



OILFIELD RESEARCH LABORATORIES

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May 23, 1989

Mack C. Colt, Inc.
P. O. Box 388
Iola, KS 66749

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from the Shephard Lease, Well No. 13, located in Douglas County, Kansas and submitted to our laboratory on April 26, 1989.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Alan M. Dunning
Alan M. Dunning

AMD:bl

5 c to Iola, KS

- REGISTERED ENGINEERS -

CORE ANALYSIS - WATER ANALYSIS - REPRESSURING ENGINEERING - SURVEYING & MAPPING - PROPERTY EVALUATION & OPERATION

Oilfield Research Laboratories
GENERAL INFORMATION & SUMMARY

Company Mack C. Colt, Inc. Lease Shephard Well No. 13

Location _____

Section 13 Twp. 14S Rge. 20E County Douglas State Kansas

Elevation, Feet

Name of Sand.....

Squirrel

Top of Core

687.0

Bottom of Core

761.0

Top of Sand

687.0

Bottom of Sand

758.6

Total Feet of Permeable Sand

64.6

Total Feet of Floodable Sand

30.0

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 20	7.2	7.2
20 - 30	4.6	11.8
30 - 40	12.3	24.1
40 - 60	13.5	37.6
60 - 80	13.0	50.6
80 - 100	4.0	54.6
100 & above	10.0	64.6

Average Permeability Millidarcys

58.2

Average Percent Porosity

22.1

Average Percent Oil Saturation

48.6

Average Percent Water Saturation

32.0

Average Oil Content, Bbls./A. Ft.

835.

Total Oil Content, Bbls./Acre

53,939.

Average Percent Oil Recovery by Laboratory Flooding Tests

6.8

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

119.

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

3,571.

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. Salt water was used as the drilling fluid.

Since only samples ten through twenty-seven were subjected to flooding susceptibility tests, the calculated recovery applies to these samples only.

FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval, Feet</u>	<u>Description</u>
687.0 - 694.3	Sandstone, dark brown with scattered shale and mica partings and inclusions.
694.3 - 695.6	Sandstone, light brown with shale and mica partings.
695.6 - 703.0	Sandstone, brown.
703.0 - 709.0	Sandstone, dark brown.
709.0 - 709.2	Limestone, gray.
709.2 - 710.6	Sandstone, dark brown.
710.6 - 711.0	Sandstone, dark brown with gray limestone vertical inclusions.
711.0 - 719.0	Sandstone, dark brown.
719.0 - 719.5	Limestone, gray.
719.5 - 729.0	Sandstone, dark brown.
729.0 - 730.0	Shale, gray with scattered brown sandstone inclusions.
730.0 - 731.0	Sandstone, brown.
731.0 - 745.0	Sandstone, dark brown.

745.0 - 753.0	Sandstone, brownish black, very slightly carbonaceous.
753.0 - 753.4	Limestone, gray.
753.4 - 753.8	Sandstone, brownish black, slightly carbonaceous.
753.8 - 754.2	Limestone, gray.
754.2 - 756.0	Sandstone, grayish brown, slightly carbonaceous.
756.0 - 757.0	Sandstone, grayish brown, slightly carbonaceous with scattered coal inclusions.
757.0 - 758.6	Sandstone, grayish brown, slightly carbonaceous.
758.6 - 760.3	Shale, gray, calcareous.
760.3 - 761.0	Shale, gray.

LABORATORY FLOODING TESTS

Samples ten through twenty-seven

The sand in this core responded to laboratory flooding tests, as a total recovery of 3,571 barrels of oil per acre was obtained from 30.0 feet of sand. The weighted average percent oil saturation was reduced from 51.0 to 44.2, or represents an average recovery of 6.8 percent. The weighted average effective permeability of the samples is 2.97 millidarcys while the average initial fluid production pressure is 25.5 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 18 samples tested, 14 produced water and oil, and 3 produced water only. This indicates that approximately 78 percent of the sand represented by these samples is floodable pay sand.

CALCULATED RECOVERY

Samples ten through twenty-seven

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 6,670 barrels of oil per acre.

This is an average recovery of 222 barrels per acre foot from 30.0 feet of floodable sand analyzed in this core.

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

Original formation volume factor, estimated	1.04
Reservoir water saturation, percent, estimated	25.0
Average porosity, percent	22.8
Oil saturation after flooding, percent	44.2
Performance factor, percent, estimated	45.0
Net floodable sand, feet	30.0

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Mack C. Colt, Inc. Lease Shepherd Well No. 13

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	688.5	22.3	34	34	68	588	107.	2.0	2.0	1176	214.00
2	690.4	21.0	40	38	78	652	17.	2.0	4.0	1304	34.00
3	691.6	22.5	42	31	73	733	68	2.0	6.0	1466	136.00
4	693.7	22.0	41	36	77	700	30.	1.3	7.3	910	39.00
5	695.7	19.7	39	46	85	596	8.0	1.4	8.7	834	11.20
6	697.3	21.6	38	38	76	637	24.	1.5	10.2	956	36.00
7	699.4	21.5	40	37	77	667	32.	1.5	11.7	1001	48.00
8	700.3	20.9	43	37	80	697	31.	1.5	13.2	1046	46.50
9	702.4	21.8	46	33	79	778	45.	1.5	14.7	1167	67.50
10	703.7	22.3	48	32	80	830	44.	2.0	16.7	1660	88.00
11	706.5	21.1	53	28	81	868	53.	2.0	18.7	1736	106.00
12	708.3	23.4	47	28	75	853	62.	2.0	20.7	1706	124.00
13	714.4	22.7	54	31	85	951	58.	3.5	24.2	3329	203.00
14	716.5	18.4	55	36	91	785	30.	2.5	26.7	1963	75.00
15	718.4	21.7	49	38	87	825	46.	2.0	28.7	1650	92.00
16	722.8	21.3	42	31	73	694	73.	3.5	32.2	2429	255.50
17	724.7	21.5	37	35	72	617	72.	2.5	34.7	1543	180.00
18	727.5	21.4	43	35	78	714	59.	2.5	37.2	1785	147.50
19	728.6	22.1	35	47	82	600	98.	1.0	38.2	600	98.00
20	730.3	22.1	39	45	84	669	30.	1.0	39.2	669	30.00
*21	733.7	25.2	49	25	74	958	128.	3.0	42.2	2874	384.00
*22	736.6	22.0	61	25	86	1041	80.	3.0	45.2	3123	240.00
23	737.5	22.3	56	30	86	969	65.	1.5	46.7	1454	97.50
24	739.7	22.4	61	28	89	1060	70.	1.5	48.2	1590	105.00
25	740.8	23.4	50	30	80	908	136.	2.0	50.2	1816	272.00
26	742.5	23.8	53	26	79	979	121.	3.0	53.2	2937	363.00
27	745.3	23.3	63	26	89	1139	31.	1.0	54.2	1139	31.00
28	746.6	22.6	60	27	87	1052	13.	2.0	56.2	2104	26.00
29	748.5	22.9	61	25	86	1084	34.	2.0	58.2	2168	68.00
30	750.4	22.4	59	30	89	1025	24.	1.5	59.7	1538	36.00

Note: *Sample unbagged.

RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Mack C. Colt, Inc. Lease Shephard Well No. 13

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.		
31	752.7	21.6	52	30	82	871	31.	1.5	61.2	1307	46.50
32	755.4	20.6	48	33	81	767	12.	1.8	63.0	1381	21.60
33	757.8	23.1	55	33	88	986	23.	1.6	64.6	1578	36.80

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Mack C. Colt, Inc. Lease Shepherd Well No. 13

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
687.0 - 745.0	53.2	65.7	3492.70
745.0 - 758.6	11.4	23.3	265.90
687.0 - 758.6	64.6	58.2	3758.60

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
687.0 - 745.0	53.2	22.0	46.9	32.6	803	42,724
745.0 - 758.6	11.4	22.3	56.7	29.1	984	11,215
687.0 - 758.6	64.6	22.1	48.6	32.0	835	53,939

RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company			Mack C. Colt, Inc.			Lease			Shepherd			Well No. 13		
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.		
10	703.7	21.9	48	816	6	102	42	54	22	0.33	35.			
11	706.5	20.9	53	859	8	130	45	53	56	1.00	30.			
12	708.3	23.6	47	861	8	146	39	54	95	1.40	30.			
13	714.4	22.4	54	938	7	122	47	51	32	0.47	30.			
14	716.5	18.4	55	785	0	0	55	43	4	0.13	50.			
15	718.4	21.7	49	825	2	34	47	49	10	0.30	45.			
16	722.8	21.1	42	688	0	0	42	54	24	0.33	30.			
17	724.7	21.5	37	617	0	0	37	60	49	0.67	20.			
18	727.5	21.3	43	711	2	33	41	56	33	0.47	25.			
19	728.6	22.6	35	614	2	35	33	65	280	6.16	15.			
20	730.3	22.0	39	666	2	34	37	59	49	0.67	20.			
21	733.7	25.4	49	966	3	59	46	48	297	4.66	20.			
22	736.6	22.3	61	1055	16	277	45	52	445	6.73	20.			
23	737.5	22.7	56	986	12	211	44	54	379	6.13	12.5			
24	739.7	22.4	61	1060	13	226	48	50	64	1.13	30.			
25	740.8	23.8	50	923	6	111	44	52	252	3.73	25.			
26	742.5	24.2	53	995	5	94	48	47	470	6.93	20.			
27	745.3	23.3	63	1139	0	0	63	27	0	Imp.	-			

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.

Well No. 13

Lease Shephard

Company Mack C. Colt, Inc.

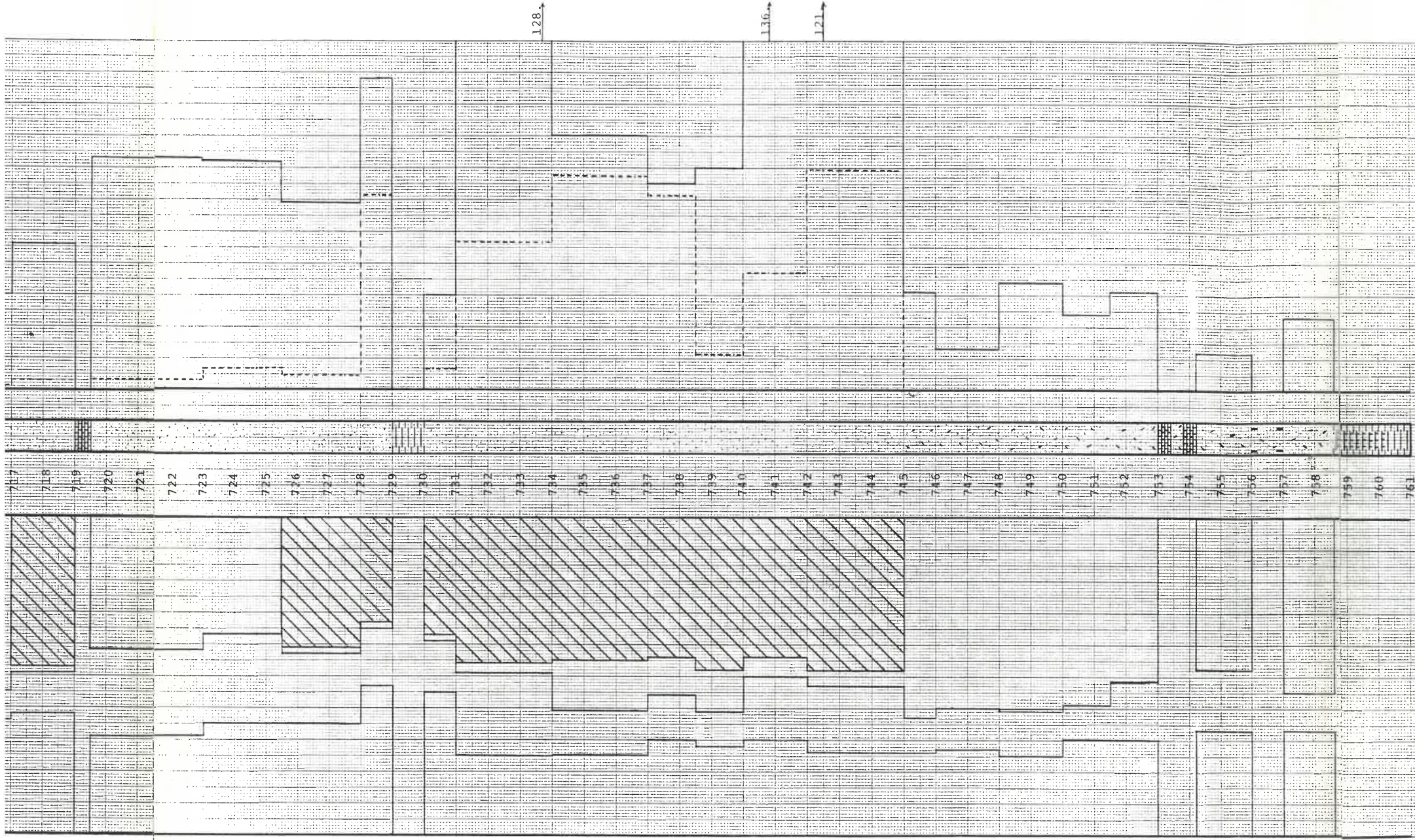
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SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company	Mack C. Colt, Inc.	Lease	Shepherd	Well No.	13
Depth Interval, Feet	703.0 - 745.0				
Feet of Core Analyzed	30.0				
Average Percent Porosity	22.8				
Average Percent Original Oil Saturation	51.0				
Average Percent Oil Recovery	6.8				
Average Percent Residual Oil Saturation	44.2				
Average Percent Residual Water Saturation	52.1				
Average Percent Total Residual Fluid Saturation	96.3				
Average Original Oil Content, Bbls./A. Ft.	901.				
Average Oil Recovery, Bbls./A. Ft.	119.				
Average Residual Oil Content, Bbls./A. Ft.	782.				
Total Original Oil Content, Bbls./Acre	27,027.				
Total Oil Recovery, Bbls./Acre	3,571.				
Total Residual Oil Content, Bbls./Acre	23,456.				
Average Effective Permeability, Millidarcys	2.97				
Average Initial Field Production Pressure, p.s.i.	25.5				

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



KEY:

SANDSTONE

SANDSTONE, CARBONACEOUS WITH COAL INCLUSIONS

SHALE, CALCAREOUS

FLOODPOT RESIDUAL OIL SATURATION

SANDSTONE, CARBONACEOUS

SHALE

LIMESTONE

IMPERMEABLE TO WATER

DEPTH INTERVAL, FEET	FEET OF CORE ANALYZED	AVERAGE POROSITY, PERCENT	AVG. OIL SATURATION PERCENT	AVG. WATER SATURATION PERCENT	AVERAGE PERMEABILITY, MILLIDARCYS	CALCULATED OIL RECOVERY, BBLs./ACRE
687.0 - 745.0	13.2	22.0	46.9	37.6	65.7	
745.0 - 758.6	11.4	22.1	56.7	27.1	23.3	
687.0 - 758.6	44.6	22.1	48.6	37.0	58.2	5,670

CHARLES, KANSAS
MAY 1989

(PRIMARY WATER FLOODING)

OILFIELD RESEARCH LABORATORIES

MACK C. COLT, INC.

LEASE Shepherd WELL NO. 13 DATE RECEIVED April 26, 1989
FIELD _____ ELEVATION _____
COUNTY Douglas STATE Kansas FORMATION Squirrel
LOCATION Section 13, T14S, R20E DRILLING FLUID Salt Water
TYPE OF CORE Rotary
INTERVAL CORED 687.0' - 761.0' INTERVAL RECEIVED 687.0' - 761.0'

