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December 4, 1984

The Oil and Natural Gas
Conservation Board
309 Legislative Building
Winnipeg, Manitoba
R3C 0V8

Attention: Mr. Ian Haugh

Dear Sir,

Re: Waskada Spearfish/Mississippian Communication Testing
Board Order No. PM 40

Omega Hydrocarbons Ltd. has completed the first part of the program as agreed to in our letter dated 84-02-28. Results of the quarterly bottom hole pressure measurements at wells 1A-27, 2A-27 and/or 9A-27-1-26 WPM will be forthcoming following a test later this month.

Using the results of the pressure monitoring program in conjunction with injection well start-up dates, completion histories and individual well production histories, the following conclusions can be made with respect to communication between the Spearfish (LAM) and Mississippian (MC3a) formations;

1. Communication exists between the two formations at wells 1-25 and 1A-25-1-26 WPM.
2. Communication between formations does not exist at wells 3A-25 and 5A-26-1-26 WPM.
3. Analysis of the data collected to date for wells 8-24, 8A-24, 11-26 and 11A-26-1-26 WPM is inconclusive in defining communication.

A table of the final bottom hole pressures obtained from acoustic well sounder tests for all the above mentioned wells is contained in Attachment 1. The raw data and the calculated bottom hole pressures taken during the test periods are contained in Attachment 2. Comments and details of the analysis performed on a well by well basis to arrive at the previously mentioned conclusions are summarized in Attachments 3-6.

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Based on the results of this analysis, it is Omega's opinion that in most cases communication between the two zones is caused by the stimulations performed at the wells rather than geological communication. This is supported by the fact that at well 5-26-1-26 WPM where Omega is injecting into the Spearfish formation no detrimental effects have been observed at the Mississippian offset. This is encouraging and suggests that communication can be controlled by the type of stimulation performed. Omega has incorporated this way of thinking into its recent stimulation programs in an effort to control frac propagation and have had some success. A detailed geological study to increase our knowledge of the two reservoirs and their behavior is also currently underway.

Since the impetus at this time is to waterflood only the Spearfish formation, Omega plans to identify all the locations where communication exists during the upcoming year. We intend to accomplish this through a combination of additional pressure tests and the monitoring of production on an individual well basis. Once the areas of communication have been identified then attempts can be made to either shut off the communication or control injection volumes into these areas. By improving our understanding of the reservoir in this manner we should not only minimize any effects to the Mississippian formation but also improve the efficiency of the Spearfish secondary recovery projects. Henceforth, any new information related to the above will be incorporated into our annual pressure maintenance performance reports.

Yours truly,
OMEGA HYDROCARBONS LTD.

G.E. Patey
Vice President, Production

GEP:ad

c.c. B. Dubreuil (Man. Petroleum Branch)
Pressure Maintenance Monitoring File
M. Mawdsley - w/o attachments

WASKADA SPEARFISH/MISSISSIPPIAN PRESSURE TESTING SUMMARY

Well Name	Producing Zone	Final Bottom Hole Pressures & Testing Dates (KPag) *			
		March 12-15	April 13-16	May 12-15	June 13-16
8-24-1-26 WPM	Mississippian	2689	3237	2339	3003
8A-24-1-26 WPM	Spearfish	3362	3453	3436	3782
1-25-1-26 WPM	Mississippian	1788	1900	tubing leak	7324
1A-25-1-26 WPM	Spearfish	7912	6917	9792	8465
3A-25-1-26 WPM	Mississippian	2179	2202	2224	2780
5A-26-1-26 WPM	Mississippian	1989	2407	2395	2388
11-26-1-26 WPM	Spearfish	6109	3430	2176	1787
11A-26-1-26 WPM	Mississippian	1647	1788	4237	3413

* A fluid column pressure was determined using an average fluid gradient based on the watercut just prior to shut in. While the Cullender and Smith technique was used to calculate gas column pressure.

8-24-1-26 WPM (Mississippian)

Raw Data and Calculated BHP

	Day March '84	Day April '84	Day May '84	Day June '84
ISI TIME 1 ISI FL 1 (mGL) ISI CP 1 (kPag) BHP 1 (kPag)	12 9:53 am 931.2 600 648	13 9:00 am 835.2 (Foamy) 620 1374	12 8:20 am	13 8:15 am
TIME 2 FL 2 CP 2 BHP 2	13 9:42 am 921.6 2000 2264	14 9:00 am 835.2 1724 2559	13 8:40 am 739.2 1034 2489	14 8:10 am 796.8 1172 2233
TIME 3 FL 3 CP 3 BHP 3	13 5:15 pm 912.0 2050 2388	14 5:40 pm 835.2 2068 2936	13 5:30 pm 748.8 1379 2789	14 4:35 pm 816.0 1379 2323
TIME 4 FL 4 CP 4 BHP 4	14	15 8:50 am 835.2 2310 3200	14 7:20 am 816.0 1724 2692	15 8:05 am 844.8 1724 2492
TIME 5 FL 5 CP 5 BHP 5	14	15 4:50 pm 835.2 2310 3200	14 6:35 pm 825.6 1999 2926	15 4:20 pm 835.2 1931 2786
TIME 6 FL 6 CP 6 BHP 6	15 9:14 am 892.8 2200 2689	16 8:25 am 835.2 2344 3237	15 8:15 am 921.6 2068 2339	16 6:45 am 825.6 2068 3003

PERFS: 931.0 - 935.0 mKB

GL: 467.8 m

TD:

MPP : 933.0 mKB

KB: 471.9 m

WC: 5.24 %

8A-24-1-26 WPM (Spearfish)
Raw Data and Calculated BHP

Attachment 2 (b)

	Day	March '84	Day	April '84	Day	May '84	Day	June '84
ISI TIME 1 ISI FL 1 (mGL) ISI CP 1 (kPag) BHP 1 (kPag)	12	9:25 am 912.0(Foamy) 650 723		S.I. 1 Day Early for Over Production	12	8:00 am 912.0 689 765	13	8:05 am 912.0 689 765
TIME 2 FL 2 CP 2 BHP 2	13	9:25 am 902.4 2500 2824	13	8:45 am 835.2 2413 3190	13	8:30 am 864.0 2620 3220	14	8:05 am 816.0 2758 3697
TIME 3 FL 3 CP 3 BHP 3	13	5:06 pm 883.2 2600 3066	13	4:30 pm 835.2 2517 3303	13	5:20 pm 835.2 2620 3417	14	4:20 pm 806.4 2758 3763
TIME 4 FL 4 CP 4 BHP 4	14		14	8:45 am 835.2 2606 3400	14	7:15 am 883.2 2689 3163	15	8:00 am 825.6 2896 3782
TIME 5 FL 5 CP 5 BHP 5	14		14	5:30 pm 835.2 2634 3430	14	6:25 pm 835.2 2758 3567	15	4:05 pm 825.6 2896 3782
TIME 6 FL 6 CP 6 BHP 6	15	9:00 am 864.0 2750 3362	15	8:45 am 835.2 2655 3453	15	8:05 am 854.4 2758 3436	16	6:30 am 825.6 2896 3782

PERFS: 908.0 - 924 mKB

GL: 468.32 m

TD: 922.95 mKB

MPP : 916.0 mKB

KB: 472.59 m

WC: 1.45 %

1-25-1-26 WPM (Mississippian)

Attachment 2 (c)

Raw Data and Calculated BHP

	Day March '84	Day April '84	Day May '84	Day June '84
ISI TIME 1 ISI FL 1 (mGL) ISI CP 1 (kPag) BHP 1 (kPag)	12 10:49 am 864.0 550 1089	13 9:15 am 902.4 552 809	Repairing Tubing Leak	13 8:25 am 739.2 483 1904
TIME 2 FL 2 CP 2 BHP 2	13 9:52 am 912.0 950 1174	14 9:20 am 892.8 758 1125		14 8:20 am 432.0 689 5218
TIME 3 FL 3 CP 3 BHP 3	13 5:26 pm 883.2 1050 1490	14 6:10 pm 892.8 793 1163		14 4:40 pm 355.2 689 5997
TIME 4 FL 4 CP 4 BHP 4	14	15 9:05 am 873.6 827 1390		15 8:20 am 307.2 827 6625
TIME 5 FL 5 CP 5 BHP 5	14	15 5:05 pm 864.0 827 1484		15 4:20 pm 268.8 965 7157
TIME 6 FL 6 CP 6 BHP 6	15 9:31 am 864.0 1200 1788	16 8:45 am 825.6 862 1900		16 6:55 am 259.2 1034 7324

PERFS: 930.0 - 937.0 mKB

GL: 467.3 m

TD: 942.88 mKB

MPP : 933.0 mKB

KB: 471.88 m

WC: 79.04 %

Raw Data and Calculated BHP

	Day	March '84	Day	April '84	Day	May '84	Day	June '84
ISI TIME 1	12	10:28 am	13	9:25 am	12	8:30 am	13	8:35 am
ISI FL 1 (mGL)		153.6		115.2		259.2		96
ISI CP 1 (kPag)		450		517		300		483
BHP 1 (kPag)		5755		6083		4881		6179
TIME 2	13	10:00 am	14	9:05 am	13	8:45 am	14	8:25 am
FL 2		67.2		Full		Full		28.8
CP 2		875		69		2206		896
BHP 2		7001		6782		9376		7240
TIME 3	13	5:32 pm	14	5:45 pm	13	5:30 pm	14	4:45 pm
FL 3		48		Full		Full		19.2
CP 3		1000		676		2448		1517
BHP 3		7307		7375		9619		7942
TIME 4	14		15	9:00 am	14	7:20 am	15	8:15 am
FL 4				Full		Full		Full
CP 4				1345		2896		1517
BHP 4				8030		10069		8128
TIME 5	14		15	5:00 pm	14	6:35 pm	15	4:15 pm
FL 5				Full		Full		Full
CP 5				138		3103		1655
BHP 5				6850		10276		8263
TIME 6	15	9:40 am	16	8:35 am	15	8:30 am	16	7:00 am
FL 6		Full		Full		Full		Full
CP 6		1150		207		2620		1862
BHP 6		7912		6917		9792		8465

PERFS: 906.0 - 916.5 mKB

GL: 467.2 m

TD: 936.93 mKB

MPP : 911.0 mKB

KB: 471.44m

WC: 94.81%

3A-25-1-26 WPM (Mississippian)

Raw Data and Calculated BHP

	Day	March '84	Day	April '84	Day	May '84	Day	June '84
ISI TIME 1	12	11:15 am	13	9:30 am	12	9:00 am	13	8:50 am
ISI FL 1 (mGL)		806.4		825.6		787.2		806.4
ISI CP 1 (kPag)		475		620		345		483
BHP 1 (kPag)		1412		1425		1409		1420
TIME 2	13	10.30 am	14		13	9:00 am	14	8:30 am
FL 2		806.4				777.6		777.6
CP 2		850				827		896
BHP 2		1805				1984		2064
TIME 3	13	5:41 pm	14	6:10 pm	13	5:40 pm	14	4:50 pm
FL 3		806.4		825.6		739.2		796.8
CP 3		925		1345		965		965
BHP 3		1886		2202		2412		1999
TIME 4	14		15	9:15 am	14	7:30 am	15	8:25 am
FL 4				825.6		729.6		768.0
CP 4				1158		1034		1103
BHP 4				1999		2553		2353
TIME 5	14		15	5:10 pm	14	6:45 pm	15	4:25 pm
FL 5				825.6		777.6		768.0
CP 5				1158		1103		1138
BHP 5				1999		2279		2391
TIME 6	15	9:54 am	16	9:00 am	15	8:40 am	16	7:05 am
FL 6		806.4		825.6		806.4		739.2
CP 6		1200		1345		1241		1310
BHP 6		2179		2202		2224		2780

PERFS: 925.0 - 937.3 mKB

GL: 466.5 m

TD: 935.0 mKB

MPP : 931.0 mKB

KB: 471.0 m

WC: 2.17%

5A-26-1-26 WPM (Mississippian)

Raw Data and Calculated BHP

	Day	March '84	Day	April '84	Day	May '84	Day	June '84
ISI TIME 1	12	12:30 pm	13	9:40 am	12	9:20 am	13	9:00 am
ISI FL 1 (mGL)		902.4		892.8		576.0		806.4
ISI CP 1 (kPag)		625		620		414		621
BHP 1 (kPag)		867		932		2947		1558
TIME 2	13	11:05 am	14	9:45 am	13	9:10 am	14	8:40 am
FL 2		883.2		873.6		844.8		854.4
CP 2		1200		1241		1241		1172
BHP 2		1662		1770		1949		1807
TIME 3	13	6:10 pm	14	6:00 pm	13	5:50 pm	14	5:00 pm
FL 3		864.0		873.6		873.6		854.4
CP 3		1320		814		1379		965
BHP 3		1959		1305		1897		1586
TIME 4	14		15	9:25 am	14	7:35 am	15	8:35 am
FL 4				873.6		864.0		844.8
CP 4				1482		1517		1413
BHP 4				2032		2113		2137
TIME 5	14		15	6:00 pm	14	6:25 pm	15	4:45 pm
FL 5				873.6		835.2		844.8
CP 5				1572		1517		1517
BHP 5				2128		2314		2247
TIME 6	15	11:10 am	16	9:10 am	15	8:50 am	16	7:10 am
FL 6		883.2		873.6		844.8		835.2
CP 6		1500		1827		1655		1586
BHP 6		1989		2407		2395		2388

PERFS: 925.0 - 935.0 mKB

GL: 465.7m

TD: 938.11 mKB

MPP : 930.0 - mKB

KB: 469.9m

WC: 18.90%

11-26-1-26 WPM (Spearfish)

Raw Data and Calculated BHP

	Day	March '84	Day	April '84	Day	May '84	Day	June '84
ISI TIME 1	12	11:45 am	13	10:10 am	12	9:45 am	13	9:25 am
ISI FL 1 (mGL)		758.4		691.2		873.6		825.6
ISI CP 1 (kPag)		600		620		621		689
BHP 1 (kPag)		1758		2248		954		1375
TIME 2	13	10:43 am	14	10:00 am	13	9:20 am	14	9:00 am
FL 2		403.2		681.6		796.8		787.2
CP 2		1460		1207		724		758
BHP 2		5862		2947		1728		1801
TIME 3	13	5:52 pm	14	6:35 pm	13	6:05 pm	14	5:15 pm
FL 3		384.0		681.6		806.4		777.6
CP 3		1525		1345		758		689
BHP 3		6101		3095		1682		1816
TIME 4	14		15	9:40 am	14	7:50 am	15	8:50 am
FL 4				681.6		729.6		796.8
CP 4				1406		758		758
BHP 4				3160		2341		1713
TIME 5	14		15	5:35 pm	14	7:00 pm	15	4:55 pm
FL 5				672.0		729.6		796.8
CP 5				1482		758		827
BHP 5				3321		2341		1787
TIME 6	15	10:26 am	16	9:35 am	15	9:15 am	16	7:25 am
FL 6		403.2		672.0		748.8		796.8
CP 6		1700		1586		758		827
BHP 6		6109		3430		2176		1787

PERFS: 907.5 - 920.0 mKB

GL: 466.4 m

TD: 936.0 mKB

MPP : 914.0 mKB

KB: 471.0 m

WC: 11.78%

Raw Data and Calculated BHP

	Day	March '84	Day	April '84	Day	May '84	Day	June '84
ISI TIME 1	12	12:06 pm	13	10:20 am	12	9:30 am	13	9:20 am
ISI FL 1 (mGL)		921.6		883.2		614.4		787.2
ISI CP 1 (kPag)		675		827		69		655
BHP 1 (kPag)		778		1228		2327		1728
TIME 2	13	10:53 am	14	9:50 am	13	9:15 am	14	8:50 am
FL 2		912.0		844.8		489.6		691.2
CP 2		975		862		69		689
BHP 2		1198		1624		3583		2745
TIME 3	13	5:59 pm	14	6:30 pm	13	6:00 pm	14	5:10 pm
FL 3		902.4		844.8		489.6		681.6
CP 3		1020		862		69		689
BHP 3		1334		1624		3654		2844
TIME 4	14		15	9:35 am	14	7:45 am	15	8:40 am
FL 4				844.8		480.0		652.8
CP 4				862		138		689
BHP 4				1624		3751		3141
TIME 5	14		15	5:30 pm	14	6:55 pm	15	4:50 pm
FL 5				844.8		451.2		643.2
CP 5				833		138		689
BHP 5				1647		4043		3240
TIME 6	15	10:40 am	16	9:25 am	15	9:00 am	16	7:20 pm
FL 6		883.2		835.2		432.0		633.6
CP 6		1150		931		138		758
BHP 6		1647		1788		4237		3413

PERFS: 928.0 - 932.0 mKB

GL: 468.53 m

TD: 937.73 mKB

MPP : 930.0 mKB

KB: 472.7m

WC: 69.59%

Spearfish/Mississippian Communication Analysis
For Wells 8-24 and 8A-24-1-26 WPM

Well 8-24-1-26 WPM (Mississippian)

- Previous pressure history
82 02 03 5167 kPag
- Bubble point pressure 3158 kPag
- Completion History
 - 81 11 12 Perforated 931-935 mKB
 - 81 11 14 Acid washed with 1500L BDA
 - 81 11 30 Acid squeezed 17000L of U80 emulsified acid
 - 82 06 24 Solvent squeezed 96L SC170 jyp solvent
 - 83 06 05 Ultravis Frac 5.9 T 20/40 + 4.3 T 10/20 sand
 - 84 09 21 BHP change
- No injection had occurred in surrounding wells prior to this test.

Well 8A-24-1-26 WPM (Spearfish)

- No previous pressure history at this well
- Bubble point pressure 4220 kPag
- Completion History
 - 83 08 11 Perforated 908-918, 919.5 - 920.5, 922.5-924 mKB
 - 83 08 13 Polyemulsion frac 27 T 10/20 sand
 - 83 09 10 BHP change
- No injection had occurred in surrounding wells prior to this test.

General Remarks

- Both formations are at or below bubble point pressures which tends to explain the high GOR's
- The Spearfish pressure measurements are consistently higher in this set of tests
- A change in GOR and WOR performance at 8-24 occurred shortly after the frac treatment and is similar to the performance of the Spearfish well
- The data collected to date at these wells is not conclusive in defining communication

Production Histories For
Well 8-24 and 8A-24-1-26 WPM

Well 8-24-1-26 WPM (Mississippian)

MNTH YR/M	HRS	PRODUCTION			RATES		WAT CUT	GOR
		OIL	WATER	GAS	OIL	FLUID		
		M3	M3	KM3	M3/D	M3/D		
8111	312	19.5	9.1	.00	1.5	2.2	32	0
8112	600	52.5	56.2	.00	2.1	4.3	52	0
8201	192	18.6	54.7	.00	2.3	9.2	75	0
8202	552	41.5	11.0	.00	1.8	2.3	21	0
8203	744	50.8	6.5	.00	1.6	1.8	11	0
8204	720	53.5	4.7	.00	1.8	1.9	8	0
8205	744	45.2	3.2	.00	1.5	1.6	7	0
8206	648	56.1	3.2	.00	2.1	2.2	5	0
8207	744	59.9	.0	.00	1.9	1.9	0	0
8208	744	52.4	.0	.00	1.7	1.7	0	0
8209	720	42.2	.0	.00	1.4	1.4	0	0
8210	739	48.2	.0	.00	1.6	1.6	0	0
8211	720	41.2	6.6	.00	1.4	1.6	14	0
8212	714	30.8	3.5	.47	1.0	1.2	10	15
8301	744	30.1	4.1	1.94	1.0	1.1	12	64
8302	648	26.5	5.0	2.16	1.0	1.2	16	82
8303	640	32.7	4.1	.97	1.2	1.4	11	30
8304	720	29.8	4.1	1.62	1.0	1.1	12	54
8305	744	29.6	6.7	.91	1.0	1.2	18	31
8306	530	67.2	68.7	15.11	3.0	6.2	51	225
8307	724	162.1	15.5	19.89	5.4	5.9	9	123
8308	744	224.8	6.8	34.60	7.3	7.5	3	154
8309	670	187.1	4.2	23.30	6.7	6.9	2	125
8310	718	217.6	4.4	15.00	7.3	7.4	2	69
8311	688	246.7	7.5	43.80	8.6	8.9	3	178
8312	676	238.0	8.6	33.90	8.4	8.8	3	142
8401	720	108.5	6.0	49.30	3.6	3.8	5	454
8402	603	227.3	7.7	61.10	9.0	9.4	3	269
8403	632	242.0	10.4	35.30	9.2	9.6	4	146
8404	505	185.1	5.0	40.30	8.8	9.0	3	218
8405	593	208.8	20.4	38.70	8.5	9.3	9	185
8406	568	203.1	11.4	57.20	8.6	9.1	5	282
8407	659	186.2	4.0	48.70	6.8	6.9	2	262
8408	606	151.8	24.4	54.80	6.0	7.0	14	361
8409	259	65.8	6.6	22.50	6.1	6.7	9	342
8410	626	82.0	.0	26.39	3.1	3.1	0	322

Well 8A-24-1-26 WPM (Spearfish)

MNTH YR/M	HRS	PRODUCTION			RATES		WAT CUT	GOR
		OIL	WATER	GAS	OIL	FLUID		
		M3	M3	KM3	M3/D	M3/D		
8308	96	140.4	68.5	16.70	35.1	52.2	33	119
8309	498	470.0	26.9	17.10	22.7	23.9	5	36
8310	559	377.9	12.0	32.80	16.2	16.7	3	87
8311	452	279.0	7.3	26.90	14.8	15.2	3	96
8312	350	193.2	4.4	35.30	13.2	13.5	2	183
8401	360	163.1	2.4	44.10	10.9	11.0	1	270
8402	456	236.9	2.9	49.40	12.5	12.6	1	209
8403	264	153.4	1.6	28.70	13.9	14.1	1	187
8404	264	165.4	1.6	28.50	15.0	15.2	1	172
8405	263	146.1	1.6	23.90	13.3	13.5	1	164
8406	360	191.7	2.2	44.90	12.8	12.9	1	234
8407	641	320.9	7.8	84.80	12.0	12.3	2	264
8408	623	243.7	5.5	105.60	9.4	9.6	2	433
8409	640	238.1	3.1	106.20	8.9	9.0	1	446
8410	652	158.9	3.2	90.60	5.8	6.0	2	570

Spearfish/Mississippian Communication Analysis
For Wells 1-25 and 1A-25-1-26 WPM

Well 1-25-1-26 WPM (Mississippian)

- Previous pressure history
81 07 07 5134 kPag (DST)
- Completion History
81 07 13 Perforated 930-933.5 mKB
81 07 14 Acidized with 1500 L BDA + 4000L 28% XFW
81 08 19 Perforated 933.5- 937 mKB and acidized
with 2000 L 15% BDA
81 08 31 Acid squeezed 8000 L U80 emulsified acid
84 05 15 Repaired tubing leak
- Water injection commenced 83 02 25 into nearby wells
15-24 and 7-25-1-26 WPM

Well 1A-25-1-26 WPM (Spearfish)

- Previous pressure history
82 12 17 5737 kPag
83 01 13 5668 kPag
- Completion History
82 10 15 Perforated 906-916.5 mKB
82 11 11 Polyemulsion frac 27T 10/20 sand @ 2.7m³/min
83 01 16 BHP change and tubing repair
84 02 23 BHP change
84 09 24 Water shut-off attempt, perforated 926.5 -
927.5mKB and cement squeezed.
- Water injection commenced 83 02 25 into nearby wells
15-24 and 7-25-1-26 WPM

General Remarks

- March and April pressure measurements at well 1-25 are erroneous due to a tubing leak
- Both wells have experienced increases in average reservoir pressure
- Both wells had dramatic increases in watercut approximately 3 months after the commencement of water injection (breakthrough is suspected)
- All evidence indicates that communication exists between wells

Production History For
Well 1-25-1-26 WPM

Well 1-25-1-26 WPM (Mississippian)

MNTH YR/M	HRS	PRODUCTION			RATES		WAT CUT	GOR
		OIL	WATER	GAS	OIL	FLUID		
		M3	M3	KM3	M3/D	M3/D		
8107	360	71.6	11.8	.00	4.8	5.6	14	0
8108	696	52.2	29.0	.00	1.8	2.8	36	0
8109	720	210.0	101.0	.00	7.0	10.4	32	0
8110	720	108.0	81.0	.00	3.6	6.3	43	0
8111	720	75.0	63.0	.00	2.5	4.6	46	0
8112	480	52.5	93.2	.00	2.6	7.3	64	0
8201	576	209.6	64.2	.00	8.7	11.4	23	0
8202	672	64.0	33.9	.00	2.3	3.5	35	0
8203	744	66.8	26.0	.00	2.2	3.0	28	0
8204	720	82.0	23.3	.00	2.7	3.5	22	0
8205	744	72.3	17.9	.00	2.3	2.9	20	0
8206	720	238.0	30.5	.00	7.9	8.9	11	0
8207	744	74.9	10.7	.00	2.4	2.8	13	0
8208	744	293.2	15.5	.00	9.5	10.0	5	0
8209	720	48.5	55.0	.00	1.6	3.5	53	0
8210	744	55.8	64.8	.00	1.8	3.9	54	0
8211	659	41.4	90.8	.00	1.5	4.8	69	0
8212	742	54.1	25.7	1.95	1.7	2.6	32	36
8301	550	38.7	21.3	2.30	1.7	2.6	35	59
8302	618	28.7	1.0	2.06	1.1	1.2	3	72
8303	594	24.7	3.1	3.60	1.0	1.1	11	146
8304	610	25.2	5.2	5.50	1.0	1.2	17	218
8305	672	77.9	83.5	1.64	2.8	5.8	52	21
8306	720	79.3	82.6	1.95	2.6	5.4	51	25
8307	728	47.0	206.5	2.47	1.5	8.4	81	53
8308	736	47.2	190.1	1.70	1.5	7.7	80	36
8309	693	37.0	229.5	1.50	1.3	9.2	86	41
8310	732	57.1	225.2	2.60	1.9	9.3	80	46
8311	720	48.2	302.8	2.60	1.6	11.7	86	54
8312	744	109.6	205.6	3.00	3.5	10.2	65	27
8401	720	60.2	227.0	6.00	2.0	9.6	79	100
8402	616	76.1	156.9	3.80	3.0	9.1	67	50
8403	632	53.1	196.1	5.80	2.0	9.5	79	109
8404	607	39.3	208.7	6.30	1.6	9.8	84	160
8405	312	18.0	112.9	2.70	1.4	10.1	86	150
8406	552	8.5	128.9	4.00	.4	6.0	94	471
8407	654	8.0	132.0	2.00	.3	5.1	94	250
8408	703	13.6	164.8	1.30	.5	6.1	92	96
8409	646	77.8	160.5	6.00	2.9	8.9	67	77
8410	619	49.3	199.3	2.40	1.9	9.6	80	49

Production History For
Well 1A-25-1-26M WPM

Well 1A - 25 - 1 - 26 WPM (Spearfish)

MNTH YR/M	HRS	PRODUCTION			RATES		WAT CUT	GOR
		OIL M3	WATER M3	GAS KM3	OIL M3/D	FLUID M3/D		
8301	343	354.8	33.2	47.72	24.8	27.1	9	134
8302	646	414.1	12.6	73.74	15.4	15.9	3	178
8303	594	270.0	.5	37.84	10.9	10.9	0	140
8304	682	174.6	182.9	35.56	6.1	12.6	51	204
8305	720	43.0	552.5	3.52	1.4	19.8	93	82
8306	720	108.4	287.2	3.42	3.6	13.2	73	32
8307	720	142.7	663.7	7.33	4.8	26.9	82	51
8308	744	42.4	913.9	3.60	1.4	30.8	96	85
8309	696	28.3	791.7	5.60	1.0	28.3	97	198
8310	44	1.8	48.6	.50	1.0	27.5	96	278
8311	48	2.1	54.8	.40	1.1	28.4	96	190
8312	744	32.5	853.0	6.40	1.0	28.6	96	197
8401	390	23.8	434.4	3.00	1.5	28.2	95	126
8402	538	22.4	210.6	3.40	1.0	10.4	90	152
8403	632	102.7	466.8	10.00	3.9	21.6	82	97
8404	648	18.2	182.8	3.60	.7	7.4	91	198
8405	626	6.1	99.0	3.40	.2	4.0	94	557
8406	574	33.8	248.8	6.90	1.4	11.8	88	204
8407	673	74.4	524.7	7.90	2.7	21.4	88	106
8408	666	8.0	416.7	1.10	.3	15.3	98	138
8409	365	7.7	391.7	1.20	.5	26.3	98	156
8410	702	.0	909.7	1.80	.0	31.1	100	0

Spearfish/Mississippian Communication Analysis
For Wells 3A-25 and 5A-26-1-26 WPM

Well 3A-25-1-26 WPM (Mississippian)

- Previous pressure history
81 07 27 7800 kPag (@ well 3-25)
- Completion History
82 10 09 Perforated 925-927, 928-932.5 mKB and
acid washed with 3m³ of 7½ % MDA
83 05 25 Perforated 931.3-937.3 mKB
83 05 26 Acidized with 15m³ of 15% MDA
- Water injection into surrounding wells 13-24, 15-24,
5-25 and 7-25-1-26 WPM commenced 83 02 25

General Remarks

- The Mississippian formation is below bubble point pressure at this well
- The watercut trend at this well has not been effected by injection into the Spearfish formation
- This well has completely different production characteristics than well 3-25
- A recent pressure measurement taken at well 5-25 was 10464 kPag which differs significantly from the pressures observed here
- All evidence indicates that communication does not exist at this well

Well 5A-26-1-26 WPM (Mississippian)

- No previous pressure history at this well
- Completion History
83 07 13 Perforated 925-935 mKB
83 08 14 Acid squeezed 11.35 m³ of MDA at 15,500 kPa
- Water injection into well 5-26 commenced 84 01 28

General Remarks

- The Mississippian formation is below bubble point pressure at this well
- No change in water cut has been observed since the start of injection in the Spearfish formation
- Pressures vary drastically between the two formations at this location (13270 kPag @ 5-26 taken 84 09 17)
- All evidence indicates that communication does not exist at this well

Production Histories For
Wells 3A-25 and 5A-26-1-26 WPM

Well 3A-25-1-26 WPM (Mississippian)

MNTH YR/M	HRS	PRODUCTION			RATES		WAT CUT	GOR
		OIL	WATER	GAS	OIL	FLUID		
		M3	M3	KM3	M3/D	M3/D		
8212	24	2.8	.1	.04	2.8	2.9	3	14
8301	744	62.8	10.5	4.08	2.0	2.4	14	65
8302	595	50.5	3.1	1.33	2.0	2.2	6	26
8303	544	51.2	2.3	1.65	2.3	2.4	4	32
8304	682	37.3	2.0	3.38	1.3	1.4	5	91
8305	594	38.1	.0	.76	1.5	1.5	0	20
8306	646	50.2	2.2	4.15	1.9	1.9	4	83
8307	708	41.6	5.9	6.41	1.4	1.6	12	154
8308	744	49.3	3.9	6.60	1.6	1.7	7	134
8309	688	53.9	.0	8.60	1.9	1.9	0	160
8310	708	57.3	.0	5.70	1.9	1.9	0	99
8311	720	63.1	.2	6.00	2.1	2.1	0	95
8312	744	34.9	.5	5.00	1.1	1.1	1	143
8401	708	40.5	.9	3.60	1.4	1.4	2	89
8402	696	49.5	1.9	2.60	1.7	1.8	4	53
8403	672	46.3	1.6	2.60	1.7	1.7	3	56
8404	607	39.7	2.1	4.30	1.6	1.7	5	108
8405	587	33.9	3.1	3.80	1.4	1.5	8	112
8406	611	35.1	2.8	5.70	1.4	1.5	7	162
8407	697	34.8	3.7	6.10	1.2	1.3	10	175
8408	708	25.5	10.1	14.80	.9	1.2	28	580
8409	643	29.6	9.9	4.30	1.1	1.5	25	145
8410	703	37.0	7.4	7.70	1.3	1.5	17	208

Well 5A-26-1-26 WPM (Mississippian)

MNTH YR/M	HRS	PRODUCTION			RATES		WAT CUT	GOR
		OIL	WATER	GAS	OIL	FLUID		
		M3	M3	KM3	M3/D	M3/D		
8307	288	143.0	1.5	13.74	11.9	12.0	1	96
8308	744	160.6	6.8	19.30	5.2	5.4	4	120
8309	672	98.2	7.4	8.20	3.5	3.8	7	84
8310	732	70.7	16.1	6.90	2.3	2.8	19	98
8311	720	48.2	25.9	5.50	1.6	2.5	35	114
8312	744	37.7	32.3	5.40	1.2	2.3	46	143
8401	744	56.2	13.1	5.80	1.8	2.2	19	103
8402	696	39.6	8.5	3.00	1.4	1.7	18	76
8403	680	30.1	28.0	3.00	1.1	2.1	48	100
8404	466	25.1	16.0	2.10	1.3	2.1	39	84
8405	672	39.4	13.2	4.20	1.4	1.9	25	107
8406	641	39.2	11.2	6.80	1.5	1.9	22	173
8407	738	31.3	9.7	4.70	1.0	1.3	24	150
8408	768	22.5	20.7	3.40	.7	1.4	48	151
8409	716	29.8	12.6	3.50	1.0	1.4	30	117
8410	745	21.1	5.5	1.30	.7	.9	21	62

Spearfish/Mississippian Communication Analysis
For Wells 11A-26 and 11-26-1-26 WPM

Well 11A-26-1-26 WPM (Mississippian)

- No previous pressure history at this well
- Completion History
 - 83 07 18 Perforated 928-932 mKB
 - 83 07 21 Ultravis Frac 10T 20/40 sand @ 3.7m³/min
spearheaded with 1 m³ 15% HCL
 - 84 07 15 Tubing repair, jt #30
- Water injection into surrounding wells 5-26, 7-26 and 13-26 commenced 84 02 01

Well 11-26-1-26 WPM (Spearfish)

- No previous pressure history at this well
- Completion History
 - 82 06 23 Perforated 907.5 - 920 mKB
 - 82 07 02 Polyemulsion frac 21T 10/20 + 6T 8/12
@ 3.6 m³/min
 - 82 10 26 Tubing repair, jt #80
 - 83 01 06 Tubing repair, jt #84
 - 84 11 14 Water shut-off; perforated 921.5-924.5 mKB
and cement squeezed
 - 84 11 20 BHP change
- Water injection into surrounding wells 5-26, 7-26 and 13-26-1-26 WPM commenced 84 02 01

General Remarks

- Spearfish well 11-26 is showing early signs of pressure maintenance (water cut ↑, GOR ↓)
- Water cut trends are different between the two formations
- The pressures obtained during this test are inconsistent and difficult to interpret
- The data collected to date at these wells is not conclusive in defining communication

Production Histories For
Wells 11A-26 and 11-26-1-26 WPM

Well 11A-26-1-26 WPM (Mississippian)

MNTH YR/M	HRS	PRODUCTION			RATES		WAT CUT	GOR
		OIL	WATER	GAS	OIL	FLUID		
		M3	M3	KM3	M3/D	M3/D		
8307	96	23.4	10.7	2.25	5.8	8.5	31	96
8308	744	248.0	110.4	29.50	8.0	11.6	31	119
8309	648	141.4	373.6	.20	5.2	19.1	73	1
8310	744	143.7	246.4	15.50	4.6	12.6	63	108
8311	720	169.4	267.3	24.30	5.6	14.6	61	143
8312	744	165.1	323.1	16.90	5.3	15.7	66	102
8401	674	16.3	37.3	5.20	.6	1.9	70	319
8402	696	28.5	48.5	20.30	1.0	2.7	63	712
8403	680	37.9	50.7	26.80	1.3	3.1	57	707
8404	497	38.2	79.7	9.60	1.8	5.7	68	251
8405	496	11.6	228.7	2.10	.6	11.6	95	181
8406	641	.5	463.1	2.30	.0	17.4	100	***
8407	264	1.8	281.0	.50	.2	25.7	99	278
8409	264	11.7	77.5	.90	1.1	8.1	87	77
8410	745	32.6	240.0	1.80	1.1	8.8	88	55

Well 11-26-1-26 WPM (Spearfish)

MNTH YR/M	HRS	PRODUCTION			RATES		WAT CUT	GOR
		OIL	WATER	GAS	OIL	FLUID		
		M3	M3	KM3	M3/D	M3/D		
8207	288	110.4	29.8	.00	9.2	11.7	21	0
8208	744	203.1	148.0	.00	6.6	11.3	42	0
8209	672	145.7	178.2	.00	5.2	11.6	55	0
8210	292	81.5	98.7	.00	6.7	14.8	55	0
8211	676	172.7	209.3	.00	6.1	13.6	55	0
8212	590	111.0	151.1	7.86	4.5	10.7	58	71
8301	648	128.5	145.8	4.06	4.8	10.2	53	32
8302	672	133.0	158.5	2.62	4.7	10.4	54	20
8303	632	133.0	128.2	4.42	5.1	9.9	49	33
8304	720	198.3	89.1	5.42	6.6	9.6	31	27
8305	744	171.2	101.6	3.68	5.5	8.8	37	21
8306	720	189.5	31.4	5.62	6.3	7.4	14	30
8307	736	190.8	61.4	8.88	6.2	8.2	24	47
8308	736	271.6	95.8	20.70	8.9	12.0	26	76
8309	716	221.4	320.1	25.80	7.4	18.2	59	117
8310	732	137.7	200.2	29.40	4.5	11.1	59	214
8311	720	91.6	111.5	11.40	3.1	6.8	55	124
8312	744	69.1	41.0	12.30	2.2	3.6	37	178
8401	744	104.3	112.0	10.60	3.4	7.0	52	102
8402	696	92.0	115.3	8.70	3.2	7.1	56	95
8403	680	89.5	150.8	10.90	3.2	8.5	63	122
8404	538	51.2	45.3	7.20	2.3	4.3	47	141
8405	716	95.8	85.7	6.10	3.2	6.1	47	64
8406	641	54.9	116.7	5.40	2.1	6.4	68	98
8407	738	36.4	205.2	4.90	1.2	7.9	85	135
8408	768	67.8	204.5	3.60	2.1	8.5	75	53
8409	716	51.5	174.7	4.60	1.7	7.6	77	89
8410	745	88.4	187.1	3.50	2.8	8.9	68	40

Spearfish - Mississippian Crossflow/Communication - A Look at Pressure Buildup. (Unit #2 - Washakie)

- Looked @ the following Unit #2 wells to see if there may be communication between the Spearfish and the Mississippian:

Omega 6-27-1-26

Omega LAM 6-27-1-26

Omega 13-27-1-26

Omega 15-27-1-26

Omega 13-26-1-26

Method of approach:

- For each well, determined effective producing time, t (hrs), based on production stats.
- generated Horner plots and noted curve characteristics to determine if there is any communication between the 2 reservoirs.

Results / Conclusions (refer to p. 123, Pressure Buildup + Flow Tests in Wells, C.S. Matthews, D.G. Russell).

6-27-1-26 (Mississippian) : very difficult to determine t because of erratic production; did not make Horner plot; final shut-in pressure = 1631 KPa ($\Delta t = 34$ hrs)

LAM 6-27-1-26 (Spearfish) : final shut-in pressure = 2670 KPa ($\Delta t = 260$ hrs), which is significantly different than that of 6-27 for the Mississippian; Horner plot: early time data appears to show some skin or wellbore storage effects; overall trend is characteristic of a ^{fracture} deep penetrating hydraulic fracture (typical of Washakie Spearfish), Spearfish was fraced June 24, 1963

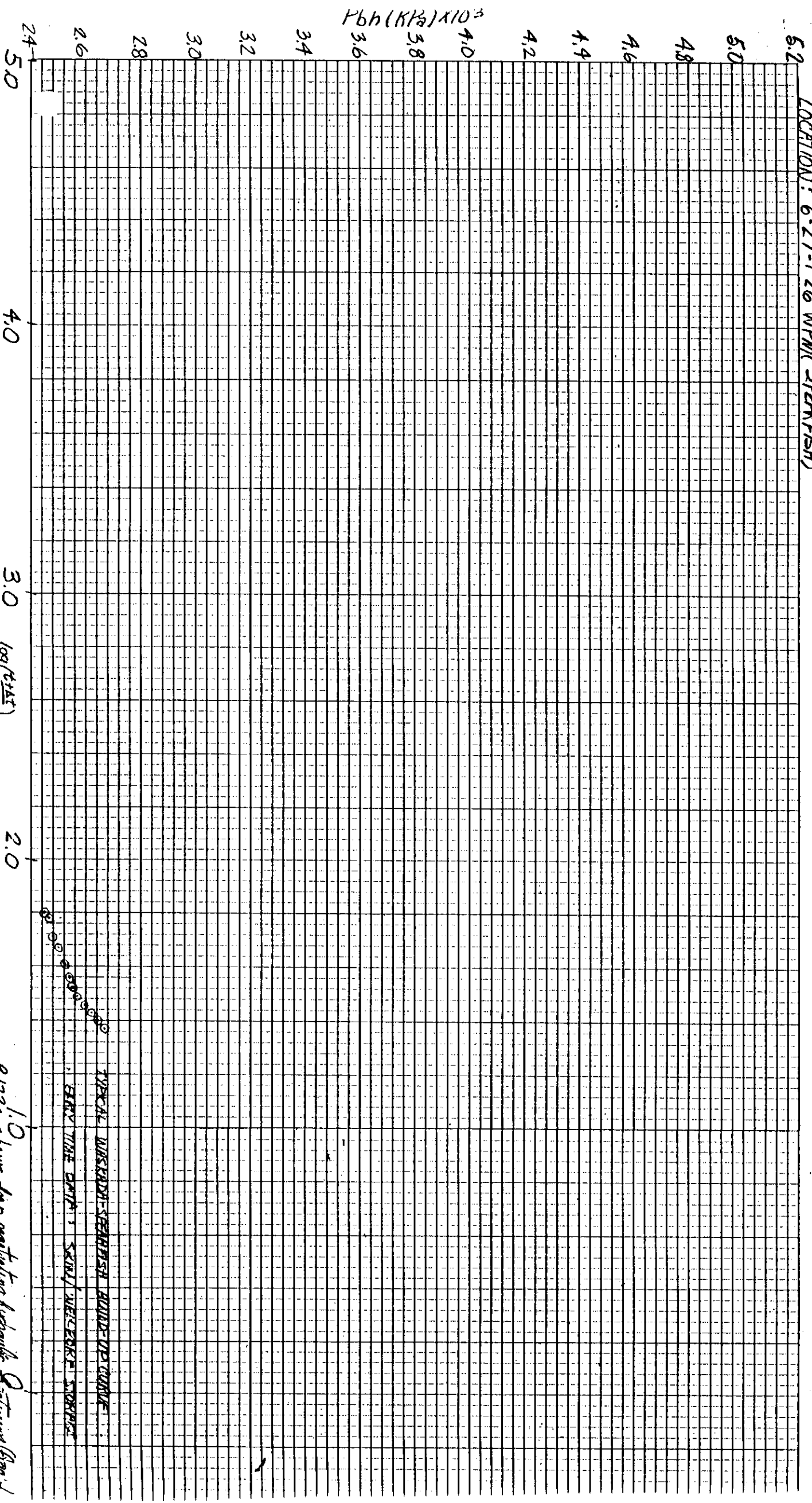
13-26-1-26 (Mississippian) : Horner plot: ideal Horner Plot response, no sign of reservoir communication

13-27-1-26 (Miss.) : Horner plot: early-time data appears to show some skin or wellbore storage effect; no sign of reservoir communication.

15-17-1-21 (Miss.) : same as for 13-27.

- None of the Horner Plots for the above wells show that there is crossflow or communication between the Spanish and the Mississippian.
- reservoir pressures (from the data) have not yet been calculated.

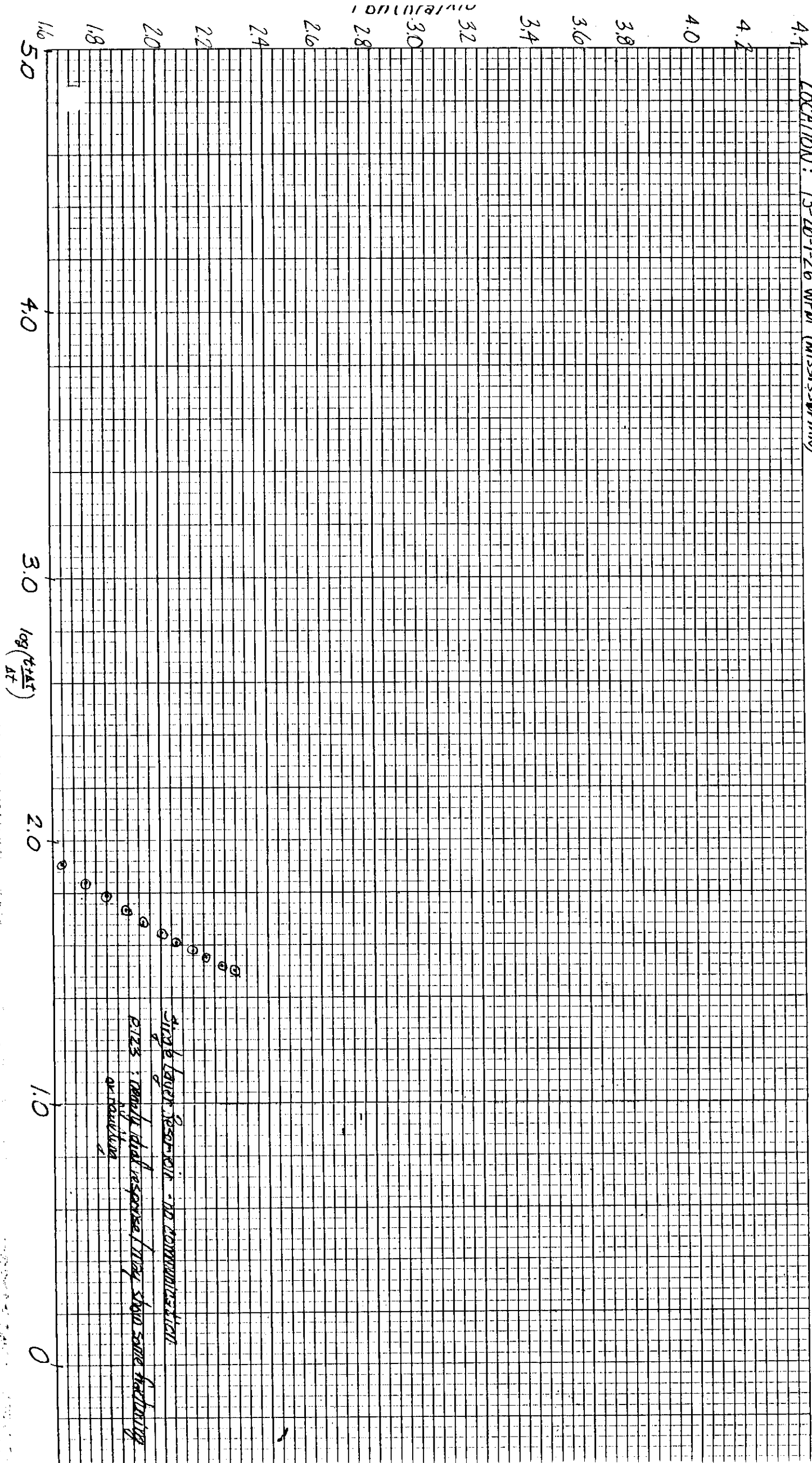
LOCATION: 6-27-1-26 WPM (SPEARFISH)



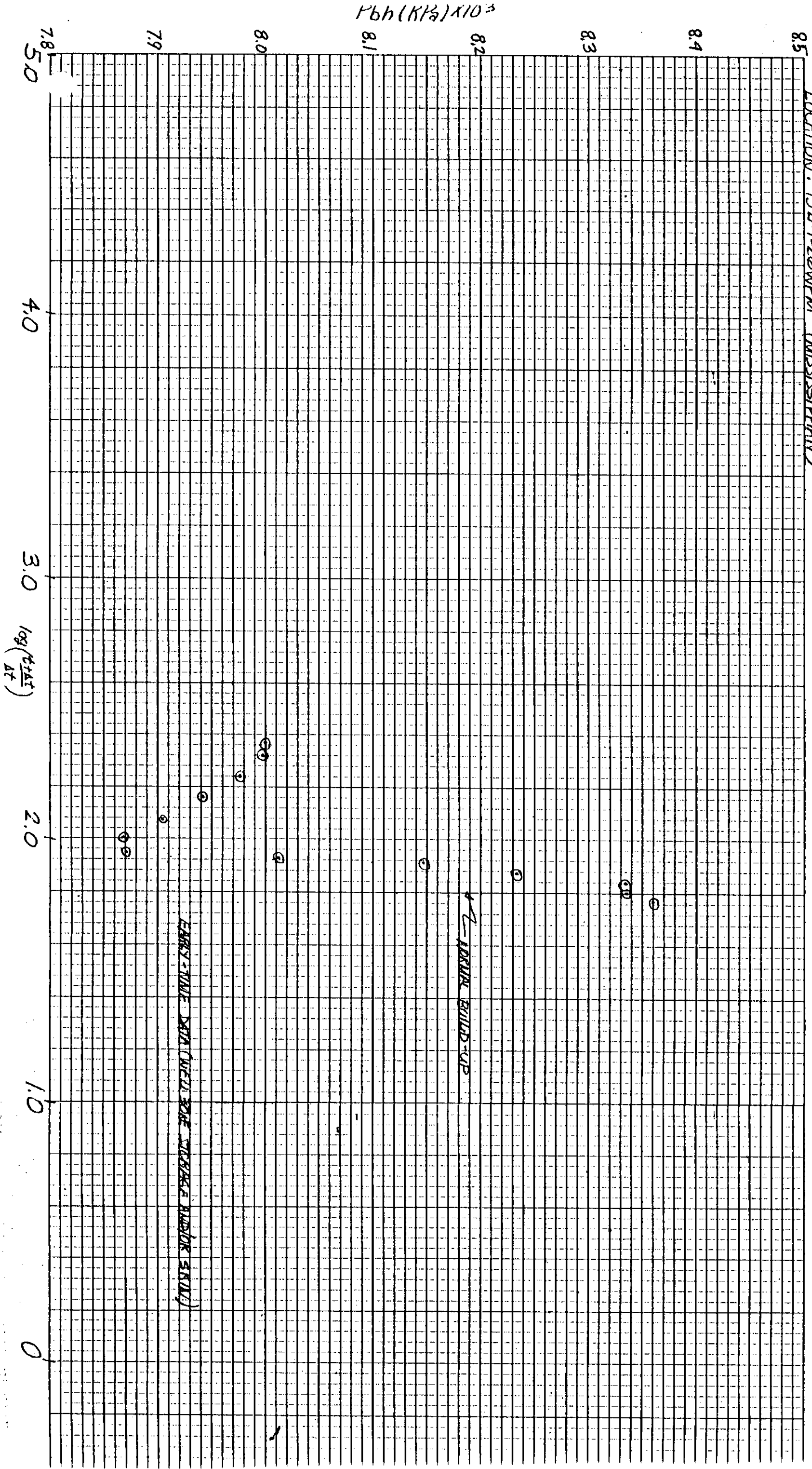
TYPICAL WINDWARD-SPEARFISH AROUND DE QUINCE
EARLY TIME DATA - SKIN/WELDER STOPPED

P.123: 5 hours deep penetrating hydraulic fracturing (Proc.)

LOCATION: 13-26-1-26 WPM (MISSISSIPPIAN)



LOCATION: 1321-26WPM (MISSISSIPPIAN)



LOCATION: 15-27-1-26WPM (MISSISSIPPIAN)

