

# OILFIELD RESEARCH LABORATORIES

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

September 29, 1981

Kindle & Clark Oil Company  
R R # 2, Box 29A  
Wellsville, Kansas 66092

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from the Watts Lease, Well No. 1, located in Franklin County, Kansas and submitted to our laboratory on September 17, 1981.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Sanford A. Michel

SAM/kas

5 c to Wellsville, Kansas

**Oilfield Research Laboratories**  
**GENERAL INFORMATION & SUMMARY**

Company Kindle & Clark Oil Company Lease Watts Well No. 1  
 Location \_\_\_\_\_  
 Section 10 Twp. 16S Rge. 19E County Franklin State Kansas

Elevation, Feet .....

Name of Sand.....

Top of Core ..... 743.0

Bottom of Core ..... 753.8

Top of Sand ..... 743.5

Bottom of Sand ..... 753.8

Total Feet of Permeable Sand ..... 3.7

Total Feet of Floodable Sand ..... 1.3

| Distribution of Permeable Sand: |             | Feet | Cum. Ft. |
|---------------------------------|-------------|------|----------|
| Permeability Range              | Millidarcys |      |          |
| 25 - 36                         |             | 2.5  | 2.5      |
| 90 - 146                        |             | 1.2  | 3.7      |

Average Permeability Millidarcys ..... 60.5

Average Percent Porosity ..... 13.6

Average Percent Oil Saturation ..... 27.6

Average Percent Water Saturation ..... 60.0

Average Oil Content, Bbls./A. Ft. .... 378.

Total Oil Content, Bbls./Acre ..... 3,895.

Average Percent Oil Recovery by Laboratory Flooding Tests ..... 5.5

Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. .... 126.

Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre ..... 164.

Total Calculated Oil Recovery, Bbls./Acre ..... See "Calculated Recovery"  
 Section

The core was sampled by a representative of Oilfield Research Laboratories. Fresh water mud was used as a drilling fluid. The core was reported to be from a virgin area.

#### FORMATION CORED

The detailed log of the formation cored is as follows:

| <u>Depth Interval,<br/>Feet</u> | <u>Description</u>                          |
|---------------------------------|---------------------------------------------|
| 743.0 - 743.5                   | Gray slightly sandy shale.                  |
| 743.5 - 745.6                   | Brown sandstone.                            |
| 745.6 - 748.5                   | Gray very calcareous sandstone.             |
| 748.5 - 749.4                   | Brown sandstone.                            |
| 749.4 - 750.1                   | Dark brown slightly carbonaceous sandstone. |
| 750.1 - 753.8                   | Gray shaly sandstone.                       |

#### LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 164 barrels of oil per acre was obtained from 1.3 feet of sand. The weighted average percent oil saturation was reduced from 50.0 to 44.5, or represents an average recovery of 5.5 percent. The weighted average effective permeability of the samples is 0.80 millidarcys, while the average initial fluid production pressure is 45.0 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 11 samples tested, 2 produced water and oil. This indicates that approximately 18 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 150 barrels of oil per acre. This is an average recovery of 112 barrels per acre foot from 1.3 feet of floodable sand analyzed in this core.

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

|                                                |      |
|------------------------------------------------|------|
| Original formation volume factor, estimated    | 1.05 |
| Reservoir water saturation, percent, estimated | 40.0 |
| Average porosity, percent                      | 22.9 |
| Oil saturation after flooding, percent         | 44.5 |
| Performance factor, percent, estimated         | 50.0 |
| Net floodable sand, feet                       | 1.3  |

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## RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Kindle & Clark Oil Company Lease Watts Well No. 1

| 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          | 743.6       | 23.3                       | 41                 | 35    | 76    | 741                       | 92.          | 0.5          | 0.5      | 371               | 46.00                    |
| 2          | 744.5       | 22.6                       | 47                 | 31    | 78    | 824                       | 33.          | 1.0          | 1.5      | 824               | 33.00                    |
| 3          | 745.4       | 20.6                       | 54                 | 30    | 84    | 863                       | 35.          | 0.6          | 2.1      | 518               | 21.00                    |
| 4          | 746.4       | 4.3                        | 16                 | 82    | 98    | 53                        | Imp.         | 1.4          | 3.5      | 74                | 0.00                     |
| 5          | 747.5       | 5.4                        | 17                 | 63    | 80    | 71                        | Imp.         | 1.5          | 5.0      | 107               | 0.00                     |
| 6          | 748.6       | 21.1                       | 62                 | 22    | 84    | 1015                      | 25.          | 0.9          | 5.9      | 914               | 22.50                    |
| 7          | 749.5       | 25.0                       | 50                 | 22    | 72    | 970                       | 145.         | 0.7          | 6.6      | 679               | 101.50                   |
| 8          | 750.4       | 11.3                       | 13                 | 83    | 96    | 114                       | Imp.         | 0.7          | 7.3      | 80                | 0.00                     |
| 9          | 751.4       | 11.5                       | 11                 | 86    | 97    | 98                        | Imp.         | 1.0          | 8.3      | 98                | 0.00                     |
| 10         | 752.6       | 10.6                       | 14                 | 80    | 94    | 115                       | Imp.         | 1.0          | 9.3      | 115               | 0.00                     |
| 11         | 753.6       | 12.3                       | 12                 | 83    | 95    | 115                       | Imp.         | 1.0          | 10.3     | 115               | 0.00                     |

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## SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

| Company | Kindle & Clark Oil Company | Lease                    | Watts                                   | Well No.                              | 1 |
|---------|----------------------------|--------------------------|-----------------------------------------|---------------------------------------|---|
|         | Depth Interval,<br>Feet    | Feet of Core<br>Analyzed | Average<br>Permeability,<br>Millidarcys | Permeability<br>Capacity<br>Ft. x Md. |   |
|         | 743.5 - 750.1              | 3.7                      | 60.5                                    | 224.00                                |   |
|         | 750.1 - 753.8              | 0.0                      | 0.00                                    | 0.00                                  |   |
|         | 743.5 - 753.8              | 3.7                      | 60.5                                    | 224.00                                |   |

|  | Depth Interval,<br>Feet | Feet of Core<br>Analyzed | Average<br>Percent<br>Porosity | Average<br>Percent Oil<br>Saturation | Average<br>Percent Water<br>Saturation | Average<br>Oil Content<br>Bbl./A. Ft. | Total Oil<br>Content<br>Bbls./Acre |
|--|-------------------------|--------------------------|--------------------------------|--------------------------------------|----------------------------------------|---------------------------------------|------------------------------------|
|  | 743.5 - 750.1           | 6.6                      | 14.7                           | 36.2                                 | 47.1                                   | 528                                   | 3,487                              |
|  | 750.1 - 753.8           | 3.7                      | 11.4                           | 12.5                                 | 83.0                                   | 110                                   | 408                                |
|  | 743.5 - 753.8           | 10.3                     | 13.6                           | 27.6                                 | 60.0                                   | 378                                   | 3,895                              |

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## RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

| Company    |             | Kindle & Clark Oil Company |                         | Lease        |              | Watts        |                     | Well No. |                               | 1                                    |                                                |
|------------|-------------|----------------------------|-------------------------|--------------|--------------|--------------|---------------------|----------|-------------------------------|--------------------------------------|------------------------------------------------|
| 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          | 743.6       | 23.7                       | 40                      | 735          | 0            | 0            | 40                  | 38       | 0                             | Imp.                                 | -                                              |
| 2          | 744.5       | 22.4                       | 47                      | 817          | 0            | 0            | 47                  | 34       | 0                             | Imp.                                 | -                                              |
| 3          | 745.4       | 20.7                       | 54                      | 867          | 10           | 161          | 44                  | 43       | 30                            | 1.20                                 | 50                                             |
| 4          | 746.4       | 4.3                        | 16                      | 53           | 0            | 0            | 16                  | 82       | 0                             | Imp.                                 | -                                              |
| 5          | 747.5       | 5.6                        | 18                      | 78           | 0            | 0            | 18                  | 62       | 0                             | Imp.                                 | -                                              |
| 6          | 748.6       | 20.8                       | 63                      | 1017         | 0            | 0            | 63                  | 23       | 0                             | Imp.                                 | -                                              |
| 7          | 749.5       | 24.8                       | 50                      | 962          | 5            | 96           | 45                  | 40       | 24                            | 0.45                                 | 40                                             |
| 8          | 750.4       | 11.4                       | 13                      | 115          | 0            | 0            | 13                  | 83       | 0                             | Imp.                                 | -                                              |
| 9          | 751.4       | 11.4                       | 11                      | 97           | 0            | 0            | 11                  | 87       | 0                             | Imp.                                 | -                                              |
| 10         | 752.6       | 10.7                       | 14                      | 116          | 0            | 0            | 14                  | 80       | 0                             | Imp.                                 | -                                              |
| 11         | 753.6       | 12.2                       | 12                      | 114          | 0            | 0            | 12                  | 83       | 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.

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## SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

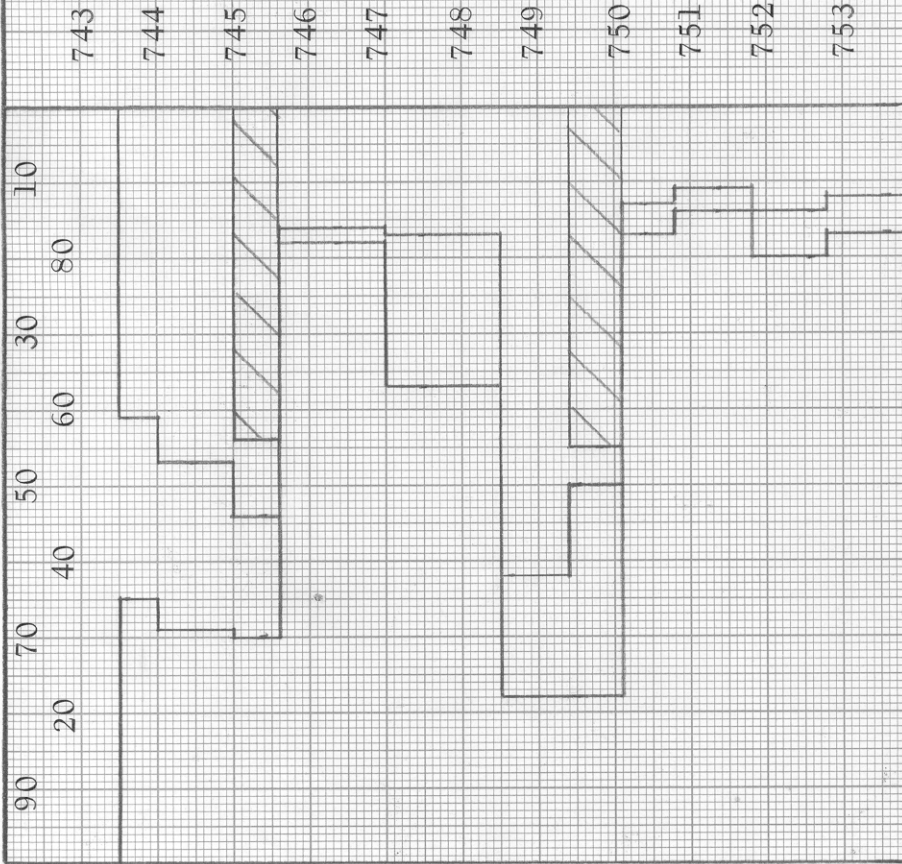
| Company                                           | Kindle & Clark Oil Company | Lease | Watts | Well No. |
|---------------------------------------------------|----------------------------|-------|-------|----------|
| Depth Interval, Feet                              | 743.5 - 750.1              |       |       |          |
| Feet of Core Analyzed                             | 1.3                        |       |       |          |
| Average Percent Porosity                          | 22.9                       |       |       |          |
| Average Percent Original Oil Saturation           | 50.0                       |       |       |          |
| Average Percent Oil Recovery                      | 5.5                        |       |       |          |
| Average Percent Residual Oil Saturation           | 44.5                       |       |       |          |
| Average Percent Residual Water Saturation         | 41.4                       |       |       |          |
| Average Percent Total Residual Fluid Saturation   | 85.9                       |       |       |          |
| Average Original Oil Content, Bbls./A. Ft.        | 918.                       |       |       |          |
| Average Oil Recovery, Bbls./A. Ft.                | 126.                       |       |       |          |
| Average Residual Oil Content, Bbls./A. Ft.        | 792.                       |       |       |          |
| Total Original Oil Content, Bbls./Acre            | 1,194.                     |       |       |          |
| Total Oil Recovery, Bbls./Acre                    | 164.                       |       |       |          |
| Total Residual Oil Content, Bbls./Acre            | 1,030.                     |       |       |          |
| Average Effective Permeability, Millidarcys       | 0.80                       |       |       |          |
| Average Initial Fluid Production Pressure, p.s.i. | 45.0                       |       |       |          |

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

WATER SAT.,  
PERCENT

OIL SAT.,  
PERCENT

PERMEABILITY, IN MILLIDARCYS  
EFFECTIVE PERMEABILITY TO WATER, IN  
MILLIDARCYS



KEY:



SANDSTONE



CARBONACEOUS SANDSTONE



CALCAREOUS SANDSTONE



SHALY SANDSTONE



SANDY SHALE



FLOODPOT RESIDUAL OIL SATURATION



IMPERMEABLE TO WATER

KINDLE & CLARK OIL COMPANY

WATTS LEASE

FRANKLIN COUNTY, KANSAS

WELL NO. 1

# KINDLE & CLARK OIL COMPANY

WATTS LEASE

WELL NO. 1

FRANKLIN COUNTY, KANSAS

| DEPTH INTERVAL,<br>FEET | FEET OF CORE<br>ANALYZED | AVERAGE<br>PERCENT | AVG. OIL<br>SATURATION<br>PERCENT | AVG. WATER<br>SATURATION<br>PERCENT | AVERAGE<br>PERMEABILITY,<br>MILLIDARCS | CALCULATED<br>OIL RECOVERY<br>BBLs. / ACRE |
|-------------------------|--------------------------|--------------------|-----------------------------------|-------------------------------------|----------------------------------------|--------------------------------------------|
|-------------------------|--------------------------|--------------------|-----------------------------------|-------------------------------------|----------------------------------------|--------------------------------------------|

743.5 - 750.1

6.6

14.7

36.2

47.1

60.5

750.1 - 753.8

3.7

11.4

12.5

83.0

0.0

743.5 - 753.8

10.3

13.6

27.6

60.0

60.5

150

(PRIMARY AND  
WATERFLOODING)

OILFIELD RESEARCH LABORATORIES  
CHANUTE, KANSAS  
SEPTEMBER, 1981

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