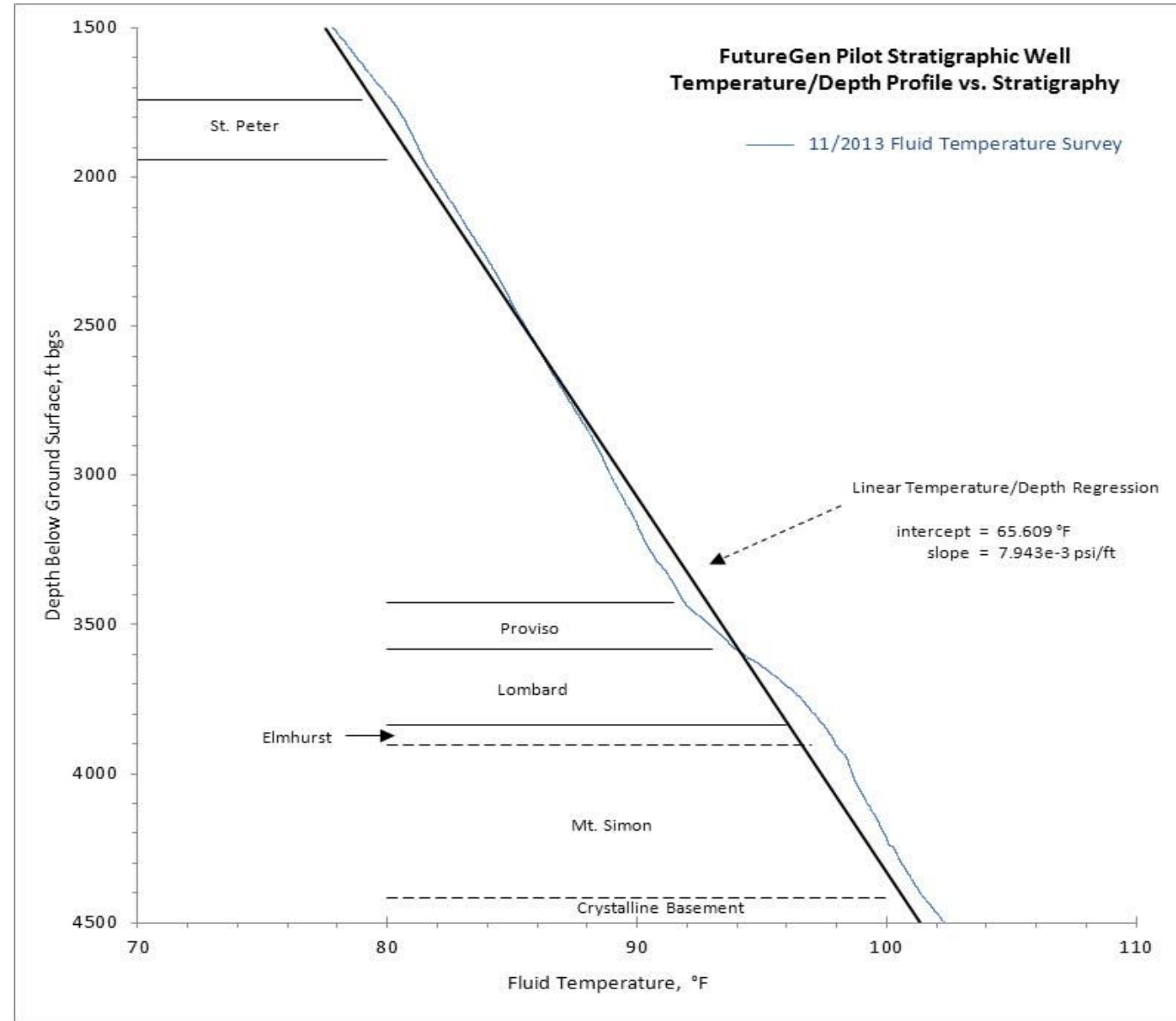
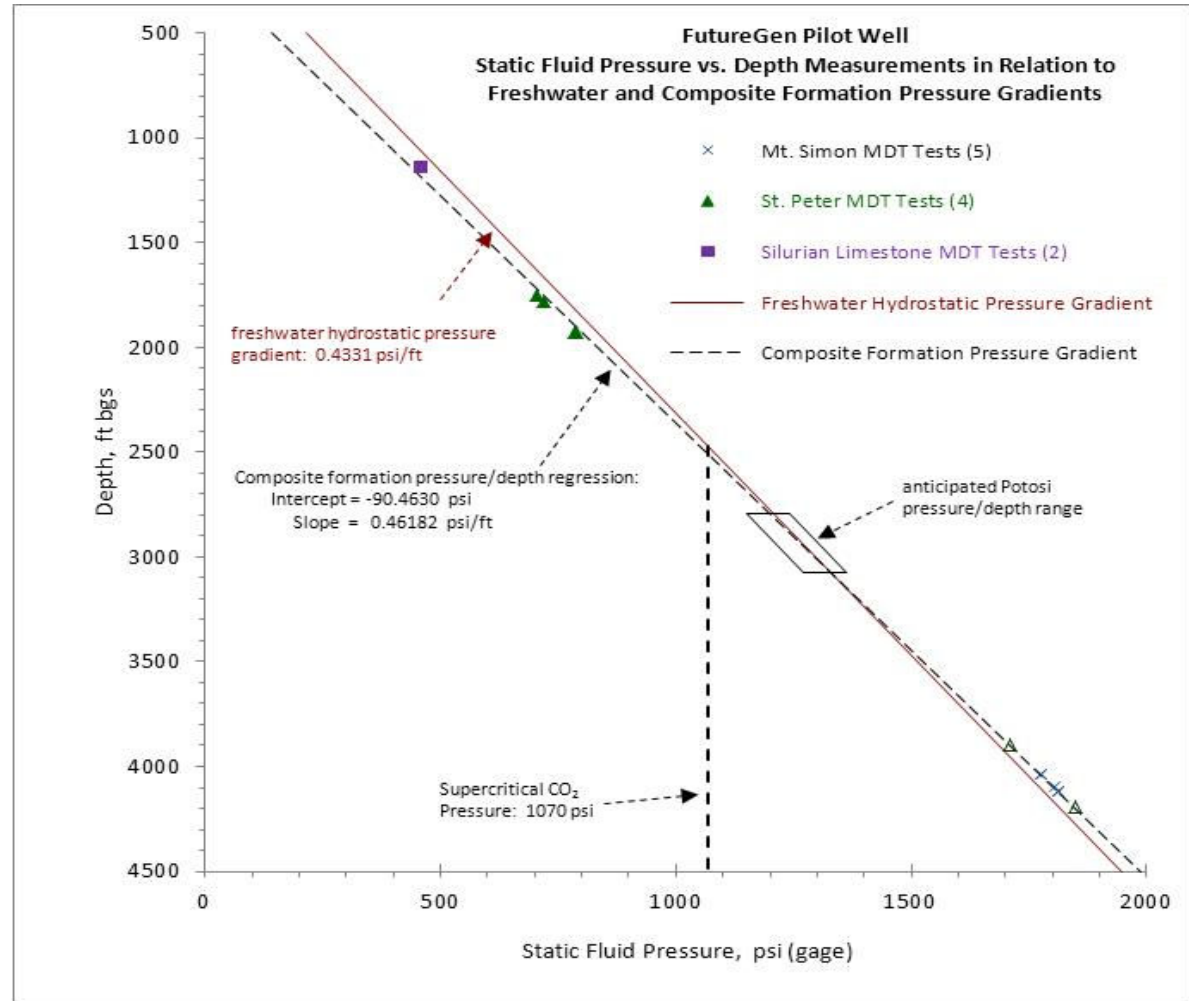
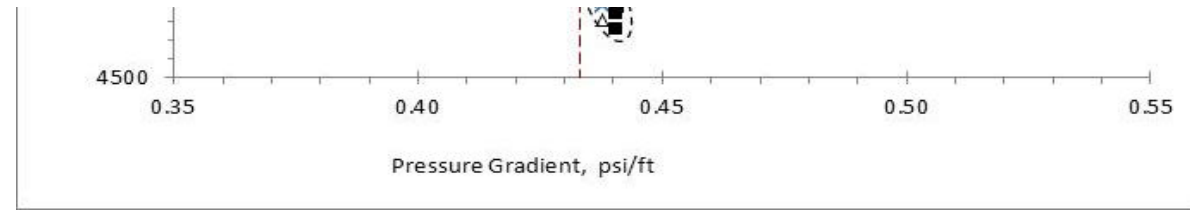
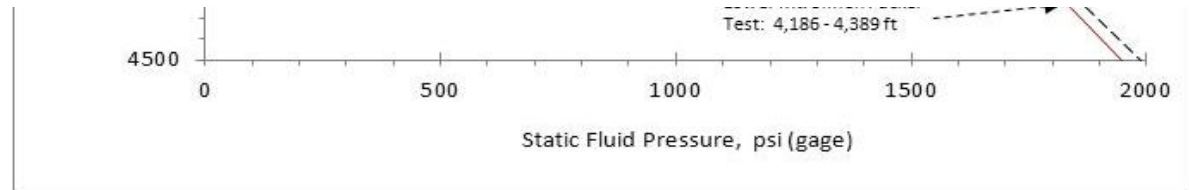


Depth ft, bgs	Total Pressure/Depth Data Set		Press/Depth Regression Equations			
	psi (gage)		Total	Mt. Simon		
1134.03	455.68	Silurian LS MDT	slope	0.46182	0.46167	
1134.97	456.06		intercept	-90.4630	-88.4401	
1930.99	786.90	St. Peter MDT	Profile Plots			
1930.06	784.34		500.00	140.4454	142.3960238	
1781.99	718.16		4500.00	1987.7124	1989.085036	
1748.96	703.39					
			Depth, ft bgs	Calculated P (Total Reg.) psig	Calculated P (Mt.Simon Reg.) psig	
4034.01	1775.56	Mt. Simon MDT	Top of Mount Simon	3904	1712.47	1713.93
4033.95	1775.48		Top of Elmhurst	3838	1681.99	1683.46
4096.48	1803.62		Top of Lombard	3581	1563.30	1564.81
4116.02	1812.85		Top of Potosi	2796	1200.78	1202.40
4116.98	1813.04		Bot. of Potosi	3072	1328.24	1329.82
3898.44	1708.33	Mt. Simon packer tests	Bot. of St. Peter	1942	806.39	808.13
4192.96	1846.98					
4235.24	1864.10	Mt. Simon GM11B				
4155.24	1829.00		GM12			
4121.55	1815.60		GM13			

- 1 Schlumberger, Inc., 2011a. "Battelle/FutureGen#1, Morgan County Illinois: Modular Dynamics Formation Tester: Pressure/Sampling/Gamma"; Schlumberger processed/analysis log
Survey Date - October 27, 2011; PDF File Name: BXDS_00005_BATTELLE_FUTUREGEN_1_MDT_Combined.PDF
- 2 Schlumberger, Inc., 2011b. "FutureGen Industrial Alliance/FutureGen 2.0 No.1, Morgan County Illinois: Modular Dynamics Formation Tester: Pressure/Sampling/Gamma"; Schlumberger processed/analysis log
Survey Date - December 14, 2011; Schlumberger PDS File Name: BPD8_35_Futuregen2_1_run4G_MDT_Combined.pds
- 3 Kelley ME, MA Moody, ER Zeller, WH Rike, NA Berelsman, C McNeil, J Holley, C Sullivan, D Appriou, FA Spane, JA Horner, and TJ Gilmore. 2012. "Borehole Completion and Characterization Report for the Stratigraphic Well, Morgan County, Illinois.", FGN-RPT-015/PNWD-4343, report prepared by Pacific Northwest National Laboratory, Richland WA for FutureGen Industrial Alliance, Inc.
- 4 Birkholzer JT, JP Nicot, CM Oldenburg, Q Zhou, S Kraemer, and K Bandilla. 2011. "Brine flow up a well caused by pressure perturbation from geologic carbon sequestration: static and dynamic evaluations." International Journal of Greenhouse Gas Control, doi:10.1016/j.ijggc.2011.01.003.
- 5 Spane FA and RB Mercer. 1985. "HEADCO: a program for converting observed water levels and pressure measurements to formation pressure and standard hydraulic head."
RHO-BW-ST-71P, Rockwell Hanford Operations, Richland, WA.





EPA Pressure Front Calculation (Eqn. 1); @ existing conditions		
Top of Mt. Simon as basis	$P_{i,f}$	11.62 Mpa
	$P_{i,f}$	1685.12 psi
	z_u-z_i	1962.00 ft
Top of Elmhurst as basis	$P_{i,f}$	11.41 Mpa
	$P_{i,f}$	1655.56 psi
	z_u-z_i	1896.00 ft
	P_u	806.39 psi
	(St. Peter to Mt. Simon) γ_w	64.4943 lb/ft ³

EPA Critical Pressure Change Calculation (Eqn. 2); @ existing conditions		
Top of Mt. Simon as basis	$\Delta P_{i,f}$	-0.19 Mpa
	$\Delta P_{i,f}$	-27.35 psi
	P_i	1712.47 psi
	z_u-z_i	1962.00 ft
Top of Elmhurst as basis	$\Delta P_{i,f}$	-0.18 Mpa
	$\Delta P_{i,f}$	-26.43 psi
	P_i	1681.99 psi
	z_u-z_i	1896.00 ft
	P_u	806.39 psi
	γ_w	64.4943 lb/ft ³

EPA Pressure Front Calculation (Eqn. 1); for hydrostatic St. Peter conditions		
Top of Mt. Simon as basis	$P_{i,f}$	11.86 Mpa
	$P_{i,f}$	1719.82 psi
	z_u-z_i	1962.00 ft
Top of Elmhurst as basis	$P_{i,f}$	11.65 Mpa
	$P_{i,f}$	1690.26 psi
	z_u-z_i	1896.00 ft
	P_u	841.08 psi
	γ_w	64.4943 lb/ft ³

EPA Critical Pressure Change Calculation (Eqn. 2); for hydrostatic St. Peter conditions		
Top of Mt. Simon as basis	$\Delta P_{i,f}$	0.05 Mpa
	$\Delta P_{i,f}$	7.35 psi
	P_i	1712.47 psi
	z_u-z_i	1962.00 ft
Top of Elmhurst as basis	$\Delta P_{i,f}$	0.06 Mpa
	$\Delta P_{i,f}$	8.27 psi
	P_i	1681.99 psi

Projected Pressure at base of St. Peter	806.39	psig	see Note 1
Projected Pressure at top of Elmhurst	1681.99	psig	see Note 1
Projected Pressure at top of Mt. Simon	1712.47	psig	see Note 1
Depth to base of St. Peter	1942	ft bgs	
Depth to top of Elmhurst	3838	ft bgs	
Depth to top of Mt. Simon	3904	ft bgs	
Ground Surface Elevation	619	ft bgs	
Base of St. Peter Elevation	-1323	ft MSL	
Top of Elmhurst Elevation	-3219	ft MSL	
Top of Mt. Simon Elevation	-3285	ft MSL	
Calculated Specific Wt. of Mt. Simon water	64.4943	lb/ft ³	γ_w
Calculated Fluid Density of Mt. Simon	1.0331	g/cm ³	ρ_w
freshwater hydrostatic gradient	0.4331	psi/ft	
Freshwater hydrostatic pressure: St. Peter	841.08	psi	

$z_u - z_i$	1896.00 ft
P_u	841.08 psi
γ_w	64.4943 lb/ft ³

Note 1: Projected static pressure for the various units based on regression relationships shown in "Mt. Simon Press-Regression" subfolder, for test data listed in "Combined Pressure Depth Data" subf

Birkholzer (2011) & EPA Pressure Front Calculation (Eqn. 1); @ existing conditions

Top of Mt. Simon as basis	$P_{i,f}$	11.63 Mpa
	$P_{i,f}$	1686.55 psi
	z_u-z_i	1962.00 ft
Top of Elmhurst as basis	$P_{i,f}$	11.42 Mpa
	$P_{i,f}$	1656.95 psi
	z_u-z_i	1896.00 ft

P_u 806.39 psi 64.7523
 (St. Peter to Mt. Simon) γ_w 64.5996 lb/ft³ calculated based on HEADCO

Birkholzer (2011) & EPA Critical Pressure Change Calculation (Eqn. 2); @ existing conditions

Top of Mt. Simon as basis	$\Delta P_{i,f}$	-0.18 Mpa
	$\Delta P_{i,f}$	-25.91 psi
	P_i	1712.47 psi
	z_u-z_i	1962.00 ft
Top of Elmhurst as basis	$\Delta P_{i,f}$	-0.17 Mpa
	$\Delta P_{i,f}$	-25.04 psi
	P_i	1681.99 psi
	z_u-z_i	1896.00 ft

P_u 806.39 psi
 (St. Peter to Mt. Simon) γ_w 64.5996 lb/ft³ calculated based on HEADCO

Birkholzer (2011 & EPA Pressure Front Calculation (Eqn. 1); for hydrostatic St. Peter conditions

Top of Mt. Simon as basis	$P_{i,f}$	11.87 Mpa
	$P_{i,f}$	1721.25 psi
	z_u-z_i	1962.00 ft
Top of Elmhurst as basis	$P_{i,f}$	11.66 Mpa
	$P_{i,f}$	1691.64 psi
	z_u-z_i	1896.00 ft

P_u 841.08 psi
 (St. Peter to Mt. Simon) γ_w 64.5996 lb/ft³ calculated based on HEADCO

Birkholzer (2011 & EPA Critical Pressure Change Calculation (Eqn. 2); for hydrostatic St. Peter conditions

Top of Mt. Simon as basis	$\Delta P_{i,f}$	0.06 Mpa
	$\Delta P_{i,f}$	8.78 psi
	P_i	1712.47 psi
	z_u-z_i	1962.00 ft
Top of Elmhurst as basis	$\Delta P_{i,f}$	0.07 Mpa
	$\Delta P_{i,f}$	9.65 psi
	P_i	1681.99 psi

$z_u - z_i$ 1896.00 ft

P_u 841.08 psi

(St. Peter to Mt. Simon) γ_w 64.5996 lb/ft³ calculated based on HEADCO

folder

Dynamic Viscosity Calculation for Temperature/Pressure/Salinity Conditions in centipoise (cp)

Ref: Meehan, D.N. 1980. "Estimating Water Viscosity at Reservoir Conditions", Petroleum Engineer, July 1980, pp. 117-118.

$$\mu^* \text{ (dynamic viscosity, cp)} = (A+B/T)*f(p,T)$$

$$A = -0.04518 + 0.009313(\%NaCl) - 0.000393 (\%NaCl)^2$$

$$B = 70.634 + 0.09576(\%NaCl)^2$$

$$f(p,T) = 1 + 3.5 \times 10^{-12} (P)^2 (T-40)$$

Density calculated values based on Temp. and Salinity (no pressure effects)

<http://www.csgnetwork.com/h2odenscalc.html>

30K ppm	1.01562
47K ppm	1.02828
60K ppm	1.03805

Temp. F	P, psi	Salinity %
97.99	1712.47	4.7

A	-0.01009
B	72.74934
f(p,T)	1.00060

μ , cp	0.73233	temp+salinity co	1 darcy	1.06240E-11	ft ²
μ , cp	0.73276	& P corrected	1 cp	2.088543E-05	lb-sec/ft ²
μ_{fw}	1.5304E-05	lb-sec/ft ²	ρ_{stp}	0.999014	g/cm ³
Res. Fluid Density ρ_{fw}	1.0331	g/cm ³	V_{std}	62.3664	lb/ft ³
Res. Specific Fluid Wt. γ_{fw}	64.4943	lb/ft ³	μ_{stp}	2.3590E-05	lb-sec/ft ²
			μ_{stp}	1.1295	cp

STP k→K equivalents

k	1000	mD *STP conditions
K	2.427	ft/day *STP conditions
1 ft/day (K) = k (mD)	412.074	mD *STP conditions

Res. Conditions k→K equivalents

k	1000	millidarcies	*Res. conditions
K	3.868	ft/day	*Res. conditions
1 ft/day (K) = k (mD)	258.513	mD	*Res. conditions

Notes:

1. P estimated from projected static pressure for the top of the Mt. Simon based on regression relationships shown in "Mt. Simon Press-Regression" subfolder, for test data listed in "Combined Pressure Depth Data" subfolder
2. ρ_{fw} saline water density calculator http://www.csgnetwork.com/water_density_calculator.html for Temp., P, and Salinity conditions shown in row 9
3. Salinity value (tds = 47,000 ppm) based on average MDT and composite Mt. Simon formation fluid samples as reported in Kelley et al. (2012)