COGCC Document # 2056212
Mamm Creek Field #52500

# Salinity Analysis of 8 Wells in Townships 6 and 7 South, Range 92 West, 6th P.M. Mamm Creek Field, Piceance Basin, Colorado

**Prepared for**
**COGCC**

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## Introduction

We were contacted in April 2015 by Dave Andrews of COGCC to assist in estimating water salinities in order to map the vertical distribution of fresh water in selected wells located in Townships 6 and 7 South, Range 92 West, 6th P.M. Mamm Creek Field, Piceance Basin, Colorado. COGCC's goal is to evaluate suitable surface casing setting depths to protect useable fresh water in the Wasatch and Upper Mesa Verde Group. For the purpose of this study, "fresh water" is defined as having a salinity of less than 10,000 ppm.

Similar to the initial study in Rulison Field, Piceance Basin, Colorado, completed in July 2014, it was decided that a study of eight wells would be used to determine if comparisons between Spontaneous Potential (SP) analysis and traditional Archie analysis could be correlated to help in mapping the fresh water depths. A purchase order for this project was issued in May 2015, when digitizing of eight wells commenced. Both an SP analysis as well as a full Archie Analysis was performed on all eight wells.

This report is a documentation of the results of this study.

## Summary

For eight wells selected by COGCC, Digital Formation identified individual sand intervals using gamma ray (GR) logs down to about 200 feet below the top of the Mesa Verde, using a new automated identification approach:

05045067440000 Sample #T 65-17 P

05045069070000 Dunn #9-2

05045069990000 KRK LTD #7-3

05045076680000 Porter Federal #13-28

05045079290000 Scott #2-36

05045089730000 Buerger Disposal #1

05045108150000 Stone #42D-34-692

05045129840000 Last Dance #13B-2-792

A newly developed approach to automatically calculate salinity from the SP log was made on each of these intervals.

Archie calculations for total porosity (from a density and neutron cross plot) and saturation from formation resistivity are calculated for all wells. An automated interpretation of Pickett Plots was used to choose water resistivity ($R_W$) for each interval. Archie cementation and saturation values of m = n = 1.8 were used for all wells. The values were chosen based on interpretation of the sands and Digital Formation's professional experience in the Piceance Basin.

Using the calculated formation temperature – based on an average annual surface temperature of 50°F, and the log header bottom hole temperature (BHT) – an equivalent salinity is calculated from the $R_W$ value. For many of the sands, there is a scatter of data on the Pickett Plots suggesting either:

1. Small amounts of residual hydrocarbons
2. Variable water salinity – thought to be unlikely

Overall, the data suggests wide variation in $R_W$, with no consistent depth trend. Water of less than 10,000 ppm is calculated within the Mesa Verde, using m = n = 1.8. There is little correlation between the salinities from Archie analysis and from the SP log.

## Data Preparation

Log ASCII Standard (LAS) files were loaded into Digital Formation's ***LESA*** petrophysical software. Curves from logging service companies were renamed for consistency:

| Log | Mnemonic | Description |
|---|---|---|
| **Density** | DF_RHOB | Copy of RhoB, or other service company mnemonic |
| **Neutron** | DF_NPHI_L | Copy of NPhi, or other service company mnemonic |
| **Acoustic compressional** | DF_DT | Copy of DT, or other service company mnemonic |
| **Acoustic shear** | DF_DTS | Copy of DTS, or other service company mnemonic |
| **Caliper** | DF_CALI | Copy of CALI, or other service company mnemonic |
| **Deep Resistivity** | DF_DEEP | Copy of resistivity curve identified as "deep" |
| **Medium Resistivity** | DF_MEDIUM | Copy of resistivity curve identified as medium or intermediate |
| **Shallow Resistivity** | DF_SHALLOW | Copy of resistivity curve identified as shallow |
| **Gamma Ray** | DF_GR | Copy of GR or other service company mnemonic |
| **SP** | DF_SP | Copy of SP or other service company |

| mnemonic |
|---|

Programmatic despiking of the porosity logs was performed, to eliminate obvious levels of invalid readings due to bad hole. Whenever the hole is out of gauge, the porosity logs tend to read anomalously high values. The despiking routines identify and eliminate these levels. De-spiked Curves were named adding "DS" – for example:

DF_RHOB_DS

From the data shown on the log header, environmental factors were corrected on the density and GR log curves for hole size, and application of the appropriate tornado chart was used to determine deep resistivity, total resistivity (Rt), and flushed zone resistivity (Rxo). If no match was available, it was assumed that Rt = deep, and Rxo = shallow.

Petrophysical zones equivalent to the operator-reported formation tops were correlated to major lithologic units. A depth plot of the caliper log was reviewed, to recognize appropriate hole size for each petrophysical zone.

## Basic Clean Formation Analysis

### Shale Volume

Shale volume ($V_{SH}$) was determined from the GR log, using the standard non-linear "Stieber" equation:

$$GRI = \frac{GR - GR_{clean}}{GR_{shale} - GR_{clean}}$$

$$V_{SH} = \frac{0.5 \times GRI}{1.5 - GRI}$$

$GR_{clean}$ and $GR_{shale}$ were chosen using interactive graphics, on a petrophysical zone basis.

### Shale Responses

Shale responses of porosity logs were determined, on a zone-by-zone basis, using interactive porosity cross plots.

### Porosity

Total porosity ($Phi_X$) was determined using a density/neutron cross plot porosity. Effective porosity ($Phi_E$) was determined using the equation:

$$Phi_E = Phi_X - (V_{SH} \times Phi_{shale})$$

## Water Saturation

The Archie parameters, water resistivity ($R_W$) and cementation exponent (*m*), were determined automatically from porosity/resistivity (Pickett) cross plots. The apparent $R_W$ ($R_{Wa}$) assuming 100% water saturation was calculated at each depth.

$$R_{Wa} = Phi^m \times R_t$$

The minimum value of this calculation over each interval is used as $R_W$. Saturation exponent (*n*) was assumed equal to m, consistent with industry practice in the Piceance Basin.

Water saturation ($S_W$) was calculated using the Archie Model:

$$S_W^n = \sqrt{\frac{a \times R_W}{\varphi^m \times R_t}}$$

## Permeability

Permeability was determined using a modified Timur equation:

$$k = \frac{62500 \times {Phi_E}^6}{{S_{Wi}}^2}$$

$S_{Wi}$ is the lower of log-calculated $S_W$ or theoretical $S_{Wi}$ from a Buckles equation:

$$Phi_E \times S_{Wi} = Constant$$

A constant of 0.05 was used. This value is suitable for most reservoirs in the Piceance Basin.

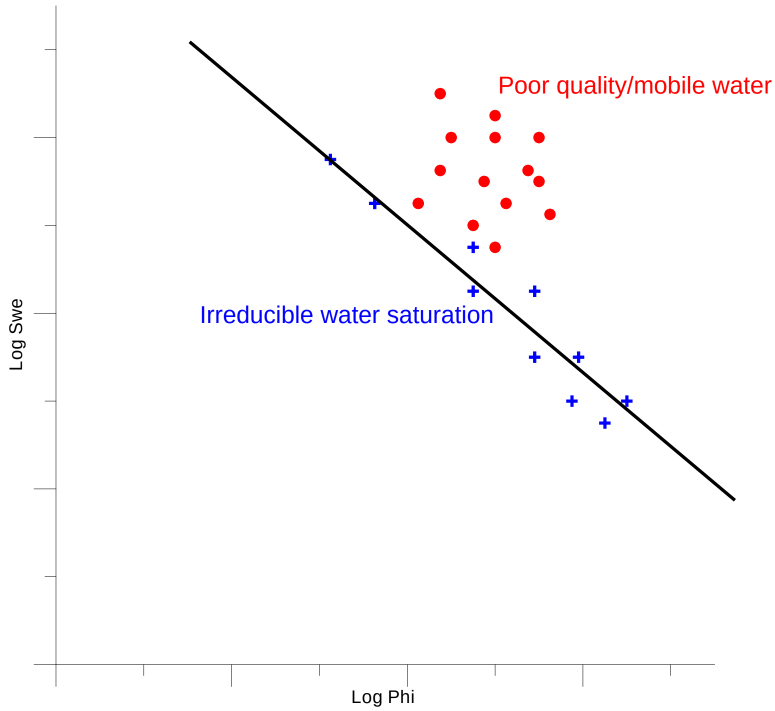
# Effective Porosity and Effective Water Saturation

Effective water saturation ($S_{WE}$) was calculated using Dewan's equation:

$$S_{WB} = V_{SH} \times \frac{Phi_{SH}}{Phi_X} = \text{Bound Water Saturation}$$

$$S_{WE} = \frac{(S_W - S_{WB})}{(1 - S_{WB})}$$

From log/log cross plots of $S_{WE}$ vs. *Phi*$_E$, by petrophysical zone, levels interpreted to be at irreducible water saturation ($S_{Wi}$) were identified. Points with $S_{WE} > S_{Wi}$ contain potential mobile water (or belong to a poorer reservoir quality rock with higher values of $S_{Wi}$). Poorer reservoir qualities indicate high values of irreducible water saturation, and consequent low permeability.




Analysis of many reservoirs, including tight gas sands, suggests relations exist between porosity and irreducible water saturations.

$$Phi^Q \times Swi = \text{Constant}$$

In literature, it is normally assumed that the exponent Q is equal to 1.0. Digital Formation's work, in a very extensive data base of all types of reservoirs, suggests that Q often diverges from (and is usually larger than) unity. A log/log cross plot of porosity vs. water saturation can be interpreted to distinguish rocks at irreducible saturation from others where $S_w > S_{wi}$. The inequality may be due to one of two possibilities:

1. Poorer rock quality than the choice made by the interpreter
2. Presence of mobile water

Values of Q and the constant have been selected for each sand identified, accounting for these factors.

## Automatic Sand Interval Identification

The procedure for identifying sands has been partially automated by looking and sand and non-sand interval thicknesses. Sands are identified as have a 70 API reading or less, and being at least 5 ft. thick, with the possibility of small non-sand streaks within them of no more than 2.5 ft. Additionally a cutoff is used to eliminate any intervals that only barely meet these requirements based on the original GR cutoff. This automatic identification was then manually reviewed to:

- Remove intervals that still did not appear to be sufficient sand intervals
- Merge nearby intervals that appear to be part of the same sand body
- Extend or reduce intervals as appropriate

## Salinity from SP Analysis

This process has also been automated. The average value of Ri/Rm is determined over the interval for input to the Schlumberger SP-5 chart (2009), which is used to correct the SP for the effects of invasion and bed thickness. For this calculation, $R_i$ was assumed to be equal to the deep resistivity, and mud resistivity ($R_m$) was read from the log header and temperature corrected to depth. Using the sand thickness and this average Ri/Rm, a corrected SP is calculated.

The minimum value of this corrected SP over the interval is used as the SP Clean value. Since the intervals are defined as the sands, an expanded interval of +/- 5 ft. is used to determine the maximum SP value, which is used as the shale base line. Using these values and the $R_{mf}$ from the log header, temperature corrected to depth, an $R_{Weq}$ value is calculated using the Schlumberger transform:

$$R_{Weq} = 0.85 \times R_{mf} \times 10^{\frac{SP}{60.5+0.133 \times Temp}}.$$

This $R_{Weq}$ was then corrected using Schlumberger SP-2 (2009) to get $R_W$, and $R_W$ was then converted to salinity using Schlumberger Gen-9.

A plot showing the Salinity vs Depth is provided for each well. This plot also includes the salinity from Archie analysis.

## Tabulation

### 05045067440000 Sample #T 65-17 P

| Top Ft | Bottom Ft | Thickness Ft | Temp °F | SP mv | Rmf ohmm | Rweq Ohmm | Rw Ohmm | TDS ppm | Archie Rw ohmm | Archie TDS ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| 1000 | 1005.5 | 5.5 | 69.7 | -14 | 1.437 | 0.774 | 1.256 | 4,534 | 0.043 | 238,951 |
| 1238.5 | 1254.5 | 16 | 74.5 | -5 | 1.352 | 0.977 | 2.049 | 2,575 | 1.825 | 2,898 |
| 1274 | 1282.5 | 8.5 | 75.2 | -2 | 1.342 | 1.054 | 2.405 | 2,170 | 1.379 | 3,836 |
| 1320 | 1351 | 31 | 76.3 | -8 | 1.323 | 0.865 | 1.638 | 3,168 | 0.761 | 7,029 |
| 1394.5 | 1405 | 10.5 | 77.5 | -6 | 1.304 | 0.915 | 1.851 | 2,753 | 0.622 | 8,574 |
| 1452 | 1490.5 | 38.5 | 78.9 | -13 | 1.282 | 0.715 | 1.176 | 4,316 | 0.453 | 11,859 |
| 1494 | 1510 | 16 | 79.6 | -12 | 1.273 | 0.734 | 1.241 | 4,051 | 0.575 | 9,087 |
| 1533 | 1554 | 21 | 80.4 | -8 | 1.261 | 0.832 | 1.577 | 3,137 | 0.371 | 14,502 |
| 1558 | 1601.5 | 43.5 | 81.1 | -9 | 1.251 | 0.807 | 1.499 | 3,277 | 0.342 | 15,701 |
| 1607.5 | 1626.5 | 19 | 81.8 | -8 | 1.241 | 0.821 | 1.559 | 3,120 | 0.337 | 15,829 |
| 1635 | 1653.5 | 18.5 | 82.4 | -11 | 1.233 | 0.725 | 1.242 | 3,918 | 0.359 | 14,649 |
| 1712.5 | 1721.5 | 9 | 83.8 | -8 | 1.214 | 0.787 | 1.464 | 3,253 | 0.400 | 12,781 |
| 1741.5 | 1756 | 14.5 | 84.4 | -3 | 1.205 | 0.918 | 1.987 | 2,363 | 0.456 | 11,008 |
| 1804 | 1833 | 29 | 85.8 | -22 | 1.188 | 0.503 | 0.683 | 7,033 | 0.088 | 77,527 |
| 1903 | 1930 | 27 | 87.7 | -8 | 1.163 | 0.761 | 1.419 | 3,216 | 0.338 | 14,683 |
| 1956 | 2004 | 48 | 89.0 | -10 | 1.148 | 0.715 | 1.278 | 3,533 | 0.320 | 15,371 |
| 2022.5 | 2039 | 16.5 | 90.0 | -10 | 1.136 | 0.708 | 1.264 | 3,536 | 0.361 | 13,309 |
| 2047.5 | 2142 | 94.5 | 91.2 | -21 | 1.122 | 0.496 | 0.692 | 6,531 | 0.243 | 20,462 |
| 2164.5 | 2180.5 | 16 | 92.7 | -14 | 1.104 | 0.612 | 0.992 | 4,407 | 0.298 | 15,924 |
| 2186 | 2195.5 | 9.5 | 93.1 | -12 | 1.100 | 0.650 | 1.108 | 3,918 | 0.383 | 12,036 |
| 2202 | 2218 | 16 | 93.5 | -7 | 1.096 | 0.737 | 1.403 | 3,061 | 0.395 | 11,588 |
| 2231 | 2255 | 24 | 94.1 | -35 | 1.089 | 0.307 | 0.348 | 13,208 | 0.263 | 18,046 |
| 2268.5 | 2276.5 | 8 | 94.7 | -3 | 1.083 | 0.842 | 1.837 | 2,296 | 0.432 | 10,396 |
| 2322.5 | 2341 | 18.5 | 95.9 | -15 | 1.071 | 0.563 | 0.879 | 4,841 | 0.416 | 10,693 |
| 2355.5 | 2415.5 | 60 | 96.9 | -23 | 1.060 | 0.436 | 0.582 | 7,375 | 0.236 | 19,812 |
| 2422.5 | 2496 | 73.5 | 98.4 | -19 | 1.045 | 0.488 | 0.702 | 5,966 | 0.269 | 16,813 |
| 2515.5 | 2533.5 | 18 | 99.7 | -16 | 1.033 | 0.534 | 0.824 | 4,988 | 0.766 | 5,380 |
| 2557.5 | 2637 | 79.5 | 101.1 | -24 | 1.019 | 0.405 | 0.533 | 7,769 | 0.259 | 17,085 |
| 2663 | 2731.5 | 68.5 | 103.1 | -15 | 1.001 | 0.540 | 0.858 | 4,627 | 0.081 | 68,200 |
| 2788.5 | 2831.5 | 43 | 105.3 | -19 | 0.981 | 0.469 | 0.686 | 5,718 | 0.078 | 70,552 |
| 2859 | 2890 | 31 | 106.6 | -34 | 0.970 | 0.287 | 0.335 | 12,140 | 0.203 | 21,317 |
| 2921 | 2933 | 12 | 107.6 | -9 | 0.961 | 0.618 | 1.127 | 3,349 | 0.272 | 15,155 |
| 2936.5 | 2961 | 24.5 | 108.0 | -21 | 0.958 | 0.421 | 0.587 | 6,571 | 0.453 | 8,645 |
| 2979.5 | 2986.5 | 7 | 108.7 | -12 | 0.952 | 0.561 | 0.955 | 3,933 | 0.461 | 8,440 |
| 2999 | 3061.5 | 62.5 | 109.6 | -30 | 0.944 | 0.322 | 0.395 | 9,856 | 0.228 | 18,103 |
| 3083.5 | 3111 | 27.5 | 110.9 | -15 | 0.934 | 0.502 | 0.796 | 4,653 | 0.161 | 26,627 |

## 05045069070000 Dunn #9-2

| Top Ft | Bottom Ft | Thickness Ft | Temp °F | SP mv | Rmf ohmm | Rweq Ohmm | Rw Ohmm | TDS ppm | Archie Rw ohmm | Archie TDS ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| 588 | 598.5 | 10.5 | 59.2 | -7 | 2.013 | 1.337 | 3.335 | 1,941 | | |
| 689.5 | 709.5 | 20 | 60.8 | -11 | 1.964 | 1.174 | 2.579 | 2,459 | | |
| 1071 | 1077 | 6 | 66.6 | -6 | 1.809 | 1.240 | 3.089 | 1,882 | | |
| 1099 | 1113 | 14 | 67.1 | -4 | 1.797 | 1.325 | 3.590 | 1,605 | | |
| 1125 | 1136 | 11 | 67.5 | -4 | 1.788 | 1.329 | 3.631 | 1,578 | | |
| 1261.5 | 1269.5 | 8 | 69.6 | -3 | 1.739 | 1.324 | 3.687 | 1,511 | | |
| 1317 | 1345 | 28 | 70.6 | -5 | 1.716 | 1.250 | 3.287 | 1,675 | | |
| 1551 | 1560 | 9 | 74.0 | -19 | 1.643 | 0.741 | 1.204 | 4,476 | | |
| 1600.5 | 1608.5 | 8 | 74.8 | -9 | 1.627 | 1.031 | 2.291 | 2,291 | | |
| 1624.5 | 1635 | 10.5 | 75.2 | -15 | 1.620 | 0.839 | 1.532 | 3,441 | | |
| 1647 | 1657.5 | 10.5 | 75.5 | -7 | 1.613 | 1.096 | 2.619 | 1,981 | | |
| 1774 | 1798.5 | 24.5 | 77.6 | -5 | 1.573 | 1.148 | 2.955 | 1,709 | | |
| 1927 | 1940 | 13 | 79.9 | -9 | 1.532 | 0.976 | 2.154 | 2,293 | 0.286 | 19,561 |
| 1951 | 1966 | 15 | 80.3 | -14 | 1.525 | 0.833 | 1.580 | 3,134 | 0.181 | 33,154 |
| 1986.5 | 1997.5 | 11 | 80.8 | -8 | 1.516 | 0.981 | 2.196 | 2,225 | 0.312 | 17,493 |
| 2027 | 2034.5 | 7.5 | 81.4 | -3 | 1.506 | 1.159 | 3.143 | 1,535 | 0.222 | 25,603 |
| 2048 | 2093 | 45 | 82.0 | -8 | 1.495 | 0.969 | 2.166 | 2,225 | 0.158 | 38,161 |
| 2105 | 2125 | 20 | 82.7 | -16 | 1.484 | 0.755 | 1.341 | 3,606 | 0.308 | 17,354 |
| 2146 | 2157.5 | 11.5 | 83.2 | -6 | 1.475 | 1.039 | 2.538 | 1,866 | | |
| 2184 | 2207.5 | 23.5 | 83.9 | -11 | 1.464 | 0.880 | 1.818 | 2,602 | | |
| 2213.5 | 2275 | 61.5 | 84.7 | -9 | 1.452 | 0.923 | 2.016 | 2,322 | | |
| 2327.5 | 2353 | 25.5 | 86.2 | -18 | 1.428 | 0.673 | 1.118 | 4,182 | 0.238 | 22,267 |
| 2358 | 2390 | 32 | 86.7 | -38 | 1.420 | 0.354 | 0.408 | 12,082 | 0.597 | 8,022 |
| 2394.5 | 2399.5 | 5 | 87.0 | -16 | 1.415 | 0.732 | 1.314 | 3,507 | 0.699 | 6,757 |
| 2453 | 2503.5 | 50.5 | 88.3 | -37 | 1.396 | 0.364 | 0.427 | 11,282 | 0.479 | 9,959 |
| 2526 | 2536.5 | 10.5 | 89.1 | -25 | 1.384 | 0.539 | 0.780 | 5,886 | | |
| 2540.5 | 2569.5 | 29 | 89.5 | -23 | 1.379 | 0.572 | 0.862 | 5,281 | | |
| 2609 | 2626.5 | 17.5 | 90.4 | -17 | 1.365 | 0.673 | 1.156 | 3,858 | | |
| 2630 | 2650 | 20 | 90.8 | -11 | 1.361 | 0.805 | 1.623 | 2,712 | | |
| 2698.5 | 2711 | 12.5 | 91.8 | -10 | 1.347 | 0.835 | 1.760 | 2,470 | | |
| 2715 | 2737.5 | 22.5 | 92.1 | -9 | 1.342 | 0.857 | 1.860 | 2,328 | | |
| 2762.5 | 2788 | 25.5 | 92.9 | -25 | 1.332 | 0.507 | 0.723 | 6,127 | 0.076 | 84,800 |
| 2800 | 2820 | 20 | 93.4 | -18 | 1.325 | 0.633 | 1.059 | 4,092 | 0.183 | 27,782 |
| 2825.5 | 2866.5 | 41 | 94.0 | -29 | 1.318 | 0.444 | 0.591 | 7,494 | 0.477 | 9,414 |
| 2883.5 | 2891.5 | 8 | 94.6 | -15 | 1.309 | 0.696 | 1.273 | 3,346 | 0.366 | 12,467 |
| 2918.5 | 2936 | 17.5 | 95.2 | -19 | 1.301 | 0.612 | 1.011 | 4,216 | | |
| 2952.5 | 2961 | 8.5 | 95.7 | -8 | 1.296 | 0.865 | 1.959 | 2,129 | | |

## 05045069990000 KRK LTD #7-3

| Top Ft | Bottom Ft | Thickness Ft | Temp °F | SP mv | Rmf ohmm | Rweq Ohmm | Rw Ohmm | TDS ppm | Archie Rw ohmm | Archie TDS ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| 928 | 949 | 21 | 66.9 | -32 | 2.229 | 0.648 | 0.903 | 6,655 | 0.669 | 9,150 |
| 959.5 | 967.5 | 8 | 67.4 | -29 | 2.216 | 0.710 | 1.059 | 5,593 | 1.108 | 5,339 |
| 1410 | 1415.5 | 5.5 | 75.5 | -4 | 1.997 | 1.507 | 5.336 | 964 | 0.496 | 11,237 |
| 1439.5 | 1450.5 | 11 | 76.1 | -4 | 1.983 | 1.487 | 5.205 | 982 | 0.492 | 11,231 |
| 1567.5 | 1582.5 | 15 | 78.4 | -2 | 1.929 | 1.552 | 5.942 | 835 | 0.459 | 11,756 |
| 1992 | 2003.5 | 11.5 | 86.0 | -3 | 1.770 | 1.357 | 4.742 | 962 | 0.423 | 11,710 |
| 2102.5 | 2111 | 8.5 | 88.0 | -3 | 1.733 | 1.337 | 4.688 | 952 | 0.261 | 19,544 |
| 2253.5 | 2261 | 7.5 | 90.7 | -2 | 1.685 | 1.332 | 4.798 | 904 | 0.360 | 13,230 |
| 2289.5 | 2302 | 12.5 | 91.4 | -5 | 1.673 | 1.202 | 3.812 | 1,132 | 0.368 | 12,823 |
| 2365.5 | 2375.5 | 10 | 92.8 | -3 | 1.651 | 1.290 | 4.555 | 933 | 0.303 | 15,648 |
| 2509.5 | 2524.5 | 15 | 95.4 | -4 | 1.608 | 1.207 | 4.029 | 1,029 | 0.388 | 11,585 |
| 2575 | 2589 | 14 | 96.6 | -17 | 1.590 | 0.800 | 1.691 | 2,452 | 0.482 | 9,043 |
| 2626 | 2631.5 | 5.5 | 97.4 | -14 | 1.577 | 0.865 | 1.993 | 2,057 | 0.518 | 8,309 |
| 2652.5 | 2659 | 6.5 | 97.9 | -5 | 1.569 | 1.135 | 3.593 | 1,127 | 1.326 | 3,103 |
| 2720 | 2725.5 | 5.5 | 99.1 | -14 | 1.551 | 0.846 | 1.935 | 2,084 | 0.423 | 10,148 |
| 2876 | 2893.5 | 17.5 | 102.0 | -7 | 1.510 | 1.036 | 3.059 | 1,275 | 0.249 | 17,621 |
| 2979 | 2987.5 | 8.5 | 103.8 | -5 | 1.486 | 1.065 | 3.317 | 1,156 | 0.283 | 15,040 |
| 3205 | 3220 | 15 | 108.0 | -4 | 1.432 | 1.083 | 3.598 | 1,026 | 0.318 | 12,699 |
| 3381 | 3407 | 26 | 111.2 | -16 | 1.392 | 0.719 | 1.549 | 2,343 | 0.163 | 26,163 |
| 3648.5 | 3656 | 7.5 | 115.9 | -11 | 1.339 | 0.815 | 2.083 | 1,666 | 0.267 | 14,260 |
| 3679 | 3742.5 | 63.5 | 117.0 | -22 | 1.328 | 0.583 | 1.085 | 3,211 | 0.093 | 48,991 |
| 3777 | 3788.5 | 11.5 | 118.3 | -22 | 1.314 | 0.583 | 1.095 | 3,147 | 0.494 | 7,206 |
| 3841 | 3858 | 17 | 119.5 | -14 | 1.302 | 0.721 | 1.669 | 2,027 | 0.381 | 9,401 |

## 05045076680000 Porter Federal #13-28

| Top Ft | Bottom Ft | Thickness Ft | Temp °F | SP mv | Rmf ohmm | Rweq Ohmm | Rw Ohmm | TDS ppm | Archie Rw ohmm | Archie TDS ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| 999 | 1011 | 12 | 67.8 | -2 | 2.959 | 2.346 | 14.756 | 383 | 0.501 | 12,375 |
| 1524.5 | 1538.5 | 14 | 77.1 | -4 | 2.631 | 1.956 | 10.442 | 482 | 0.601 | 8,941 |
| 1650 | 1656 | 6 | 79.2 | -20 | 2.565 | 1.127 | 2.888 | 1,715 | 0.622 | 8,395 |
| 1701 | 1708.5 | 7.5 | 80.1 | -3 | 2.538 | 1.957 | 10.919 | 444 | 0.588 | 8,814 |
| 2053.5 | 2061 | 7.5 | 86.3 | -2 | 2.369 | 1.912 | 11.232 | 403 | 0.441 | 11,146 |
| 2107.5 | 2120.5 | 13 | 87.3 | -22 | 2.343 | 0.994 | 2.409 | 1,881 | 0.426 | 11,445 |
| 2938.5 | 2961.5 | 23 | 102.1 | -76 | 2.025 | 0.164 | 0.172 | 27,034 | 0.432 | 9,634 |
| 3012.5 | 3068 | 55.5 | 103.7 | -63 | 1.996 | 0.244 | 0.269 | 15,915 | 0.438 | 9,331 |
| 3155 | 3177.5 | 22.5 | 105.9 | -25 | 1.957 | 0.768 | 1.690 | 2,246 | 0.312 | 13,191 |
| 3184.5 | 3194.5 | 10 | 106.4 | -27 | 1.950 | 0.727 | 1.519 | 2,495 | 0.158 | 28,459 |
| 3501.5 | 3533 | 31.5 | 112.1 | -38 | 1.855 | 0.490 | 0.770 | 4,766 | 0.329 | 11,744 |
| 3615 | 3641.5 | 26.5 | 114.1 | -35 | 1.825 | 0.529 | 0.892 | 4,026 | 0.550 | 6,664 |

## 05045079290000 Scott #2-36

| Top Ft | Bottom Ft | Thickness Ft | Temp °F | SP mv | Rmf ohmm | Rweq Ohmm | Rw Ohmm | TDS ppm | Archie Rw ohmm | Archie TDS ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| 781 | 804 | 23 | 64.6 | -6 | 3.015 | 2.120 | 10.747 | 550 | 0.438 | 15,030 |
| 1440 | 1451 | 11 | 76.6 | -2 | 2.581 | 2.050 | 11.734 | 431 | 0.473 | 11,656 |
| 1565 | 1573.5 | 8.5 | 78.9 | -4 | 2.512 | 1.880 | 9.658 | 510 | 0.503 | 10,590 |
| 2097.5 | 2108 | 10.5 | 88.7 | -10 | 2.254 | 1.378 | 5.072 | 874 | 0.490 | 9,680 |
| 2328 | 2344 | 16 | 93.0 | -7 | 2.157 | 1.459 | 6.143 | 689 | 0.205 | 24,312 |
| 2368 | 2380 | 12 | 93.7 | -7 | 2.142 | 1.462 | 6.222 | 676 | 0.509 | 8,802 |
| 2389 | 2397 | 8 | 94.0 | -2 | 2.135 | 1.678 | 8.861 | 472 | 0.352 | 13,065 |
| 2868.5 | 2878 | 9.5 | 102.9 | -15 | 1.963 | 1.059 | 3.244 | 1,193 | 0.228 | 19,309 |
| 2888 | 2904.5 | 16.5 | 103.3 | -38 | 1.955 | 0.519 | 0.802 | 4,952 | 0.322 | 13,089 |
| 2914 | 2919.5 | 5.5 | 103.7 | -12 | 1.948 | 1.150 | 3.942 | 972 | 0.284 | 14,969 |
| 2941 | 2958 | 17 | 104.3 | -29 | 1.938 | 0.676 | 1.300 | 2,983 | 0.216 | 20,276 |
| 2980.5 | 2986.5 | 6 | 104.9 | -27 | 1.927 | 0.713 | 1.446 | 2,659 | 0.403 | 10,108 |
| 3034 | 3051.5 | 17.5 | 106.0 | -35 | 1.908 | 0.543 | 0.885 | 4,362 | 0.531 | 7,438 |
| 3089 | 3100.5 | 11.5 | 106.9 | -18 | 1.892 | 0.931 | 2.544 | 1,469 | 0.183 | 23,882 |
| 3313 | 3338 | 25 | 111.2 | -8 | 1.824 | 1.231 | 5.041 | 710 | 0.109 | 42,410 |
| 3385 | 3405.5 | 20.5 | 112.5 | -17 | 1.804 | 0.900 | 2.496 | 1,428 | 0.380 | 10,013 |
| 3414 | 3433 | 19 | 113.0 | -23 | 1.797 | 0.766 | 1.788 | 1,994 | 0.112 | 40,591 |
| 3488 | 3497.5 | 9.5 | 114.2 | -12 | 1.778 | 1.056 | 3.630 | 963 | 0.286 | 13,457 |
| 3558 | 3565 | 7 | 115.5 | -21 | 1.759 | 0.792 | 1.954 | 1,783 | 0.520 | 6,988 |
| 3603 | 3615 | 12 | 116.4 | -17 | 1.747 | 0.897 | 2.569 | 1,342 | 0.176 | 22,823 |

## 05045089730000 Buerger Disposal #1

| Top Ft | Bottom Ft | Thickness Ft | Temp °F | SP mv | Rmf ohmm | Rweq Ohmm | Rw Ohmm | TDS ppm | Archie Rw ohmm | Archie TDS ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| 722 | 735.5 | 13.5 | 63.0 | -45 | 0.756 | 0.144 | 0.147 | 56,760 | | |
| 842 | 851 | 9 | 65.1 | -1 | 0.734 | 0.600 | 0.787 | 7,899 | | |
| 880.5 | 893 | 12.5 | 65.8 | -1 | 0.727 | 0.595 | 0.781 | 7,879 | | |
| 1034 | 1040.5 | 6.5 | 68.5 | -2 | 0.701 | 0.566 | 0.736 | 8,082 | | |
| 1110 | 1125.5 | 15.5 | 70.0 | -1 | 0.687 | 0.561 | 0.733 | 7,955 | | |
| 1162 | 1170 | 8 | 70.8 | -2 | 0.680 | 0.546 | 0.706 | 8,180 | | |
| 1266.5 | 1279 | 12.5 | 72.7 | -1 | 0.664 | 0.542 | 0.706 | 7,964 | | |
| 1283 | 1293 | 10 | 73.0 | -2 | 0.661 | 0.524 | 0.670 | 8,392 | | |
| 1336 | 1355 | 19 | 74.0 | -2 | 0.653 | 0.525 | 0.677 | 8,187 | | |
| 1474 | 1496.5 | 22.5 | 76.5 | -2 | 0.633 | 0.502 | 0.643 | 8,377 | | |
| 1504.5 | 1510.5 | 6 | 76.9 | -3 | 0.630 | 0.489 | 0.618 | 8,700 | | |
| 1531 | 1536 | 5 | 77.4 | -2 | 0.627 | 0.494 | 0.630 | 8,464 | | |
| 1600 | 1608 | 8 | 78.7 | -7 | 0.618 | 0.423 | 0.505 | 10,579 | | |
| 1628 | 1639 | 11 | 79.2 | -4 | 0.614 | 0.459 | 0.570 | 9,215 | | |
| 1643 | 1663.5 | 20.5 | 79.5 | -2 | 0.611 | 0.494 | 0.638 | 8,133 | | |
| 1709.5 | 1732 | 22.5 | 80.7 | -2 | 0.603 | 0.482 | 0.620 | 8,270 | | |
| 1738 | 1744 | 6 | 81.1 | -2 | 0.600 | 0.483 | 0.622 | 8,197 | | |
| 1780 | 1784.5 | 4.5 | 81.8 | -2 | 0.595 | 0.478 | 0.616 | 8,211 | | |
| 1798 | 1808 | 10 | 82.2 | -6 | 0.593 | 0.422 | 0.512 | 9,968 | | |
| 1915 | 1943 | 28 | 84.5 | -4 | 0.578 | 0.435 | 0.541 | 9,137 | | |
| 1961.5 | 1978 | 16.5 | 85.2 | -7 | 0.574 | 0.392 | 0.467 | 10,610 | | |
| 1983.5 | 1993 | 9.5 | 85.5 | -6 | 0.572 | 0.403 | 0.487 | 10,114 | | |
| 2058.5 | 2083.5 | 25 | 87.0 | -44 | 0.563 | 0.117 | 0.126 | 47,606 | | |
| 2087.5 | 2155.5 | 68 | 87.9 | -52 | 0.557 | 0.089 | 0.102 | 61,722 | 0.146 | 39,088 |
| 2162 | 2194 | 32 | 88.9 | -13 | 0.551 | 0.314 | 0.352 | 13,849 | 0.274 | 18,357 |
| 2218 | 2248.5 | 30.5 | 89.9 | -13 | 0.546 | 0.303 | 0.338 | 14,336 | 0.294 | 16,726 |
| 2302.5 | 2325.5 | 23 | 91.3 | -9 | 0.538 | 0.341 | 0.396 | 11,827 | 0.418 | 11,177 |
| 2353.5 | 2366 | 12.5 | 92.2 | -3 | 0.533 | 0.406 | 0.510 | 8,929 | 0.883 | 5,009 |
| 2512 | 2539 | 27 | 95.1 | -2 | 0.518 | 0.413 | 0.532 | 8,265 | 0.516 | 8,548 |
| 2574.5 | 2613.5 | 39 | 96.4 | -7 | 0.512 | 0.354 | 0.427 | 10,350 | 0.332 | 13,606 |
| 2634 | 2665.5 | 31.5 | 97.3 | -7 | 0.507 | 0.345 | 0.414 | 10,565 | 0.345 | 12,888 |
| 2676 | 2710 | 34 | 98.1 | -16 | 0.503 | 0.262 | 0.289 | 15,595 | 0.295 | 15,196 |
| 2724 | 2758.5 | 34.5 | 99.0 | -18 | 0.499 | 0.243 | 0.264 | 17,073 | 0.231 | 19,872 |
| 2801.5 | 2827 | 25.5 | 100.3 | -12 | 0.493 | 0.285 | 0.323 | 13,434 | 0.379 | 11,282 |
| 2960 | 2975 | 15 | 103.0 | -5 | 0.481 | 0.355 | 0.442 | 9,313 | 0.483 | 8,472 |
| 3430 | 3436 | 6 | 111.3 | -5 | 0.447 | 0.326 | 0.406 | 9,424 | 0.422 | 9,036 |
| 3784.5 | 3795 | 10.5 | 117.7 | -7 | 0.424 | 0.289 | 0.352 | 10,379 | 0.409 | 8,844 |
| 3828 | 3835 | 7 | 118.5 | -10 | 0.421 | 0.266 | 0.315 | 11,662 | 0.356 | 10,199 |
| 3898 | 3906 | 8 | 119.7 | -5 | 0.417 | 0.304 | 0.381 | 9,373 | 0.448 | 7,890 |
| 4048.5 | 4056 | 7.5 | 122.4 | -9 | 0.408 | 0.267 | 0.321 | 11,029 | 0.223 | 16,508 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 4064 | 4080.5 | 16.5 | 122.8 | -8 | 0.407 | 0.268 | 0.324 | 10,895 | 0.291 | 12,248 |
| 4205 | 4209.5 | 4.5 | 125.2 | -5 | 0.400 | 0.297 | 0.377 | 9,078 | 0.136 | 28,475 |
| 4239 | 4265.5 | 26.5 | 126.0 | -13 | 0.397 | 0.229 | 0.265 | 13,227 | 0.232 | 15,307 |
| 4318 | 4331 | 13 | 127.3 | -10 | 0.394 | 0.245 | 0.291 | 11,794 | 0.497 | 6,655 |
| 4343 | 4351.5 | 8.5 | 127.7 | -6 | 0.392 | 0.279 | 0.348 | 9,669 | 0.205 | 17,308 |
| 4425.5 | 4442 | 16.5 | 129.2 | -7 | 0.388 | 0.269 | 0.333 | 10,044 | 0.106 | 37,054 |
| 4458.5 | 4491.5 | 33 | 130.0 | -8 | 0.386 | 0.257 | 0.312 | 10,692 | 0.115 | 33,425 |
| 4534 | 4541 | 7 | 131.1 | -4 | 0.383 | 0.290 | 0.372 | 8,788 | 0.084 | 48,752 |
| 4597 | 4613 | 16 | 132.3 | -4 | 0.379 | 0.287 | 0.368 | 8,797 | 0.067 | 64,561 |
| 4625 | 4637 | 12 | 132.7 | -4 | 0.378 | 0.287 | 0.370 | 8,720 | 0.085 | 46,894 |
| 4646.5 | 4658.5 | 12 | 133.1 | -9 | 0.377 | 0.246 | 0.297 | 10,999 | 0.227 | 14,790 |
| 4704.5 | 4712 | 7.5 | 134.1 | -7 | 0.374 | 0.259 | 0.320 | 10,069 | 0.233 | 14,263 |
| 4805.5 | 4827.5 | 22 | 136.1 | -10 | 0.369 | 0.235 | 0.283 | 11,334 | 0.104 | 35,823 |
| 4832 | 4837.5 | 5.5 | 136.4 | -12 | 0.369 | 0.219 | 0.258 | 12,494 | 0.350 | 9,004 |
| 4926 | 4940 | 14 | 138.1 | -12 | 0.364 | 0.221 | 0.261 | 12,168 | 0.360 | 8,617 |
| 5047 | 5065.5 | 18.5 | 140.3 | -8 | 0.359 | 0.241 | 0.296 | 10,475 | 0.158 | 20,967 |
| 5089.5 | 5116.5 | 27 | 141.2 | -12 | 0.357 | 0.215 | 0.255 | 12,226 | 0.101 | 35,619 |
| 5192 | 5202 | 10 | 142.9 | -13 | 0.353 | 0.203 | 0.238 | 13,007 | 0.096 | 37,140 |
| 5232.5 | 5260 | 27.5 | 143.7 | -15 | 0.351 | 0.192 | 0.221 | 14,016 | 0.113 | 30,322 |
| 5282.5 | 5290 | 7.5 | 144.5 | -20 | 0.349 | 0.167 | 0.187 | 16,776 | 0.117 | 28,927 |
| 5363.5 | 5400 | 36.5 | 146.2 | -16 | 0.345 | 0.183 | 0.210 | 14,581 | 0.264 | 11,345 |

## 05045108150000 Stone #42D-34-692

| Top Ft | Bottom Ft | Thickness Ft | Temp °F | SP mv | Rmf ohmm | Rweq Ohmm | Rw Ohmm | TDS ppm | Archie Rw ohmm | Archie TDS ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| 1022 | 1036.5 | 14.5 | 67.0 | -2 | 1.867 | 1.470 | 4.531 | 1,270 | 0.590 | 10,469 |
| 1313 | 1322.5 | 9.5 | 71.7 | -2 | 1.754 | 1.401 | 4.299 | 1,257 | 0.756 | 7,512 |
| 1472.5 | 1485.5 | 13 | 74.4 | -2 | 1.696 | 1.336 | 3.987 | 1,312 | 0.838 | 6,502 |
| 1682 | 1717 | 35 | 78.0 | -5 | 1.623 | 1.174 | 3.118 | 1,610 | 0.504 | 10,669 |
| 1813.5 | 1825.5 | 12 | 80.0 | -1 | 1.586 | 1.302 | 4.013 | 1,218 | 0.445 | 11,924 |
| 1950 | 1961 | 11 | 82.2 | -4 | 1.546 | 1.167 | 3.225 | 1,481 | 0.420 | 12,355 |
| 2044 | 2057 | 13 | 83.8 | -16 | 1.520 | 0.778 | 1.431 | 3,329 | 0.491 | 10,218 |
| 2156.5 | 2165.5 | 9 | 85.6 | -16 | 1.490 | 0.762 | 1.400 | 3,337 | 0.465 | 10,606 |
| 2328.5 | 2346 | 17.5 | 88.5 | -8 | 1.444 | 0.957 | 2.253 | 1,988 | 0.287 | 17,441 |
| 2365.5 | 2380 | 14.5 | 89.1 | -16 | 1.435 | 0.743 | 1.374 | 3,274 | 1.140 | 3,969 |
| 2388.5 | 2410.5 | 22 | 89.6 | -7 | 1.429 | 0.980 | 2.392 | 1,851 | 0.396 | 12,090 |
| 2657.5 | 2665 | 7.5 | 93.9 | -2 | 1.368 | 1.087 | 3.123 | 1,351 | 0.299 | 15,690 |
| 2678.5 | 2699.5 | 21 | 94.3 | -19 | 1.361 | 0.635 | 1.074 | 3,997 | 0.520 | 8,545 |
| 2743.5 | 2751 | 7.5 | 95.3 | -1 | 1.349 | 1.097 | 3.239 | 1,284 | 0.467 | 9,481 |
| 2915.5 | 2925.5 | 10 | 98.2 | -3 | 1.312 | 1.019 | 2.837 | 1,427 | 0.251 | 18,199 |
| 2934.5 | 2953 | 18.5 | 98.5 | -11 | 1.307 | 0.783 | 1.646 | 2,473 | 0.798 | 5,213 |
| 3193 | 3218 | 25 | 102.9 | -19 | 1.256 | 0.586 | 0.991 | 3,995 | 0.374 | 11,172 |
| 3248 | 3278 | 30 | 103.8 | -19 | 1.245 | 0.580 | 0.978 | 4,014 | 0.451 | 9,040 |
| 3294 | 3319 | 25 | 104.5 | -24 | 1.237 | 0.506 | 0.775 | 5,074 | 0.538 | 7,447 |
| 3339 | 3404 | 65 | 105.6 | -23 | 1.225 | 0.510 | 0.793 | 4,906 | 0.550 | 7,199 |
| 3428 | 3442 | 14 | 106.6 | -19 | 1.214 | 0.583 | 1.007 | 3,795 | 0.737 | 5,242 |
| 3474.5 | 3487 | 12.5 | 107.4 | -18 | 1.206 | 0.597 | 1.056 | 3,588 | 0.682 | 5,647 |
| 3508 | 3513 | 5 | 107.9 | -13 | 1.201 | 0.682 | 1.362 | 2,752 | 0.713 | 5,367 |
| 3612 | 3619 | 7 | 109.6 | -24 | 1.183 | 0.488 | 0.754 | 4,981 | 0.752 | 4,999 |
| 3657.5 | 3674.5 | 17 | 110.4 | -8 | 1.174 | 0.774 | 1.787 | 2,039 | 0.314 | 12,570 |
| 4088 | 4107 | 19 | 117.6 | -9 | 1.107 | 0.713 | 1.606 | 2,140 | 0.570 | 6,228 |
| 4171.5 | 4184 | 12.5 | 118.9 | -8 | 1.095 | 0.731 | 1.710 | 1,987 | 0.405 | 8,860 |
| 4253 | 4267.5 | 14.5 | 120.2 | -5 | 1.084 | 0.799 | 2.076 | 1,614 | 0.489 | 7,157 |
| 4662.5 | 4675 | 12.5 | 127.0 | -4 | 1.029 | 0.786 | 2.134 | 1,490 | 0.382 | 8,802 |
| 4979.5 | 5009.5 | 30 | 132.4 | -9 | 0.989 | 0.653 | 1.516 | 2,024 | 0.700 | 4,470 |
| 5093 | 5125.5 | 32.5 | 134.2 | -9 | 0.976 | 0.632 | 1.441 | 2,103 | 0.272 | 12,028 |
| 5150 | 5165 | 15 | 135.0 | -8 | 0.971 | 0.654 | 1.556 | 1,934 | 0.331 | 9,660 |
| 5351.5 | 5378.5 | 27 | 138.5 | -10 | 0.948 | 0.602 | 1.352 | 2,178 | 0.519 | 5,837 |
| 5399 | 5408 | 9 | 139.1 | -10 | 0.944 | 0.607 | 1.378 | 2,126 | 0.879 | 3,365 |
| 5491.5 | 5502 | 10.5 | 140.6 | -11 | 0.934 | 0.572 | 1.240 | 2,342 | 0.698 | 4,225 |
| 5545 | 5566.5 | 21.5 | 141.6 | -11 | 0.928 | 0.575 | 1.262 | 2,285 | 0.808 | 3,606 |
| 5846 | 5861.5 | 15.5 | 146.5 | -12 | 0.898 | 0.535 | 1.134 | 2,464 | 0.273 | 10,943 |
| 5894.5 | 5901.5 | 7 | 147.3 | -12 | 0.894 | 0.540 | 1.160 | 2,396 | 0.234 | 12,831 |
| 5921.5 | 5926.5 | 5 | 147.7 | -19 | 0.891 | 0.440 | 0.794 | 3,525 | 0.273 | 10,851 |
| 5962 | 5972.5 | 10.5 | 148.4 | -11 | 0.887 | 0.554 | 1.232 | 2,238 | 0.367 | 7,859 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 5991 | 6000.5 | 9.5 | 148.9 | -11 | 0.884 | 0.549 | 1.211 | 2,270 | 0.415 | 6,872 |
| 6070 | 6079 | 9 | 150.2 | -20 | 0.877 | 0.416 | 0.728 | 3,791 | 0.204 | 14,675 |
| 6123 | 6130 | 7 | 151.0 | -39 | 0.872 | 0.246 | 0.316 | 9,041 | 0.544 | 5,095 |
| 6153.5 | 6173.5 | 20 | 151.6 | -17 | 0.869 | 0.450 | 0.847 | 3,213 | 0.155 | 19,777 |
| 6220 | 6238 | 18 | 152.7 | -16 | 0.863 | 0.467 | 0.911 | 2,960 | 1.346 | 1,989 |
| 6254 | 6276.5 | 22.5 | 153.3 | -10 | 0.860 | 0.553 | 1.270 | 2,102 | 0.394 | 7,048 |
| 6283.5 | 6311.5 | 28 | 153.8 | -12 | 0.857 | 0.516 | 1.112 | 2,397 | 0.349 | 7,971 |
| 6320 | 6337.5 | 17.5 | 154.4 | -6 | 0.854 | 0.607 | 1.546 | 1,710 | 0.310 | 9,027 |
| 6368.5 | 6398.5 | 30 | 155.3 | -5 | 0.850 | 0.634 | 1.707 | 1,537 | 0.244 | 11,632 |
| 6458.5 | 6471.5 | 13 | 156.6 | -11 | 0.843 | 0.520 | 1.149 | 2,280 | 15.261 | 169 |
| 6612 | 6620.5 | 8.5 | 159.1 | -16 | 0.830 | 0.444 | 0.865 | 3,002 | 11.576 | 219 |
| 6700 | 6733 | 33 | 160.7 | -26 | 0.822 | 0.341 | 0.545 | 4,785 | 0.457 | 5,743 |
| 6740 | 6791 | 51 | 161.6 | -5 | 0.818 | 0.603 | 1.615 | 1,565 | 0.120 | 24,684 |
| 6799 | 6826 | 27 | 162.3 | -20 | 0.814 | 0.395 | 0.709 | 3,607 | 0.164 | 17,179 |
| 6832 | 6840.5 | 8.5 | 162.7 | -24 | 0.812 | 0.354 | 0.587 | 4,376 | 0.173 | 16,125 |

## 05045129840000 Last Dance #13B-2-792

| Top Ft | Bottom Ft | Thickness Ft | Temp °F | SP mv | Rmf ohmm | Rweq Ohmm | Rw Ohmm | TDS ppm | Archie Rw ohmm | Archie TDS ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| 1205 | 1224 | 19 | 75.5 | -17 | 1.502 | 0.723 | 1.166 | 4,544 | 0.240 | 25,461 |
| 1313 | 1323.5 | 10.5 | 77.6 | -35 | 1.463 | 0.398 | 0.460 | 11,840 | 0.261 | 22,394 |
| 1329 | 1342.5 | 13.5 | 78.0 | -28 | 1.457 | 0.495 | 0.634 | 8,347 | 0.323 | 17,470 |
| 1375 | 1380.5 | 5.5 | 78.9 | -11 | 1.442 | 0.850 | 1.622 | 3,102 | 0.373 | 14,686 |
| 1392.5 | 1405 | 12.5 | 79.3 | -12 | 1.434 | 0.829 | 1.551 | 3,229 | 0.334 | 16,533 |
| 1586.5 | 1596.5 | 10 | 83.4 | -16 | 1.370 | 0.701 | 1.177 | 4,092 | 0.441 | 11,547 |
| 1623.5 | 1639 | 15.5 | 84.2 | -21 | 1.357 | 0.580 | 0.852 | 5,670 | 0.338 | 15,305 |
| 1750 | 1771.5 | 21.5 | 86.9 | -10 | 1.318 | 0.809 | 1.583 | 2,900 | 0.389 | 12,703 |
| 1843.5 | 1856 | 12.5 | 88.8 | -17 | 1.292 | 0.644 | 1.054 | 4,321 | 0.307 | 16,149 |
| 1874 | 1882 | 8 | 89.4 | -17 | 1.284 | 0.632 | 1.025 | 4,420 | 0.351 | 13,839 |
| 1901.5 | 1923 | 21.5 | 90.1 | -17 | 1.275 | 0.633 | 1.034 | 4,344 | 0.358 | 13,412 |
| 2093.5 | 2111 | 17.5 | 94.1 | -33 | 1.225 | 0.372 | 0.453 | 9,939 | 0.204 | 24,252 |
| 2121.5 | 2156 | 34.5 | 94.8 | -37 | 1.215 | 0.325 | 0.377 | 12,041 | 0.218 | 22,199 |
| 2303 | 2309 | 6 | 98.3 | -14 | 1.175 | 0.635 | 1.107 | 3,721 | 0.231 | 19,993 |
| 2463.5 | 2496 | 32.5 | 102.0 | -50 | 1.135 | 0.207 | 0.221 | 20,272 | 0.323 | 13,242 |
| 2500.5 | 2530 | 29.5 | 102.7 | -32 | 1.128 | 0.359 | 0.450 | 9,169 | 0.285 | 15,098 |
| 2548 | 2563.5 | 15.5 | 103.6 | -34 | 1.119 | 0.337 | 0.411 | 10,017 | 0.231 | 18,879 |
| 2585.5 | 2600 | 14.5 | 104.3 | -40 | 1.111 | 0.273 | 0.310 | 13,507 | 0.727 | 5,431 |
| 2705.5 | 2715.5 | 10 | 106.8 | -23 | 1.087 | 0.456 | 0.662 | 5,858 | 0.560 | 6,983 |
| 2976 | 2990.5 | 14.5 | 112.5 | -49 | 1.035 | 0.198 | 0.215 | 18,776 | 0.088 | 55,201 |
| 3052 | 3061.5 | 9.5 | 114.1 | -32 | 1.022 | 0.328 | 0.414 | 9,007 | 0.402 | 9,306 |
| 3081.5 | 3087.5 | 6 | 114.6 | -35 | 1.017 | 0.303 | 0.371 | 10,092 | 0.166 | 24,827 |
| 3100 | 3108.5 | 8.5 | 115.1 | -30 | 1.013 | 0.345 | 0.449 | 8,193 | 0.564 | 6,434 |
| 3129 | 3154.5 | 25.5 | 115.8 | -52 | 1.007 | 0.177 | 0.191 | 20,828 | 0.230 | 16,895 |
| 3162.5 | 3178.5 | 16 | 116.4 | -38 | 1.002 | 0.273 | 0.324 | 11,499 | 0.248 | 15,414 |
| 3269 | 3296 | 27 | 118.8 | -48 | 0.983 | 0.197 | 0.217 | 17,541 | 0.015 | 264,563 |
| 3816 | 3831.5 | 15.5 | 130.1 | -26 | 0.902 | 0.352 | 0.496 | 6,517 | 0.170 | 21,007 |
| 3873 | 3906 | 33 | 131.5 | -33 | 0.893 | 0.284 | 0.362 | 9,006 | 0.152 | 23,517 |
| 4286.5 | 4294.5 | 8 | 139.9 | -20 | 0.842 | 0.398 | 0.637 | 4,672 | 0.190 | 17,118 |
| 4538 | 4553 | 15 | 145.3 | -30 | 0.812 | 0.294 | 0.401 | 7,308 | 0.228 | 13,422 |
| 4773.5 | 4807.5 | 34 | 150.4 | -36 | 0.786 | 0.239 | 0.302 | 9,541 | 0.068 | 54,282 |
| 4910 | 4929.5 | 19.5 | 153.1 | -39 | 0.772 | 0.219 | 0.270 | 10,568 | 0.339 | 8,285 |
| 5078 | 5085.5 | 7.5 | 156.5 | -30 | 0.756 | 0.277 | 0.384 | 7,094 | 0.153 | 19,318 |
| 5212 | 5230.5 | 18.5 | 159.4 | -25 | 0.743 | 0.311 | 0.466 | 5,679 | 0.034 | 124,284 |
| 5427 | 5434.5 | 7.5 | 163.8 | -22 | 0.724 | 0.332 | 0.530 | 4,831 | 0.205 | 13,265 |
| 5460.5 | 5475 | 14.5 | 164.6 | -28 | 0.721 | 0.280 | 0.403 | 6,397 | 0.150 | 18,753 |
| 5548.5 | 5588.5 | 40 | 166.7 | -34 | 0.712 | 0.236 | 0.312 | 8,279 | 0.128 | 22,205 |
| 5598 | 5629 | 31 | 167.6 | -54 | 0.708 | 0.134 | 0.149 | 18,464 | 0.064 | 51,355 |
| 5740.5 | 5759 | 18.5 | 170.5 | -23 | 0.697 | 0.313 | 0.495 | 4,980 | 0.013 | 280,201 |
| 5820 | 5834 | 14 | 172.1 | -51 | 0.690 | 0.143 | 0.163 | 16,240 | 3.572 | 661 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 5847 | 5864.5 | 17.5 | 172.7 | -44 | 0.688 | 0.173 | 0.207 | 12,449 | 0.273 | 9,223 |
| 5872 | 5911.5 | 39.5 | 173.5 | -46 | 0.685 | 0.164 | 0.193 | 13,335 | 0.194 | 13,272 |
| 5953.5 | 5974.5 | 21 | 175.0 | -22 | 0.679 | 0.319 | 0.519 | 4,618 | 0.149 | 17,639 |
| 5978 | 6008.5 | 30.5 | 175.6 | -34 | 0.677 | 0.227 | 0.303 | 8,104 | 0.138 | 19,192 |
| 6068 | 6079.5 | 11.5 | 177.3 | -36 | 0.671 | 0.215 | 0.283 | 8,642 | 8.813 | 259 |
| 6138 | 6146.5 | 8.5 | 178.7 | -15 | 0.666 | 0.378 | 0.716 | 3,246 | 0.156 | 16,423 |
| 6156 | 6168.5 | 12.5 | 179.1 | -19 | 0.664 | 0.332 | 0.569 | 4,104 | 0.124 | 21,192 |
| 6190.5 | 6216 | 25.5 | 180.0 | -11 | 0.661 | 0.412 | 0.847 | 2,713 | 0.173 | 14,533 |
| 6254.5 | 6267.5 | 13 | 181.2 | -38 | 0.657 | 0.198 | 0.253 | 9,524 | 11.850 | 189 |
| 6287 | 6296 | 9 | 181.9 | -42 | 0.655 | 0.180 | 0.222 | 10,939 | 0.021 | 195,816 |
| 6305.5 | 6334.5 | 29 | 182.5 | -76 | 0.653 | 0.070 | 0.077 | 36,266 | 20.446 | 109 |
| 6342.5 | 6366.5 | 24 | 183.2 | -21 | 0.650 | 0.312 | 0.519 | 4,412 | 0.074 | 38,081 |
| 6371 | 6416 | 45 | 184.0 | -24 | 0.647 | 0.284 | 0.446 | 5,149 | 0.055 | 54,737 |
| 6420 | 6439 | 19 | 184.8 | -32 | 0.645 | 0.229 | 0.316 | 7,362 | 0.088 | 30,538 |

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File: **05045067440000 Sample #T 65-17 P.lbs** Well Name: **SAMPLE #T 65-17 P**

Plot: **Salinity by Depth**

Gross Interval: **1000** to **3111** by **0.5** **F**

Ranges:

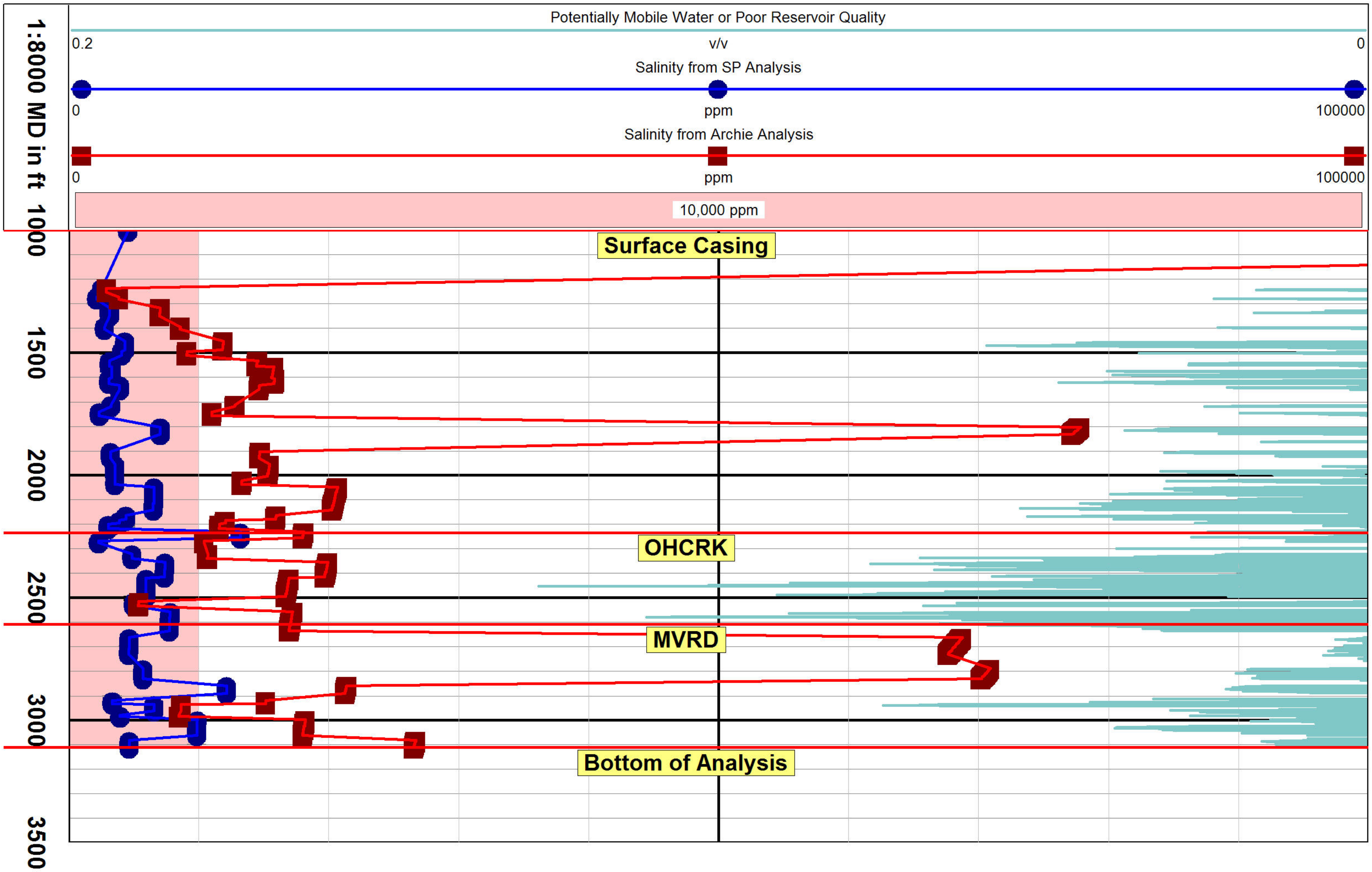
**1000-3111**

Time: **10:52 AM** Date: **Fri, Jun 12, 2015**

Section: **SECTION** Township: **TOWNSHIP** API #: **05045067440000**

Location: **LOCATION** Range: **RANGE** UWI: **05045067440000**

Comments:



LESA 9.8, © 1992-2015 Digital Formation, Inc.

File: 05045067440000 Sample #T 65-17 P.lbs    Well Name: SAMPLE #T 65-17 P

Plot: SP Shift Deflection

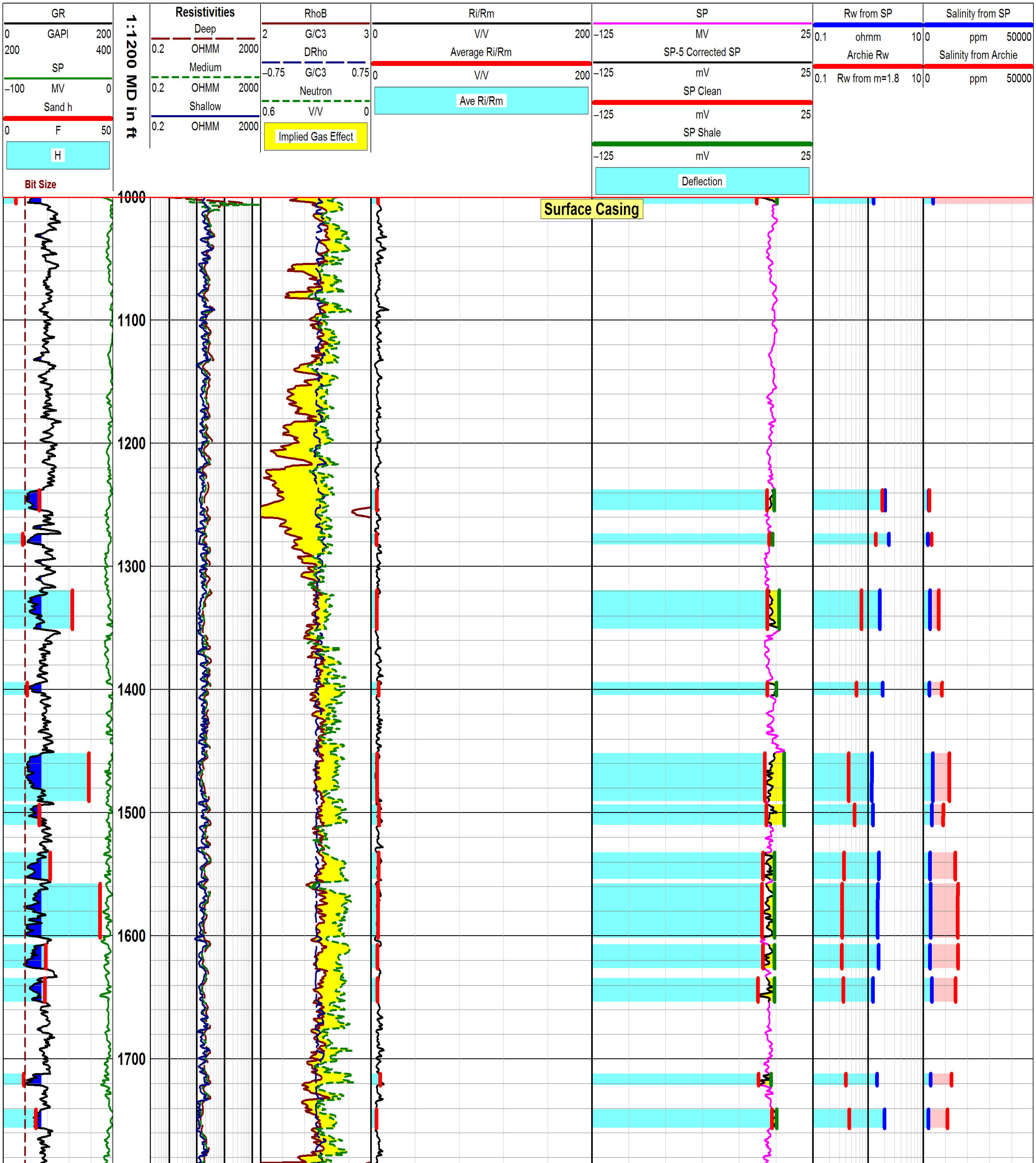
Gross Interval: 1000 to 3111 by 0.5 F

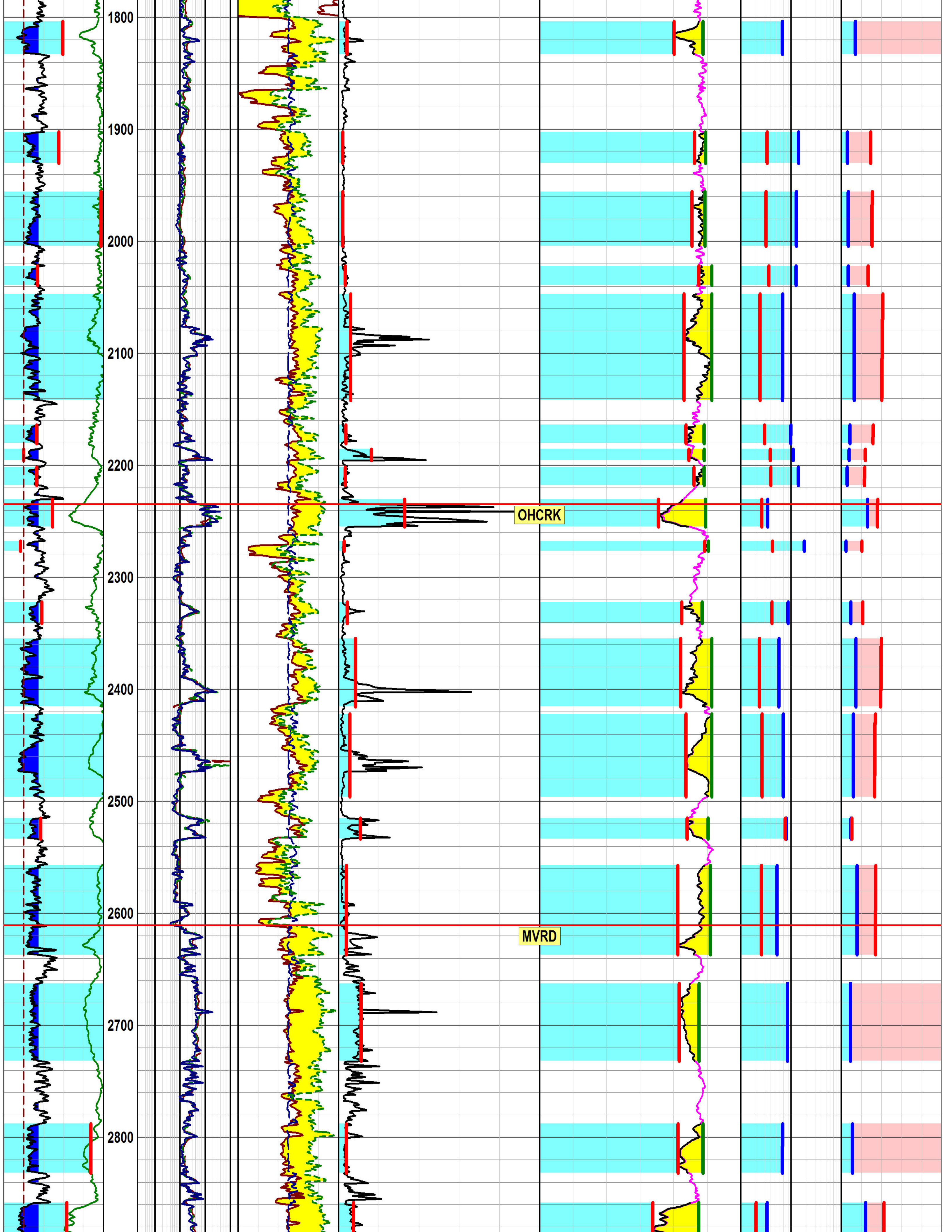
Ranges:

1000-3111

| | | | | | |
|---|---|---|---|---|---|
| Time: | 10:54 AM | Date: | Fri, Jun 12, 2015 | | |
| Section: | SECTION | Township: | TOWNSHIP | API #: | 05045067440000 |
| Location: | LOCATION | Range: | RANGE | UWI: | 05045067440000 |

Comments:





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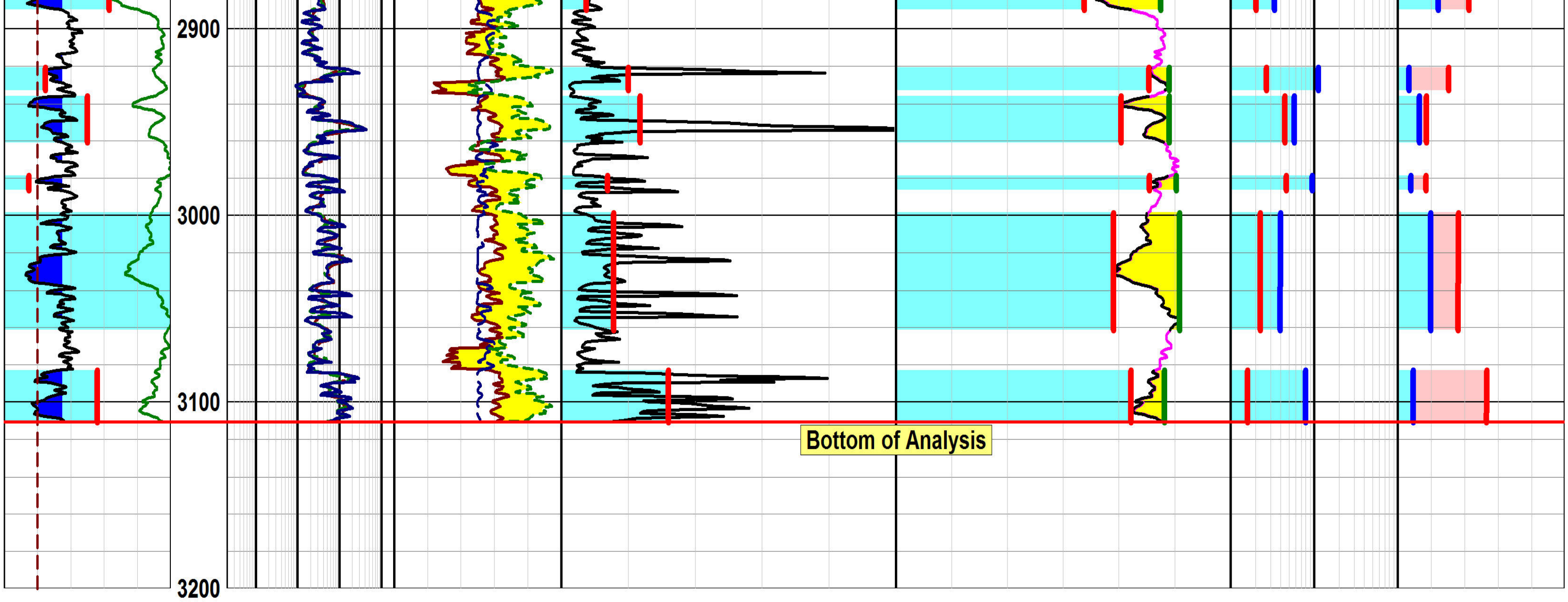
2900
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Bottom of Analysis

LESA 9.8, © 1992-2015 Digital Formation, Inc.

File: 05045069070000 Dunn #9-2.lbs

Well Name: DUNN 9-2

Plot: Salinity by Depth

Gross Interval: 554 to 3025 by 0.5 F

Ranges:

554-3025

Time: 10:53 AM

Date: Fri, Jun 12, 2015

Section: SECTION

Township: TOWNSHIP

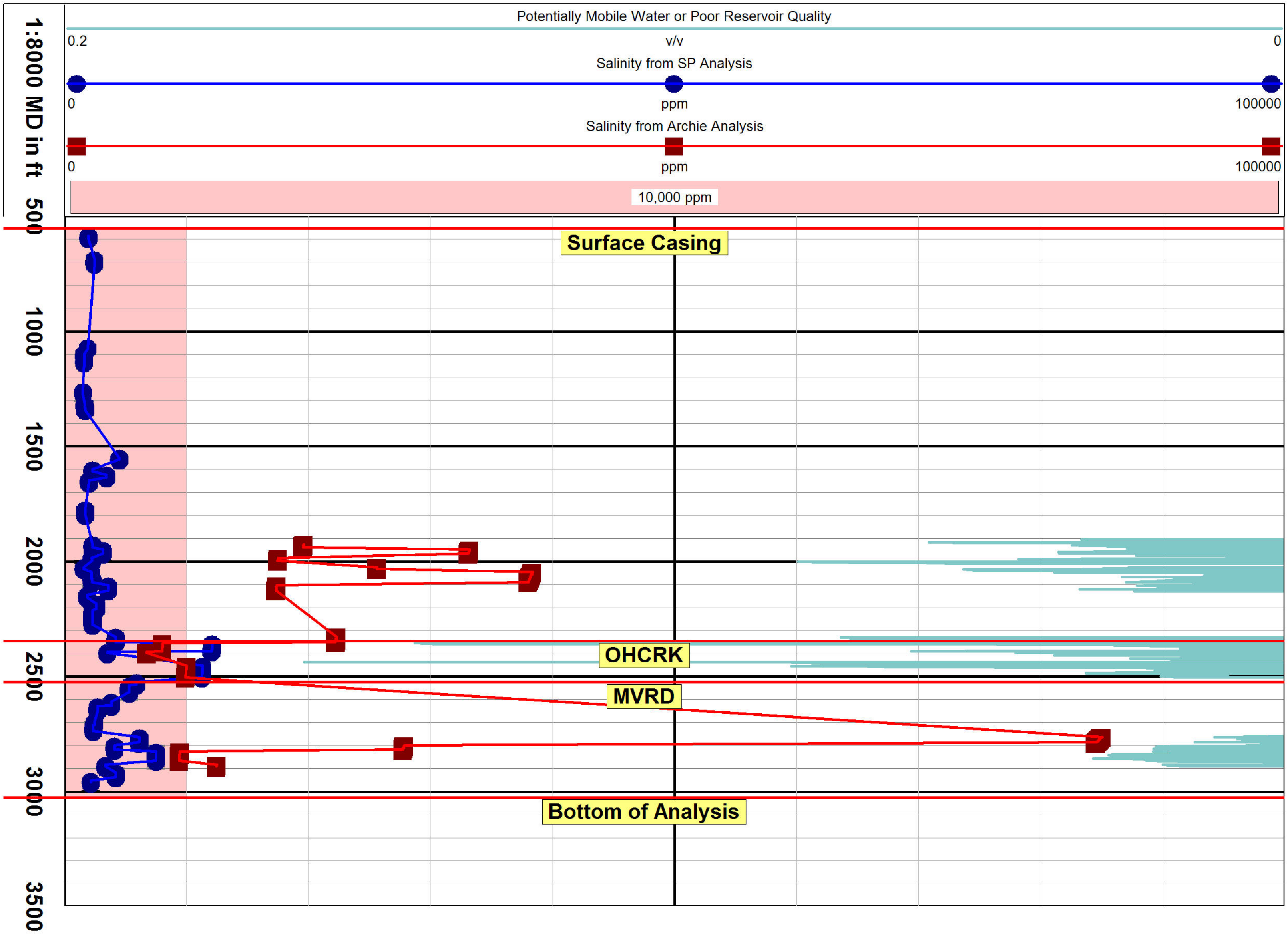
API #: 05045069070000

Location: LOCATION

Range: RANGE

UWI: 05045069070000

Comments:



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LESA 9.8, © 1992-2015 Digital Formation, Inc.

File: 05045069070000 Dunn #9-2.lbs — Well Name: DUNN 9-2

Plot: SP Shift Deflection

Gross Interval: 554 to 3025 by 0.5 F

Ranges:

554-3025

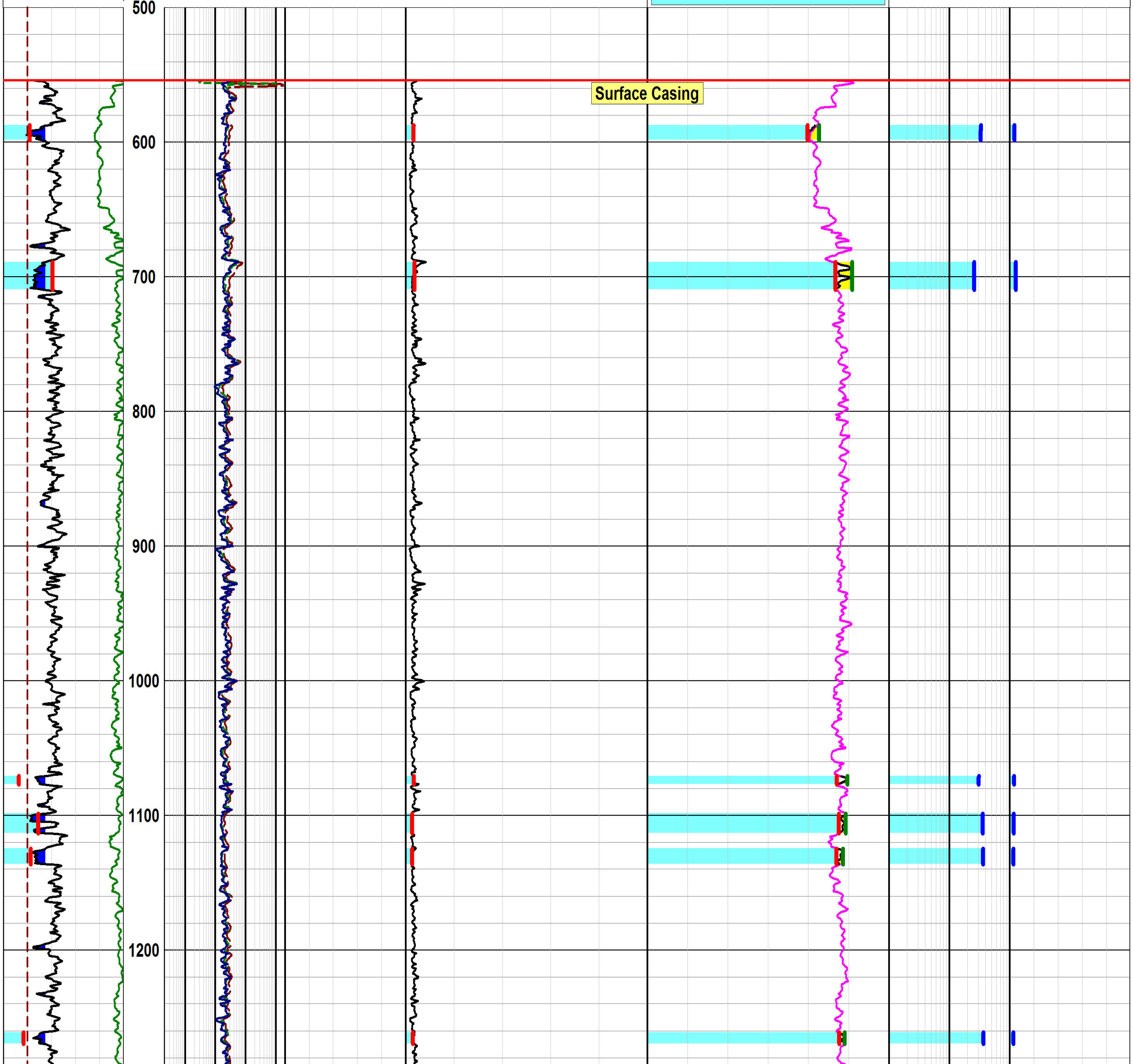
Time: 10:55 AM — Date: Fri, Jun 12, 2015

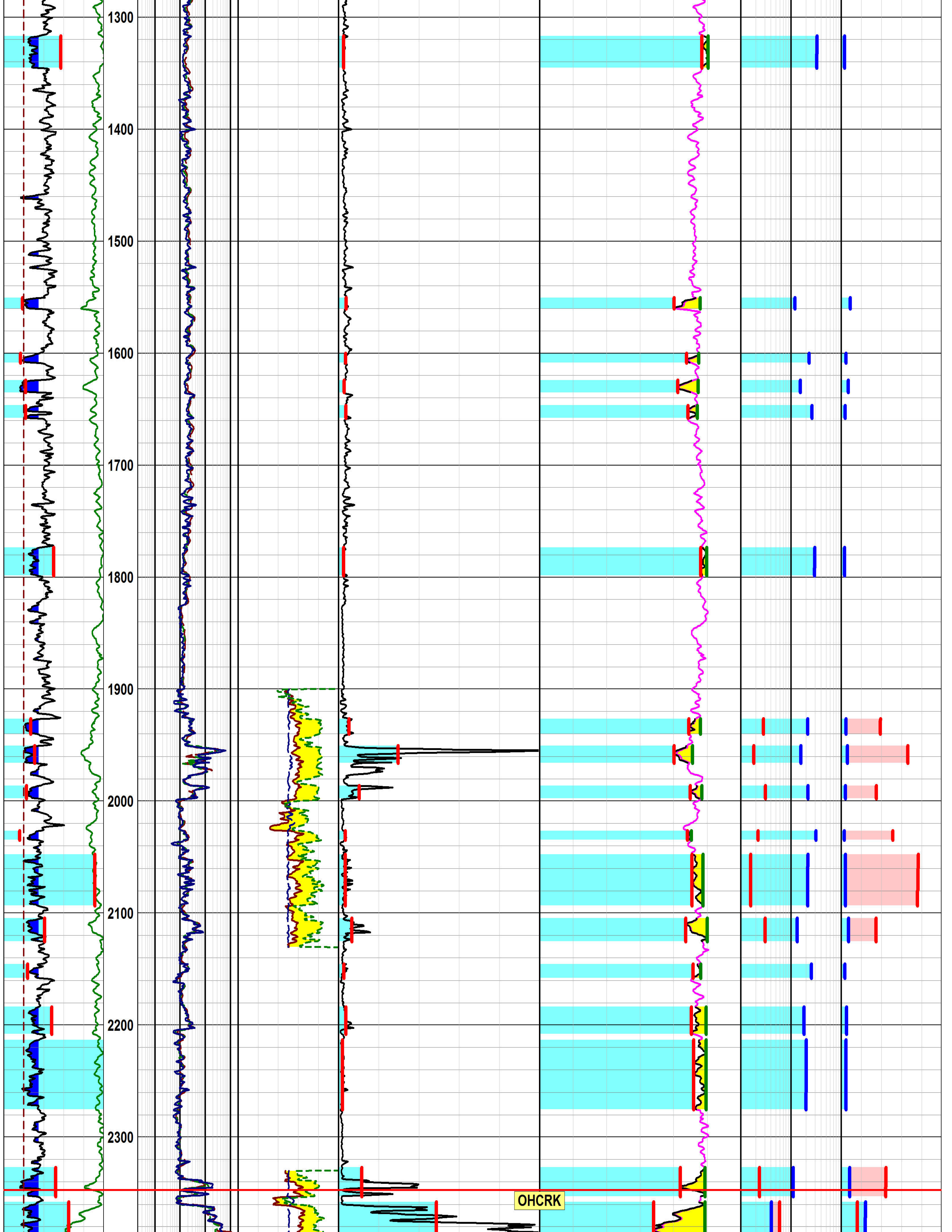
Section: SECTION — Township: TOWNSHIP — API #: 05045069070000

Location: LOCATION — Range: RANGE — UWI: 05045069070000

Comments:

| GR | 1:1200 MD in ft | Resistivities | RhoB | Ri/Rm | SP | Rw from SP | Salinity from SP |
|---|---|---|---|---|---|---|---|
| 0 GAPI 200 | | Deep | 2 G/C3 3 | 0 V/V 200 | –125 MV 25 | 0.1 ohmm 10 | 0 ppm 50000 |
| 200 400 | | 0.2 OHMM 2000 | DRho | Average Ri/Rm | SP-5 Corrected SP | Archie Rw | Salinity from Archie |
| SP | | Medium | –0.75 G/C3 0.75 | 0 V/V 200 | –125 mV 25 | 0.1 Rw from m=1.8 10 | 0 ppm 50000 |
| –100 MV 0 | | 0.2 OHMM 2000 | Neutron | Ave Ri/Rm | SP Clean | | |
| Sand h | | Shallow | 0.6 V/V 0 | | –125 mV 25 | | |
| 0 F 50 | | 0.2 OHMM 2000 | Implied Gas Effect | | SP Shale | | |
| H | | | | | –125 mV 25 | | |
| Bit Size | | | | | Deflection | | |





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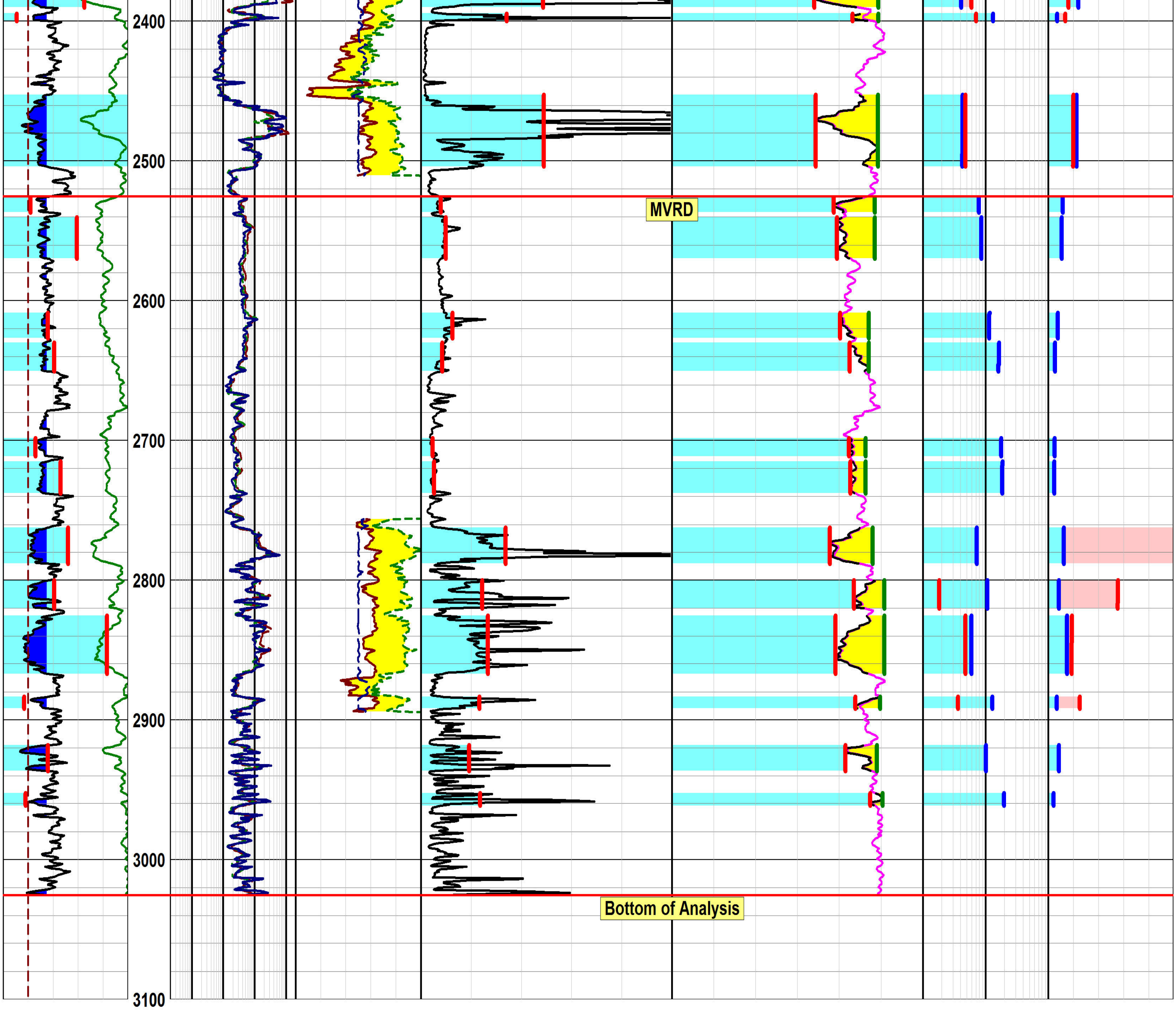

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3100

LESA 9.8, © 1992-2015 Digital Formation, Inc.

File: 05045069990000 KRK LTD #7-3.lbs | Well Name: KRK LTD 7-3

Plot: Salinity by Depth

Gross Interval: 525 to 3909 by 0.5 F

Ranges:

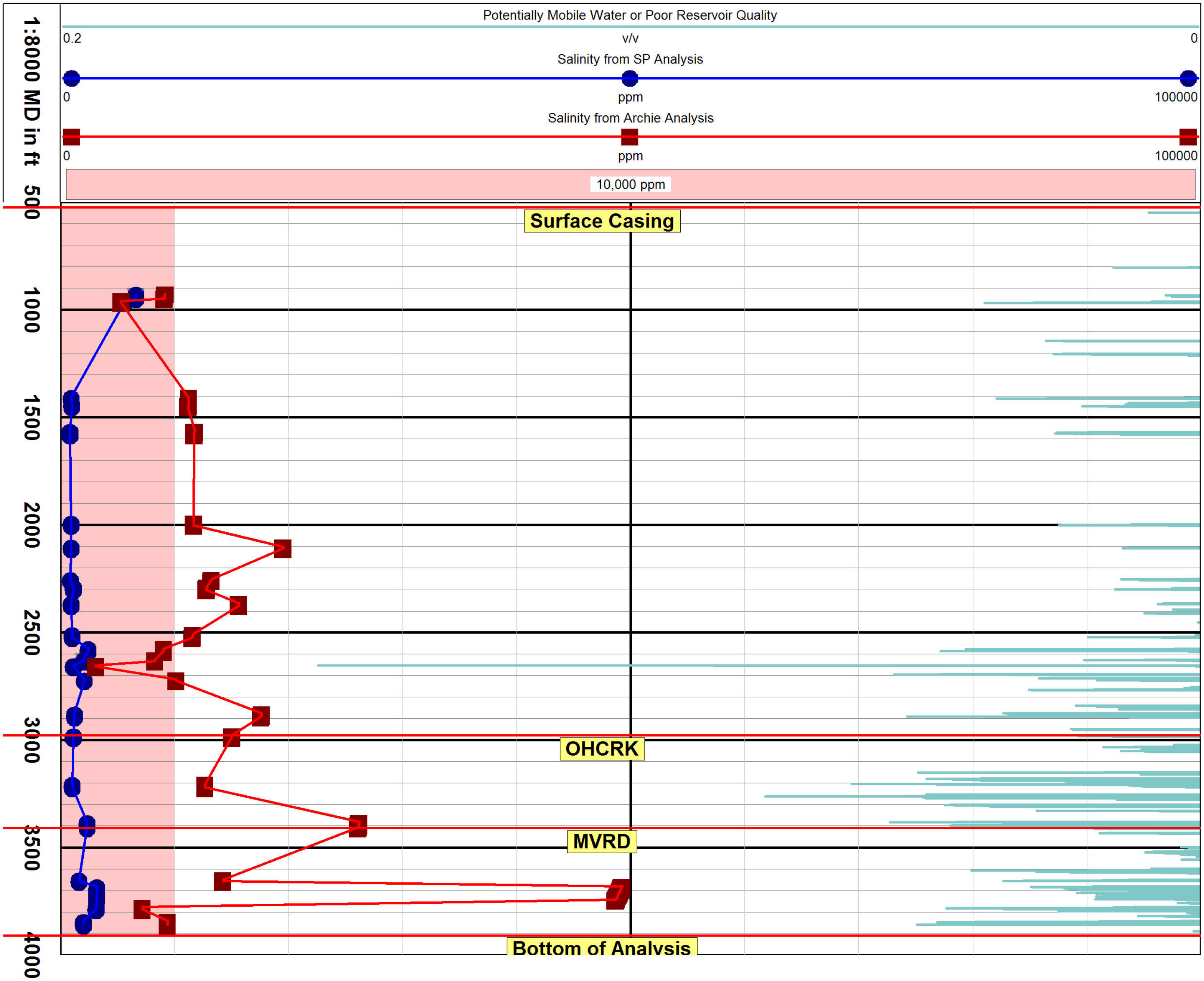
525-3909

Time: 10:53 AM | Date: Fri, Jun 12, 2015

Section: SECTION | Township: TOWNSHIP | API #: 05045069990000

Location: LOCATION | Range: RANGE | UWI: 05045069990000

Comments:



DIGITAL FORMATION

LESA 9.8, © 1992-2015 Digital Formation, Inc.

File: 05045069990000 KRK LTD #7-3.lbs | Well Name: KRK LTD 7-3

Plot: SP Shift Deflection

Gross Interval: 525 to 3909 by 0.5 F

Ranges:

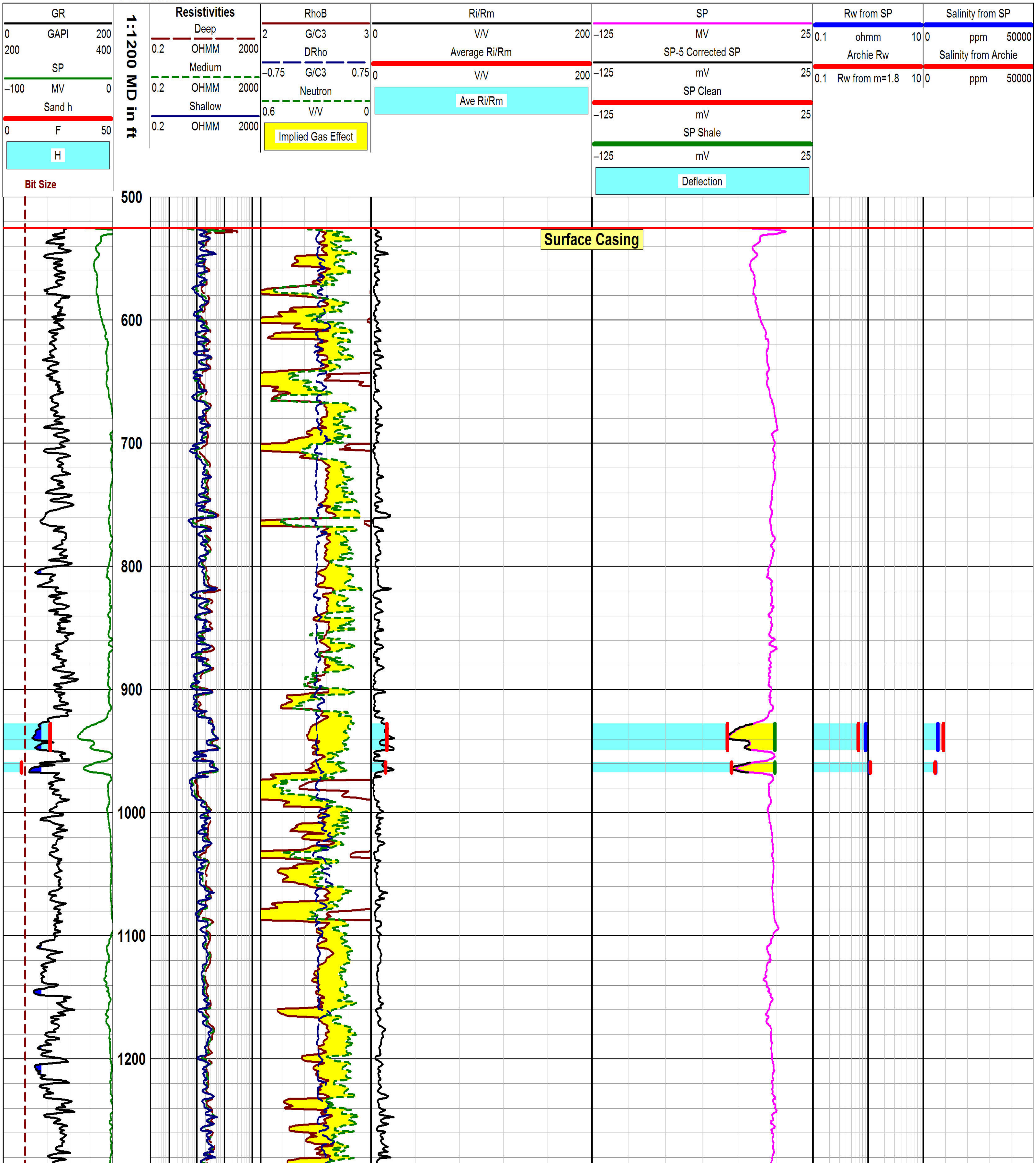
525-3909

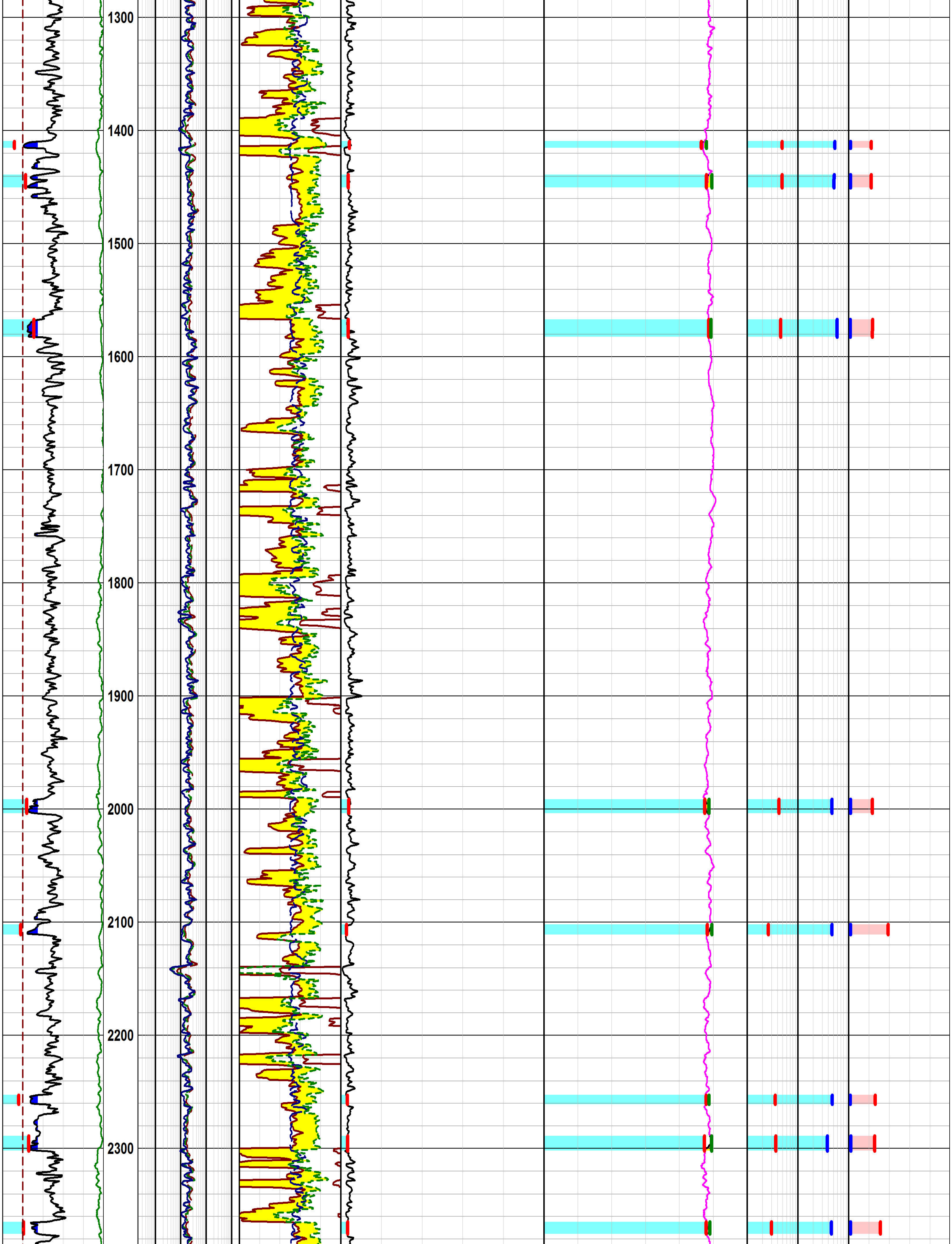
Time: 10:55 AM | Date: Fri, Jun 12, 2015

Section: SECTION | Township: TOWNSHIP | API #:05045069990000

Location: LOCATION | Range: RANGE | UWI: 05045069990000

Comments:

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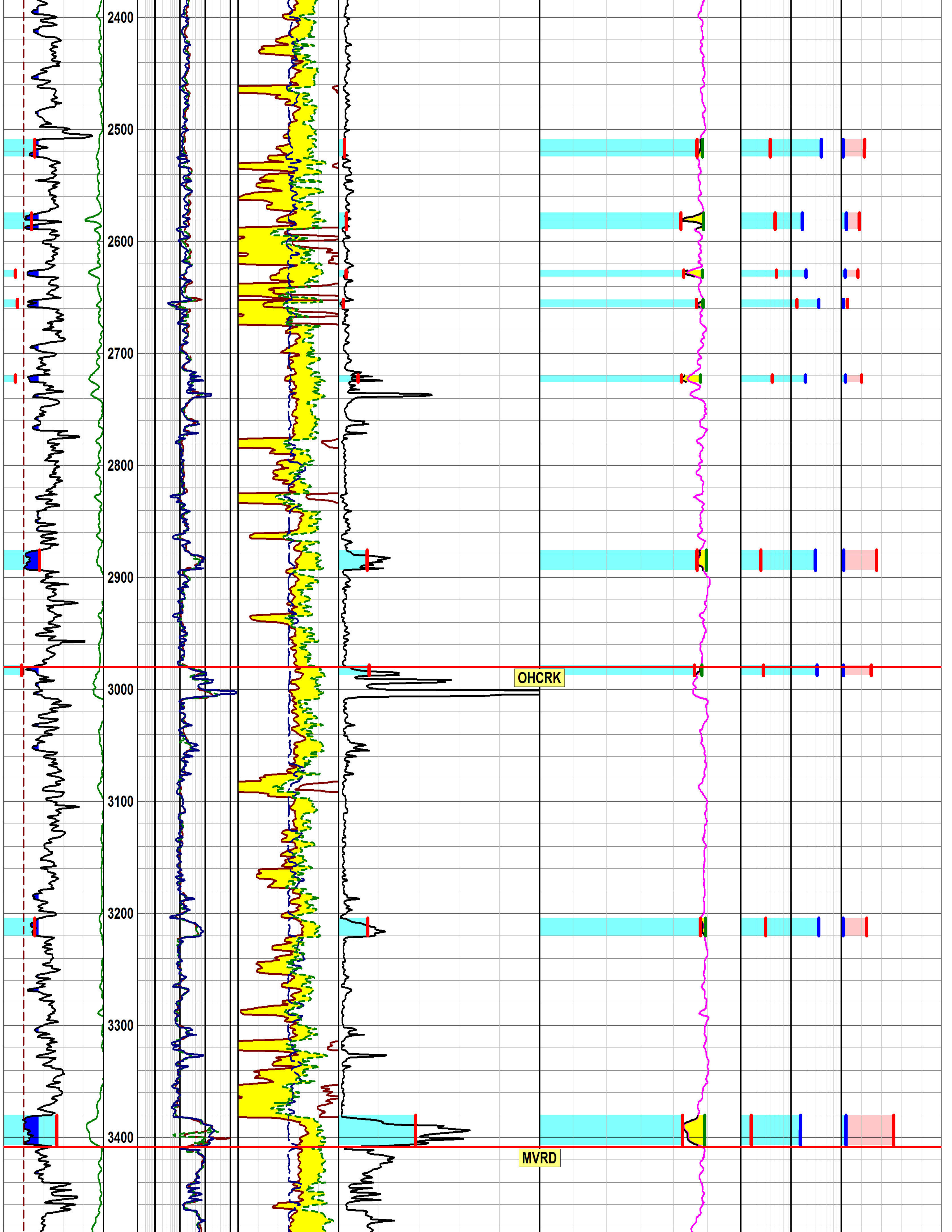
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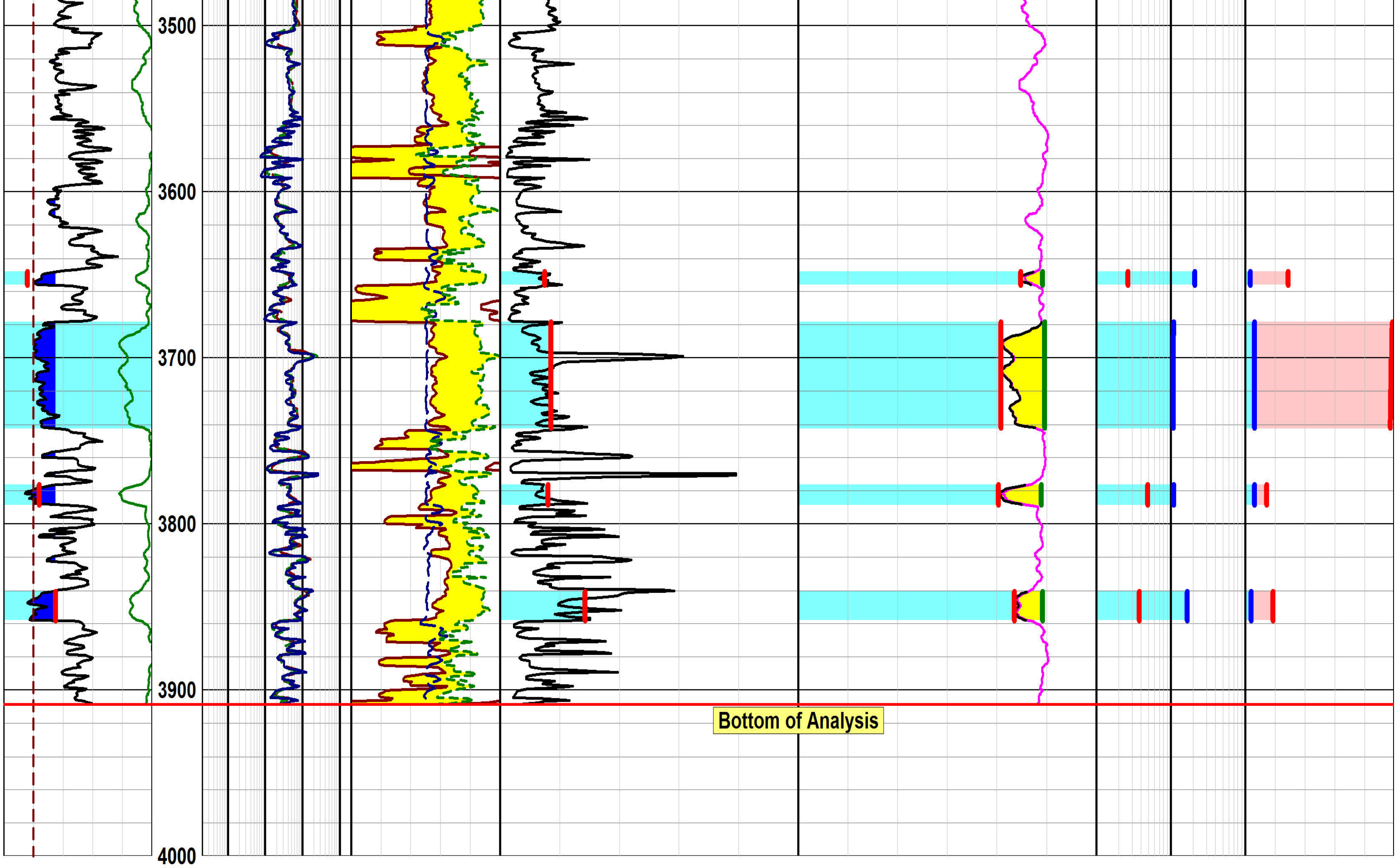
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Bottom of Analysis

LESA 9.8, © 1992-2015 Digital Formation, Inc.

File: **05045076680000 Porter Federal #13-28.lbs** Well Name: **PORTER FEDERAL #13-28**

Plot: **Salinity by Depth**

Gross Interval: **660** to **3665** by **0.5** **F**

Ranges:

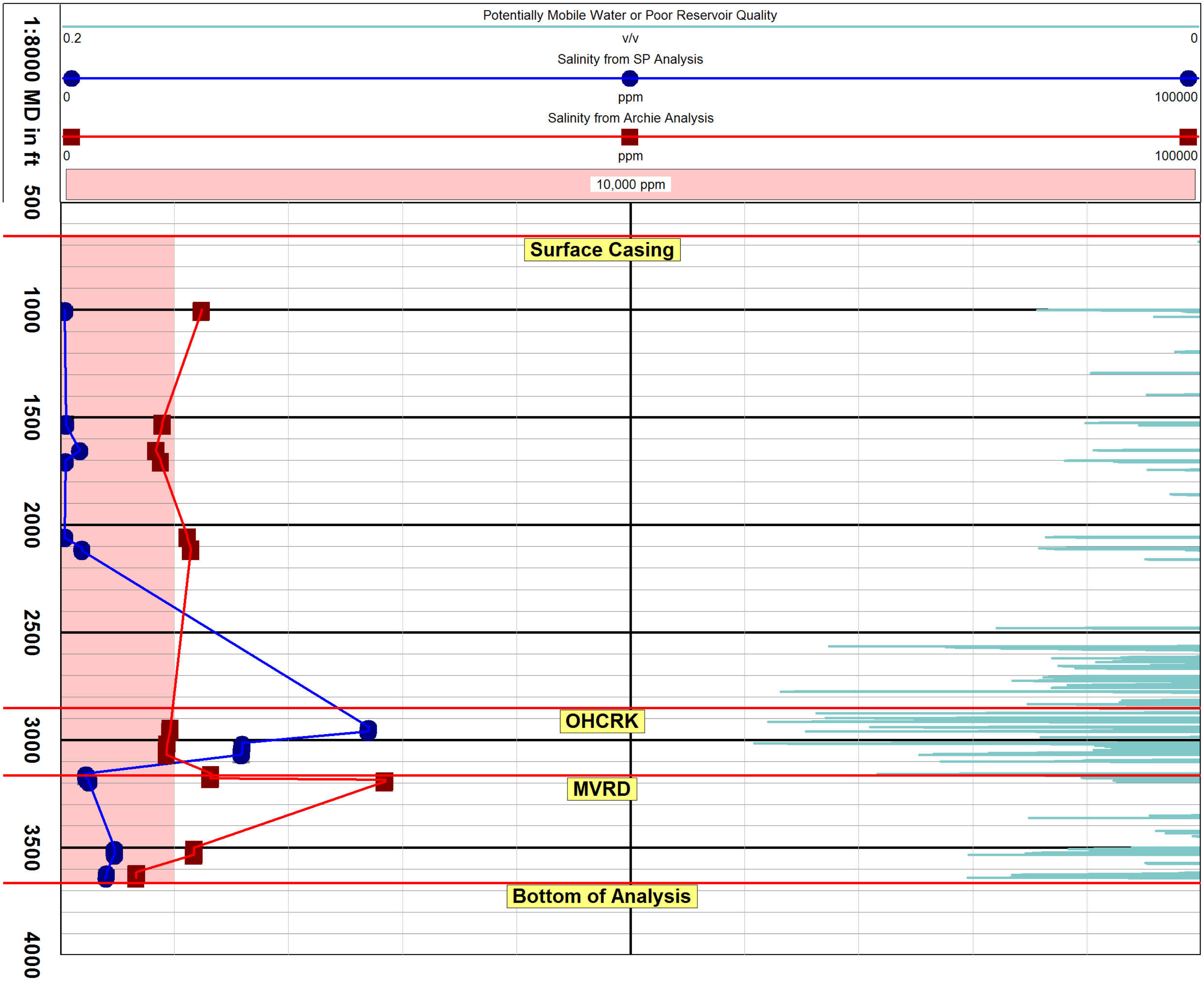
**660-3665**

Time: **10:53 AM** Date: **Fri, Jun 12, 2015**

Section: **SECTION** Township: **TOWNSHIP** API #: **05045076680000**

Location: **LOCATION** Range: **RANGE** UWI: **05045076680000**

Comments:



LESA 9.8, © 1992-2015 Digital Formation, Inc.

File: 05045076680000 Porter Federal #13-28.lbs | Well Name: PORTER FEDERAL #13-28

Plot: SP Shift Deflection

Gross Interval: 660 to 3665 by 0.5 F

Ranges:

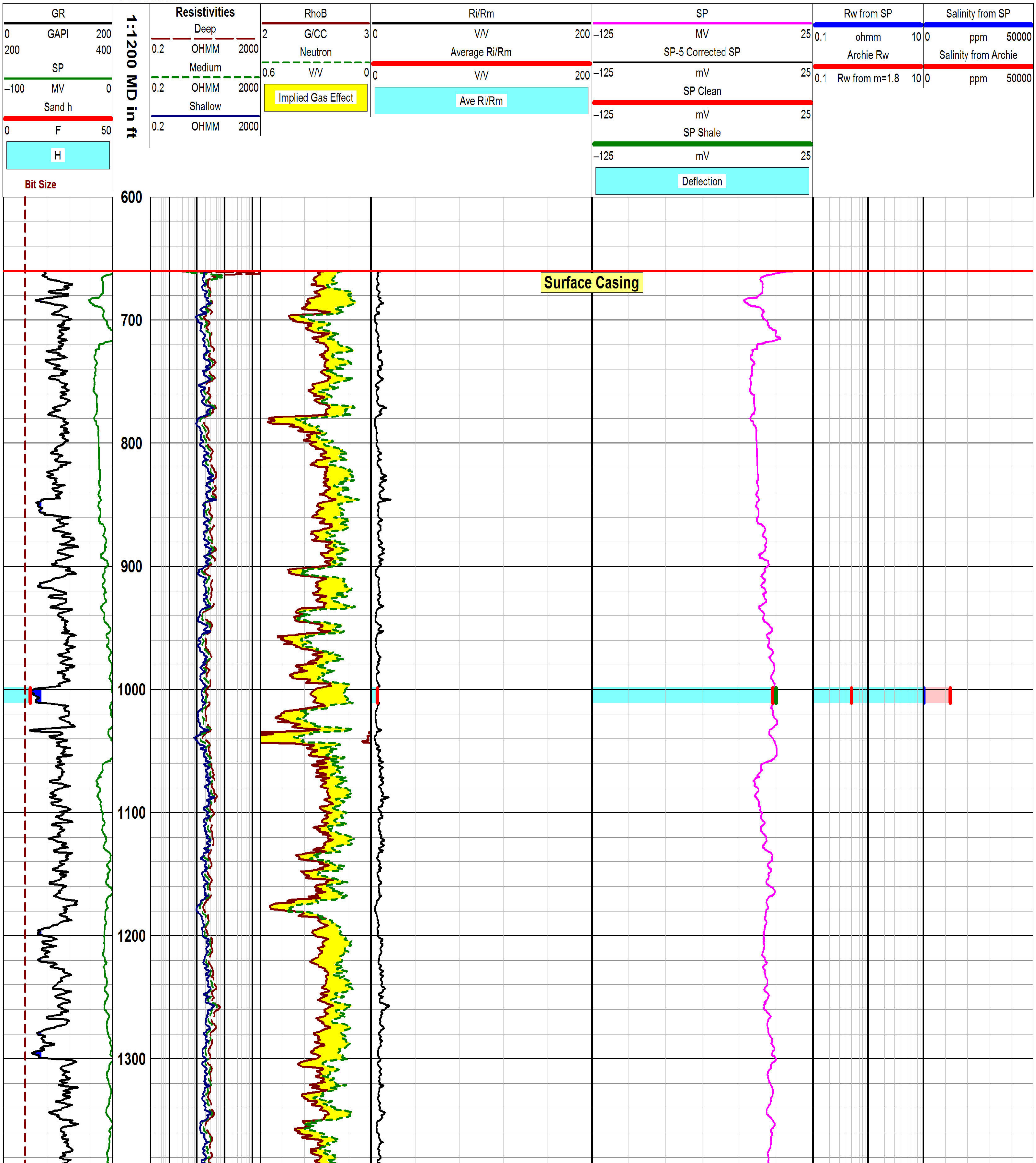
660-3665

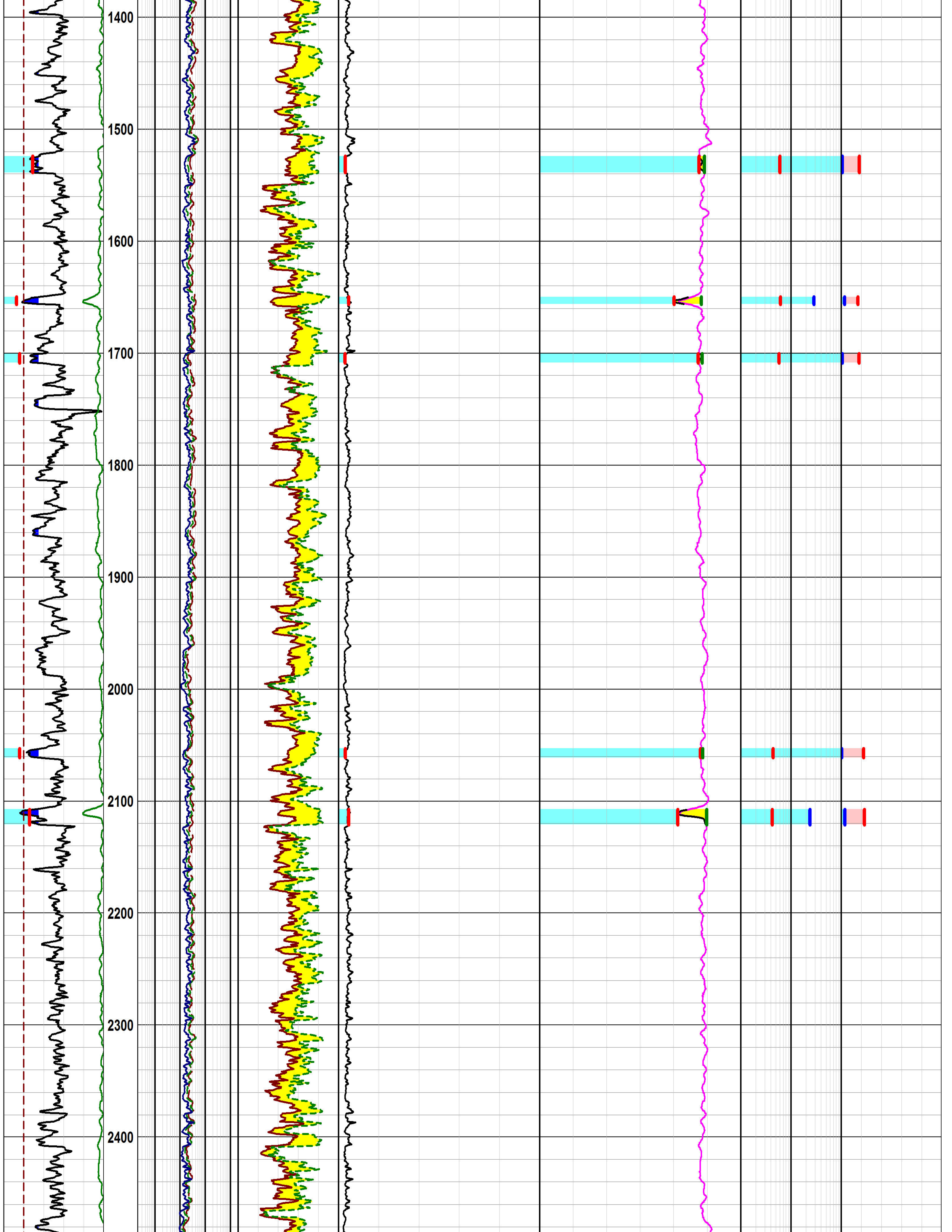
Time: 10:56 AM | Date: Fri, Jun 12, 2015

Section: SECTION | Township: TOWNSHIP | API #: 05045076680000

Location: LOCATION | Range: RANGE | UWI: 05045076680000

Comments:

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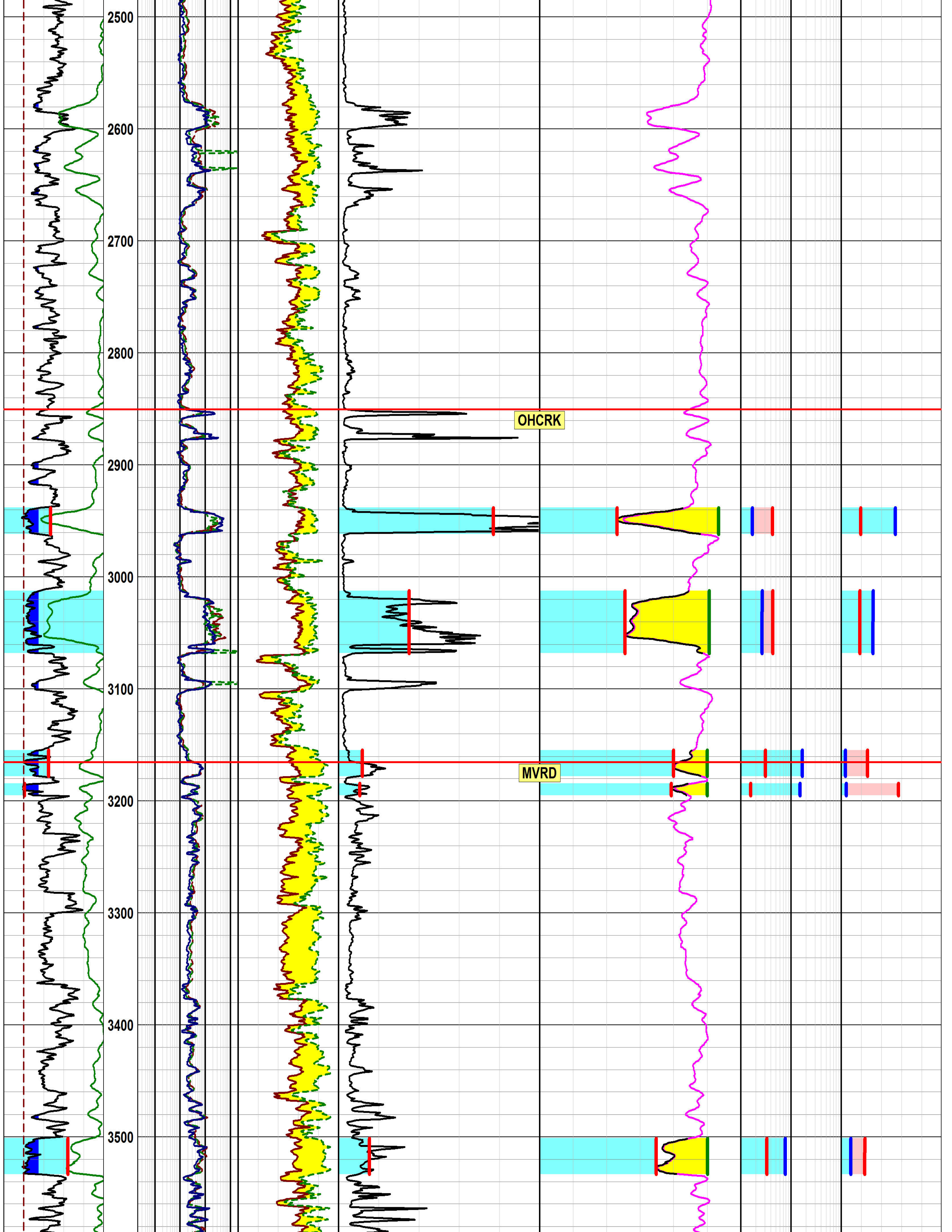

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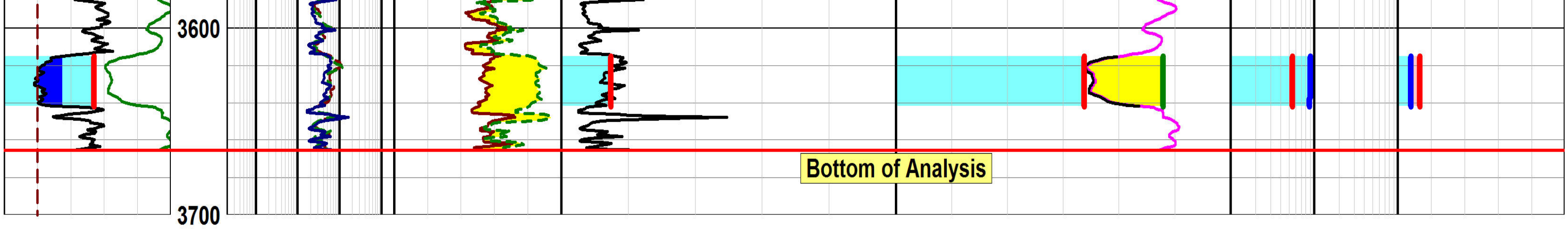

3600
Bottom of Analysis
3700

LESA 9.8, © 1992-2015 Digital Formation, Inc.

File: 05045079290000 Scott #2-36.lbs

Well Name: SCOTT #2-36

Plot: Salinity by Depth

Gross Interval: 650 to 3625 by 0.5 F

Ranges:

650-3625

Time: 10:53 AM

Date: Fri, Jun 12, 2015

Section: SECTION

Township: TOWNSHIP

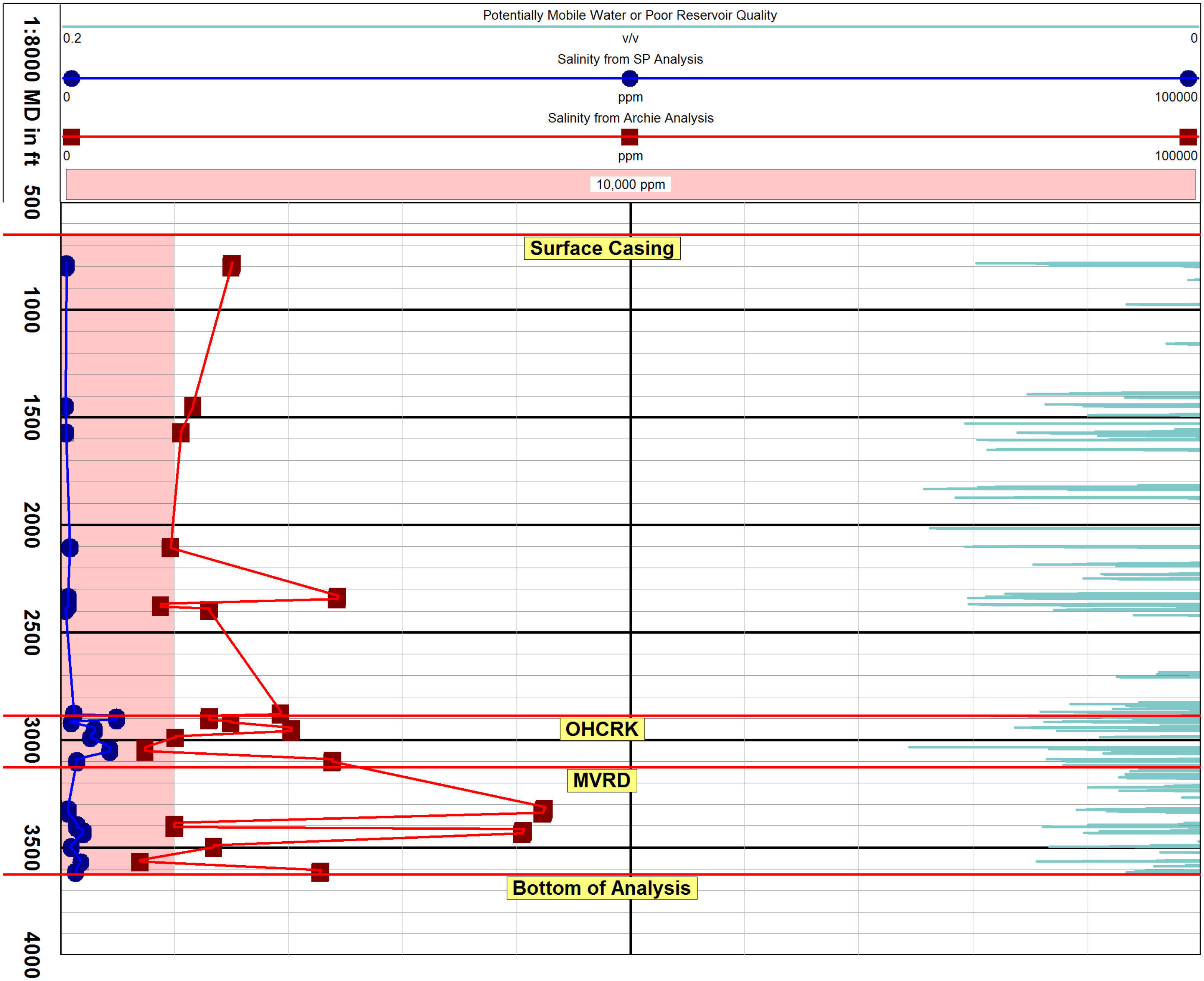
API #: 05045079290000

Location: LOCATION

Range: RANGE

UWI: 05045079290000

Comments:



LESA 9.8, © 1992-2015 Digital Formation, Inc.

File: 05045079290000 Scott #2-36.lbs

Well Name: SCOTT #2-36

Plot: SP Shift Deflection

Gross Interval: 650 to 3625 by 0.5 F

Ranges:

650-3625

Time: 10:57 AM

Date: Fri, Jun 12, 2015

Section: SECTION

Township: TOWNSHIP

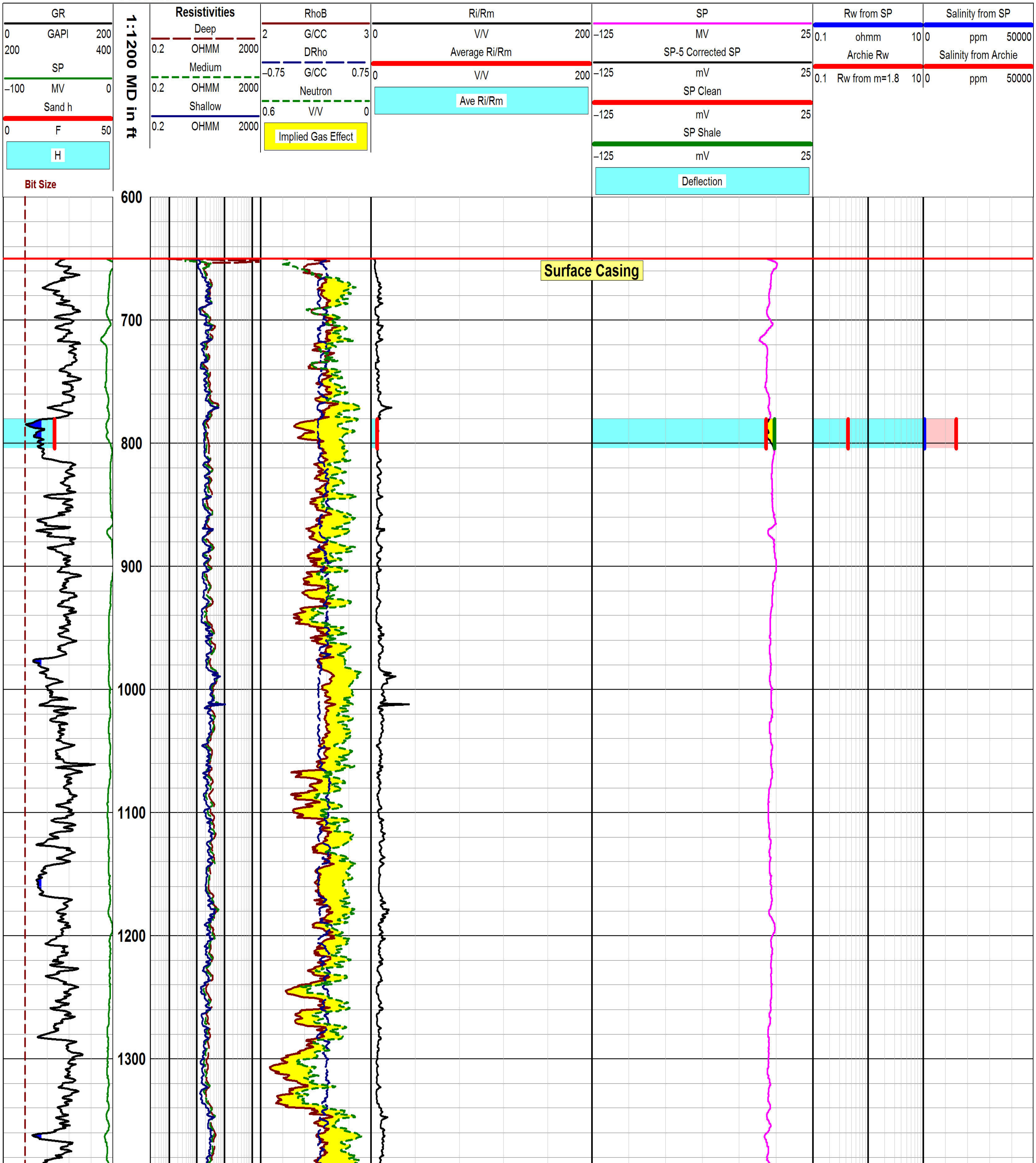
API #: 05045079290000

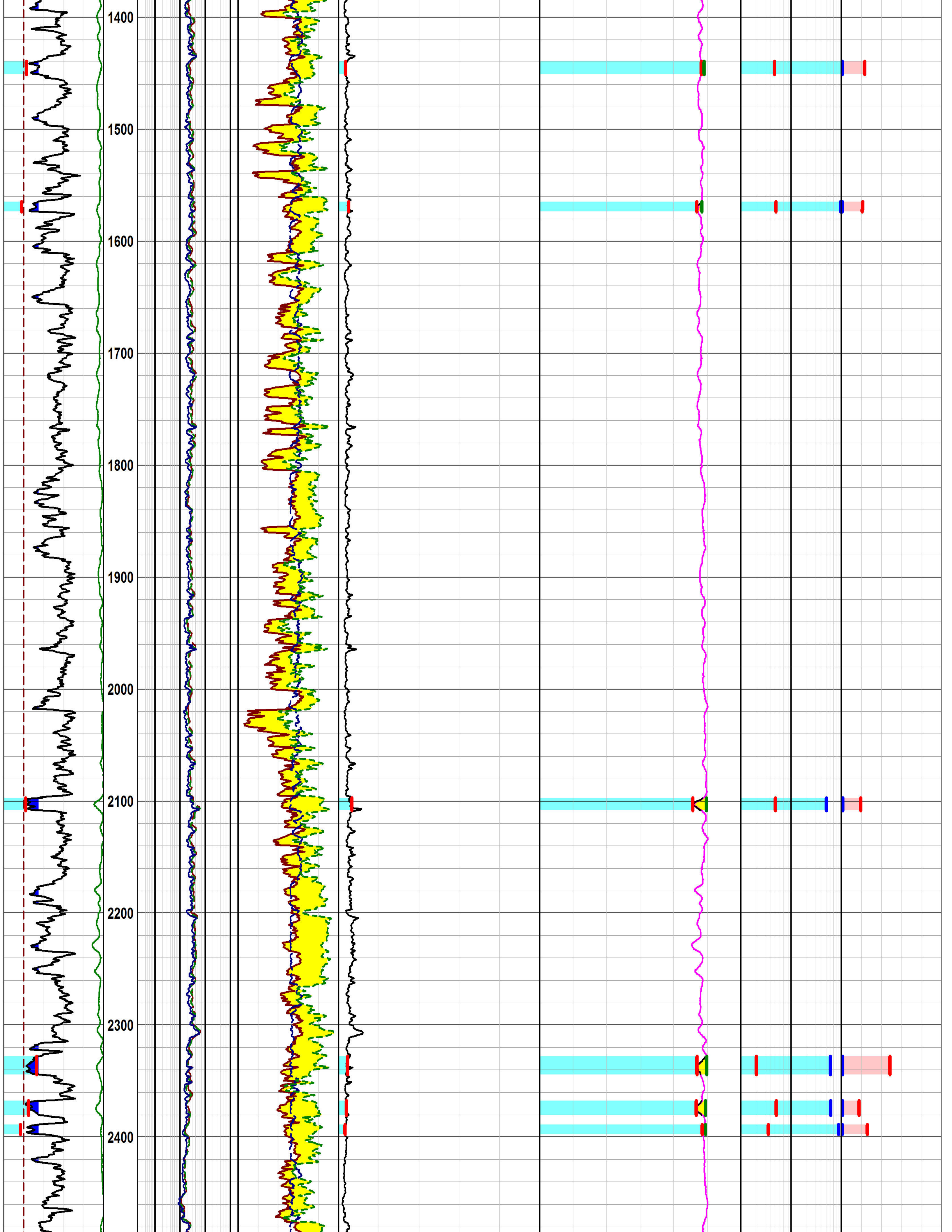
Location: LOCATION

Range: RANGE

UWI: 05045079290000

Comments:

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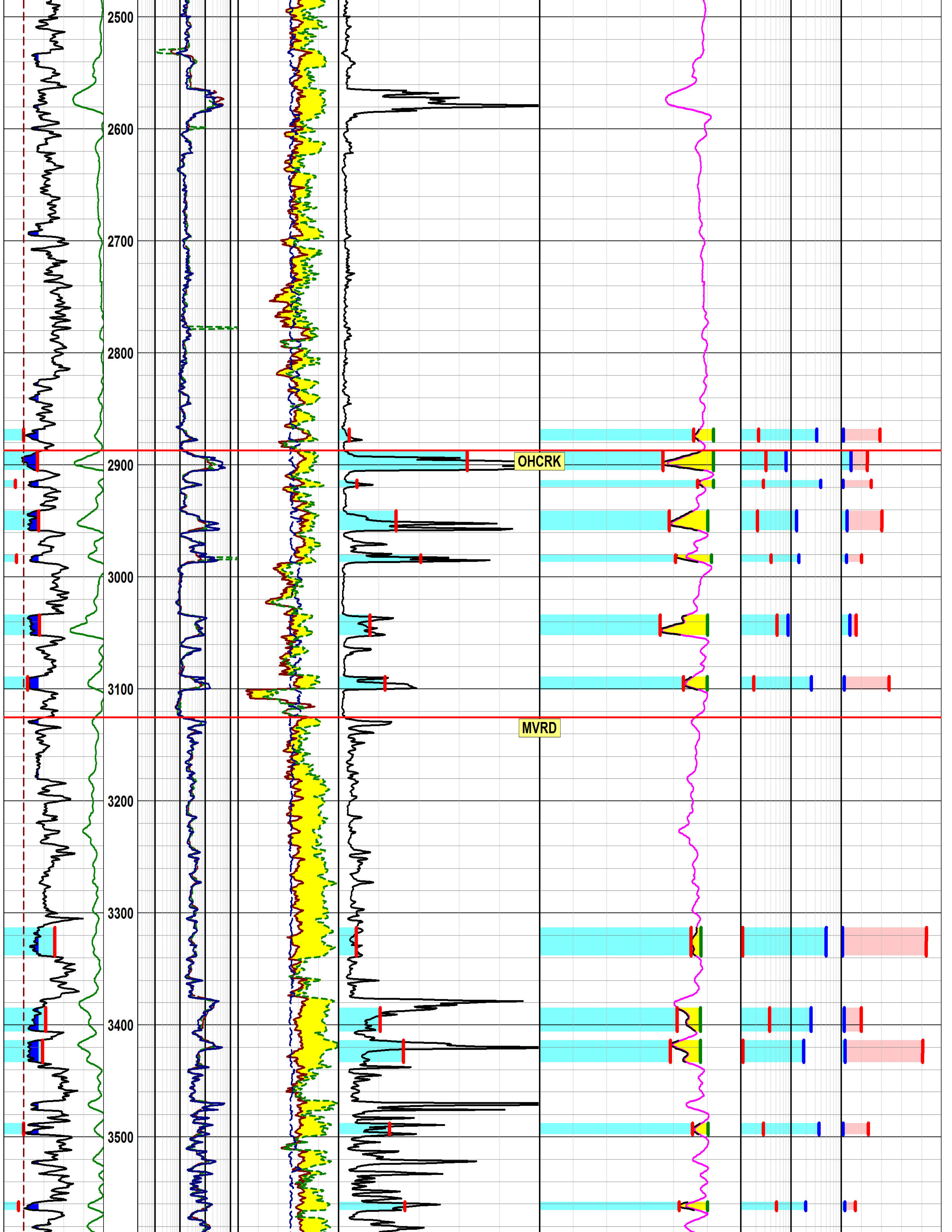
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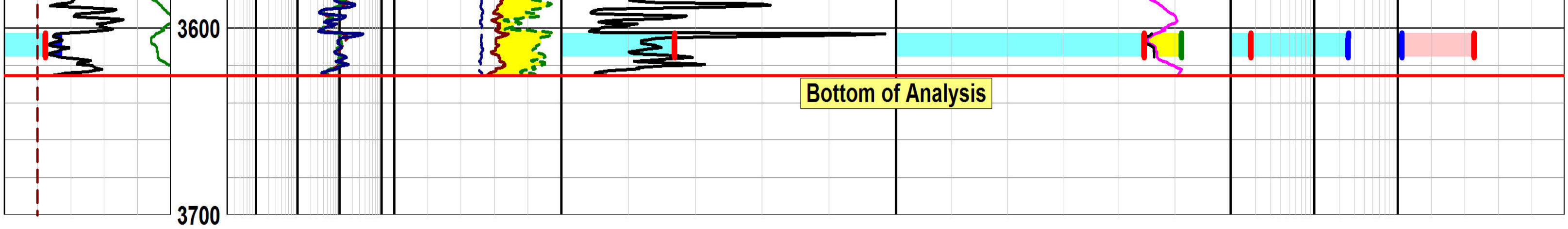
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LESA 9.8, © 1992-2015 Digital Formation, Inc.

File: 05045089730000 Buerger Disposal #1.lbs

Well Name: Buerger 21-3A

Plot: Salinity by Depth

Gross Interval: 720 to 5400 by 0.5 F

Ranges:

720-5400

Time: 10:53 AM

Date: Fri, Jun 12, 2015

Section: SECTION

Township: TOWNSHIP

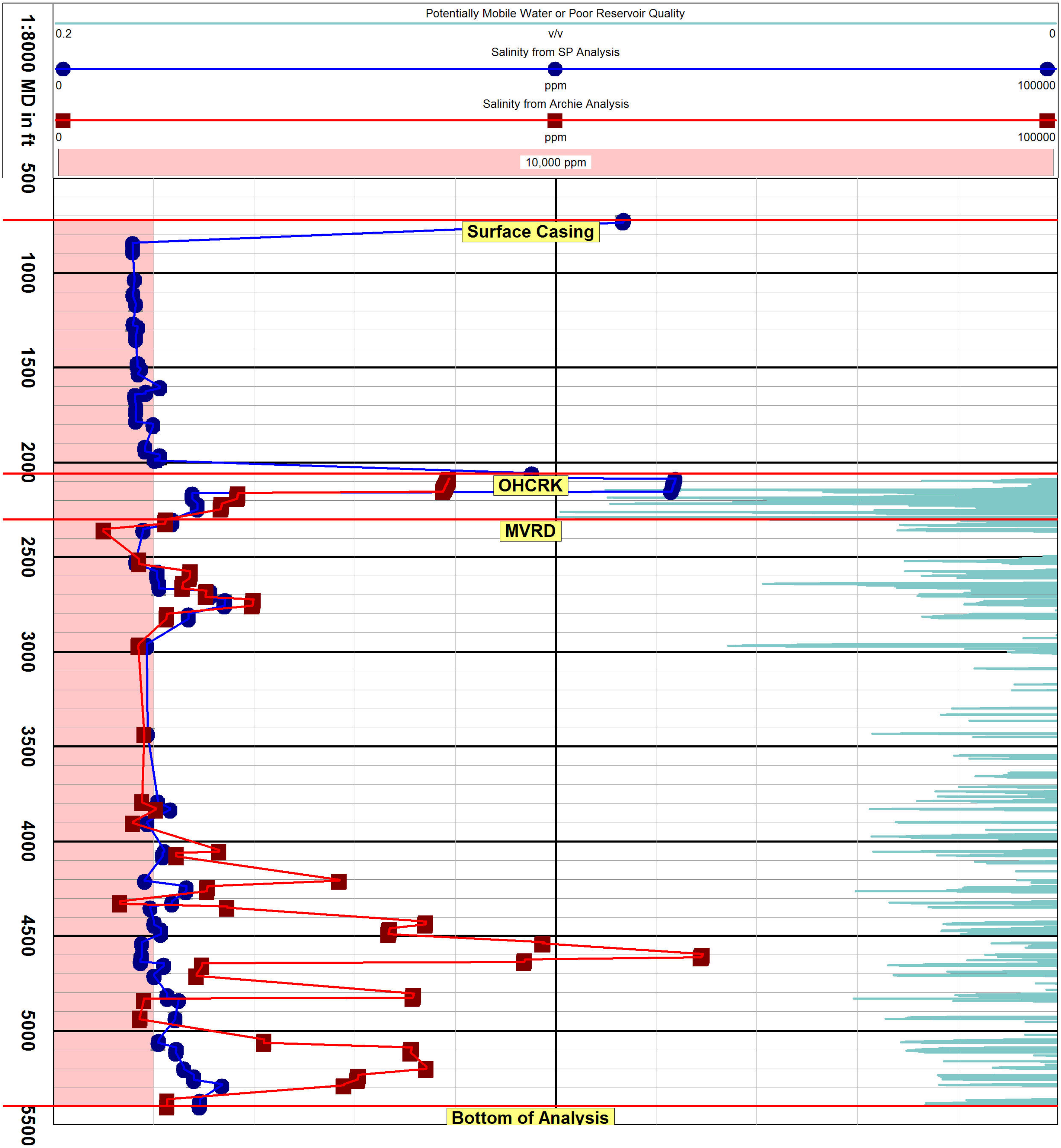
API #: 05045089730000

Location: LOCATION

Range: RANGE

UWI: 05045089730000

Comments:



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LESA 9.8, © 1992-2015 Digital Formation, Inc.

File: 05045089730000 Buerger Disposal #1.lbs — Well Name: Buerger 21-3A

Plot: SP Shift Deflection

Gross Interval: 720 to 5400 by 0.5 F

Ranges:

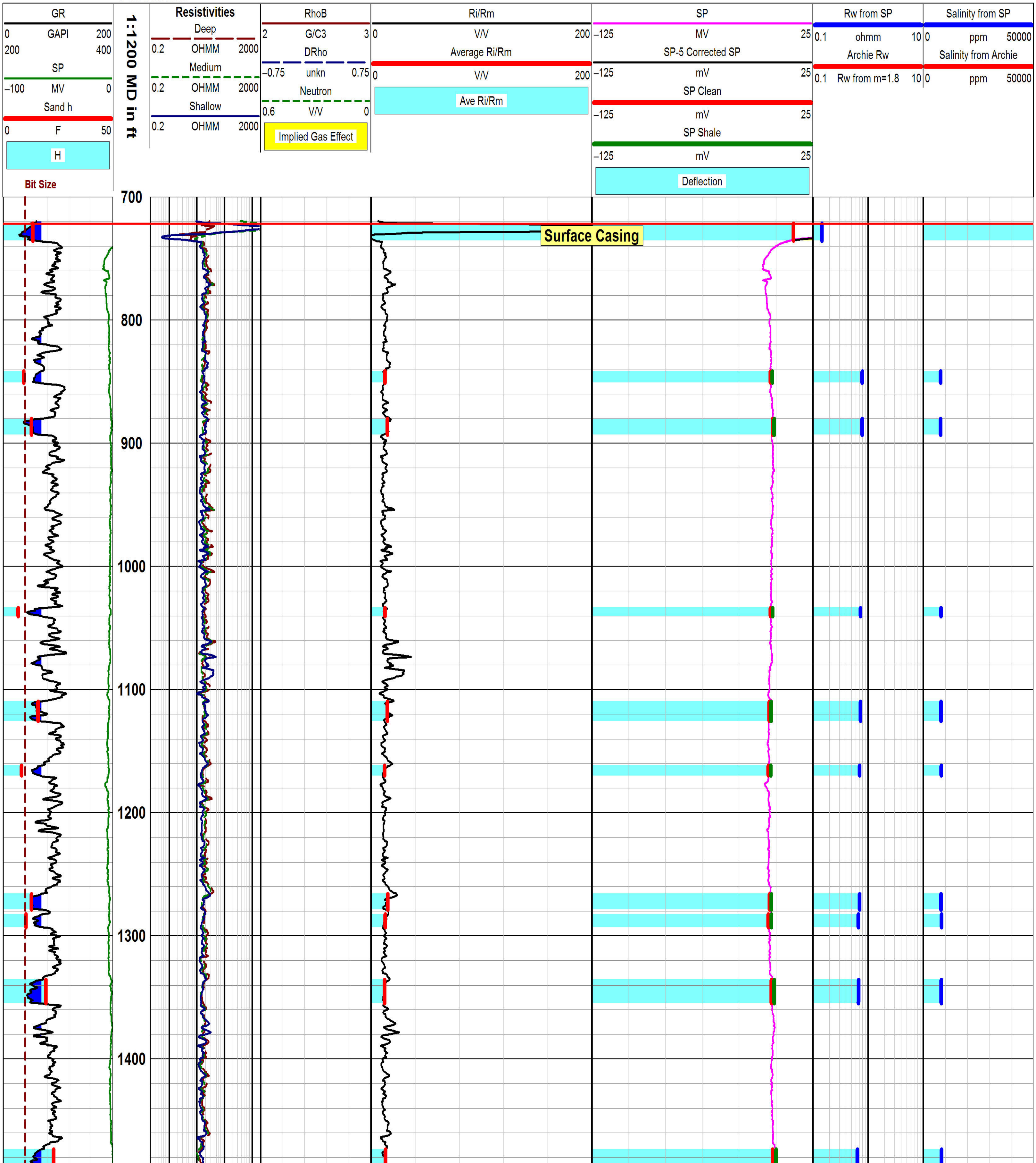
720-5400

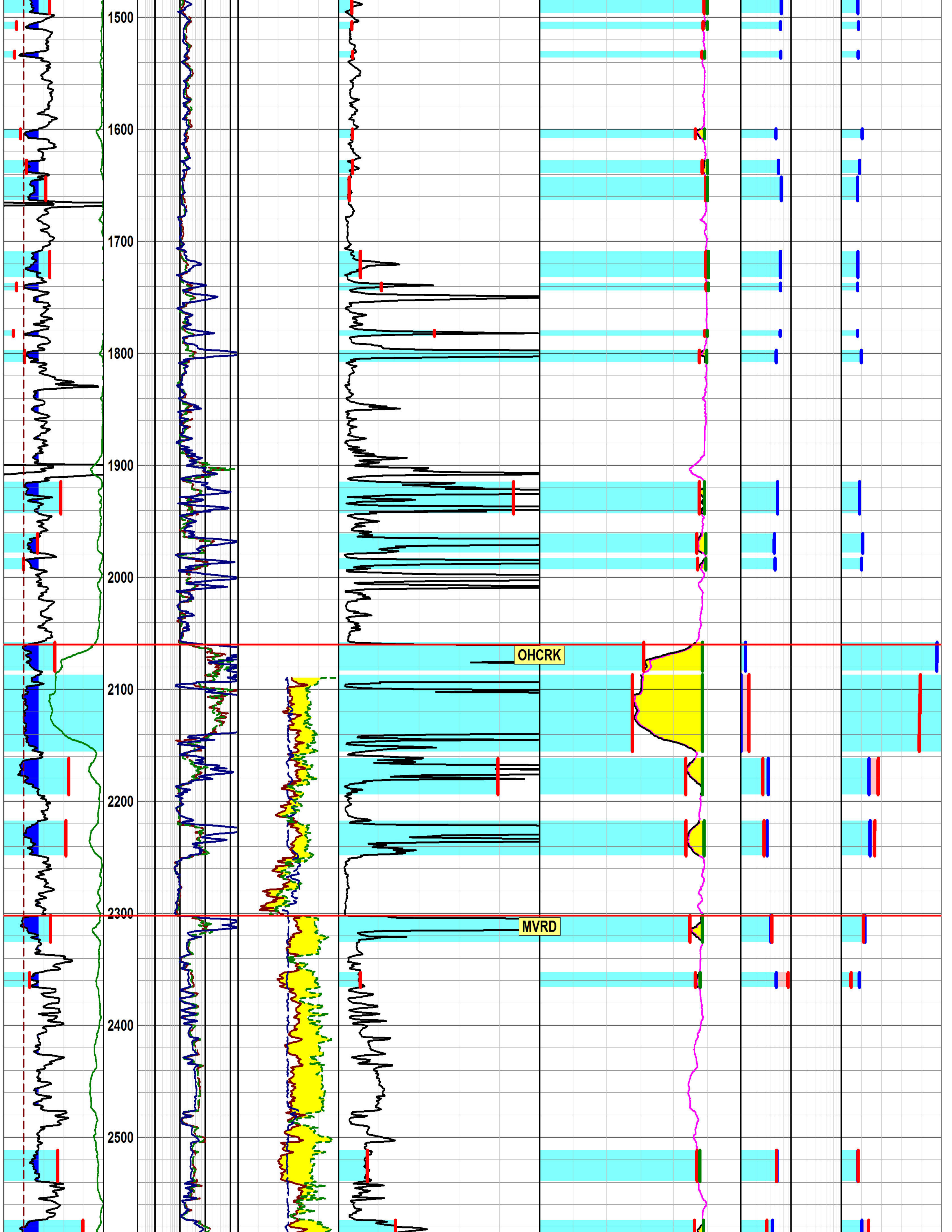
Time: 10:58 AM — Date: Fri, Jun 12, 2015

Section: SECTION — Township: TOWNSHIP — API #:05045089730000

Location: LOCATION — Range: RANGE — UWI: 05045089730000

Comments:





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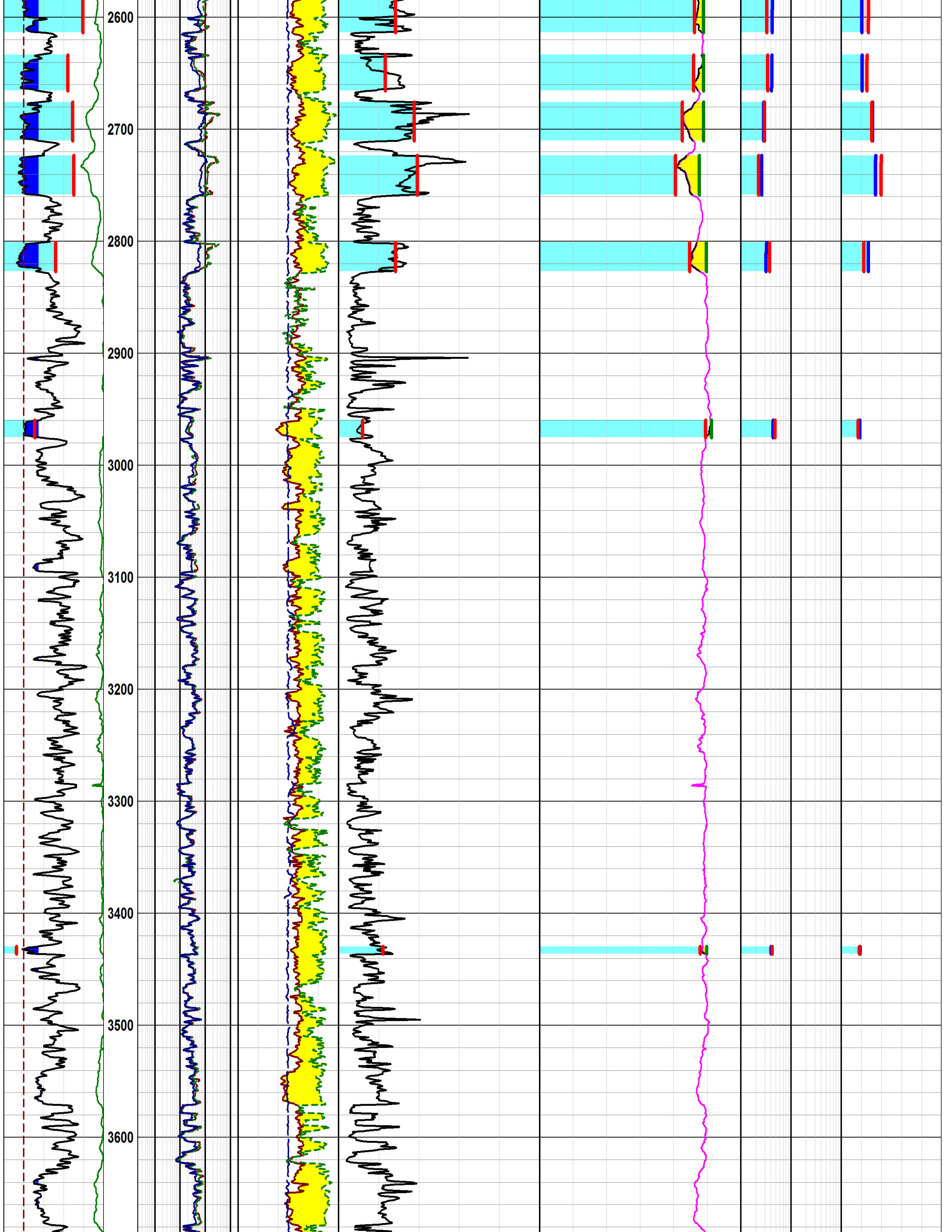
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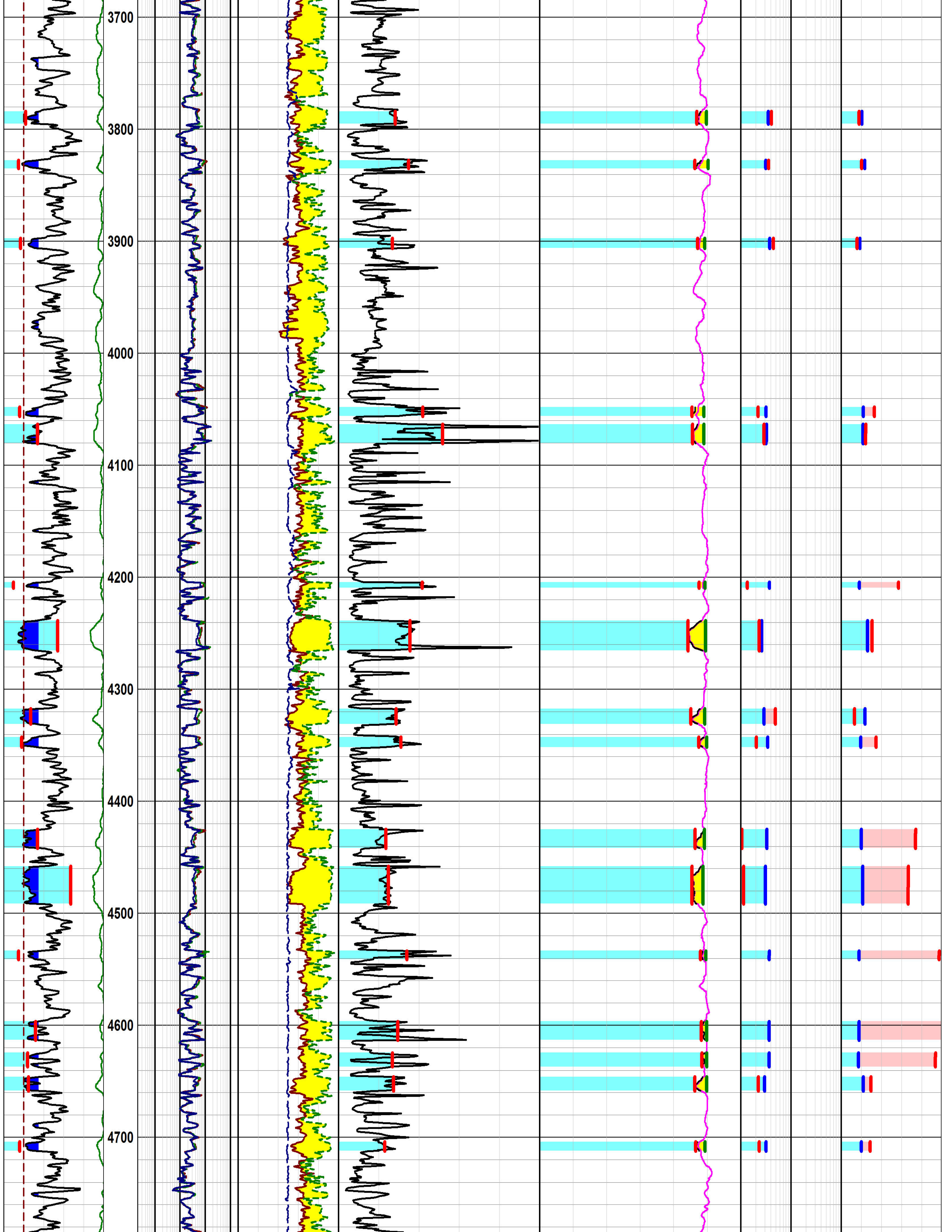
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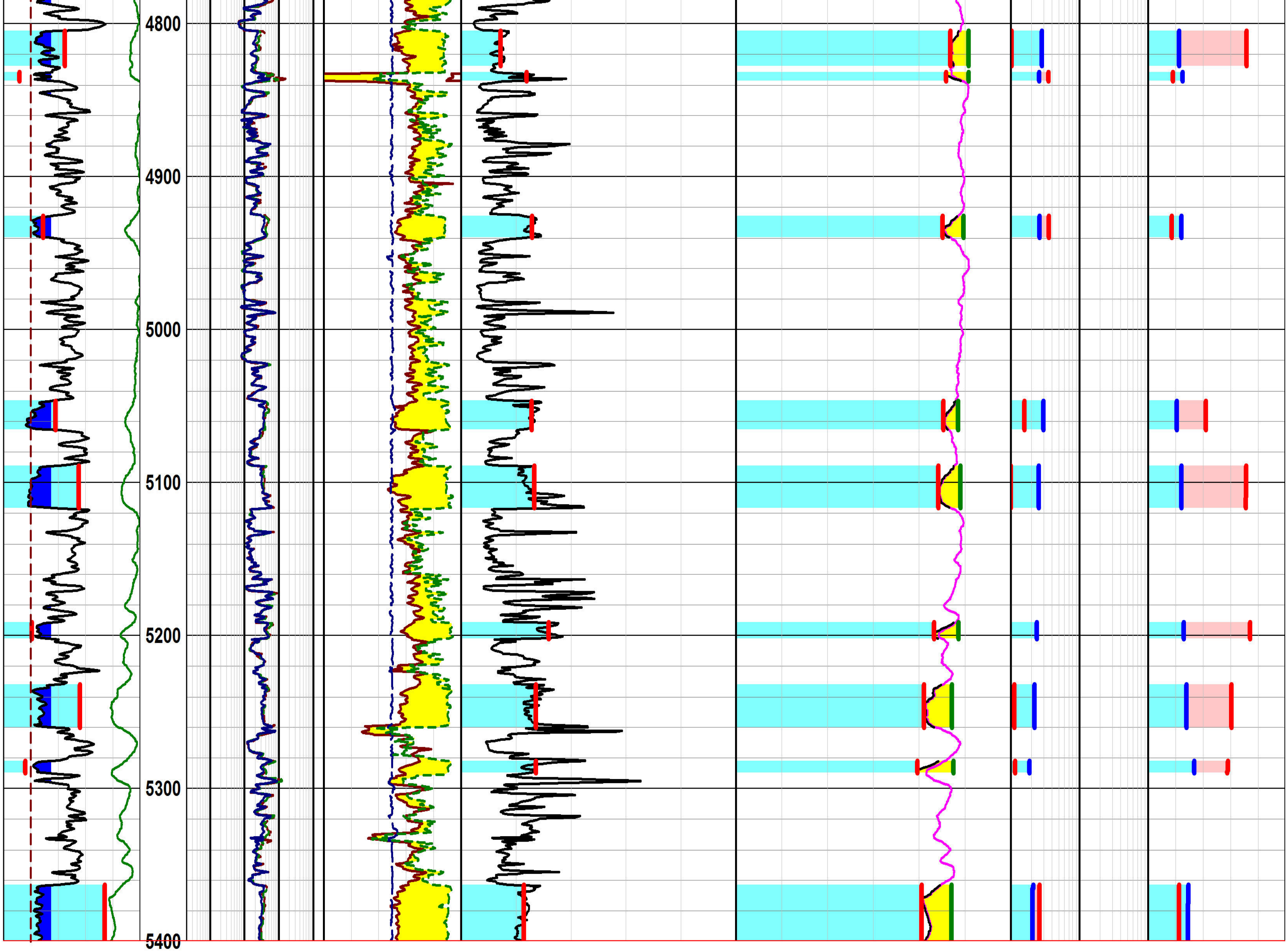

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LESA 9.8, © 1992-2015 Digital Formation, Inc.

DIGITAL FORMATION

File: **05045108150000 Stone #42D-34-692.lbs** Well Name: **STONE 42D-34-692**

Plot: **Salinity by Depth**

Gross Interval: **0.5** to **7044** by **0.5** **ft**

Ranges:

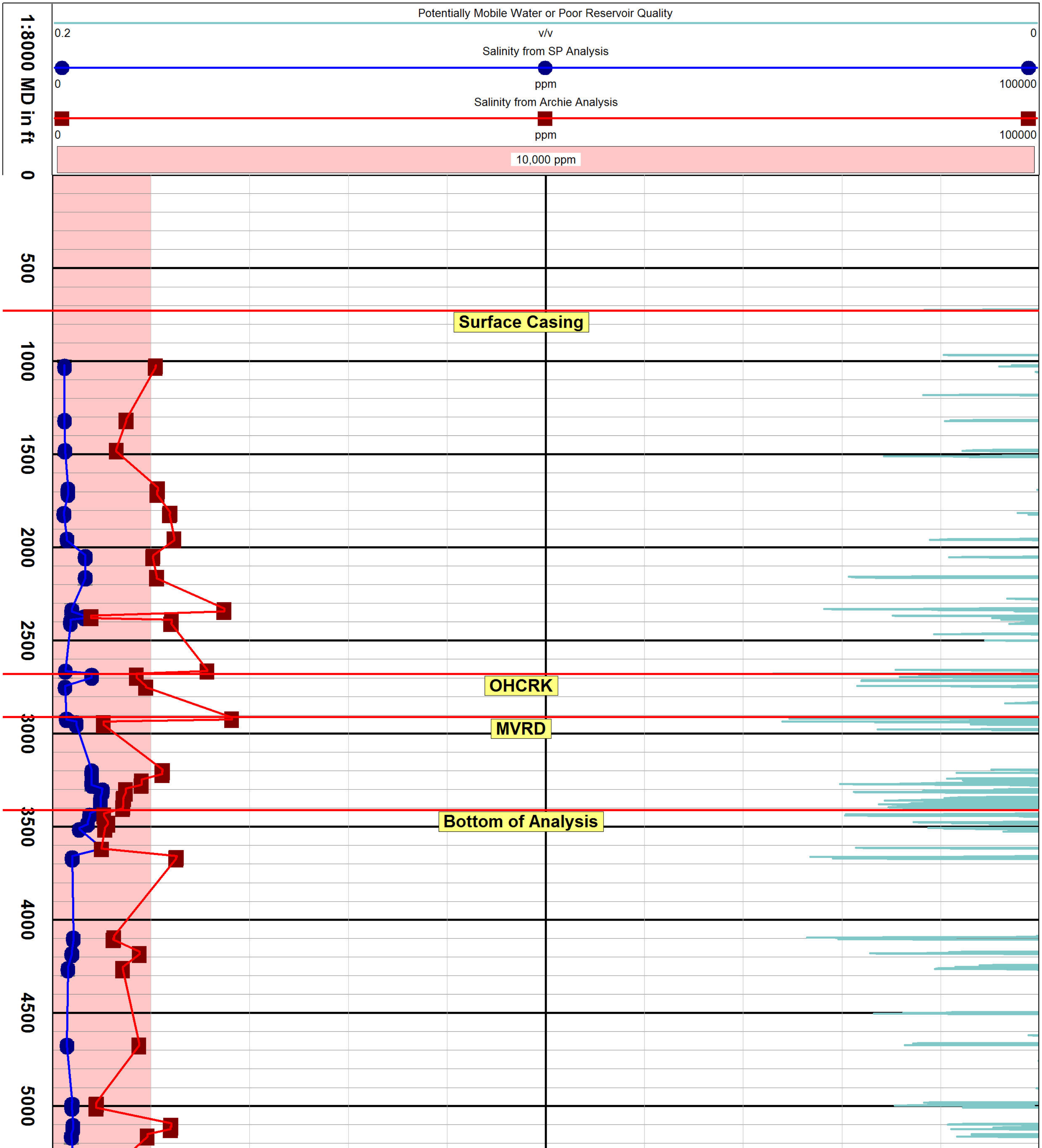
**0.5-7044**

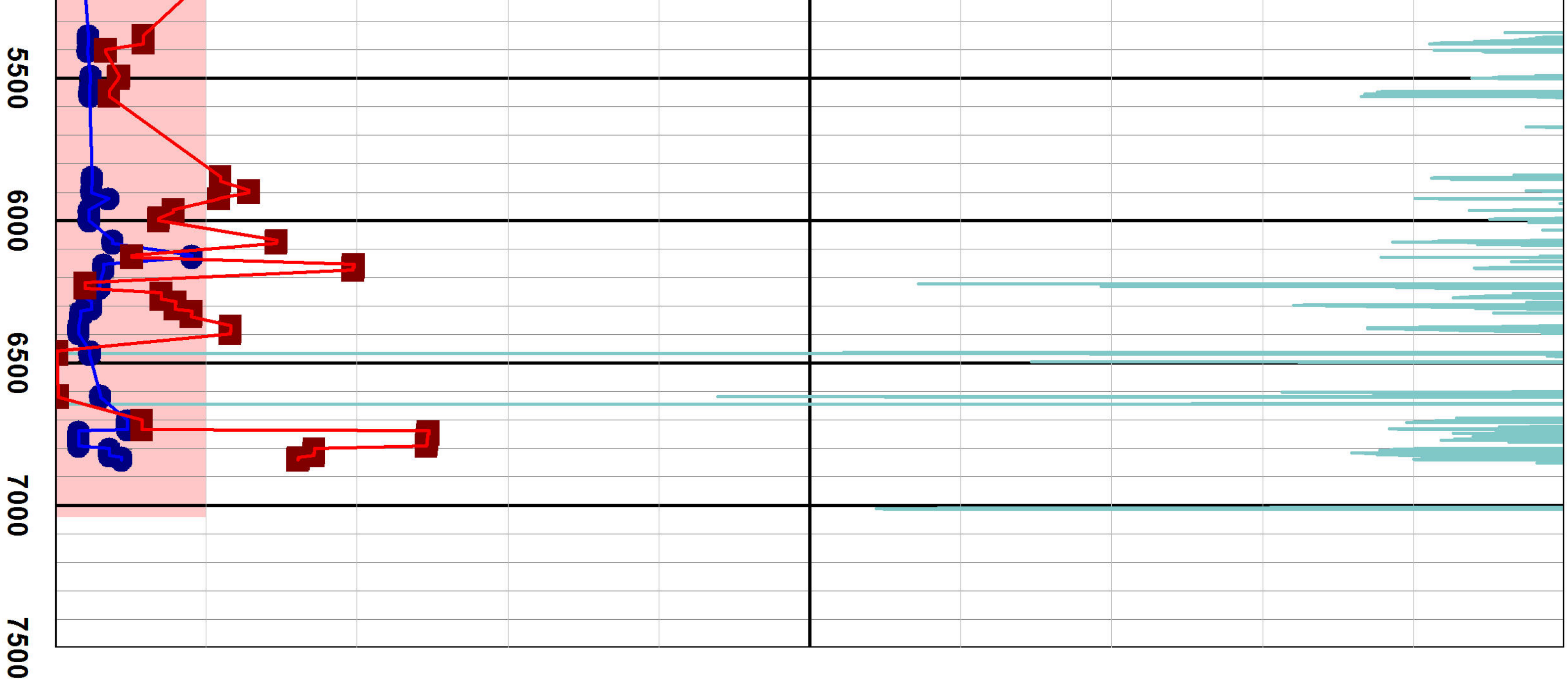
Time: **10:53 AM** Date: **Fri, Jun 12, 2015**

Section: Township: API #: **05045108150000**

Location: **SHL** Range: UWI: **05045108150000**

Comments:





5500
6000
6500
7000
7500

LESA 9.8, © 1992-2015 Digital Formation, Inc.

File: 05045108150000 Stone #42D-34-692.lbs

Well Name: STONE 42D-34-692

Plot: SP Shift Deflection

Gross Interval: 0.5 to 7044 by 0.5 ft

Ranges:

0.5-7044

Time: 10:58 AM

Date: Fri, Jun 12, 2015

Section:

Township:

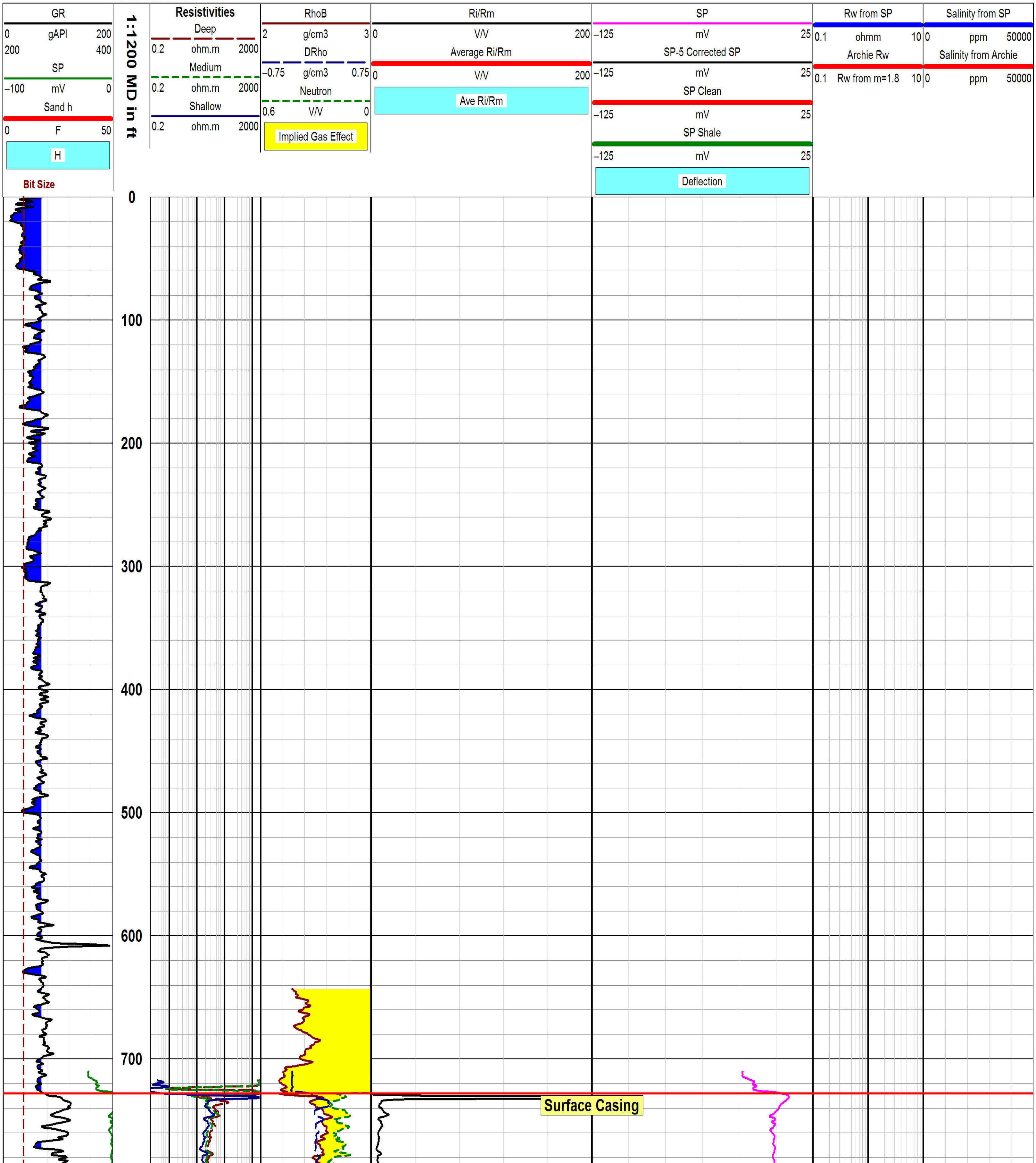
API #:05045108150000

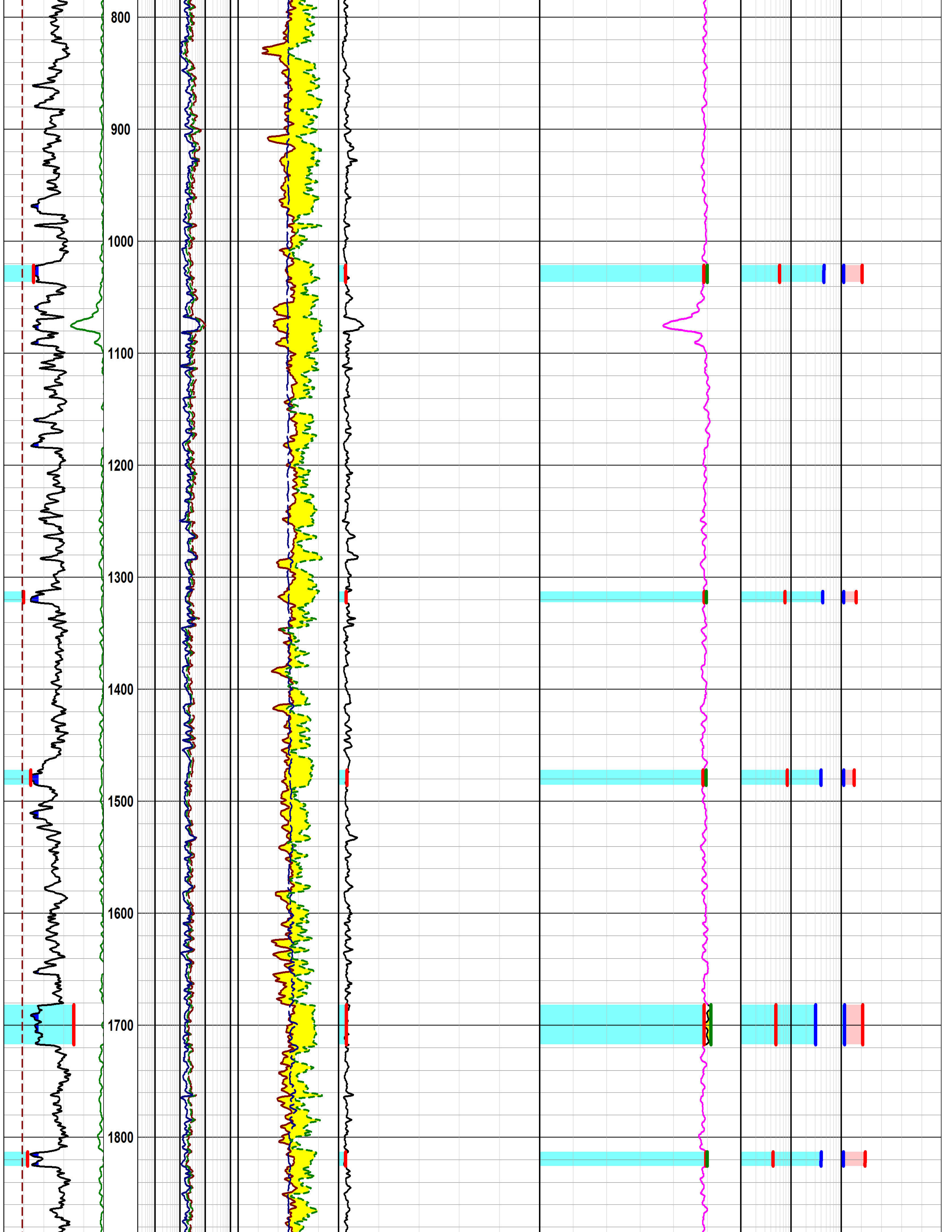
Location: SHL

Range:

UWI: 05045108150000

Comments:

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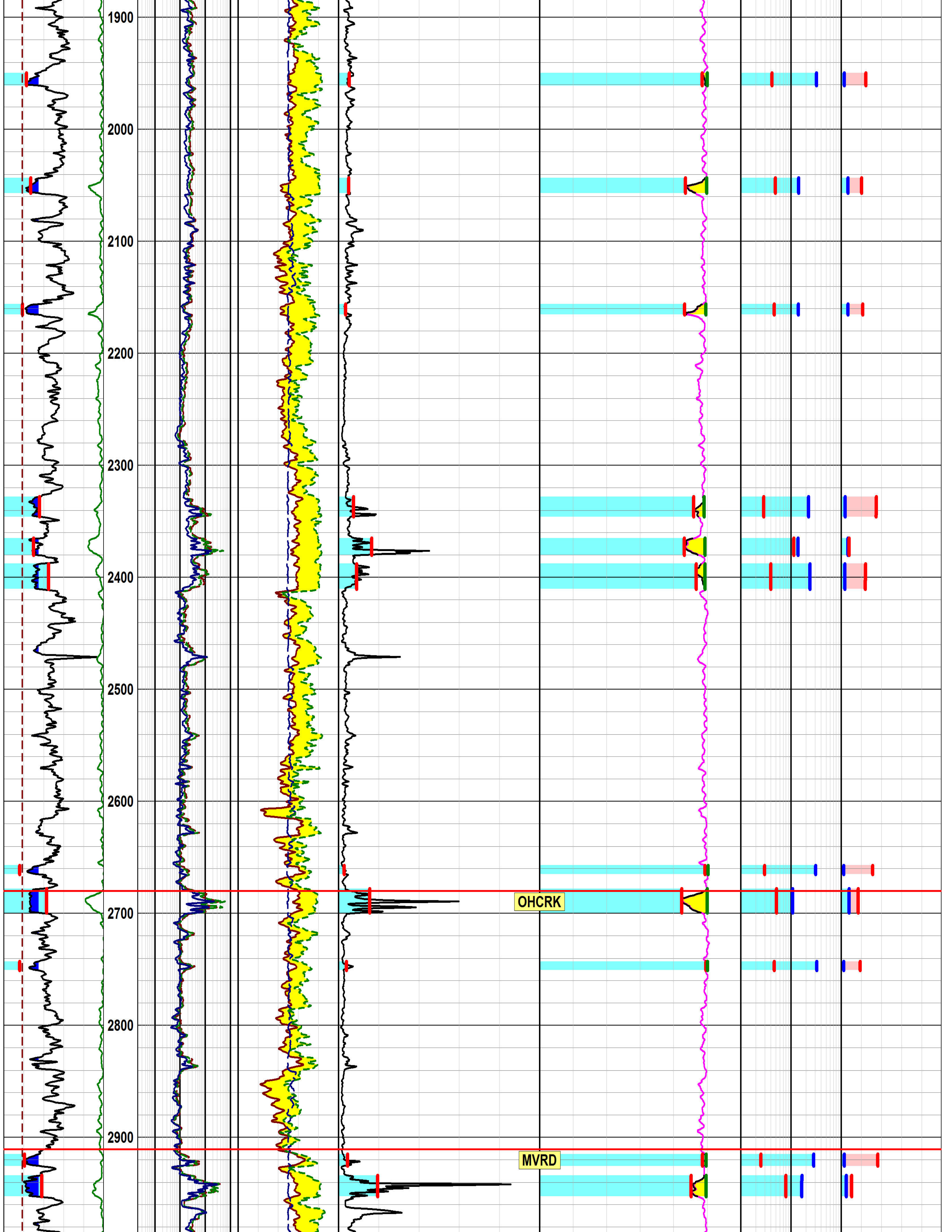
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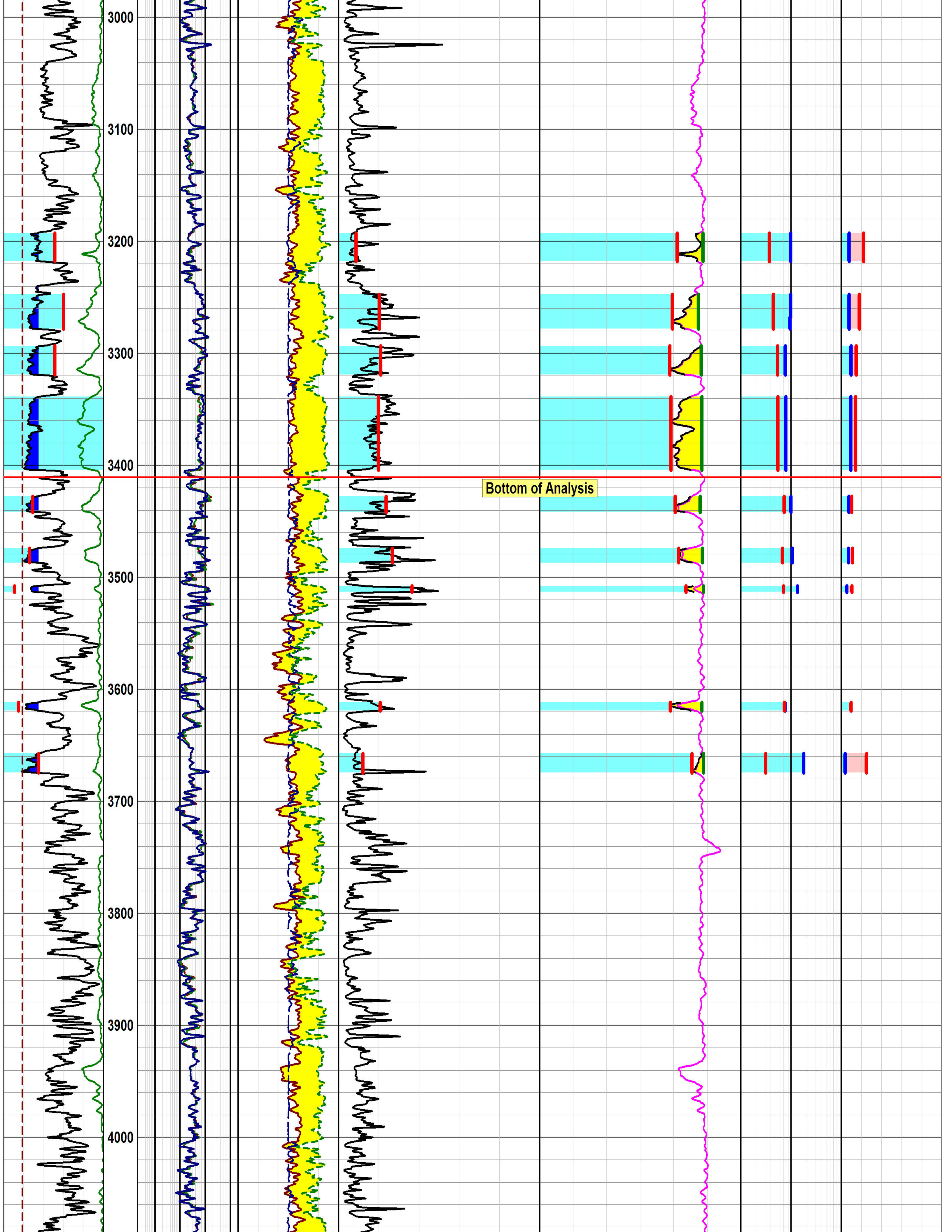
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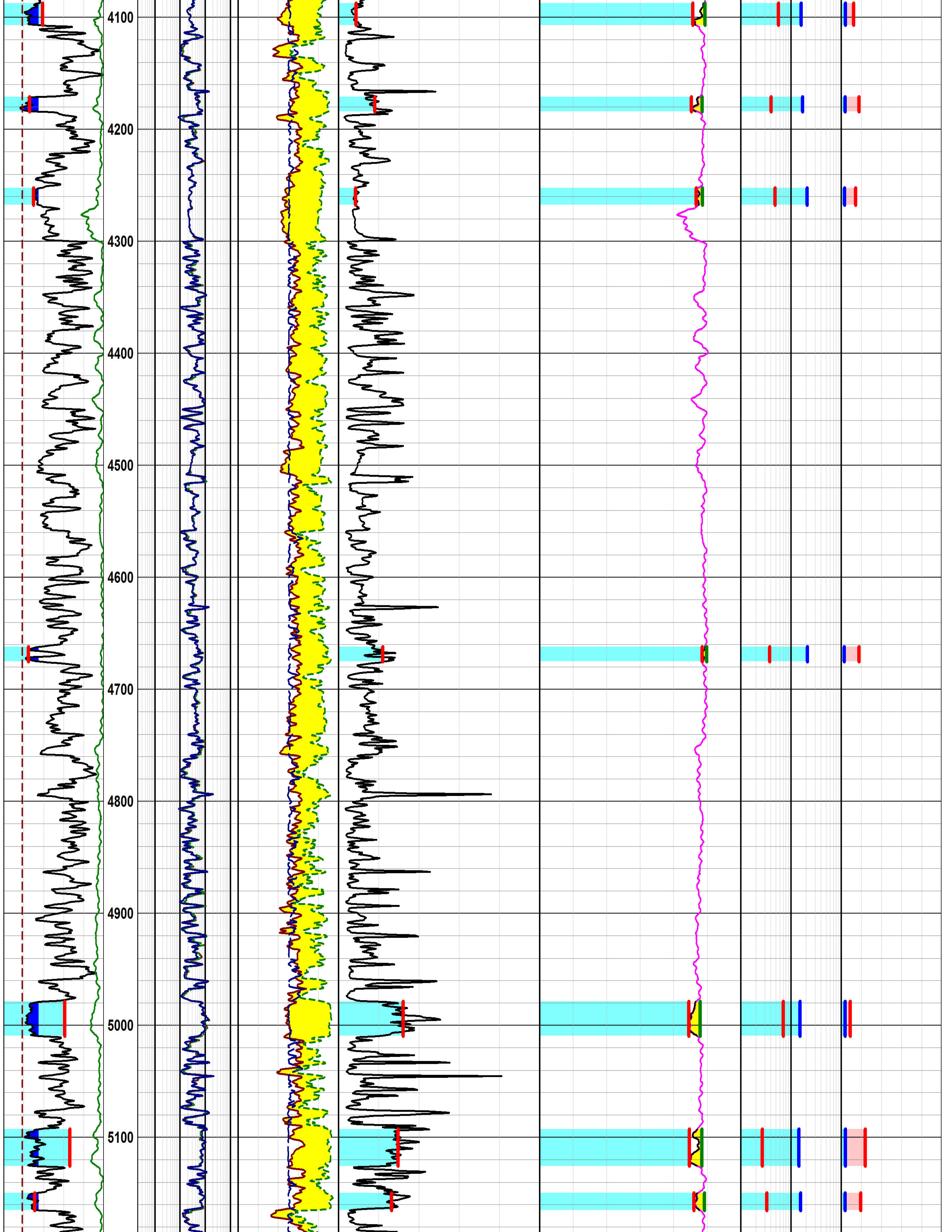
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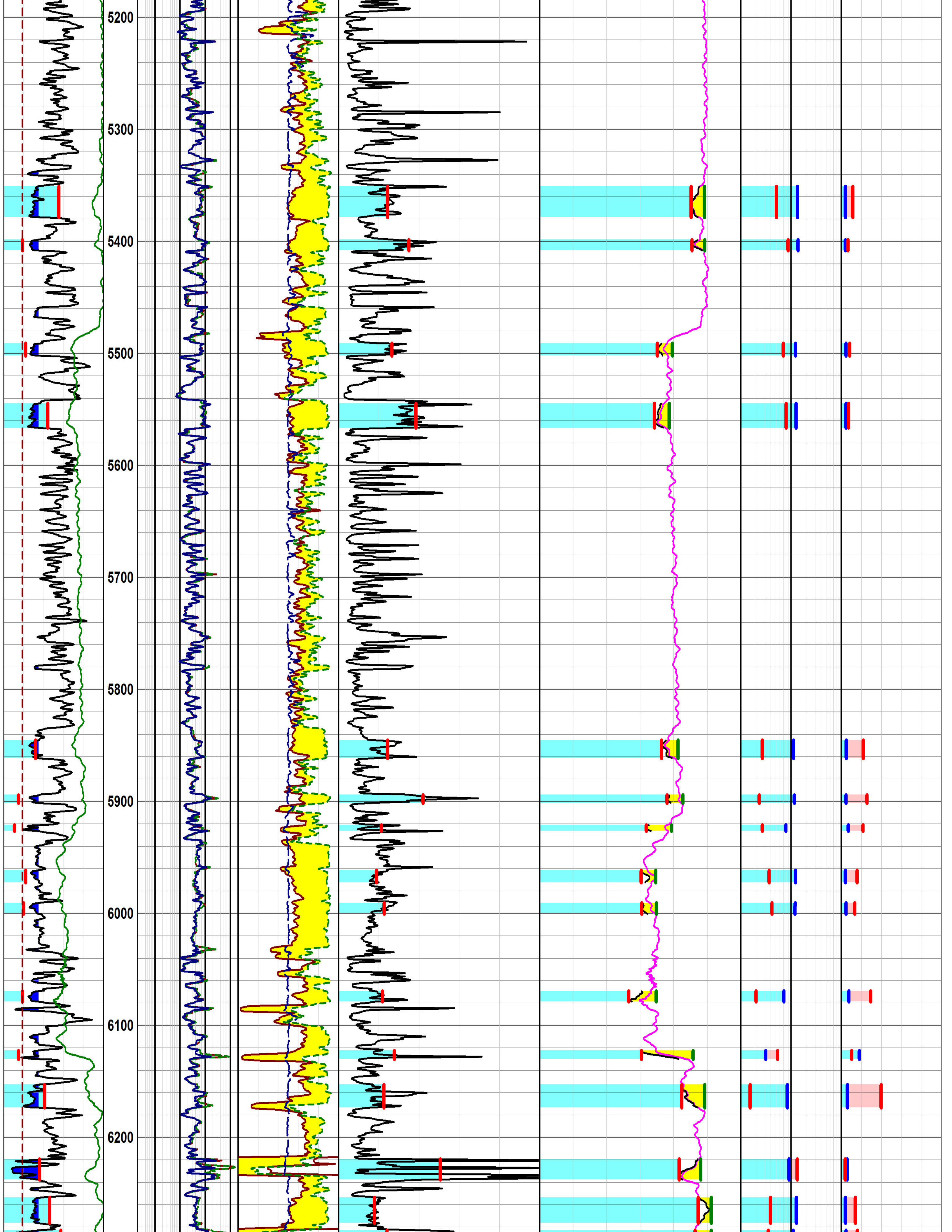
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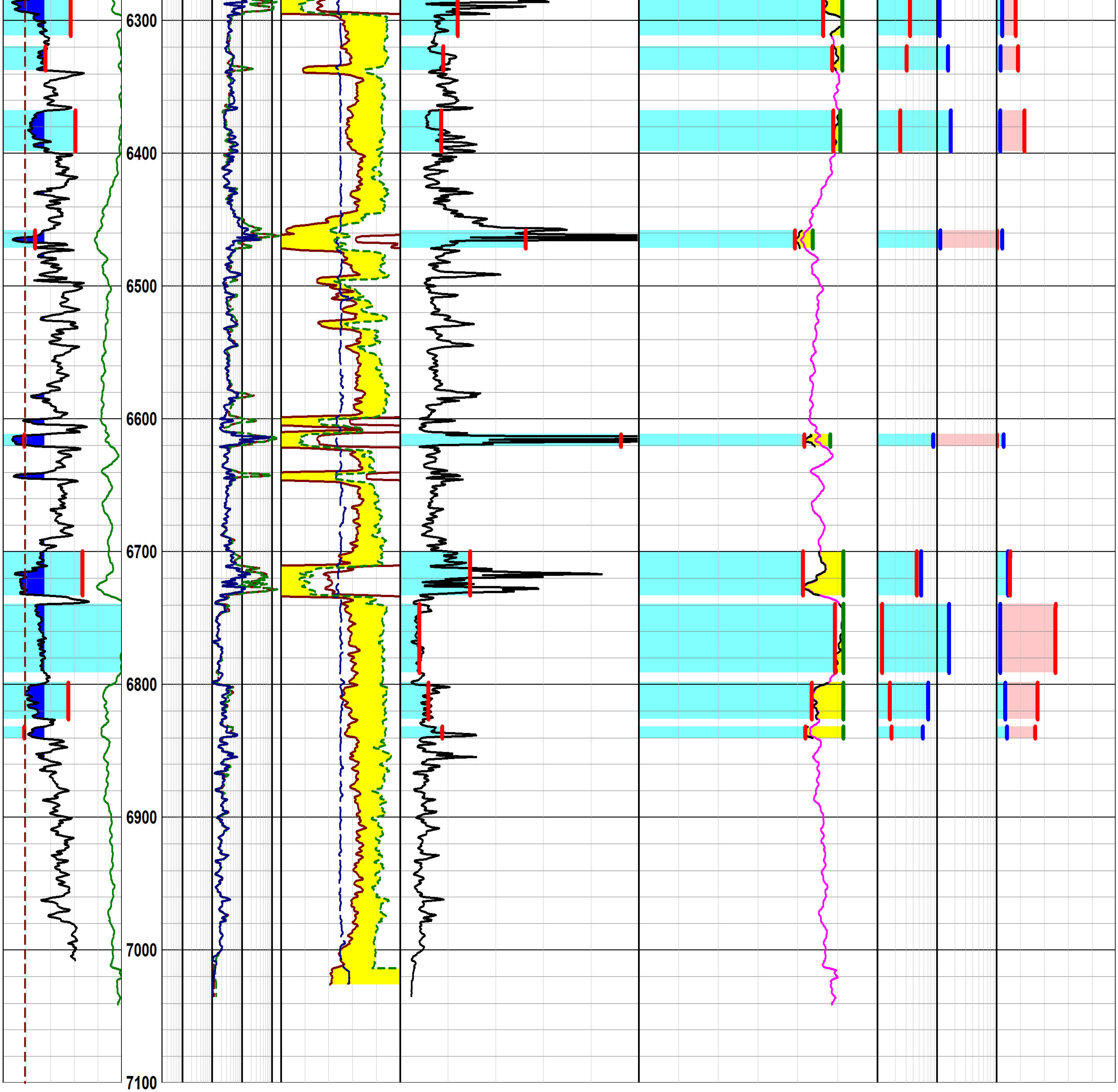
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LESA 9.8, © 1992-2015 Digital Formation, Inc.

File: **05045129840000 Last Dance #13B-2-792.lbs** Well Name: **LAST DANCE 13B-2-792**

Plot: **Salinity by Depth**

Gross Interval: **270** to **6680** by **0.5** **F**

Ranges:

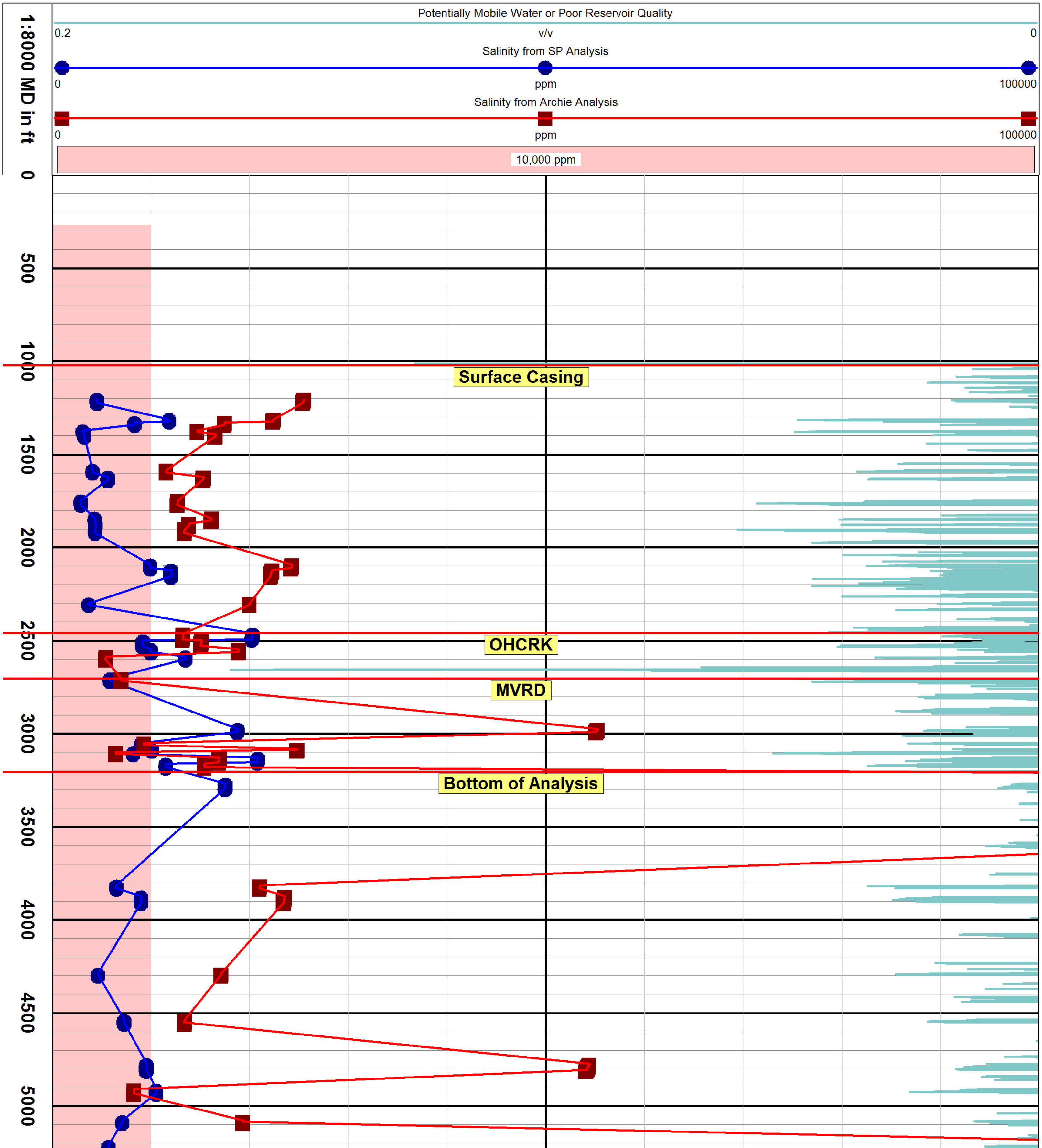
**270-6680**

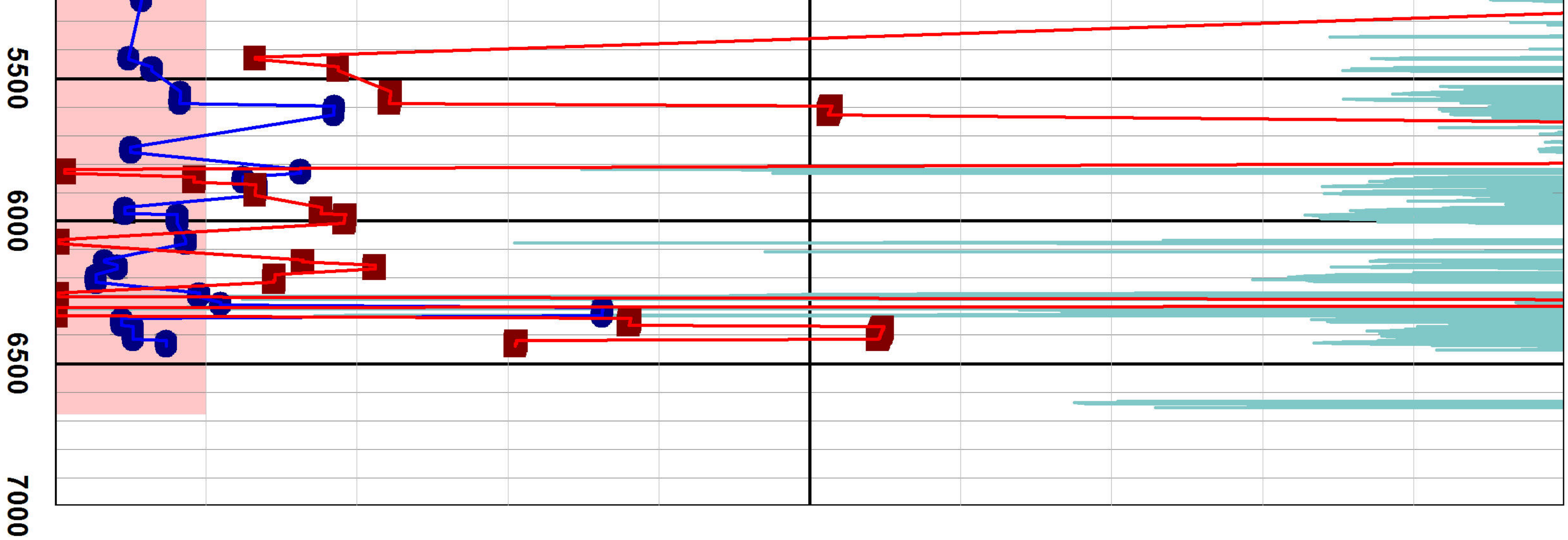
Time: **10:54 AM** Date: **Fri, Jun 12, 2015**

Section: **2** Township: **7S** API #: **05045129840000**

Location: **749 FNL & 1017 FWL** Range: **92W** UWI: **05045129840000**

Comments:





5500
6000
6500
7000

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File: 05045129840000 Last Dance #13B-2-792.lbs    Well Name: LAST DANCE 13B-2-792

Plot: SP Shift Deflection

Gross Interval: 270 to 6680 by 0.5 F

Ranges:

270-6680

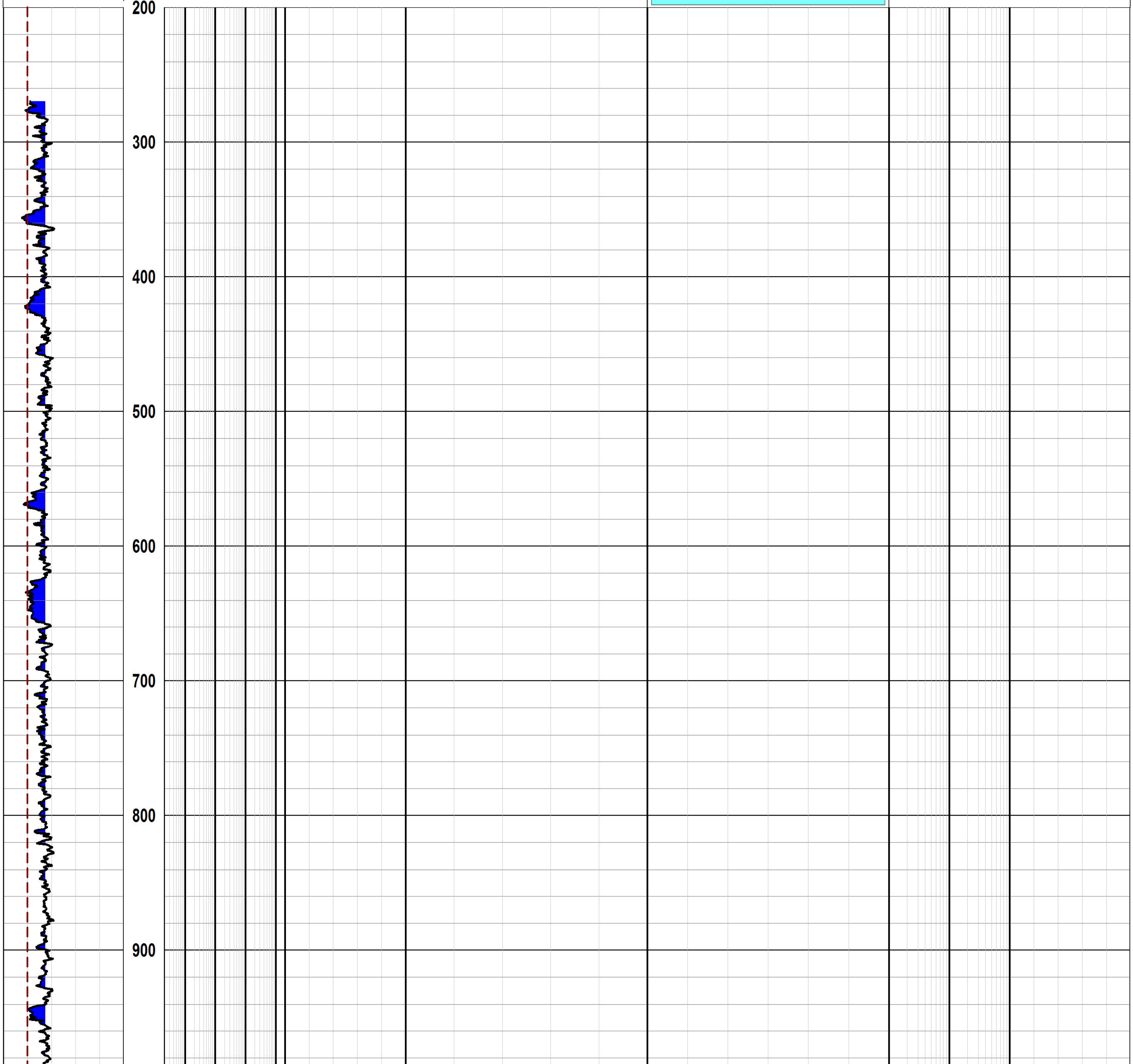
Time: 11:00 AM    Date: Fri, Jun 12, 2015

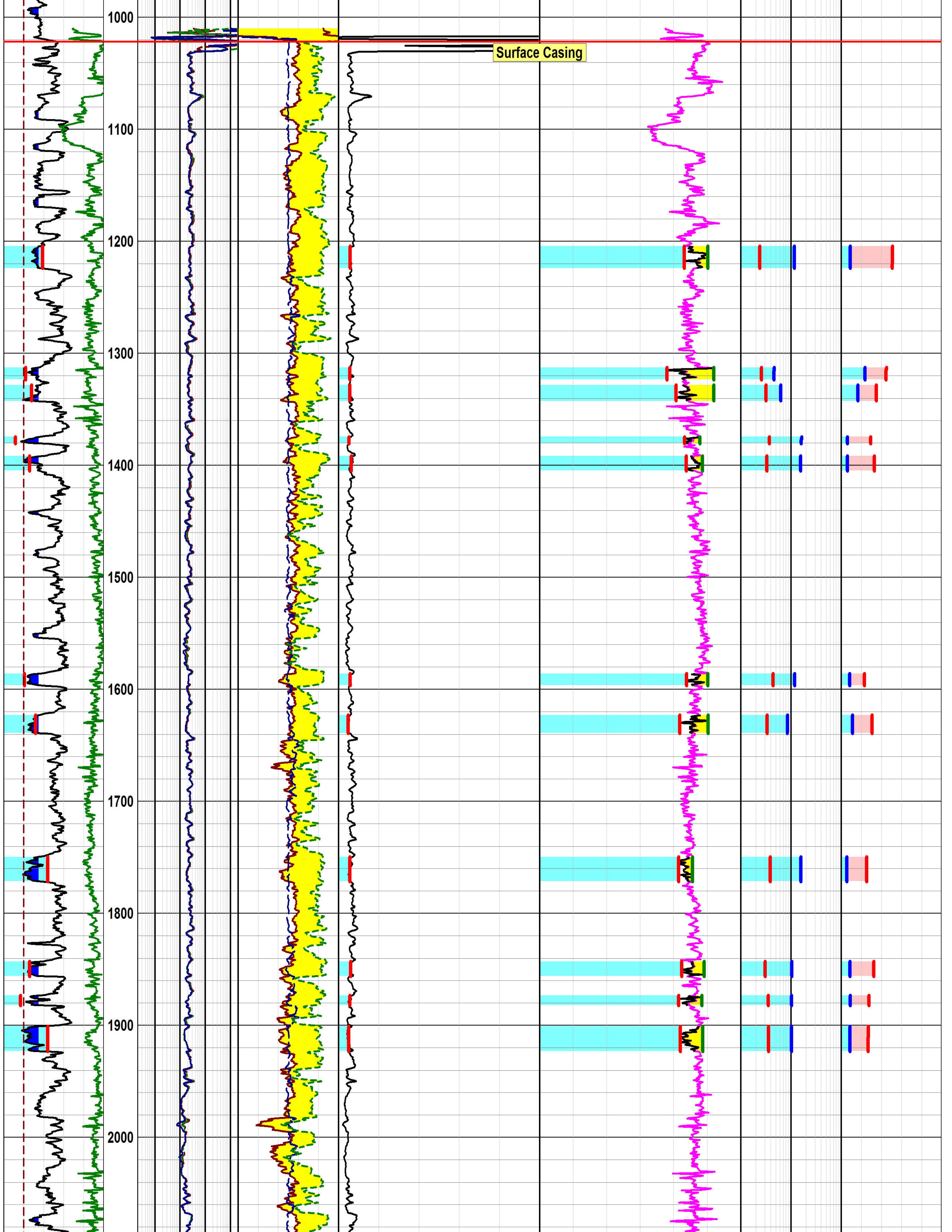
Section: 2    Township: 7S    API #: 05045129840000

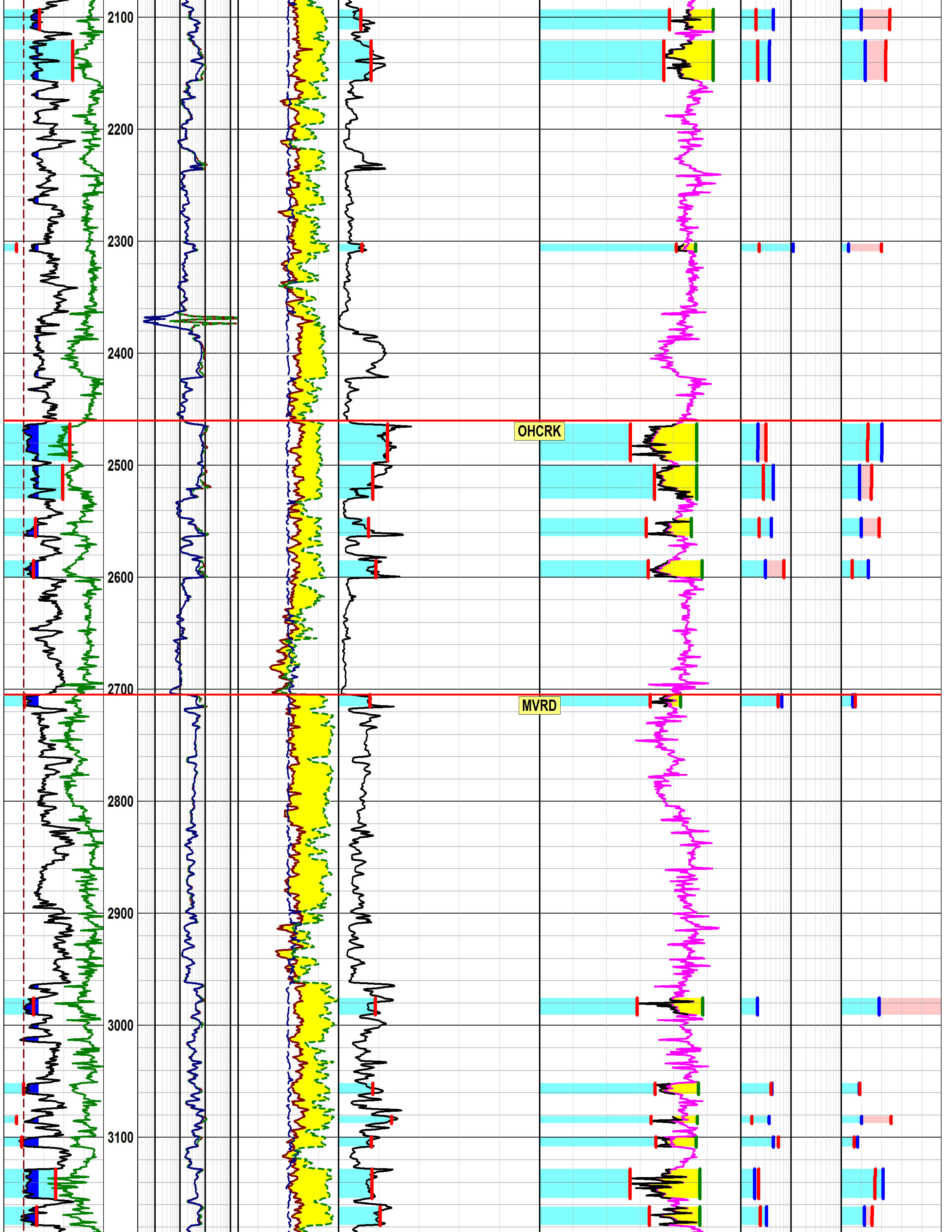
Location: 749 FNL & 1017 FWL    Range: 92W    UWI: 05045129840000

Comments:

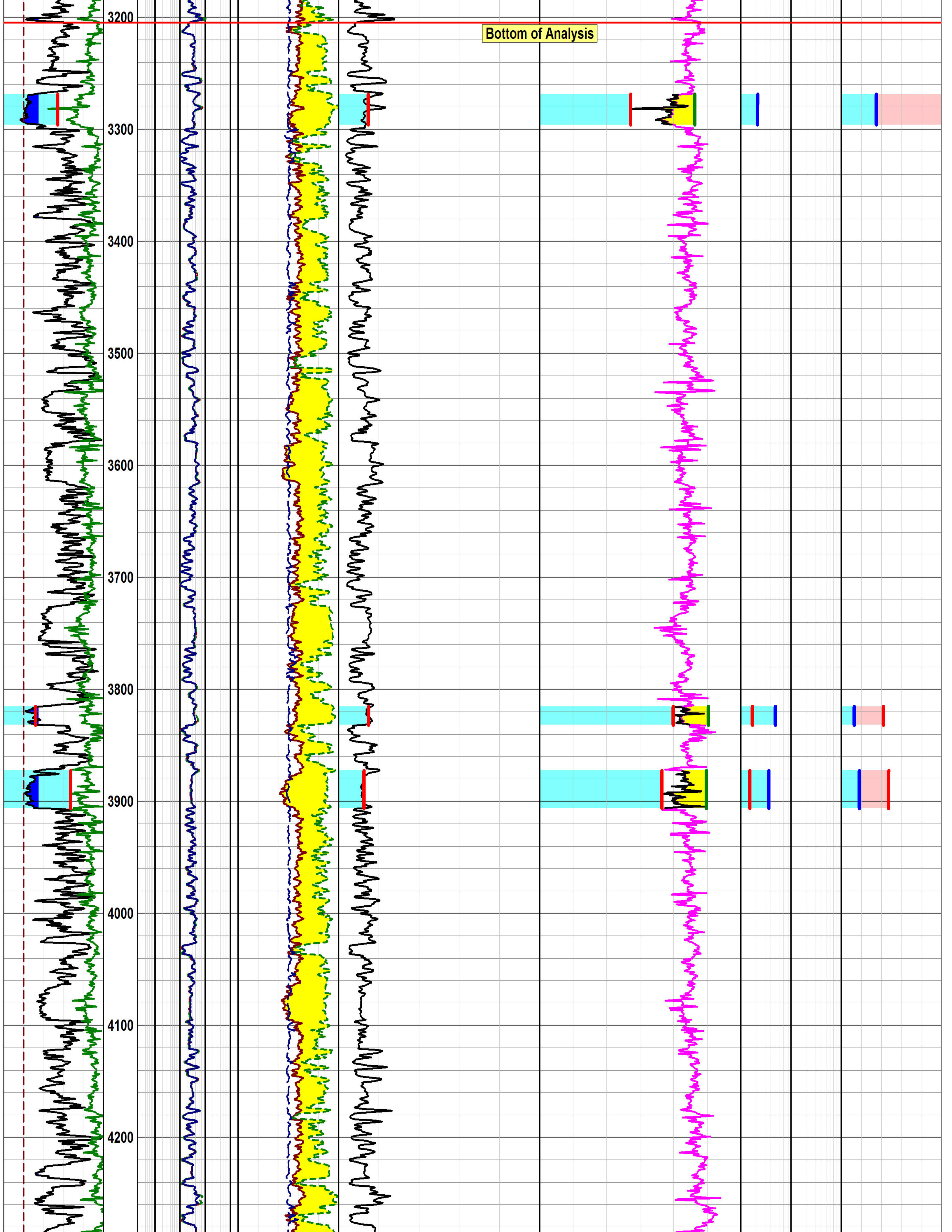
| GR | Depth | Resistivities | RhoB | Ri/Rm | SP | Rw from SP | Salinity from SP |
|---|---|---|---|---|---|---|---|
| 0 api 200 | 1:1200 MD in ft | Deep | 2 g/cc 3 | 0 V/V 200 | -125 mV 25 | 0.1 ohmm 10 | 0 ppm 50000 |
| 200 400 | | 0.2 ohmm 2000 | DRho | Average Ri/Rm | SP-5 Corrected SP | Archie Rw | Salinity from Archie |
| SP | | Medium | -0.75 g/cc 0.75 | 0 V/V 200 | -125 mV 25 | 0.1 Rw from m=1.8 10 | 0 ppm 50000 |
| -100 mV 0 | | 0.2 ohmm 2000 | Neutron | Ave Ri/Rm | SP Clean | | |
| Sand h | | Shallow | 0.6 V/V 0 | | -125 mV 25 | | |
| 0 F 50 | | 0.2 ohmm 2000 | Implied Gas Effect | | SP Shale | | |
| H | | | | | -125 mV 25 | | |
| Bit Size | | | | | Deflection | | |



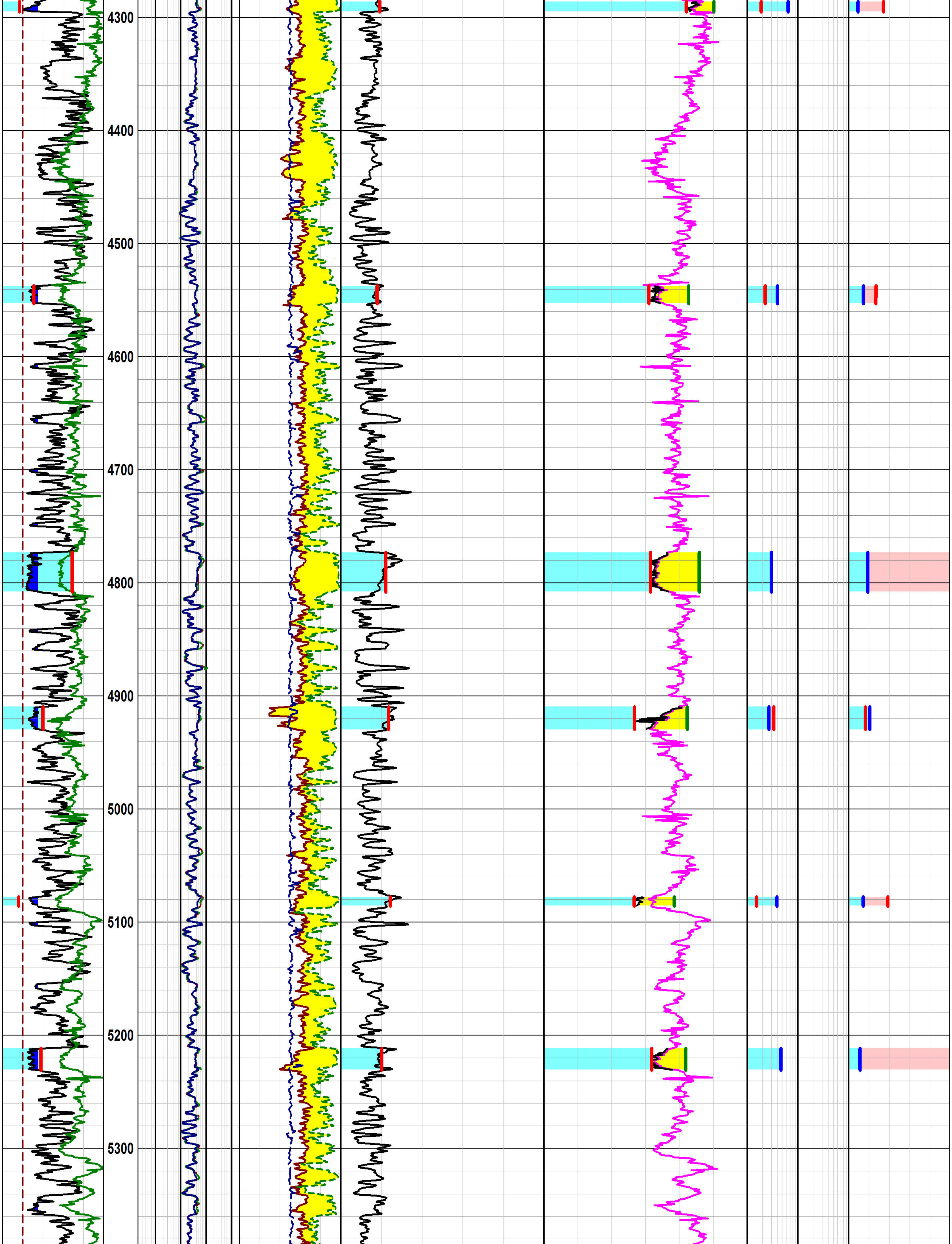

1000
Surface Casing
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000



2100
2200
2300
2400
OHCRK
2500
2600
2700
MVRD
2800
2900
3000
3100



Bottom of Analysis
3200
3300
3400
3500
3600
3700
3800
3900
4000
4100
4200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4400
4500
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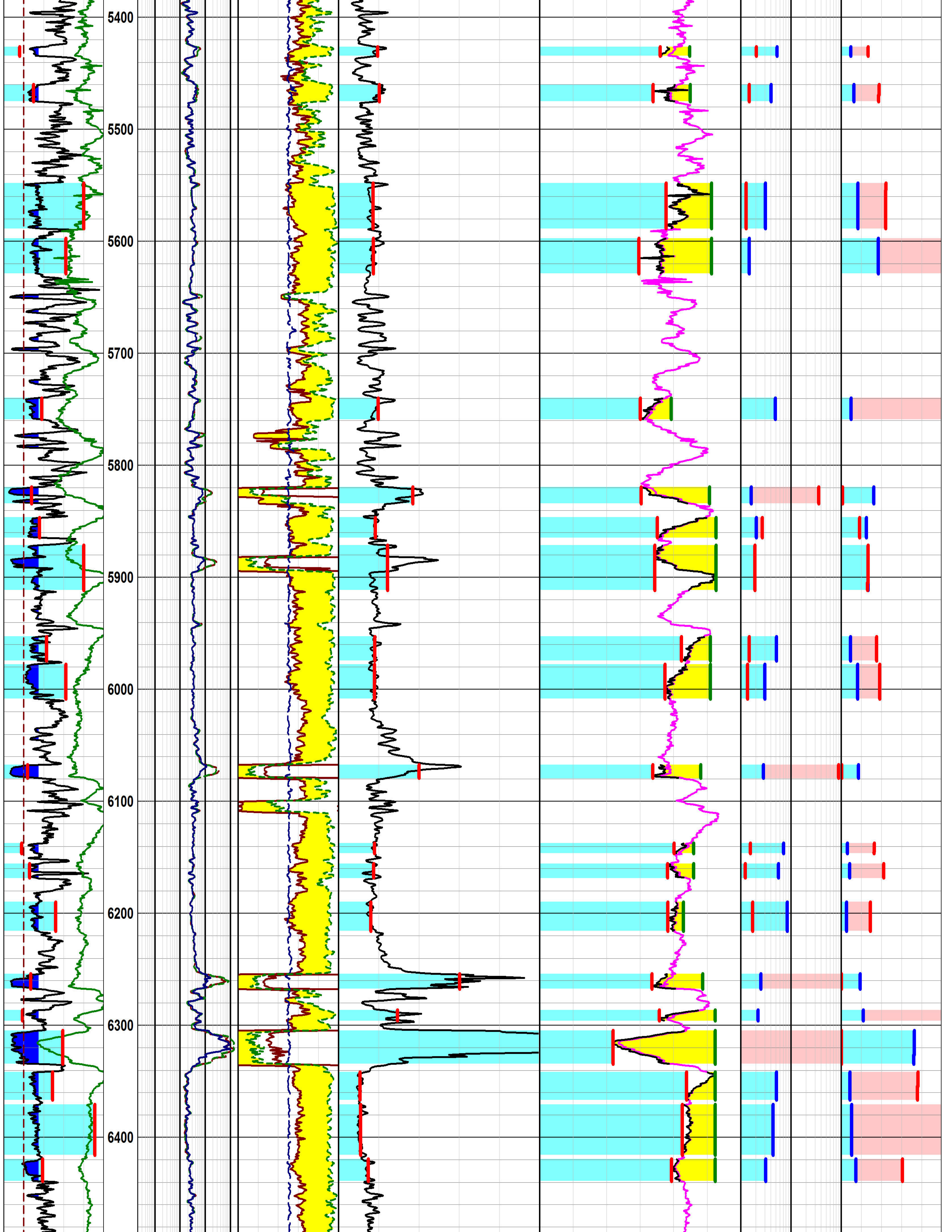
4700
4800
4900
5000
5100
5200
5300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5500
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5800
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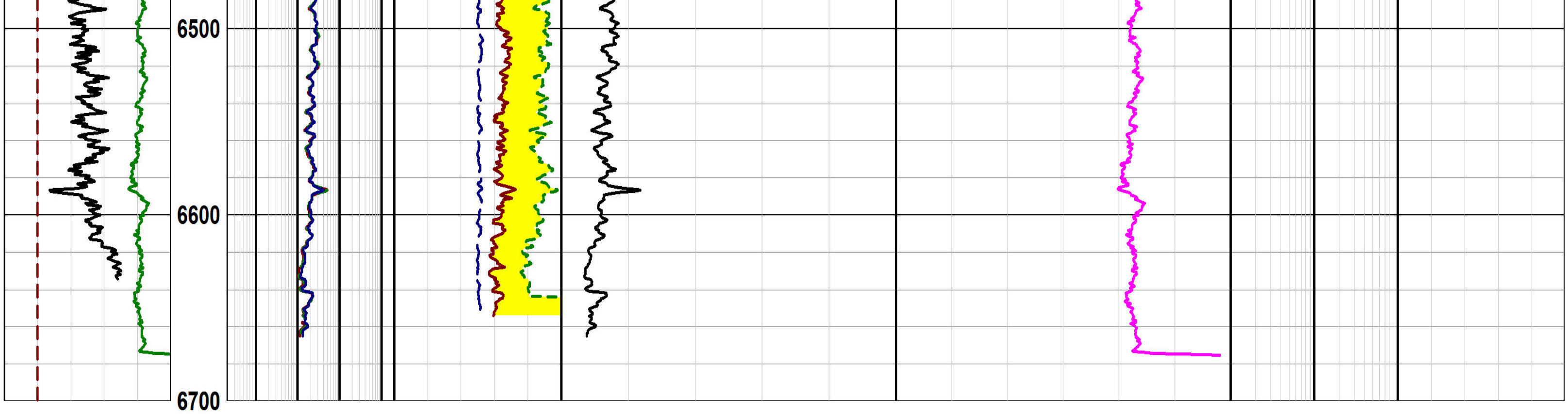
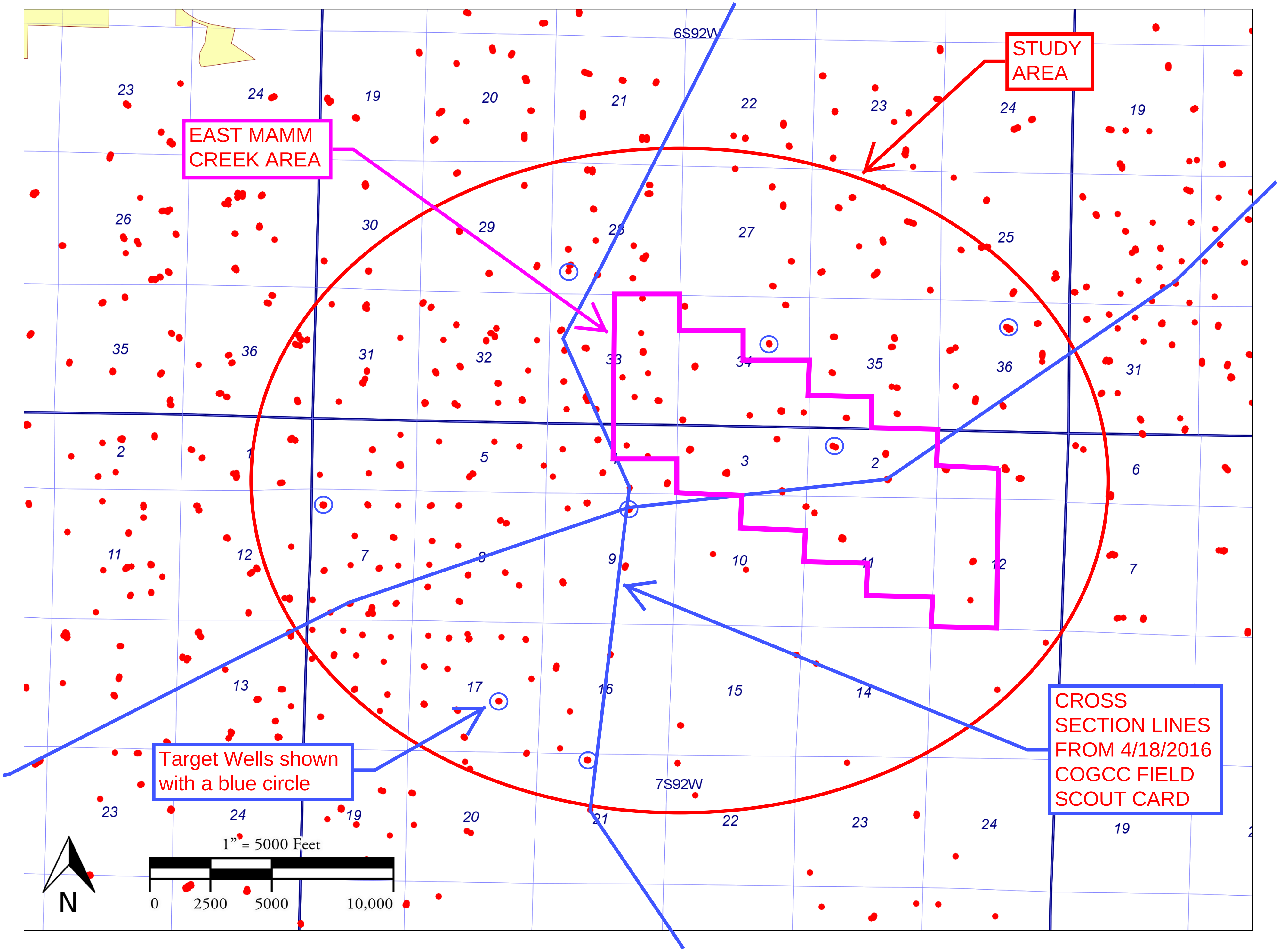
6300
6400


6500
6600
6700

# Piceance Petrophysics Project - Phase 2



**PICEANCE BASIN PETROPHYSICAL PROJECT - PHASE 2**
**LOG ESITIMATION OF WASATCH, OHIO CREEK, AND UPPER MESAVERDE FORMATION WATER TDS**
**TARGET INVESTIGATION AREA: SOUTHERN PORTION OF 6S-92W AND NORTHERN PORTION OF 7S-92W**

**LIST OF WELLS TO EVALUATE**

| Well Index | Well Name and Number | API | Legal QQ and Section | Legal Twp Rng | Surface Casing Depth | Log Tops (COGCC 2015 Project RFQ) | Log Tops (COGCC revised 5/25/2016) | Log Type | Log Date | Log Document No. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Porter Federal #13-28 | 045-07668 | SWSW 28 | 6S92W | 660 | 2850 OHCRK (COGCC pick)<br>3165 MVRD (COGCC pick)<br>3665 Bottom Depth for Analysis | **---- UWSTCG<br>---- LWSTCG<br>---- FTUN<br>2568 LWSTC<br>2850 OHCRK<br>3165 MVRD** | IND-SP-GR, TIF file<br>NEU-DEN-GR, TIF file | 7/31/2001<br>7/31/2001 | 1328861<br>1328860 |
| 3 | Stone #42D-34-692 | 045-10815 | SWNE 34 | 6S92W | 728 | 2680 OHCRK (COGCC pick)<br>2911 MVRD (Opr pick)<br>3411 Bottom Depth for Analysis | **---- UWSTCG<br>---- LWSTCG<br>---- FTUN<br>2337 LWSTC<br>2680 OHCRK<br>2911 MVRD** | IND-NEU-DEN-SP-GR TIF file and LAS file | 09/10/2005 | 460923<br>700002550 |
| 5 | Scott #2-36 | 045-07929 | NWNE 36 | 6S92W | 650 | 2887 OHCRK (COGCC pick)<br>3125 MVRD (COGCC pick)<br>3625 Bottom Depth for Analysis | **693 UWSTCG<br>852 LWSTCG<br>1338 FTUN<br>2533 LWSTC<br>2887 OHCRK<br>3125 MVRD** | IND-SP-GR, TIF file<br>NEU-DEN-GR, TIF file | 11/21/2001<br>11/21/2001 | 1104974<br>1104975 |
| 2 | Last Dance #13B-2-792 | 045-12984 | NWSW 2 | 7S92W | 1022 | 2460 OHCRK (COGCC pick)<br>2705 MVRD (COGCC pick)<br>3205 Bottom Depth for Analysis | **---- UWSTCG<br>---- LWSTCG<br>---- FTUN<br>2090 LWSTC<br>2364 OHCRK<br>2705 MVRD** | IND-SP-GR, TIF file<br>NEU-DEN-GR, TIF file | 11/28/2006<br>11/28/2006 | 1420484<br>1420483 |
| 6 | KRK LTD #7-3 | 045-06999 | NENW 7 | 7S92W | 525 | 2980 OHCRK (COGCC pick)<br>3409 MVRD (Opr pick)<br>3909 Bottom Depth for Analysis | **990 UWSTCG<br>1200 LWSTCG<br>1520 FTUN<br>2780 LWSTC<br>3180 OHCRK<br>3409 MVRD** | IND-SP-GR, TIF file<br>NEU-DEN-GR, TIF file | 08/02/1995<br>08/02/1995 | 1042138<br>1042139 |
| 4 | Dunn #9-2 | 045-06907 | NWNE 9 | 7S92W | 554 | 2347 OHCRK (COGCC pick)<br>2525 MVRD (COGCC pick)<br>3025 Bottom Depth for Analysis | **---- UWSTCG<br>---- LWSTCG<br>---- FTUN<br>1910 LWSTC<br>2330 OHCRK<br>2525 MVRD** | IND-SP-GR, TIF file<br>NEU-DEN-GR, TIF file | 10/26/1994<br>10/26/1994 | 1043787<br>1043786 |
| 7 | Sample #T 65-17 P | 045-06744 | NWSE 17 | 7S92W | 1000 | 2235 OHCRK (COGCC pick)<br>2611 MVRD (Opr pick)<br>3111 Bottom Depth for Analysis | **---- UWSTCG<br>---- LWSTCG<br>---- FTUN<br>2024 LWSTC<br>2390 OHCRK<br>2611 MVRD** | IND-SP-GR, TIF file<br>NEU-DEN-GR, TIF file | 02/07/1991<br>03/05/1991 | 1049328<br>1049327 |
| 8 | Buerger Disposal #1<br>f.k.a. Buerger 21-3A (C21) | 045-08973 | NENW 21 | 7S92W | 722 | 2060 OHCRK (COGCC pick)<br>2302 MVRD (COGCC pick)<br>5400 Bottom Depth for Analysis | **---- UWSTCG<br>---- LWSTCG<br>---- FTUN<br>1710 LWSTC<br>2060 OHCRK<br>2302 MVRD** | IND-SP-GR, TIF file<br>NEU-DEN-GR, TIF file | 12/31/2002<br>12/31/2002 | 1274246<br>1274245 |

**WATER SAMPLE DATA FOR COMPARISON WITH LOGGING ANALYSIS RESULTS**

| Well Index | Well Name and Number* | API | Sample Type | Sample Top | Sample Bottom | Zone | TDS (mg/l) | Source |
|---|---|---|---|---|---|---|---|---|
| 8 | Buerger Disposal #1 | 045-08973 | Disposal Test | 2,324 | 3,096 | Ohio Creek** | 3,300 | WH - 10/28/2010 |
| 8 | Buerger Disposal #2 | 045-09003 | Disposal Test | 4,832 | 5,324 | Williams Fork | 16,422 | FLOW - 6/7/2003 |

* Buerger Disposal #1 and Buerger Disposal #2 are on the same pad.
** Designated the Ohio Creek Formation by the operator, but in 2015 COGCC staff contends that this interval is entirely Upper Mesaverde.

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File: 05045067440000 Sample #T 65-17 P.lbs | Well Name: SAMPLE #T 65-17 P

Plot: Salinity by Depth

Gross Interval: 1000 to 3111 by 0.5 F

Ranges:

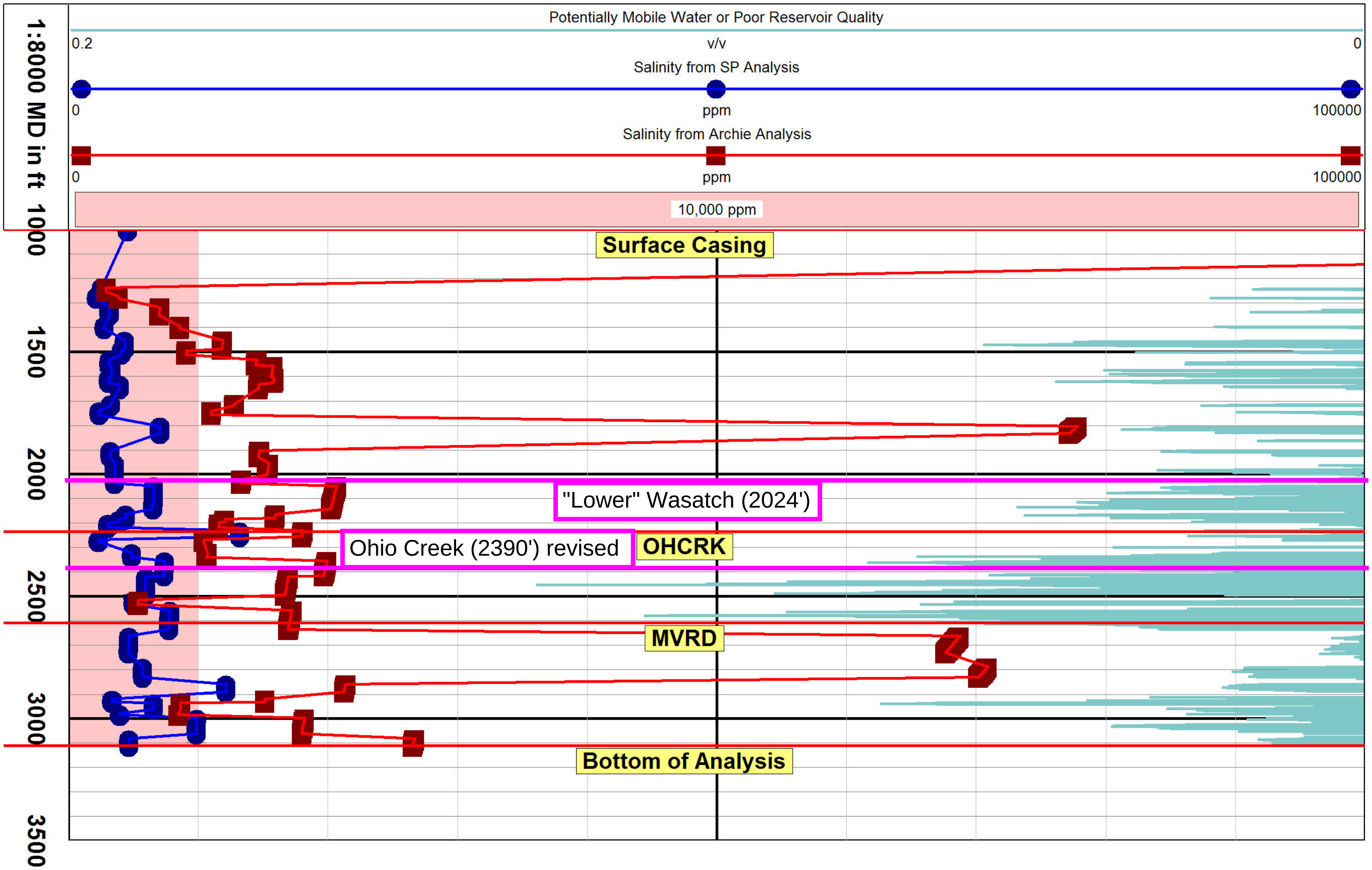
1000-3111

Time: 10:52 AM | Date: Fri, Jun 12, 2015

Section: SECTION | Township: TOWNSHIP | API #: 05045067440000

Location: LOCATION | Range: RANGE | UWI: 05045067440000

Comments:




"Lower" Wasatch top added and Ohio Creek top revised by COGCC on 5/25/2016, after completing formation top correlations on COGCC Field Scout Card, dated 4/18/2016
Fort Union top above surface casing shoe
Wasatch G top(s) near surface or outcropped

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File: 05045069070000 Dunn #9-2.lbs | Well Name: DUNN 9-2

Plot: Salinity by Depth

Gross Interval: 554 to 3025 by 0.5 F

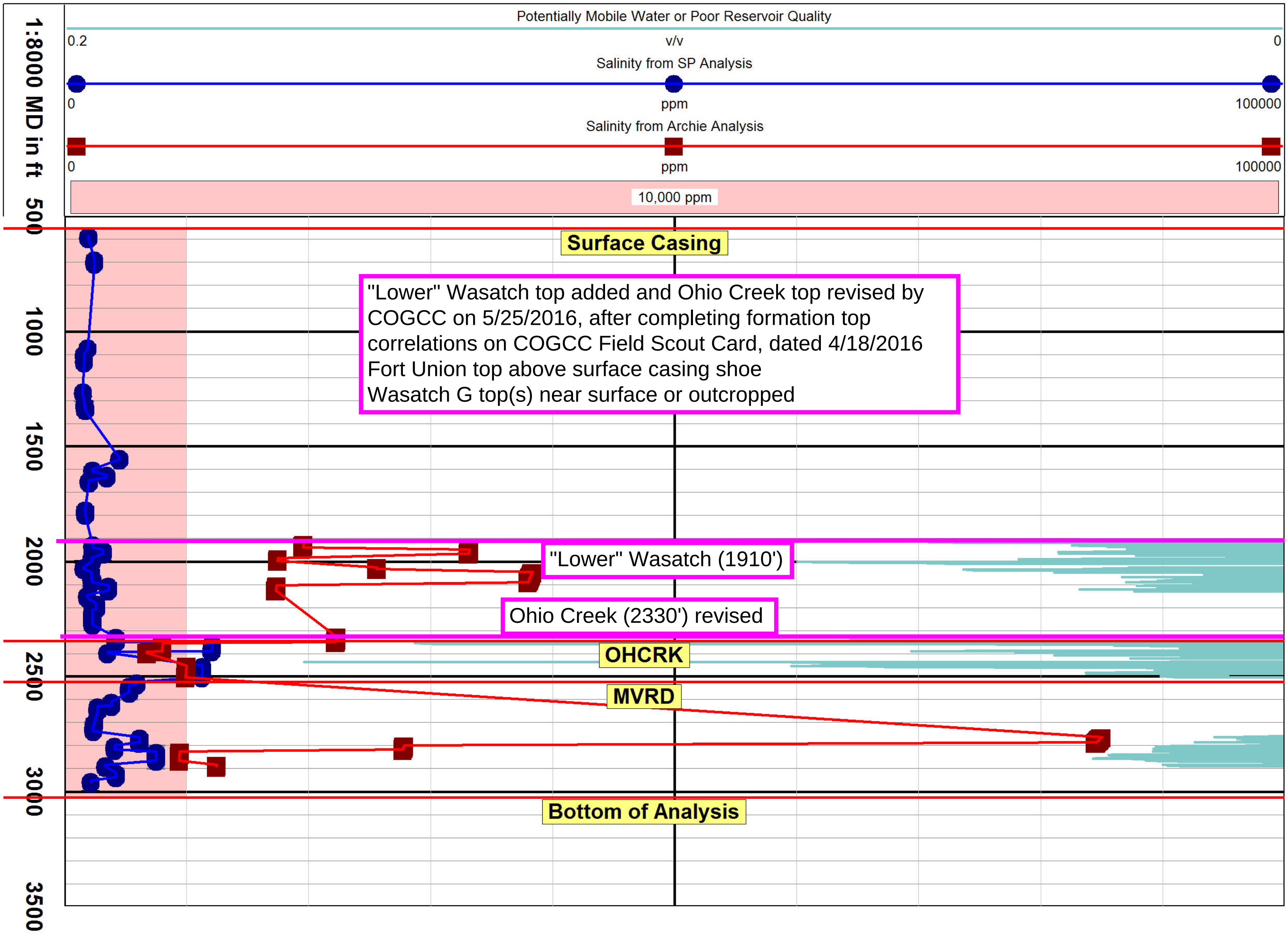
Ranges:
554-3025

Time: 10:53 AM | Date: Fri, Jun 12, 2015

Section: SECTION | Township: TOWNSHIP | API #: 05045069070000

Location: LOCATION | Range: RANGE | UWI: 05045069070000

Comments:



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File: **05045069990000 KRK LTD #7-3.lbs** Well Name: **KRK LTD 7-3**

Plot: **Salinity by Depth**

Gross Interval: **525** to **3909** by **0.5** **F**

Ranges:

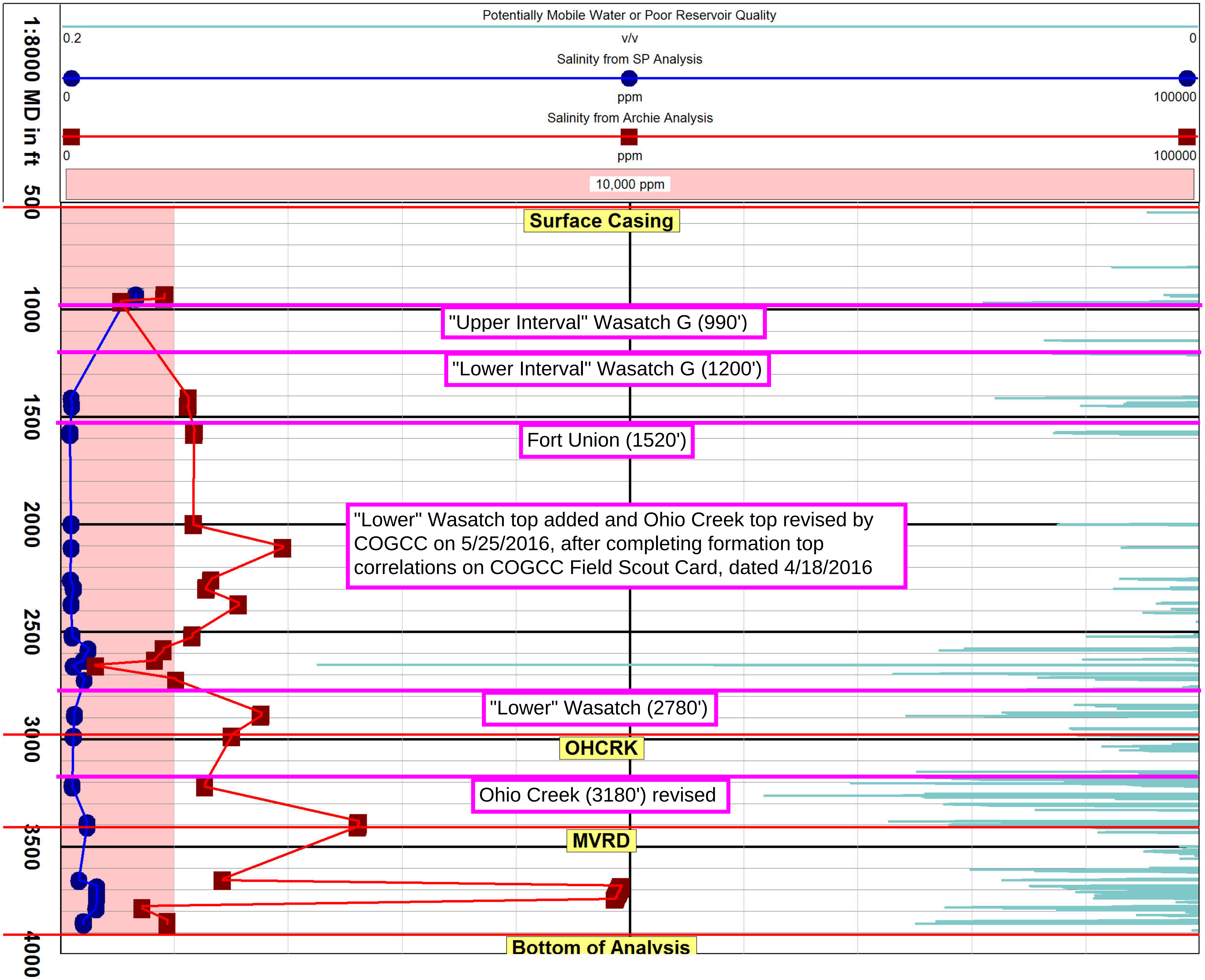
**525-3909**

Time: **10:53 AM** Date: **Fri, Jun 12, 2015**

Section: **SECTION** Township: **TOWNSHIP** API #: **05045069990000**

Location: **LOCATION** Range: **RANGE** UWI: **05045069990000**

Comments:



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File: 05045076680000 Porter Federal #13-28.lbs

Well Name: PORTER FEDERAL #13-28

Plot: Salinity by Depth

Gross Interval: 660 to 3665 by 0.5 F

Ranges:

660-3665

Time: 10:53 AM

Date: Fri, Jun 12, 2015

Section: SECTION

Township: TOWNSHIP

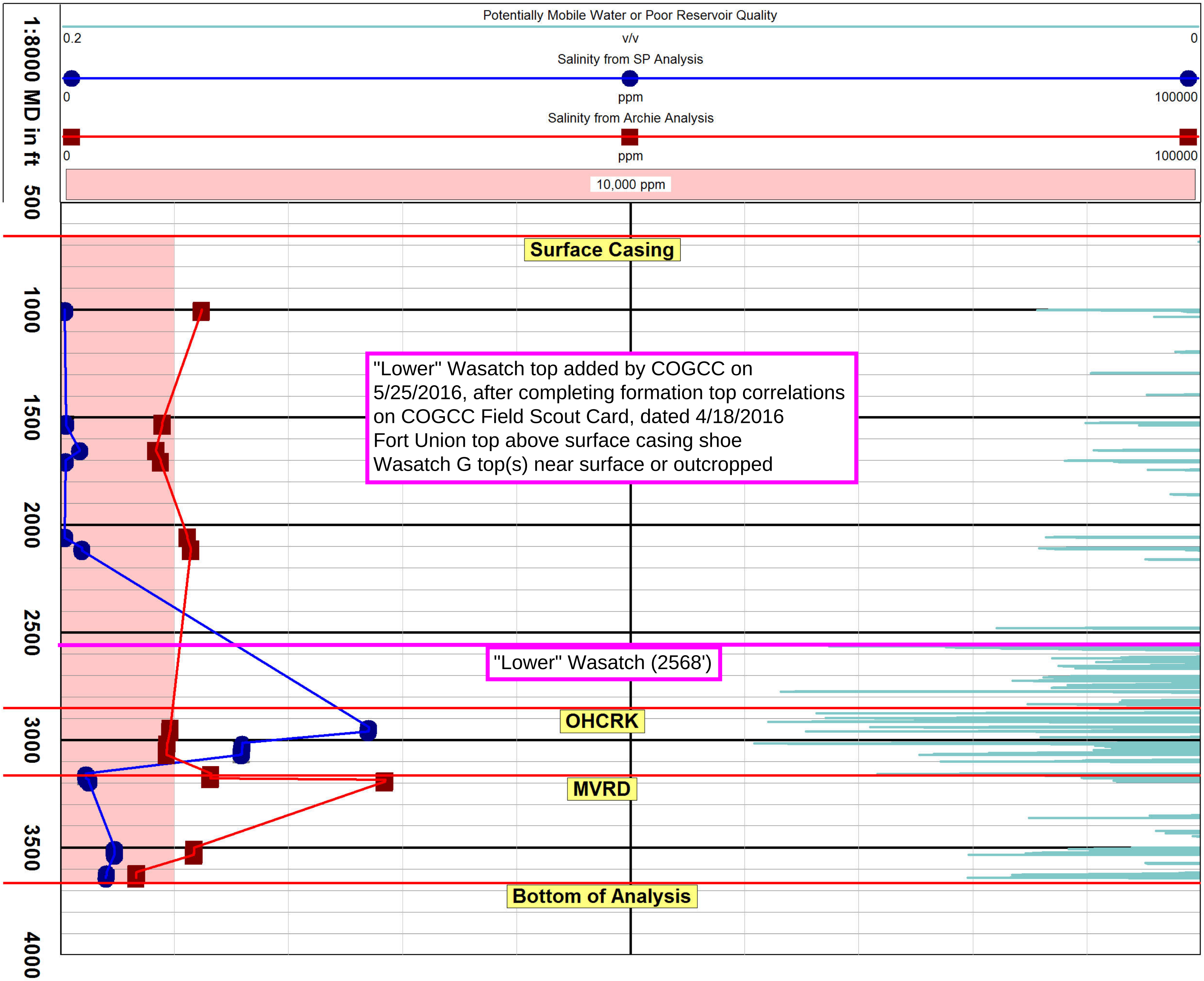
API #: 05045076680000

Location: LOCATION

Range: RANGE

UWI: 05045076680000

Comments:



LESA 9.8, © 1992-2015 Digital Formation, Inc.

File: 05045079290000 Scott #2-36.lbs

Well Name: SCOTT #2-36

Plot: Salinity by Depth

Gross Interval: 650 to 3625 by 0.5 F

Ranges:

650-3625

Time: 10:53 AM

Date: Fri, Jun 12, 2015

Section: SECTION

Township: TOWNSHIP

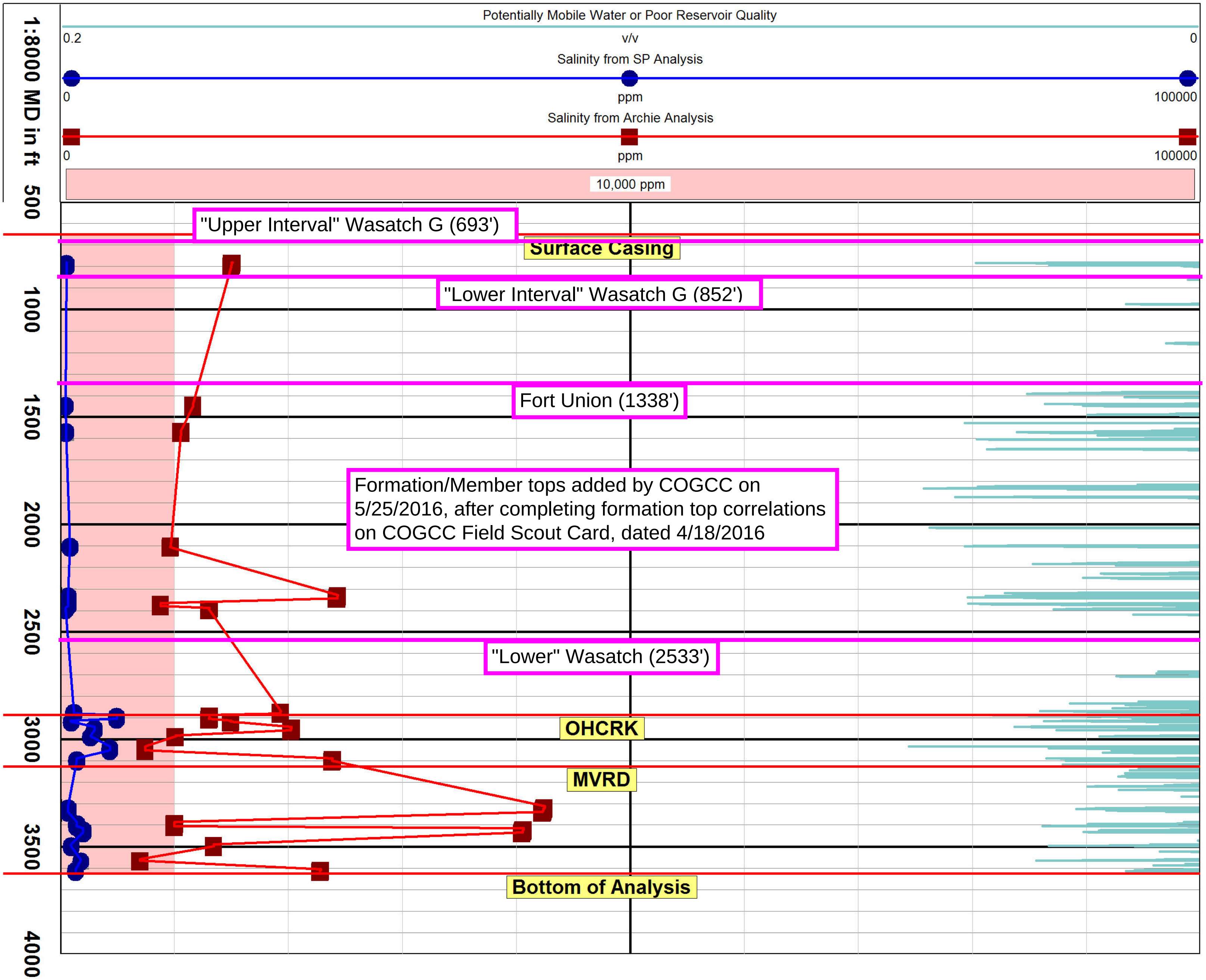
API #: 05045079290000

Location: LOCATION

Range: RANGE

UWI: 05045079290000

Comments:



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File: **05045089730000 Buerger Disposal #1.lbs** Well Name: **Buerger 21-3A**

Plot: **Salinity by Depth**

Gross Interval: **720** to **5400** by **0.5** **F**

Ranges:

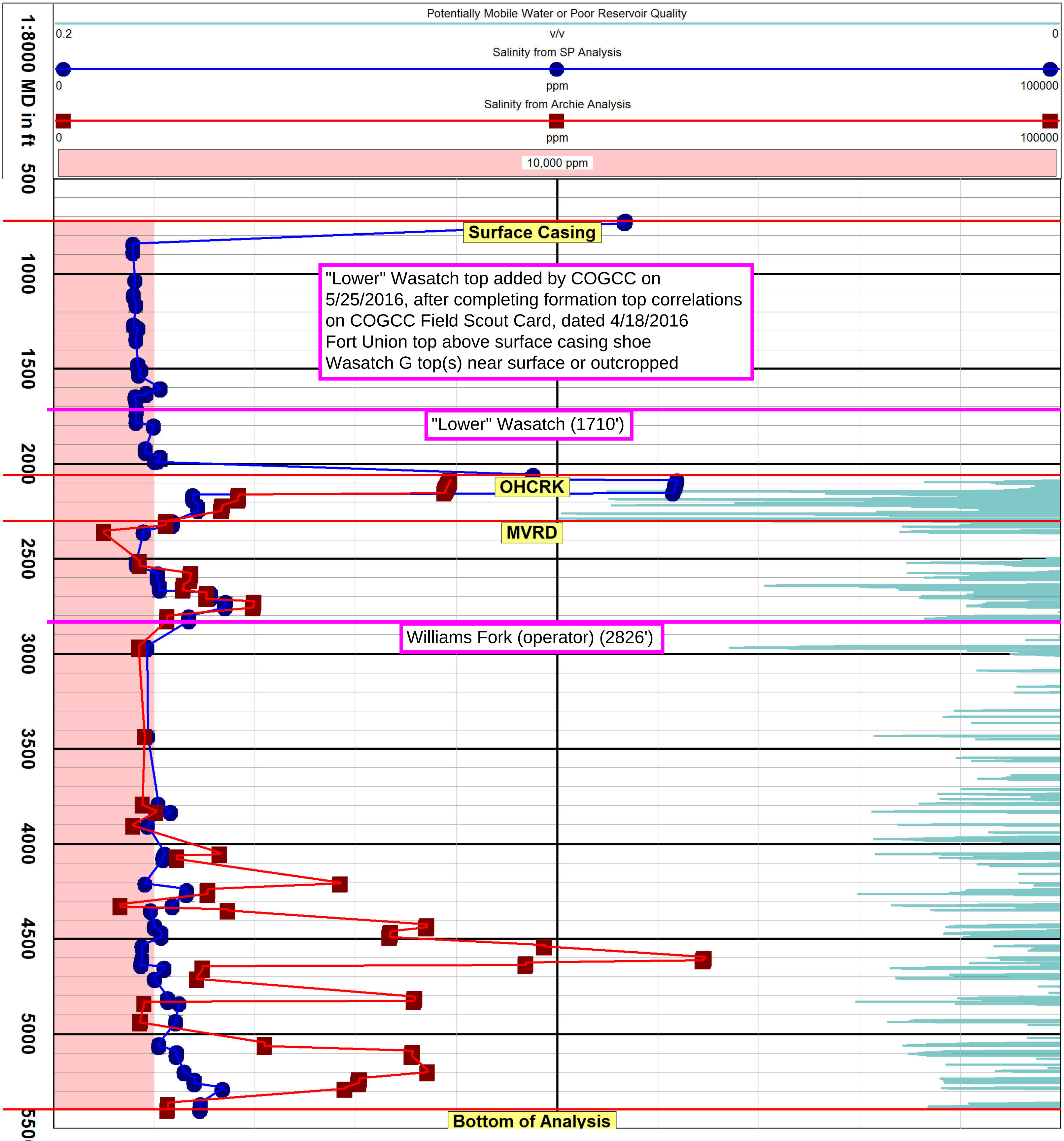
**720-5400**

Time: **10:53 AM** Date: **Fri, Jun 12, 2015**

Section: **SECTION** Township: **TOWNSHIP** API #: **05045089730000**

Location: **LOCATION** Range: **RANGE** UWI: **05045089730000**

Comments:



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File: **05045108150000 Stone #42D-34-692.lbs** Well Name: **STONE 42D-34-692**

Plot: **Salinity by Depth**

Gross Interval: **0.5** to **7044** by **0.5** **ft**

Ranges:

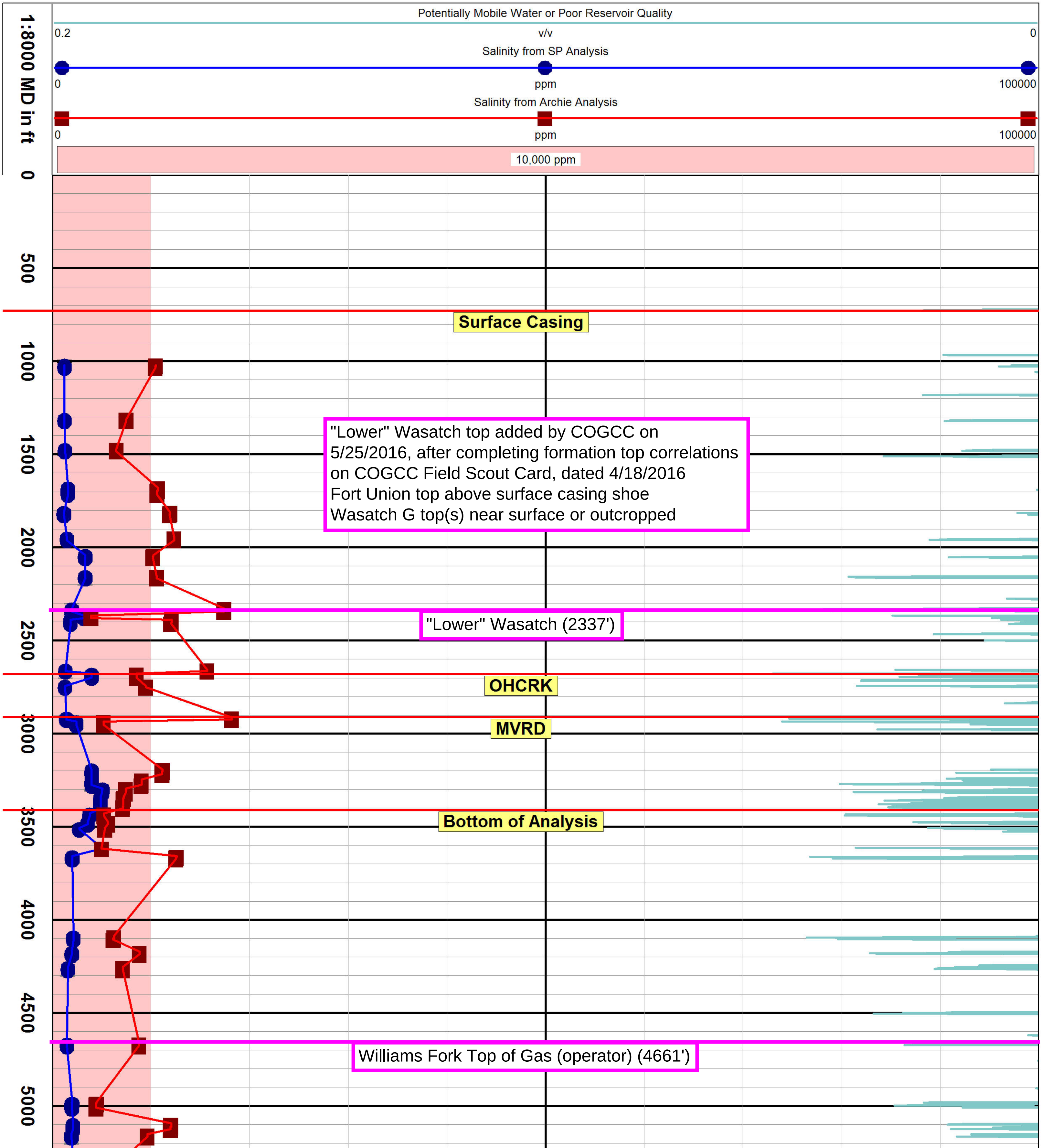
**0.5-7044**

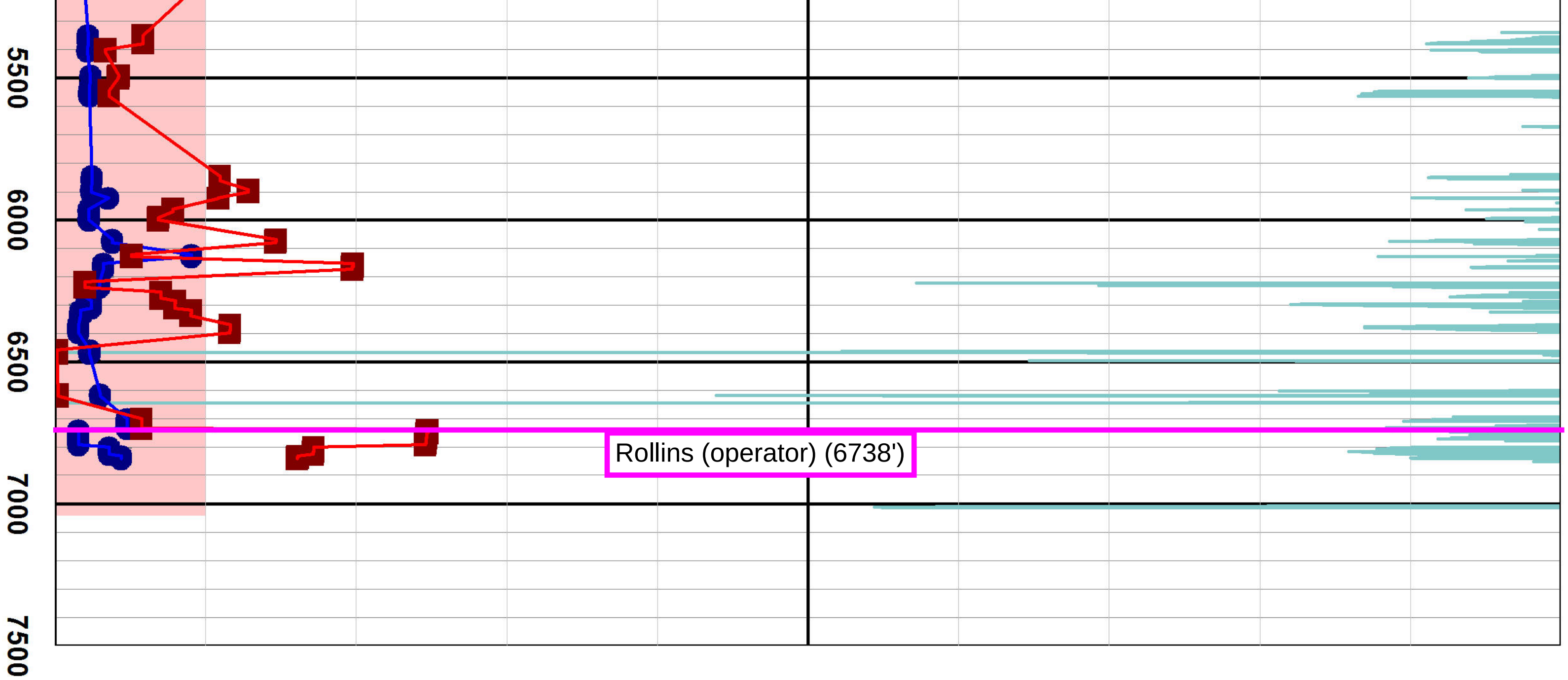
Time: **10:53 AM** Date: **Fri, Jun 12, 2015**

Section: Township: API #: **05045108150000**

Location: **SHL** Range: UWI: **05045108150000**

Comments:




5500
6000
6500
7000
7500
Rollins (operator) (6738')

LESA 9.8, © 1992-2015 Digital Formation, Inc.

File: 05045129840000 Last Dance #13B-2-792.lbs

Well Name: LAST DANCE 13B-2-792

Plot: Salinity by Depth

Gross Interval: 270 to 6680 by 0.5 F

Ranges:

270-6680

Time: 10:54 AM

Date: Fri, Jun 12, 2015

Section: 2

Township: 7S

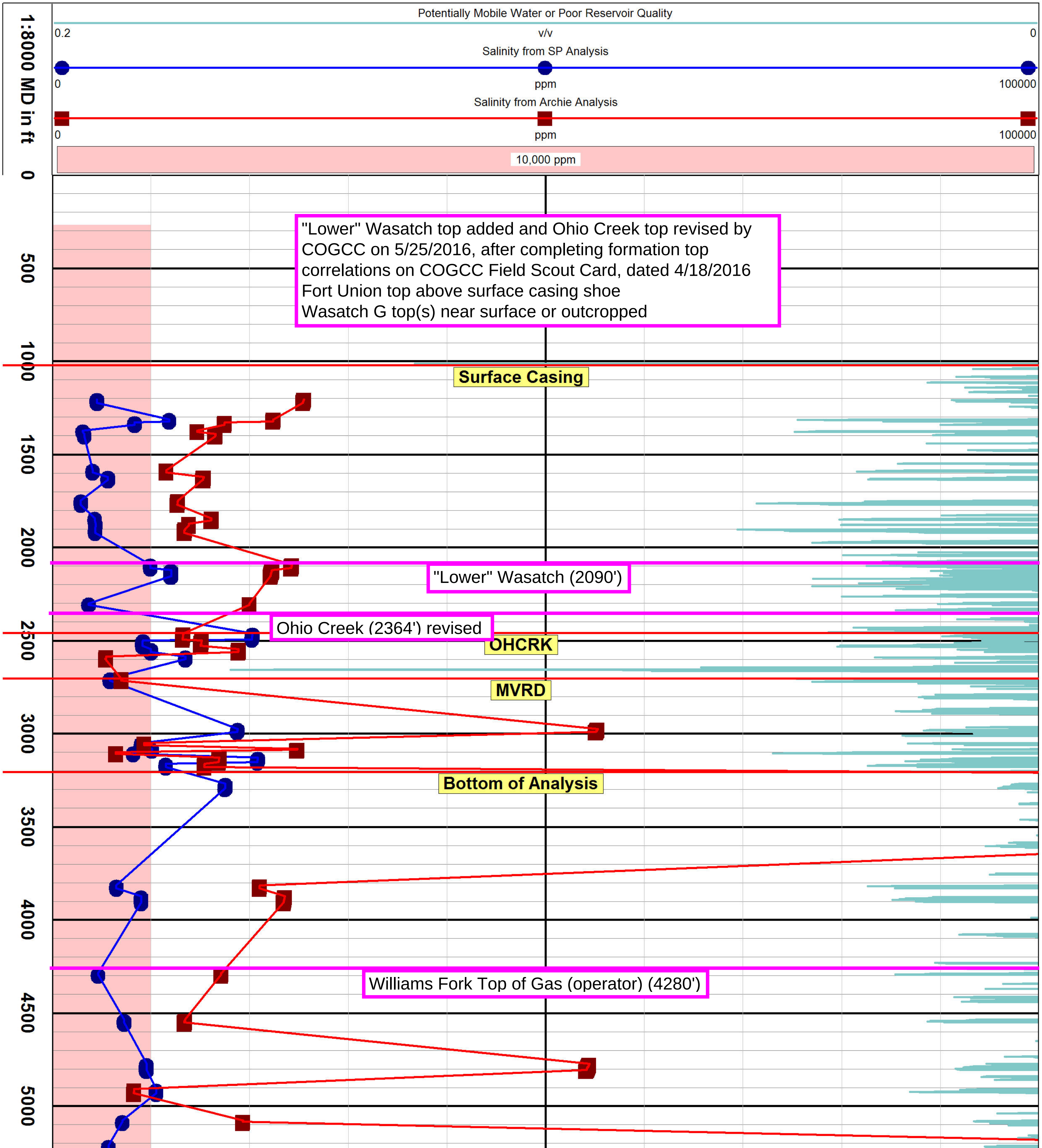
API #: 05045129840000

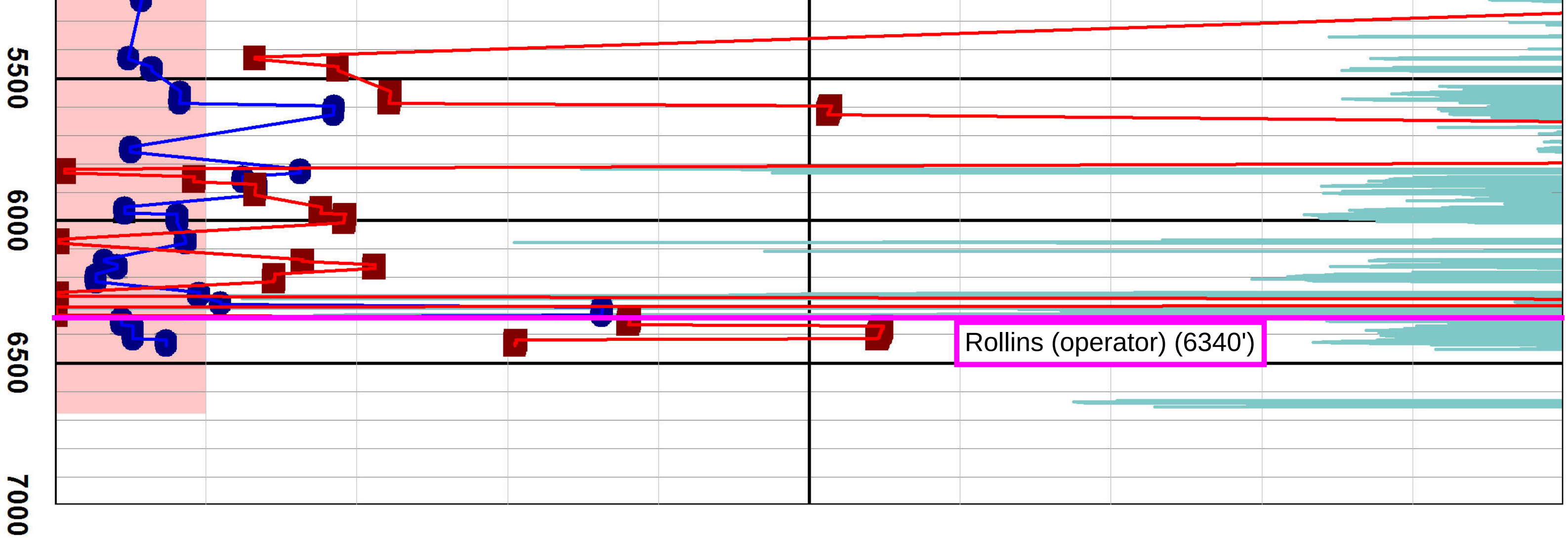
Location: 749 FNL & 1017 FWL

Range: 92W

UWI: 05045129840000

Comments:




5500
6000
6500
7000
Rollins (operator) (6340')