8-28-17E

April 3, 1950

Mr. Roy Ensminger
101½ West Main
Chanute, Kansas

Gentlemen:

Enclosed herewith is the report of the analysis made on the 3" Rotary core taken from the J. A. Larson Lease, Well No. 1, Wilson County, Kansas, and submitted to our laboratory on March 27, 1950.

Very truly yours,

OIL FIELD RESEARCH LABORATORIES

William H. Sturdevant

William H. Sturdevant

By: Berva White

WHS:bb
o.c.

J. A. Larson 1

ROY ENGINEER

CORE ANALYSIS REPORT

J. A. LARSON LEASE WELL NO. 1

WILSON COUNTY, KANSAS

OIL FIELD RESEARCH LABORATORIES

GRANUTE, KANSAS

APRIL 3, 1950

Oil Field Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Roy Ensminger Lease J. A. Larson Well No. 1

Location East Eighty of SW¼

Section 8 Twp. 28 Rge. 17 County Wilson State Kansas

Name of Sand	Bartlesville
Top of Core	973.00
Bottom of Core	1019.20
Top of Sand	985.10
Bottom of Sand	1006.25
Total Feet of Permeable Sand	19.60

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 20	1.05	1.05
20 - 40	3.60	4.65
40 - 80	3.75	8.40
80 - 120	6.25	14.65
120 - 160	1.50	16.15
160 & above	3.45	19.60

Average Permeability, Millidarcys	101.78
Average Percent Porosity	21.15
Average Percent Oil Saturation	46.85
Average Percent Water Saturation	36.12
Average Oil Content, Bbls./A. Ft.	768.
Total Oil Content, Bbls./Acre	15,390.
Average Percent Oil Recovery by Laboratory Flooding Tests	23.93
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	394.
Aotal Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	7,608.
Total Calculated Oil Recovery, Bbls./Acre	5,000.
Packer Setting, Feet	985.5
Viscosity, Centipoises @ 86°F.	21.8
A. P. I. Gravity, degrees @ 60 °F	28.5

Note: The above averages are for that part of the sand section extending from the packer setting to the top of the cement plug.

Fresh water was used as a circulating fluid in the coring of the sand in this well.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
973.00 - 973.45	Gray shale.
973.45 - 974.15	Hard gray sandy shale.
974.15 - 977.20	Gray sandy shale.
977.20 - 977.40	Laminated sandstone and shale.
977.40 - 977.95	Laminated shale and sandstone.
977.95 - 978.05	Gray shale.
978.05 - 978.25	Brown fine grained micaceous shaley sandstone.
978.25 - 978.90	Laminated sandstone and shale.
978.90 - 979.45	Gray sandy shale.
979.45 - 980.00	Laminated sandstone and shale.
980.00 - 980.40	Light brown fine grained micaceous shaley sandstone.
980.40 - 980.50	Gray sandy shale.
980.50 - 980.70	Brown fine grained micaceous shaley sandstone.
980.70 - 980.90	Hard gray sandy shale.
980.90 - 981.50	Laminated sandstone and shale.
981.50 - 981.70	Light brown fine grained micaceous shaley sandstone.
981.70 - 982.10	Laminated shale and sandstone.
982.10 - 982.65	Laminated sandstone and shale.
982.65 - 983.42	Hard light brown fine grained micaceous calcareous sandstone.
983.42 - 984.20	Hard brown fine grained micaceous sandstone.
984.20 - 984.40	Light brown fine grained micaceous sandstone.
984.40 - 984.76	Light brown fine grained laminated micaceous sandstone.

984.76 - 985.10 - Laminated sandstone and shale.

985.10 - 985.75 - Brown fine grained slightly laminated micaceous sandstone.

985.75 - 987.10 - Brown fine grained micaceous sandstone.

987.10 - 988.70 - Dark brown fine grained micaceous sandstone.

988.70 - 988.95 - Dark brown fine grained micaceous sandstone containing one limestone inclusion.

988.95 - 989.30 - Dark brown fine grained micaceous sandstone.

989.30 - 989.50 - Very hard gray fine grained sandstone.

989.50 - 991.45 - Dark brown fine grained micaceous sandstone.

991.45 - 991.70 - Dark brown fine grained slightly laminated micaceous sandstone.

991.70 - 996.10 - Dark brown fine grained micaceous sandstone.

996.10 - 997.00 - Dark brown fine grained micaceous sandstone containing shale inclusions.

997.00 - 998.65 - Dark brown fine grained micaceous sandstone.

998.65 - 998.85 - Dark brown fine grained micaceous sandstone containing shale inclusions.

998.85 - 1006.25 - Dark brown fine grained micaceous sandstone.

1006.25 - 1007.00 - Soft gray shale.

1007.00 - 1007.50 - Gray sandy shale.

1007.50 - 1008.90 - Gray shale.

1008.90 - 1019.20 - Gray shale (discarded at well).

Coring was started at a depth of 977.00 feet in gray shale and completed at 1019.20 feet in gray shale. This core shows a total of approximately 26.11 feet of formation containing oil of which 20.70 feet could be considered good oil sand. For the most part, the pay sand is made up of fine grained micaceous sandstone.

PERMEABILITY

For the sake of distribution, this core was divided into three

sections. The weighted average permeability of the upper, middle and lower sections are 49.54, 106.07 and 87.95 millidarcys respectively; while that of the pay sand, or that part of the sand section extending from the packer setting to the top of the cement plug, is 101.78 millidarcys (See Table II). By observing the data given on the coregraph, it is noticeable that the sand has a rather irregular permeability profile.

PERCENT SATURATION & OIL CONTENT

The pay sand in this core has a good weighted average percent oil saturation, namely 46.85. The weighted average percent oil saturation of the upper, middle and lower sections are 22.62, 44.01 and 51.59 respectively. The weighted average percent water saturation of the upper, middle and lower sections are 31.66, 37.20 and 37.55 respectively; while that of the pay sand is 36.12 (See Table IV). This gives an overall weighted average total fluid saturation (for the pay sand) of 82.97 percent.

In order to get some idea of the degree of flushing of the sand during coring, all of the saturation samples were analyzed for chloride content. The results of these tests are given in Tables VII and VIII. By observing the data given in these tables and on the coregraph, it is evident that considerable flushing of the sand did occur during coring, especially, in the middle section.

The weighted average oil content of the upper, middle and lower sections are 325, 709, and 864 barrels per acre foot respectively; while that of the pay sand is 768. The total oil content, as shown by this core, is 17,580 barrels per acre of which 15,390 barrels is in the pay sand zone.

VISCOSITY

The viscosity of a sample of crude oil taken from the bleeder at a nearby producing well is 21.8 centipoises at 86° F. The A.P.I. gravity of the oil is 28.5° at 60° F. With other factors being favorable, a sand containing an oil of this viscosity should respond very satisfactorily to water repressuring.

LABORATORY FLOODING TESTS

The pay sand in this core responded very well to laboratory flooding tests, as a total recovery of 7,608 barrels of oil per acre was obtained from 19.30 feet of sandstone. The weighted average percent oil saturation was reduced from 49.67 to 25.74, or represents an average recovery of 23.93 percent. The weighted average effective permeability of the samples is 5.93 millidarcys, while the average initial fluid production pressure is 11.4 pounds per square inch (See Table VI).

By observing the data given in Table V, you will note that of the 24 samples tested, 18 produced oil and 19 took water. Furthermore, these tests show that all of the pay sand represented by these samples is floodable.

CONCLUSION

From a study of the above data, we believe that an efficient water flood within the vicinity of this well will recover approximately 5,000 barrels of oil per acre. In calculating this recovery, an allowance was made for oil lost during coring and it was assumed that the true water saturation of the sand is 36 percent.

In case it is decided to flood this property, it would be advisable to use a comparatively low water input rate, otherwise, by-passing is apt

to occur. We would suggest that an input rate of two barrels per foot of floodable sand per day be used at the start and after approximately 2,000 barrels has been injected into any given input well, gradually increase the injection rate to 3 barrels per foot of floodable sand per day.

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SHOT RECOMMENDATION

Company Roy Fneminger Lease J. A. Lerson Well No. 1

Depth Interval, Feet	Feet of Sand	Size of Shell Inches	Qts./Ft.	Total Quarts
990.0 - 1004.5	14.5	3½	2.0	29.0

Recommended Packer Setting - 985.5 feet
Note: Plug hole back to 1006.0 feet

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RESULTS OF PERMEABILITY TESTS

TABLE I

Company Roy Knesinger Lease J. A. Larson Well No. 1

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	978.05	Imp.	0.10	0.10	0.00
2	979.93	Imp.	0.55	0.65	0.00
3	980.35	3.4	0.40	1.05	1.36
4	982.70	80.	0.35	1.40	28.00
5	983.30	Imp.	0.42	1.82	0.00
6	983.78	98.	0.58	2.40	56.84
7	984.13	32.	0.20	2.60	6.40
8	984.65	2.9	0.36	2.96	1.04
9	985.25	3.0	0.65	3.61	1.95
10	985.85	23.	0.25	3.86	5.75
11	986.20	30.	0.40	4.26	12.00
12	986.57	220.	0.70	4.96	154.00
13	987.15	95.	0.20	5.16	19.00
14	987.48	87.	0.40	5.56	34.80
15	987.85	274.	0.50	6.06	137.00
16	988.48	212.	0.50	6.56	106.00
17	989.00	141.	0.35	6.91	49.35
18	989.61	54.	0.30	7.21	16.20
19	990.00	28.	0.40	7.61	11.20
20	990.40	102.	0.50	8.11	51.00
21	990.97	224.	0.45	8.56	100.80
22	991.30	19.	0.30	8.86	5.70
23	991.95	36.	0.45	9.31	16.20
24	992.30	111.	0.25	9.56	27.75
25	992.50	71.	0.40	9.96	28.40
26	993.21	109.	0.60	10.56	65.40
27	993.52	164.	0.30	10.86	49.20
28	993.82	37.	0.40	11.26	14.80
29	994.35	112.	0.40	11.66	44.80
30	994.70	244.	0.40	12.06	97.60
31	995.07	107.	0.45	12.51	48.15
32	995.65	150.	0.45	12.96	67.50
33	996.00	167.	0.30	13.26	50.10
34	996.60	62.	0.60	13.86	37.20
35	996.85	83.	0.30	14.16	24.90
36	997.20	15.	0.50	14.66	7.50
37	997.75	81.	0.40	15.06	32.40
38	998.04	24.	0.30	15.36	7.20
39	998.38	87.	0.45	15.81	39.15
40	998.90	155.	0.20	16.01	31.00

Oil Field Research Laboratories

RESULTS OF PERMEABILITY TESTS

TABLE I

Company Roy Enominger Lease J. A. Larson Well No. 1

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
41	999.20	59.	0.35	16.36	20.65
42	999.65	76.	0.50	16.86	38.00
43	1000.24	155.	0.50	17.36	77.50
44	1000.60	41.	0.40	17.76	16.40
45	1000.98	110.	0.50	18.26	55.00
46	1001.50	56.	0.35	18.61	19.60
47	1001.80	69.	0.35	18.96	24.15
48	1002.10	37.	0.40	19.36	14.80
49	1002.70	45.	0.50	19.86	22.50
50	1003.15	29.	0.50	20.36	14.50
51	1003.75	37.	0.50	20.86	18.50
52	1004.15	115.	0.50	21.36	57.50
53	1004.60	118.	0.50	21.86	59.00
54	1005.25	95.	0.50	22.36	47.50
55	1005.62	170.	0.35	22.71	59.50
56	1005.82	228.	0.25	22.96	57.00
57	1006.15	71.	0.25	23.21	17.75

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SUMMARY OF PERMEABILITY TESTS

TABLE II

Company Roy Fneminger Lease Larson Well No. 1

Depth Interval Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Md.
980.00 - 984.76	1.89	49.54	93.64
985.10 - 998.65	12.85	106.07	1363.00
998.85 - 1006.25	7.40	87.95	650.85
985.50 - 1006.00	19.60	101.78	1994.90

Oil Field Research Laboratories

RESULTS OF SATURATION TESTS

TABLE III

Company Roy Ensminger Lease J. A. Larson Well No. 1

Sat. No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content Bbls./A. Ft.	Feet of Core		Total Oil Content Bbls./Acre
			Oil	Water	Total		Ft.	Cum. Ft.	
F-1	977.30	12.9	30.0	-	-	301	0.20	0.20	60
1	977.50	13.5	33.1	42.8	75.9	347	0.55	0.75	191
2	978.55	10.8	30.5	60.0	90.5	256	0.65	1.40	166
3	979.75	12.4	26.2	54.9	81.1	252	0.55	1.95	139
F-4	980.60	14.0	33.5	-	-	364	0.20	2.15	73
F-5	981.60	14.3	34.8	-	-	386	0.20	2.35	77
5	981.80	11.7	34.1	56.8	90.9	310	0.95	3.30	294
6	983.10	9.4	44.8	46.1	90.9	327	1.55	4.85	507
F-7	984.30	20.4	21.5	-	-	341	0.20	5.05	68
7	984.50	14.5	45.3	48.0	93.3	511	0.36	5.41	184
8	985.45	18.1	33.8	47.1	80.9	475	0.65	6.06	309
9	986.95	19.7	45.4	37.1	82.5	695	1.35	7.41	940
10	988.30	18.8	45.2	40.6	85.8	659	1.60	9.01	1,054
F-11	989.20	24.2	45.0	-	-	847	0.35	9.36	296
12	990.80	20.0	48.3	32.2	80.5	751	1.95	11.31	1,465
F-13	991.60	17.5	50.1	-	-	682	0.25	11.56	170
13	991.80	23.4	38.8	40.4	79.2	706	0.70	12.26	495
14	993.00	21.7	42.3	42.2	84.5	714	1.20	13.46	856
15	994.20	22.3	44.0	39.1	83.1	763	1.10	14.56	840
16	995.50	22.0	38.8	45.2	84.0	663	1.40	15.96	928

Oil Field Research Laboratories

RESULTS OF SATURATION TESTS

TABLE III

Company Roy Kneninger Lease Larsen Well No. 1

Sat. No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content Bbls./A. Ft.	Feet of Core		Total Oil Content Bbls./Acre
			Oil	Water	Total		Ft.	Cum. Ft.	
17	996.40	20.8	33.9	51.8	85.7	568	0.90	16.86	493
18	997.60	22.9	48.2	40.0	88.2	857	1.10	17.96	945
F19	998.55	19.4	64.4	-	-	971	0.55	18.51	535
19	998.75	18.0	37.6	52.0	89.6	525	0.20	18.71	105
20	999.85	20.5	69.5	21.2	90.7	1,107	1.75	20.46	1,940
21	1001.35	20.9	45.5	39.1	84.6	739	1.30	21.76	960
22	1002.50	22.0	45.3	39.4	84.7	775	1.10	22.86	853
23	1003.55	21.4	44.3	44.6	88.9	737	1.20	24.06	885
24	1005.00	24.0	48.1	37.8	85.9	895	1.00	25.06	895
25	1005.45	22.7	38.6	46.6	85.2	680	0.55	25.61	374
F25	1006.00	21.7	57.1	-	-	965	0.50	26.11	483
							Total	- - - -	17,580

Oil Field Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE V

Company Ray Ensminger Lease J. A. Larson Well No. 1

Sample No.	Depth, Feet	Effective Porosity Percent	Original Oil Saturation		Oil Recovery		Residual Saturation			Volume of Water Recovered cc*	[redacted] Effective Permeability, Millidarcys **	Initial Fluid Production Pressure Lbs./Sq. In.
			Percent	Bbls./A. Ft.	Percent	Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.			
1	977.30	12.9	30.0	301	0.0	0	30.0	56.1	301	0	Imp.	50+
2	978.35	12.5	30.7	298	0.0	0	30.7	59.5	298	0	Imp.	50+
3	980.60	14.0	33.5	364	0.0	0	33.5	58.2	364	0	Imp.	50+
5	981.60	14.3	34.8	386	0.0	0	34.8	58.7	386	0	Imp.	50+
6	982.90	12.2	31.5	298	0.0	0	31.5	55.0	298	0	Imp.	50+
7	984.30	20.4	21.5	341	0.0	0	21.5	71.9	341	140	9.61	5
8	985.45	19.1	36.7	645	4.5	67	32.2	64.5	478	7	0.204	35
9	986.75	20.9	41.4	673	12.0	195	29.4	68.2	478	129.5	6.37	15
10	988.10	21.7	45.3	765	15.6	264	29.7	58.2	501	92	9.77	10
11	989.20	24.2	45.0	847	19.5	367	25.5	71.8	480	226.5	23.71	5
12	990.50	18.4	56.8	842	32.7	466	26.1	71.9	374	15.5	0.651	10
13	991.60	17.5	50.1	662	21.4	291	28.7	68.7	391	17	0.494	5
14	992.80	23.0	40.9	732	16.4	293	24.5	68.0	439	225	12.57	10
15	994.00	20.9	46.4	755	21.7	353	24.7	70.0	402	82	13.10	10
16	995.20	21.5	38.1	631	12.1	200	26.0	70.2	431	77.5	2.17	20
17	996.20	22.9	37.2	662	13.5	240	23.7	72.6	422	72	6.93	5
18	997.40	21.1	50.8	834	32.3	530	18.5	78.6	304	29	2.51	10
19	998.55	19.4	64.4	971	38.6	582	25.8	69.5	389	41	0.854	10
20	999.85	22.5	64.4	1129	44.2	775	20.2	76.0	354	51	3.44	5
21	1001.15	19.3	49.7	746	21.4	321	28.3	67.2	428	73	2.08	15
22	1002.30	20.6	59.2	957	32.3	522	26.9	72.6	435	45	1.65	10
23	1003.25	22.6	50.6	897	22.9	406	27.7	71.5	491	92	3.38	10
24	1004.80	23.1	52.9	968	27.1	497	26.8	70.8	462	97	10.65	10
25	1006.90	21.7	57.1	965	29.5	500	27.5	72.0	465	38	11.31	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.

Oil Field Research Laboratories

SUMMARY OF SATURATION TESTS

TABLE IV

Company Roy Enseminger Lease J. A. Larson Well No. 1

Depth Interval, Feet	Feet of Core Analyzed	Average Percent Porosity	Average Percent Oil Saturation	Average Percent Water Saturation	Average Oil Content Bbls./A. Ft.	Total Oil Content Bbls./Acre
977.20-984.76	5.41	11.92	22.62	31.66	325	1,759
985.10-998.85	13.30	20.77	44.01	37.20	709	9,431
998.85-1006.25	7.40	21.68	51.59	33.55	864	6,390
985.50-1006.00	20.05	21.15	46.85	36.12	768	15,390

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SUMMARY OF LABORATORY FLOODING TESTS

TABLE VI

Company Roy Sheminger Lease J. A. Larson Well No. 1

Depth Interval, Feet	985.10-998.65	998.85-1006.25	985.50-1006.00
Feet of Core Analyzed	13.10	6.85	19.30
Average Percent Porosity	21.00	21.71	21.28
Average Percent Original Oil Saturation	45.96	56.20	49.67
Average Percent Oil Recovery	19.92	30.66	23.93
Average Percent Residual Oil Saturation	26.04	25.62	25.74
Average Percent Residual Water Saturation	68.39	71.97	69.69
Average Percent Total Residual Fluid Saturation	94.43	97.59	95.43
Average Original Oil Content, Bbls./A. Ft.	744.	953.	819.
Average Oil Recovery, Bbls./A. Ft.	320.	522.	394.
Average Residual Oil Content, Bbls./A. Ft.	424.	431.	425.
Total Original Oil Content, Bbls./Acre	9,744.	6,527	15,811.
Total Oil Recovery, Bbls./Acre	4,186.	3,574.	7,608.
Total Residual Oil Content, Bbls./Acre	5,558.	2,953.	8,203.
Average Effective Permeability, Millidarcys	6.60	4.51	5.93
Average Initial Fluid Production Pressure, p.s.i.	12.1	10.0	11.4

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

8-28-17E

J.A. Larson 1

Oil Field Research Laboratories

RESULTS OF WATER DIFFERENTIATION TESTS

TABLE VII

Company Roy Ensminger Lease J. A. Larson Well No. 1

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation		
			Connate	Drilling & Foreign	Total
1	977.50	46,400			
2	978.55	45,200			
3	979.75	37,100			
5	981.80	35,800			
6	983.10	42,200			
7	984.50	32,700			
8	985.45	21,800			
9	986.95	18,700			
10	988.30	20,200			
12	990.80	35,300			
13	991.80	8,530			
14	993.00	15,400			
15	994.30	13,450			
16	995.50	33,000			
17	996.40	5,600			
18	997.60	24,700			
19	998.75	26,800			
20	999.85	52,500			
21	1001.35	29,400			
22	1002.50	37,000			
23	1003.55	28,800			
24	1005.00	20,500			
25	1005.45	15,200			

Note: ppm - parts per million.

Oil Field Research Laboratories

SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VIII

Company Roy Ensminger Lease J. A. Larson Well No. 1

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
977.20 - 984.76	40,477		
985.10 - 998.85	21,709		
998.85 - 1006.25	33,965		
985.50 - 1006.00	26,421		

Note: ppm - parts per million.