Bottom Hole Pressure (static): The Clara Field #20 well was hydraulically fractured on 8/21/2008 by the original operator, North Coast Energy, using Superior Well Services. Frac Treatment Summaries and a formation table with ISIP value are shown in Figure 1. It should be noted that Stages 5, 6, and 19 did not break; and Stages 7 and 21 were not treated.
The CPR5-0, SHF3-1 and KANE3-0, the proposed injection zones, are highlighted in Figure 1.
The deepest producing gas zone in this well occurs at 1,827 feet in the Kane 3-0 sandstone. In a gas well the static bottom hole pressure is calculated using the formula: ***BHP (static) = Casing Pressure + Hydrostatic Pressure Gas Column + Hydrostatic Pressure Liquid Column***

The liquid level in the Clara #20 well was recorded at 2,261 feet, 423 feet below the notch in the Kane 3-0 zone. Therefore, there was no liquid column in this well across from the reservoirs at the time the casing pressure was measured after the frac. The completion report indicates that the shut-in casing pressure was 500 psi after three days.

Therefore, BHP = (500 psi + 14.5psi) + (Fluid Density of gas x depth) = 514.5 + (0.025 x 1,827) = **560.2 psi.**

This results in a calculated pressure gradient at 1,827 feet of 0.307 psi/ft, which is subnormally pressured as are most Upper Devonian sandstone reservoirs of the Bradford Group. It should be noted that it is likely that the shut-in casing pressure would have continued to increase in value if the well had been shut-in longer than three days before gauging the pressure.

Fracture Gradient: The Fracture Gradient (FG) and Maximum Allowable Injection Pressure (MIP) were calculated for each of the proposed injection zones using the formulas below and the data from the frac report (Figure 1).

FG = [ISIP + (0.433 x Specific Gravity of the Frac fluid (SG) x Depth)] / Depth, where

ISIP = Initial Shut-in Pressure taken from Frac report with SG = 1.0 (frac fluid)

MIP = [FG - (0.433 x Specific Gravity of the Disposal fluids (SG))] x Depth

CPR5-0: FG = [1,045 psi + (0.433 x 1.0 x 1,490 ft)] / 1,490 ft   = 1.13 psi/ft
CPR5-0: MIP = [1.13 - (0.433 x 1.1)] x 1,490 ft   = 974 psi

SHF3-1: FG = [1,089 psi + (0.433 x 1.0 x 1,599 ft)] / 1,599 ft   = 1.11 psi/ft
SHF3-1: MIP = [1.11 - (0.433 x 1.1)] x 1,599 ft   = 1,013 psi

KANE3-0: FG = [1,221 psi + (0.433 x 1.0 x 1,827 ft) / 1,827 ft   = 1.10 psi/ft
KANE3-0: MIP = [1.10 - (0.433 x 1.1)] x 1,827 ft   = 1,139 psi

Therefore, the MIP below the packer at 1,460 feet will be that of the shallowest zone or **974 psi**.

SUPERIOR
WELL SERVICES

Superior Well Services
350 High St.
Bradford, Pa. 16701
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CUSTOMER & WELL INFORMATION

Date:	8/21/2008	Invoice #	21-00 9129

Customer: NORTH COAST ENERGY	Lease & Well Name: CLARA FIELD #20

County: POTTER	State: PA

Size & Weight-Pipe 3.5	Frac Supervisor: DANIEL HEMPHILL

Frac Treatment Summary

Stage #	Formation	Notch Depth	Sand-SKS.	Treatment	Flush	SAS/CW	Breaker	‡ ISIP	Time
1	N/A	952	50	3550	760	12.0	0.2	779	5:53 AM
2	N/A	1002	80	5550	750	17.0	0.3	654	6:16 AM
3	N/A	1033	100	6550	750	20.0	0.4	683	6:44 AM
4	N/A	1037	100	8200	800	25.0	0.4	791	7:16 AM
5	N/A	1043							7:41 AM
6	N/A	1047							8:08 AM
7	N/A	1051							8:52 AM
8	N/A	1055	90	6850	800	21.0	0.3	801	9:16 AM
9	N/A	1249	80	6500	1000	20.0	0.2	879	10:00 AM
10	N/A	1253	80	6500	1000	20.0	0.2	942	10:23 AM
11	N/A	1447	80	6500	1000	20.0	0.2	923	11:05 AM
12	N/A	1451	80	6500	1000	20.0	0.2	942	11:29 AM
13	N/A	1490	80	6500	1000	20.0	0.2	1045	11:56 AM
14	N/A	1496	80	5200	1000	16.0	0.2	1069	12:17 PM
15	N/A	1599	80	6500	1000	20.0	0.2	1089	12:48 PM
16	N/A	1603	80	6500	1000	20.0	0.2	1167	1:08 PM
17	N/A	1607	80	6500	1000	27.0	0.2	1080	1:30 PM
18	N/A	1611	25	3500	1000	15.0			2:05 PM
19	N/A	1615							2:37 PM
20	N/A	1827	80	6500	1100	21.0	0.3	1221	3:56 PM
21	N/A	2107							5:15 PM
22									
23									
24									
25									
26									
27									
28									
29									
30									
31									
	Job Totals:		1245	97900	14950	314.0	3.7	0.0	

Figure 1