OILFIELD RESEARCH LABORATORIES
536 NORTH HIGHLAND - CHANUTE, KANSAS 66720 - PHONE (316) 431-2650

15-133-21352

January 17, 1980

Hickory Creek Oil Company
1128 Main Street
Parsons, Kansas 67357

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from Well No. HCO-87, and submitted to our laboratory on December 14, 1979.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Sanford A. Michel

SAM/tem

4 c to Parsons, Kansas
1 c to Chanute, Kansas

HILLER #22

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Hickory Creek Oil Company Lease – Well No. HCO-87

Location –

Section – Twp. – Rge. – County – State –

Elevation, Feet	–
Name of Sand	–
Top of Core	175.0
Bottom of Core	238.0
Top of Sand	175.0
Bottom of Sand	237.7
Total Feet of Permeable Sand	60.3
Total Feet of Floodable Sand	21.3

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 – 50	33.3	33.3
50 – 100	9.4	42.7
100 – 300	12.7	55.4
300 – 600	4.9	60.3

Average Permeability Millidarcys	86.2
Average Percent Porosity	22.2
Average Percent Oil Saturation	40.1
Average Percent Water Saturation	39.8
Average Oil Content, Bbls./A. Ft.	679.
Total Oil Content, Bbls./Acre	42,209.
Average Percent Oil Recovery by Laboratory Flooding Tests	4.6
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	80.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	1,706.
Total Calculated Oil Recovery, Bbls./Acre	See "Calculated Recovery" Section.

The core was sampled and the samples sealed in plastic bags by a representative of the client.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
175.0 - 179.8	Dark brown sandstone.
179.8 - 181.3	Light brown slightly shaly sandstone.
181.3 - 192.1	Dark brown sandstone.
192.1 - 193.0	Light brown shaly sandstone.
193.0 - 197.7	Dark brown sandstone.
197.7 - 199.9	Light brown shaly sandstone.
199.9 - 202.7	Brown sandstone.
202.7 - 203.2	Brown shaly sandstone.
203.2 - 206.7	Dark brown slightly carbonaceous sandstone.
206.7 - 208.5	Light brown shaly sandstone.
208.5 - 211.0	Brown sandstone.
211.0 - 212.1	Light brown shaly sandstone.
212.1 - 212.7	Light brown slightly shaly sandstone.
212.7 - 215.0	Brown sandstone.
215.0 - 215.9	Gray laminated sandstone and shale.
215.9 - 224.3	Brown sandstone.
224.3 - 225.0	Light brown slightly shaly sandstone.
225.0 - 226.7	Brown sandstone.
226.7 - 229.9	Black carbonaceous sandstone.
229.9 - 230.8	Light brown sandstone.

Depth Interval, Feet	Description
230.8 - 236.7	Black shaly slightly conglomeratic sandstone.
236.7 - 237.7	Gray shaly conglomeratic sandstone.
237.7 - 238.0	Gray sandy shale.

LABORATORY FLOODING TESTS

The upper portion of the sand in this core responded well, relative to the lower portion of the sand, to laboratory flooding tests, as a total overall recovery of 1,706 barrels of oil per acre was obtained from 21.3 feet of sand. The weighted average percent oil saturation was reduced from 47.0 to 42.4, or represents an average recovery of 4.6 percent. The weighted average effective permeability of the samples is 7.97 millidarcys, while the average initial fluid production pressure is 19.3 pounds per square inch (See Table V).

Please note that the coregraph now presents residual oil saturation instead of recovery, as in the past.

By observing the data given in Table IV, you will note that of the 63 samples tested, 21 produced water and oil, and 37 samples produced water only. This indicates that approximately 33 percent of the sand represented by these samples is floodable pay sand. The tests also show that the sand has an erratic permeability profile.

HILLER 22

CALCULATED RECOVERY

It would appear from a study of the core data, that efficient primary and waterflood operations in the vicinity of this well should recover approximately 7,430 barrels of oil per acre. This is an average recovery of 349 barrels per acre foot from 21.3 feet of floodable sand analyzed in this core.

These recovery values were calculated using the following data and assumptions:

Original formation volume factor, estimated	1.03
Reservoir water saturation, percent, estimated	10.0 / 21.4
Average porosity, percent	22.2 / 23.4
Oil saturation after flooding, percent	42.4 / 48.1
Performance factor, percent, estimated	45.0
Net floodable sand, feet	21.3 / 9.0

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Hickory Creek Oil Company Lease - H 22 Well No. HCO-87

Sample No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content Bbls. / A Ft.	Perm., Mill.	Feet of Sand		Total Oil Content	Perm. Capacity Ft. X md.
			Oil	Water	Total			Ft.	Cum. Ft.		
1	175.5	22.7	57	16	73	1004	280.	1.0	1.0	1004	280.00
2	176.5	24.4	58	13	71	1098	399.	1.0	2.0	1098	399.00
3	177.5	25.6	58	14	72	1152	236.	1.0	3.0	1152	236.00
4	178.5	23.7	54	20	74	993	301.	1.0	4.0	993	301.00
5	179.5	25.5	48	21	69	950	536.	0.8	4.8	760	428.80
6	180.5	25.2	53	23	76	1036	38.	1.5	6.3	1554	57.00
7	181.5	19.7	58	26	84	886	158.	0.7	7.0	620	110.60
8	182.5	23.2	46	25	71	828	239.	1.0	8.0	828	239.00
9	183.5	20.6	64	35	99	1023	96.	1.0	9.0	1023	96.00
10	184.5	25.8	40	26	66	801	133.	1.0	10.0	801	133.00
11	185.5	25.2	39	32	71	763	188.	1.0	11.0	763	188.00
12	186.5	24.8	34	35	69	654	115.	1.0	12.0	654	115.00
13	187.5	25.8	44	27	71	881	175.	1.0	13.0	881	175.00
14	188.5	25.5	32	44	76	633	163.	1.0	14.0	633	163.00
15	189.5	25.1	43	26	69	837	127.	1.0	15.0	837	127.00
16	190.5	25.6	30	37	67	596	340.	1.0	16.0	596	340.00
17	191.5	26.4	38	43	81	778	346.	1.1	17.1	856	380.60
18	192.5	19.2	41	50	91	611	9.9	0.9	18.0	550	8.91
19	193.5	21.8	43	40	83	727	34.	1.0	19.0	727	34.00
20	194.5	22.7	40	39	79	704	106.	1.0	20.0	704	106.00
21	195.5	22.2	37	40	77	637	52.	1.0	21.0	637	52.00
22	196.5	23.2	40	32	72	720	75.	1.0	22.0	720	75.00
23	197.5	22.0	36	45	81	614	97.	0.7	22.7	430	67.90
24	198.3	19.3	33	46	79	494	18.	1.3	24.0	642	23.40
25	199.4	18.3	39	46	85	554	4.4	0.9	24.9	499	3.96
26	200.8	19.7	41	46	87	627	106.	1.1	26.0	690	116.60
27	201.6	21.9	36	44	80	612	59.	1.0	27.0	612	59.00
28	202.4	22.4	36	46	82	626	68.	0.7	27.7	438	47.60
29	203.5	18.8	40	54	94	583	35.	0.8	28.5	466	28.00

Oilfield Research Laboratories

RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Hickory Creek Oil Company Lease - H22 Well No. HCO-87

Sample No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content Bbls. / A Ft.	Perm., Mill.	Feet of Sand		Total Oil Content	Perm. Capacity Ft. X md.
			Oil	Water	Total			Ft.	Cum. Ft.		
30	204.6	22.1	44	39	83	754	35.	1.0	29.5	754	35.00
31	205.5	21.7	38	36	74	640	22.	1.0	30.5	640	22.00
32	206.5	23.8	30	44	74	554	38.	0.7	31.2	388	26.60
33	207.5	15.5	34	53	87	409	2.9	1.3	32.5	532	3.77
34	208.3	21.9	40	41	81	680	1.7	0.5	33.0	340	0.85
35	209.5	21.8	45	33	78	761	13.	1.5	34.5	1142	19.50
36	210.5	19.7	40	44	84	611	24.	1.0	35.5	611	24.00
37	211.4	18.0	47	42	89	656	0.80	1.1	36.6	722	0.88
38	212.5	17.0	48	42	90	633	9.9	0.6	37.2	380	5.94
39	213.4	19.5	38	47	85	575	15.	1.3	38.5	748	19.50
40	214.4	20.3	40	36	76	630	39.	1.0	39.5	630	39.00
41	215.5	14.6	14	67	81	159	Imp.	0.9	40.4	143	0.00
42	216.5	21.1	31	42	73	508	13.	1.1	41.5	559	14.30
43	217.5	22.5	42	50	92	733	62.	1.0	42.5	733	62.00
44	218.5	22.8	33	54	87	584	87.	1.0	43.5	584	87.00
45	219.5	20.3	40	48	88	630	60.	1.0	44.5	630	60.00
46	220.5	20.0	41	57	98	636	45.	1.0	45.5	636	45.00
47	221.8	22.2	32	47	79	551	19.	1.0	46.5	551	19.00
48	222.7	22.0	38	55	93	649	35.	1.0	47.5	649	35.00
49	223.5	22.2	33	52	85	568	31.	1.3	48.8	738	40.30
50	224.5	20.8	24	49	73	387	8.6	0.7	49.5	271	6.02
51	225.5	22.4	35	43	78	608	52.	1.0	50.5	608	52.00
52	226.5	22.4	32	54	86	556	37.	0.7	51.2	389	25.90
53	227.5	22.0	44	41	85	751	11.	1.3	52.5	976	14.30
54	228.5	21.5	44	42	86	734	22.	1.0	53.5	734	22.00
55	229.5	22.7	50	34	84	881	16.	0.9	54.4	793	14.40
56	230.5	22.2	25	31	56	431	101.	0.9	55.3	388	90.90
57	231.5	22.7	42	35	77	740	4.4	1.2	56.5	888	5.28
58	232.5	19.5	32	34	66	484	7.9	1.0	57.5	484	7.90

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Hickory Creek Oil Company Lease - H 22 Well No. HCO-87

Sample No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content Bbls. / A Ft.	Perm., Mill.	Feet of Sand		Total Oil Content	Perm. Capacity Ft. X md.
			Oil	Water	Total			Ft.	Cum. Ft.		
59	233.5	17.3	43	44	87	577	1.5	1.0	58.5	577	1.50
60	234.5	17.1	9	57	66	119	Imp.	1.0	59.5	119	0.00
61	235.5	20.2	58	29	87	909	5.1	1.0	60.5	909	5.10
62	236.5	17.3	50	33	83	671	2.0	0.7	61.2	470	1.40
63	237.5	15.5	27	68	95	325	0.90	1.0	62.2	325	0.90
	13009.6	1358.9		2466			5352.00				

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Hickory Creek Oil Company Lease - H22 Well No. HCO-87

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
175.0 - 184.0	9.0	238.6	2147.40
184.0 - 237.7	51.3	59.5	3051.21
175.0 - 237.7	60.3	86.2	5198.61

Depth Interval, Feet	Feet of Core Analyzed	Average Percent Porosity	Average Percent Oil Saturation	Average Percent Water Saturation	Average Oil Content Bbl./A. Ft.	Total Oil Content Bbls./Acre
175.0 - 184.0	9.0	23.6	55.1	21.4	1004	9,032
184.0 - 237.7	53.2	21.0	37.6	42.9	624	33,177
175.0 - 237.7	62.2	22.2	40.1	39.8	679	42,209

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company: Hickory Creek Oil Company Lease: - H22 Well No. HCO-87

Sample No.	Depth, Feet	Effective Porosity Percent	Original Oil Saturation		Oil Recovery		Residual Saturation			Volume of Water Recovered cc*	Effective Permeability Millidarcys**	Initial Fluid Production Pressure Lbs./Sq./In.
			%	Bbls./A. Ft.	%	Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.			
1	175.5	22.8	57	1009	7	124	50	46	885	204	16.49	10
2	176.5	24.3	58	1093	7	132	51	37	961	203	18.29	10
3	177.5	25.3	58	1138	8	157	50	41	981	167	14.99	15
4	178.5	23.5	54	984	7	128	47	28	856	163	2.70	30
5	179.5	25.6	48	953	2	40	46	49	913	422	38.98	10
6	180.5	25.0	53	1028	4	78	49	42	950	280	11.10	20
7	181.5	20.1	58	904	10	156	48	50	748	188	4.05	25
8	182.5	23.2	46	828	4	72	42	50	756	357	14.83	25
9	183.5	21.0	64	1043	14	228	50	47	815	263	4.20	25
10	184.5	25.5	40	791	0	0	40	52	791	344	24.23	15
11	185.5	25.4	39	769	0	0	39	53	769	371	20.61	15
12	186.5	24.8	34	654	0	0	34	60	654	206	12.85	15
13	187.5	25.7	44	877	0	0	44	48	877	302	15.21	15
14	188.5	25.1	32	623	0	0	32	60	623	167	10.71	15
15	189.5	25.4	43	847	0	0	43	50	847	324	13.92	10
16	190.5	25.9	30	603	0	0	30	56	603	154	19.12	10
17	191.5	26.7	38	787	0	0	38	54	787	387	48.73	10
18	192.5	19.4	41	617	0	0	41	57	617	284	15.85	10
19	193.5	22.0	43	734	0	0	43	54	734	253	14.57	15
20	194.5	22.6	40	701	0	0	40	58	701	292	9.50	15
21	195.5	22.4	37	643	0	0	37	59	643	241	3.90	15
22	196.5	23.0	40	714	0	0	40	56	714	274	3.60	15
23	197.5	22.4	36	625	0	0	36	61	625	450	6.75	15
24	198.5	19.3	33	494	0	0	33	58	494	25	0.22	15
25	199.4	18.8	39	569	0	0	39	57	569	96	1.95	30
26	200.8	20.0	41	636	2	31	39	55	605	233	12.85	10

Notes: cc—cubic centimeter.

*—Volume of water recovered at the time of maximum oil recovery.

**—Determined by passing water through sample which still contains residual oil.

Oilfield Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Hickory Creek Oil Company Lease - H22 Well No. HCO-87

Sample No.	Depth, Feet	Effective Porosity Percent	Original Oil Saturation		Oil Recovery		Residual Saturation			Volume of Water Recovered cc*	Effective Permeability Millidarcys**	Initial Fluid Production Pressure Lbs./Sq./In.
			%	Bbls./A. Ft.	%	Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.			
27	201.6	22.1	36	617	2	34	34	60	583	281	4.05	15
28	202.4	22.8	36	637	2	35	34	62	602	126	2.40	15
29	203.5	19.1	40	593	2	30	38	60	563	420	9.16	10
30	204.5	22.3	44	761	3	52	41	52	709	105	1.50	20
31	205.5	22.0	38	649	0	0	38	57	649	79	1.05	20
32	206.5	23.5	30	547	0	0	30	66	547	172	2.10	15
33	207.5	16.0	34	422	0	0	34	62	422	11	0.15	45
34	208.3	21.5	40	667	0	0	40	50	667	244	3.30	15
35	209.5	21.4	45	747	0	0	45	51	747	77	0.90	20
36	210.5	19.9	40	618	0	0	48	50	618	65	1.05	30
37	211.4	17.6	47	642	0	0	47	38	642	12	0.15	45
38	212.5	17.4	48	648	0	0	48	47	648	8	0.15	45
39	213.4	19.7	38	581	3	46	35	62	535	147	4.05	25
40	214.4	20.0	40	621	4	62	36	60	559	229	4.50	15
41	215.5	14.6	14	158	0	0	14	70	158	0	Imp.	-
42	216.5	21.4	31	514	0	0	31	66	514	336	6.75	15
43	217.5	22.3	42	727	0	0	42	55	727	339	13.74	10
44	218.5	22.4	33	573	0	0	33	63	573	311	11.62	10
45	219.5	20.3	40	630	0	0	40	58	630	474	8.70	10
46	220.5	19.6	41	624	0	0	41	57	624	300	10.31	10
47	221.8	22.0	32	546	0	0	32	65	546	345	7.95	10
48	222.7	21.8	38	643	3	51	35	62	592	227	4.04	30
49	223.5	22.6	33	579	0	0	33	60	579	358	9.90	10
50	224.5	20.5	24	382	0	0	24	71	382	107	1.65	20
51	225.5	22.2	35	603	0	0	35	63	603	301	8.10	15
52	226.5	22.2	32	551	0	0	32	65	551	225	13.24	10

Notes: cc—cubic centimeter.

*—Volume of water recovered at the time of maximum oil recovery.

**—Determined by passing water through sample which still contains residual oil.

Oilfield Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Hickory Creek Oil Company Lease - H22 Well No. HCO-87

Sample No.	Depth, Feet	Effective Porosity Percent	Original Oil Saturation		Oil Recovery		Residual Saturation			Volume of Water Recovered cc*	Effective Permeability Millidarcys**	Initial Fluid Production Pressure Lbs./Sq./In.
			%	Bbls./A. Ft.	%	Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.			
53	227.5	22.3	44	761	4	69	40	54	692	140	1.95	20
54	228.5	21.3	44	727	3	50	41	50	677	41	0.60	25
55	229.5	22.7	50	881	4	70	46	48	811	126	1.65	20
56	230.5	22.2	25	431	0	0	25	60	431	163	1.27	20
57	231.5	22.5	42	733	3	52	39	46	681	31	0.45	30
58	232.5	19.8	32	492	0	0	32	59	492	26	0.30	35
59	233.5	17.2	43	574	0	0	43	48	574	0	Imp.	–
60	234.5	17.2	9	120	0	0	9	82	120	0	Imp.	–
61	235.5	20.0	58	900	0	0	58	30	900	20	0.30	40
62	236.5	17.1	50	663	0	0	50	40	663	0	Imp.	–
63	237.5	15.6	27	327	0	0	27	70	327	0	Imp.	–
							2431				497.21	

Notes: cc—cubic centimeter.

*—Volume of water recovered at the time of maximum oil recovery.

**—Determined by passing water through sample which still contains residual oil.

Oilfield Research Laboratories

SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company Hickory Creek Oil Company Lease - Well No. HCO-87

Depth Interval, Feet	175.0 - 184.0	184.0 - 237.7	175.0 237.7
Feet of Core Analyzed	9.0	12.3	21.3
Average Percent Porosity	23.6	21.4	22.2
Average Percent Original Oil Saturation	55.0	41.2	47.0
Average Percent Oil Recovery	6.8	3.0	4.6
Average Percent Residual Oil Saturation	48.2	38.2	42.4
Average Percent Residual Water Saturation	42.9	55.7	50.3
Average Percent Total Residual Fluid Saturation	91.1	93.9	92.7
Average Original Oil Content, Bbls./A. Ft.	1,003.	683.	814.
Average Oil Recovery, Bbls./A. Ft.	122.	49.	80.
Average Residual Oil Content, Bbls./A. Ft.	881.	634.	734.
Total Original Oil Content, Bbls./Acre	9,032.	8,307.	17,339.
Total Oil Recovery, Bbls./Acre	1,099.	607.	1,706.
Total Residual Oil Content, Bbls./Acre	7,933.	7,700.	15,633.
Average Effective Permeability, Millidarcys	13.57	3.87	7.97
Average Initial Fluid Production Pressure, p.s.i.	18.9	19.6	19.3

NOTE: Only those samples which recovered oil were used in calculating the above averages.

47 1512

WATER SAT., PERCENT → ← OIL SAT., PERCENT

——— PERMEABILITY, IN MILLIDARCYS

- - - - - EFFECTIVE PERMEABILITY TO WATER, IN MILLIDARCYS