

OILFIELD RESEARCH LABORATORIES

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

August 31, 1981

Lincoln 77
3633 O Street, Suite 4
P. O. Box 30538
Lincoln, Nebraska 68510

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from the Bedwell Lease, Well No. 3, located in Coffey County, Kansas and submitted to our laboratory on August 25, 1981.

Your business is greatly appreciated.

Very truly yours,

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Sanford A. Michel

SAM/kas

4 c to Lincoln, Nebraska
1 c to Topeka, Kansas

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GENERAL INFORMATION & SUMMARY

Company Lincoln 77 Lease Bedwell Well No. 3
 Location NE, NW, SW, SW $\frac{1}{4}$
 Section 11 Twp. 23S Rge. 16E County Coffey State Kansas

Elevation, Feet

Name of Sand..... Lower Squirrel

Top of Core 955.0

Bottom of Core 972.5

Top of Sand (Tested) 958.6

Bottom of Sand (Tested) 967.7

Total Feet of Permeable Sand 6.0

Total Feet of Floodable Sand..... 6.0

Distribution of Permeable Sand:
Permeability Range
Millidarcys

	Feet	Cum. Ft.
10 - 15	0.4	0.4
35 - 60	2.4	2.8
70 - 105	1.2	4.0
135 - 205	2.0	6.0

Average Permeability Millidarcys 92.5

Average Percent Porosity 19.7

Average Percent Oil Saturation 44.1

Average Percent Water Saturation..... 22.3

Average Oil Content, Bbls./A. Ft. 686.

Total Oil Content, Bbls./Acre..... 4,388.

Average Percent Oil Recovery by Laboratory Flooding Tests..... 4.8

Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. 74.

Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre 446.

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. Fresh water mud was used as a drilling fluid. The core was reported to be from a non-virgin area.

At the request of the client, and where possible, two permeability measurements per foot were obtained.

FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval, Feet</u>	<u>Description</u>
955.0 - 958.6	Grayish light brown very shaly sandstone.
958.6 - 959.0	Black slightly carbonaceous sandstone.
959.0 - 959.5	Gray and black laminated shale and sandstone.
959.5 - 961.1	Dark brown sandstone.
961.1 - 962.8	Gray and black laminated shale and slightly carbonaceous sandstone (almost friable).
962.8 - 963.3	Alternate layers gray shale and brown sandstone.
963.3 - 963.7	Grayish brown shaly sandstone.
963.7 - 967.7	Brownish black slightly carbonaceous sandstone.
967.7 - 972.5	Gray and brown laminated shale and sandstone.

LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 446 barrels of oil per acre was obtained from 6.0 feet of sand. The weighted average percent oil saturation was reduced from 46.0 to 41.2, or represents an average recovery of 4.8 percent. The weighted average effective permeability of the samples is 9.21 millidarcys, while the average initial fluid production pressure is 17.86 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 8 samples tested, 7 produced water and oil. This indicates that approximately 88 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 2,040 barrels of oil per acre. This is an average recovery of 341 barrels per acre foot from 6.0 feet of floodable sand analyzed in this core.

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

Original formation volume factor, estimated	1.05
Reservoir water saturation, percent, estimated	15.0
Average porosity, percent	20.1
Oil saturation after flooding, percent	41.2
Performance factor, percent, estimated	55.0
Net floodable sand, feet	6.0

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RESULTS OF PERMEABILITY AND POROSITY TESTS

TABLE I A

Company Lincoln 77 Lease Bedwell Well No. 3

Sample No.	Depth Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.	Percent Porosity
			Ft.	Cum. Ft.		
1A	958.9	203.	0.4	0.4	81.20	
2A	959.6	10.	0.4	0.8	4.00	
2B	960.2	141.	0.4	1.2	56.40	
3A	960.4	101.	0.4	1.6	40.40	
3B	960.9	77.	0.4	2.0	30.80	
4A	963.4	Imp.	0.4	2.4	0.00	
5A	964.7	57.	1.1	3.5	62.70	
6A	965.2	169.	0.8	4.3	135.20	
6B	965.7	37.	0.3	4.6	11.10	
7A	966.1	40.	0.4	5.0	16.00	
7B	966.6	72.	0.4	5.4	28.80	
8A	967.1	57.	0.6	6.0	34.20	
8B	967.6	135.	0.4	6.4	54.00	

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Lincoln 77 Lease Bedwell Well No. 3

Sample No.	Depth, Feet	Effective Porosity Percent	Percent Saturation		Oil Content Bbbs. / A Ft.	Perm., Mill.	Feet of Sand		Total Oil Content	Perm. Capacity Ft. X md.
			Oil	Water			Ft.	Cum. Ft.		
1	958.9	23.0	40	29	714		0.4	0.4	286	
2	959.6	14.8	38	39	436		0.8	1.2	349	
3	960.4	21.5	36	19	601		0.8	2.0	481	
4	963.4	11.2	21	55	182		0.4	2.4	73	
5	964.7	20.8	50	18	807		1.1	3.5	888	
6	965.2	22.6	45	13	789		1.1	4.6	631	
7	966.1	19.1	54	12	800		0.8	5.4	880	
8	967.1	20.3	51	19	803		1.0	6.4	803	

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company	Lincoln 77	Lease	Bedwell	Well No.		
				3		
Depth Interval, Feet	Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.		
958.6 - 963.7	958.6 - 963.7	2.0	106.4	212.80		
963.7 - 967.7	963.7 - 967.7	4.0	85.5	342.00		
958.6 - 967.7	958.6 - 967.7	6.0	92.5	554.80		
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
958.6 - 963.7	2.4	17.8	34.8	33.3	495	1,189
963.7 - 967.7	4.0	20.9	49.7	15.7	800	3,199
958.6 - 967.7	6.4	19.7	44.1	22.3	686	4,388

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Lincoln 77 Lease Bedwell Well No. 3

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			
1	958.9	23.1	40	717	4	72	36	54	210	13.00	10
2	960.2	14.9	38	439	3	35	35	48	330	15.37	10
3	960.4	21.0	37	603	3	49	34	52	236	11.24	15
4	963.4	11.3	21	184	0	0	21	61	0	Imp.	-
5	964.7	20.9	50	811	5	81	45	38	314	11.06	15
6	965.2	22.1	46	789	4	69	42	40	278	6.90	25
7	966.1	19.2	54	804	9	134	45	51	202	9.00	20
8	967.1	20.2	51	799	5	78	46	43	92	1.80	30

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

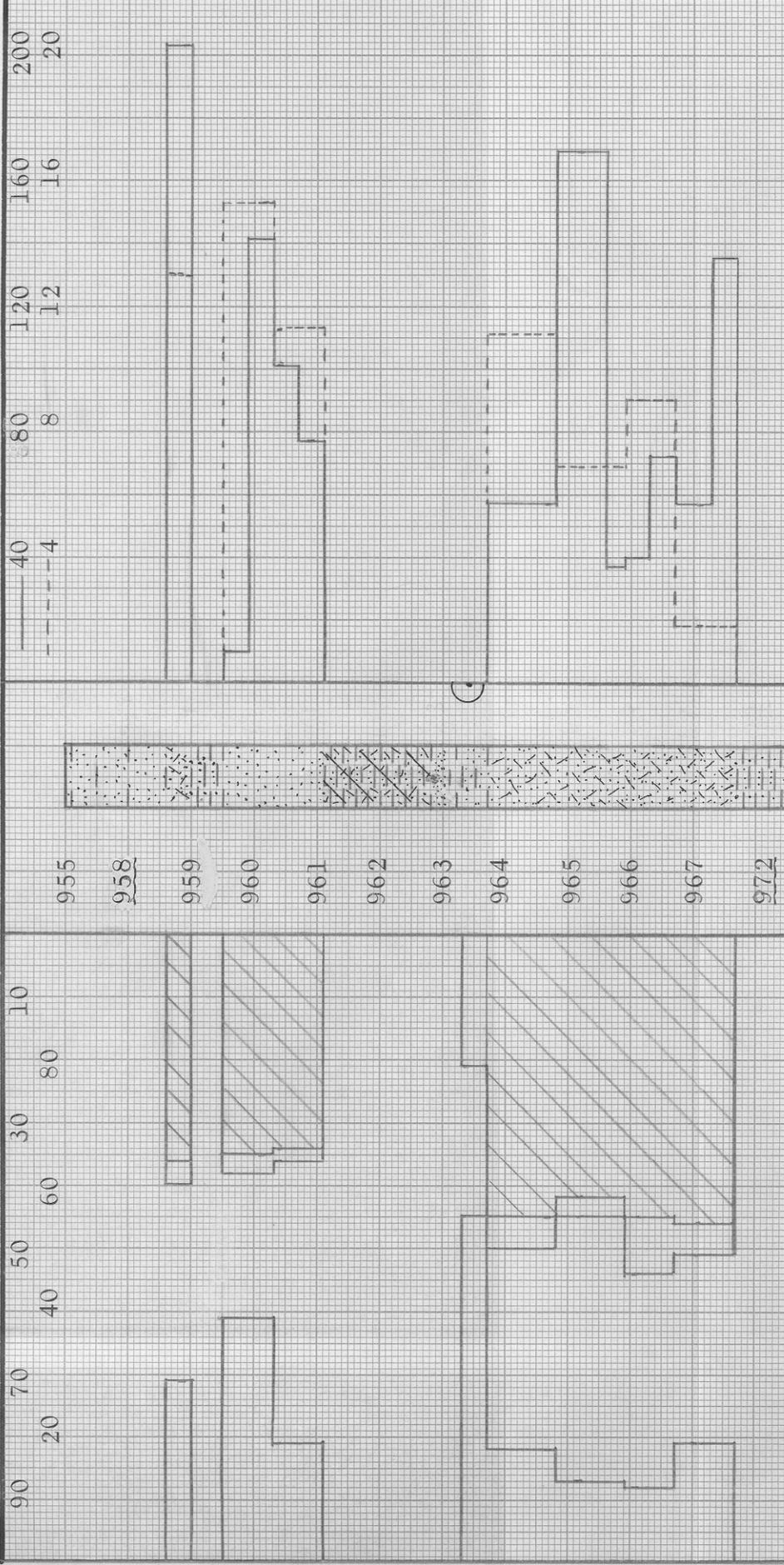
Company	Lease	Bedwell	Well No.
Lincoln 77			3
Depth Interval, Feet	958.6 - 963.7	963.7 - 967.7	958.6 - 967.7
Feet of Core Analyzed	2.0	4.0	6.0
Average Percent Porosity	19.0	20.7	20.1
Average Percent Original Oil Saturation	38.0	49.9	46.0
Average Percent Oil Recovery	3.2	5.5	4.8
Average Percent Residual Oil Saturation	34.8	44.4	41.2
Average Percent Residual Water Saturation	50.8	42.4	45.2
Average Percent Total Residual Fluid Saturation	85.6	86.8	86.4
Average Original Oil Content, Bbls./A. Ft.	560.	801.	720.
Average Oil Recovery, Bbls./A. Ft.	48.	88.	74.
Average Residual Oil Content, Bbls./A. Ft.	512.	713.	646.
Total Original Oil Content, Bbls./Acre	1,120.	3,202.	4,322.
Total Oil Recovery, Bbls./Acre	96.	350.	446.
Total Residual Oil Content, Bbls./Acre	1,024.	2,852.	3,876.
Average Effective Permeability, Millidarcys	13.25	7.19	9.21
Average Initial Fluid Production Pressure, p.s.i.	11.67	22.50	17.86

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

WATER SAT.,
PERCENT

← OIL SAT.,
PERCENT

PERMEABILITY, IN MILLIDARCY
EFFECTIVE PERMEABILITY TO WATER,
MILLIDARCY



KEY:

-  SHALY SANDSTONE
-  CARBONACEOUS SANDSTONE
-  LAMINATED SANDSTONE AND SHALE

-  LAMINATED SHALE AND CARBONACEOUS FRIABLE SANDSTONE
-  ALTERNATE LAYERS SANDSTONE AND SHALE
-  FLOODPOT RESIDUAL OIL SATURATION
-  IMPERMEABLE TO WATER

LINCOLN 77



LAMINATED SANDSTONE AND SHALE ○ IMPERMEABLE TO WATER

LINCOLN 77

BEDWELL LEASE
COFFEY COUNTY, KANSAS
WELL NO. 3

DEPTH INTERVAL, FEET	FEET OF CORE ANALYZED	AVERAGE POROSITY	AVG. OIL SATURATION PERCENT	AVG. WATER SATURATION PERCENT	AVERAGE PERMEABILITY, MILLIDARCS	CALCULATED OIL RECOVERY BBLs. / ACRE
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958.6 - 963.7	2.4	17.8	34.8	33.33	106.4	
963.7 - 967.7	4.0	20.9	49.7	15.7	85.5	
958.6 - 967.7	6.4	19.7	44.1	22.3	92.5	2040 (PRIMARY AND WATERFLOODING)

OILFIELD RESEARCH LABORATORIES
CHANUTE, KANSAS
AUGUST, 1981

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