

OILFIELD RESEARCH LABORATORIES

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15-133-21351

February 7, 1980

Hickory Creek Oil Company
P.O. Box 379
Parsons, Kansas 67357

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from Well No. HCO-96, and submitted to our laboratory on January 3, 1980.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES


Sanford A. Michel

SAM/kas
4 c to Parsons, Kansas
1 c to Chanute, Kansas

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Hickory Creek Oil Co. Lease - Well No. HCO 96

Location -

Section - Twp - Rge - County - State -

Elevation, Feet - - - - -

Name of Sand - - - - -

Top of Core - - - - - 178.0

Bottom of Core - - - - - 219.0

Top of Sand - - - - - 178.0

Bottom of Sand - - - - - 219.0

Total Feet of Permeable Sand - - - - - 37.2

Total Feet of Floodable Sand - - - - - 22.3

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
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0 - 50	7.4	7.4
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50 - 100	20.3	27.7
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100 - 200	7.5	35.2
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300 - 400	2.0	37.2
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Average Permeability Millidarcys - - - - - 92.8

Average Percent Porosity - - - - - 22.5

Average Percent Oil Saturation - - - - - 37.5

Average Percent Water Saturation - - - - - 40.0

Average Oil Content, Bbls./A. Ft. - - - - - 655.

Total Oil Content, Bbls./Acre - - - - - 24,356.

Average Percent Oil Recovery by Laboratory Flooding Tests - - - - - 5.0

Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. - - - - - 85.

Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre - - - - - 1,417.

Total Calculated Oil Recovery, Bbls./Acre - - - - -

See "Calculated
Recovery Section"

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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 is as follows:

<u>Depth Interval, Feet</u>	<u>Description</u>
178.0 - 184.0	Brown slightly carbonaceous sandstone.
184.0 - 186.1	Brown sandstone.
186.1 - 186.3	Gray sandy shale.
186.3 - 190.8	Brown sandstone.
190.8 - 191.1	Gray laminated sandy shale.
191.1 - 191.7	Brown shaly sandstone.
191.7 - 192.3	Gray laminated sandy shale.
192.3 - 192.8	Brown sandstone.
192.8 - 193.2	Gray sandy shale.
193.2 - 195.4	Brown sandstone.
195.4 - 195.7	Gray laminated sandy shale.
195.7 - 204.7	Brown sandstone.
204.7 - 205.0	Gray sandy shale.
205.0 - 212.6	Brown sandstone.
212.6 - 213.0	Gray sandy shale.
213.0 - 213.2	Brown shaly sandstone.
213.2 - 213.5	Gray sandy shale.
213.5 - 216.2	Brown sandstone.
216.2 - 217.3	Brown shaly sandstone.
217.3 - 217.5	Coal.
217.5 - 219.0	Brown sandstone with fine carbonaceous partings.

LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 1,417 barrels of oil per acre was obtained from 16.6 feet of sand. The weighted average percent oil saturation was reduced from 43.1 to 38.1, or represents an average recovery of 5.0 percent. The weighted average effective permeability of the samples is 5.07 millidarcys, while the average initial fluid production pressure is 20.6 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 21 samples tested, 9 produced water and oil and 10 samples produced water only. This indicates that approximately 43 percent of the sand represented by these samples is floodable pay sand.

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 4,480 barrels of oil per acre. This is an average recovery of 270 barrels per acre foot from 16.6 feet of floodable sand analyzed in this core.

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

HILLER 21

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Original formation volume factor, estimated	✓ 1.03	
Reservoir water saturation, percent, estimated	25.0	✓ 40.0
Average porosity, percent	22.3	✓ 23.1
Oil saturation after flooding, percent	38.1	✓ 32.5
Performance factor, percent, estimated	✓ 45.0	
Net floodable sand, feet	16.6	✓ 2.0

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Hickory Creek Oil Company

Lease - H 2 L

Well No. HCO-96

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.	Car. Ft.		
	<u>179</u>										
1	178.5	26.0	33	35	68	666	351.	2.0	2.0	1332	702.00
3	180.5	25.4	38	26	64	749	150.	2.0	4.0	1498	300.00
5	182.5	23.2	38	37	75	684	135.	2.0	6.0	1368	270.00
7	184.5	23.1	35	32	67	627	77.	2.1	8.1	1317	161.70
9	186.5	22.5	33	43	76	576	56.	1.4	9.5	806	78.40
11	188.5	23.2	32	41	73	576	115.	1.5	11.0	864	172.50
13	190.5	23.7	29	49	78	533	48.	1.6	12.6	853	76.80
15	192.5	20.6	33	49	82	527	93.	0.5	13.1	264	46.50
17	194.5	22.5	36	41	77	628	79.	2.2	15.3	1382	173.80
19	196.5	16.9	32	59	91	420	77.	2.3	17.6	966	177.10
21	198.5	24.3	33	52	85	622	118.	2.0	19.6	1244	236.00
23	200.5	22.9	33	55	88	586	96.	2.0	21.6	1172	192.00
25	202.5	21.6	54	34	88	905	21.	1.3	22.9	1177	27.30
27	204.5	22.6	38	32	70	666	30.	1.4	24.3	932	42.00
29	206.5	20.9	47	38	85	762	44.	2.0	26.3	1524	88.00
31	208.5	23.6	42	32	74	769	99.	2.0	28.3	1538	198.00
33	210.5	22.8	35	39	74	619	59.	2.0	30.3	1238	118.00
35	212.5	22.1	50	27	77	857	63.	1.6	31.9	1371	100.80
37	214.5	21.3	49	34	83	810	59.	2.7	34.6	2187	159.30
39	216.5	17.2	35	62	97	467	5.3	1.1	35.7	514	5.83
41	218.5	22.4	31	51	82	539	83.	1.5	37.2	809	124.50
	<u>4168.5</u>	<u>468.8</u>		<u>868</u>			<u>1858.3</u>				

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Hickory Creek Oil Company Lease — Well No. HCO-96

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
178.0 - 192.8	12.6	139.8	1761.40
193.2 - 211.0	17.7	73.4	1298.70
211.0 - 219.0	6.9	56.6	390.43
178.0 - 219.0	37.2	92.8	3450.53

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
178.0 - 192.8	12.6	24.0	34.3	36.8	638	8,032
193.2 - 211.0	17.7	21.9	38.0	43.6	646	11,437
211.0 - 219.0	6.9	21.4	41.8	40.5	707	4,881
178.0 - 219.0	37.2	22.5	37.5	40.0	655	24,356

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company <u>Hickory Creek Oil Company</u> Lease <u>- H 2 L</u> Well No. <u>HCO-96</u>													
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	178.5	25.8	33	661	0	0	33	63	661	368	29.99	10	1 X 4
3	180.5	25.2	38	743	0	0	38	56	743	418	27.48	10	
5	182.5	23.5	38	693	4	73	34	51	620	246	13.49	10	
7	184.5	22.9	35	622	0	0	35	60	622	255	9.00	20	
9	186.5	22.7	33	581	2	35	31	64	546	256	9.75	20	4 1/2" CI BP
11	188.5	23.2	32	576	0	0	32	65	576	291	8.75	15	
13	190.5	23.4	29	526	0	0	29	66	526	399	5.02	10	
15	192.5	20.9	33	535	0	0	33	60	535	50	0.82	35	
17	194.5	22.4	36	626	3	52	33	58	574	237	8.75	15	
19	196.5	17.4	32	432	0	0	32	64	432	171	2.70	25	
21	198.5	24.0	33	614	0	0	33	63	614	344	5.73	10	
23	200.5	22.9	33	586	0	0	33	64	586	290	3.33	10	
25	202.5	22.0	54	922	17	290	37	52	632	87	1.20	25	
27	204.5	22.4	38	660	3	52	35	58	608	33	0.45	30	1 X 2
29	206.5	21.2	47	773	8	132	39	57	641	296	4.27	20	
31	208.5	23.4	42	762	3	54	39	58	708	240	3.15	20	
33	210.5	22.8	35	619	0	0	35	52	619	0	Imp.	-	
35	212.5	22.3	50	865	4	69	46	47	796	106	1.50	25	
37	214.5	21.0	49	798	4	65	45	49	733	157	1.80	20	
39	216.5	17.4	35	472	0	0	35	63	472	0	Imp.	-	148.01
41	218.5	22.3	31	536	0	0	31	66	536	326	7.83	15	

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.

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SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

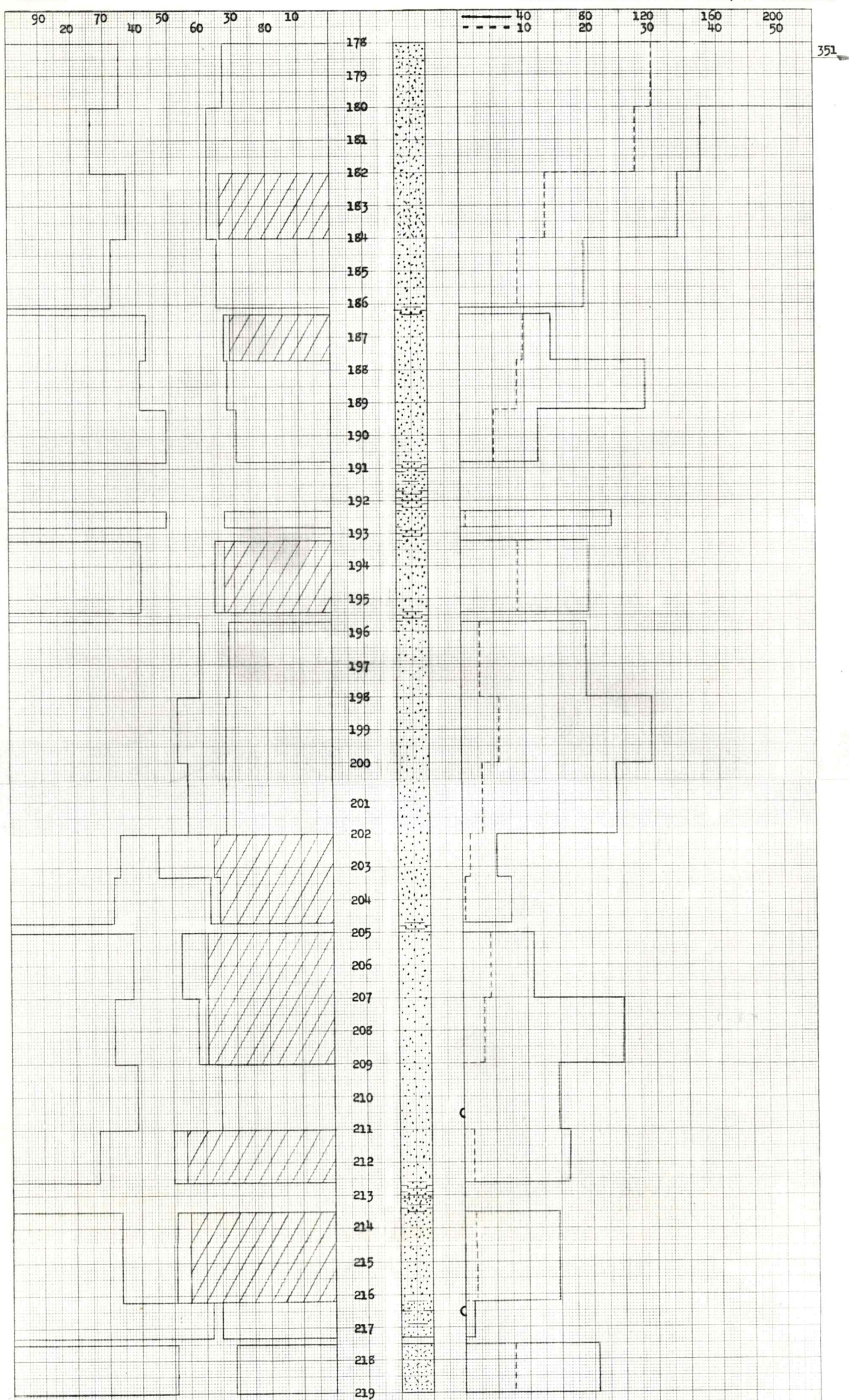
Company	Hickory Creek Oil Company			Lease	—	Well No.	HCO-96
Depth Interval, Feet	178.0 - 192.8	193.2 - 211.0	211.0 - 219.0	178.0 - 219.0			
Feet of Core Analyzed	3.4	8.9	4.3	16.6			
Average Percent Porosity	23.2	22.3	21.5	22.3			
Average Percent Original Oil Saturation	36.0	42.8	49.4	43.1			
Average Percent Oil Recovery	3.2	6.2	4.0	5.0			
Average Percent Residual Oil Saturation	32.8	36.6	45.4	38.1			
Average Percent Residual Water Saturation	56.2	56.9	48.3	54.5			
Average Percent Total Residual Fluid Saturation	89.0	93.5	93.7	92.6			
Average Original Oil Content, Bbls./A. Ft.	647.	738.	823.	741.			
Average Oil Recovery, Bbls./A. Ft.	57.	105.	67.	85.			
Average Residual Oil Content, Bbls./A. Ft.	590.	633.	756.	656.			
Total Original Oil Content, Bbls./Acre	2,199.	6,569.	3,539.	12,307.			
Total Oil Recovery, Bbls./Acre	195.	936.	286.	1,417.			
Total Residual Oil Content, Bbls./Acre	2,004.	5,633.	3,253.	10,890.			
Average Effective Permeability, Millidarcys	11.95	4.08	1.69	5.07			
Average Initial Fluid Production Pressure, p.s.i.	15.0	22.0	22.5	20.6			

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

WATER SAT.,
PERCENTOIL SAT.,
PERCENT

PERMEABILITY, IN MILLIDARCY

EFFECTIVE PERMEABILITY TO WATER, IN MILLIDARCY



KEY:

SANDSTONE

CARBONACEOUS SANDSTONE

SANDY SHALE

FLOODPOT RESIDUAL OIL SATURATION

SHALY SANDSTONE

SANDSTONE WITH FINE CARBON
PARTINGS

COAL

O IMPERMEABLE TO WATER

HICKORY CREEK OIL COMPANY

-- LEASE

WELL NO. HCO - 96

-- COUNTY, --

DEPTH INTERVAL, FEET	FEET OF CORE ANALYZED	AVERAGE PERCENT POROSITY	AVG. OIL SATURATION PERCENT	AVG. WATER SATURATION PERCENT	AVERAGE PERMEABILITY, MILLIDARCY	CALCULATED OIL RECOVERY BBL./ACRE
178.0 - 192.3	12.6	24.0	34.3	36.8	139.8	
193.2 - 211.0	17.7	21.9	38.0	43.6	73.4	
211.0 - 219.0	6.9	21.4	41.8	40.5	56.6	
178.0 - 219.0	37.2	22.5	37.5	40.0	92.8	4,480 (PRIMARY AND WATERFLOODING)