CARGILL, INC.
CONFIDENTIALITY JUSTIFICATION

Cargill, Inc. hereby requests under 6 NYCRR Part 616 and the Public Officer's Law that the Department except from disclosure the following information provided in the Cargill, Inc. response to the Department of Environmental Conservation December 15, 2015 Notice of Incomplete Application, Cargill Salt Mine DEC #-9999-00075, New Ventilation and Access Shaft #4:

a. Cargill Deicing Technology Lansing Mine Corehole #18 Stratigraphic Test Hole Installation and Data Collection Report.

The information constitutes confidential commercial information of Cargill, Inc. and/or records maintained for the regulation of commercial enterprise which if disclosed would cause substantial injury to the competitive position of Cargill, Inc. As a result, this information is subject to protection against disclosure as provided in paragraph (d) of subdivision (2) of Section 87 of the Public Officer's Law.

The information that is subject to this claim of exemption from disclosure is not known outside of Cargill, Inc. and is known by the employees and others involved in the business of Cargill, Inc. only to the extent required to accomplish the functions assigned to such employees and others by Cargill, Inc. The deicing salt business is a highly competitive market where product quality is critical and competitive pricing is determined by production efficiencies measured in pennies per ton of product. Knowledge by a competitor of Cargill, Inc.'s mineral volumes and stratigraphy that relates directly to cost of production holds potential for significant quality, production and economic advantage to the competitor and disadvantage to Cargill which has devoted a substantial investment to developing its mineral reserves and market position. Because Cargill, Inc. holds this information as proprietary and highly confidential, the information could not be properly acquired or duplicated by others, absent disclosure by the Department.

Based on these factors, the information identified above is entitled to protection against disclosure under the Public Officer's Law.

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CARGILL DEICING TECHNOLOGY LANSING MINE
COREHOLE #18 STRATIGRAPHIC TEST HOLE
INSTALLATION AND DATA COLLECTION

Topical Report RSI-2381

prepared for

Cargill Deicing Technology
Cayuga Mine
P.O. Box 191
Portland Point Road
Lansing, New York 14882

November 2013

RESPEC
CONSULTING & SERVICES

CARGILL DEICING TECHNOLOGY LANSING MINE
COREHOLE #18 STRATIGRAPHIC TEST HOLE
INSTALLATION AND DATA COLLECTION

Topical Report RSI-2381

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November 2013

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1.0 INTRODUCTION

Cargill Deicing Technology plans to sink an additional mine shaft (#4 Shaft) at their Cayuga Mine in Lansing, New York. As part of the design process, Cargill has completed a stratigraphic test hole (Corehole #18) in the area of the proposed mine shaft to confirm stratigraphy and gain a better understanding of potential water and gas zones that may be encountered during shaft sinking.

RESPEC assisted Cargill with the completion of Corehole #18, which was drilled to a depth of 2,486 feet below ground surface (ft bgs) by using a combination of air-rotary, percussion (hammer), and wet-rotary methods. The following tasks associated with the test hole field program were completed:

- Test Hole Drilling and Testing Observation
- Core Logging
- Observation of Geophysical Logging
- Aquifer Pumping Test
- Water Sampling and Analyses.

Each of these tasks is described further in Chapter 2.0.

Additionally, RESPEC completed the following tasks associated with the analysis of the test hole data collected during the field program:

- Stratigraphy and Structure
- Water-Bearing Zone Definition and Sustained Shaft Excavation Inflow Estimate
- Geomechanical Laboratory Testing of Core Samples
- Interpretation of Formation Water Geochemical Data
- Summary on Findings.

Each of these tasks is described further in Chapter 3.0.

2.0 FIELD PROGRAM AND DATA COLLECTION

The field activities that were conducted by RESPEC as part of installing Corehole #18 are discussed in this chapter.

2.1 TEST HOLE DRILLING AND TESTING OBSERVATION

A RESPEC field geologist observed the advancement of Corehole #18 through the upper stratigraphic section in the Helderberg Group carbonates from ground surface to 1,555 feet. The drilling was conducted by Frey Well Drilling, Inc. (Frey) of Alden, New York, and drilling began by installing a 10.75-inch conductor/overburden casing to 28.5 feet using air-rotary drilling methods. After installing the conductor casing, a nominal 8.75-inch borehole was advanced into the Hamilton Group shales to a depth of 590 ft bgs using air-rotary methods, a 7-inch surface casing was then installed and cemented from 590 feet to surface. New York State Department of Environmental Conservation (NYSDEC) personnel were also present for installing and grouting the surface casing. After allowing the surface casing cement to set, the borehole was advanced into the Helderberg Group carbonates to a depth of approximately 1,555 ft bgs by using percussion drilling methods (air-hammer). With the exception of the conductor casing, all drilling activities were conducted through a hydraulically activated blowout preventer (BOP).

RESPEC collected and photograph-documented rock chip samples from top of rock (26.8 ft bgs) to 1,555 ft bgs. Samples were collected at 20-foot intervals from the top of rock to the Devonian carbonates (top of Cherry Valley Limestone at approximately 1,400 ft bgs) and then the sample collection frequency increased to every 10 feet. Appendix A provides a photographic log of the chip samples collected.

A water-and-gas-producing zone was encountered at approximately 1,485 ft bgs in the lower Onondaga/Oriskany interval. Based on water returns, the estimated water make from the interval during drilling was 10–15 gallons per minute (gpm). The estimated gas production rate was 13,300 cubic feet per day (cfd). No other significant water production zones were noted in the upper 1,555 feet of the borehole. Based on the estimated water production from this Onondaga/Oriskany interval, Cargill requested that a pumping test be conducted to more accurately determine fluid production from this zone before advancing the borehole further. The pumping test is discussed further in Section 2.4.

When the pumping test was complete, Frey installed 1,535 feet of 4.5-inch inner diameter (ID) temporary steel casing. The casing was suspended in the borehole by using a mechanical packer. The packer and 4.5-inch casing were intended to isolate the water and gas production zone from the lower portions of the borehole.

After the temporary casing was installed, Boart Longyear (Boart) of Wytheville, Virginia, mobilized to the site to continue advancing the borehole using wet-rotary coring methods. Before the coring activities, Cargill constructed a gravel ramp to provide Boart sufficient clearance to install their BOP on the temporary intermediate casing.

Boart advanced the borehole from 1,556 ft bgs to total depth (TD) at 2,486 ft bgs by using a wet- (brine) rotary HQ core barrel, which provides nominally 3.75-inch-diameter corehole and 2.5-inch core. Core was extracted in 10-foot runs. Per Cargill's request, RESPEC's field geologist was only on site part time during coring activities, but while there, the geologist logged the core quality, noted major changes in stratigraphy and water returns (to interpret water-bearing zones), and photographed the core. The bedrock core-quality data are provided in Table 2-1, and Figure 2-1 contains a borehole diagram. Appendix B contains a photographic log of the core collected..

Following completion of coring activities and Boart demobilization, Cargill removed the gravel ramp and restored the test hole surface elevation to the same approximate elevation that existed during the air-rotary drilling activities.

2.2 CORE LOGGING

After coring was completed, Dr. William Goodman and Mr. David Gnage (RESPEC) conducted a more detailed logging of the 930 feet of core collected from 1,556–2,486 feet. Figure 2-2 provides lithographic descriptions of the core collected and the gamma log for the cored interval and is also included on the enclosed CD. Section 3.1 discusses the stratigraphic picks based on a comparison of the chip samples, core, and wireline logs.

2.3 OBSERVATION OF GEOPHYSICAL LOGGING

Geophysical logging was conducted by Weatherford International of Muncy, Pennsylvania. Weatherford initially completed wireline logging runs before installing the surface casing (0–590 feet) and the temporary intermediate casing (0–1,555 feet). Weatherford provided the following wireline geophysical logs: gamma ray, resistivity, neutron porosity, density, sonic velocity, and depth. RESPEC's field geologist was on site during geophysical logging to observe the activities and to relay pertinent information to Cargill. The NYSDEC did not require a bond log for the surface casing; therefore, none was run.

After completing the coring activities, Weatherford returned to the site to complete wireline logging of the lower portion of the test hole (1,555–2,486 feet [wireline TD]). This run of wireline logs included gamma ray, resistivity, neutron porosity, density, sonic velocity, depth, and deviation.

Table 2-1. Bedrock Core Quality Log (Page 1 of 2)

Sample Interval					Sample Interval					Sample Interval				
Run No.	From	To	Recovery (%)	RQD (%)	Run No.	From	To	Recovery (%)	RQD (%)	Run No.	From	To	Recovery (%)	RQD (%)
1	1,556	1,566	90	98	34	1,886	1,896	100	100	67	2,216	2,226	100	100
2	1,566	1,576	100	99	35	1,896	1,906	100	100	68	2,226	2,236	100	100
3	1,576	1,586	100	100	36	1,906	1,916	100	100	69	2,236	2,246	100	100
4	1,586	1,596	100	99.5	37	1,916	1,926	100	100	70	2,246	2,256	100	100
5	1,596	1,606	100	100	38	1,926	1,936	100	100	71	2,256	2,266	100	100
6	1,606	1,616	100	99.8	39	1,936	1,946	100	100	72	2,266	2,276	100	100
7	1,616	1,626	100	100	40	1,946	1,956	100	100	73	2,276	2,286	100	95
8	1,626	1,636	100	100	41	1,956	1,966	100	100	74	2,286	2,296	100	96
9	1,636	1,646	100	97.5	42	1,966	1,976	100	100	75	2,296	2,306	100	100
10	1,646	1,656	100	100	43	1,976	1,986	100	100	76	2,306	2,316	100	100
11	1,656	1,666	100	100	44	1,986	1,996	100	100	77	2,316	2,326	100	100
12	1,666	1,676	100	100	45	1,996	2,006	100	100	78	2,326	2,336	100	100
13	1,676	1,686	100	100	46	2,006	2,016	100	100	79	2,336	2,346	100	100
14	1,686	1,696	100	100	47	2,016	2,026	100	100	80	2,346	2,356	100	100
15	1,696	1,706	100	100	48	2,026	2,036	100	100	81	2,356	2,366	100	100
16	1,706	1,716	100	100	49	2,036	2,046	100	100	82	2,366	2,376	100	98
17	1,716	1,726	100	100	50	2,046	2,056	100	100	83	2,376	2,386	100	100
18	1,726	1,736	92	100	51	2,056	2,066	100	100	84	2,386	2,396	100	100
19	1,736	1,746	99	100	52	2,066	2,076	100	100	85	2,396	2,406	100	100
20	1,746	1,756	100	100	53	2,076	2,086	100	100	86	2,406	2,416	100	100

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Table 2-1. Bedrock Core Quality Log (Page 2 of 2)

Sample Interval					Sample Interval					Sample Interval				
Run No.	From	To	Recovery (%)	RQD (%)	Run No.	From	To	Recovery (%)	RQD (%)	Run No.	From	To	Recovery (%)	RQD (%)
21	1,756	1,766	100	100	54	2,086	2,096	100	100	87	2,416	2,426	100	100
22	1,766	1,776	100	100	55	2,096	2,106	100	100	88	2,426	2,436	100	100
23	1,776	1,786	100	100	56	2,106	2,116	100	100	89	2,436	2,446	100	100
24	1,786	1,796	100	100	57	2,116	2,126	100	100	90	2,446	2,456	100	100
25	1,796	1,806	100	100	58	2,126	2,136	100	100	91	2,456	2,466	100	100
26	1,806	1,816	100	100	59	2,136	2,146	100	100	92	2,466	2,476	100	100
27	1,816	1,826	100	100	60	2,146	2,156	100	100	93	2,476	2,486	100	100
28	1,826	1,836	100	100	61	2,156	2,166	100	100					
29	1,836	1,846	100	100	62	2,166	2,176	100	100					
30	1,846	1,856	100	100	63	2,176	2,186	100	100					
31	1,856	1,866	100	100	64	2,186	2,196	100	100					
32	1,866	1,876	100	100	65	2,196	2,206	100	100					
33	1,876	1,886	100	100	66	2,206	2,216	100	100					

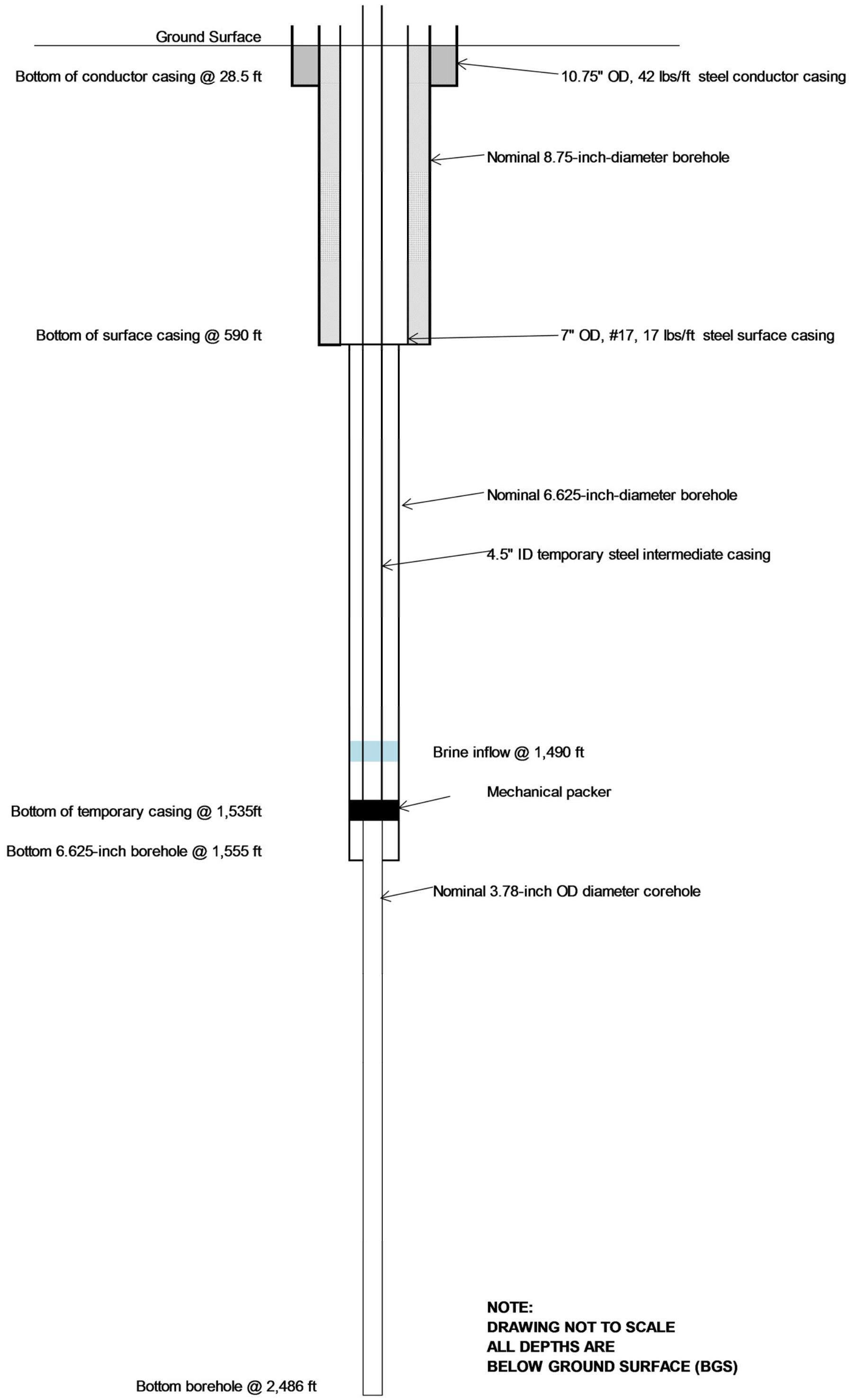

Figure 2-1. Borehole Diagram.

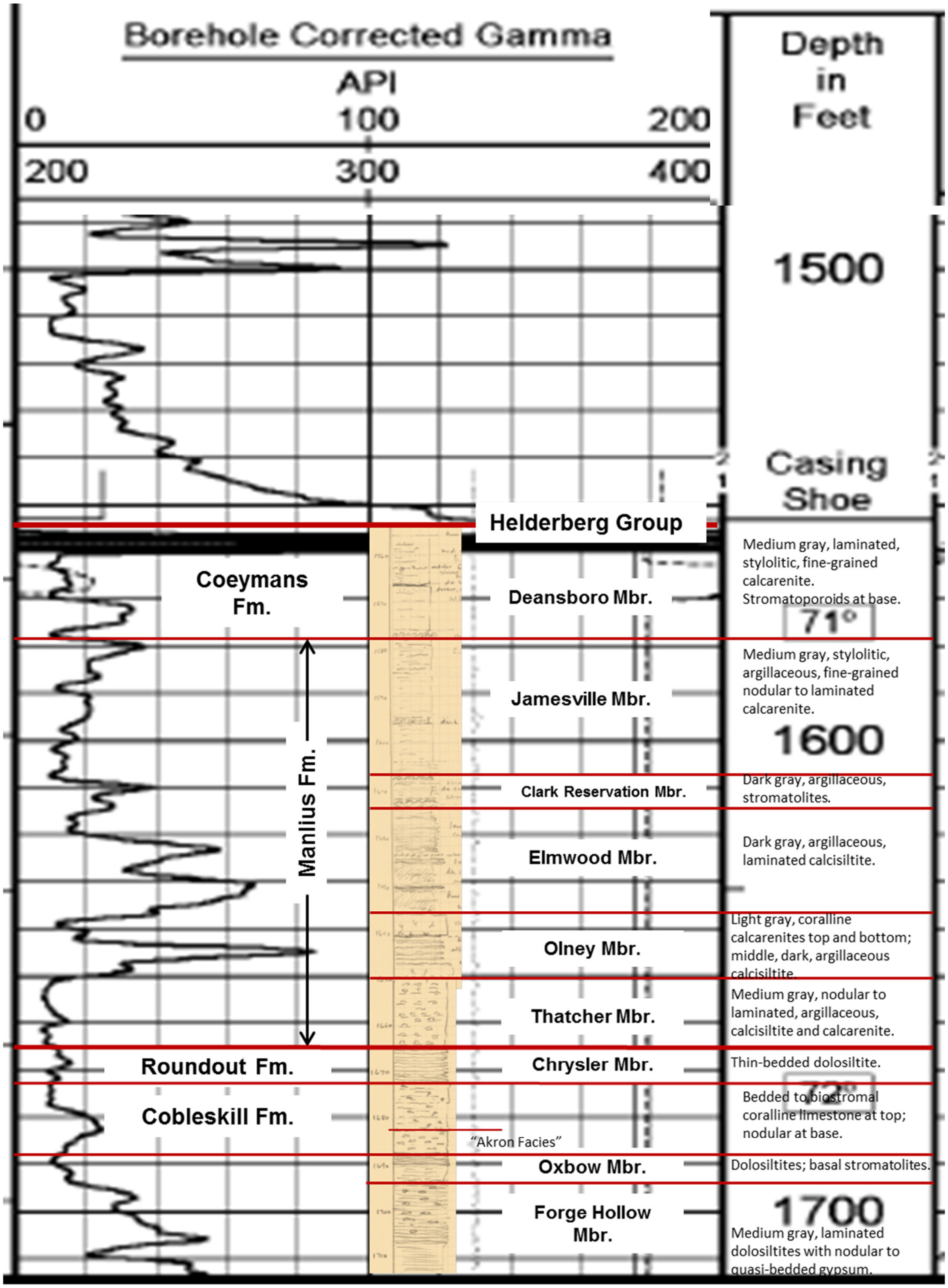

Figure 2-2. Lithologic Descriptions of the Cored Formations (Page 1 of 5).

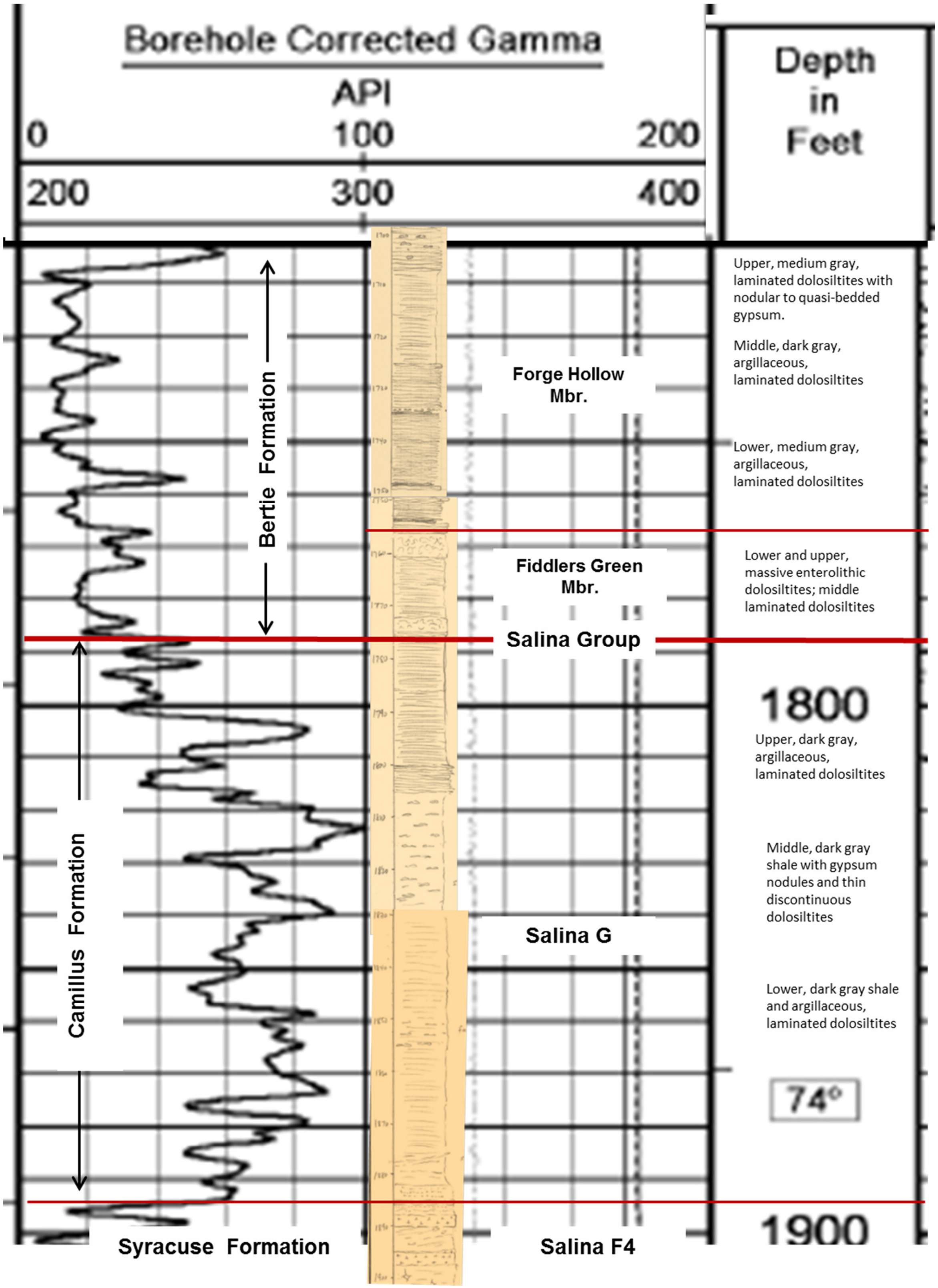

Figure 2-2. Lithologic Descriptions of the Cored Formations (Part 2 of 5).

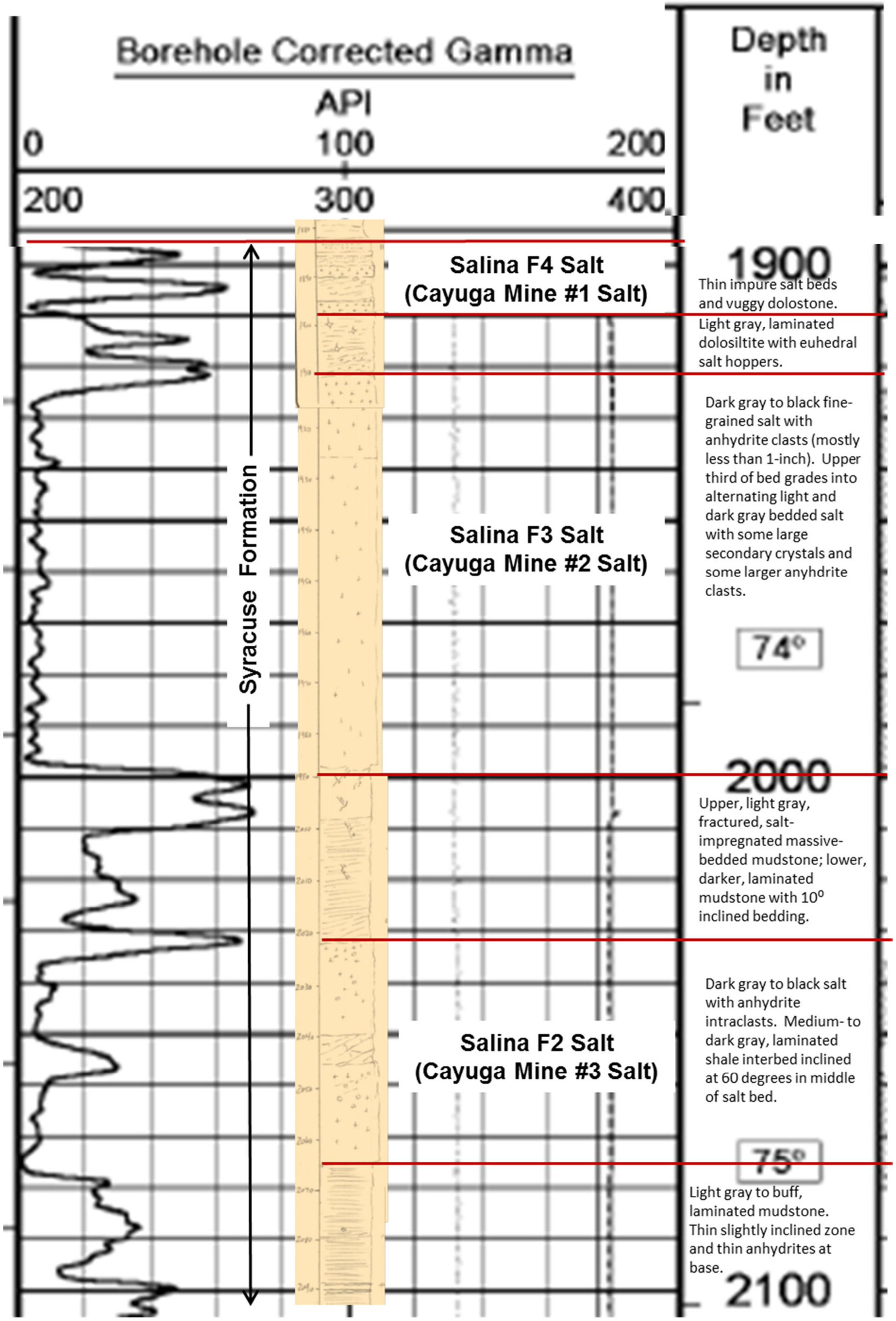

Figure 2-2. Lithologic Descriptions of the Cored Formations (Part 3 of 5).

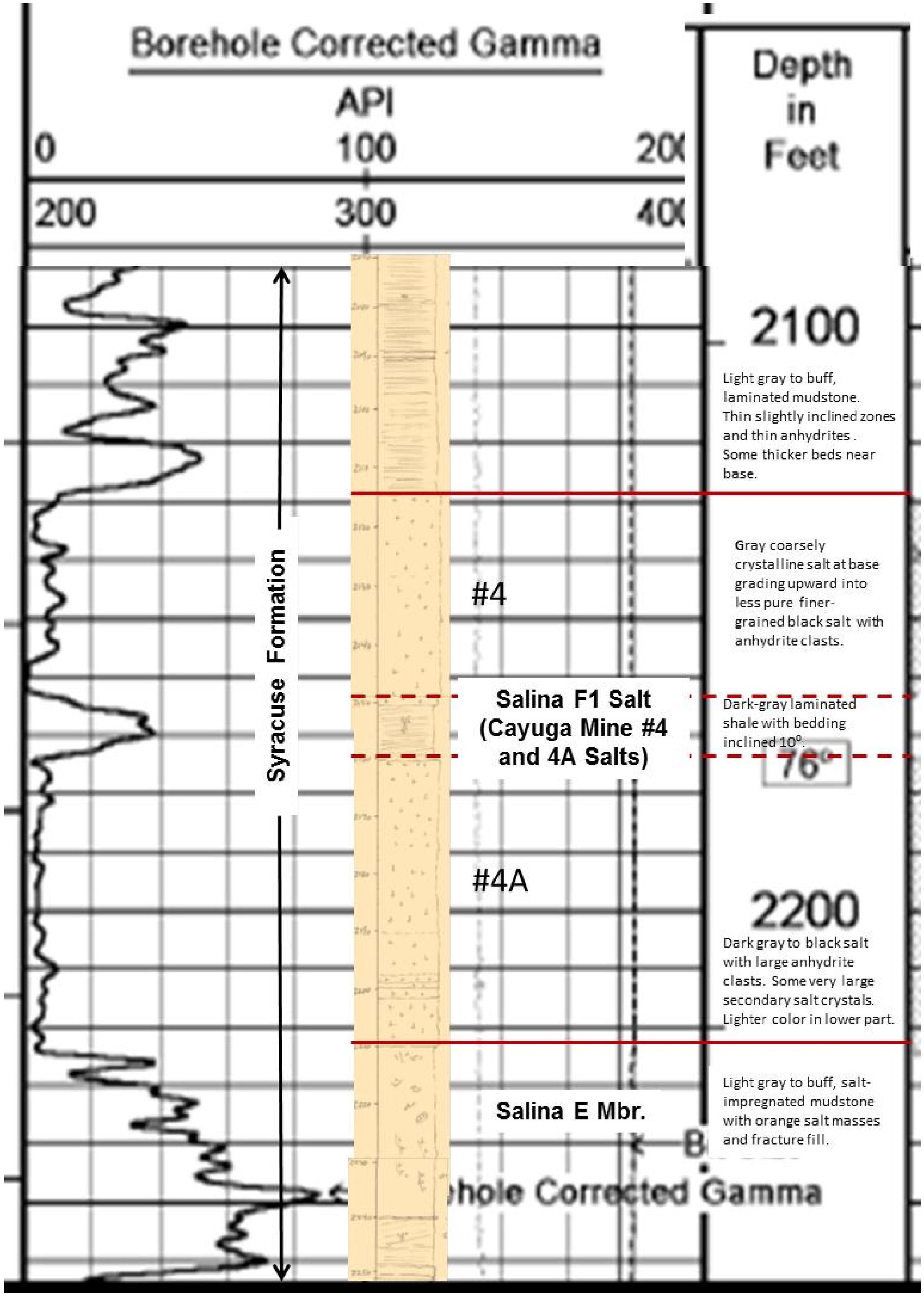

Figure 2-2. Lithologic Descriptions of the Cored Formations (Part 4 of 5).

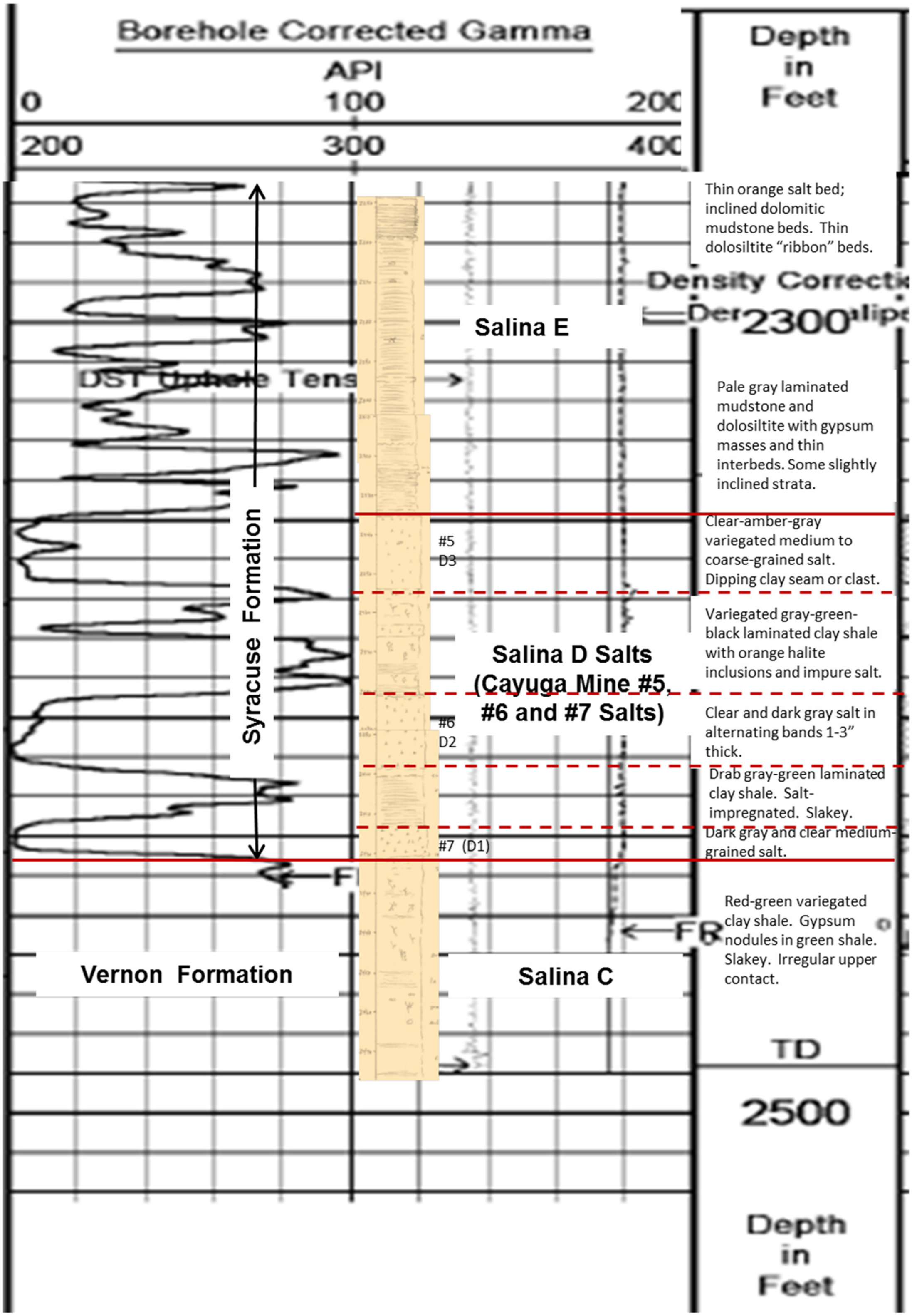

Figure 2-2. Lithologic Descriptions of the Cored Formations (Part 5 of 5).

Copies of the wireline logs are included in Appendix C and in the attached CD. Note that while Weatherford logged the test hole in three sections, the suite of logs for the first section (0–590 feet) required two runs; only one run was required for each of the second (590–1,555 feet) and third (1,555–2,488 feet) sections. Weatherford provided logs for the second run for the first section. Weatherford's "Run 3" log covers the second section. For the third section, Weatherford did not report the sections individually but, instead, provided a combined log (Run #5) that covers the depth interval from surface to TD.

2.4 AQUIFER PUMPING TEST

No aquifer testing was originally specified for the stratigraphic hole. Because of water encountered in the lower Onondaga/Oriskany at a field-estimated water inflow of 10–15 gpm, Cargill requested that a pumping test be conducted to better understand the potential water inflow to the new shaft (#4 Shaft) during construction. Cargill was concerned that a protracted 10–15 gpm inflow rate would exceed their water-handling capacity.

The basic pumping testing procedure is outlined below. Note that the first attempt to conduct the pumping test was cut short because of a pump malfunction. The issue was resolved, and the test was conducted. The results of the testing will be discussed in Section 3.3.

Before beginning the pumping test, the static water level was measured by using a sonic water-level meter and a "graduated" pressure transducer cable. The water level was estimated to be approximately 500 ft bgs, or 950 above the production zone.

Frey Drilling, Inc. provided and installed a 15-horsepower submersible pump capable of producing 30 gpm from a depth of 1,450 feet with zero head. Cargill provided on-site fluid storage of approximately 60,000 gallons with arrangements to remove additional fluids if needed.

1. The borehole was vented of gas via the valve system currently in place on the wellhead.
2. The pump and discharge piping were equipped with a check valve immediately above the pump to prevent the back-flow of the water column into the well when the pump was shut off at the end of the test.
3. The pump and discharge tubing were run into the borehole to a depth of 1,435 ft bgs.
4. A 300 psi pressure transducer was attached to the piping string approximately 415 feet above the pump (1,020 ft bgs). The transducer was attached to a vented communication cable, which was attached to the discharge piping and run to the surface.
5. The borehole was allowed to equilibrate after pump installation.

6. A logging flow meter was installed near the wellhead to monitor flow rate. A second analog flow meter was installed upstream of the logging flowmeter as back-up. (Note that both meters failed during the test; however, manual flow readings were collected and used.)

7. Discharge piping was attached to a manifold to allow discharge of waste water/brine to multiple storage vessels.

8. The borehole was initially intended to be pumped at a steady rate of 15 gpm for a period of 12 hours, or until the water level decreased to within 50 feet of the transducers. During the failed first attempt at the pumping test, it was determined that the water-bearing zone could not sustain this rate. Based on the limited pumping rate information from the failed pumping test, a pumping rate of 6 gpm was targeted. After 60 minutes of pumping at 6 gpm, it was determined that the water-bearing zone could not sustain a rate of 6 gpm either. A rate of approximately 3 gpm was then set approximately 165 minutes after beginning the test. This rate was maintained until the test was terminated after a head decrease of 500 feet (252.3 psi) at the 13-hour mark.

9. The borehole was then shut-in, and the borehole was allowed to recover for 4.25 days (almost 8 times the pumping period).

10. After the recovery period, the pump and piping were pulled out of the borehole, the pressure transducers were recovered, and the transducer data were downloaded.

The discharge brine generated during the pumping test was contained in a 20,000-gallon tank.

2.5 WATER SAMPLING AND ANALYSIS

RESPEC anticipated collecting water samples from approximately eight water-bearing zones above the cored interval before drilling. However, only one water-bearing zone was encountered above the cored interval. As discussed above, the water-bearing zone was encountered at approximately 1,490 ft bgs. RESPEC's field geologist collected two samples from this zone, one return-water sample from the zone during air-rotary drilling, and one discharge sample at the 9-hour mark of the pumping test conducted. Before collecting the samples for laboratory analysis, RESPEC collected general chemistry field parameters (temperature, pH, conductivity, oxidation-reduction potential, and salinity). RESPEC also collected field parameters throughout the pumping test to ensure the sample collected was representative of the discharge brine. Table 2-2 contains a summary of the field parameter data collected.

In addition to the samples collected from the water-bearing zone in the lower Onondaga/Oriskany interval, RESPEC collected a sample of drilling brine used during coring. Boart did not report to RESPEC any evidence of water-bearing zones in the cored interval.

Table 2-2. Water-Quality Field Parameters

Sample I.D.	Date	Depth (ft bgs)	Time	Temperature (°C)	pH (SU)	Conductivity (ms/cm)	ORP (eV)	Salinity (ppt)	Laboratory Analysis
#18-1490	05/22/13	1,490	9:00	25.3	9.4	151.90	-43.8	123.5	Yes
CH#18-PT-001	06/19/13	1,440	13:00	17.3	7.3	205.80	–132.8	199.4	No
Water-Quality Check	06/27/13	1,440	9:00	16.5	6.5	201.30	–143.5	174.9	No
Water-Quality Check	06/27/13	1,440	12:35	18.4	6.2	209.10	–230.9	185.5	No
Water-Quality Check	06/27/13	1,440	14:20	18.3	6.3	207.60	–273.5	183.7	No
Water-Quality Check	06/27/13	1,440	15:50	18.3	6.2	208.50	–274	185.9	No
CH#18-PT-002	06/27/13	1,440	16:50	18.2	6.2	210.40	–277.1	187.0	Yes
CH#18-drillingbrine	07/16/13	NA	14:00	27.6	7.3	223.20	–265.5	204.0	Yes

°C = degrees Celsius
SU = standard units
ms/cm = millisiemens per centimeter
eV = electrovolts
ppt = parts per thousand
NA = Not Applicable

The water samples collected were analyzed for stable isotopes (δ deuterium and δ^{18}O) and tritium at the Isotech Laboratories, Inc. of Champaign, Illinois, and major ions (alkalinity, sulfate, total dissolved solids, chloride, and select metals) at Paradigm Environmental Services, Rochester, New York. Table 2-4 provides an analytical sample summary. The results of the laboratory analyses are discussed in Section 3.3.

Table 2-3. Water-Sample Analysis Summary Table

Sample I.D.	Location	Date	Method	Parameters
#18-1490	depth of 1,490 ft bgs collected during rotary drilling	5/22/13	Grab	Metals (Ca, Mg, Na, K)
				Chloride
				Sulfate
				Alkalinity
				Total Dissolved Solids
				Density
				Deutrium, •^{18}O, Tritum
CH#18-PT-002	depth of 1,440 ft bgs, during pumping test	6/27/13	Grab	Metals (Ca, Mg, Na, K)
				Chloride
				Sulfate
				Alkalinity
				Total Dissolved Solids
				Specific Gravity
				Deutrium, •^{18}O, Tritum
CH#18-drillingbrine	Drilling fluid recirculation tank	7/16/13	Grab	Metals (Ca, Mg, Na, K)
				Chloride
				Sulfate
				Alkalinity
				Total Dissolved Solids
				Specific Gravity
				Deutrium, •^{18}O, Tritum

2.6 PLUG AND ABANDONMENT

RESPEC understands that Frey plugged and abandoned (P&A) Corehole #18 on September 26, 2013, in accordance with an NYSDEC-approved P&A plan under Cargill's supervision.

3.0 COMPLETION OF DATA ANALYSIS AND REPORTING

To assist Cargill with compiling data for sinking the #4 Shaft, RESPEC completed the following tasks associated with the analysis of the test hole data:

- Stratigraphic Picks
- Water-Bearing Zone Definition and Aquifer Determinations
- Interpretation of Formation Water Geochemical Data
- Pumping Test Data Analysis
- Geomechanical Laboratory Testing of Core Samples
- Reporting on Findings of the Test Hole.

Each of these tasks is described in the following sections.

3.1 STRATIGRAPHY AND STRUCTURE

The following sections provide general background information on the bedrock stratigraphy and structure in the vicinity of the Cayuga Mine and the specific findings in Corehole #18.

3.1.1 Stratigraphy

RESPEC reviewed the chip samples collected, wireline logs, and the core collected during the field program to determine stratigraphic picks for the major formations and members in the Corehole #18. Table 3-1 presents bedrock formations from ground surface to the base of the evaporite-bearing Salina Group. The stratigraphic picks for these formations were based on the chip samples and core, and the corresponding formation picks were based on the wireline logs. Figure 3-1 presents the stratigraphic picks for the major formations and the gamma ray wireline log with select photographs.

The bedrock formations in the rock sequence penetrated by Corehole #18 span in age from Upper Silurian to Upper Devonian. The youngest rocks exposed in the area are Upper Devonian shales. The Tully Limestone, which forms a distinctive marker horizon, is bounded by the major shale sequences of the Genesee shales above and the Hamilton Group below. The combined thickness of this shale-dominated interval is approximately 1,500 feet in Corehole #18.

A major carbonate-dominated interval is beneath the Devonian shales. In descending order, this sequence of “Siluro-Devonian” carbonates includes the following units: Cherry Valley Limestone, Union Springs Shale, Onondaga Limestone, Oriskany Sandstone, Helderberg Group, Rondout Dolostone, and the Bertie Group. The thickness of this “carbonate beam” over the Silurian evaporite sequence is approximately 385 feet in Core Hole #18.

Table 3-1. Stratigraphic Picks (Page 1 of 4)

Depth to Top of Formation	Top of Formation Based on Chips/Core (ft bgs)	Elevation (ft msl)	Thickness (ft)	Combined Log (Run #5)			Comments
				Top of Formation Based on Wireline (ft bgs)	Elevation (ft msl)	Thickness (ft)	
Overburden Soils	0	784		0	784		
Genesee Shales	26.8	757.2		26.8	757.2	345.2	Bottom of conductor casing
Sherburne Member				28.5	755.5	151.5	
Hubbard Quarry Member				180	604	62	
Firtree Member				242	542	5	
Geneseo Shale Member				247	537	125	
Tully Limestone				372	412	23	Samples collected just before and just after Tully
Hamiliton Group							
Moscow Shale	372	412		395	389	132	
Kashong Member				395	389	85	
Windom				480	304	42	
Portland Point Limestone				522	262	5	
Ludlowville Shale				527	257	283	
Spafford Member				527	257	55	
Ivy Point Member				582	202	30	
Otisco Member				612	172	168	
Centerfield Member				780	4	30	

Table 3-1. Stratigraphic Picks (Page 2 of 4)

Depth to Top of Formation	Top of Formation Based on Chips/Core (ft bgs)	Elevation (ft msl)	Thickness (ft)	Combined Log (Run #5)			Comments
				Top of Formation Based on Wireline (ft bgs)	Elevation (ft msl)	Thickness (ft)	
Skaneatleles Shale				810	–26	525	
Butternut Shale Member				810	–26	188	
Pompey Member				998	–214	219	
Delphi Station Member				1,217	–433	95	
Mottville Member				1,312	–528	23	
Marcellus	1,300	–516		1,335	–551	117	
Oatka Creek Member				1,335	–551	83	
Cherry Valley LS	1,405	–621		1,418	–634	2	
Union Springs Shale				1,420	–636	32	
Onondaga Limestone	1,430	–646		1,452	–668	40	
Seneca Member				1,452	–668	26	
Undifferentiated				1,478	–694	14	Moorehouse, Nedrow, Edgecliff Members
Oriskany-Carlisle Center	1,485	–701		1,492	–708	8	Reworked Oriskany at base of Onondaga
<u>Helderberg Group</u>	1,515	–731	173	1,500	–716		All formation thicknesses from here to TD are based on the core samples.
Coeymans Formation-Deansboro Member	1,515	–731	63	1,500	–716		

Table 3-1. Stratigraphic Picks (Page 3 of 4)

Depth to Top of Formation	Top of Formation Based on Chips/Core (ft bgs)	Elevation (ft msl)	Thickness (ft)	Combined Log (Run #5) Top of Formation Based on Wireline (ft bgs)	Combined Log (Run #5) Elevation (ft msl)	Combined Log (Run #5) Thickness (ft)	Comments
Manlius Formation	1,578	-794	86	1,575	–791		
Manlius Formation -Jamesville Member	1,578	-794	30	1,575	–791		
Manlius Formation-Clark Reservation Member	1,608	-824	5				
Manlius Formation-Elmwood Member	1,613	-829	21	1,610	–826		
Manlius Fm-Olney Member	1,634	-850	16	1,630	–846		
Manlius Fm-Thacher Member	1,650	-866	14	1,645	–861		
Rondout Fm-Chrysler Member	1,664	-880	8	1,668	–884		
Cobleskill Formation	1,672	-888	16	1,683	–899		
Bertie Formation	1,688	-904	87	1,702	–918		
Oxbow Member	1,688	-904	4	1,702	–918		
Forge Hollow Member	1,692	-908	63	1,716	–932		
Fiddlers Green	1,755	-971	20	1,760	–976		
Salina Group	1,775	-991		1,800	–1,016		
Camillus Shale/Salina G	1,775	-991	112	1,800	–1,016		
Syracuse Formation	1,885	-1,101		1,896	–1,112		
#1 Salt/F4	1,887	–1,103	24	1,896	–1,112		
#2 Salt/F3	1,911	–1,127	111	1,927	–1,143		
#3 Salt/F2	2,022	-1,238	96	2,036	–1,252		

Table 3-1. Stratigraphic Picks (Page 4 of 4)

Depth to Top of Formation	Top of Formation Based on Chips/Core (ft bgs)	Elevation (ft msl)	Thickness (ft)	Combined Log (Run #5)			Comments
				Top of Formation Based on Wireline (ft bgs)	Elevation (ft msl)	Thickness (ft)	
#4 Salt/Upper F1	2,114	–1,330	46	2,128	–1,344		
#4A Salt/F1	2,160	–1,376	50	2,175	–1,391		
#5 Shales/Dolomites/Salina E	2,210	-1,426	125	2,225	–1,441		
#5 Salt/D3	2,335	–1,551	18	2,348	–1,564		
#6 Claystone	2,353	-1,569	28	2,380	–1,596		
#6 Salt/ D2	2,381	–1,597	17	2,396	–1,612		
#7 Dolomite	2,398	-1,614	14	2,412	–1,628		
#7 Salt/ D1	2,412	–1,628	9	2,425	–1,641		
Vernon Shale / Salina C	2,421	–1,637		2,437	–1,653		

Blank= not picked
ft msl = feet mean sea level

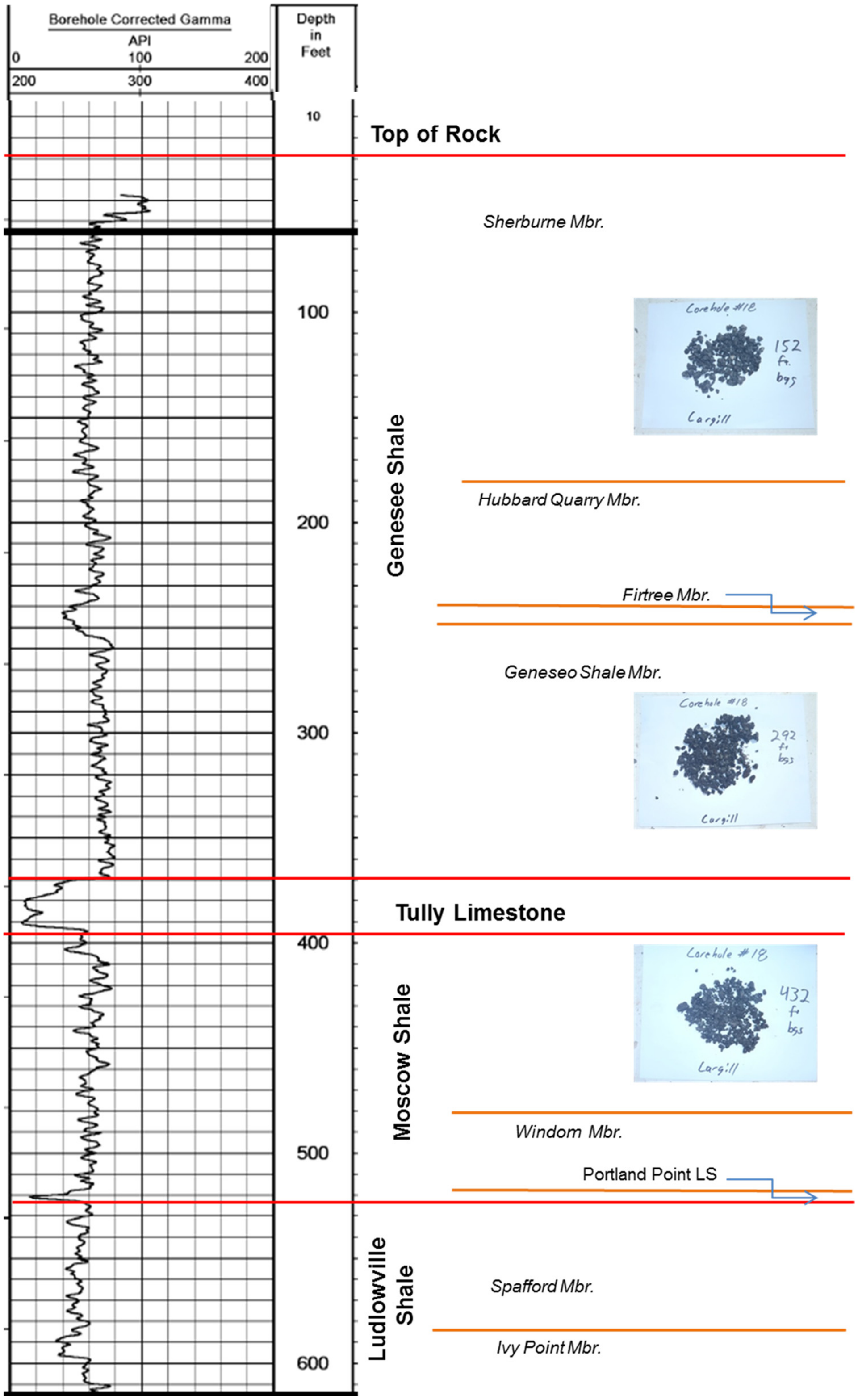

Figure 3-1. Stratigraphic Formation Picks With Gamma Ray Log and Select Formation Pictures (Page 1 of 5).

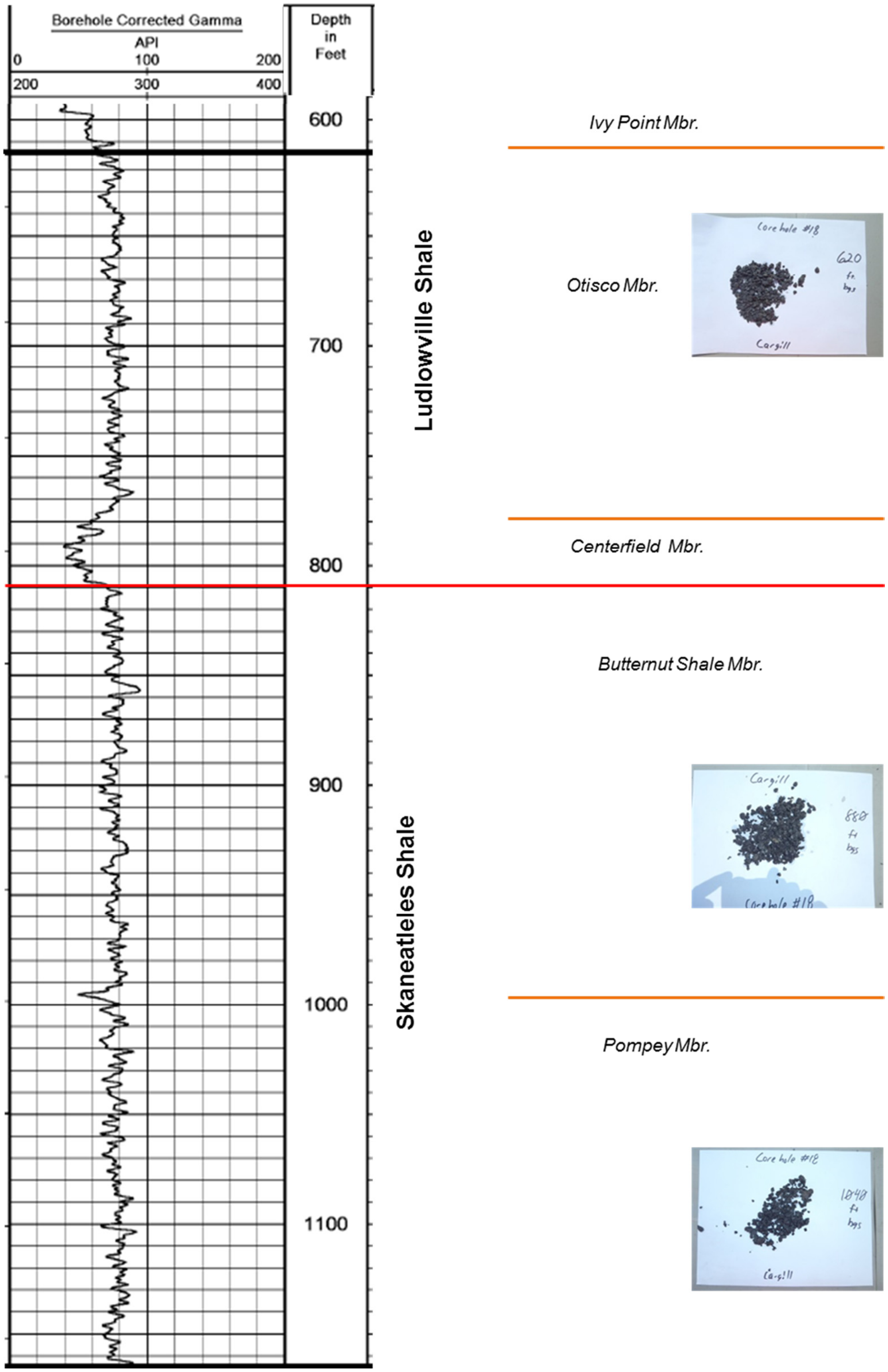

Figure 3-1. Stratigraphic Formation Picks With Gamma Ray Log and Select Formation Pictures (Page 2 of 5).

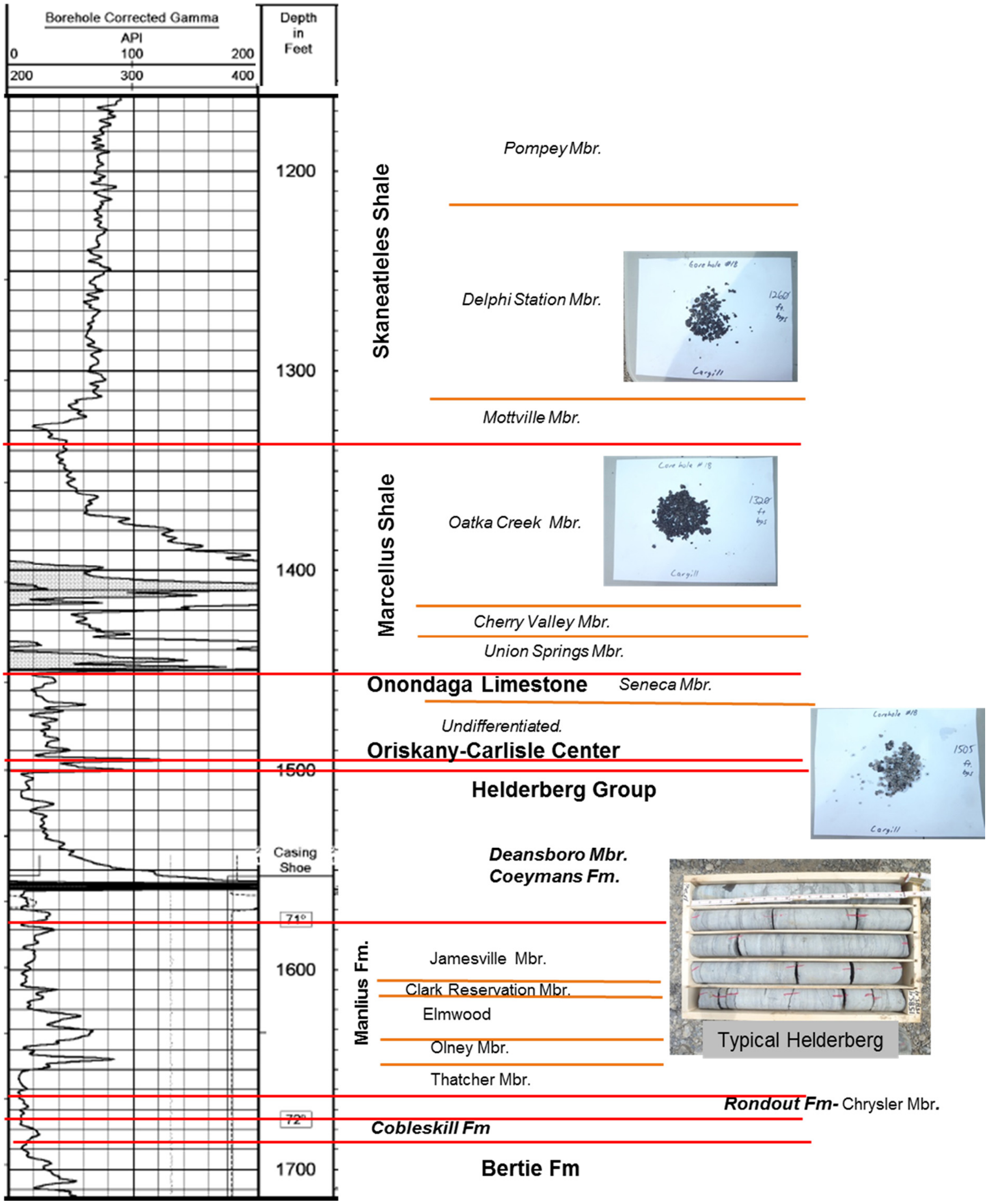

Figure 3-1. Stratigraphic Formation Picks With Gamma Ray Log and Select Formation Pictures (Page 3 of 5).

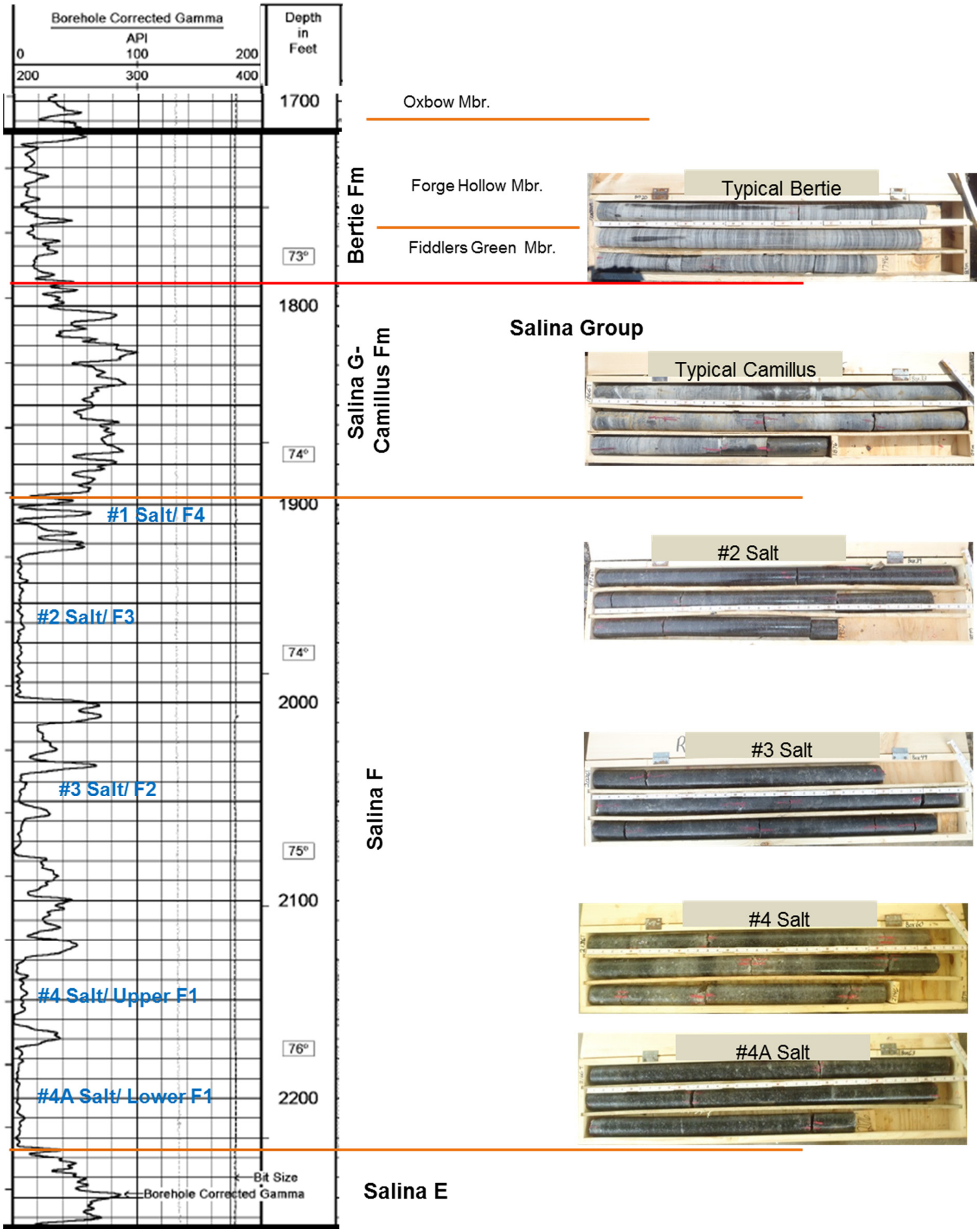

Figure 3-1. Stratigraphic Formation Picks With Gamma Ray Log and Select Formation Pictures (Page 4 of 5).

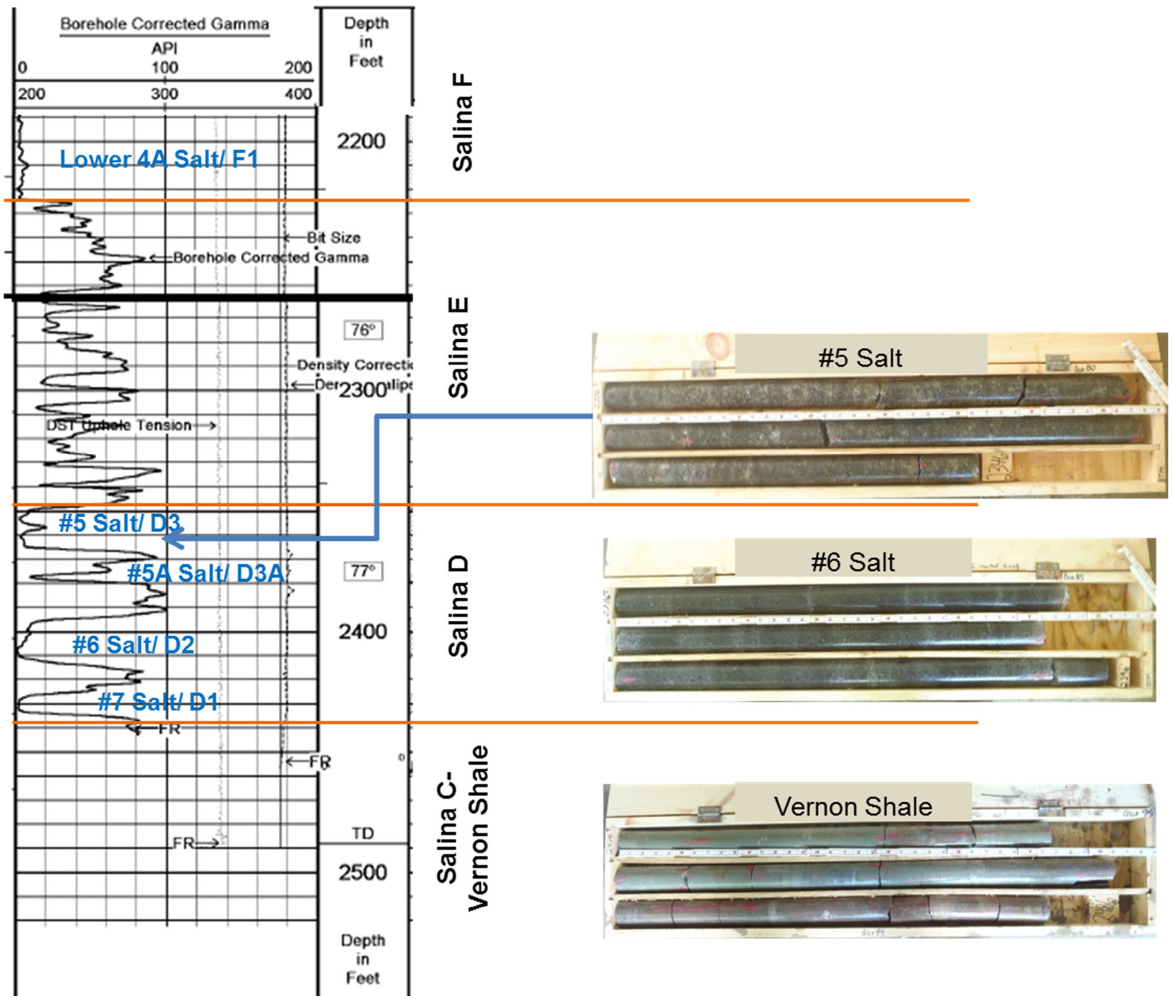

Figure 3-1. Stratigraphic Formation Picks With Gamma Ray Log and Select Formation Pictures (Page 5 of 5).

The salts that have been mined in the Cayuga Lake Valley are assigned to the Silurian Salina Group. Two stratigraphic schemes are applied to these strata in the literature, and the mine has also employed its own numbering system to the salt beds. These three different nomenclatural schemes are cross referenced in Table 3-1.

The traditional New York lithostratigraphic units internal to the Salina Group are (in descending order) the Camillus shale, the Syracuse Formation, and the Vernon Formation. The Camillus shale is also exposed at the #1 salt bed level in the Cayuga Mine. The Syracuse Formation contains all of the salt beds that the shafts of the Cayuga Mine have penetrated. The #1–4A salt beds are concentrated in the upper Syracuse Formation, and the #5–7 salt beds are concentrated at the base of the Syracuse Formation. The two salt-rich zones are separated by approximately 125 feet of interbedded dolostones and shales. The Vernon shale is not salt bearing in the Cayuga Valley, although it does contain the salt beds that are mined farther west in New York. The Vernon shale beds that correlate with the salt-bearing strata mined in the Genesee Valley lie below the base of the deepest salt bed in the Syracuse Formation (i.e., #7 Salt) in the Cayuga Lake Valley and are not of any economic importance locally.

The salt beds that have been penetrated by the shafts of the Cayuga Mine are part of an immense deposit that extends beneath parts of New York; Pennsylvania; West Virginia; Ohio; Michigan; and Ontario, Canada. The salt deposits infilled two separate, juxtaposed sedimentary troughs (the Appalachian and Michigan Basins). The two basins were connected by a narrow channel beneath Lake Erie called the Chatham Sag.

Because the salt beds are so laterally extensive, over the years, stratigraphers have attempted to make correlations and to devise a stratigraphic nomenclature that crosses state lines. The most useful terminology for the salt beds was developed by Mr. Kenneth Landes for the Michigan Basin in the 1940s. He designated internal Salina Group units from A at the base to G at the top. There is little difficulty recognizing the Salina A-G Units in Ohio and New York. In these states, the major salt zones are the Salina B (the lower salts mined in western New York), the Salina D (lower Syracuse #5–7 beds at Cayuga), and the Salina F (upper Syracuse #1–4A beds at Cayuga). The interbedded shales and dolostones separating the #5–7 beds from the #1–4A beds at Cayuga comprise the Salina E. The Camillus shale that caps the salt sequence is equivalent to the Salina G.

Stratigraphers have numbered the salt beds in each interval from the bottom up, which is opposite to the way the engineers at the Cayuga Mine have numbered them. For example, the #1 salt bed, as it was named at the Cayuga Mine, is recognized regionally as the F4 Salt. The combined #4–4A Salt is recognized regionally as the F1 Salt. The #5 salt is the D3 Salt, the #6 Salt is the D2 Salt, and the #7 Salt is the D1 Salt.

3.1.2 Structure

Bedrock structures at the Cayuga Mine include folds, faults, and joints. The most prominent feature is the Fir Tree Point Anticline, which is the major east-west trending fold whose axis crosses Cayuga Lake between Myers Point and Portland Point. The smaller-scale structures observed in the mine at the #1 Salt, the #4 Salt, and the #6 Salt levels are related to regionally extensive tectonic deformation that produced the Fir Tree Point Anticline and even larger folds to the south.

Smaller-scale folds and faults occur on the limbs and in the core of the Fir Tree Point Anticline. The extreme relief on the #4 salt bed is related to buckling in the core of the larger fold. The well-known thrust fault in the Tully Limestone in the quarry above the mine occurs along the crest of the fold. Faults are also known to occur on the limbs of the fold at the Onondaga Limestone level based on well control and can also be clearly observed in seismic data.

The data collected from Corehole #18 have been incorporated into existing data RESPEC previously compiled for Cargill. These results are presented in the following paragraphs.

Salt Thickness. In Corehole #18, the #6 salt is approximately 16 feet thick. Based upon interpolation of well control, the #6 salt thickens progressively from 16 to 20 feet in a northward direction from Corehole #18 in the Northern Reserves, which is illustrated in Figure 3-2.

Cargill has expressed an interest in the nature of the #5 salt at the in the area of Corehole #18. The #5 salt is approximately 15 feet thick in Core Hole #18. Based on well log interpretation the #5 salt increases in thickness to the west, with a thickness depression over the northeast corner of the old level 4 mine workings. Figure 3-3 provides an isopach map of the #5 salt.

Salt Purity. In Corehole #18, the #6 salt appears to maintain its normal purity, as seen in the previous logs. Based upon gamma ray logs from area wells, the purity of the #6 Salt in the region inclusive of the Northern Reserves generally looks consistent with the quality of the salt bed where mining has already occurred.

Salt Structure. No evidence of faulting was noted in the seismic reflection data north of the Frontenac Point Anomaly. In addition, structural contour maps in Figures 3-4 through 3-8, for the #6 Salt, the base of the #4 Salt (Salina E), the top of the salt sequence (Salina F), the top of the Camillus shale, and the top of the overlying carbonates all appear relatively simple.

In Corehole #18, the banding in the #6 salt is near-horizontal. There is some inclination of bedding in the #4 and #3 Salts. Dips as high as 60 degrees are noted but do not appear to be representative of large intervals within the sequence. Compressional deformation of the salt beds by internal shortening (i.e., thickening) appears to be responsible for the inclined strata in the #4 and #3 salt beds.

Log sections for the F1 Salt (#4 Salt) in the Zeifle #1, Dunkle, and Campion wells also suggest some tectonic deformation in the region surrounding the Northern Reserves. The typical bedding sequence for the F salts is disrupted, the interval appears thicker, and the F1 Salt is less pure (see Figure 3-6).

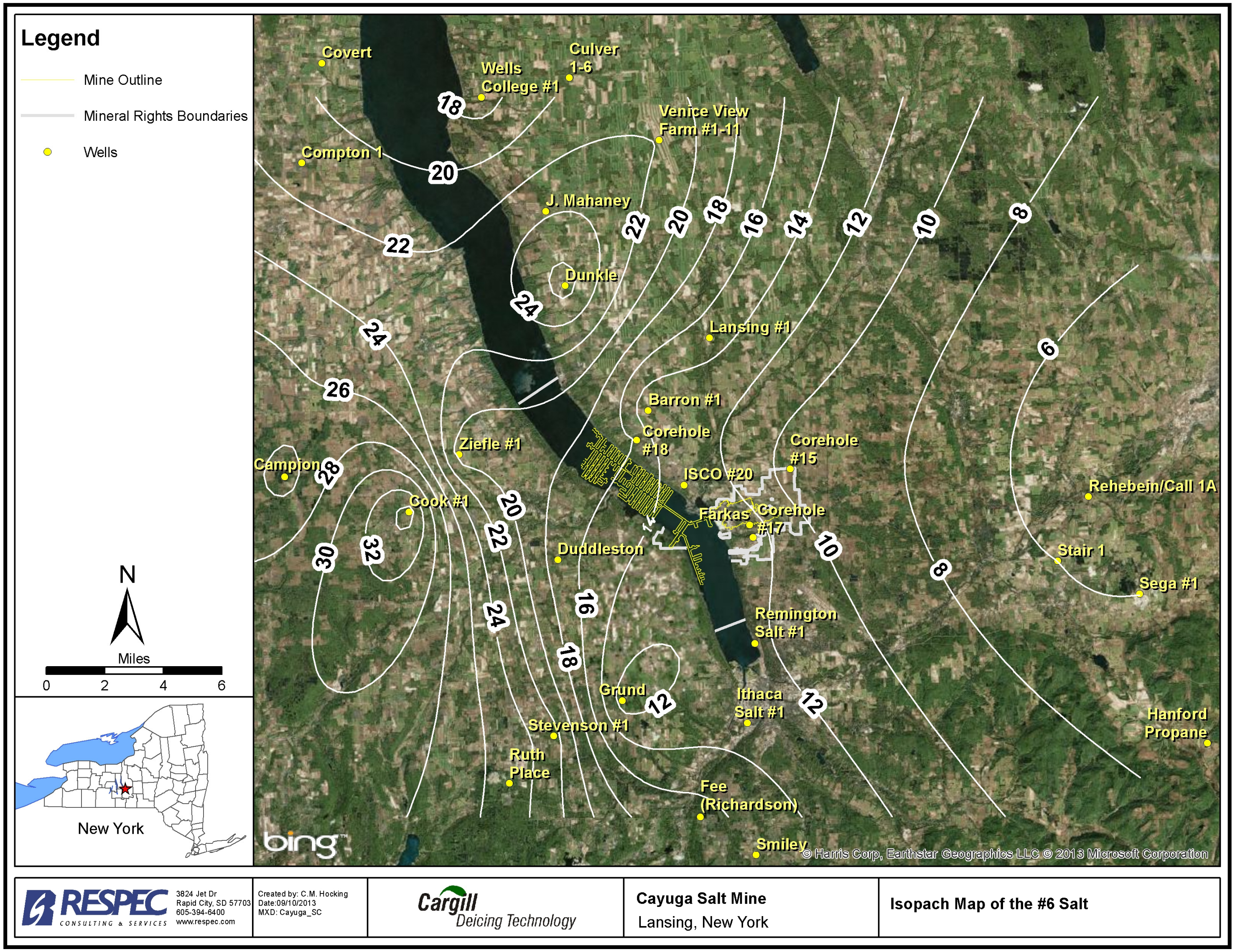

Figure 3-2. Isopach Map of the #6 Salt.

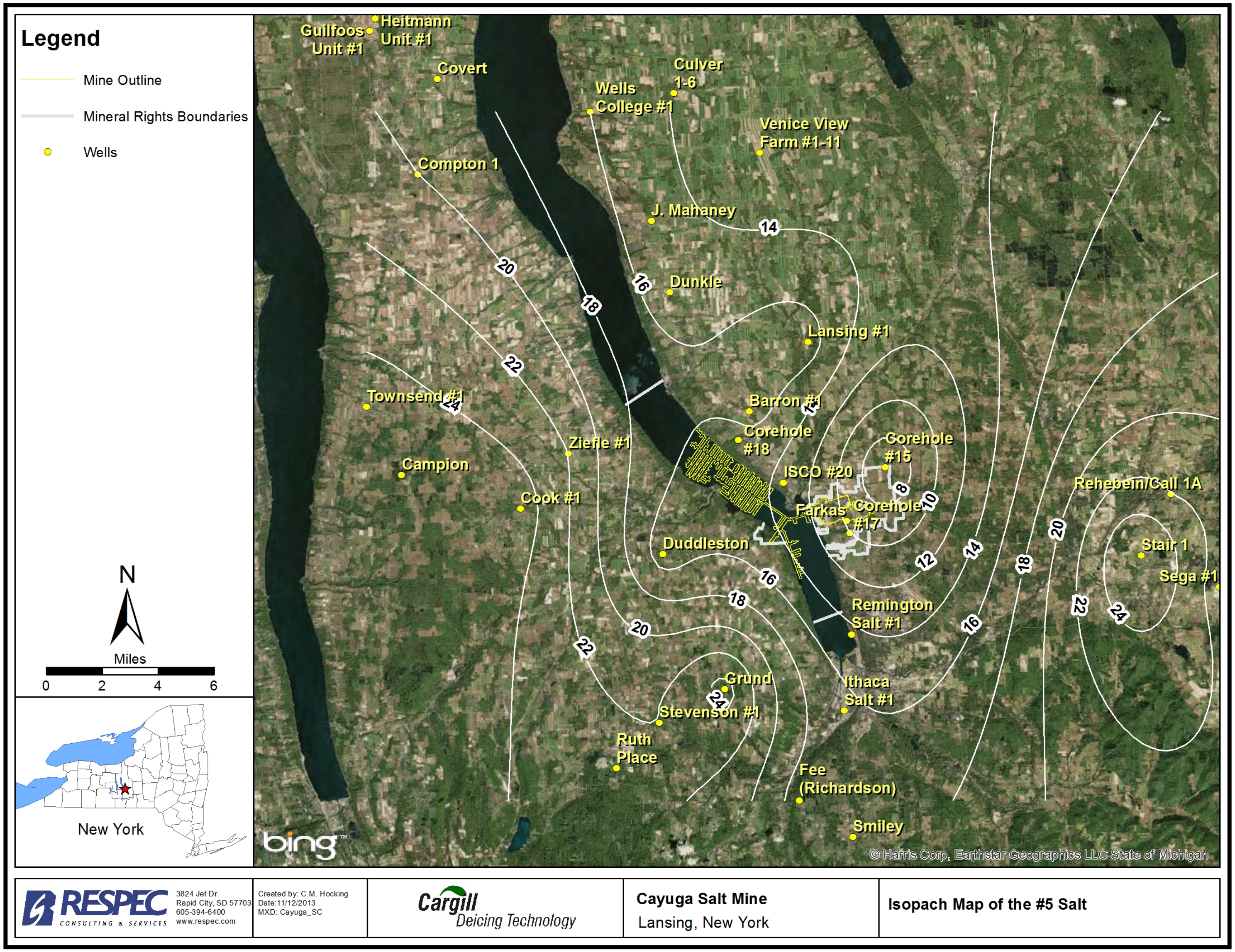

Figure 3-3. Isopach Map of the #5 Salt.

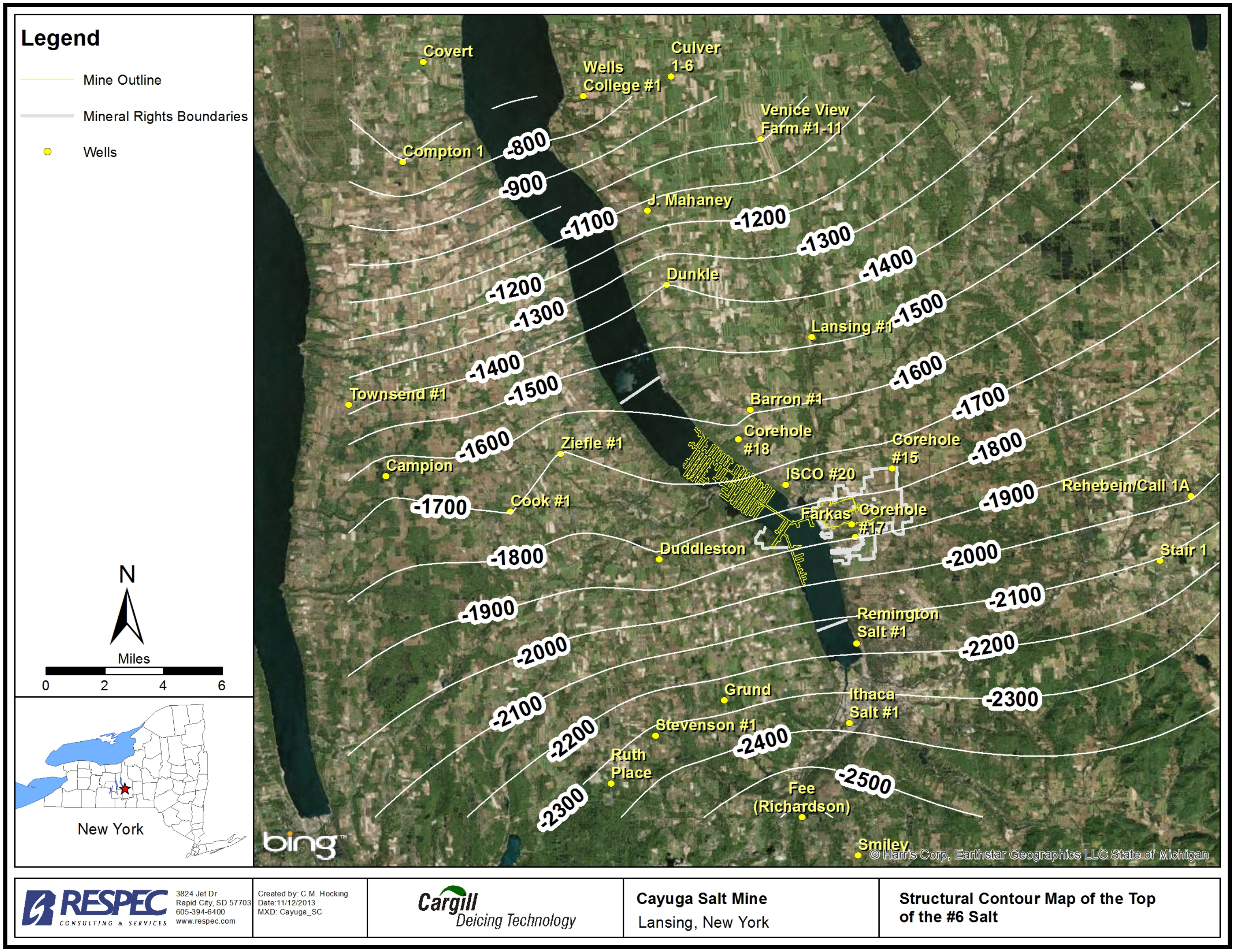

Figure 3-4. Structural Contour Map of the Top of the #6 Salt.

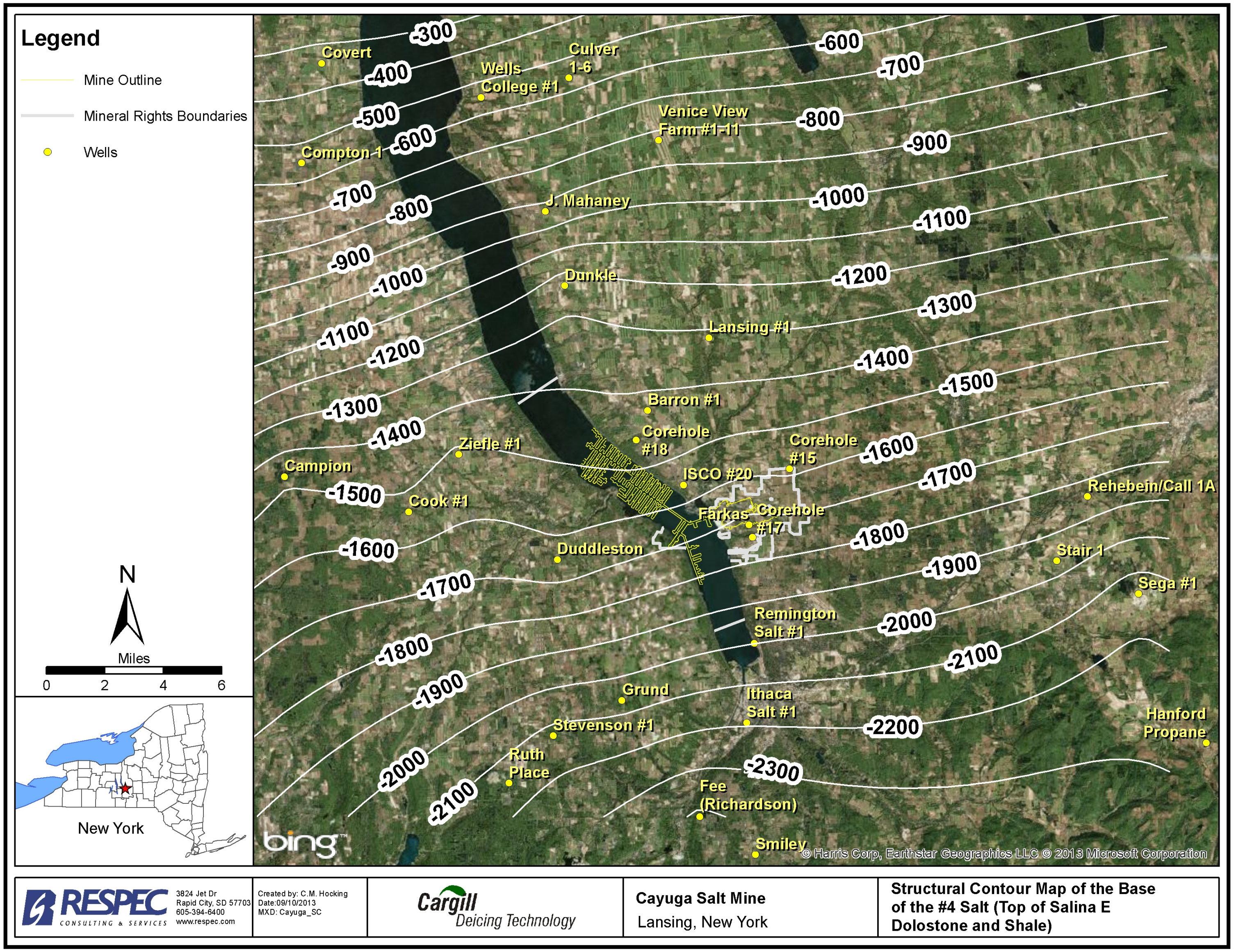

Figure 3-5. Structural Contour Map of the Base of the #4A Salt (Top of the Salina E Dolostone and Shale).

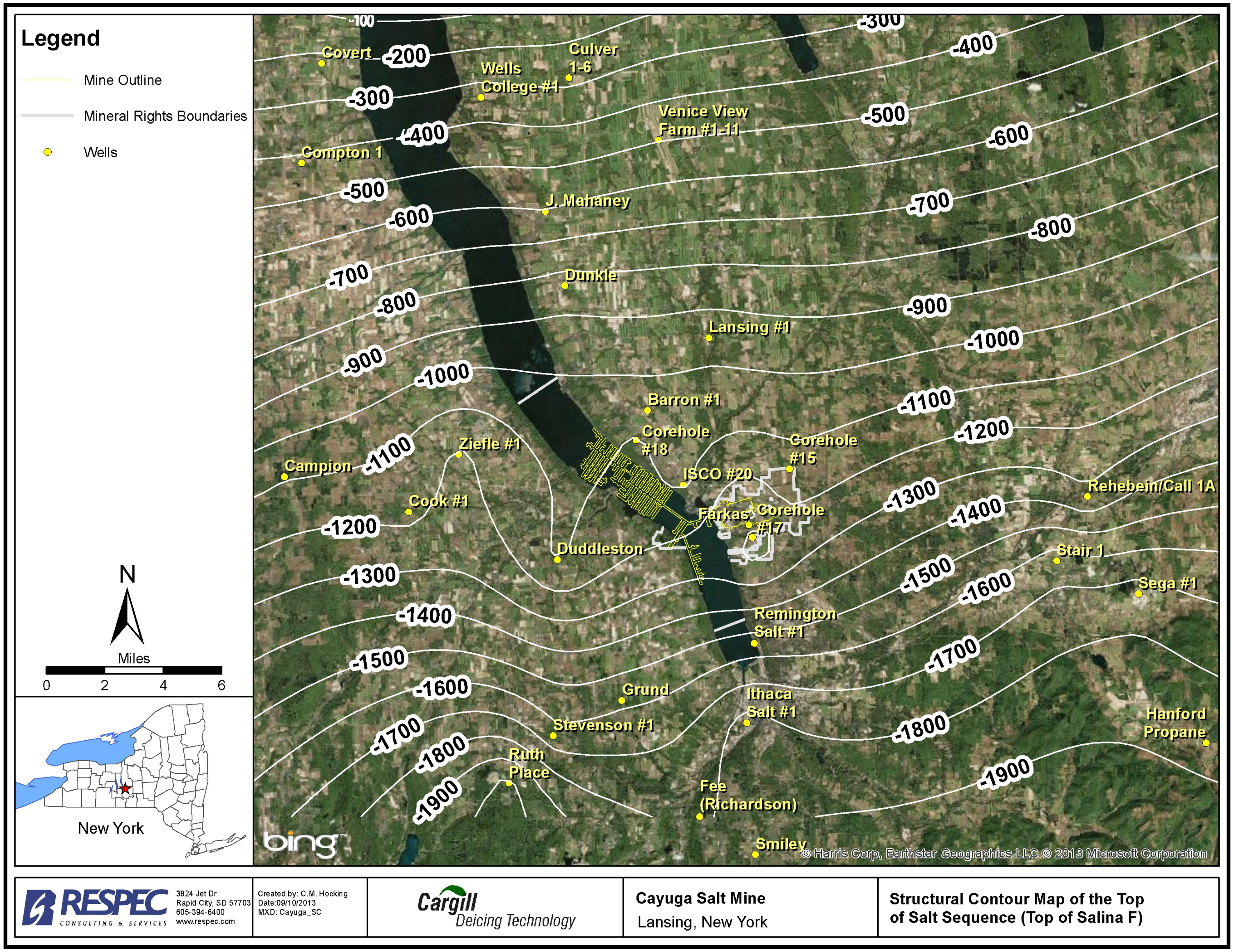

Figure 3-6. Structural Contour Map of the Top of the Salt Sequence (Salina F).

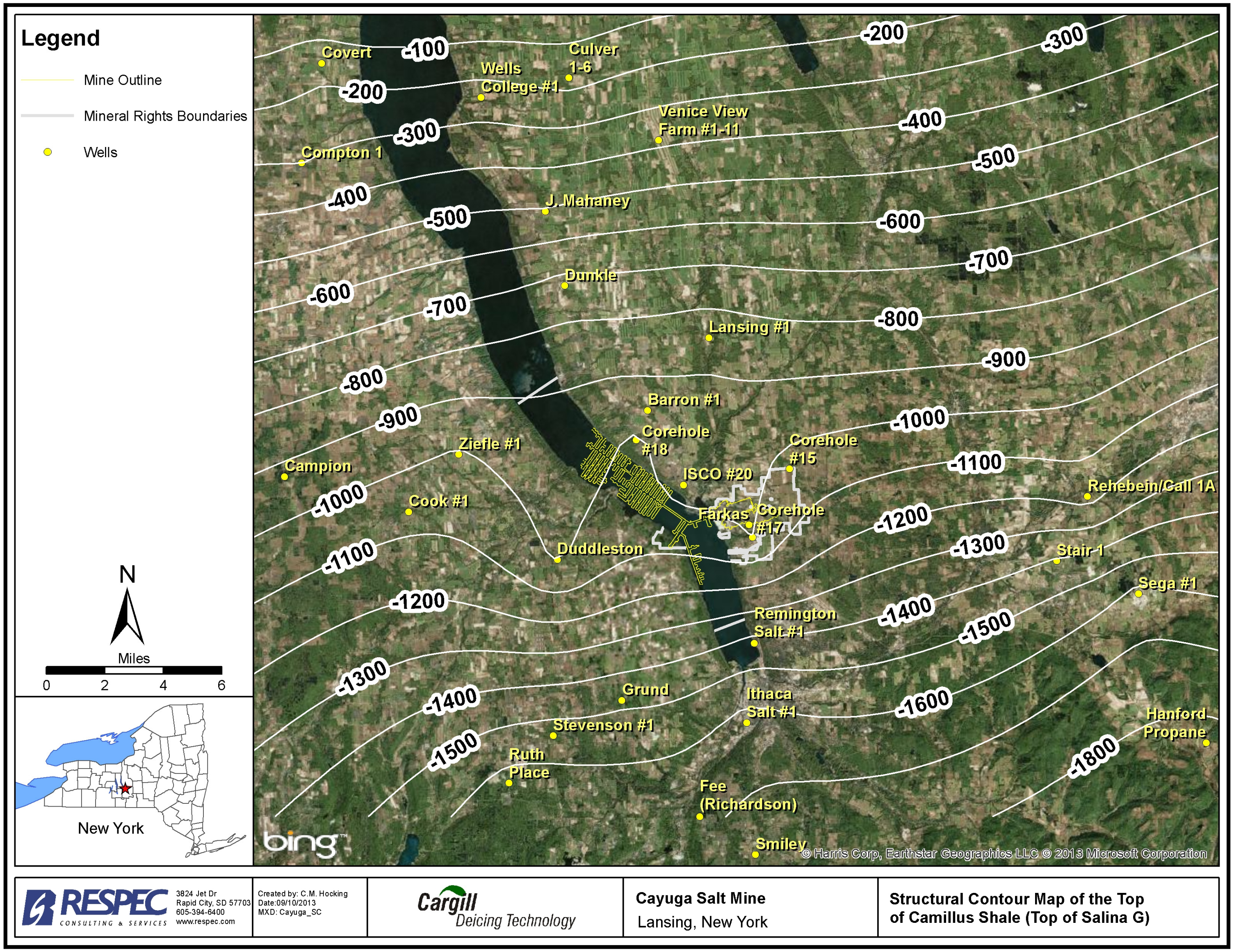

Figure 3-7. Structural Contour Map of the Top of the Camillus Shale (Salina G).

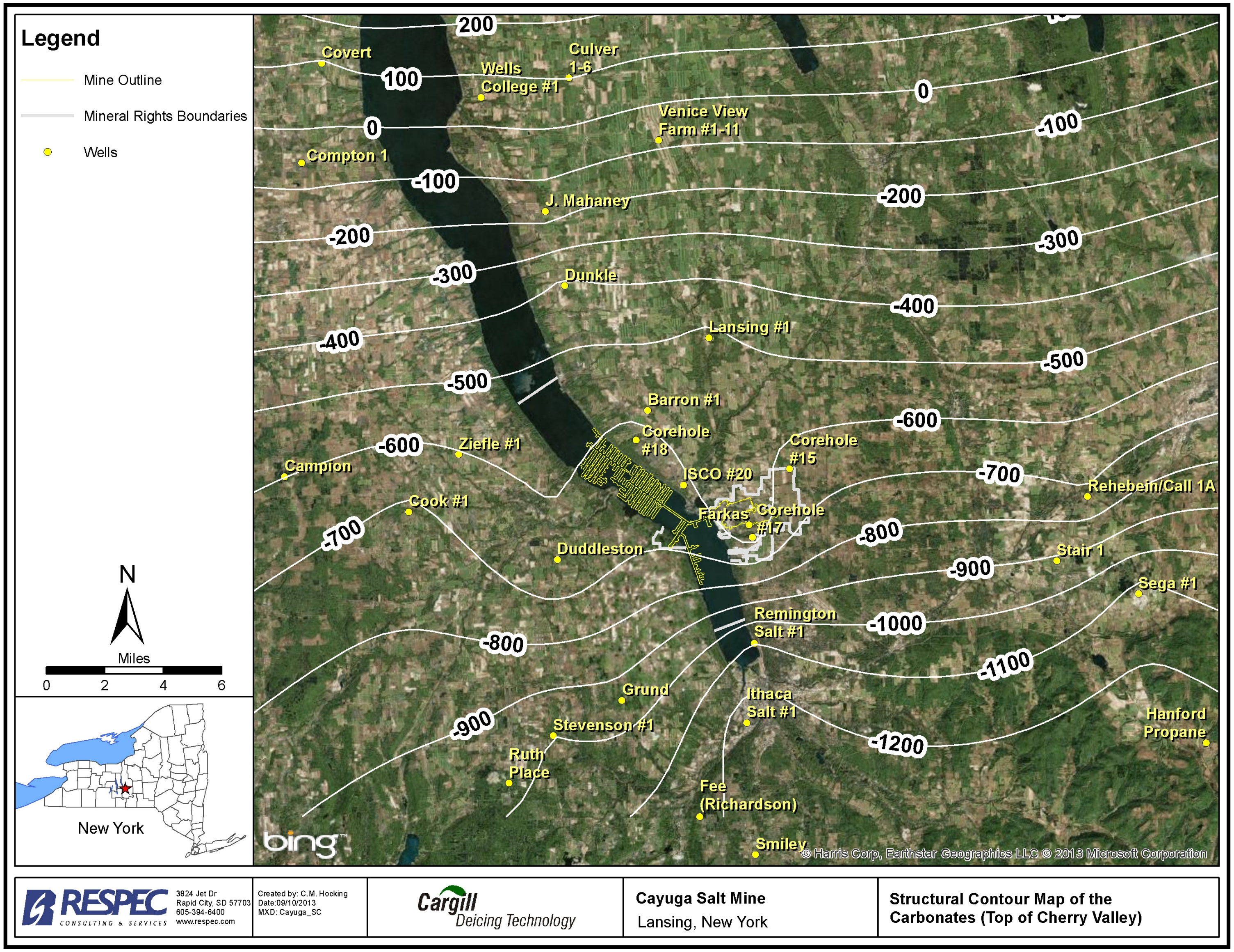

Figure 3-8. Structural Contour Map of the Carbonates (Top of Cherry Valley).

3.2 WATER-BEARING ZONE DEFINITION AND SUSTAINED SHAFT EXCAVATION INFLOW ESTIMATE

RESPEC analyzed the data collected during the installation of Corehole #18 to define potential water-bearing zones that will be passed through during sinking the #4 Shaft. In close proximity to the mine's current workings beneath the eastern uplands, the base of water can reasonably be expected to be at, or above, the base of the Bertie Group. Water in Corehole #18 was encountered at approximately 1,490 ft bgs in the Oriskany Sandstone. The flow rate from the Oriskany Sandstone was estimated in the field at the time of drilling to be 10 gpm; however, the subsequent pumping test suggested that the sustained inflow rate is approximately 3 gpm.

Gas was observed in the Oriskany Sandstone at 1,505 ft bgs. The estimated production rate was approximately 13,300 cfd.

3.2.1 Pumping Test Data Analysis

As stated in Section 2.4, the borehole was not able to sustain a pumping rate of approximately 3 gpm without significant drawdown, and the test was terminated at the 13-hour mark after a head decrease of 500 feet (252.3 psi). Figure 3-9 illustrates the response of the pumping well versus time in feet of displacement (i.e., drawdown).

RESPEC used **AQTESOLV**, which is a commercially available and widely used program, to analyze the pumping test data. RESPEC selected the Dougherty and Babu [1984] solution for a pumping test in an confined aquifer with wellbore storage to analyze the data. Copies of the **AQTESOLV** solution data are presented in Appendix D and the digital pumping test transducer data are included on the attached CD.

Figure 3-10 presents the displacement data and the predicted type curve versus time for the pumping well. The type curve fits the data fairly well, especially in the early pumping and early recovery time data. The average transmissivity estimated for the well is 1.0 ft^2/day with a storativity of 0.00005. The hydraulic conductivity for the test hole is estimated to be 7.0×10^{-6} centimeters per second (cm/sec), based on an aquifer thickness of 50 feet.

3.2.2 Shaft Inflow Rate Estimation

One of the key pieces of information needed from installing Corehole #18 is the potential water inflow to the mine level during shaft construction if Cargill chooses an up-reamed shaft method. RESPEC understands this method involves installing an initial 18-inch pilot hole to the mine level, and then attaching the reaming bit, which is then pulled upward to the surface to create the 18-foot opening for the shaft construction. Both of these holes will be open to the mine level to allow any cuttings and fluids encountered to fall to the mine for removal.

RESPEC used the data generated from the Corehole #18 pumping test to develop inflow estimates for an 18-inch-diameter borehole and an 18-foot-diameter shaft. The pump test yielded an estimate of 7.0×10^{-6} cm/s for the average hydraulic conductivity of the Oriskany

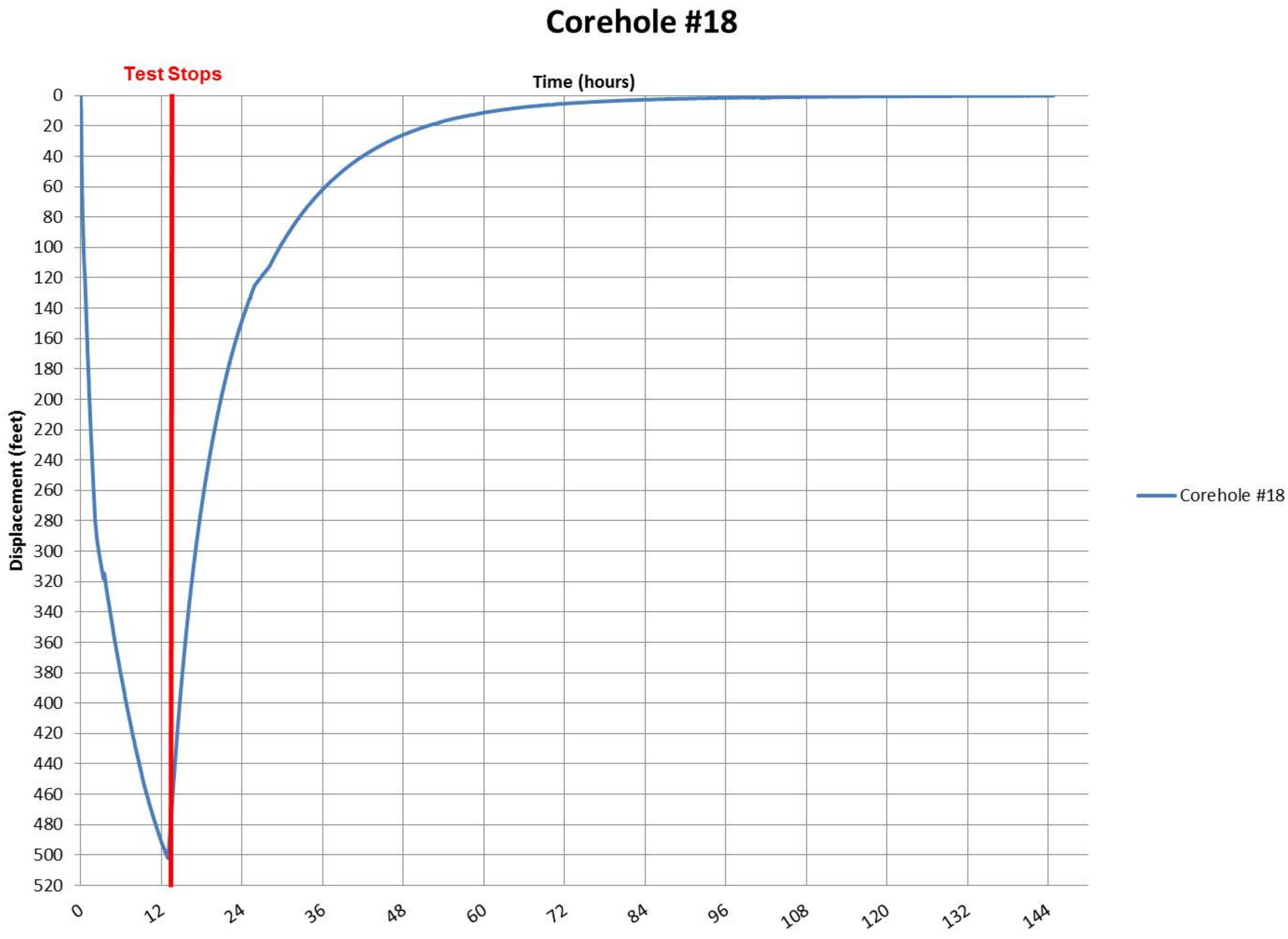

Figure 3-9. Corehole #18 Response to Pumping (Displacement Versus Time).

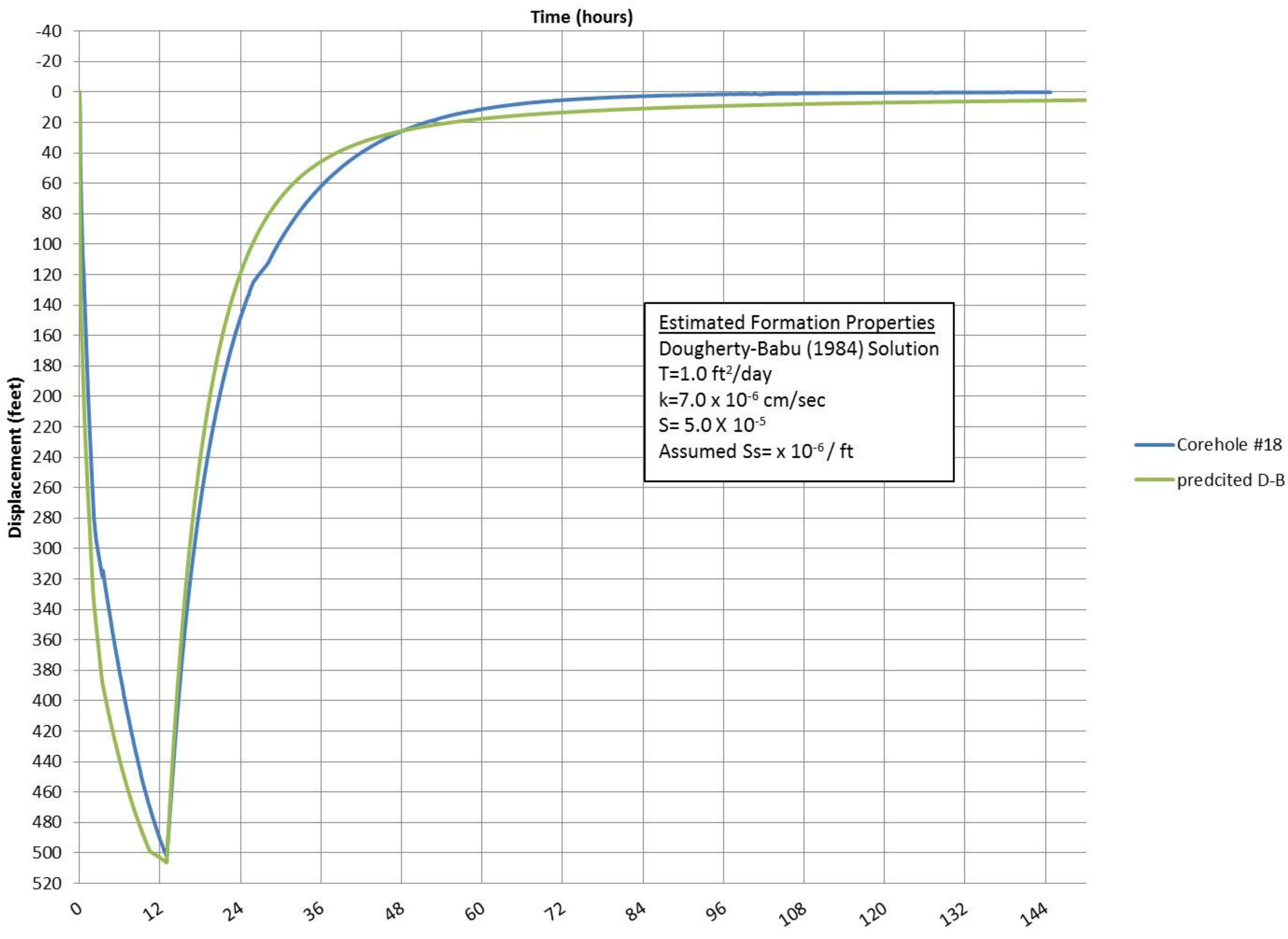

Figure 3-10. Corehole #18 Response to Pumping Compared to the Predicted Response to Pumping.

Sandstone. Considering the lithology and depth of the formation, this estimate seems reasonable. As illustrated in Figure 3-10, the drawdown predicted using this estimate is an excellent match to the drawdown data from the test. Because a single-well pump test cannot yield a reliable estimate of the storativity of the units, RESPEC assumed a typical value of 10^{-6} per foot for the specific storage. The estimate of the hydraulic conductivity is not particularly sensitive to this assumption.

Using the hydraulic conductivity estimate and the assumed value of specific storage, RESPEC used **AQTESOLV** to model the inflow into an 18-inch borehole and 18-foot-diameter shaft maintained at atmospheric pressure by using a forward solution for a constant head model. Considering that the initial fluid level before the pumping test was 502 ft bgs, a drawdown of 979 feet would yield atmospheric pressure down to the base of the Oriskany Sandstone at approximately 1,481 ft bgs. Hard Copies of the **AQTESOLV** data presented in Appendix D and digital copies of the processed pumping test data for this solution are included in the attached CD.

As illustrated in Figure 3-11, the modeling predicts initial inflow rates of 7 and 14 gpm into 18-inch and 18-foot "wells," respectively. After 100 days, these rates are predicted to drop off to less than 4 and 6 gpm, respectively. The actual inflow rates are suspected to be somewhat greater because the larger diameters of the borehole and shaft are likely to intersect a more permeable feature (e.g., fracture) than the small-diameter corehole intercepted. Hence, these estimated inflow values should be used as a general guide only.

3.3 INTERPRETATION OF FORMATION WATER GEOCHEMICAL DATA

During the drilling activities, the test hole was monitored for water production or water loss (an indicator of a permeable zone). As stated above, only one water-bearing zone was observed in the upper portion of the test hole (0–1,555 ft bgs). No water-bearing zones were observed in the lower portion of the test hole (1,555–2,486 ft bgs)

RESPEC's field geologist submitted three water samples collected during the drilling program for laboratory analysis (Table 2-4). Two of these samples were from the water-bearing zone in the Oriskany Sandstone at approximately 1,490 ft bgs. The third sample was from the drilling fluids used during the coring operations. The results of the laboratory analysis are presented in Table 3-2. RESPEC reviewed and interpreted the major ion, stable isotope, and tritium data for water-return samples.

As shown in Table 3-2, the two water samples interpreted to be Oriskany brine (Samples #18-1490 and CH#18-PT-002) have chloride and total dissolved solids concentrations that are typical of regional conditions for fluids in deep subsurface formations. What is significant to note is the presence of tritium in the formation water samples and their stable isotopic signatures. The detectable tritium indicates the presence of some modern (i.e., post-1960) water. Small quantities of water used during the air-rotary portion of the drilling could possibly have introduced modern meteoritic water into the borehole. Drilling water could explain the

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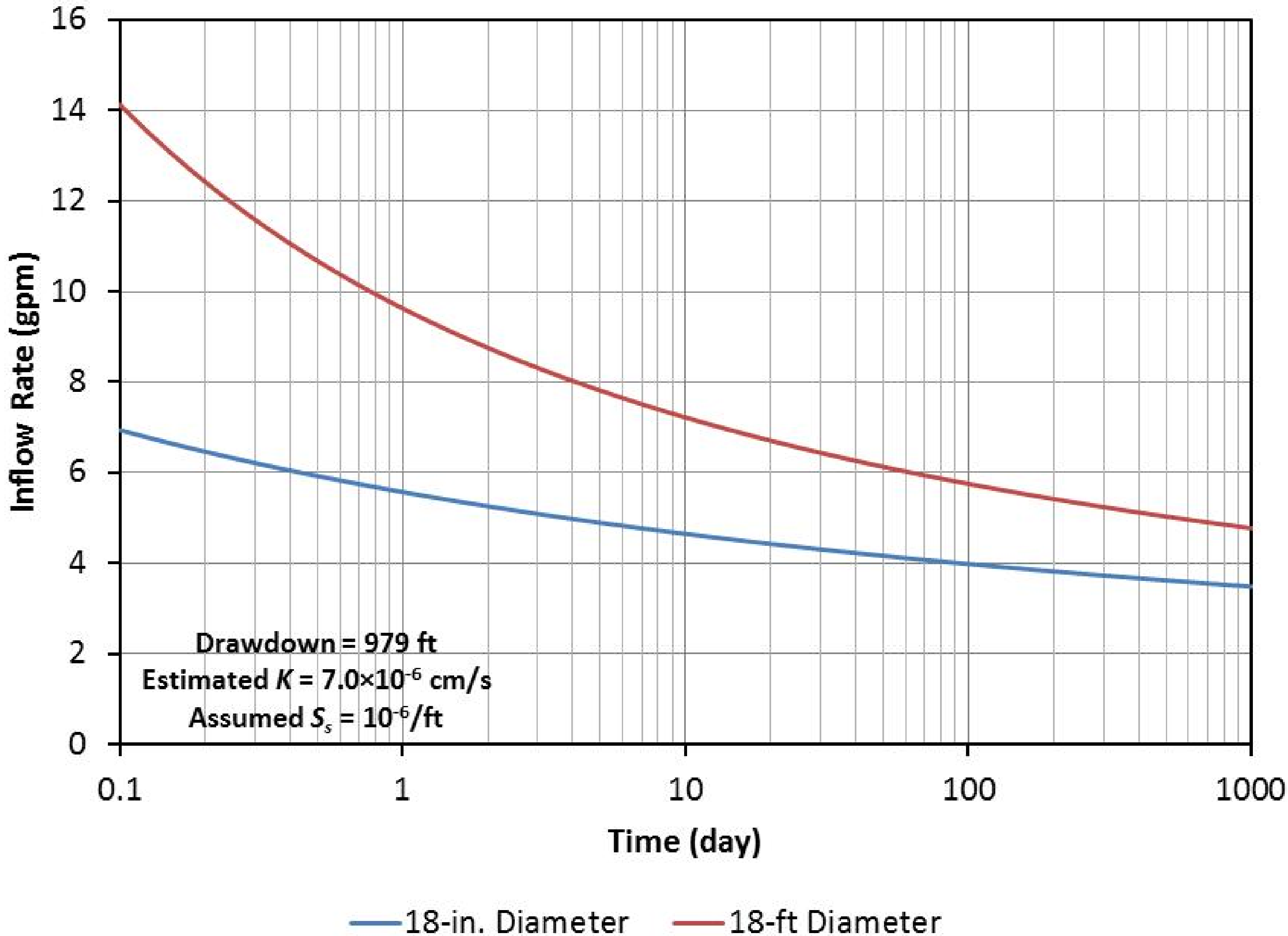

Figure 3-11. Predicted Water Production From an 18-Inch- (Pilot Hole) and 18-Foot- (Shaft) Diameter Borehole.

low levels found in Sample #18-1490, which was collected after penetrating the Oriskany water-bearing zone during the air-rotary drilling program. However, the tritium levels actually increase for the sample collected during the pumping test (Sample CH#18-PT-002). This sample was collected nearly a month after the rotary drilling was completed—a period of time after which artificially introduced fluids would be expected to have been removed through the system. Additionally, Sample CH#18-PT-002 was collected after pumping formation water from the corehole for over 9 hours. If the detected tritium in the initial sample were reflective of drilling fluid contamination, the levels would be expected to decrease from the first sample to the second and not increase. Therefore, RESPEC believes these results reflect the presence of modern (i.e., post-1960) meteoric waters in the formation.

Table 3-2. Water Sample Analytical Results

	Sample I.D.		
	#18-1490	**CH#18-PT-002**	**CH#18-drillingbrine**
Date	5/22/13	6/24/13	7/16/13
Alkalinity (milligrams per liter [mg/L])	1,310	92	40
Chloride (mg/L)	95,900	130,000	220,000
Density (grams per milliliter [g/mL])	1.16	1.14	1.2
Calcium (mg/L)	12,200	7,040	2,870
Magnesium (mg/L)	2,000	1,880	508
Potassium (mg/L)	1,840	720	393
Sodium (mg/L)	12,300	39,200	102,000
Total Dissolved Solids (mg/L)	178,000	190,000	280,000
Sulfate (mg/L)	282	1,600	5,000
δD H_2O (%)	–74.1	–74.9	–40.1
$\delta^{18}O$ H_2O (%)	–9.99	–10.26	–7.53
Tritium (TU)	0.84	1.94	15.5
Standard Deviation	0.15	0.17	0.3

Note: Major ion analyses by Paradigm Environment Services and stable isotope and tritium analyses by Isotech Laboratories.

As illustrated in Figure 3-12, the stable isotope samples analyzed fit along the meteoric water line, which is indicative of the Oriskany Formation waters having entered the geologic system via atmospheric precipitation. Low-level detections of tritium also exist in the Oriskany samples. This tritium could be residual drilling fluid contamination from the air-rotary, but it could also mean some post-1960 water has found its way into the local Oriskany section. The detectable tritium cannot be explained as coring fluid, however, because the brine used for coring has a distinctively heavier isotopic signature (note where the drilling fluid sample plots along the meteoric water line in Figure 3-12). At the present time, RESPEC cannot discount

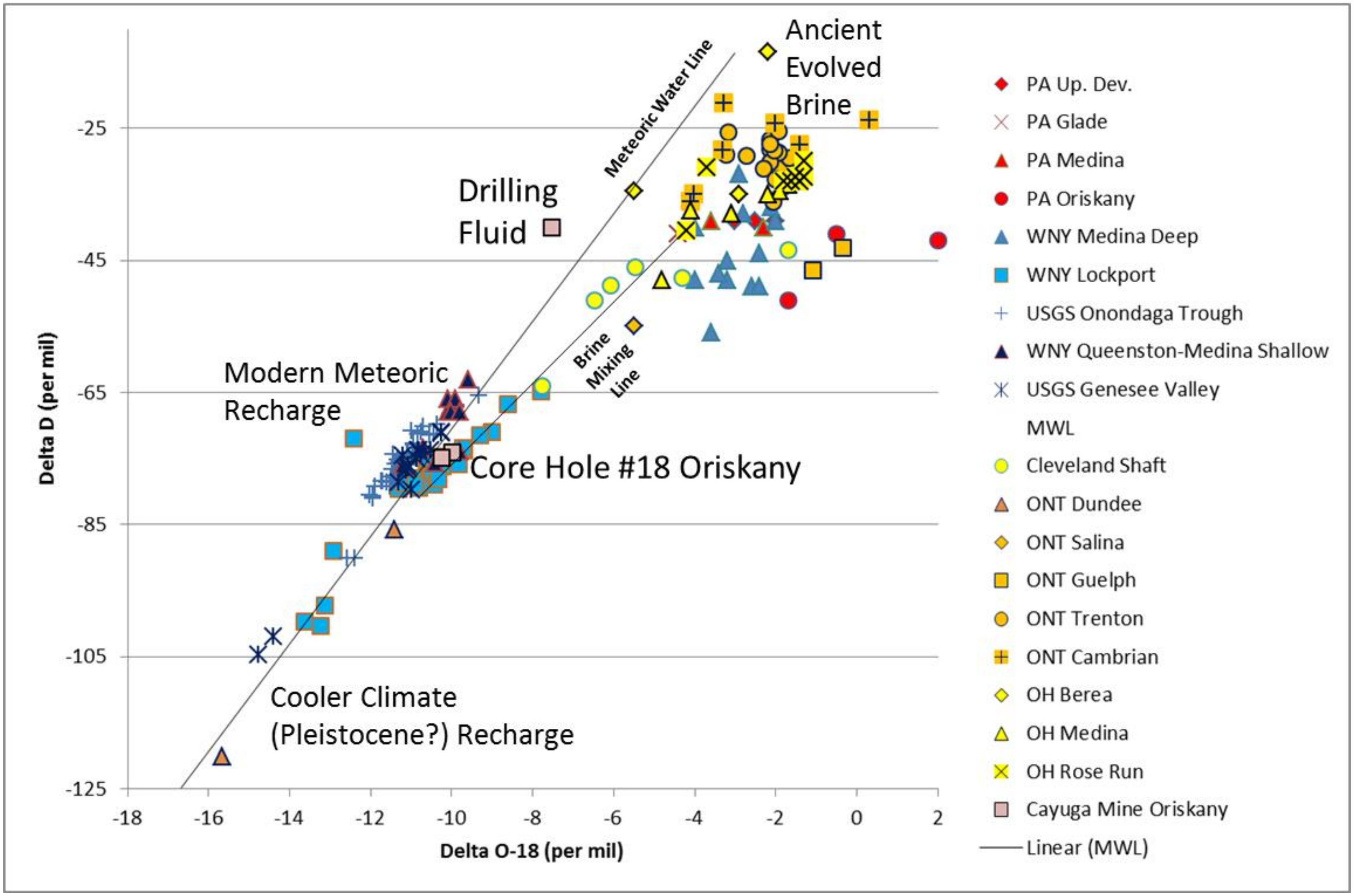

Figure 3-12. Comparison of Corehole #18 Isotope Samples With Regional Isotope Data Points.

the presence of modern water in the Oriskany section in Corehole #18. The lake trough penetrates into the Helderberg Group carbonates approximately 4,000 feet west-southwest Corehole #18. The subglacial aquifer under the sediments in the lake could be the source of this water. However, RESPEC does not believe this is the likely source of the isotopic signature, because the isotopic signature of the fluid does not plot in the portion of the graph indicative of cold climate, glacial recharge.

RESPEC suspects that these isotope results could be the result of fluid losses during decades of solution-mining at Ludlowville. The abandoned solution mining operation is located 3 miles to the south of the Corehole #18 site.

3.4 GEOMECHANICAL LABORATORY TESTING OF CORE SAMPLES

To better understand the bedrock strength above the mine, both for the purposes of the #4 shaft installation and to aid Cargill with its mine stability studies, and to understand the nature of the salt in the area of #4 shaft, geomechanical testing samples were selected. The emphasis of the testing was on the strength of the carbonate strata above the salts (Helderberg Group through the Camillus Formation) and the potentially mined salts. For the purposes of this testing, the Helderberg Group and Bertie Formation were treated as one geologic unit, and the sample selection was conducted on a uniform spacing basis through these units. Uniform spacing was also used through the Camillus Formation. RESPEC selected 28 core specimens from the carbonate roof bedrock and select salt zones for geomechanical testing. Table 3-3 presents the core sample depths and the analysis performed. Cargill indicated that additional testing above and beyond these 37 samples may be requested. Both this initial testing and any additional testing will be reported under separate cover from RESPEC's in-house rock mechanics laboratory.

3.5 SUMMARY OF FINDINGS

A brief summary of the findings of Corehole #18 includes the following.

1. The stratigraphy in the area of the test hole was typical of regional stratigraphy.
   a. The #6 Salt currently mined by Cargill is approximately 16 feet thick and appears to be of similar purity to the currently mined sections. The #4, #4A lower, and #5 salts, which are of potential interest to Cargill, are 47 feet, 50 feet, and 15 feet in thickness, respectively.
   b. No evidence of faulting exists at the #6 Salt level in Corehole #18.
2. One water-bearing zone (in the Oriskany-Onondaga section) was encountered during the installation of Corehole #18. This zone produced a sustainable flow rate of less than 3 gpm. Computer modeling of the zone's production, based on a pumping test, estimates

initial production rates for an 18-inch pilot hole and 18-foot open shaft of 7 gpm and 14 gpm, respectively, which will decrease to 4 gpm and 6 gpm, respectively, over time.

3. Water geochemistry indicates the presence of modern meteoric water in the Oriskany Sandstone could potentially be the result of decades of solution mining between the current mine shaft location and the #4 Shaft location.

Table 3-3. Summary of Samples Selected for Geomechanical Analysis

Sample Depth	Sample Formation	Analytical Parameters
1,559–1,559.6	Carbonates	Triaxial Compression
1,564.9–1,565.6	Carbonates	Uniaxial Compression, Brazilian
1,583.8–1,584.4	Carbonates	Triaxial Compression
1,609.2–1,609.8	Carbonates	Triaxial Compression
1,616.6–1,617.4	Carbonates	Uniaxial Compression, Brazilian
1,635.4–1,636	Carbonates	Triaxial Compression
1,660.4–1,661.1	Carbonates	Triaxial Compression
1,664.8–1,665.7	Carbonates	Uniaxial Compression, Brazilian
1,683.25–1,683.9	Carbonates	Triaxial Compression
1,708.7–1,709.5	Carbonates	Triaxial Compression
1,715–1,716	Carbonates	Uniaxial Compression, Brazilian
1,733–1,734	Carbonates	Triaxial Compression
1,759.6–1,760.7	Carbonates	Triaxial Compression
1,764.8–1,765.8	Carbonates	Uniaxial Compression, Brazilian
1,778.8–1,779.4	Carbonates	Triaxial Compression
1,799.3–1,799.7	Camillus Formation	Uniaxial Compression
1,814.5–1,815	Camillus Formation	Uniaxial Compression
1,832.4–1,833	Camillus Formation	Uniaxial Compression
1,846.8–1,847.2	Camillus Formation	Uniaxial Compression
1,862.9–1,863.3	Camillus Formation	Uniaxial Compression
2,129.6–2,129.95	#4 salt	X Ray Diffraction
2,142.5–2,142.9	#4 salt	X Ray Diffraction
2,338.9–2,339.9	#5 Salt	X Ray Diffraction, Creep Testing
2,345.6–2,346	#5 Salt	X Ray Diffraction
2,348–2,349	#5 Salt	X Ray Diffraction, Creep Testing
2,385.1–2,386	#6 Salt	X Ray Diffraction, Creep Testing
2,389.3–2,390.3	#6 Salt	X Ray Diffraction, Creep Testing
2,395.6–2,396	#6 Salt	X Ray Diffraction

Note: the depths reflect the core deep below ground surface.
Carbonates = Helderberg Group through the Bertie Formation

4.0 REFERENCES

Dougherty, D. E and D. K. Babu, 1984. “Flow to a Partially Penetrating Well in a Double-Porosity Reservoir,” *Water Resources Research*, Vol. 20, No. 8, pp. 1116–1122.

APPENDIX A

CHIP SAMPLE PHOTOGRAPHS

RSI-2099-13-022

Figure A-1. Corehole #18: 4–26 Feet Below Ground Surface.

RSI-2099-13-023

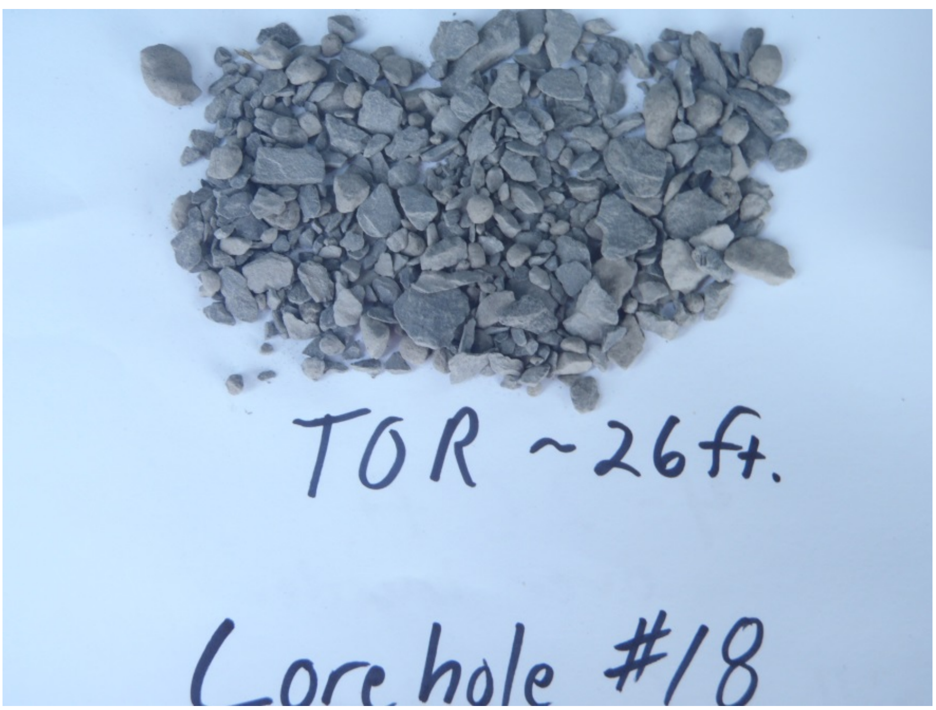

Figure A-2. Corehole #18: Approximately 26 Feet Below Ground Surface. Genesee Formation–Sherburne Member.

RSI-2099-13-024

Figure A-3. Corehole #18: 52 Feet Below Ground Surface.
Genesee Shale Formation–Sherburne Member.

RSI-2099-13-025

Figure A-4. Corehole #18: 72 Feet Below Ground Surface.
Genesee Shale Formation–Sherburne Member.

RSI-2099-13-026

Figure A-5. Corehole #18: 92 Feet Below Ground Surface. Genesee Shale Formation–Sherburne Member.

RSI-2099-13-027

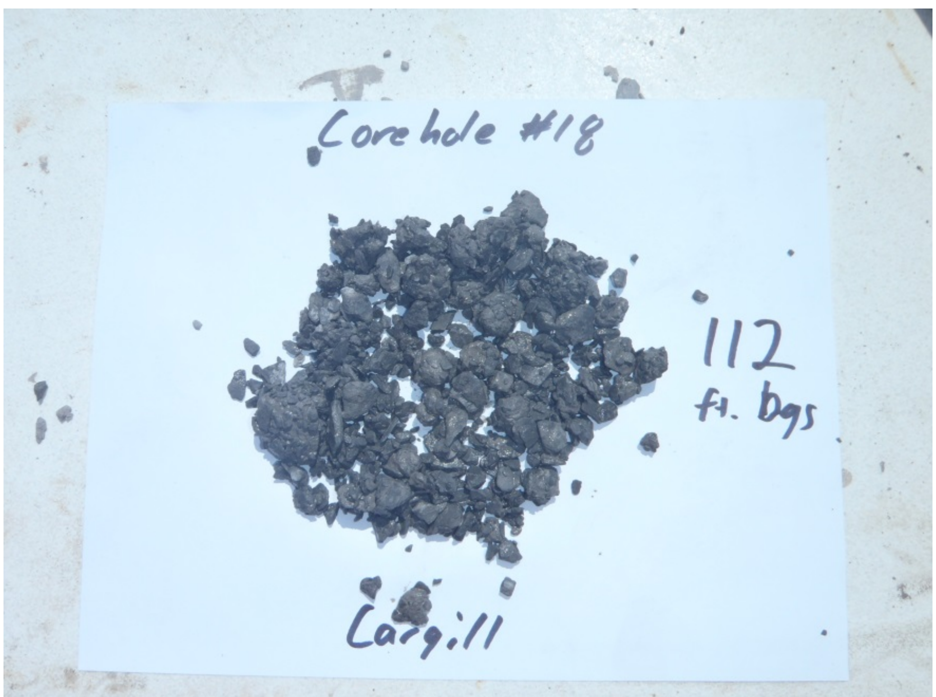

Figure A-6. Corehole #18: 112 Feet Below Ground Surface. Genesee Shale Formation–Sherburne Member.

RSI-2099-13-028

Figure A-7. Corehole #18: 132 Feet Below Ground Surface.
Genesee Shale Formation–Sherburne Member.

RSI-2099-13-029

Figure A-8. Corehole #18: 152 Feet Below Ground Surface.
Genesee Shale Formation–Sherburne Member.

RSI-2099-13-030

Figure A-9. Corehole #18: 172 Feet Below Ground Surface.
Genesee Shale Formation–Sherburne Member.

RSI-2099-13-031

Figure A-10. Corehole #18: 192 Feet Below Ground Surface.
Genesee Shale Formation–Hubbard Quarry Member.

RSI-2099-13-032

Figure A-11. Corehole #18: 212 Feet Below Ground Surface.
Genesee Shale Formation–Hubbard Quarry Member.

RSI-2099-13-033

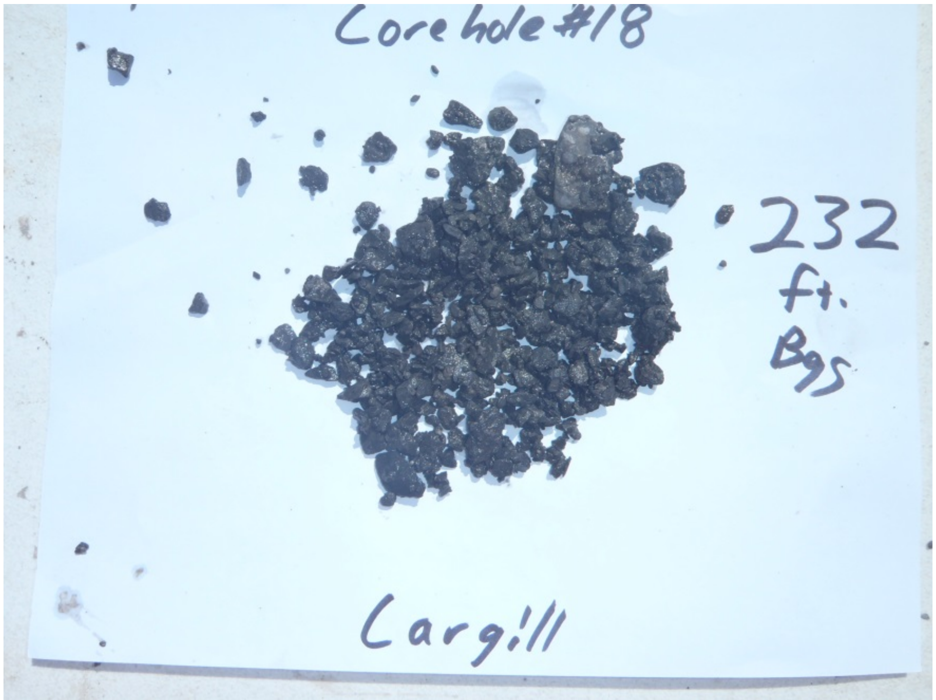

Figure A-12. Corehole #18: 232 Feet Below Ground Surface.
Genesee Shale Formation–Hubbard Quarry Member.

RSI-2099-13-034

Figure A-13. Corehole #18: 252 Feet Below Ground Surface.
Genesee Shale Formation–Geneseo Shale Member.

RSI-2099-13-035

Figure A-14. Corehole #18: 272 Feet Below Ground Surface.
Genesee Shale Formation–Geneseo Shale Member.

RSI-2099-13-036

Figure A-15. Corehole #18: 292 Feet Below Ground Surface.
Genesee Shale Formation–Geneseo Shale Member.

RSI-2099-13-037

Figure A-16. Corehole #18: 312 Feet Below Ground Surface.
Genesee Shale Formation–Geneseo Shale Member.

Figure A-17. Corehole #18: 332 Feet Below Ground Surface.
Genesee Shale Formation–Geneseo Shale Member.

RSI-2099-13-039

Figure A-18. Corehole #18: 352 Feet Below Ground Surface.
Genesee Shale Formation–Geneseo Shale Member.

RSI-2099-13-040

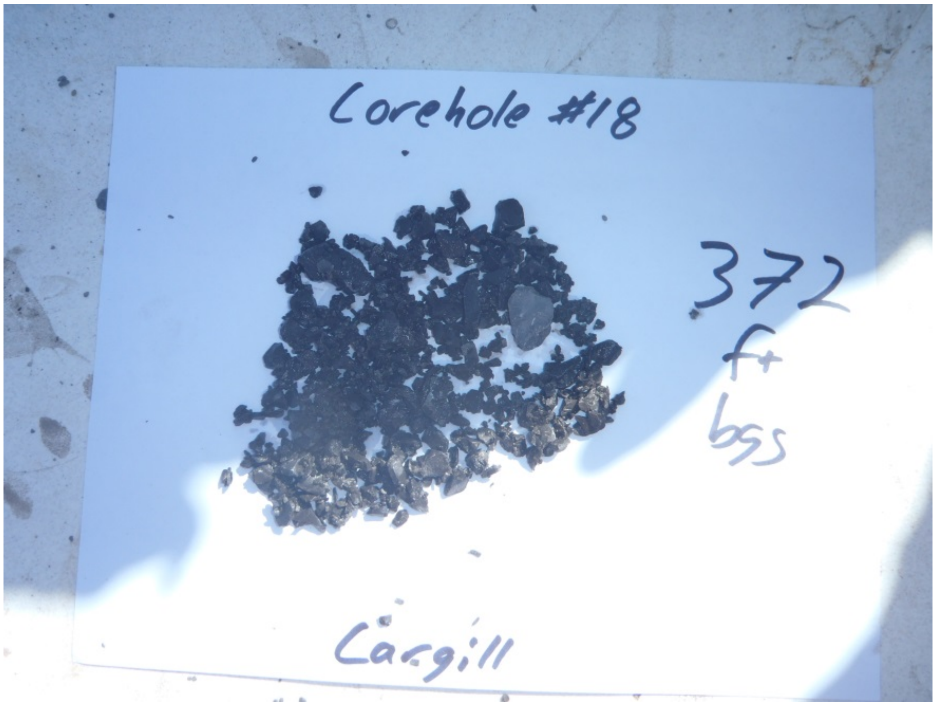

Figure A-19. Corehole #18: 372 Feet Below Ground Surface.
Hamilton Group: Moscow Shale Formation–Kashong Member.

RSI-2099-13-041

Figure A-20. Corehole #18: 392 Feet Below Ground Surface.
Hamilton Group: Moscow Shale Formation–Kashong Member.

RSI-2099-13-042

Figure A-21. Corehole #18: 412 Feet Below Ground Surface.
Hamilton Group: Moscow Shale Formation–Kashong Member.

RSI-2099-13-043

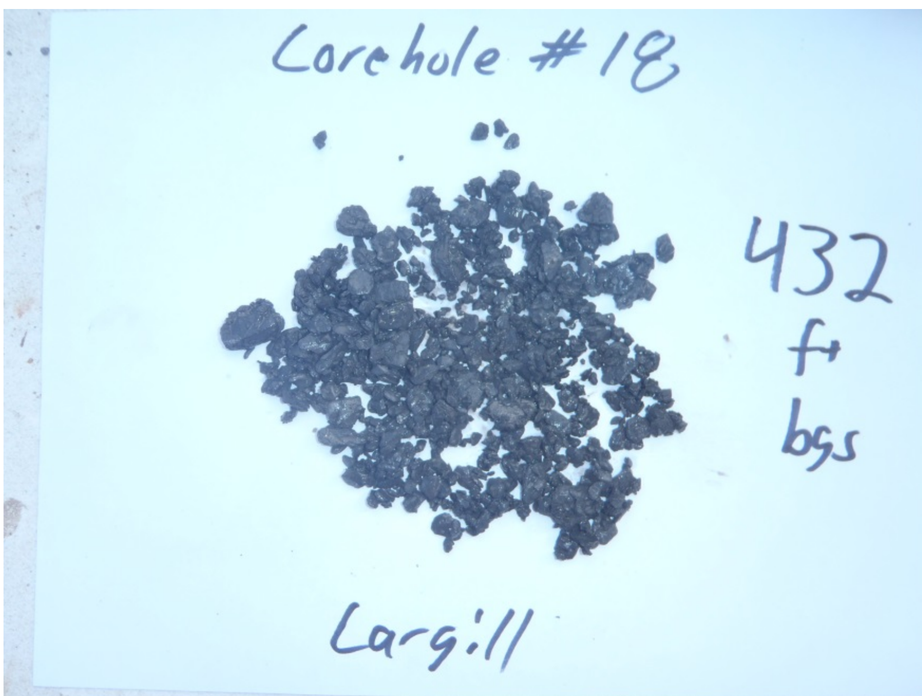

Figure A-22. Corehole #18: 432 Feet Below Ground Surface.
Hamilton Group: Moscow Shale Formation–Kashong Member.

RSI-2099-13-044

Figure A-23. Corehole #18: 452 Feet Below Ground Surface.
Hamilton Group: Moscow Shale Formation–Kashong Member.

RSI-2099-13-045

Figure A-24. Corehole #18: 472 Feet Below Ground Surface.
Hamilton Group: Moscow Shale Formation–Windom Member.

RSI-2099-13-046

Figure A-25. Corehole #18: 492 Feet Below Ground Surface.
Hamilton Group: Moscow Shale Formation–Kashong Member.

RSI-2099-13-047

Figure A-26. Corehole #18: 512 Feet Below Ground Surface.
Hamilton Group: Ludlowville Shale Formation–Spafford Member.

RSI-2099-13-048

Figure A-27. Corehole #18: 532 Feet Below Ground Surface.
Hamilton Group: Ludlowville Shale Formation–Spafford Member.

RSI-2099-13-049

Figure A-28. Corehole #18: 552 Feet Below Ground Surface.
Hamilton Group: Ludlowville Shale Formation–Spafford Member.

RSI-2099-13-050

Figure A-29. Corehole #18: 572 Feet Below Ground Surface.
Hamilton Group: Ludlowville Shale Formation–Ivy Point Member.

RSI-2099-13-051

Figure A-30. Corehole #18: 592 Feet Below Ground Surface.
Hamilton Group: Ludlowville Shale Formation–Otisco Member.

RSI-2099-13-052

Figure A-31. Corehole #18: 600 Feet Below Ground Surface.
Hamilton Group: Ludlowville Shale Formation–Otisco Member.

RSI-2099-13-053

Figure A-32. Corehole #18: 620 Feet Below Ground Surface.
Hamilton Group: Ludlowville Shale Formation–Otisco Member.

RSI-2099-13-054

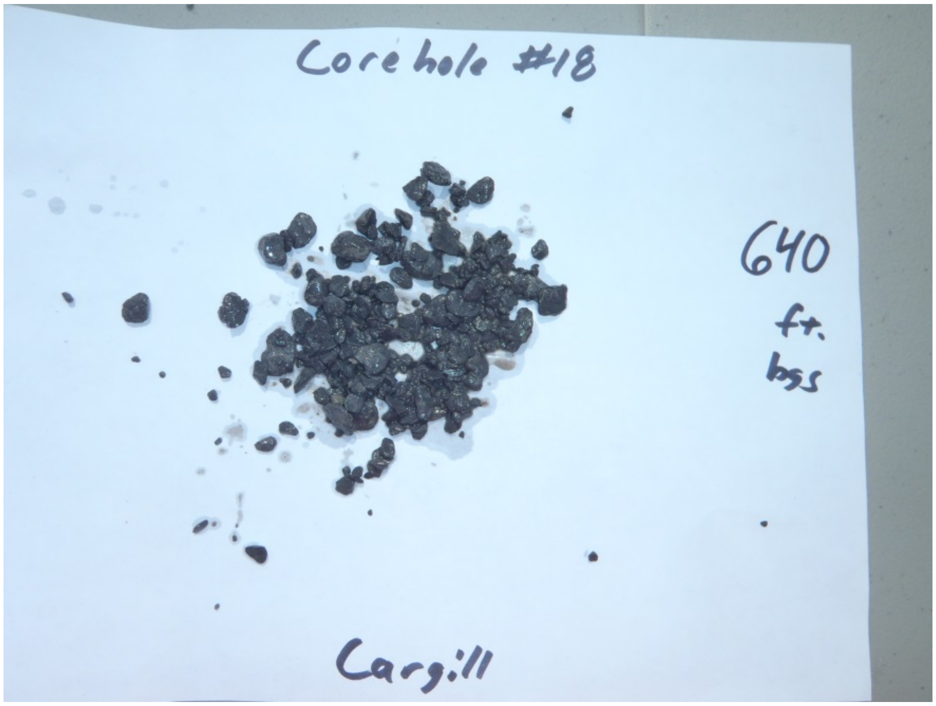

Figure A-33. Corehole #18: 640 Feet Below Ground Surface.
Hamilton Group: Ludlowville Shale Formation–Otisco Member.

RSI-2099-13-055

Figure A-34. Corehole #18: 660 Feet Below Ground Surface.
Hamilton Group: Ludlowville Shale Formation–Otisco Member.

RSI-2099-13-056

Figure A-35. Corehole #18: 680 Feet Below Ground Surface.
Hamilton Group: Ludlowville Shale Formation–Otisco Member.

RSI-2099-13-057

Figure A-36. Corehole #18: 700 Feet Below Ground Surface.
Hamilton Group: Ludlowville Shale Formation–Otisco Member.

RSI-2099-13-058

Figure A-37. Corehole #18: 720 Feet Below Ground Surface.
Hamilton Group: Ludlowville Shale Formation–Otisco Member.

RSI-2099-13-059

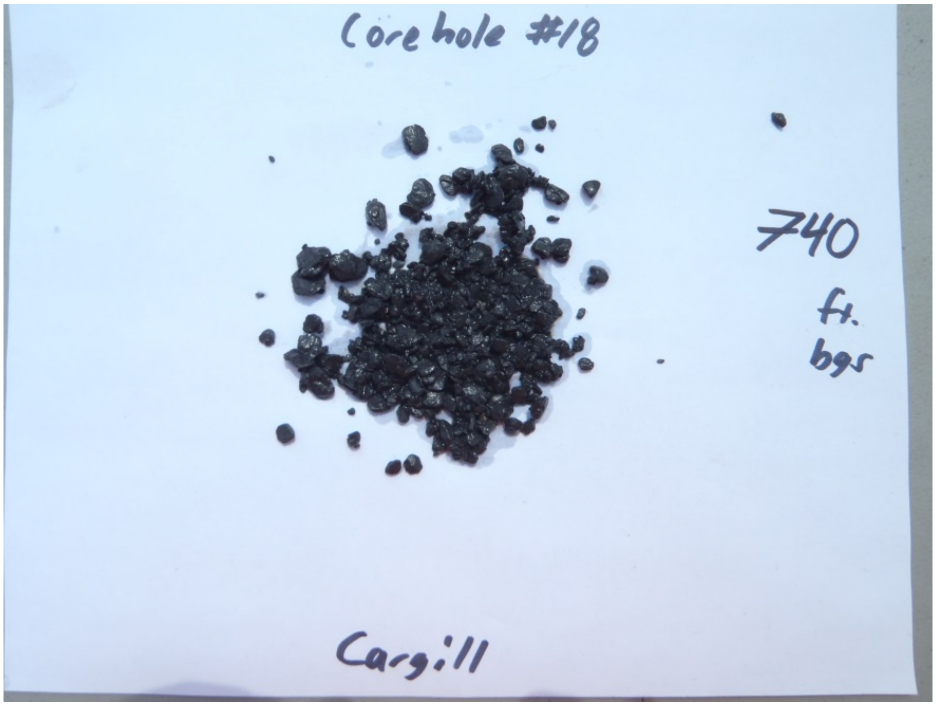

Figure A-38. Corehole #18: 740 Feet Below Ground Surface.
Hamilton Group: Ludlowville Shale Formation–Otisco Member.

RSI-2099-13-060

Figure A-39. Corehole #18: 760 Feet Below Ground Surface.
Hamilton Group: Ludlowville Shale Formation–Centerfield Member.

RSI-2099-13-061

Figure A-40. Corehole #18: 780 Feet Below Ground Surface.
Hamilton Group: Ludlowville Shale Formation–Centerfield Member.

RSI-2099-13-062

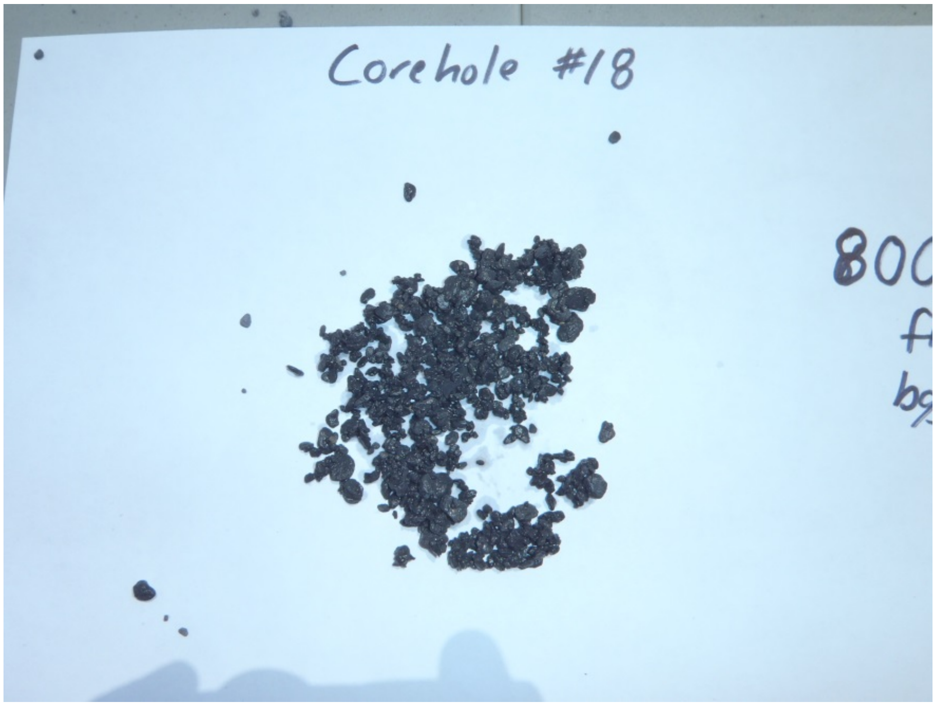

Figure A-41. Corehole #18: 800 Feet Below Ground Surface.
Hamilton Group: Skaneatleles Shale Formation–Butternut Shale Member.

RSI-2099-13-063

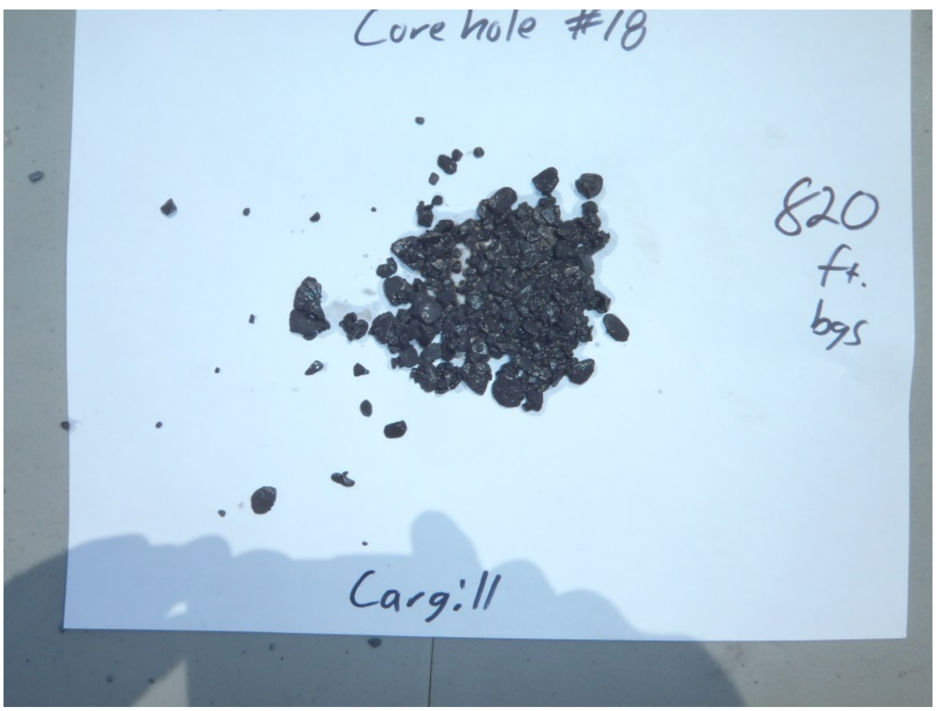

Figure A-42. Corehole #18: 820 Feet Below Ground Surface.
Hamilton Group: Skaneatleles Shale Formation–Butternut Shale Member.

RSI-2099-13-064

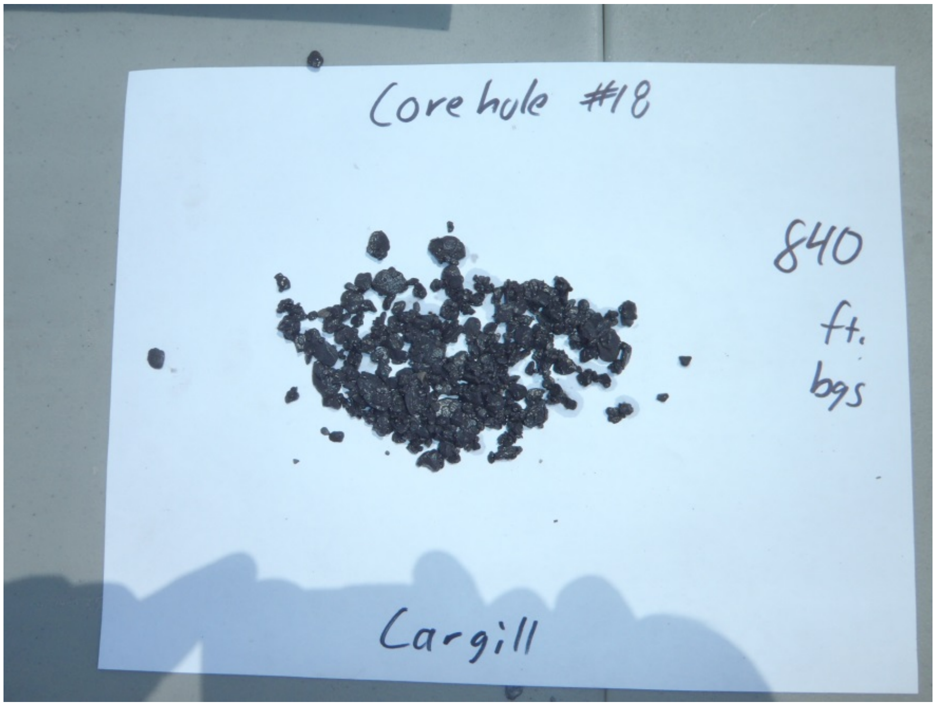

Figure A-43. Corehole #18: 840 Feet Below Ground Surface.
Hamilton Group: Skaneatleles Shale Formation–Butternut Shale Member.

RSI-2099-13-065

Figure A-44. Corehole #18: 860 Feet Below Ground Surface.
Hamilton Group: Skaneatleles Shale Formation–Butternut Shale Member.

RSI-2099-13-066

Figure A-45. Corehole #18: 880 Feet Below Ground Surface.
Hamilton Group: Skaneatleles Shale Formation–Butternut Shale Member.

RSI-2099-13-067

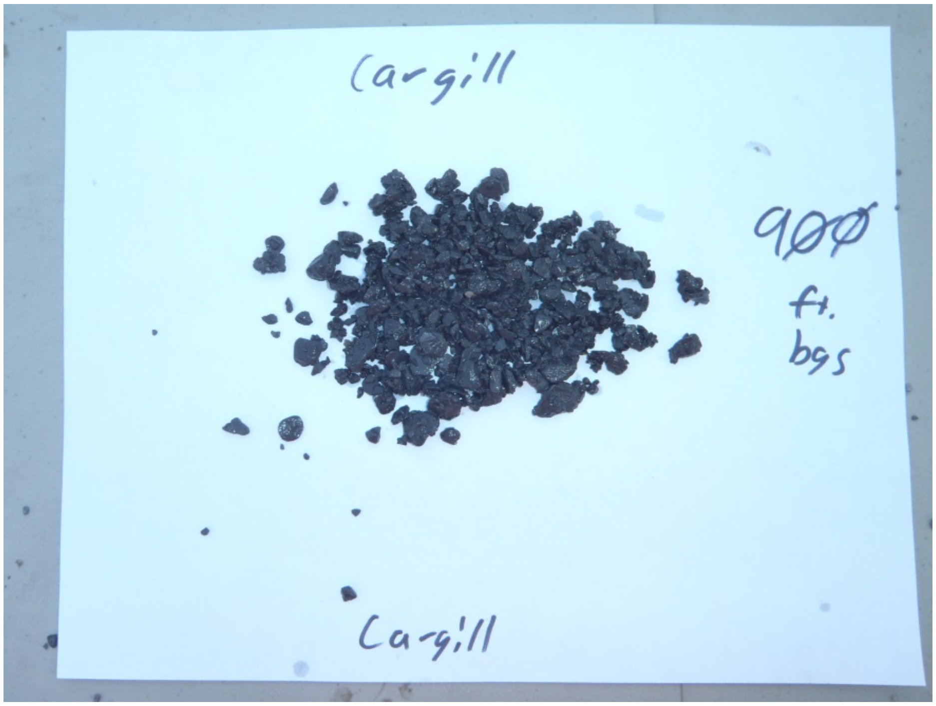

Figure A-46. Corehole #18: 900 Feet Below Ground Surface.
Hamilton Group: Skaneatleles Shale Formation–Butternut Shale Member.

RSI-2099-13-068

Figure A-47. Corehole #18: 920 Feet Below Ground Surface.
Hamilton Group: Skaneatleles Shale Formation–Butternut Shale Member.

RSI-2099-13-069

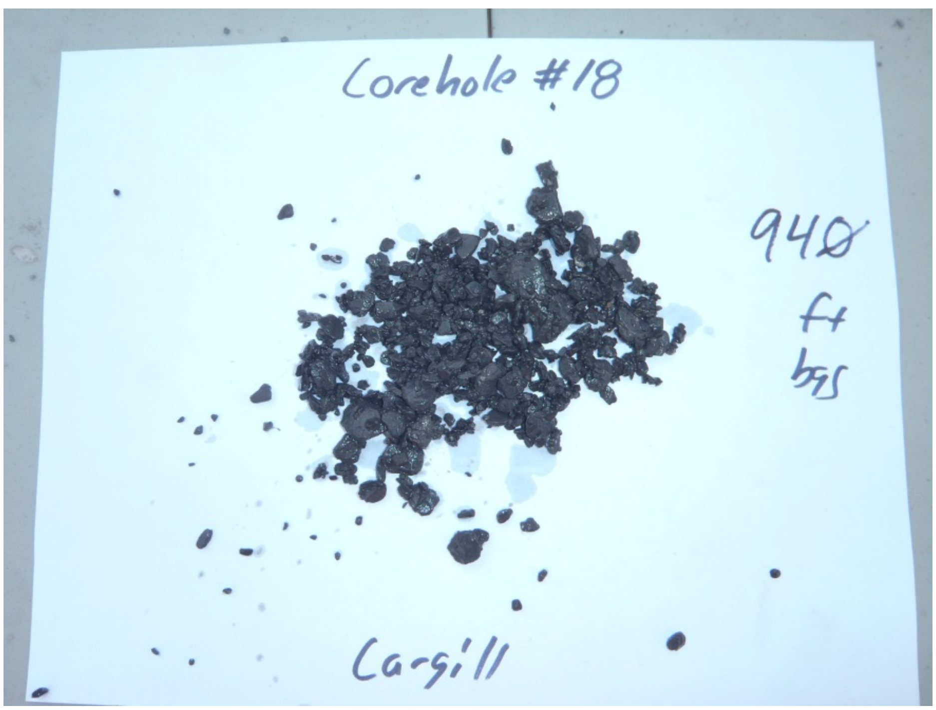

Figure A-48. Corehole #18: 940 Feet Below Ground Surface.
Hamilton Group: Skaneatleles Shale Formation–Butternut Shale Member.

RSI-2099-13-070

Figure A-49. Corehole #18: 960 Feet Below Ground Surface.
Hamilton Group: Skaneatleles Shale Formation–Butternut Shale Member.

RSI-2099-13-071

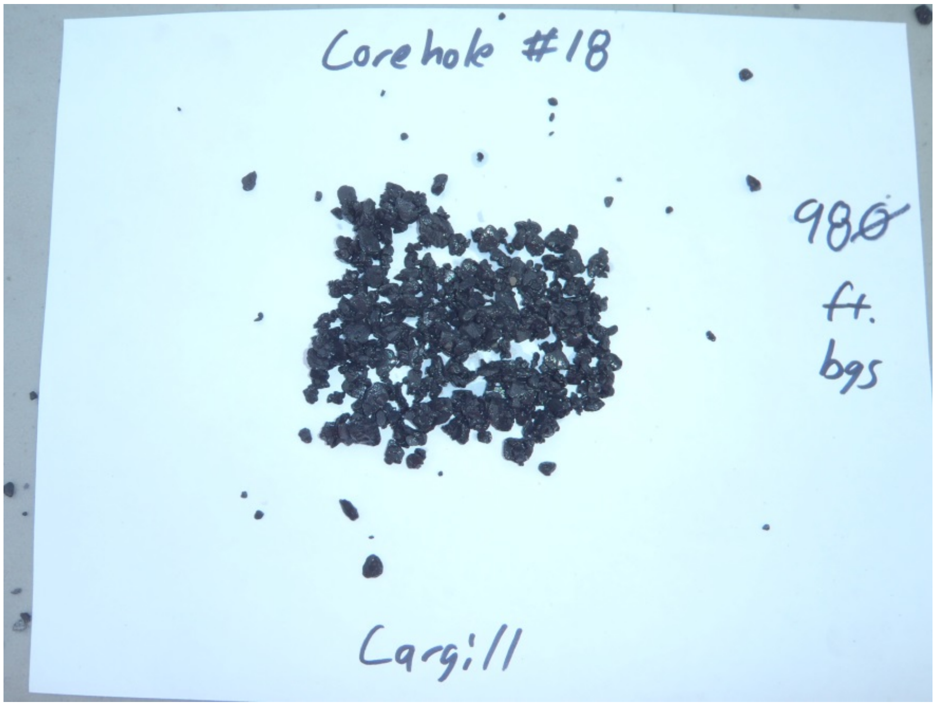

Figure A-50. Corehole #18: 980 Feet Below Ground Surface.
Hamilton Group: Skaneatleles Shale Formation–Pompey Member.

RSI-2099-13-072

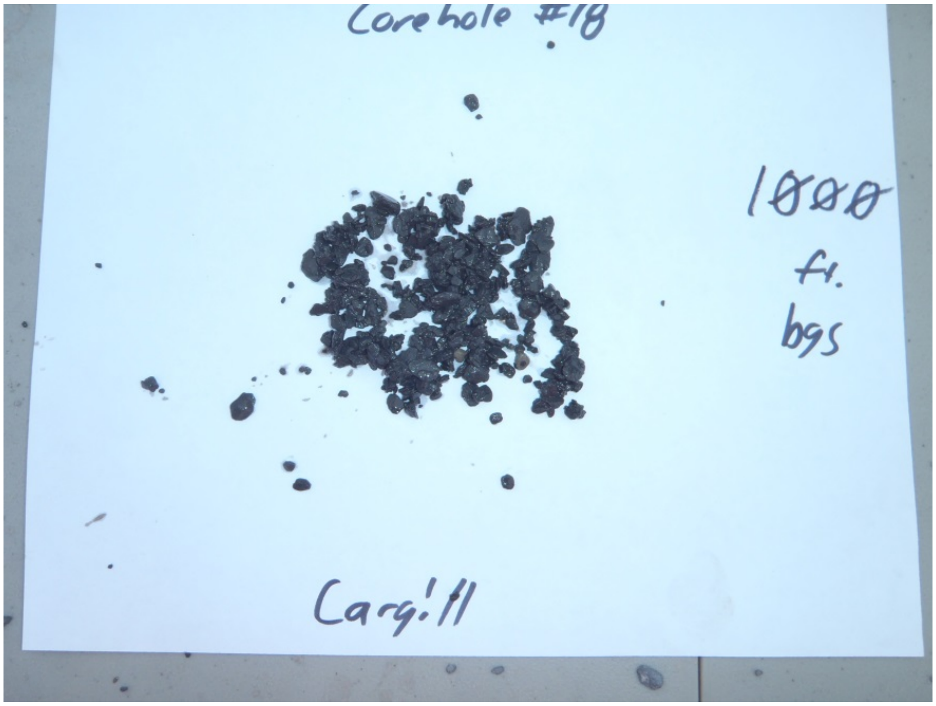

Figure A-51. Corehole #18: 1,000 Feet Below Ground Surface.
Hamilton Group: Skaneatleles Shale Formation–Pompey Member.

RSI-2099-13-073

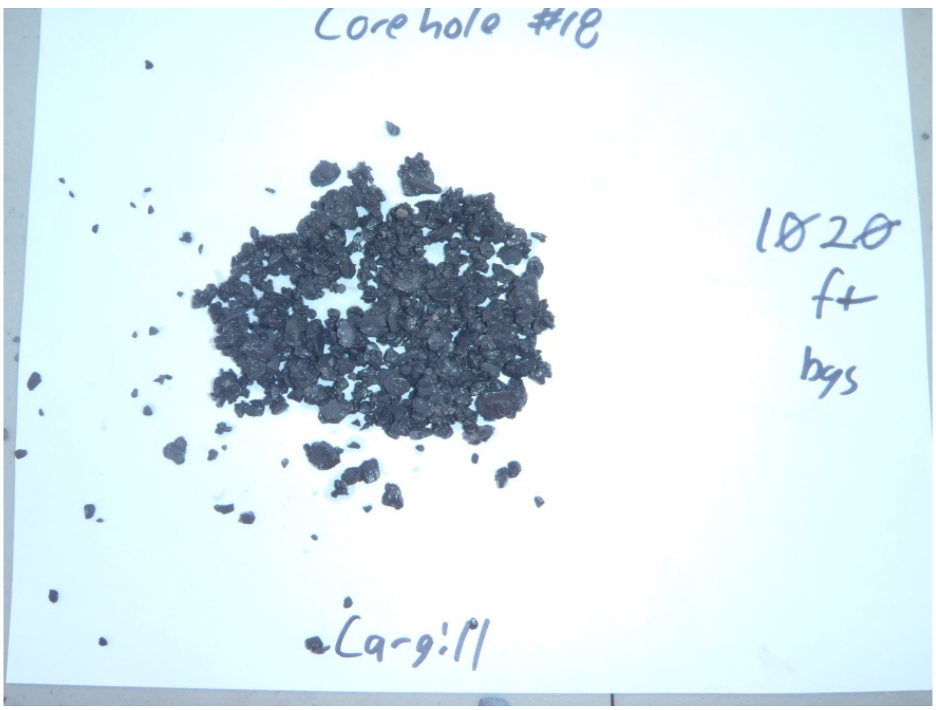

Figure A-52. Corehole #18: 1,020 Feet Below Ground Surface.
Hamilton Group: Skaneatleles Shale Formation–Pompey Member.

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RSI-2099-13-074

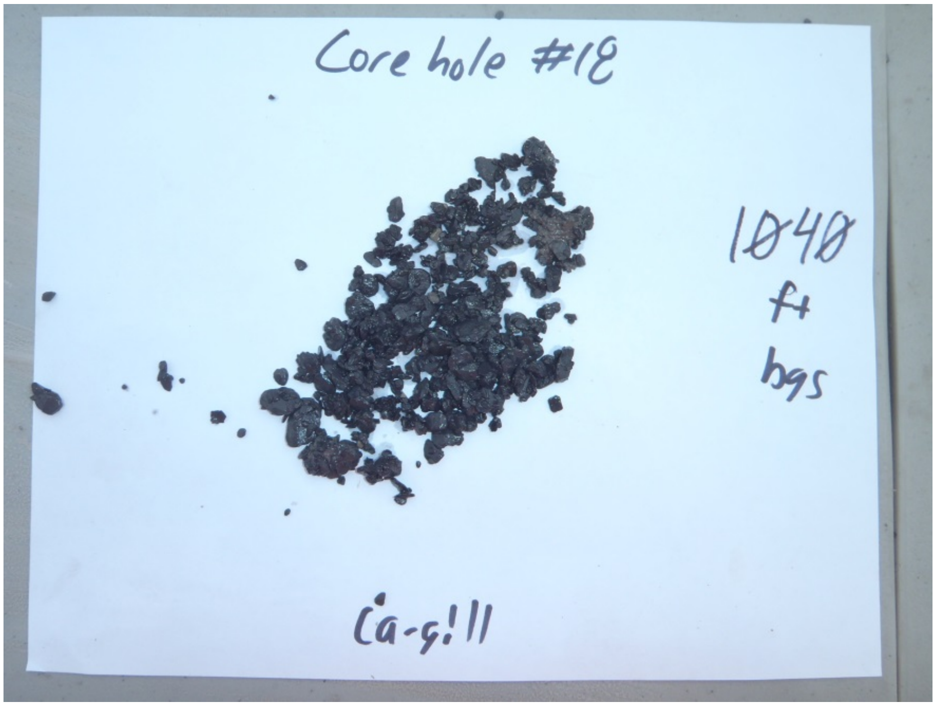

Figure A-53. Corehole #18: 1,040 Feet Below Ground Surface.
Hamilton Group: Skaneatleles Shale Formation–Pompey Member.

RSI-2099-13-075

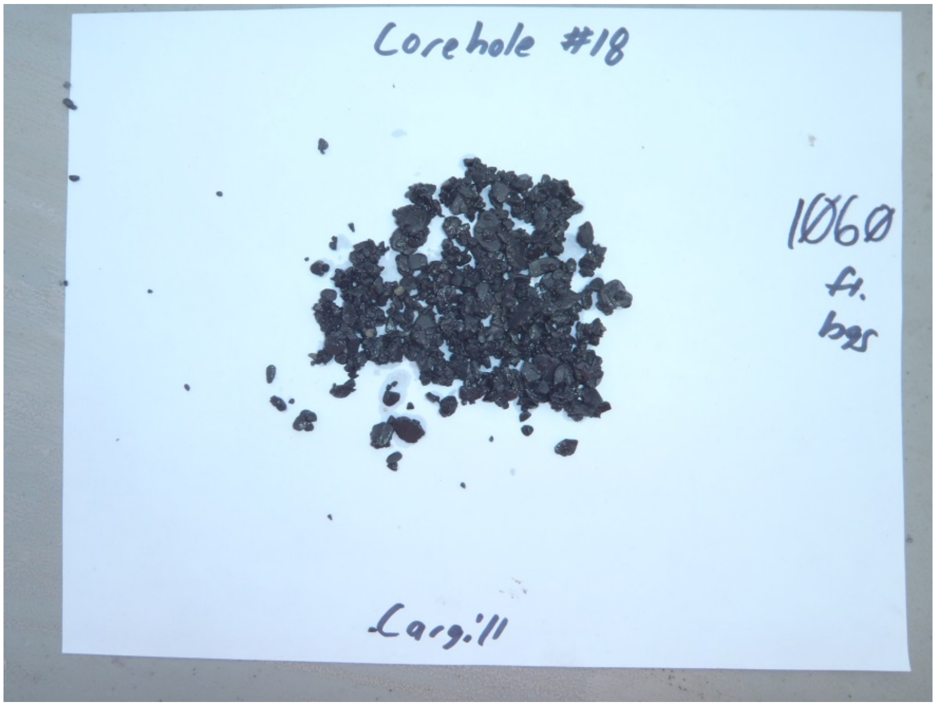

Figure A-54. Corehole #18: 1,060 Feet Below Ground Surface.
Hamilton Group: Skaneatleles Shale Formation–Pompey Member.

RSI-2099-13-076

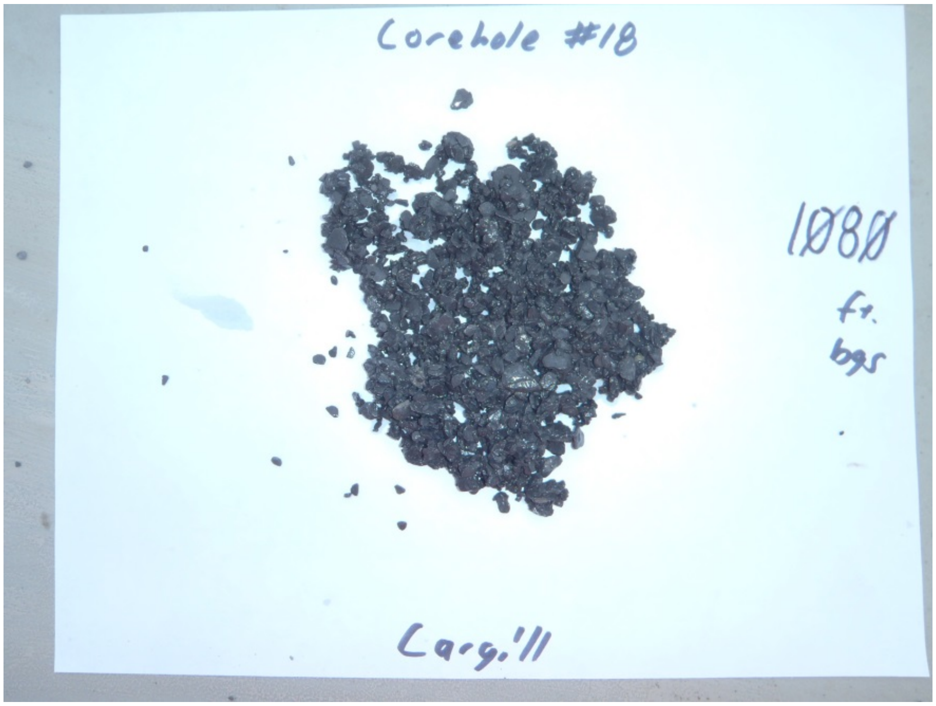

Figure A-55. Corehole #18: 1,080 Feet Below Ground Surface.
Hamilton Group: Skaneatleles Shale- Pompey Member.

RSI-2099-13-077

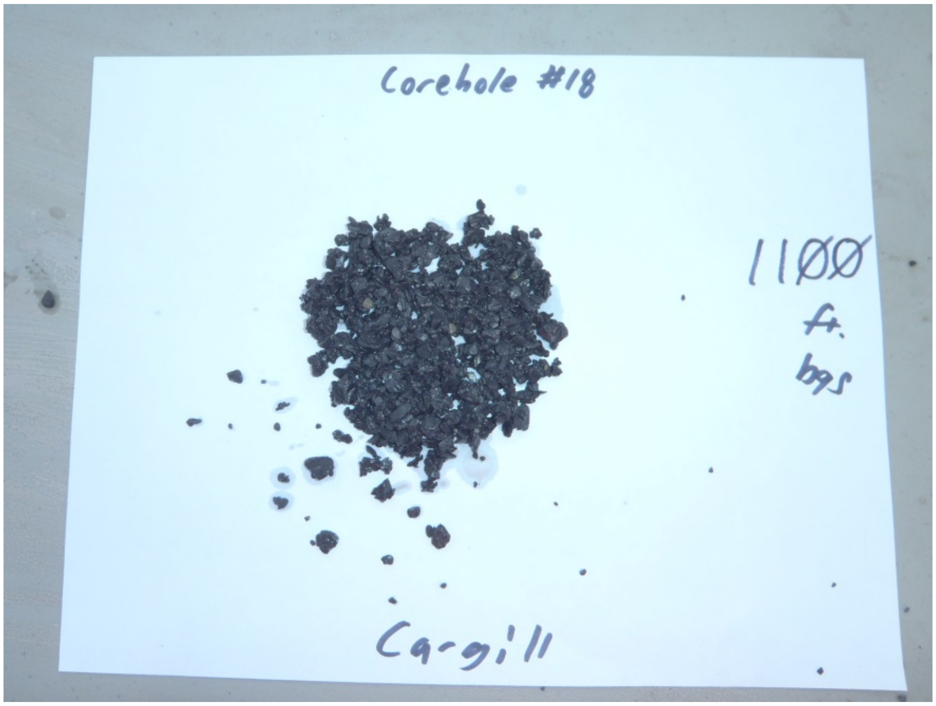

Figure A-56. Corehole #18: 1,100 Feet Below Ground Surface.
Hamilton Group: Skaneatleles Shale Formation–Pompey Member.

RSI-2099-13-078

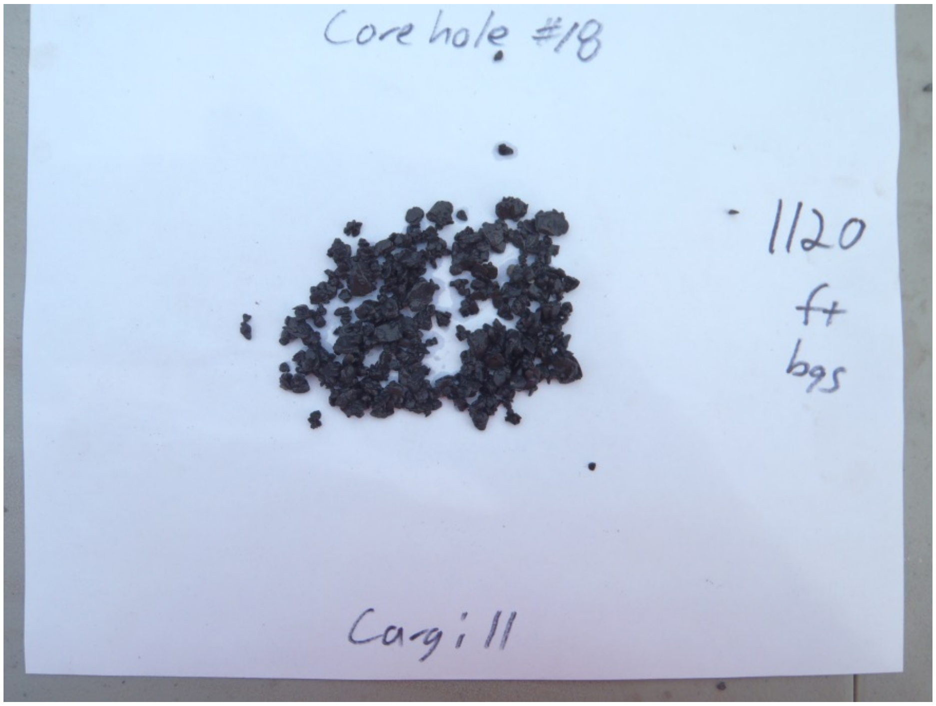

Figure A-57. Corehole #18: 1,120 Feet Below Ground Surface.
Hamilton Group: Skaneatleles Shale Formation–Pompey Member.

RSI-2099-13-079

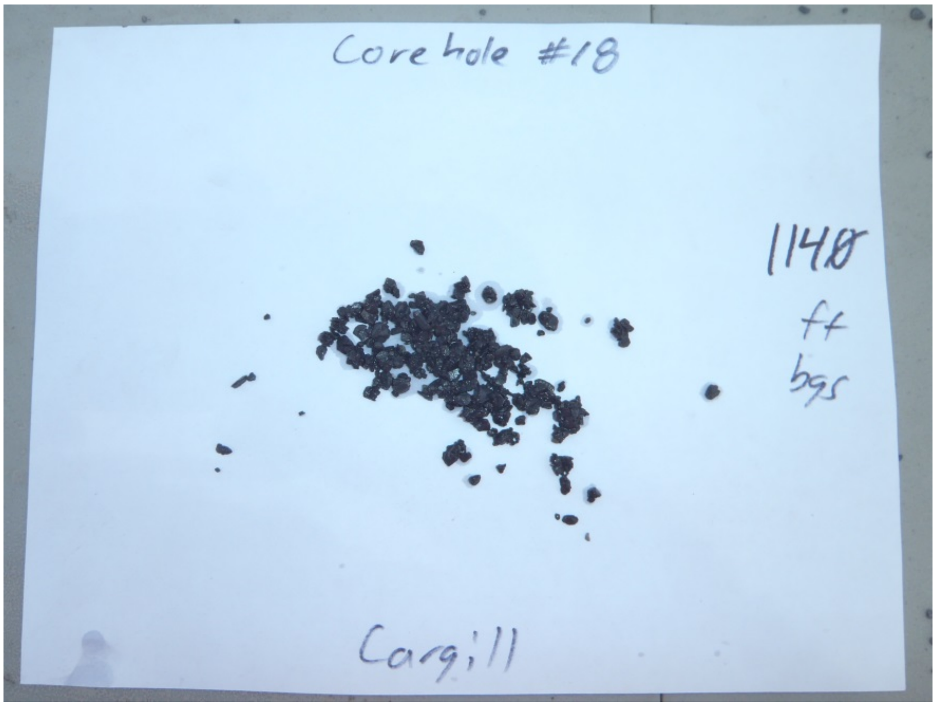

Figure A-58. Corehole #18: 1,140 Feet Below Ground Surface.
Hamilton Group: Skaneatleles Shale Formation–Pompey Member.

RSI-2099-13-080

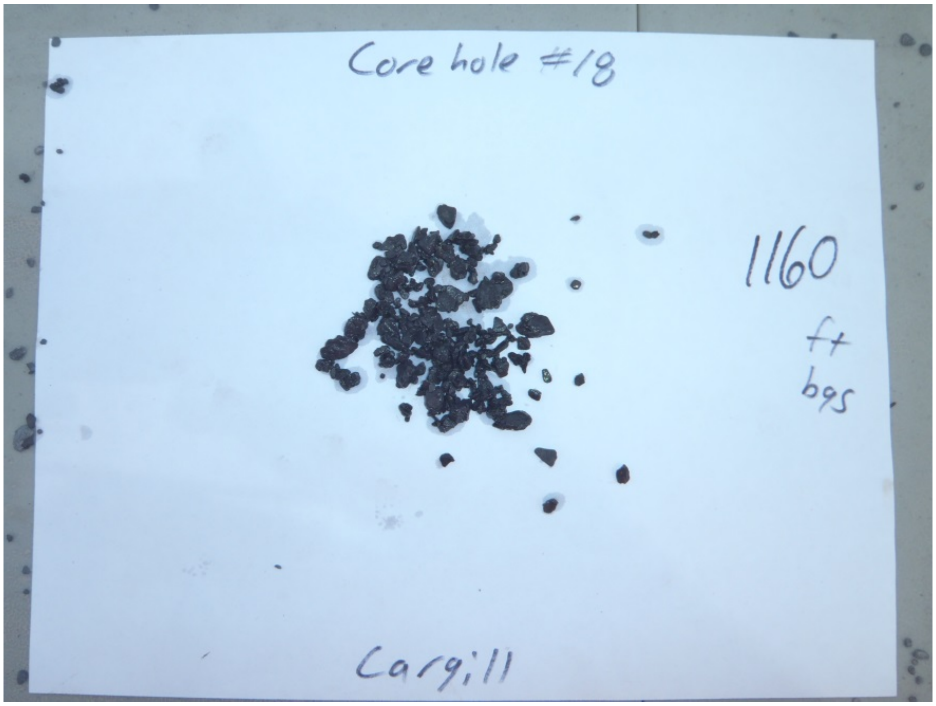

Figure A-59. Corehole #18: 1,160 Feet Below Ground Surface.
Hamilton Group: Skaneatleles Shale Formation–Pompey Member.

RSI-2099-13-081

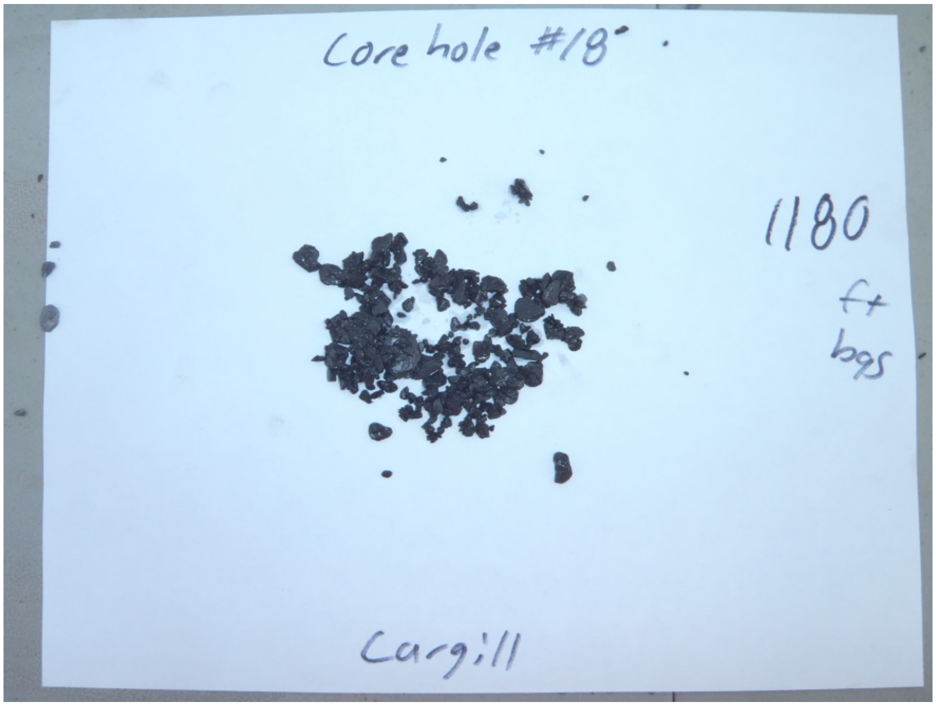

Figure A-60. Corehole #18: 1,180 Feet Below Ground Surface.
Hamilton Group: Skaneatleles Shale Formation–Pompey Member.

RSI-2099-13-082

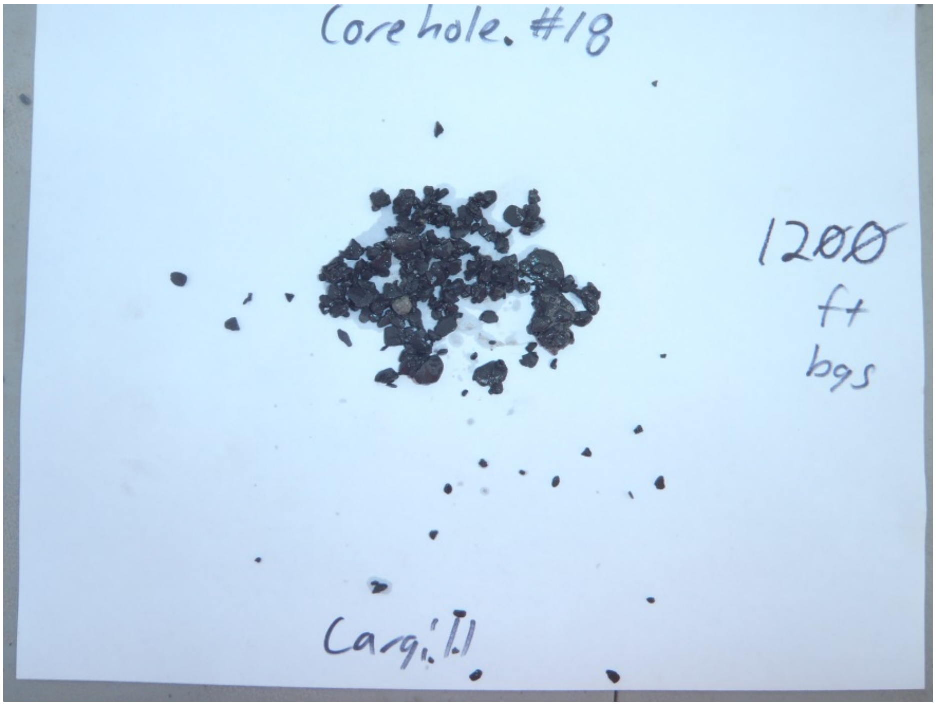

Figure A-61. Corehole #18: 1,200 Feet Below Ground Surface.
Hamilton Group: Skaneatleles Shale Member- Delphi Station Member.

RSI-2099-13-083

Figure A-62. Corehole #18: 1,220 Feet Below Ground Surface.
Hamilton Group: Skaneatleles Shale Member- Delphi Station Member.

RSI-2099-13-084

Figure A-63. Corehole #18: 1,240 Feet Below Ground Surface.
Hamilton Group: Skaneatleles Shale Member- Delphi Station Member.

RSI-2099-13-085

Figure A-64. Corehole #18: 1,260 Feet Below Ground Surface.
Hamilton Group: Skaneatleles Shale Member- Delphi Station Member.

RSI-2099-13-086

Figure A-65. Corehole #18: 1,280 Feet Below Ground Surface.
Hamilton Group: Skaneatleles Shale Member- Delphi Station Member.

RSI-2099-13-087

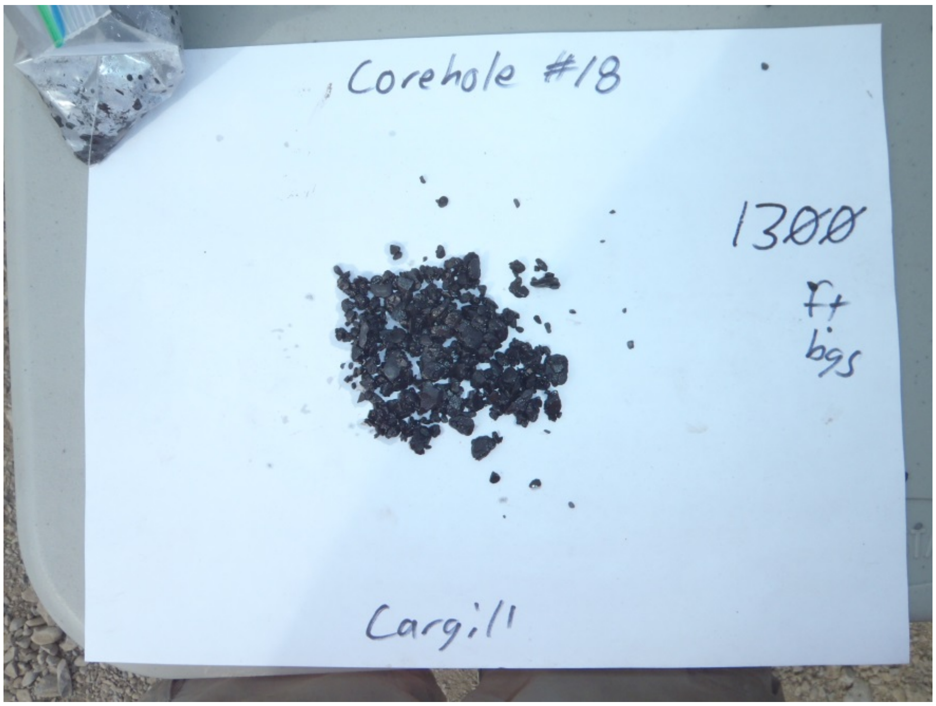

Figure A-66. Corehole #18: 1,300 Feet Below Ground Surface.
Hamilton Group: Marcellus Shale Formation–Oatka Creek Member.

RSI-2099-13-088

Figure A-67. Corehole #18: 1,320 Feet Below Ground Surface.
Hamilton Group: Marcellus Shale Formation–Oatka Creek Member.

RSI-2099-13-089

Figure A-68. Corehole #18: 1,340 Feet Below Ground Surface.
Hamilton Group: Marcellus Shale Formation–Oatka Creek Member.

RSI-2099-13-090

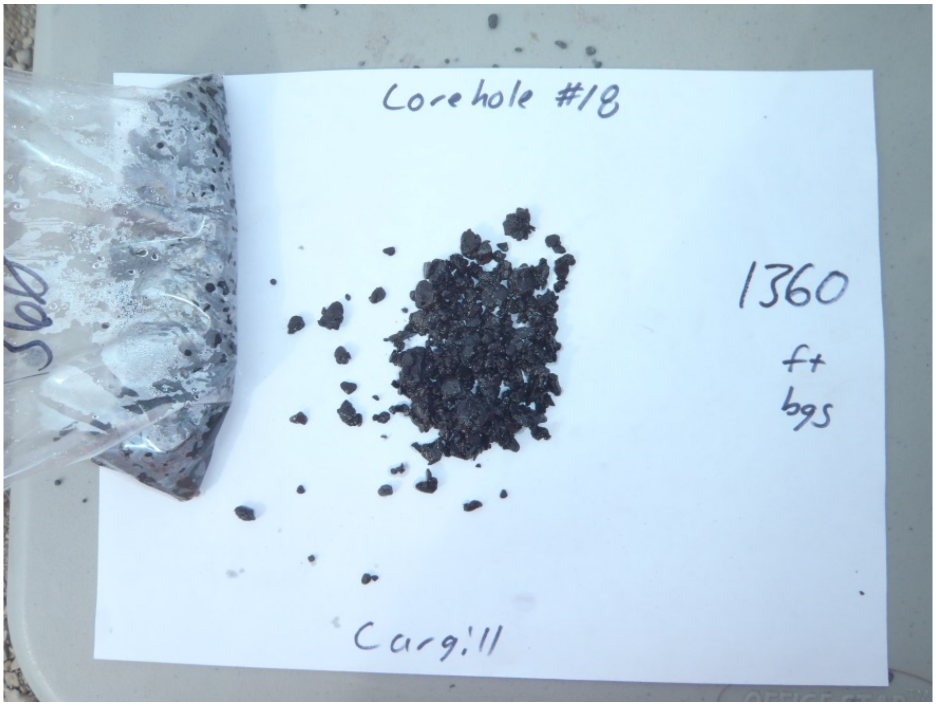

Figure A-69. Corehole #18: 1,360 Feet Below Ground Surface.
Hamilton Group: Marcellus Shale Formation–Oatka Creek Member.

RSI-2099-13-091

Figure A-70. Corehole #18: 1,380 Feet Below Ground Surface.
Hamilton Group: Marcellus Shale Formation–Oatka Creek Member.

RSI-2099-13-092

Figure A-71. Corehole #18: 1,400 Feet Below Ground Surface.
Hamilton Group: Marcellus Shale Formation–Oatka Creek Member.

RSI-2099-13-093

Figure A-72. Corehole #18: 1,410 Feet Below Ground Surface.
Hamilton Group: Marcellus Shale Formation–Cherry Valley Member.

RSI-2099-13-094

Figure A-73. Corehole #18: 1,420 Feet Below Ground Surface.
Hamilton Group: Marcellus Shale Formation–Union Springs Member.

RSI-2099-13-095

Figure A-74. Corehole #18: 1,430 Feet Below Ground Surface.
Hamilton Group: Marcellus Shale Formation–Union Springs Member.

RSI-2099-13-096

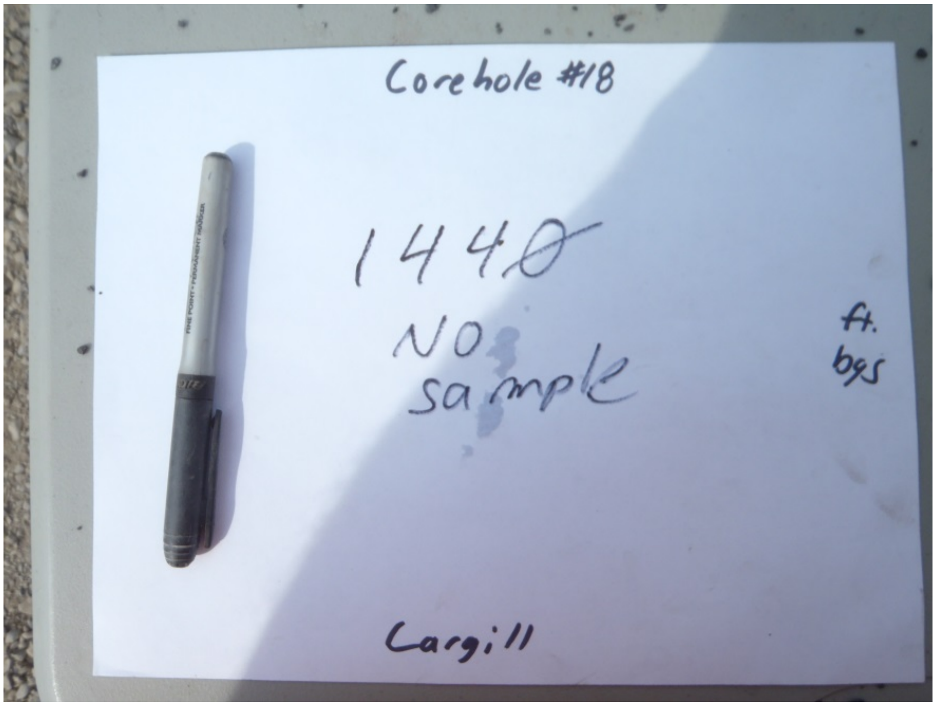

Figure A-75. Corehole #18: 1,440 Feet Below Ground Surface.
Suspected Onondaga Limestone Formation–Seneca Member.

RSI-2099-13-097

Figure A-76. Corehole #18: 1,450 Feet Below Ground Surface.
Onondaga Limestone Formation–Seneca Member.

RSI-2099-13-098

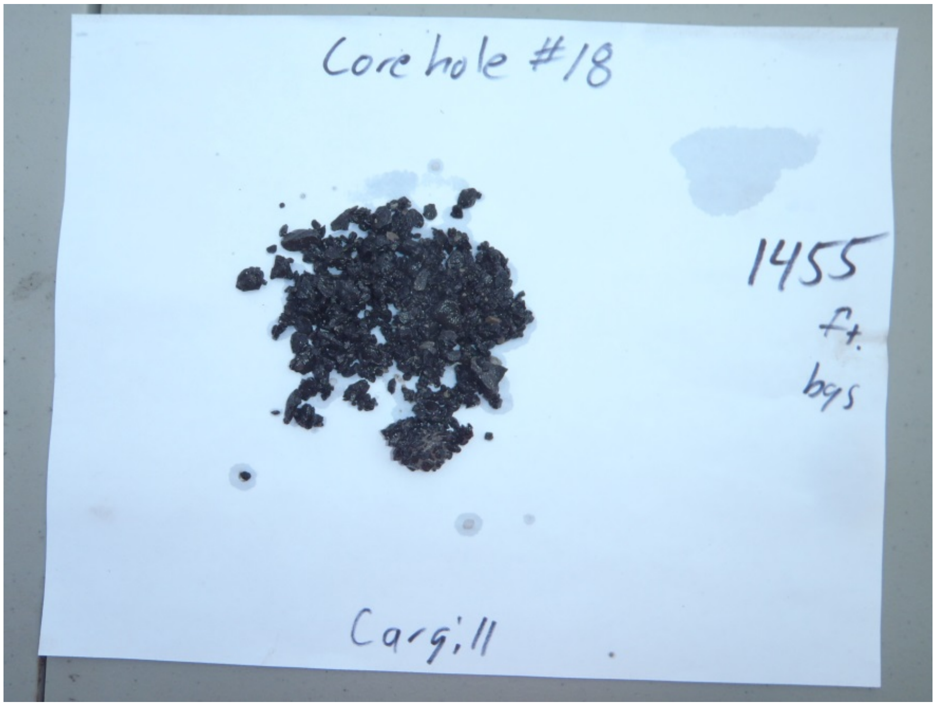

Figure A-77. Corehole #18: 1,455 Feet Below Ground Surface.
Onondaga Limestone Formation–Undifferentiated.

RSI-2099-13-099

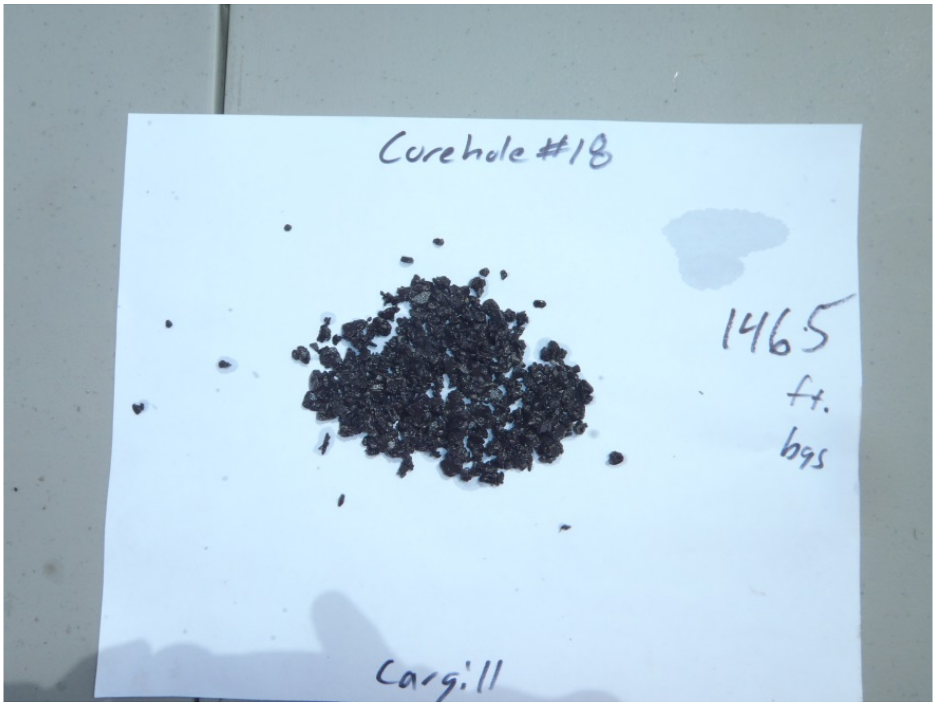

Figure A-78. Corehole #18: 1,465 Feet Below Ground Surface.
Onondaga Limestone Formation–Undifferentiated.

RSI-2099-13-100

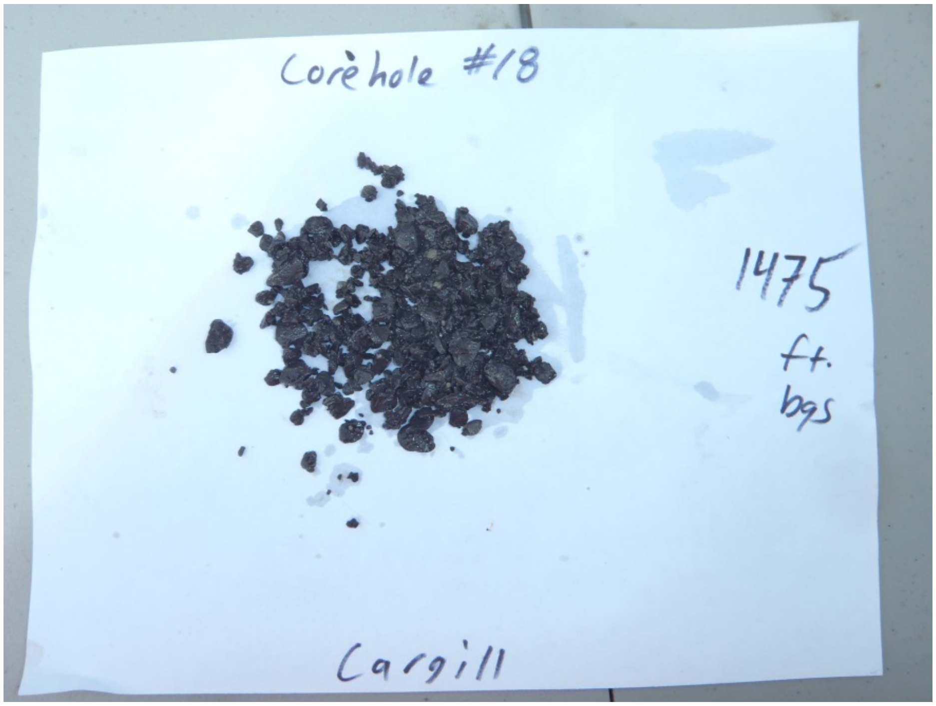

Figure A-79. Corehole #18: 1,475 Feet Below Ground Surface.
Onondaga Limestone Formation–Undifferentiated.

RSI-2099-13-101

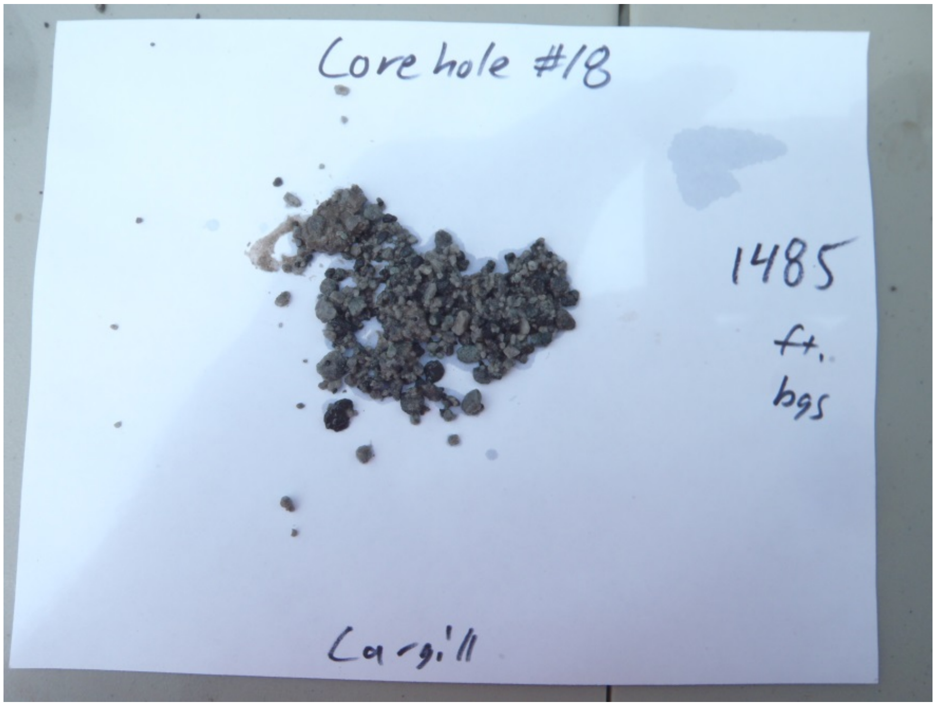

Figure A-80. Corehole #18: 1,485 Feet Below Ground Surface.
Tristates Group: Carlisle Center Formation.

RSI-2099-13-102

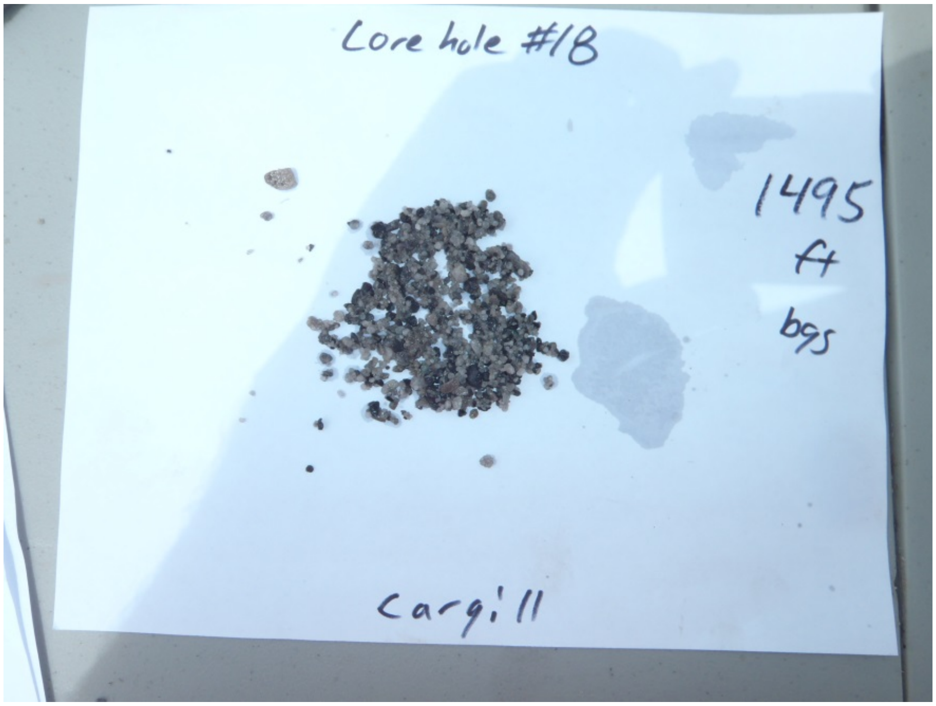

Figure A-81. Corehole #18: 1,495 Feet Below Ground Surface.
Tristates Group: Carlise Center-Oriskany Sandstone Formations.

RSI-2099-13-103

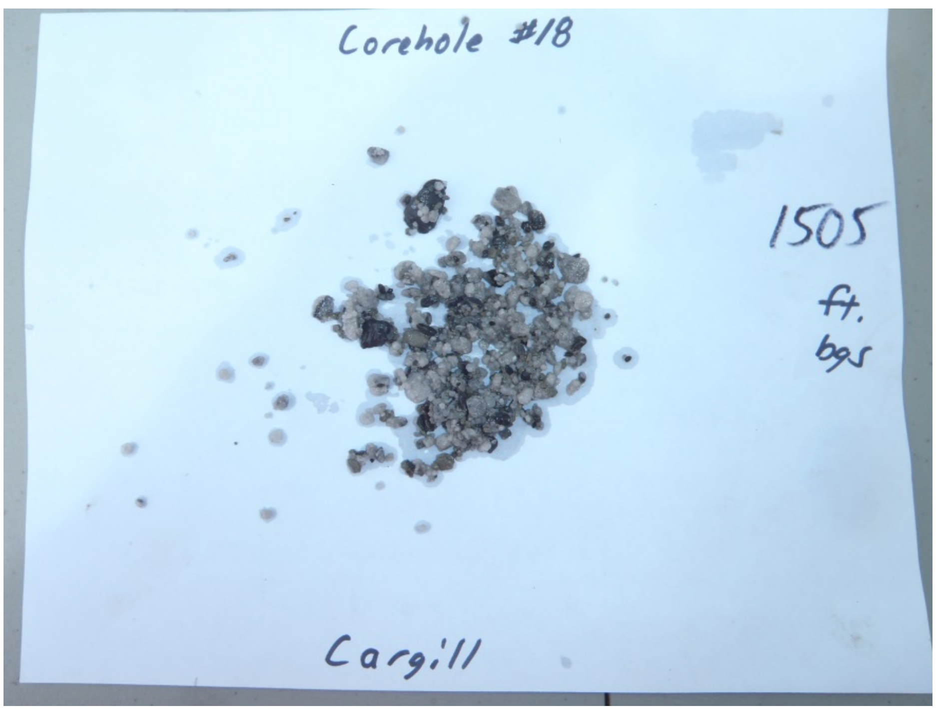

Figure A-82. Corehole #18: 1,505 Feet Below Ground Surface.
Tristates Group: Carlisle Center-Oriskany Formations.

RSI-2099-13-104

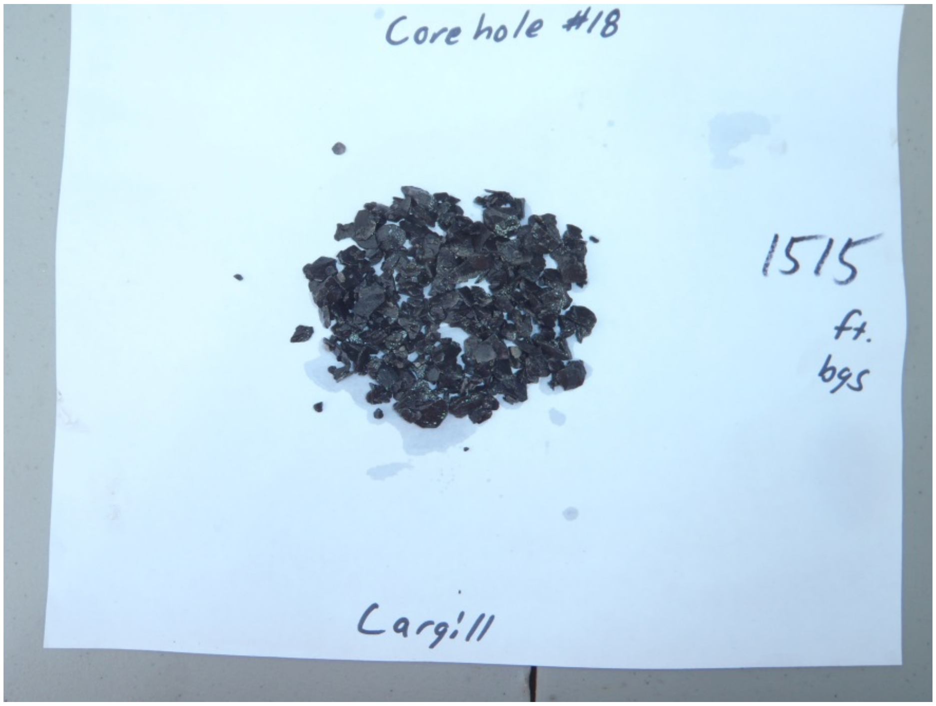

Figure A-83. Corehole #18: 1,515 Feet Below Ground Surface.
Helderberg Group: Coeymans Formation–Deansboro Member.

RSI-2099-13-105

Figure A-84. Corehole #18: 1,525 Feet Below Ground Surface.
Helderberg Group: Coeymans Formation–Deansboro Member.

RSI-2099-13-106

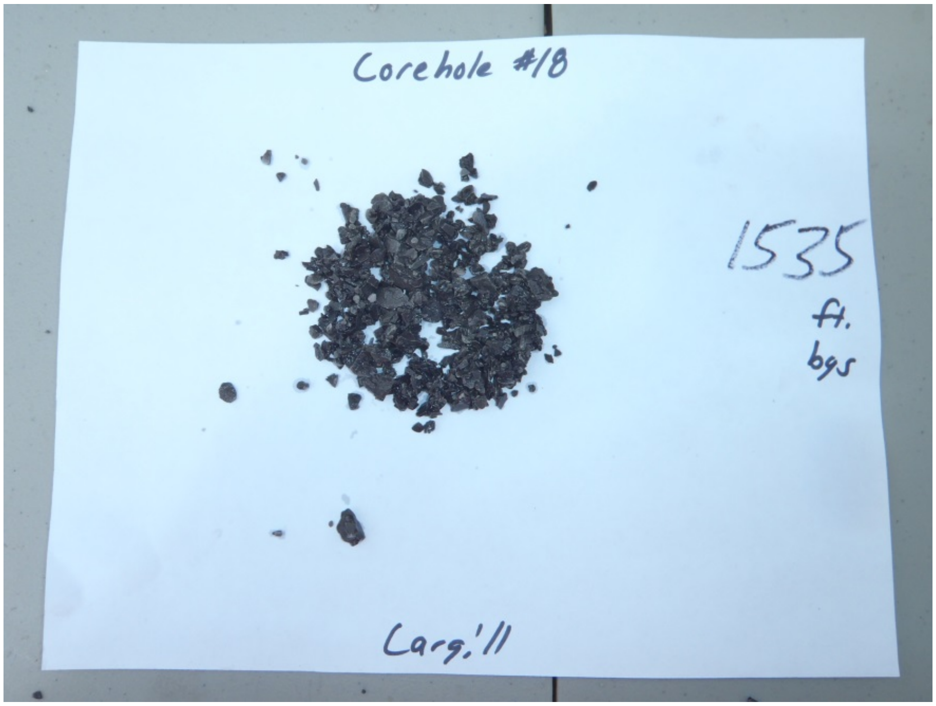

Figure A-85. Corehole #18: 1,535 Feet Below Ground Surface.
Helderberg Group: Coeymans Formation–Deansboro Member.

RSI-2099-13-107

Figure A-86. Corehole #18: 1,545 Feet Below Ground Surface.
Helderberg Group: Coeymans Formation–Deansboro Member.

Figure A-87. Corehole #18: 1,555 Feet Below Ground Surface.
Helderberg Group: Coeymans Formation–Deansboro Member.

APPENDIX B

BEDROCK CORE SAMPLE PHOTOGRAPHS

RSI-2099-13-109

Figure B-1. 1,555–1,566 Feet Below Ground Surface.
Helderberg Group: Coeymans Formation–Deansboro Member.

RSI-2099-13-110

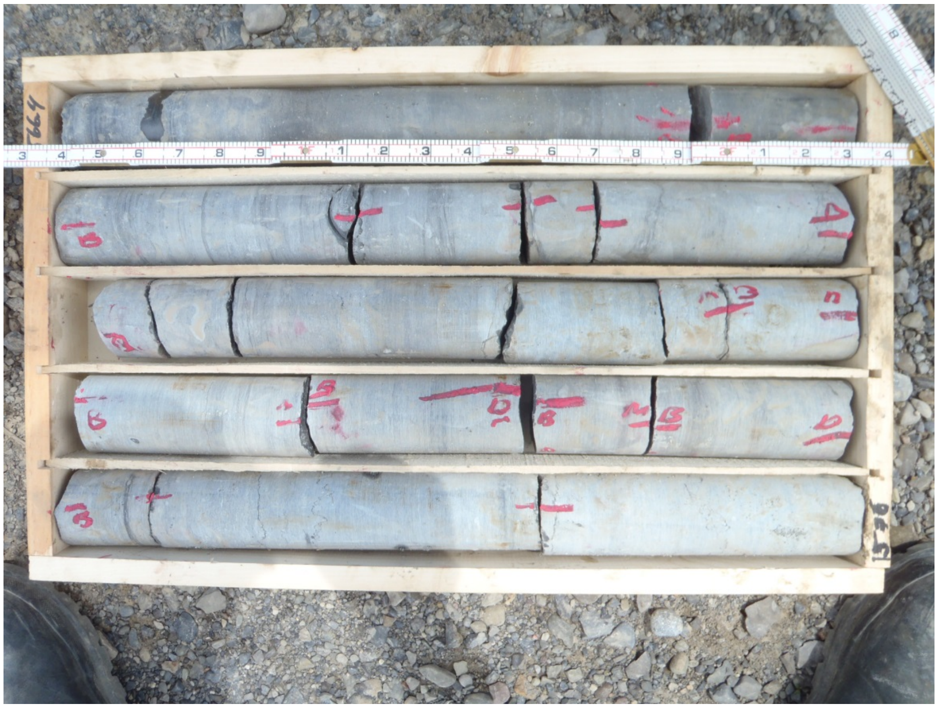

Figure B-2. 1,566–1,576 Feet Below Ground Surface.
Helderberg Group: Coeymans Formation–Deansboro Member.

RSI-2099-13-111

Figure B-3. 1,576–1,585.4 Feet Below Ground Surface.
Helderberg Group: Coeymans Formation–Manlius Formation Contact.

RSI-2099-13-112

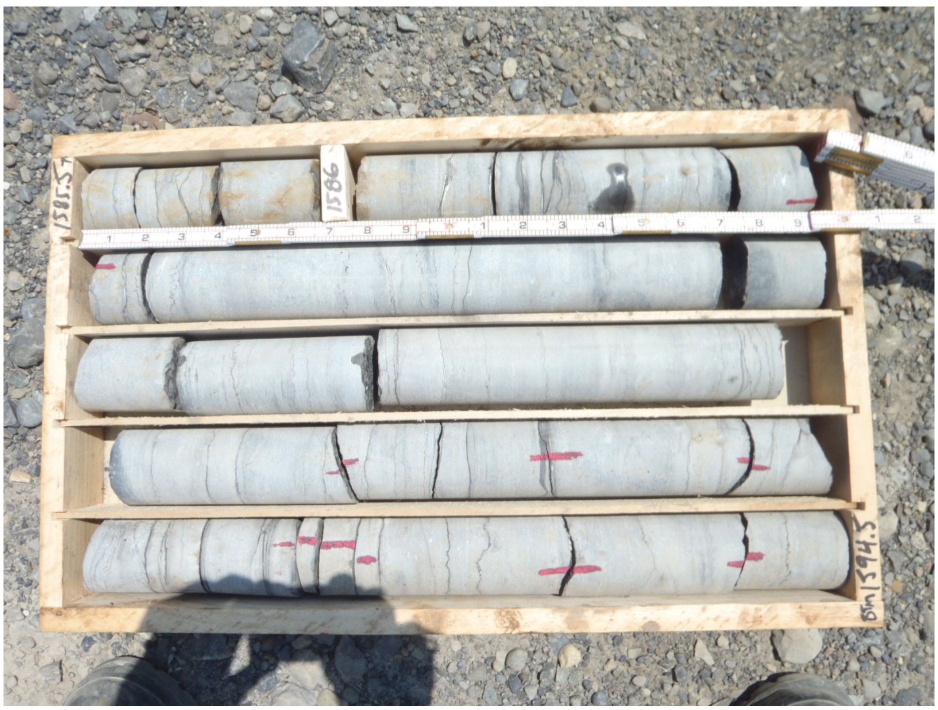

Figure B-4. 1585.4–1,594.5 Feet Below Ground Surface.
Helderberg Group: Manlius Formation–Jamesville Member.

RSI-2099-13-113

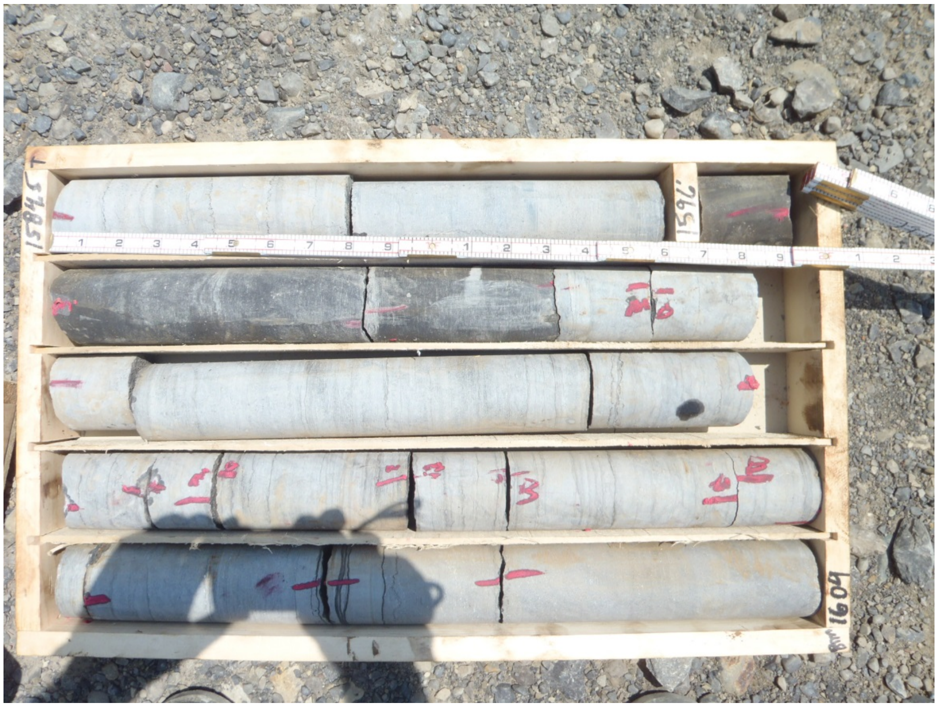

Figure B-5. 1,594.5–1,604 Feet Below Ground Surface.
Helderberg Group: Manlius Formation–Jamesville Member.

RSI-2099-13-114

Figure B-6. 1,604–1,613 Feet Below Ground Surface.
Helderberg Group: Manlius Formation–Clark Reservation Member.

RSI-2099-13-115

Figure B-7. 1,613–1,622 Feet Below Ground Surface.
Helderberg Group: Manlius Formation–Elmwood Member.

RSI-2099-13-116

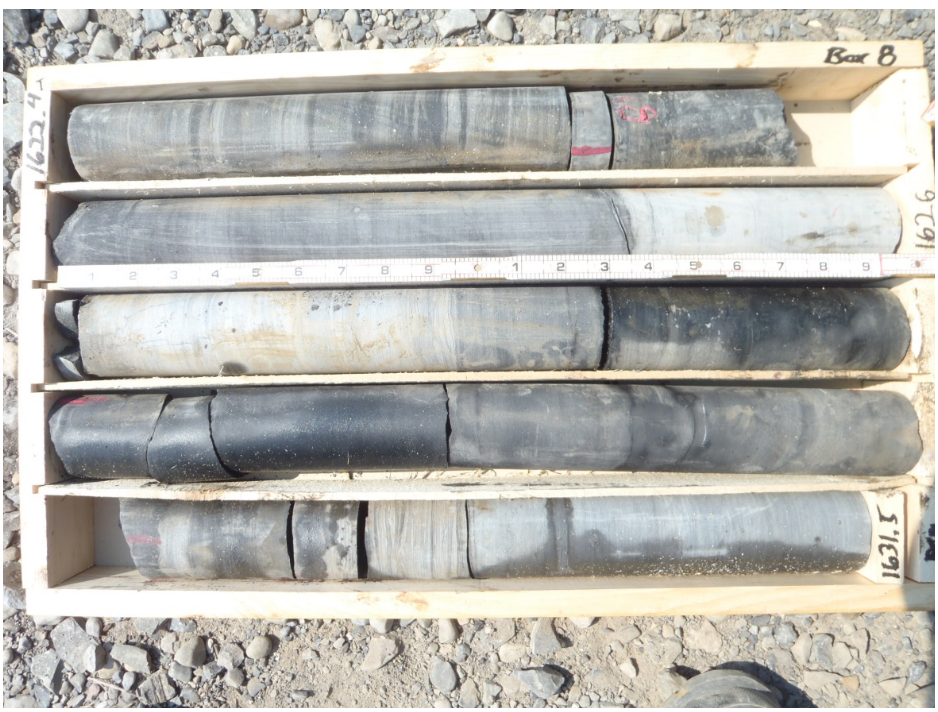

Figure B-8. 1,622–1,631.5 Feet Below Ground Surface.
Helderberg Group: Manlius Formation–Elmwood Member.

RSI-2099-13-117

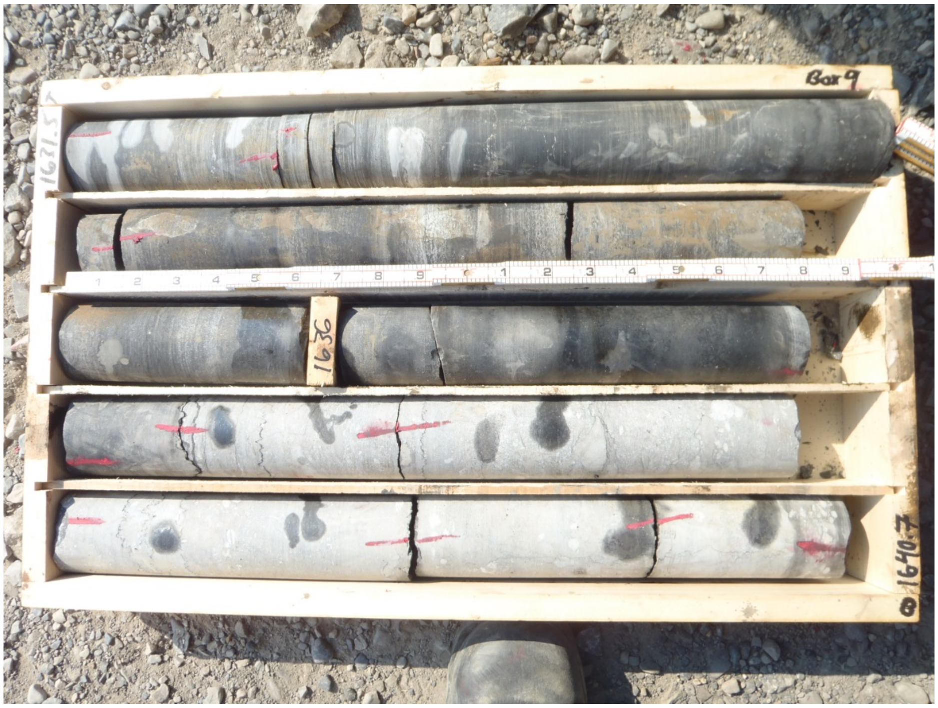

Figure B-9. 1,631.5–1,640.7 Feet Below Ground Surface.
Helderberg Group: Manlius Formation–Elmwood and Olney Members.

RSI-2099-13-118

Figure B-10. Core Before Breaking to Fit in the Core Box.
Helderberg Group: Manlius Formation–Olney Member.

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Figure B-11. 1,640.7–1,649.3 Feet Below Ground Surface.
Helderberg Group: Manlius Formation–Olney Member.

RSI-2099-13-120

Figure B-12. Core Before Breaking to Fit in Core Box.
Helderberg Group: Manlius Formation–Thatcher Member.

RSI-2099-13-121

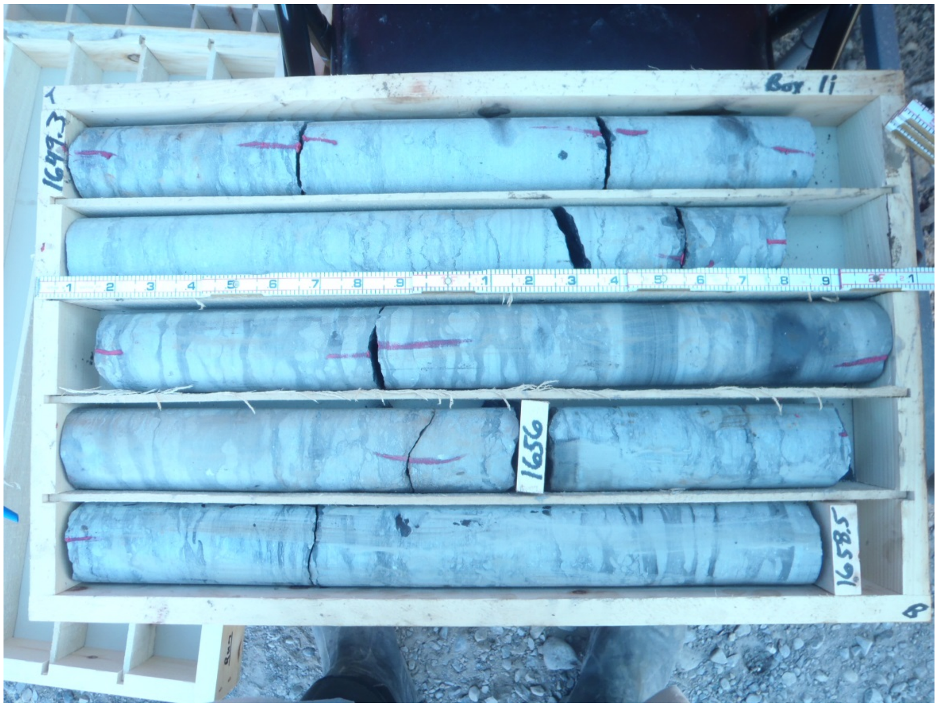

Figure B-13. 1,649.3–1,658.5 Feet Below Ground Surface.
Helderberg Group: Manlius Formation–Olney Member.

RSI-2099-13-122

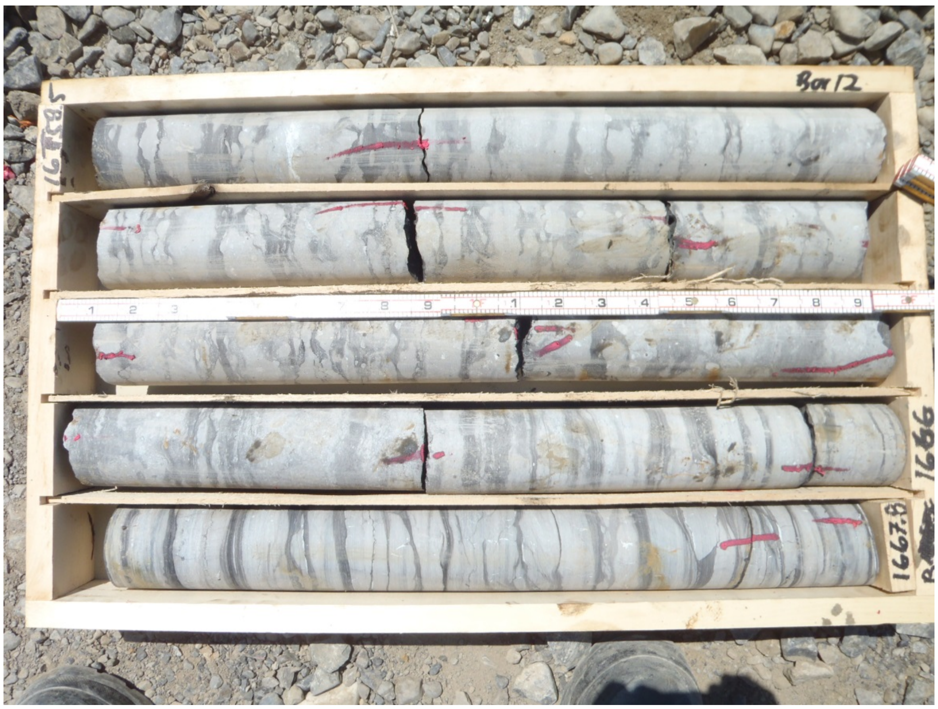

Figure B-14. 1,658.5–1,667.8 Feet Below Ground Surface.
Helderberg Group: Manilus Formation–Rondout Formation–Contact.

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Figure B-15. 1,667.8–1,676.6 Feet Below Ground Surface.
Helderberg Group: Rondout Formation–Cobleskill Formation Contact.

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Figure B-16. 1,676.6–1,685.8 Feet Below Ground Surface.
Helderberg Group: Cobleskill Formation–“Akron Facies.”

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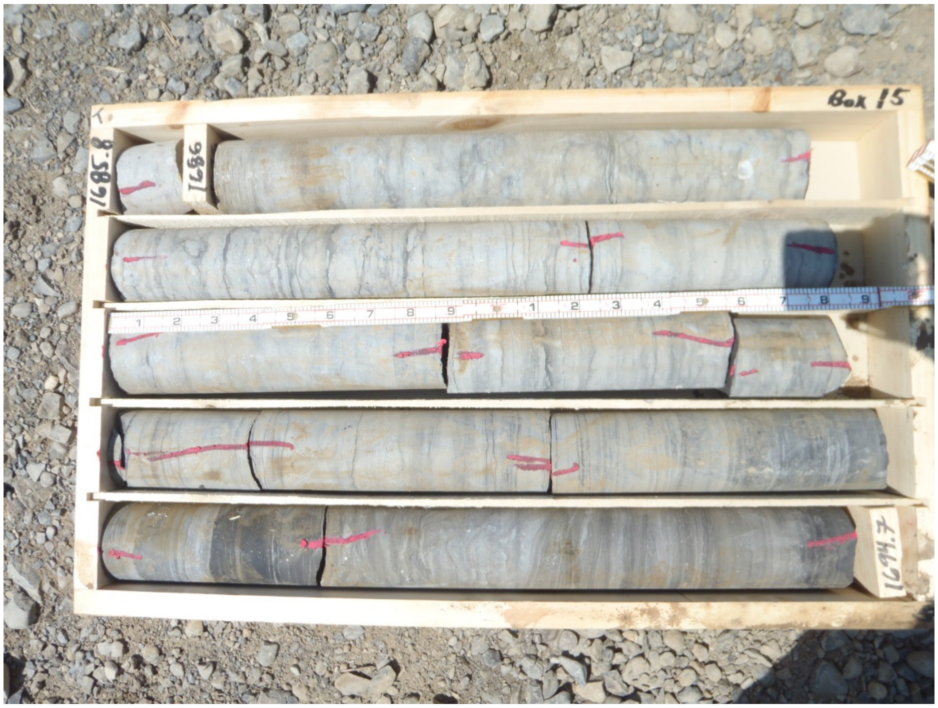

Figure B-17. 1,685.8–1,694.7 Feet Below Ground Surface.
Helderberg Group: Cobleskill Formation–Bertie Formation Contact.

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Figure B-18. Core Before Breaking to Fit in Core Box.
Helderberg Group: Bertie Formation–Forge Hollow Member.

RSI-2099-13-127

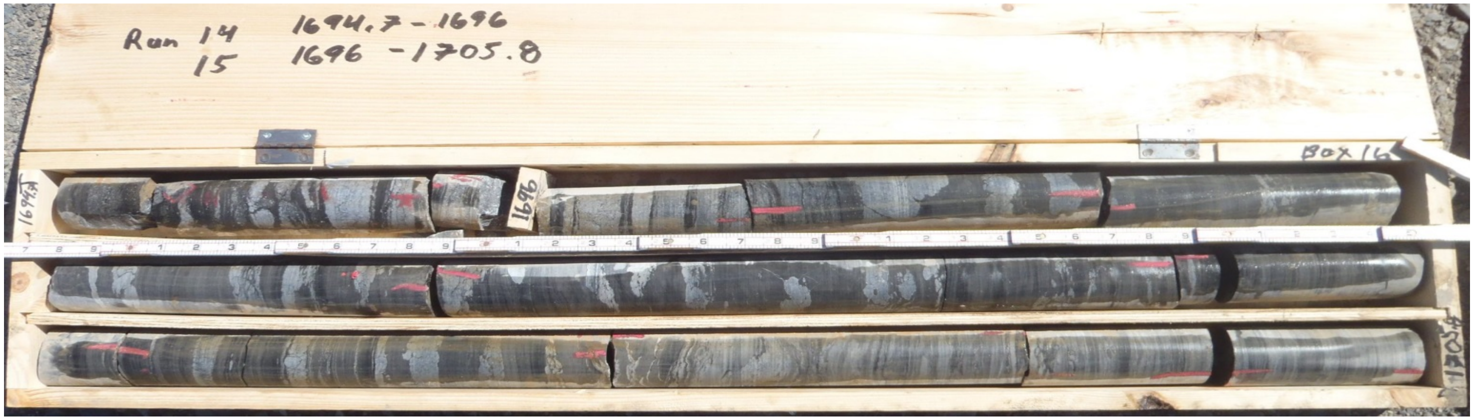

Figure B-19. Runs 14 and 15: 1,694.7–1,705.8 Feet Below Ground Surface.
Helderberg Group: Bertie Formation–Forge Hollow Member.

RSI-2099-13-128

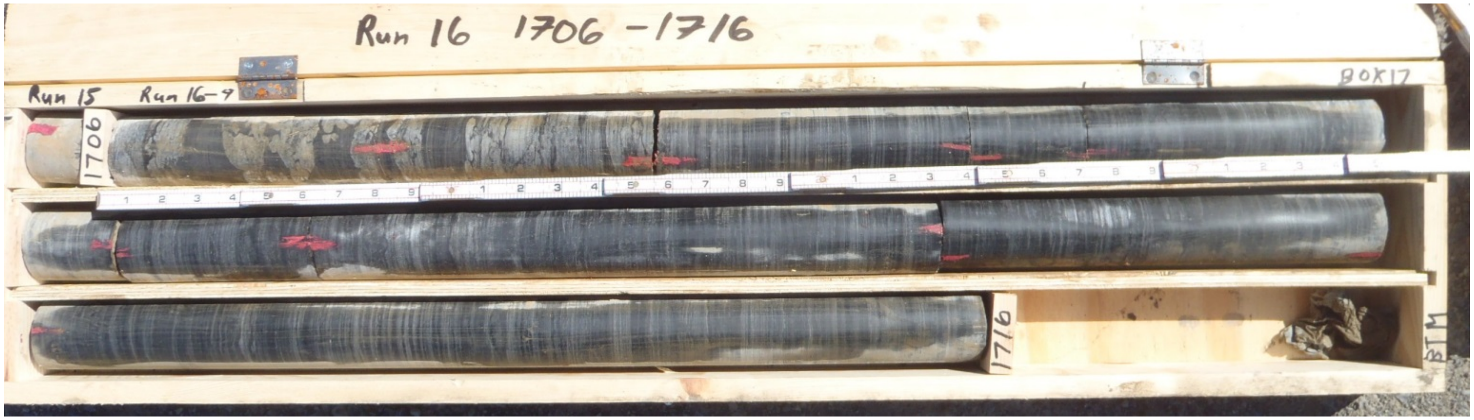

Figure B-20. Run 16: 1,705.8–1,716 Feet Below Ground Surface.
Helderberg Group: Bertie Formation–Forge Hollow Member.

RSI-2099-13-129

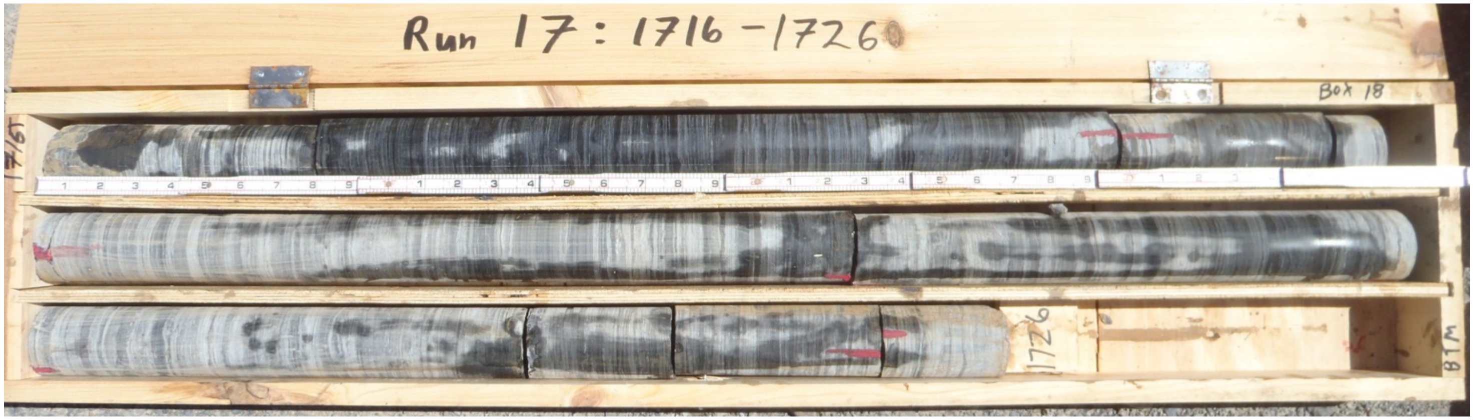

Figure B-21. Run 17: 1,716–1,726 Feet Below Ground Surface.
Helderberg Group: Bertie Formation–Forge Hollow Member.

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Figure B-22. Run 18: 1,726–1,736 Feet Below Ground Surface.
Helderberg Group: Bertie Formation–Forge Hollow Member.

RSI-2099-13-131

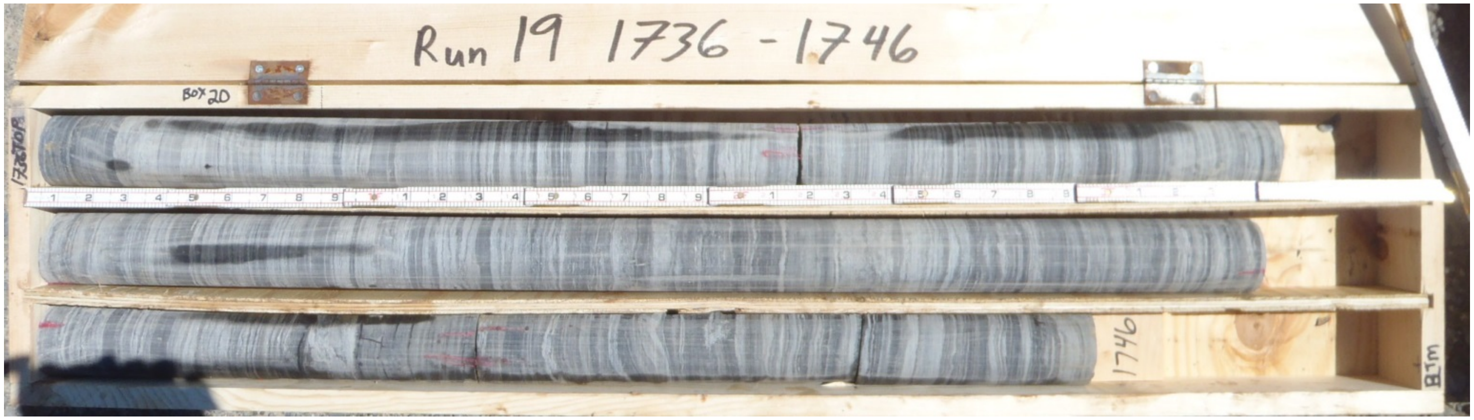

Figure B-23. Run 19: 1,736–1,746 Feet Below Ground Surface.
Helderberg Group: Bertie Formation–Forge Hollow Member.

RSI-2099-13-132

Figure B-24. Run 20: 1,746–1,756 Feet Below Ground Surface.
Bertie Formation Helderberg Group: Bertie Formation–Forge Hollow Member.

RSI-2099-13-133

Figure B-25. Run 21: 1,756–1,766 Feet Below Ground Surface.
Helderberg Group: Bertie Formation–Fiddlers Green Member.

RSI-2099-13-134

Figure B-26. Run 22: 1,766–1,776 Feet Below Ground Surface.
Helderberg Group: Bertie Formation–Fiddlers Green Member.

RSI-2099-13-135

Figure B-27. Run 23: 1,776–1,786 Feet Below Ground Surface.
Salina Group-Salina G/Camillus Formation.

RSI-2099-13-136

Figure B-28. Run 24: 1,786–1,796 Feet Below Ground Surface.
Salina Group-Salina G/Camillus Formation.

RSI-2099-13-137

Figure B-29. Run 25: 1,796–1,806 Feet Below Ground Surface.
Salina Group- Salina G/Camillus Formation.

RSI-2099-13-138

Figure B-30. Run 26: 1,806–1,816 Feet Below Ground Surface.
Salina Group-Salina G/Camillus Formation.

RSI-2099-13-139

Figure B-31. Run 27: 1,816–1,826 Feet Below Ground Surface.
Salina Group-Salina G/Camillus Formation.

RSI-2099-13-140

Figure B-32. Run 28: 1,826–1,836 Feet Below Ground Surface.
Salina Group-Salina G/Camillus Formation.

RSI-2099-13-141

Figure B-33. Run 29: 1,836–1,846 Feet Below Ground Surface.
Salina Group-Salina G/Camillus Formation.

RSI-2099-13-142

Figure B-34. Run 30: 1,846–1,856 Feet Below Ground Surface.
Salina Group- Salina G/Camillus Formation

RSI-2099-13-143

Figure B-35. Run 31: 1,856–1,866 Feet Below Ground Surface.
Salina Group- Salina G/Camillus Formation.

RSI-2099-13-144

Figure B-36. Run 32: 1,866–1,876 Feet Below Ground Surface.
Salina Group- Salina G/Camillus Formation.

RSI-2099-13-145

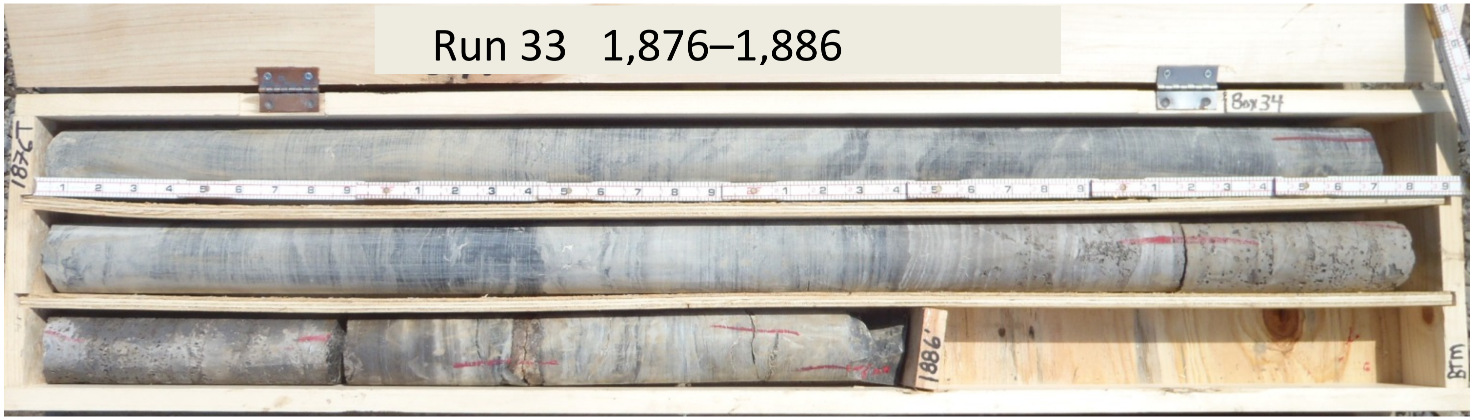

Figure B-37. Run 33: 1,876–1,886 Feet Below Ground Surface.
Salina Group: Salina G/ Camillus and Syracuse Formation–Salina F Contact.

RSI-2099-13-146

Figure B-38. Orange Salt Infilling at 1,884.9.

RSI-2099-13-147

Figure B-39. Run 34: 1,886–1,896 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F4/ #1 Salt.

RSI-2099-13-148

Figure B-40. 1,896 Feet Below Ground Surface. Close-up of Salina F4- #1 Salt.

RSI-2099-13-149

Figure B-41. Run 35: 1,896–1,906 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F4.

RSI-2099-13-150

Figure B-42. Run 36: 1,906–1,916 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F3/ #2 Salt.

RSI-2099-13-151

Figure B-43. Run 37: 1,916–1,926 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F3-/#2 Salt.

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Figure B-44. Run 38: 1,926–1,936 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F3-/#2 Salt.

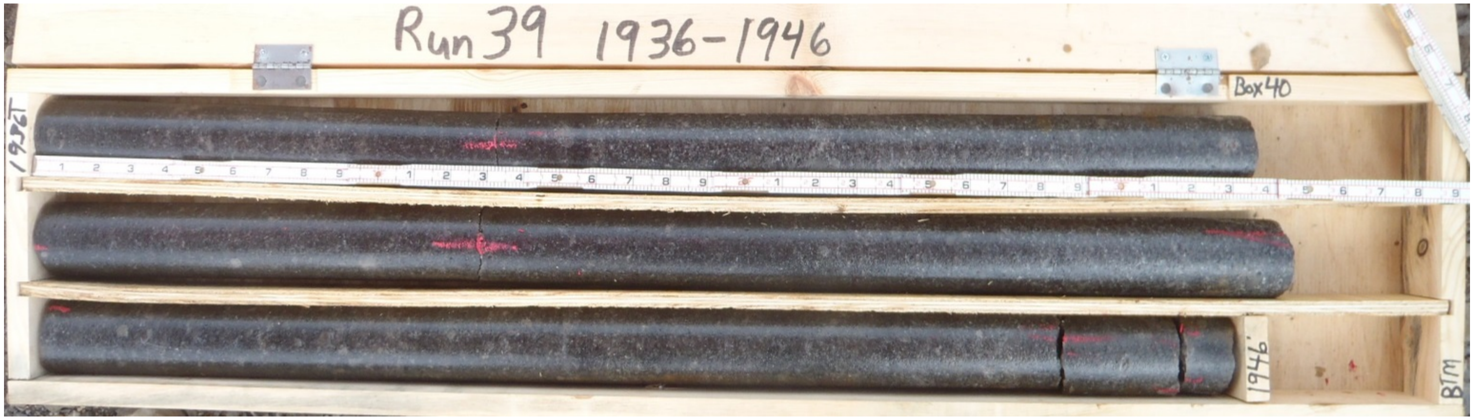

Figure B-45. Run 39: 1,936–1,946 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F3-/#2 Salt.

Figure B-46. Run 40: 1,946–1,956 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F3-/#2 Salt.

Figure B-47. Close-Up View at 1,951 Feet Below Ground Surface.

Figure B-48. Run 41: 1,956–1,966 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F3/ #2 Salt.

RSI-2099-13-157

Figure B-49. Run 42: 1,966–1,976 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F3/ #2 Salt.

RSI-2099-13-158

Figure B-50. Run 43: 1,976–1,986 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F3/ #2 Salt.

RSI-2099-13-159

Figure B-51. Transition Zone at 1,985.6 Feet Below Ground Surface.

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Figure B-52. Run 44: 1,986–1,996 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F3.

RSI-2099-13-161

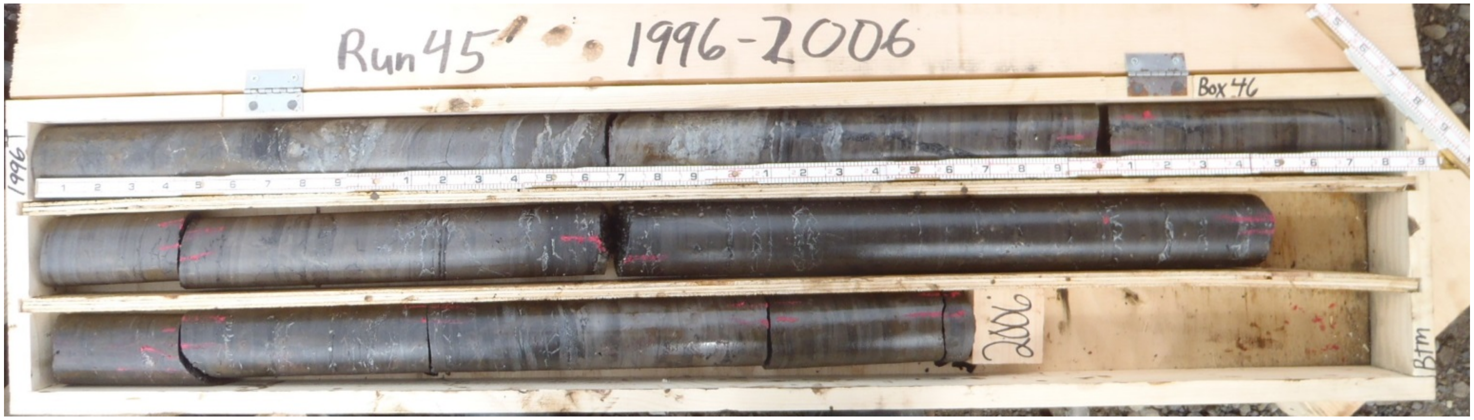

Figure B-53. Run 45: 1,996–2,006 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F3.

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Figure B-54. Run 46: 2,006–2,016 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F3.

RSI-2099-13-163

Figure B-55. Salt Infilling at 2,009.7 Feet Below Ground Surface.

RSI-2099-13-164

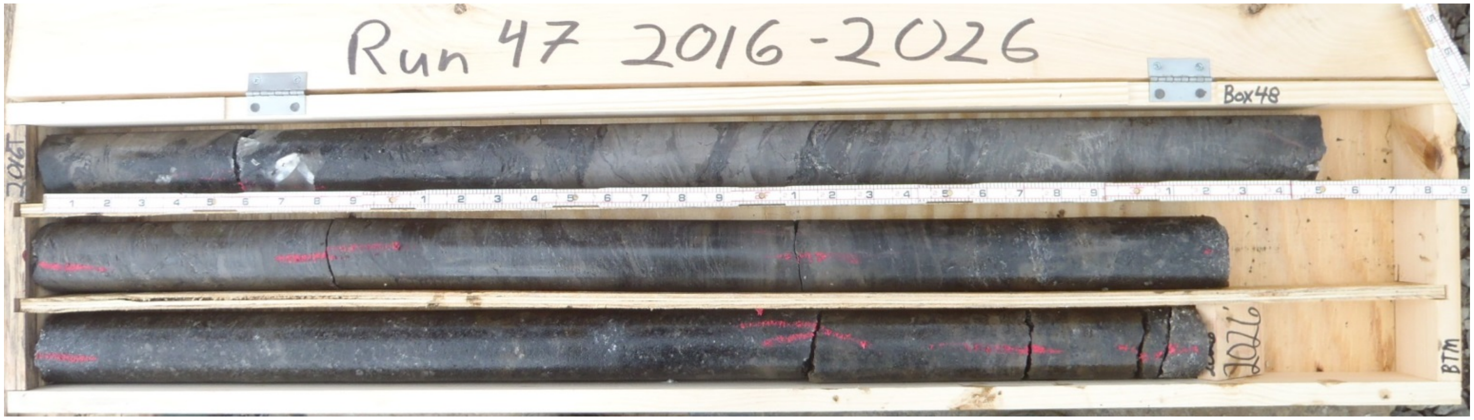

Figure B-56. Run 47: 2,016–2,026 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F3-Salina F2/#3 Salt Contact.

RSI-2099-13-165

Figure B-57. Dolostone "Pebble" at 2,025.8 Feet Below Ground Surface.

RSI-2099-13-166

Figure B-58. Large Salt Crystals at 2,016.7 Feet Below Ground Surface.

Figure B-59. Run 48: 2,026–2,036 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F2/#3Salt.

Figure B-60. Run 49: 2,036–2,046 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F2/#3Salt.

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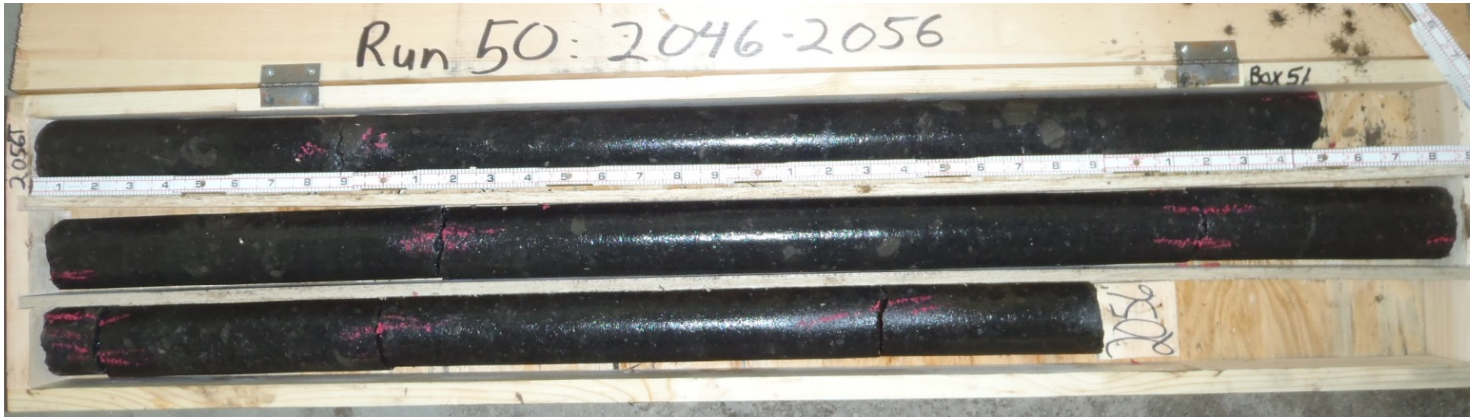

Figure B-61. Run 50: 2,046–2,056 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F2/#3Salt.

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Figure B-62. Run 51: 2,056–2,066 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F2/#3Salt.

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Figure B-63. Run 52: 2,066–2,076 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F

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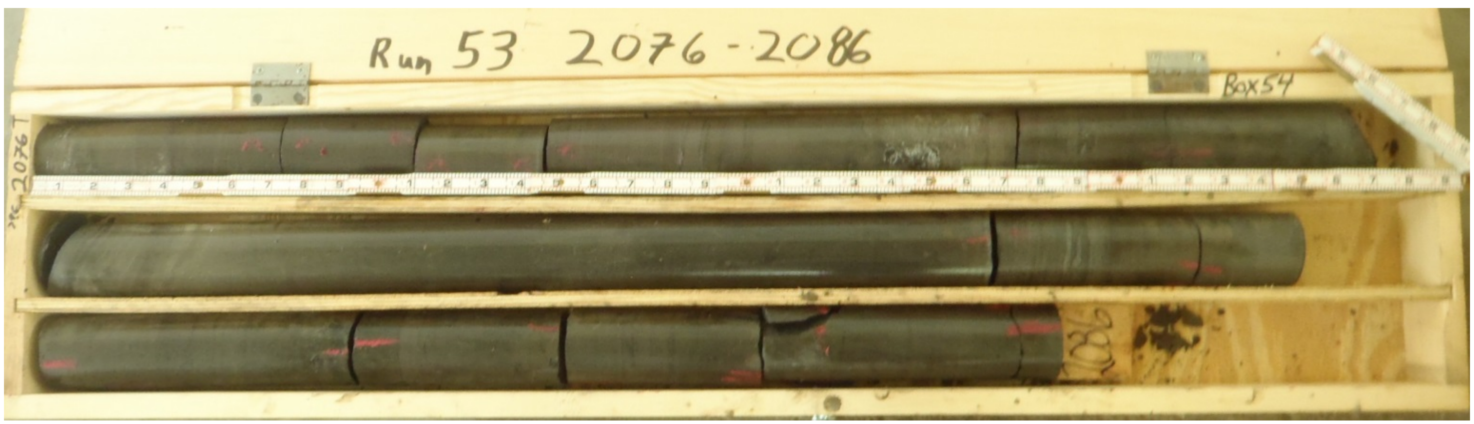

Figure B-64. Run 53: 2,076–2,086 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F.

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Figure B-65. Run 54: 2,086–2,096 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F.

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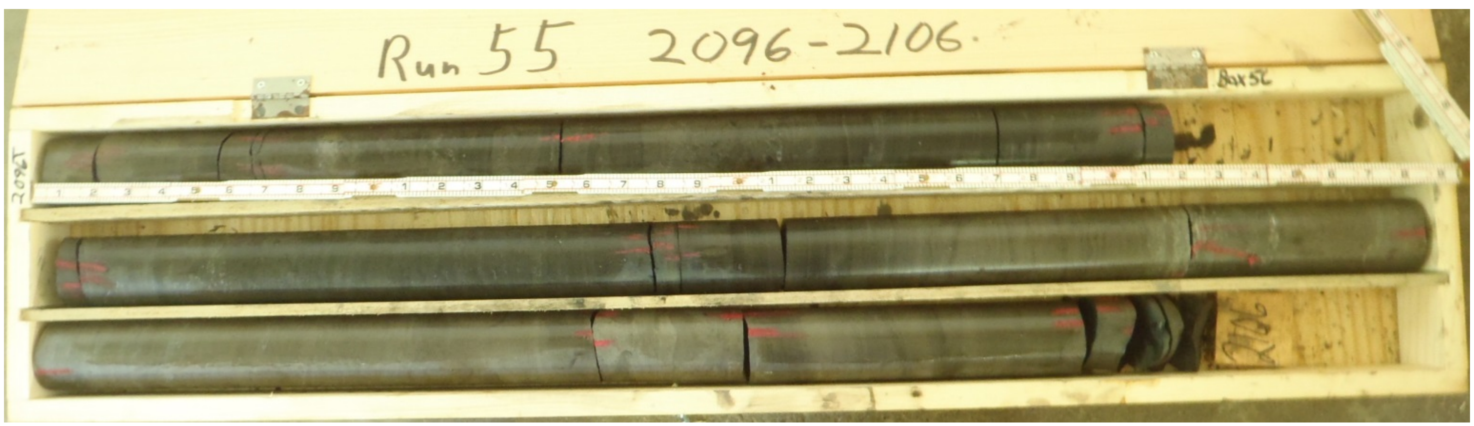

Figure B-66. Run 55: 2,096–2,106 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F.

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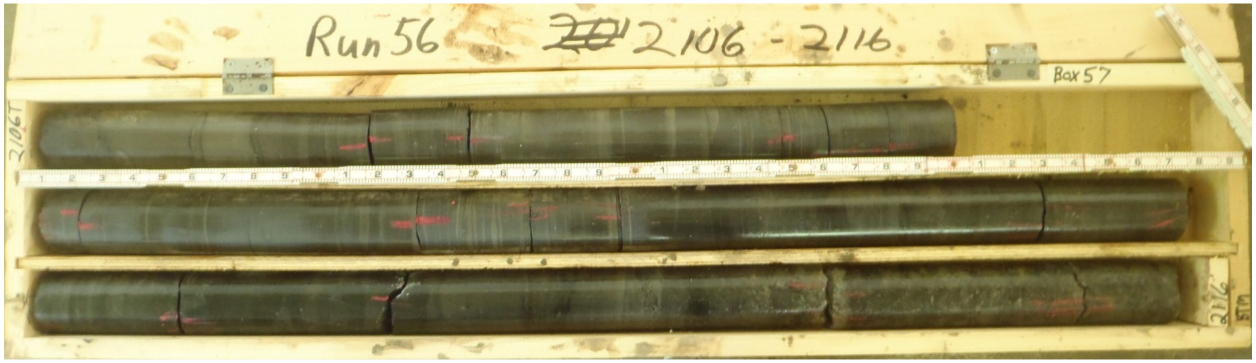

Figure B-67. Run 56: 2,106–2,116 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F.

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Figure B-68. Run 57: 2,116–2,126 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F1/#4 Salt.

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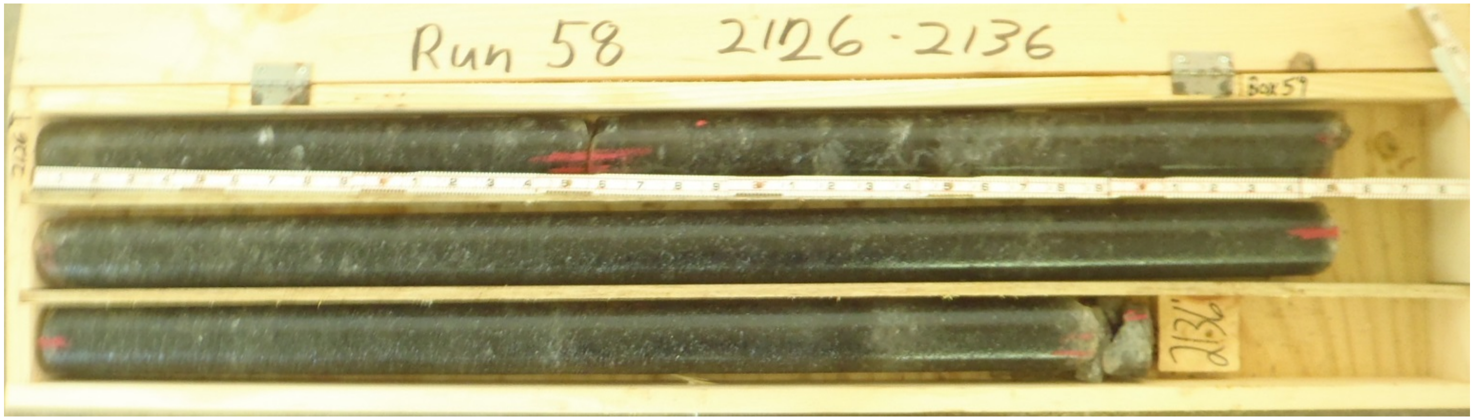

Figure B-69. Run 58: 2,126–2,136 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F1/#4 Salt.

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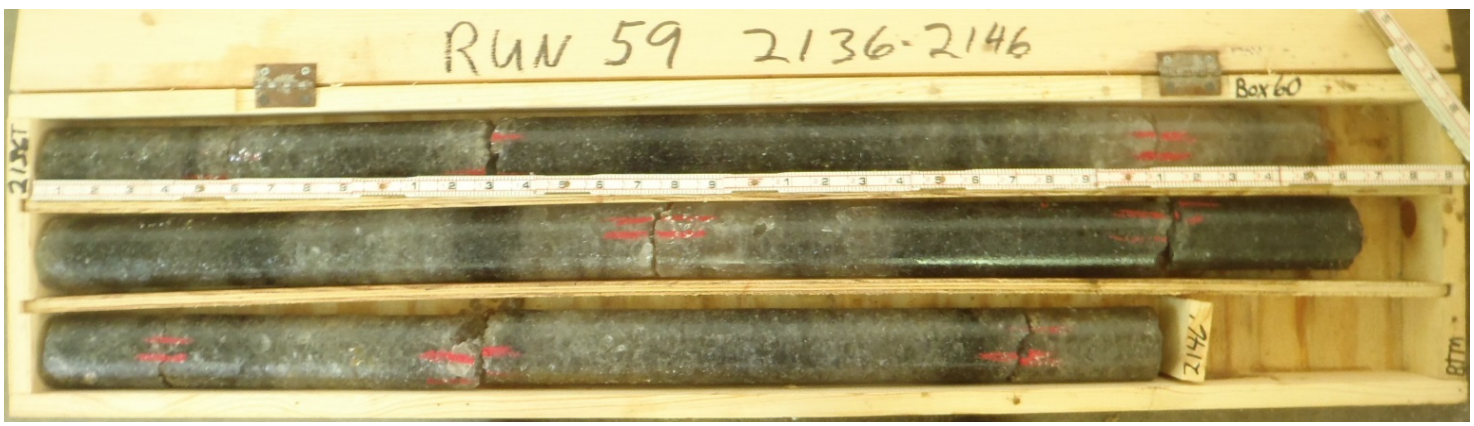

Figure B-70. Run 59: 2,136–2,146 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F1/#4 Salt.

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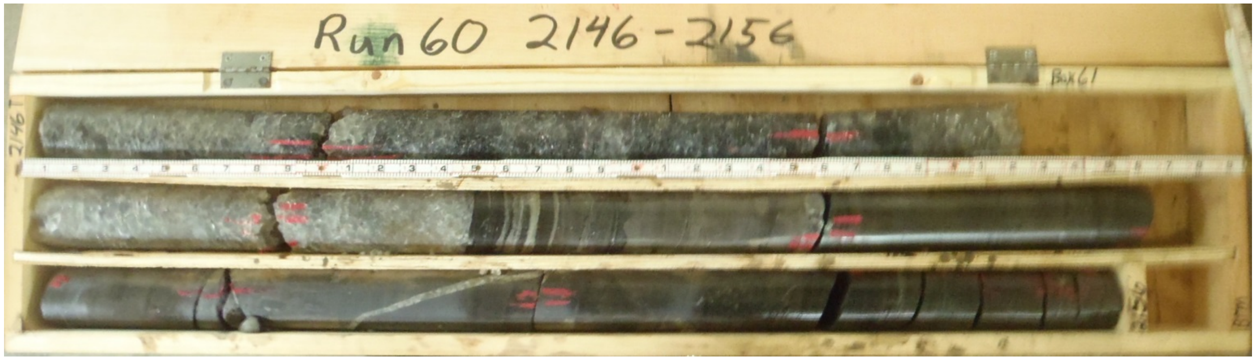

Figure B-71. Run 60: 2,146–2,156 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F1/#4 Salt and laminated Shale.

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Figure B-72. Run 61: 2,156–2,166 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Laminated Shale and Salina F1/4A Salt.

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Figure B-73. Run 62: 2,166–2,176 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F1/4A Salt.

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Figure B-74. Run 63: 2,176–2,186 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F1/4A Salt.

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Figure B-75. Run 64: 2,186–2,196 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F1/4A Salt.

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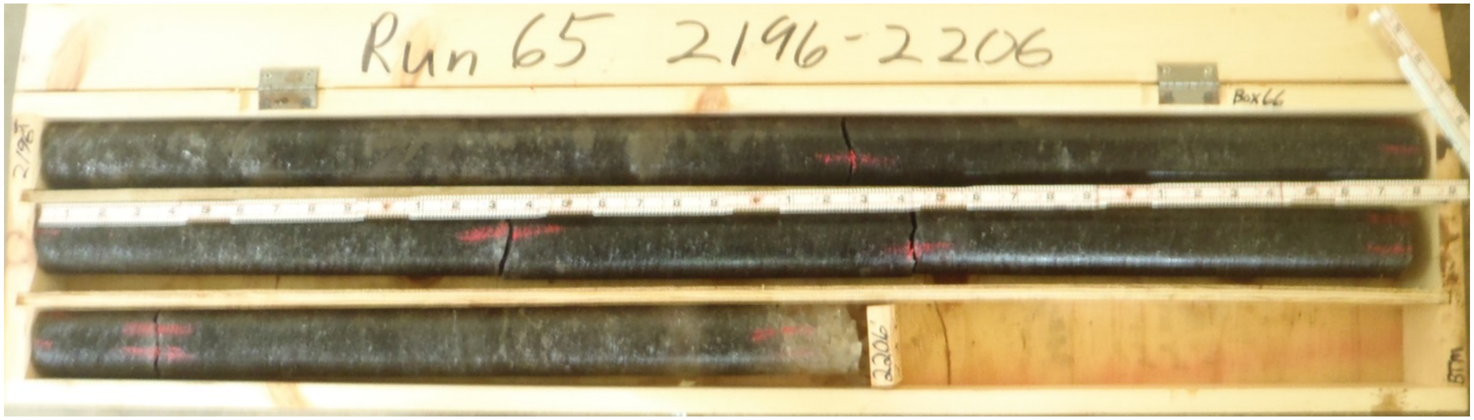

Figure B-76. Run 65: 2,196–2,206 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F1/4A Salt.

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Figure B-77. Run 66: 2,206–2,216 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina F1/4A Salt and Salina E Member Contact.

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Figure B-78. Run 67: 2,216–2,226 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina E Member.

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Figure B-79. Orange Salt Seam at 2,223.6 Feet Below Ground Surface.

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Figure B-80. Run 68: 2,226–2,236 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina E Member.

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Figure B-81. Run 69: 2,236–2,246 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina E Member.

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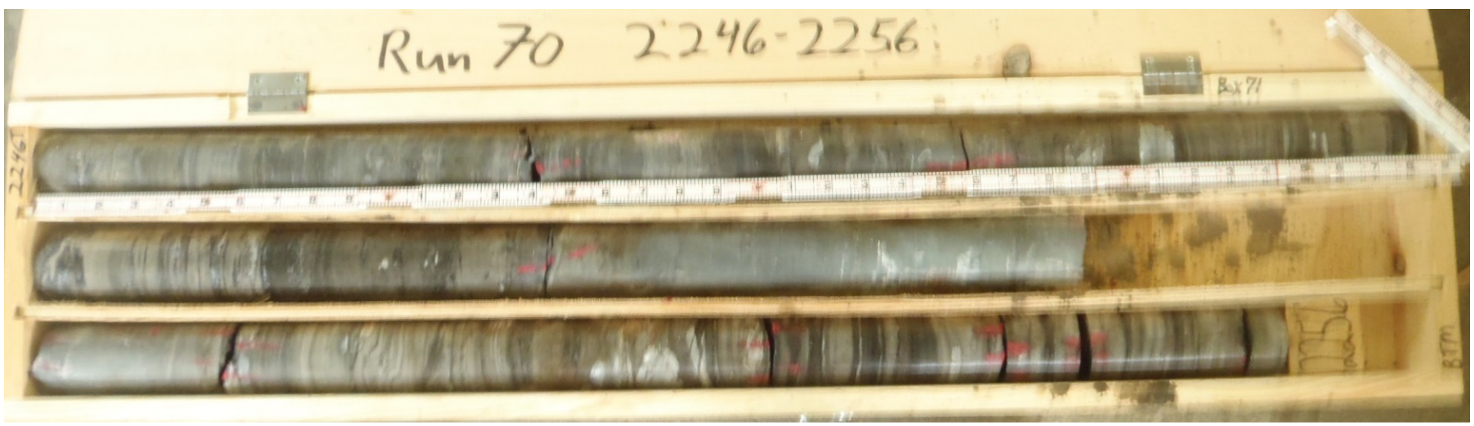

Figure B-82. Run 70: 2,246–2,256 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina E Member.

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Figure B-83. Run 71: 2,256–2,266 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina E Member.

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Figure B-84. Run 72: 2,266–2,276 Feet Below Ground Surface.
Salina Group: Syracuse Formation– Salina E Member.

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Figure B-85. Run 73: 2,276–2,286 Feet Below Ground Surface.
Salina Group: Syracuse Formation– Salina E Member.

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Figure B-86. Run 74: 2,286–2,296 Feet Below Ground Surface.
Salina Group: Syracuse Formation– Salina E Member.

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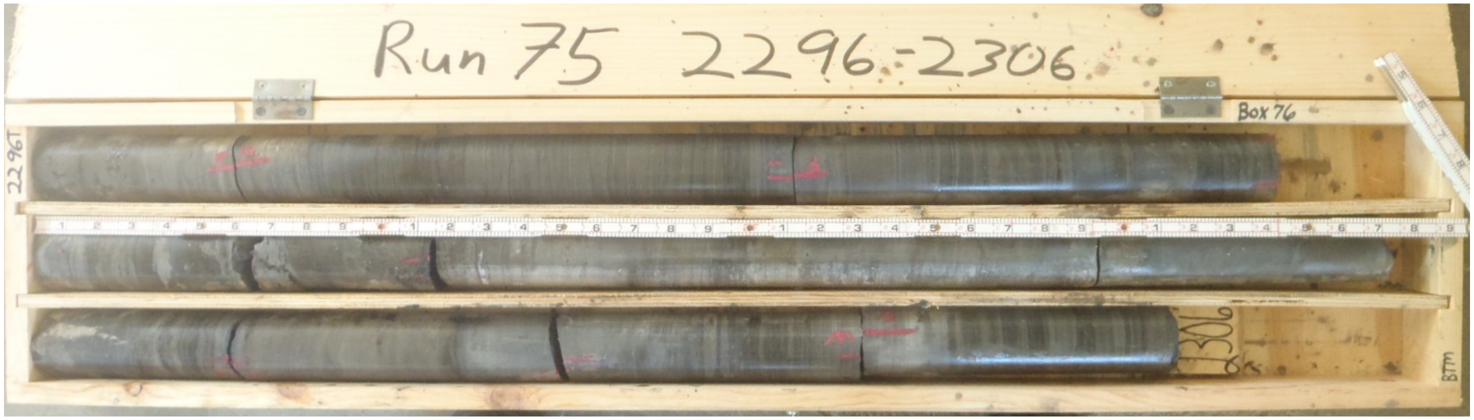

Figure B-87. Run 75: 2,296–2,306 Feet Below Ground Surface.
Salina Group: Syracuse Formation– Salina E Member.

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Figure B-88. Run 76: 2,306–2,316 Feet Below Ground Surface.
Salina Group: Syracuse Formation– Salina E Member.

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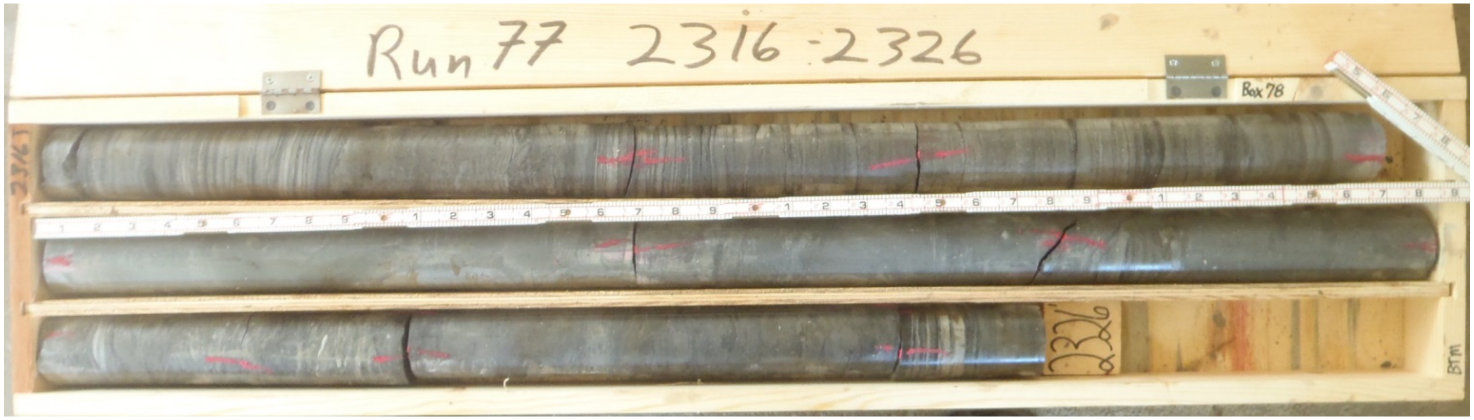

Figure B-89. Run 77: 2,316–2,326 Feet Below Ground Surface.
Salina Group: Syracuse Formation– Salina E Member.

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Figure B-90. Run 78: 2,326–2,336 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina E Member and Salina D Contact at Salina D3/ #5 Salt.

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Figure B-91. Run 79: 2,336–2,346 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina D3/#5 Salt.

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Figure B-92. Run 80: 2,346–2,356 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina D3/#5 Salt and Claystone.

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Figure B-93. Run 81: 2,356–2,366 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina D Claystone and #5A Salt.

RSI-2099-13-202

Figure B-94. Run 82: 2,366–2,376 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina D Claystone.

RSI-2099-13-203

Figure B-95. Run 83: 2,376–2,386 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina D Claystone and Salina D2/#6 Salt.

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Figure B-96. Run 84: 2,386–2,396 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina D2/#6 Salt.

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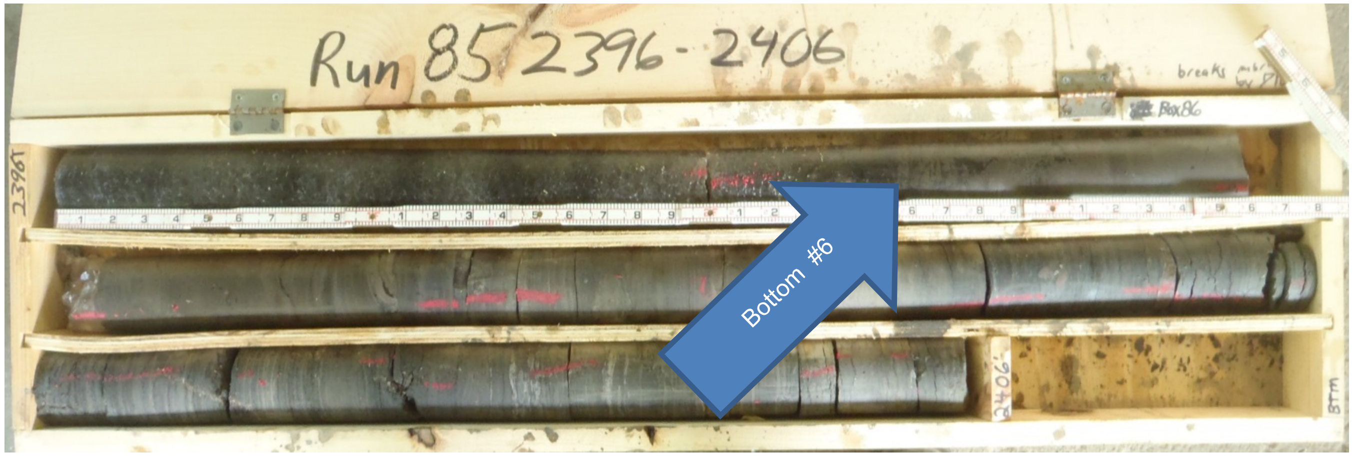

Figure B-97. Run 85: 2,396–2,406 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina D2/#6 Salt and Dolomite.

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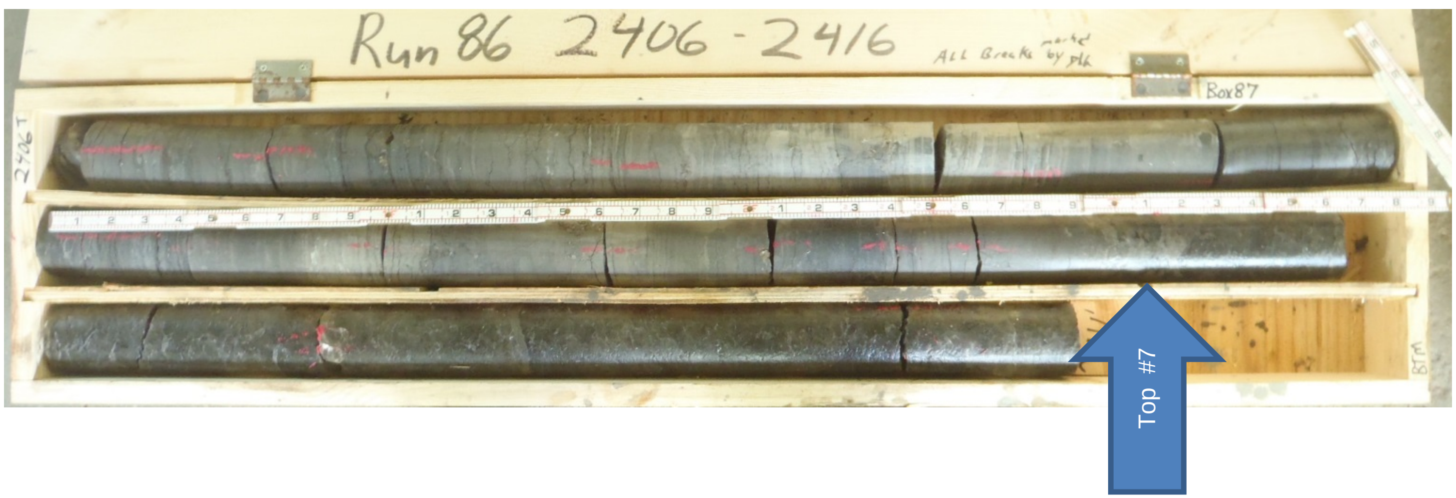

Figure B-98. Run 86: 2,406–2,416 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina D Dolomite and Salina D1/# 7 Salt.

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Figure B-99. Run 87: 2,416–2,426 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina D1/# 7 Salt and Salina C/Vernon Shale Contact.

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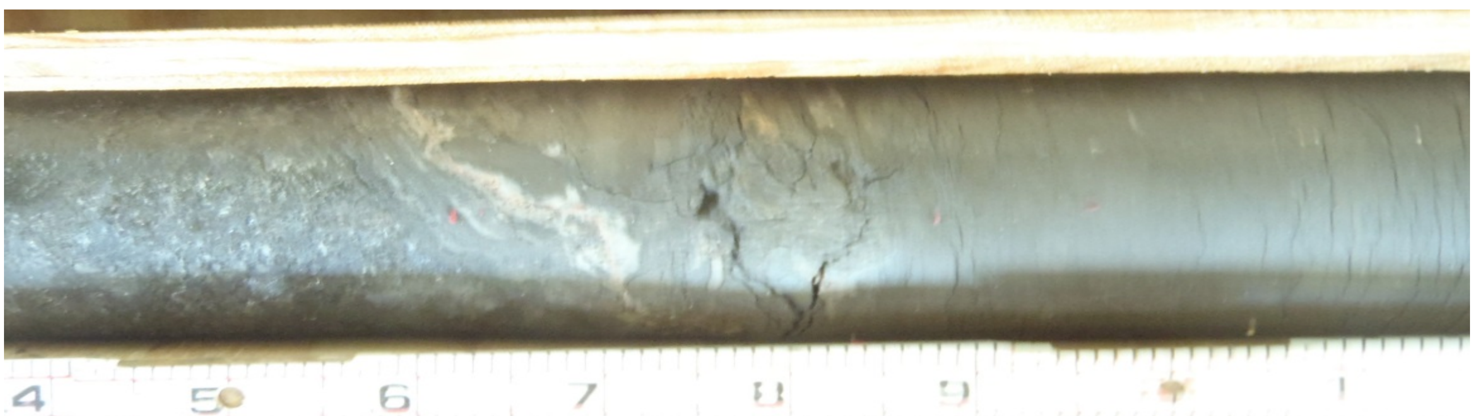

Figure B-100. Bottom of Salina D1/#7 Salt Salina C/Vernon Formation Transition Zone.

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Figure B-101. Run 88: 2,426–2,436 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina C/Vernon Shale.

RSI-2099-13-210

Figure B-102. Run 89: 2,436–2,446 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina C/ Vernon Shale

RSI-2099-13-211

Figure B-103. Run 90: 2,446–2,456 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina C/Vernon Shale.

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Figure B-104. Run 91: 2,456–2,466 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina C/Vernon Shale.

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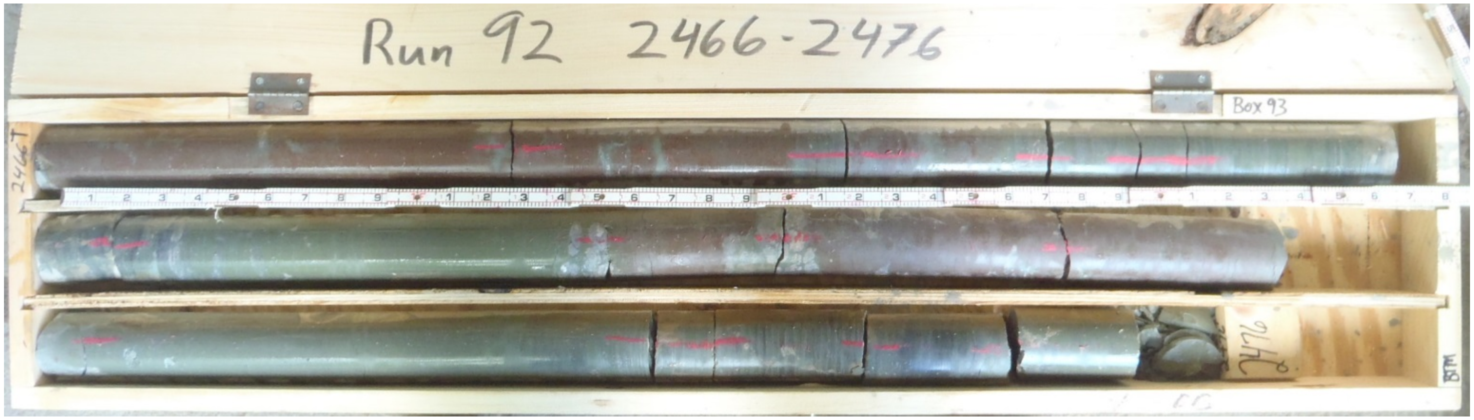


Figure B-105. Run 92: 2,466–2,476 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina C/Vernon Shale.

RSI-2099-13-214

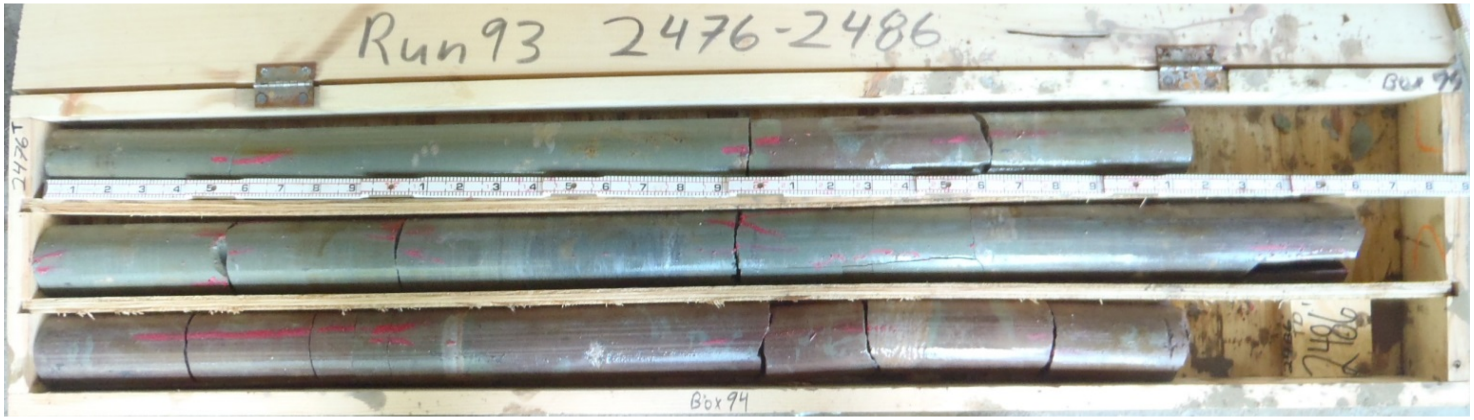


Figure B-106. Run 93: 2,476–2,486 Feet Below Ground Surface.
Salina Group: Syracuse Formation–Salina C Vernon Shale.

Figure B-107. Brine Bubbles Under the Salt Sheet in the Vertical Fracture at 2,484 Feet Below Ground Surface. Salina Group: Syracuse Formation–Salina C/Vernon Shale.

APPENDIX C

WEATHERFORD WIRELINE LOGS

-CONFIDENTIAL-

Weatherford

Photo Density
Compensated Neutron
Gamma Ray

COMPANY	**Cargill Inc.**
WELL	**Cargill 18**
FIELD	**Lansing**
PROVINCE/COUNTY	**Tompkins County**
COUNTRY/STATE	**U.S.A. / New York**
LOCATION	

FIELD PRINT

SEC	TWP	RGE

API Number
Permit Number 31-109-26509-00

Other Services
Array Induction — Data Pack
Compensated Sonic — Caliper
Vectar

Permanent Datum Ground Level, Elevation 887 feet
Log Measured From GL
Drilling Measured From GLL

Elevations:	feet
KB	883.00
DF	887.00
GL	887.00

Date	15-May-2013			
Run Number	One			
Service Order	3531401			
Depth Driller	590.00 feet			
Depth Logger	587.00 feet			
First Reading	587.00 feet			
Last Reading	0.00 feet			
Casing Driller	28.00 feet			
Casing Logger	28.00 feet			
Bit Size	8.875 inches			
Hole Fluid Type	Water Based			
Density / Viscosity	8.50 lb/USg	27.00 sec/qt		
PH / Fluid Loss				
Sample Source	Flow Line			
Rm @ Measured Temp	9.51 @ 68.0 ohm-m			
Rmf @ Measured Temp	7.133 @ 68.0 ohm-m			
Rmc @ Measured Temp	14.265@ 68.0 ohm-m			
Source Rmf / Rmc	Calc.	Calc.		
Rm @ BHT	9.51 @ 68.0 ohm-m			
Time Since Circulation	4 Hrs			
Max Recorded Temp				
Equipment / Base	13041	Muncy		
Recorded By	Nibras Nureldin			
Witnessed By	Patrick mcgrath			

BOREHOLE RECORD

Last Edited: 15-MAY-2013 13:47

Bit Size (inches)	Depth From (feet)	Depth To (feet)
8.750	28.50	587.00

CASING RECORD

Type	Size (inches)	Depth From (feet)	Shoe Depth (feet)	Weight (pounds/ft)
	10.750	0.00	28.50	42.00

REMARKS

Software: WLS 13.05.9583

Tools Run 2: SHA, MCG, MDN, MPD, MFE,,MAI

Hardware: MDN - Dual Eccentraliser
MAI - Two-1 Inch Standoffs
MPD - Two Roll over subs

Density Matrix was ran on 2.71 gg/cc

Crew: Nibras Nureldin
Bruce Clark

Gamma ray spikes up at the bottom of the borehole because the gamma ray sub ran below the sources
7 inch casing was used to calculate annular hole volumes
Gamma ray was recorded to ground level

Gamma ray was recorded to ground level

Mud Density is 8.5 lbs/USg

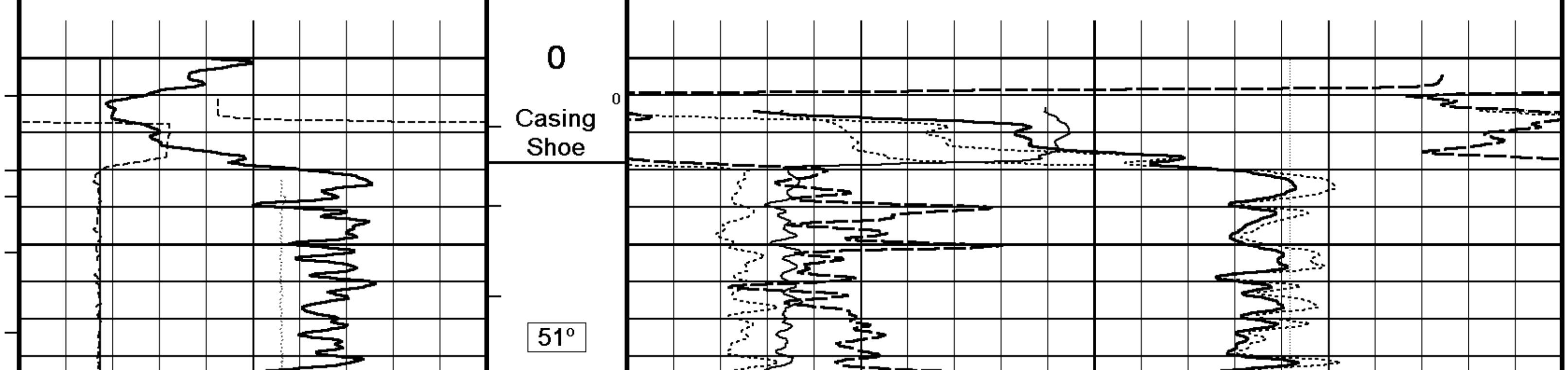
-CONFIDENTIAL-

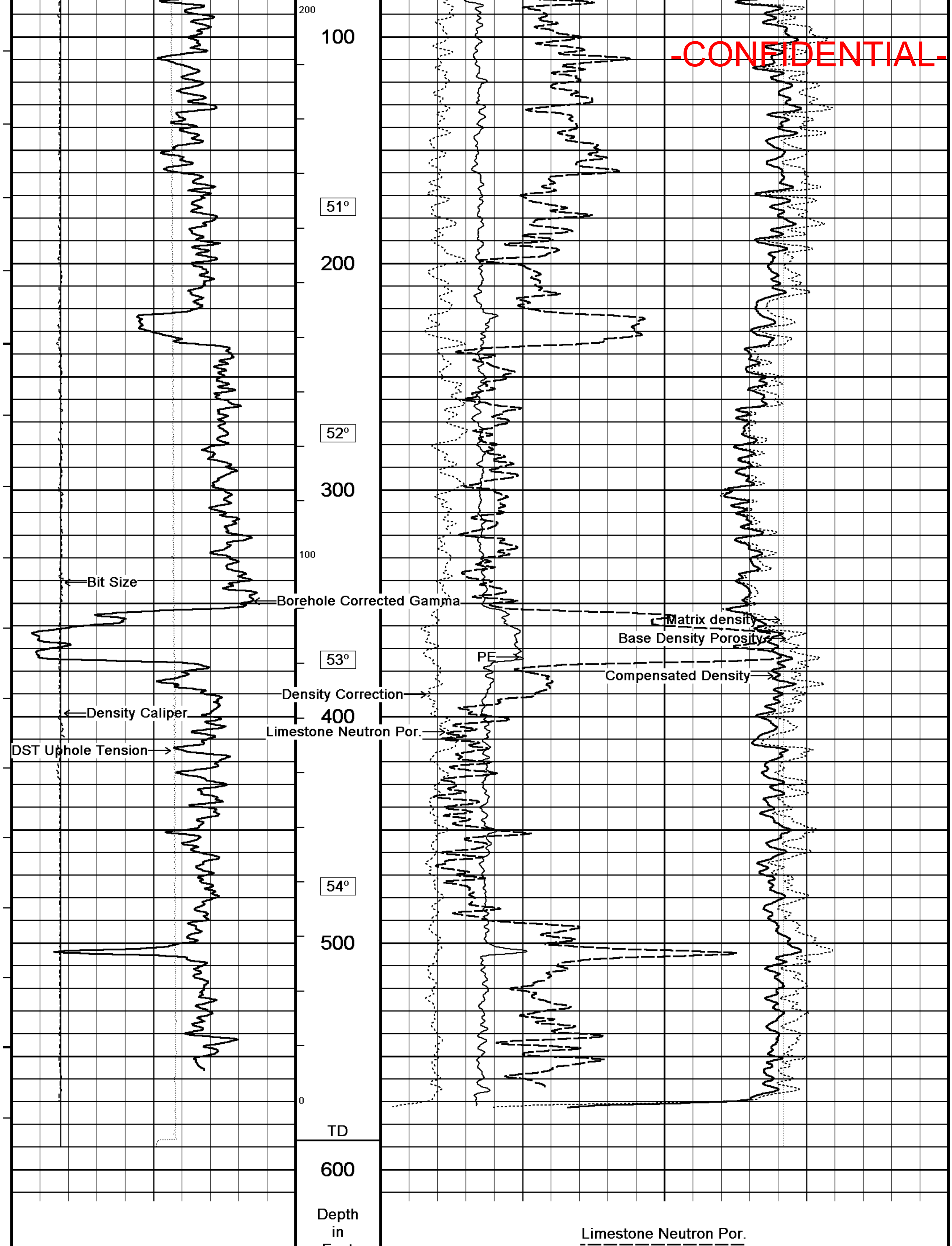
All interpretations are opinions based on inferences from electrical or other measurements and we cannot, and do not, guarantee the accuracy or correctness of any interpretations, and we shall not, except in the case of gross or wilful negligence on our part, be liable or responsible for any loss, costs, damages or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, agents or employees. These interpretations are also subject to our general terms and conditions in our price schedule.

2 Inch Main Log

Depth Based Data - Maximum Sampling Increment 10.0cm | Plotted on 15-MAY-2013 14:22
Filename: C:\Logs\Cargill Inc\Cargill 18\...\Cargill Inc_Cargill 18_Run_2 Triple_3531401 Main Pass.dta | Recorded on 15-MAY-2013 12:48
System Versions: Logged with 13.05.9583 Processed with 13.05.9583 Plotted with 13.05.9583

Timing Marks, every 60.0 sec	Depth in Feet	Limestone Neutron Por., percent: 30 / 20 / 10 / 0 / -10
Density Caliper, inches: 7 / 12 / 17	Borehole Temp in deg F	Compensated Density, grams/cc: 2 / 2.25 / 2.50 / 2.75 / 3
Borehole Corrected Gamma, API: 0 / 100 / 200; 200 / 300 / 400	HVI every 10 cu ft	Base Density Porosity, percent: 30 / 20 / 10 / 0 / -10
Bit Size, inches: 7 / 12 / 17	Annular Integral every 10 cu ft	Matrix density, grams/cc: 2 / 2.25 / 2.50 / 2.75 / 3
		Density Correction, grams/cc: -0.05 / 0.20 / 0.45
DST Uphole Tension, pounds: 0 / 3000; 3000 / 6000	Replay Scale 1:600	PE, barns/electron: 0 / 5 / 10




200
100
-CONFIDENTIAL-
51º
200
52º
300
100
Bit Size
Borehole Corrected Gamma
Matrix density
Base Density Porosity
53º
PE
Compensated Density
Density Correction
Density Caliper
400
Limestone Neutron Por.
DST Uphole Tension
54º
500
0
TD
600
Depth
in
Limestone Neutron Por.

Feet

percent

30 20 10 0 -10

-CONFIDENTIAL-

Timing Marks
every 60.0 sec

Compensated Density
grams/cc
2 2.25 2.50 2.75 3

Density Caliper
inches
7 12 17

Borehole Temp in deg F

Base Density Porosity
percent
30 20 10 0 -10

HVI every 10 cu ft

Borehole Corrected Gamma
API
0 100 200
200 300 400

Matrix density
grams/cc
2 2.25 2.50 2.75 3

Annular Integral every 10 cu ft

Bit Size
inches
7 12 17

Density Correction
grams/cc
-0.05 0.20 0.45

DST Uphole Tension
pounds
0 3000
3000 6000

Replay Scale 1:600

PE
barns/electron
0 5 10

Depth Based Data - Maximum Sampling Increment 10.0cm | Plotted on 15-MAY-2013 14:22
Filename: C:\Logs\Cargill Inc\Cargill 18\...\Cargill Inc_Cargill 18_Run_2 Triple_3531401 Main Pass.dta | Recorded on 15-MAY-2013 12:48
System Versions: Logged with 13.05.9583 Processed with 13.05.9583 Plotted with 13.05.9583

2 Inch Main Log

5 Inch Main Log

Depth Based Data - Maximum Sampling Increment 10.0cm | Plotted on 15-MAY-2013 14:22
Filename: C:\Logs\Cargill Inc\Cargill 18\...\Cargill Inc_Cargill 18_Run_2 Triple_3531401 Main Pass.dta | Recorded on 15-MAY-2013 12:48
System Versions: Logged with 13.05.9583 Processed with 13.05.9583 Plotted with 13.05.9583

Depth in Feet

Limestone Neutron Por.
percent
30 20 10 0 -10

Timing Marks
every 60.0 sec

Compensated Density
grams/cc
2 2.25 2.50 2.75 3

Density Caliper
inches
7 12 17

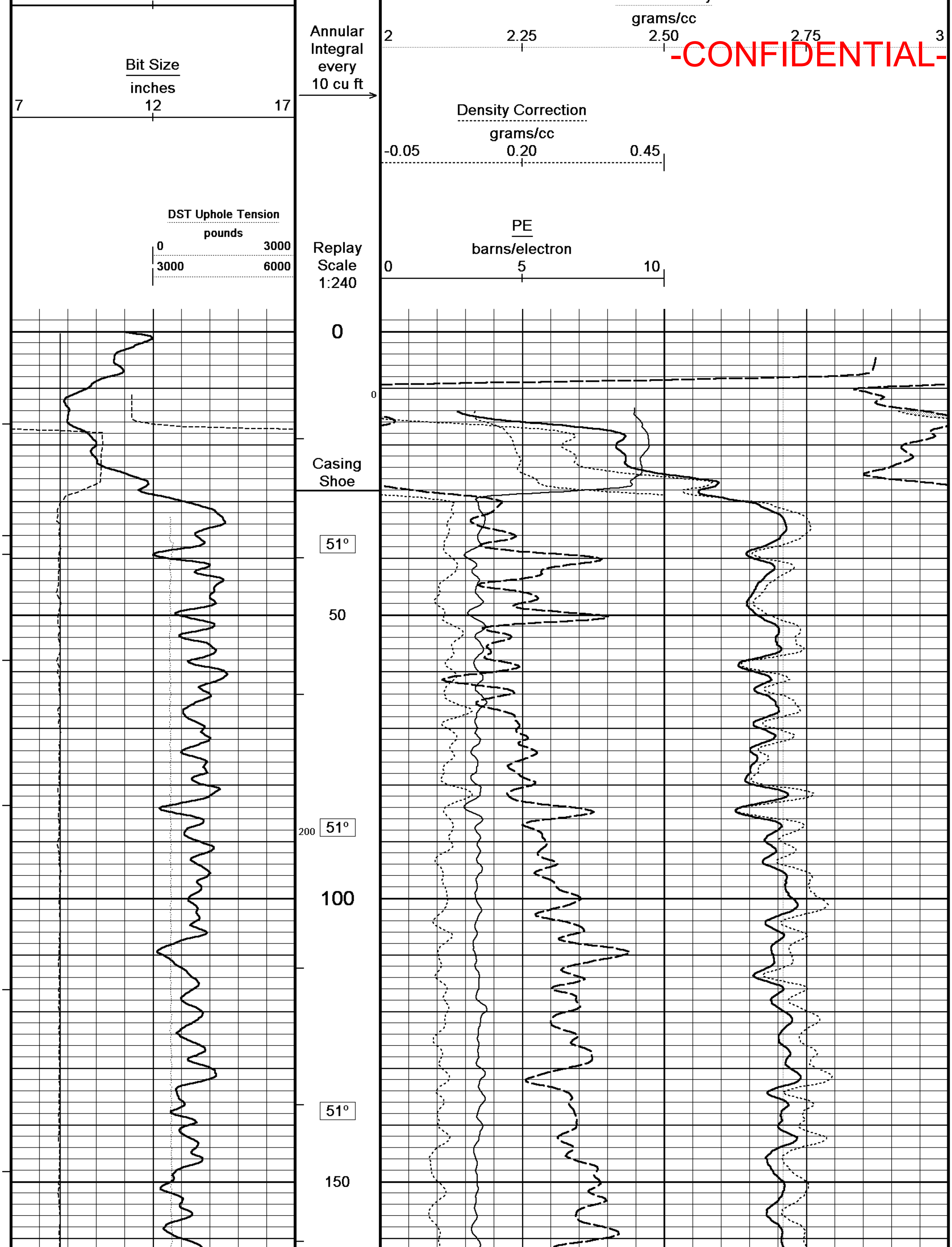
Borehole Temp in deg F

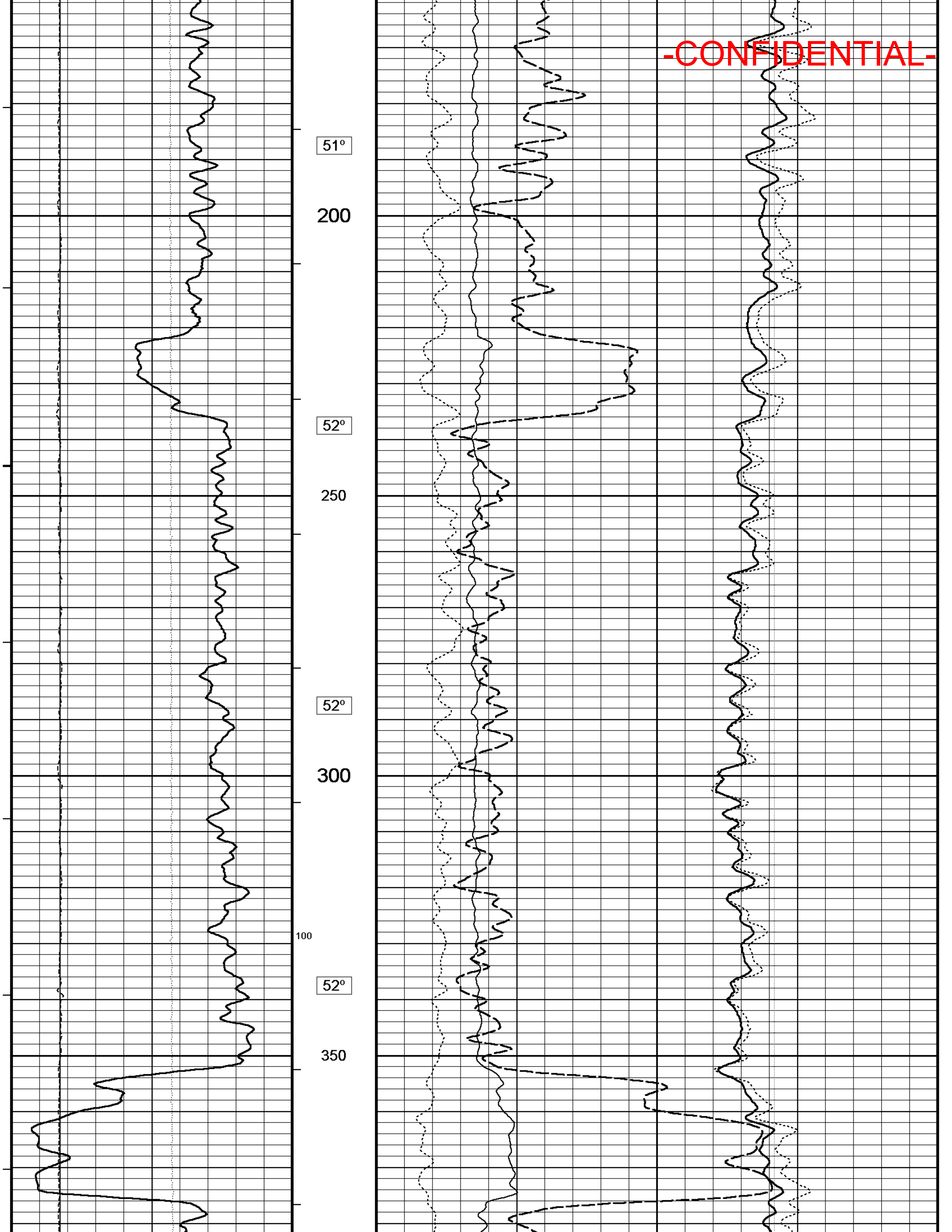
Base Density Porosity
percent
30 20 10 0 -10

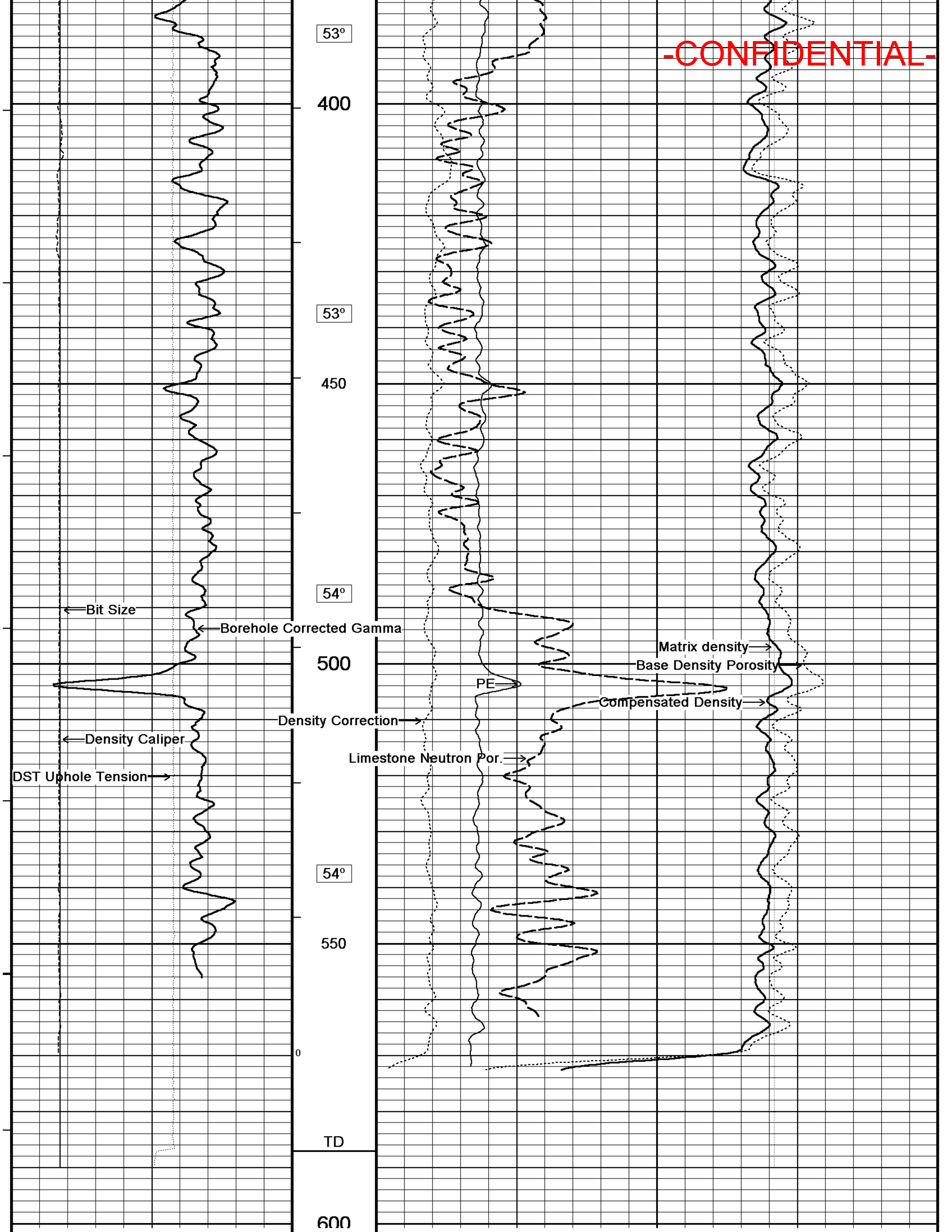
HVI every 10 cu ft

Borehole Corrected Gamma
API
0 100 200
200 300 400

Matrix density


grams/cc
2
2.25
2.50
2.75
3
-CONFIDENTIAL-
Bit Size
inches
7
12
17
Annular Integral every 10 cu ft
Density Correction
grams/cc
-0.05
0.20
0.45
DST Uphole Tension
pounds
0
3000
3000
6000
Replay Scale 1:240
PE
barns/electron
0
5
10
0
0
Casing Shoe
51°
50
200
51°
100
51°
150


-CONFIDENTIAL-
51°
200
52°
250
52°
300
100
52°
350



-CONFIDENTIAL-
53°
400
53°
450
54°
500
54°
550
0
TD
600
Bit Size
Borehole Corrected Gamma
Matrix density
Base Density Porosity
PE
Compensated Density
Density Correction
Density Caliper
Limestone Neutron Por.
DST Uphole Tension

Timing Marks every 60.0 sec	Depth in Feet	Limestone Neutron Por. percent 30 20 10 0 -10
Density Caliper inches 7 12 17	Borehole Temp in deg F	Compensated Density grams/cc 2 2.25 2.50 2.75 3
Borehole Corrected Gamma API 0 100 200 200 300 400	HVI every 10 cu ft	Base Density Porosity percent 30 20 10 0 -10
Bit Size inches 7 12 17	Annular Integral every 10 cu ft	Matrix density grams/cc 2 2.25 2.50 2.75 3
		Density Correction grams/cc -0.05 0.20 0.45
DST Uphole Tension pounds 0 3000 3000 6000	Replay Scale 1:240	PE barns/electron 0 5 10

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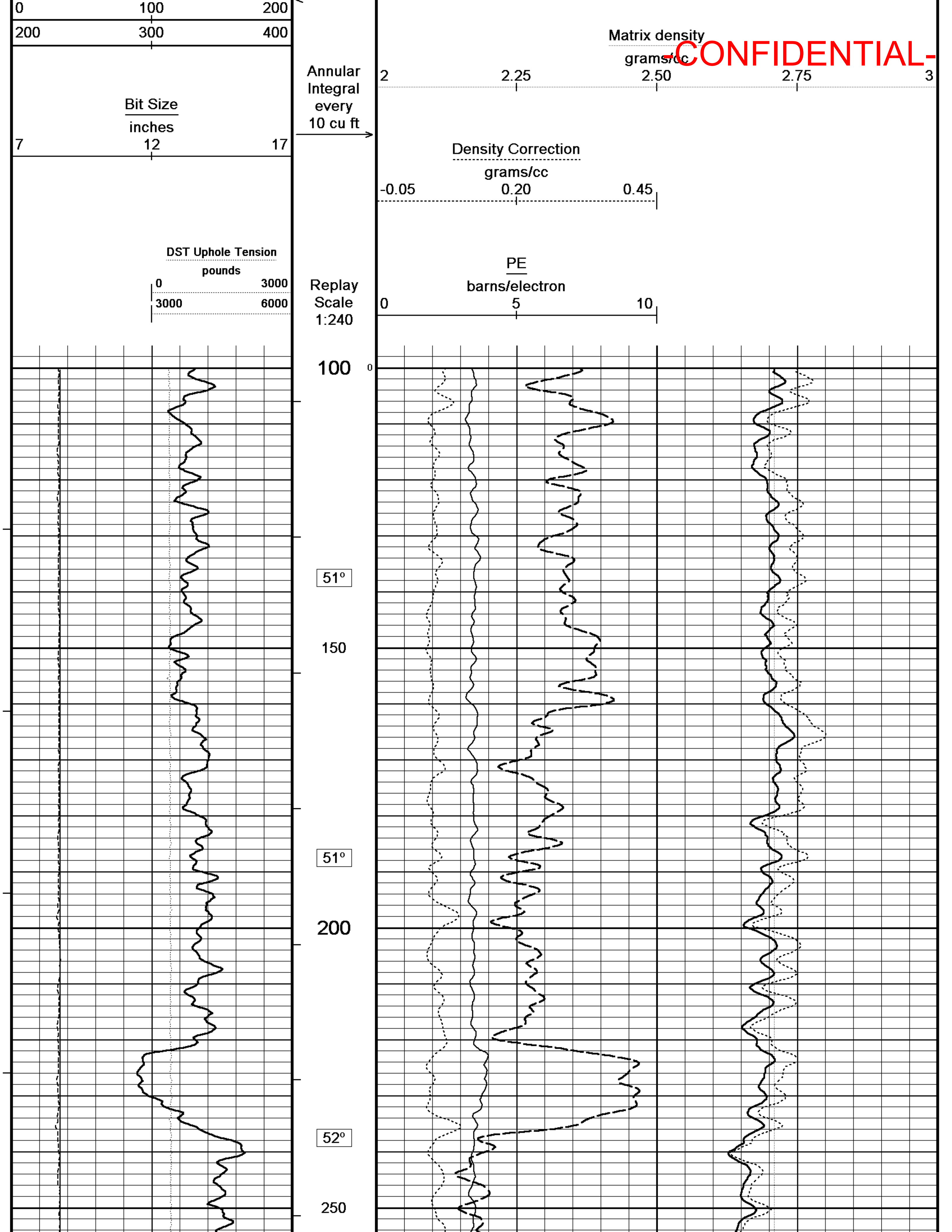
Depth Based Data - Maximum Sampling Increment 10.0cm — Plotted on 15-MAY-2013 14:22
Filename: C:\Logs\Cargill Inc\Cargill 18\...\Cargill Inc_Cargill 18_Run_2 Triple_3531401 Main Pass.dta — Recorded on 15-MAY-2013 12:48
System Versions: Logged with 13.05.9583 Processed with 13.05.9583 Plotted with 13.05.9583

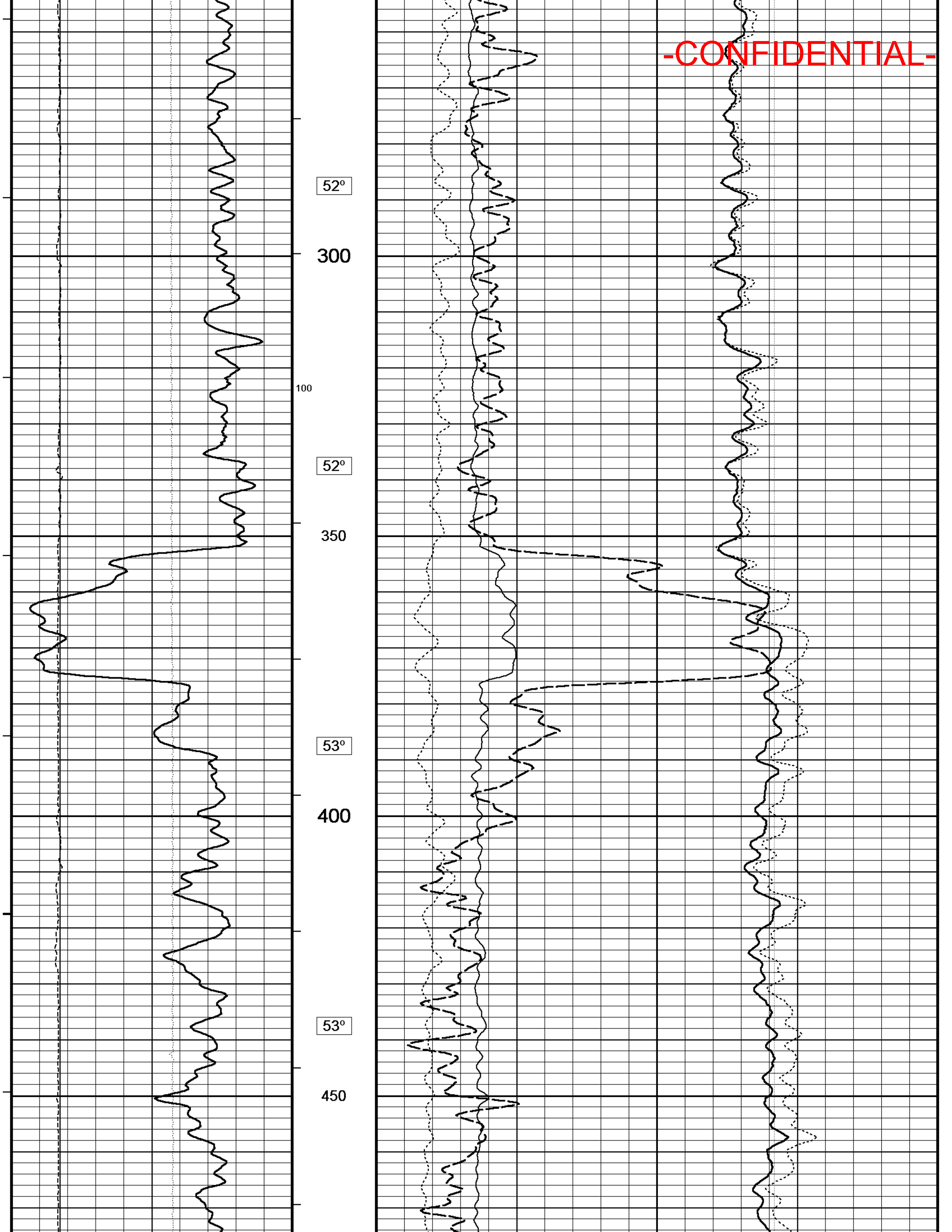
5 Inch Main Log

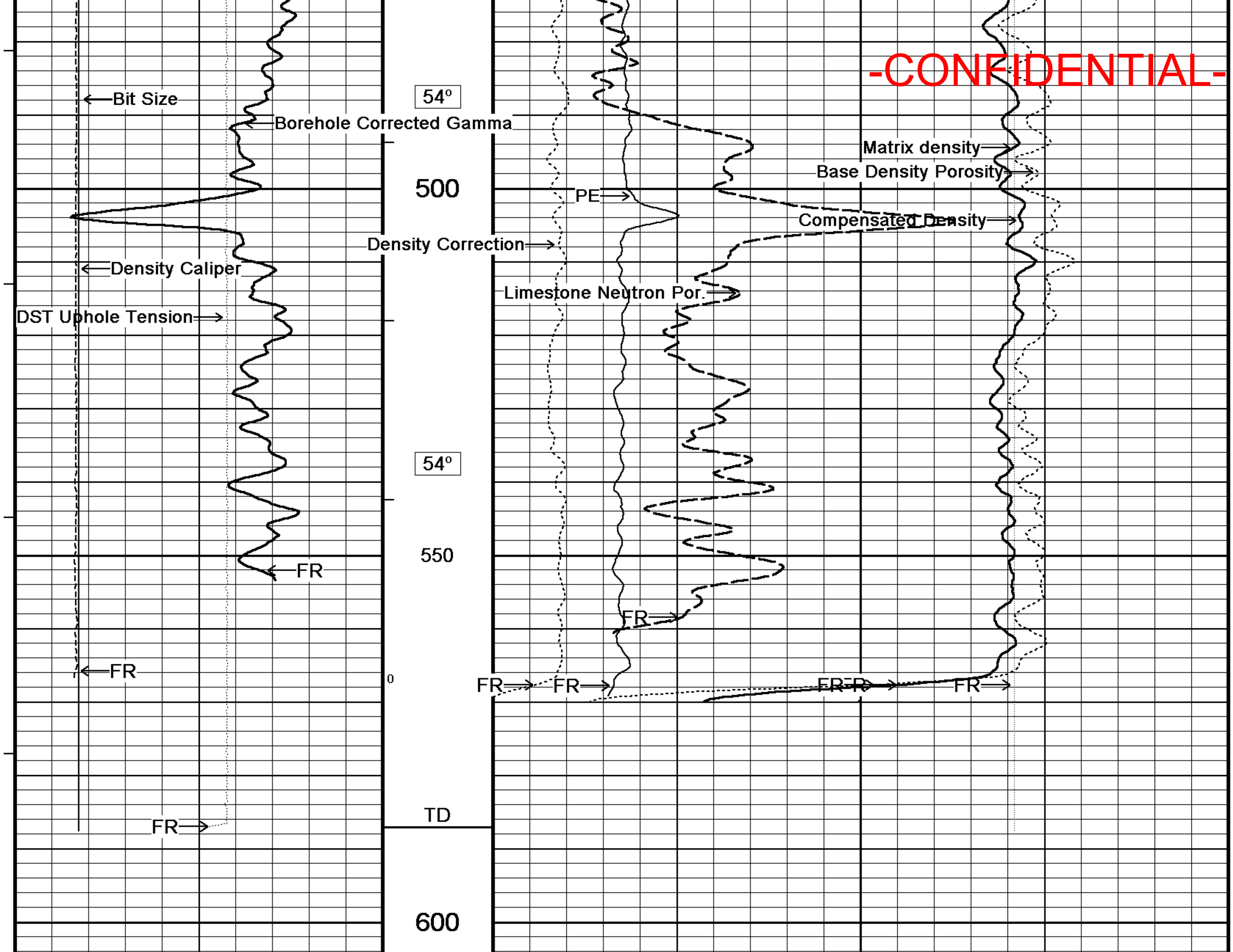
5 Inch Repeat Section

Depth Based Data - Maximum Sampling Increment 10.0cm — Plotted on 15-MAY-2013 14:22
Filename: C:\Logs\Cargill Inc\Cargill ...\Cargill Inc_Cargill 18_Run_2 Triple_3531401 Repeat Pass2.dta — Recorded on 15-MAY-2013 12:25
System Versions: Logged with 13.05.9583 Processed with 13.05.9583 Plotted with 13.05.9583

Timing Marks every 60.0 sec	Depth in Feet	Limestone Neutron Por. percent 30 20 10 0 -10
Density Caliper inches 7 12 17	Borehole Temp in deg F	Compensated Density grams/cc 2 2.25 2.50 2.75 3
Borehole Corrected Gamma API	HVI every 10 cu ft	Base Density Porosity percent 30 20 10 0 -10


0 100 200
200 300 400
Bit Size
inches
7 12 17
DST Uphole Tension
pounds
0 3000
3000 6000
Annular Integral every 10 cu ft
Replay Scale 1:240
100
150
200
250
51°
51°
52°
Matrix density
grams/cc
2 2.25 2.50 2.75 3
Density Correction
grams/cc
-0.05 0.20 0.45
PE
barns/electron
0 5 10


52°
300
100
52°
350
53°
400
53°
450



Depth in Feet

Timing Marks
every 60.0 sec

Density Caliper
inches
7 12 17

Borehole Corrected Gamma
API
0 100 200
200 300 400

Bit Size
inches
7 12 17

Borehole Temp in deg F

HVI every 10 cu ft

Annular Integral every 10 cu ft

Limestone Neutron Por.
percent
30 20 10 0 -10

Compensated Density
grams/cc
2 2.25 2.50 2.75 3

Base Density Porosity
percent
30 20 10 0 -10

Matrix density
grams/cc
2 2.25 2.50 2.75 3

Density Correction

DST Uphole Tension pounds	Replay Scale 1:240	grams/cc
0 — 3000		-0.05 — 0.20 — 0.45
3000 — 6000		PE barns/electron
		0 — 5 — 10

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Depth Based Data - Maximum Sampling Increment 10.0cm — Plotted on 15-MAY-2013 14:22
Filename: C:\Logs\Cargill Inc\Cargill ...\Cargill Inc_Cargill 18_Run_2 Triple_3531401 Repeat Pass2.dta — Recorded on 15-MAY-2013 12:25
System Versions: Logged with 13.05.9583 Processed with 13.05.9583 Plotted with 13.05.9583

5 Inch Repeat Section

BEFORE SURVEY CALIBRATION

C:\Logs\Cargill Inc\Cargill 18\Run_2 Triple\3531401\Cargill Inc_Cargill 18_Run_2 Triple_3531401 Repeat Pass2.dta

General Constants All 000

Last Edited on 15-MAY-2013,08:32

General Parameters		
Mud Resistivity	9.510	ohm-metres
Mud Resistivity Temperature	68.000	degrees F
Water Level	0.000	feet
Borehole Fluid Processing	Water Level Switch	
Hole/Annular Volume and Differential Caliper Parameters		
HVOL Method	Single Caliper	
HVOL Caliper 1	Density Caliper	
HVOL Caliper 2	N/A	
Annular Volume Diameter	10.750	inches
Caliper for Differential Caliper	Density Caliper	
Rwa Parameters		
Porosity used	Base Density Porosity	
Resistivity used	Array Ind. Two Res Rt	
RWA Constant A	0.610	
RWA Constant M	2.150	
SW/APOR Tool Source	0.000	

Gamma Calibration MCG-B 60

Field Calibration on 09-MAY-2013 10:29

	Measured	Calibrated (API)
Background	46	32
Calibrator (Gross)	2206	1571
Calibrator (Net)	2160	1539

Gamma Constants MCG-B 60

Last Edited on 15-MAY-2013,08:32

Gamma Calibrator Number	45	
Mud Density	1.02	gm/cc
Caliper Source for Processing	Density Caliper	
Tool Position	Eccentred	
Concentration of KCl		kppm
K Mud Type	Chloride	
K Mud Concentration	0.00	%

High Resolution Temperature Calibration MCG-B 60

Field Calibration on 24-APR-2013,11:52

	Measured	Calibrated(Deg F)
Lower	60.00	60.00
Upper	101.00	100.00

High Resolution Temperature Constants MCG-B 60

Last Edited on 24-APR-2013,11:52

Pre-filter Length	11

Neutron Calibration MDN-A.B 80

Base Calibration on 24-APR-2013,12:07
Field Check on 24-APR-2013 12:15

Base Calibration

Base Calibration

	Measured Near	Measured Far	Calibrated (cps) Near	Calibrated (cps) Far
	3504	108	3714	110
Ratio	32.559		33.764	

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Field Calibrator at Base

	Calibrated (cps)	
	1457	2097
Ratio	0.695	

Field Check

	Calibrated (cps)	
	1206	1797
Ratio	0.671	

Neutron Constants MDN-A.B 80

Last Edited on 15-MAY-2013,08:32

Neutron Source Id	P0197NN	
Neutron Jig Number	50656N	
Epithermal Neutron	No	
Caliper Source for Processing	Density Caliper	
Stand-off	0.00	inches
Mud Density	1.02	gm/cc
Limestone Sigma	7.10	cu
Sandstone Sigma	4.26	cu
Dolomite Sigma	4.70	cu
Formation Pressure Source	Constant Value	
Formation Pressure	0.00	kpsi
Temperature Source	Constant Value	
Temperature	68.00	degrees F
Mud Salinity	0.00	kppm
Salinity Correction	Not Applied	
Formation Fluid Salinity Source	Constant Value	
Formation Fluid Salinity	0.00	kppm
Barite Mud Correction	Not Applied	

Caliper Calibration MPD-A.A 20

Base Calibration on 14-MAY-2013 15:42
Field Calibration on 14-MAY-2013 15:47

Base Calibration

Reading No	Measured	Calibrator Size (in)
1	25425	6.03
2	35728	7.99
3	45344	9.85
4	55749	11.82
5	0	0.00
6	N/A	N/A

Field Calibration

Measured Caliper (in)	Actual Caliper (in)
7.95	7.99

Photo Density Calibration MPD-A.A 20

Base Calibration on 14-MAY-2013 15:29
Field Check on

Density Calibration

Base Calibration

	Measured Near	Measured Far	Calibrated (sdu) Near	Calibrated (sdu) Far
Reference 1	42764	15583	53453	19407
Reference 2	20333	2614	25381	2580

Field Check at Base

1286.4	1488.0

Field Check

PE Calibration

Base Calibration

	Measured WS	Measured WH	Measured Ratio	Calibrated Ratio
Background	232	1140		
Reference 1	14360	42576	0.341	0.320
Reference 2	5518	20178	0.278	0.274

Field Check at Base

232.2	1139.7

Field Check

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Density Constants MPD-A.A 20

Last Edited on 15-MAY-2013,08:31

Density Source Id	21145B	
Nylon Calibrator Number	DNC-D-520	
Aluminium Calibrator Number	DAC-D-520	
Density Shoe Profile	8 inch	
Caliper Source for Processing	Density Caliper	
PE Correction to Density	Not Applied	
Mud Density	1.02	gm/cc
Mud Density Z/A Multiplier	1.11	
Mud Filtrate Density	1.00	gm/cc
Dry Hole Mud Filtrate Density	0.70	gm/cc
DNCT	0.00	gm/cc
CRCT	0.00	gm/cc
Density Z/A Correction	Hybrid	

Matrix Density (gm/cc)	Depth (ft)
2.71	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00

DOWNHOLE EQUIPMENT

C:\Logs\Cargill Inc\Cargill 18\Run_2 Triple\3531401\Cargill Inc_Cargill 18_Run_2 Triple_3531401 Repeat Pass2.dta

3/8" Triple Cone Cable Head (MCB F B)
MCB-F.B 52 LG: 1.58 ft WT: 15.4 lb OD: 2.24 in

SHA-J.A Compact Swivel Head Adaptor
SHA-J.A 353 LG: 2.30 ft WT: 22.0 lb OD: 2.24 in

Compact Comms Gamma
MCG-B 60 LG: 8.70 ft WT: 63.9 lb OD: 2.24 in

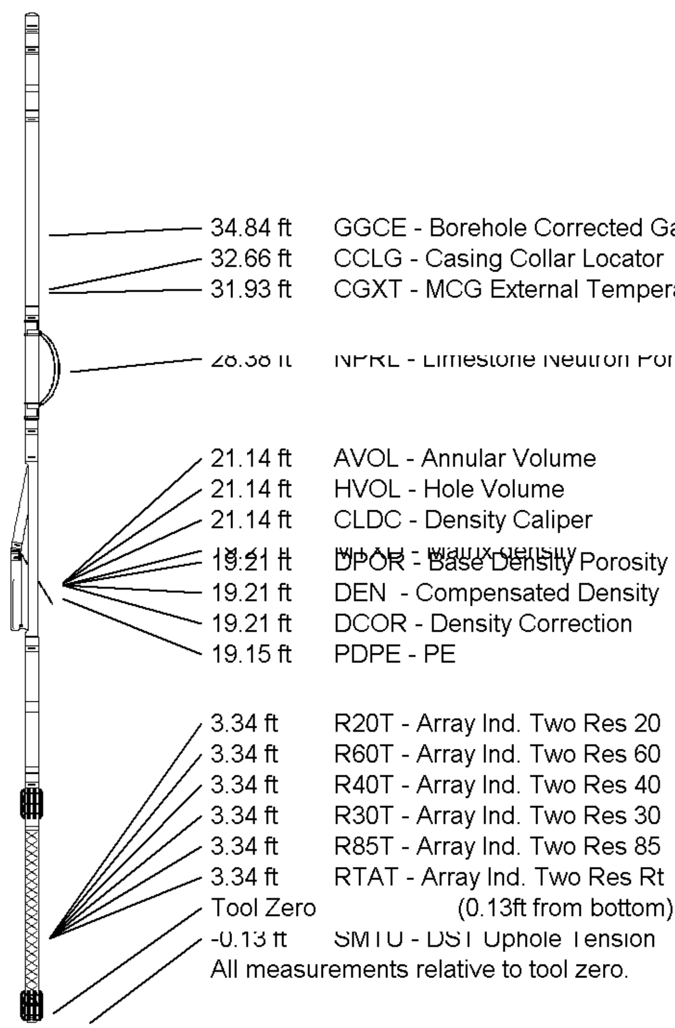
Compact Neutron
MDN-A.B 80 LG: 5.04 ft WT: 50.7 lb OD: 2.24 in

Compact Density/Caliper
MPD-A.A 20 LG: 9.53 ft WT: 90.4 lb OD: 2.45 in

Compact Focussed Electric
MFE-A.A 9 LG: 6.05 ft WT: 48.5 lb OD: 2.24 in

Compact Induction
MAI-A.A 80 LG: 10.81 ft WT: 48.5 lb OD: 2.24 in

Total Length: 44.00 ft Weight: 339.5 lb



-CONFIDENTIAL-

COMPANY	Cargill Inc.
WELL	Cargill 18
FIELD	Lansing
PROVINCE/COUNTY	Tompkins County
COUNTRY/STATE	U.S.A. / New York

Elevation Kelly Bushing	883.00	feet	First Reading	587.00	feet
Elevation Drill Floor	887.00	feet	Depth Driller	590.00	feet
Elevation Ground Level	887.00	feet	Depth Logger	587.00	feet

Weatherford®

Photo Density
Compensated Neutron
Gamma Ray

Weatherford

Array Induction
Gamma Ray

COMPANY	**Cargill Inc.**
WELL	**Cargill 18**
FIELD	**Lansing**
PROVINCE/COUNTY	**Tompkins County**
COUNTRY/STATE	**U.S.A. / New York**
LOCATION	

FIELD PRINT

SEC	TWP	RGE	Other Services	
			Photo Density	Data Pack
API Number			Compensated Neutron	Caliper
Permit Number 31-109-26509-00			Compensated Sonic	Vectar

Permanent Datum Ground Level, Elevation 887 feet
Log Measured From GL
Drilling Measured From GLL

Elevations:	feet
KB	883.00
DF	887.00
GL	887.00

Date	15-May-2013			
Run Number	One			
Service Order	3531401			
Depth Driller	590.00 feet			
Depth Logger	587.00 feet			
First Reading	547.00 feet			
Last Reading	0.00 feet			
Casing Driller	28.00 feet			
Casing Logger	28.00 feet			
Bit Size	8.875 inches			
Hole Fluid Type	Water Based			
Density / Viscosity	8.50 lb/USg	27.00 sec/qt		
PH / Fluid Loss				
Sample Source	Flow Line			
Rm @ Measured Temp	9.51 @ 68.0 ohm-m			
Rmf @ Measured Temp	7.133 @ 68.0 ohm-m			
Rmc @ Measured Temp	14.265@ 68.0 ohm-m			
Source Rmf / Rmc	Calc.	Calc.		
Rm @ BHT	9.51 @ 68.0 ohm-m			
Time Since Circulation	4 Hrs			
Max Recorded Temp				
Equipment / Base	13041	Muncy		
Recorded By	Nibras Nureldin			
Witnessed By	Patrick mcgrath			

BOREHOLE RECORD

Last Edited: 15-MAY-2013 13:47

Bit Size inches	Depth From feet	Depth To feet
8.750	28.50	587.00

CASING RECORD

Type	Size inches	Depth From feet	Shoe Depth feet	Weight pounds/ft
	10.750	0.00	28.50	42.00

REMARKS

Software: WLS 13.05.9583

Tools Run 2: SHA, MCG, MDN, MPD, MFE,,MAI

Hardware: MDN - Dual Eccentraliser
MAI - Two-1 Inch Standoffs
MPD - Two Roll over subs

Density Matrix was ran on 2.71 gg/cc

Crew: Nibras Nureldin
Bruce Clark

Gamma ray spikes up at the bottom of the borehole because the gamma ray sub ran below the sources
7 inch casing was used to calculate annular hole volumes
Gamma ray was recorded to ground level

Gamma ray was recorded to ground level

Mud Density is 8.5 lbs/USg

-CONFIDENTIAL-

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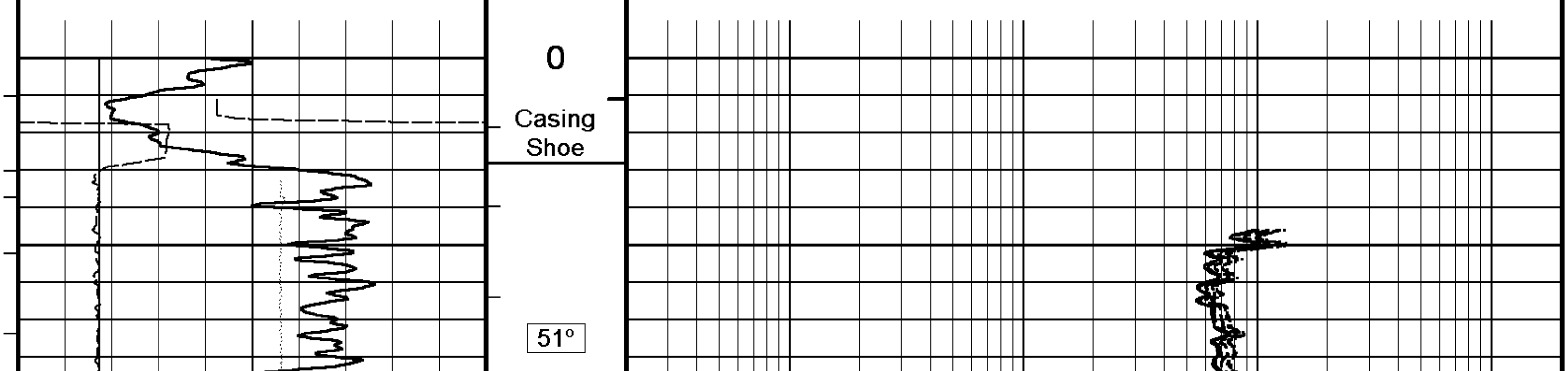
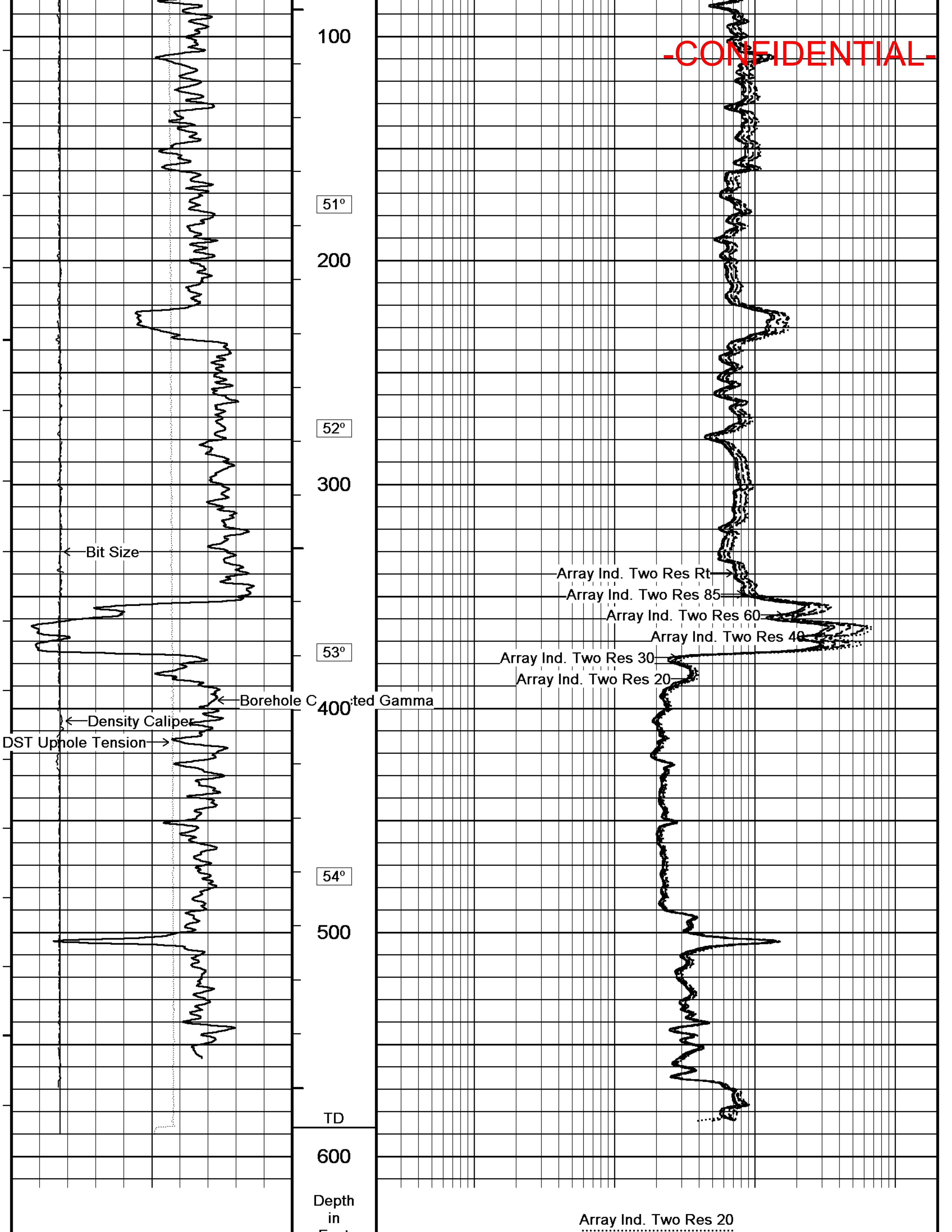
2 Inch Main Log

Depth Based Data - Maximum Sampling Increment 10.0cm — Plotted on 15-MAY-2013 14:23
Filename: C:\Logs\Cargill Inc\Cargill 18\...\Cargill Inc_Cargill 18_Run_2 Triple_3531401 Main Pass.dta — Recorded on 15-MAY-2013 12:48
System Versions: Logged with 13.05.9583 Processed with 13.05.9583 Plotted with 13.05.9583

Timing Marks, every 60.0 sec	Depth in Feet	Array Ind. Two Res 20, ohm metres, 0.20 – 2000 (1, 10, 100, 1000)
Density Caliper, inches, 7 – 12 – 17	Borehole Temp in deg F	Array Ind. Two Res 30, ohm metres, 0.20 – 2000 (1, 10, 100, 1000)
Borehole Corrected Gamma, API, 0 – 100 – 200; 200 – 300 – 400	HVI every 10 cu ft	Array Ind. Two Res 40, ohm metres, 0.20 – 2000 (1, 10, 100, 1000)
Bit Size, inches, 7 – 12 – 17	Annular Integral every 10 cu ft	Array Ind. Two Res 60, ohm metres, 0.20 – 2000 (1, 10, 100, 1000)
DST Uphole Tension, pounds, 0 – 3000; 3000 – 6000	Replay Scale 1:600	Array Ind. Two Res 85, ohm metres, 0.20 – 2000 (1, 10, 100, 1000)
		Array Ind. Two Res Rt, ohm metres, 0.20 – 2000 (1, 10, 100, 1000)





-CONFIDENTIAL-
100
51°
200
52°
300
Bit Size
Array Ind. Two Res Rt
Array Ind. Two Res 85
Array Ind. Two Res 60
Array Ind. Two Res 40
53°
Array Ind. Two Res 30
Array Ind. Two Res 20
Borehole Corrected Gamma
400
Density Caliper
DST Uphole Tension
54°
500
TD
600
Depth
in
Array Ind. Two Res 20

Feet

ohm metres

0.20 2000

1 10 100 1000

-CONFIDENTIAL-

Timing Marks

every 60.0 sec

Density Caliper

inches

7 12 17

Borehole Temp in deg F

Array Ind. Two Res 30

ohm metres

0.20 2000

1 10 100 1000

HVI every 10 cu ft

Borehole Corrected Gamma

API

0 100 200

200 300 400

Array Ind. Two Res 40

ohm metres

0.20 2000

1 10 100 1000

Annular Integral every 10 cu ft

Bit Size

inches

7 12 17

Array Ind. Two Res 60

ohm metres

0.20 2000

1 10 100 1000

Array Ind. Two Res 85

ohm metres

0.20 2000

1 10 100 1000

DST Uphole Tension

pounds

0 3000

3000 6000

Replay Scale 1:600

Array Ind. Two Res Rt

ohm metres

0.20 2000

1 10 100 1000

Depth Based Data - Maximum Sampling Increment 10.0cm — Plotted on 15-MAY-2013 14:23

Filename: C:\Logs\Cargill Inc\Cargill 18\...\Cargill Inc_Cargill 18_Run_2 Triple_3531401 Main Pass.dta — Recorded on 15-MAY-2013 12:48

System Versions: Logged with 13.05.9583 Processed with 13.05.9583 Plotted with 13.05.9583

2 Inch Main Log

5 Inch Main Log

Depth Based Data - Maximum Sampling Increment 10.0cm — Plotted on 15-MAY-2013 14:23

Filename: C:\Logs\Cargill Inc\Cargill 18\...\Cargill Inc_Cargill 18_Run_2 Triple_3531401 Main Pass.dta — Recorded on 15-MAY-2013 12:48

System Versions: Logged with 13.05.9583 Processed with 13.05.9583 Plotted with 13.05.9583

Depth in Feet

Array Ind. Two Res 20

ohm metres

0.20 2000

1 10 100 1000

Timing Marks

every 60.0 sec

Array Ind. Two Res 30

ohm metres

Density Caliper

inches

7 12 17

Borehole Temp in deg F

0.20 2000

1 10 100 1000

Array Ind. Two Res 40

ohm metres

HVI every 10 cu ft

Borehole Corrected Gamma

API

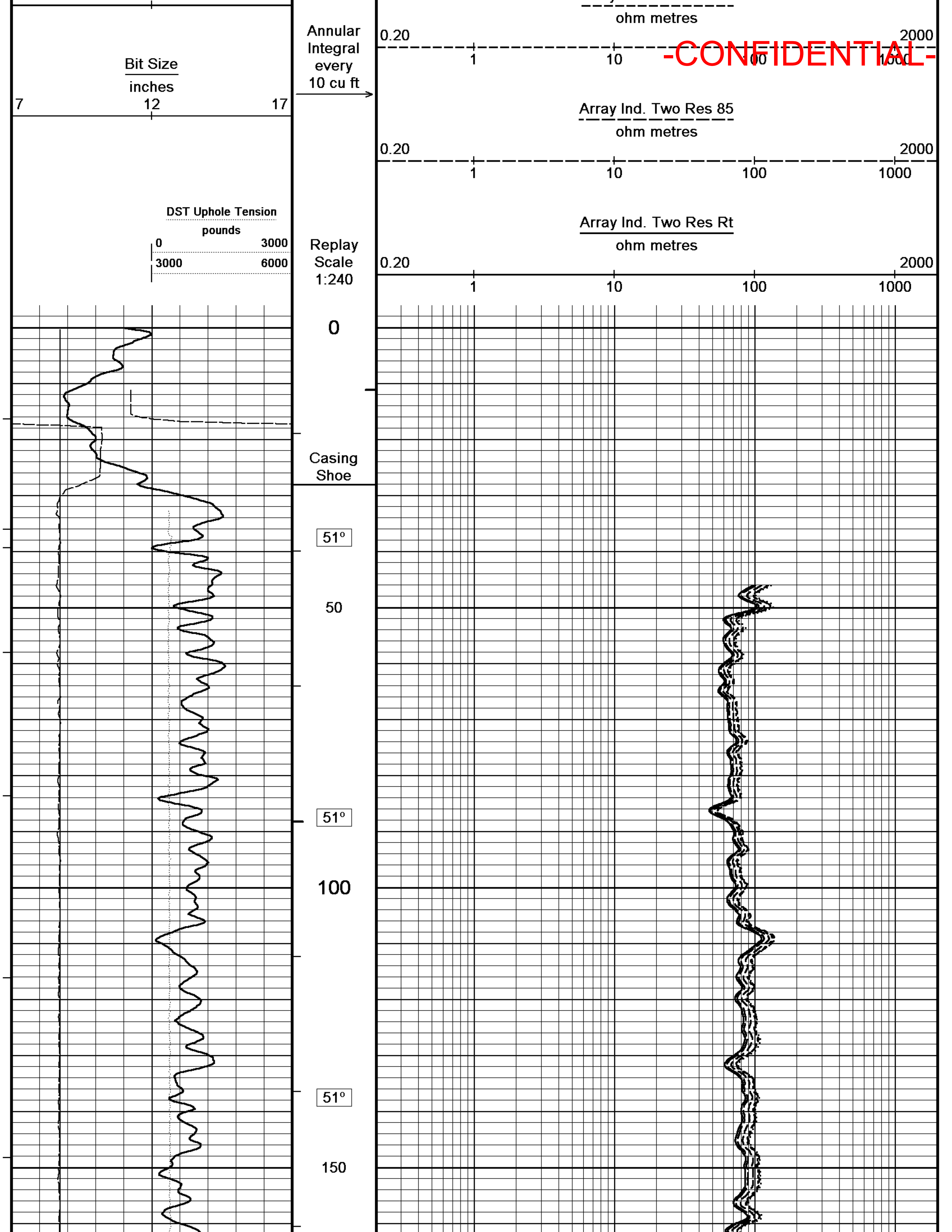
0 100 200

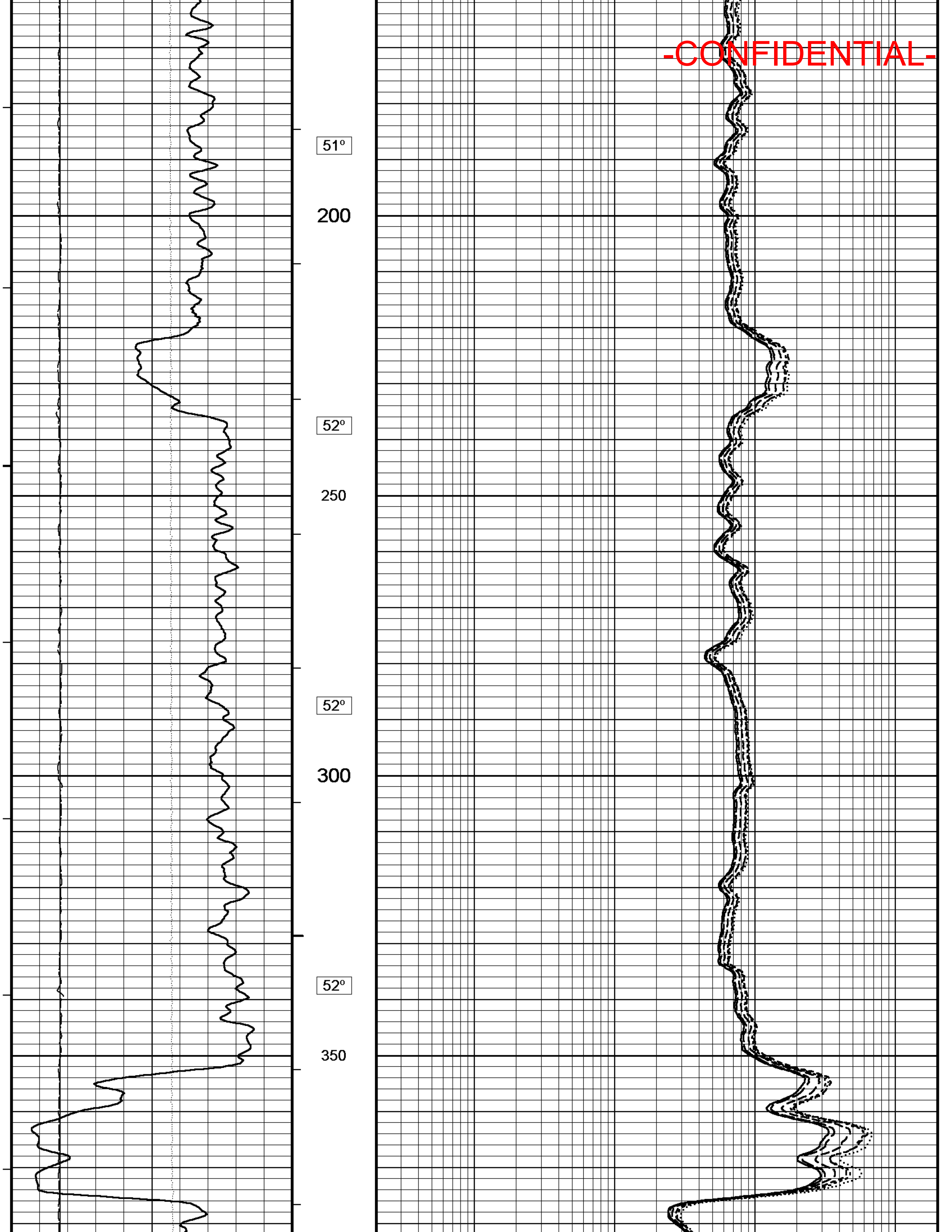
200 300 400

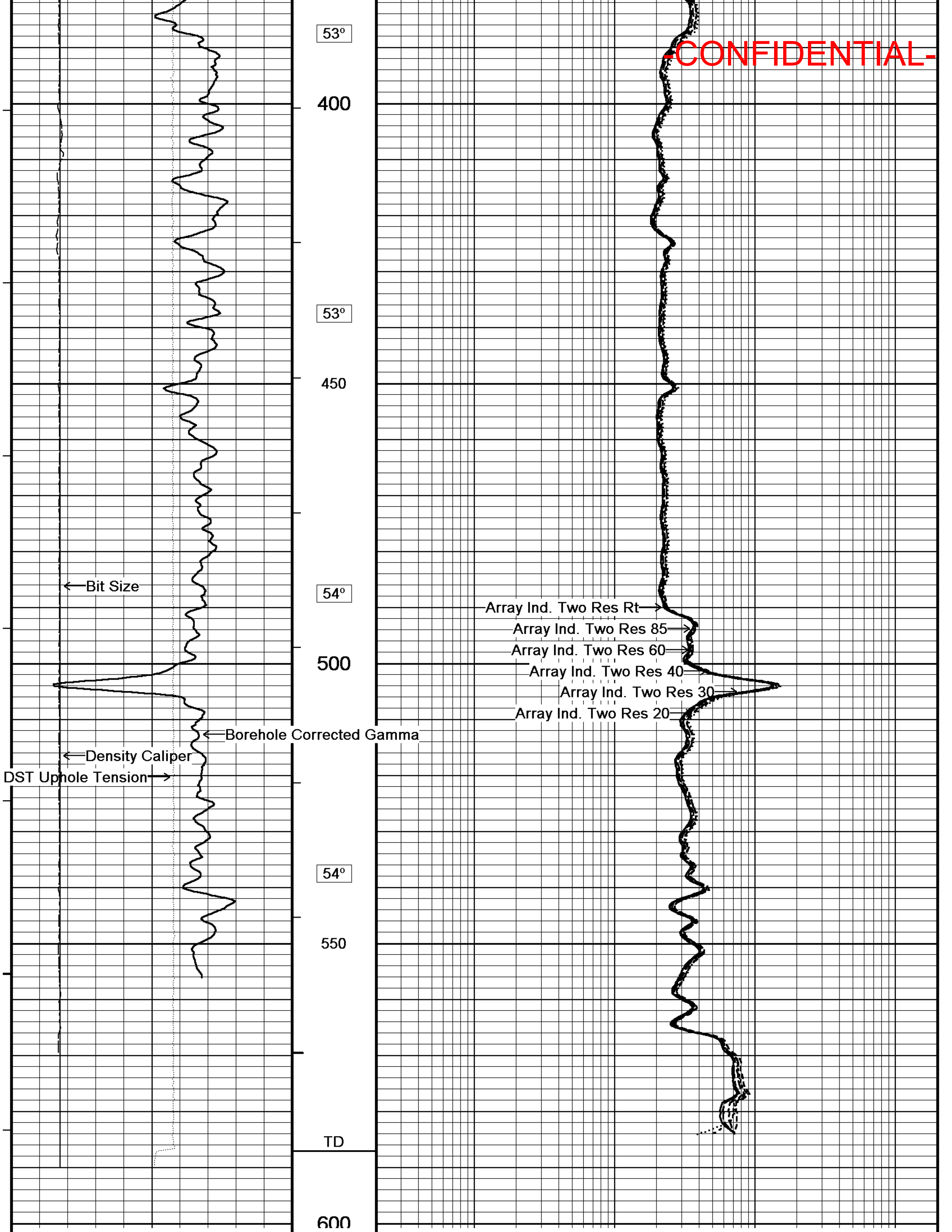
0.20 2000

1 10 100 1000

Array Ind. Two Res 60


ohm metres
0.20
2000
1
10
100
1000
-CONFIDENTIAL-
Bit Size
inches
7
12
17
Annular
Integral
every
10 cu ft
Array Ind. Two Res 85
ohm metres
0.20
2000
1
10
100
1000
DST Uphole Tension
pounds
0
3000
3000
6000
Replay
Scale
1:240
Array Ind. Two Res Rt
ohm metres
0.20
2000
1
10
100
1000
0
Casing
Shoe
51°
50
51°
100
51°
150


-CONFIDENTIAL-
51°
200
52°
250
52°
300
52°
350


53°
-CONFIDENTIAL-
400
53°
450
54°
Bit Size
Array Ind. Two Res Rt
Array Ind. Two Res 85
Array Ind. Two Res 60
500
Array Ind. Two Res 40
Array Ind. Two Res 30
Array Ind. Two Res 20
Borehole Corrected Gamma
Density Caliper
DST Uphole Tension
54°
550
TD
600

Timing Marks every 60.0 sec	Depth in Feet	Array Ind. Two Res 20 ohm metres 0.20 — 2000 1 10 100 1000
Density Caliper inches 7 12 17	Borehole Temp in deg F	Array Ind. Two Res 30 ohm metres 0.20 — 2000 1 10 100 1000
Borehole Corrected Gamma API 0 100 200 200 300 400	HVI every 10 cu ft	Array Ind. Two Res 40 ohm metres 0.20 — 2000 1 10 100 1000
Bit Size inches 7 12 17	Annular Integral every 10 cu ft	Array Ind. Two Res 60 ohm metres 0.20 — 2000 1 10 100 1000
DST Uphole Tension pounds 0 3000 3000 6000	Replay Scale 1:240	Array Ind. Two Res 85 ohm metres 0.20 — 2000 1 10 100 1000 Array Ind. Two Res Rt ohm metres 0.20 — 2000 1 10 100 1000

-CONFIDENTIAL-

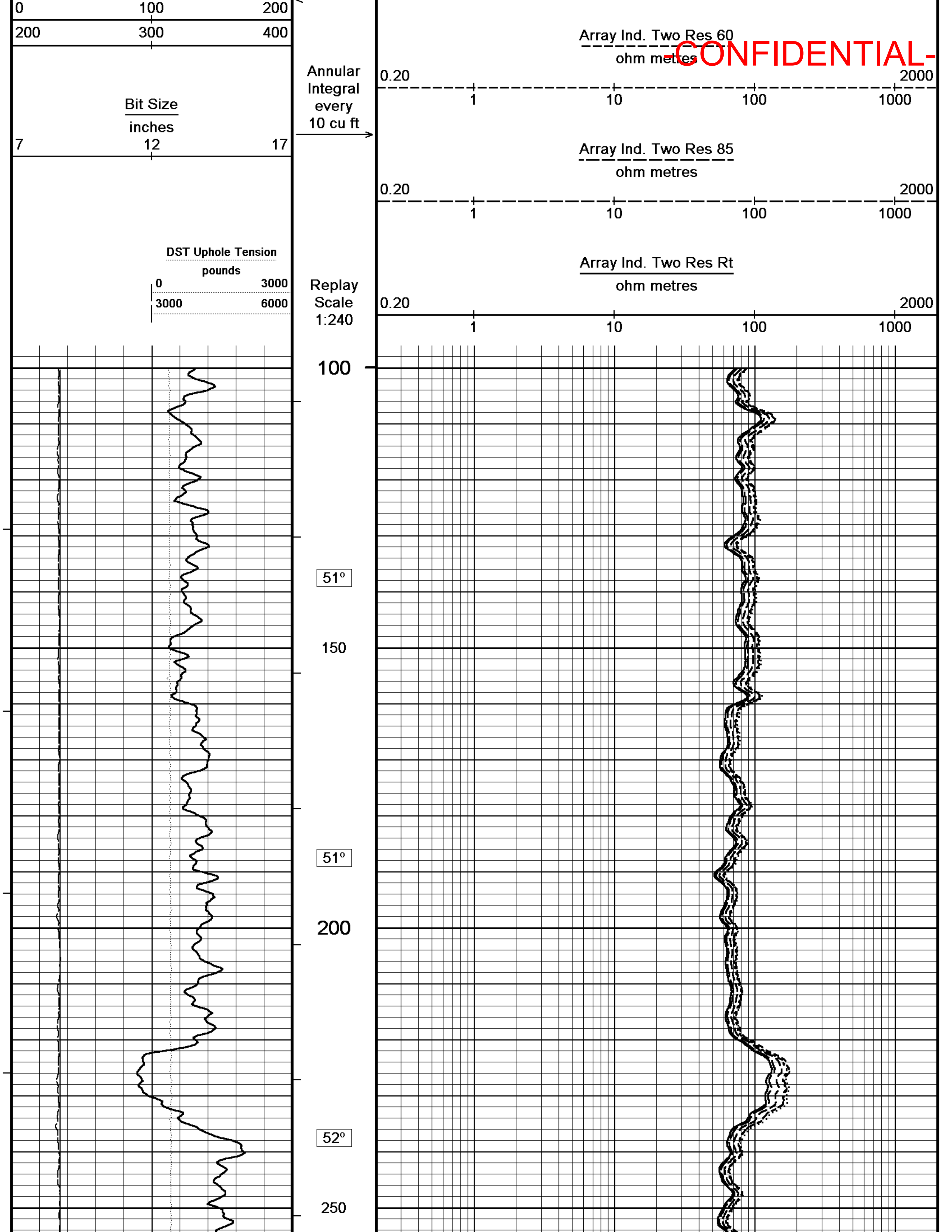
Depth Based Data - Maximum Sampling Increment 10.0cm — Plotted on 15-MAY-2013 14:23
Filename: C:\Logs\Cargill Inc\Cargill 18\...\Cargill Inc_Cargill 18_Run_2 Triple_3531401 Main Pass.dta — Recorded on 15-MAY-2013 12:48
System Versions: Logged with 13.05.9583 Processed with 13.05.9583 Plotted with 13.05.9583

5 Inch Main Log

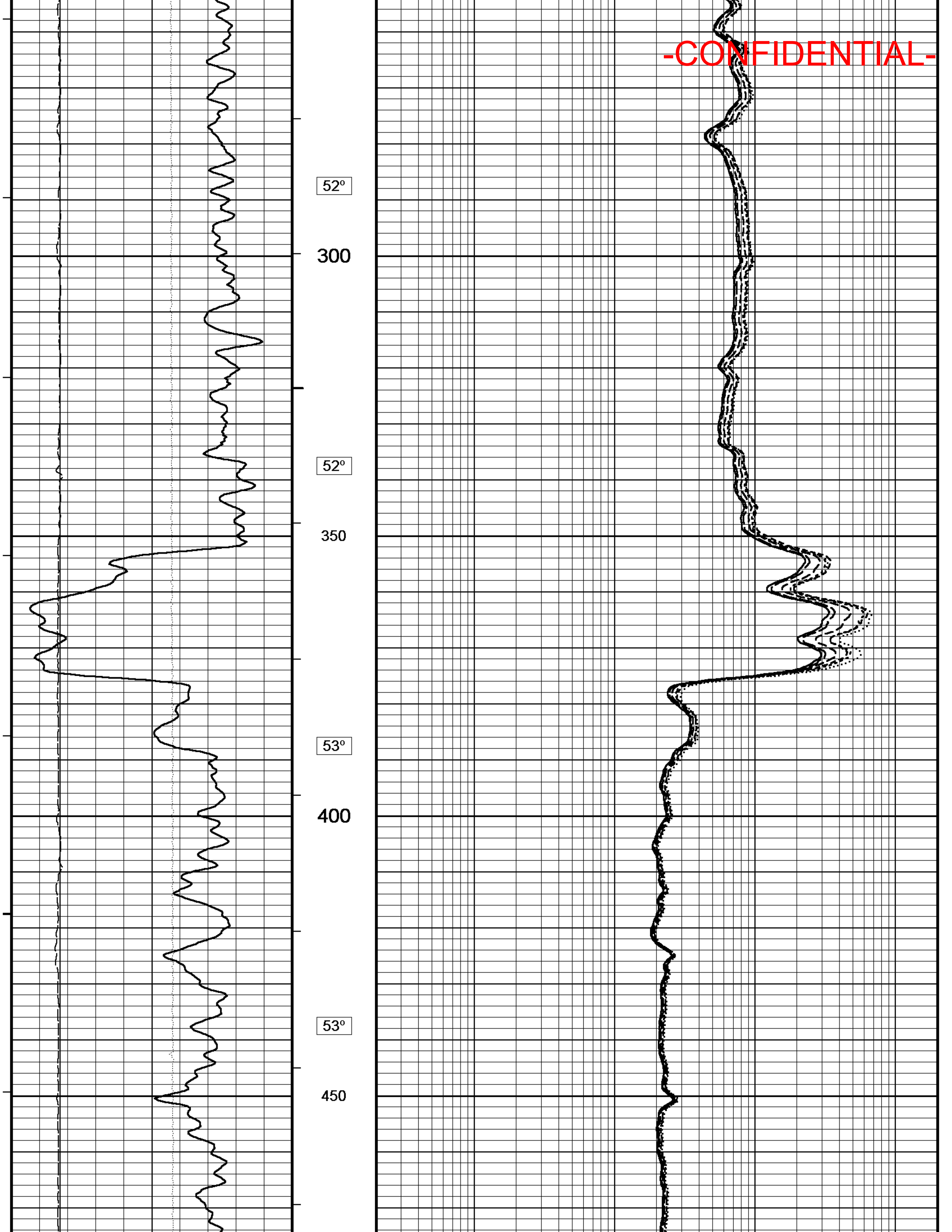
5 Inch Repeat Section

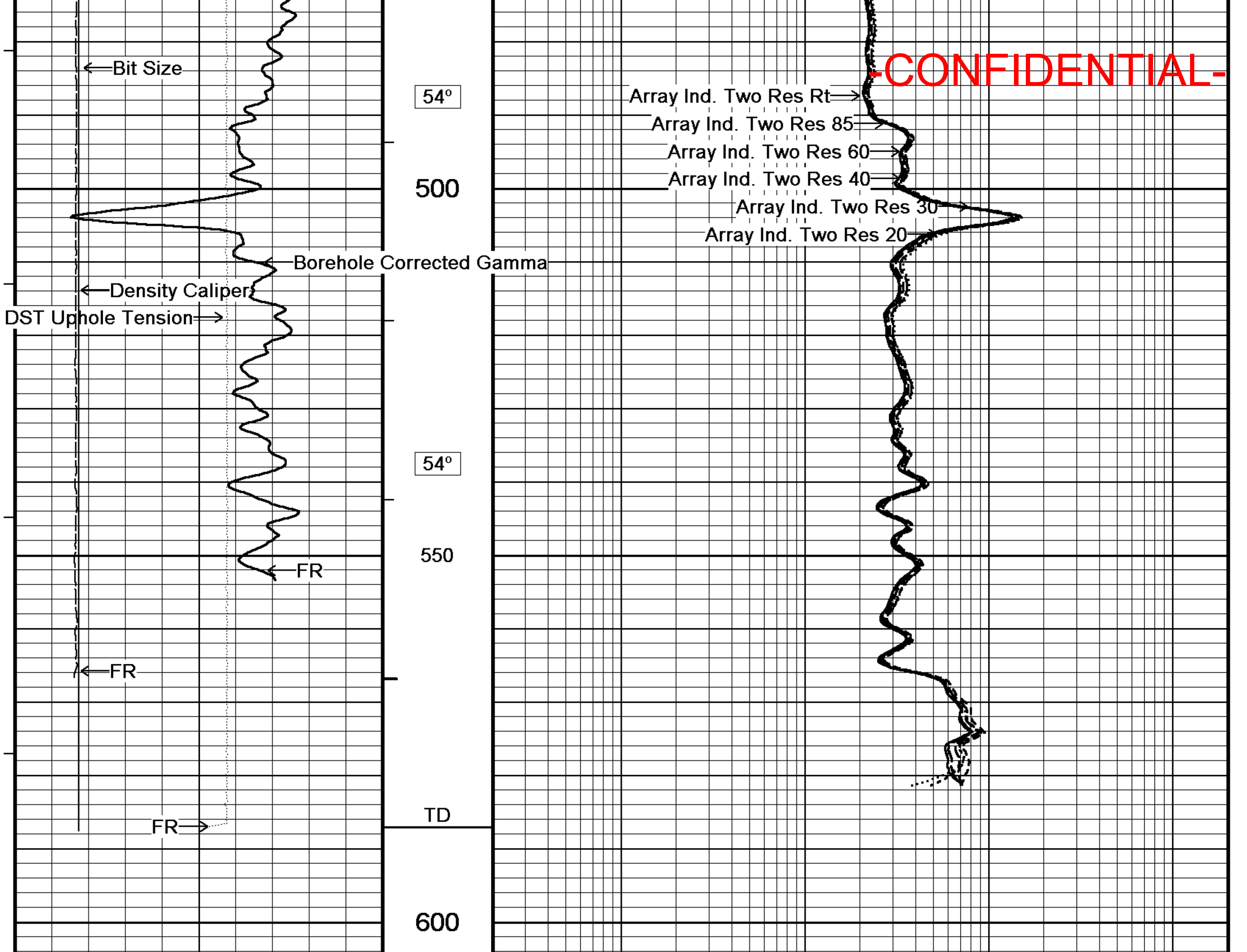
Depth Based Data - Maximum Sampling Increment 10.0cm — Plotted on 15-MAY-2013 14:23
Filename: C:\Logs\Cargill Inc\Cargill ...\Cargill Inc_Cargill 18_Run_2 Triple_3531401 Repeat Pass2.dta — Recorded on 15-MAY-2013 12:25
System Versions: Logged with 13.05.9583 Processed with 13.05.9583 Plotted with 13.05.9583

Timing Marks every 60.0 sec	Depth in Feet	Array Ind. Two Res 20 ohm metres 0.20 — 2000 1 10 100 1000
Density Caliper inches 7 12 17	Borehole Temp in deg F	Array Ind. Two Res 30 ohm metres 0.20 — 2000 1 10 100 1000
Borehole Corrected Gamma API	HVI every 10 cu ft	Array Ind. Two Res 40 ohm metres 0.20 — 2000 1 10 100 1000



0 100 200
200 300 400
Bit Size
inches
7 12 17
DST Uphole Tension
pounds
0 3000
3000 6000
Annular Integral every 10 cu ft
Replay Scale 1:240
Array Ind. Two Res 60
ohm metres
0.20 2000
1 10 100 1000
Array Ind. Two Res 85
ohm metres
0.20 2000
1 10 100 1000
Array Ind. Two Res Rt
ohm metres
0.20 2000
1 10 100 1000
-CONFIDENTIAL-
100
51°
150
51°
200
52°
250


52°
300
52°
350
53°
400
53°
450



Depth in Feet

Array Ind. Two Res 20
ohm metres
0.20 2000
1 10 100 1000

Timing Marks
every 60.0 sec

Array Ind. Two Res 30
ohm metres
0.20 2000
1 10 100 1000

Density Caliper
inches
7 12 17

Borehole Temp in deg F

Array Ind. Two Res 40
ohm metres
0.20 2000
1 10 100 1000

HVI every 10 cu ft

Borehole Corrected Gamma
API
0 100 200
200 300 400

Array Ind. Two Res 60
ohm metres
0.20 2000
1 10 100 1000

Annular Integral every 10 cu ft

Bit Size
inches
7 12 17

Array Ind. Two Res 85

DST Uphole Tension pounds 0 3000 3000 6000	Replay Scale 1:240	ohm metres 0.20 2000 1 10 100 1000 -CONFIDENTIAL- Array Ind. Two Res Rt ohm metres 0.20 2000 1 10 100 1000

Depth Based Data - Maximum Sampling Increment 10.0cm — Plotted on 15-MAY-2013 14:23

Filename: C:\Logs\Cargill Inc\Cargill ...\Cargill Inc_Cargill 18_Run_2 Triple_3531401 Repeat Pass2.dta — Recorded on 15-MAY-2013 12:25

System Versions: Logged with 13.05.9583 Processed with 13.05.9583 Plotted with 13.05.9583

5 Inch Repeat Section

BEFORE SURVEY CALIBRATION

C:\Logs\Cargill Inc\Cargill 18\Run_2 Triple\3531401\Cargill Inc_Cargill 18_Run_2 Triple_3531401 Main Pass.dta

General Constants All 000

Last Edited on 15-MAY-2013,08:32

General Parameters		
Mud Resistivity	9.510	ohm-metres
Mud Resistivity Temperature	68.000	degrees F
Water Level	0.000	feet
Borehole Fluid Processing	Water Level Switch	
Hole/Annular Volume and Differential Caliper Parameters		
HVOL Method	Single Caliper	
HVOL Caliper 1	Density Caliper	
HVOL Caliper 2	N/A	
Annular Volume Diameter	10.750	inches
Caliper for Differential Caliper	Density Caliper	
Rwa Parameters		
Porosity used	Base Density Porosity	
Resistivity used	Array Ind. Two Res Rt	
RWA Constant A	0.610	
RWA Constant M	2.150	
SW/APOR Tool Source	0.000	

Gamma Calibration MCG-B 60

Field Calibration on 09-MAY-2013 10:29

	Measured	Calibrated (API)
Background	46	32
Calibrator (Gross)	2206	1571
Calibrator (Net)	2160	1539

Gamma Constants MCG-B 60

Last Edited on 15-MAY-2013,08:32

Gamma Calibrator Number	45	
Mud Density	1.02	gm/cc
Caliper Source for Processing	Density Caliper	
Tool Position	Eccentred	
Concentration of KCl		kppm
K Mud Type	Chloride	
K Mud Concentration	0.00	%

High Resolution Temperature Calibration MCG-B 60

Field Calibration on 24-APR-2013,11:52

	Measured	Calibrated(Deg F)
Lower	60.00	60.00
Upper	101.00	100.00

High Resolution Temperature Constants MCG-B 60

Last Edited on 24-APR-2013,11:52

Pre-filter Length	11

Induction Calibration MAI-A.A 80

Base Calibration on 14-APR-2013,21:52

Field Check on

Base Calibration

Base Calibration

Test Loop Calibration	Measured		Calibrated (mmho/m)	
Channel	Low	High	Low	High
1	14.6	466.5	9.3	966.2
2	6.0	375.7	7.6	821.4
3	3.7	255.2	5.2	566.0
4	2.0	131.6	2.6	279.2

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Array Temperature 74.3 Deg F

Channel	Base Check (mmho/m)		Field Check (mmho/m)	
	Low	High	Low	High
1				
2				
3				
4				
Deep				
Medium				
Shallow				
Array Temperature		0.0		0.0 Deg F

Induction Constants MAI-A.A 80

Last Edited on 15-MAY-2013,08:30

Induction Model	RtAP-WBM	
Caliper for Borehole Corr.	Density Caliper	
Hole Size for Borehole Correction	N/A	inches
Tool Centred	No	
Stand-off Type	Fins	
Stand-off	1.00	inches
Number of Fins on Stand-off	6.0000	
Stand-off Fin Angle	60.00	degrees
Stand-off Fin Width	1.0000	inches
Borehole Corr. Rm Source	Temperature Corr	
Temp. for Rm Corr.	MCG External Temperature	
Squasher Start	0.0020	mhos/metre
Squasher Offset	N/A	mhos/metre

Borehole Normalisation

DRM1	0.0000	DRC1	0.0000
DRM2	0.0000	DRC2	0.0000
MRM1	0.0000	MRC1	0.0000
MRM2	0.0000	MRC2	0.0000
SRM1	0.0000	SRC1	0.0000
SRM2	0.0000	SRC2	0.0000

Calibration Site Corrections

Channel 1	0.00	mmhos/metre
Channel 2	0.00	mmhos/metre
Channel 3	0.00	mmhos/metre
Channel 4	0.00	mmhos/metre

Apparent Porosity and Water Saturation Constants

Archie Constant (A)	1.00	
Cementation Exponent (M)	2.00	
Saturation Exponent (N)	2.00	
Saturation of Water for Apor	100.00	percent
Resistivity of Water for Apor and Sw	0.05	ohm-m
Resistivity of Mud Filtrate for Sw	0.00	ohm-m
Source for Rt	0.00	
Source for Rxo	0.00	

Caliper Calibration MPD-A.A 20

Base Calibration on 14-MAY-2013 15:42
Field Calibration on 14-MAY-2013 15:47

Base Calibration

Reading No	Measured	Calibrator Size (in)
1	25425	6.03
2	35728	7.99
3	45344	9.85
4	55749	11.82
5	0	0.00
6	N/A	N/A

Field Calibration

	Measured Caliper (in)	Actual Caliper (in)
	7.95	7.99

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DOWNHOLE EQUIPMENT

C:\Logs\Cargill Inc\Cargill 18\Run_2 Triple\3531401\Cargill Inc_Cargill 18_Run_2 Triple_3531401 Main Pass.dta

3/8" Triple Cone Cable Head (MCB F B)
MCB-F.B 52 LG: 1.58 ft WT: 15.4 lb OD: 2.24 in

SHA-J.A Compact Swivel Head Adaptor
SHA-J.A 353 LG: 2.30 ft WT: 22.0 lb OD: 2.24 in

Compact Comms Gamma
MCG-B 60 LG: 8.70 ft WT: 63.9 lb OD: 2.24 in

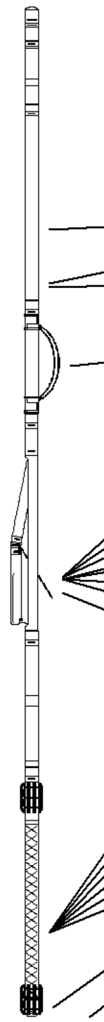
Compact Neutron
MDN-A.B 80 LG: 5.04 ft WT: 50.7 lb OD: 2.24 in

Compact Density/Caliper
MPD-A.A 20 LG: 9.53 ft WT: 90.4 lb OD: 2.45 in

Compact Focussed Electric
MFE-A.A 9 LG: 6.05 ft WT: 48.5 lb OD: 2.24 in

Compact Induction
MAI-A.A 80 LG: 10.81 ft WT: 48.5 lb OD: 2.24 in

Total Length: 44.00 ft Weight: 339.5 lb



34.84 ft	GGCE - Borehole Corrected Gamma
32.66 ft	CCLG - Casing Collar Locator
31.93 ft	CGXT - MCG External Temperature
28.38 ft	NPRL - Limestone Neutron Por.
21.14 ft	AVOL - Annular Volume
21.14 ft	HVOL - Hole Volume
21.14 ft	CLDC - Density Caliper
19.21 ft	MTXD - Matrix density
19.21 ft	DPOR - Base Density Porosity
19.21 ft	DEN - Compensated Density
19.21 ft	DCOR - Density Correction
19.15 ft	PDPE - PE
3.34 ft	R20T - Array Ind. Two Res 20
3.34 ft	R60T - Array Ind. Two Res 60
3.34 ft	R40T - Array Ind. Two Res 40
3.34 ft	R30T - Array Ind. Two Res 30
3.34 ft	R85T - Array Ind. Two Res 85
3.34 ft	RTAT - Array Ind. Two Res Rt
Tool Zero	(0.13ft from bottom)
-0.13 ft	SMTU - DST Uphole Tension

All measurements relative to tool zero.

COMPANY	Cargill Inc.
WELL	Cargill 18
FIELD	Lansing
PROVINCE/COUNTY	Tompkins County
COUNTRY/STATE	U.S.A. / New York

Elevation Kelly Bushing	883.00	feet	First Reading	547.00	feet
Elevation Drill Floor	887.00	feet	Depth Driller	590.00	feet
Elevation Ground Level	887.00	feet	Depth Logger	587.00	feet

Weatherford®

Array Induction
Gamma Ray

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Weatherford®

MONOPOLE - DIPOLE ARRAY SEMBLANCE

COMPANY:	**Cargill, Inc.**		
WELL:	**Cargill 18**		
FIELD:	**Lansing**		
COUNTY:	**Tompkins County**	STATE:	**U.S.A. / New York**

Location:	**X=820507.58, Y=937023.59**	Latitude:		Other Services: Gamma Ray, Density Caliper
API:		Longitude:		
Licence:	**Z/Elevation=784.16 ft**			
Permanent Datum:	G.L.	Elevation:	748.16 ft	Elevations: K.B.: 752.16 ft
Log measured from	G.L.	above Permanent Datum		D.F.: 752.16 ft
Drilling measured from	G.L.L.			G.L.: 748.16 ft

Date		20-Aug-2013			
Run Number		Five			
Service Order		3540548			
Depth Driller		2486.00 ft			
Depth Logger		2488.00 ft			
First Reading		2488.00 ft			
Last Reading		2488.00 ft			
Casing Driller		10.75 in	@ 1554.00 ft	@	
Casing Logger		1553.00 ft			
Bit Size		3.780 in			
Hole Fluid Type		Brine			
Density	Viscosity	8.600 lb/U	27.00 sec/		
pH	Fluid Loss				
Sample Source		Flow Line			
Rm @ Measured Temperature		0.049 ohm-	@ 78.0 ohm-m	@	
Rmf @ Measured Temperature		0.037 OHMM	@ 78.0 ohm -m	@	
Rmc @ Measured Temperature		0.073 OHMM	@ 78.0 ohm-m	@	
Source Rmf	Rmc	Calc.	Calc.		
Rm @ BHT		0.049 ohm-	@	@	
Time Since Circulation		4 Hrs			
Maximum Recorded Temperature		78.0°F	@	@	
Equipment No.	Location	1304	Muncy		
Recorded By		Nibras Nureldin			
Witnessed By		Patrick McGrath			

Rig:	Remarks: Service Order # 3540548
Drilling Stopped	Software: WLS 13.06.9804
Circulation Stopped 4 Hrs	Tools Run 1: MBE, MBE,SHA, MCG, MDN, MPD, MFE, UG,MDL,MLG,BHT
Tool on Bottom	Hardware: MDL - Two-1 Inch Standoff
BHT	Density Matrix was ran on 2.71 gg/cc Crew: Nibras Nureldin Shane Glowcheski

Equipment Data

Tool Type	Tool Type	Other

```
LOG CURVE DESCRIPTION

TRACK 1
       GGCE            BOREHOLE CRRECTED GAMMA RAY
```

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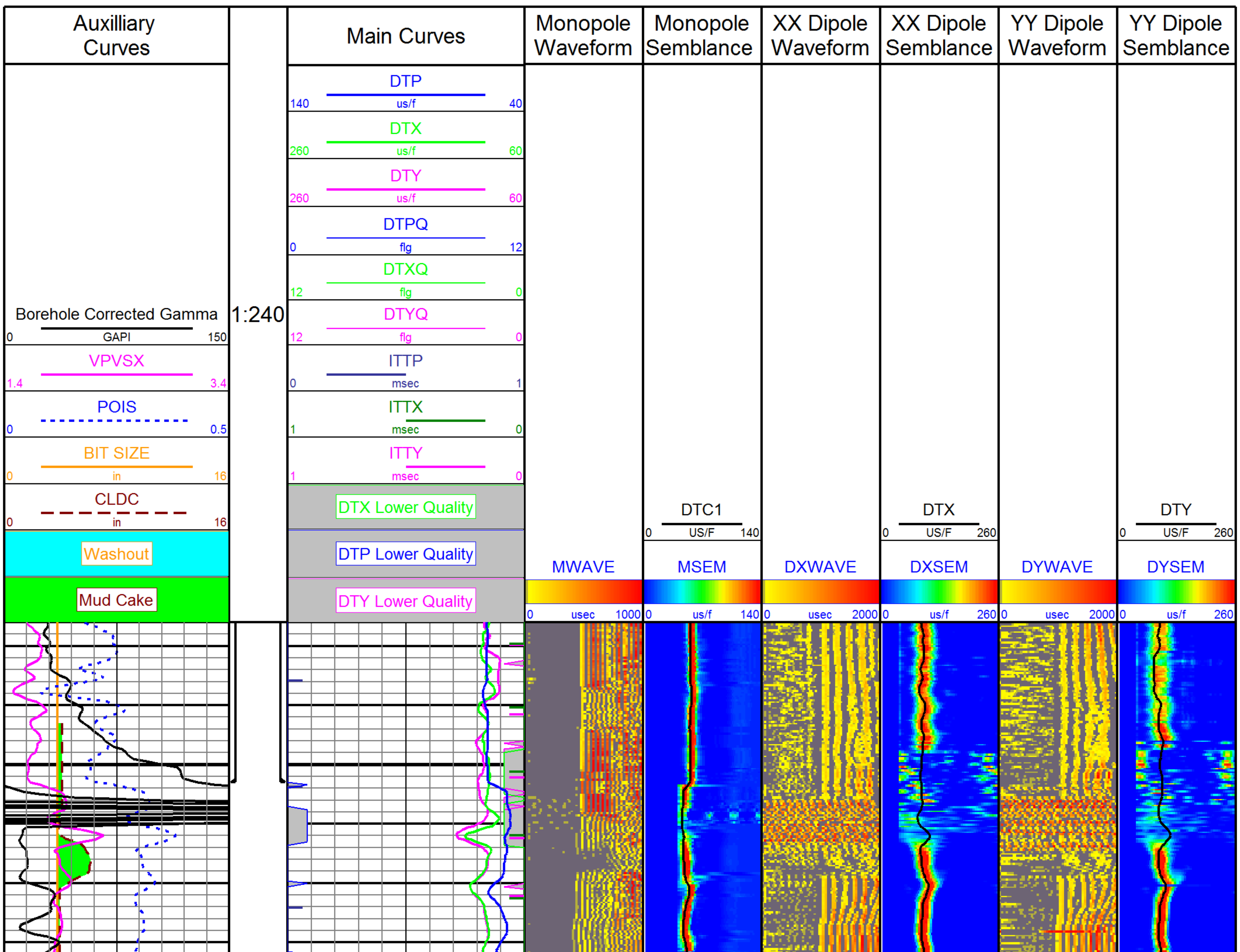
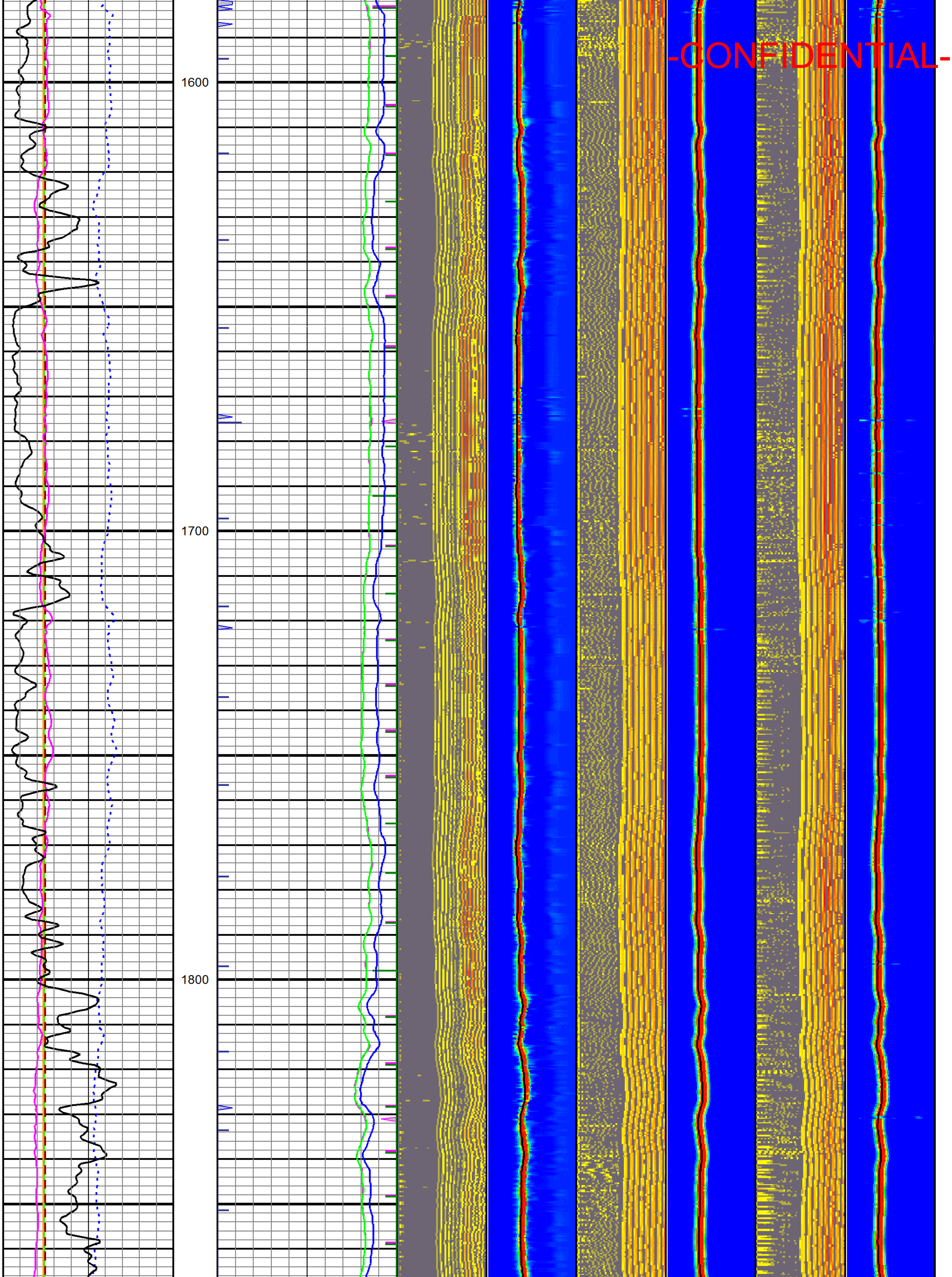
```
      VPVSX         VP/VS RATIO X-SHEAR
      CLDC          DENSITY CALIPER
      POIS          POISSON RATIO FROM DTX
      BIT SIZE      BITSIZE

TRACK 3
      DTP           DELTA TIME COMPRESSIONAL - FROM SEMBLANCE
      DTX           DELTA TIME SHEAR - FROM X DIPOLE SEMBLANCE
      DTY           DELTA TIME SHEAR - FROM Y DIPOLE SEMBLANCE
      ITTP          INTEGRATED TRAVEL TIME COMPRESSIONAL
      ITTX          INTEGRATED TRAVEL TIME X DIPOLE SHEAR
      ITTY          INTEGRATED TRAVEL TIME Y DIPOLE SHEAR

TRACK 4
      MWAVE         MONOPOLE WAVEFORM - FIRST RECIEVER

TRACK 5
      MSEM          MONOPOLE SEMBLANCE PLOT
      DTP           DELTA TIME COMPRESSIONAL - FROM SEMBLANCE

TRACK 6
      XWAVE         X DIPOLE WAVEFORM - FIRST RECEIVER

TRACK 7
      DXSEM         X DIPOLE SEMBLANCE PLOT
      DTX           DELTA TIME SHEAR X - FROM SEMBLANCE

TRACK 8
      YWAVE         Y DIPOLE WAVEFORM - FIRST RECEIVER

TRACK 9
      DYSEM         Y DIPOLE SEMBLANCE PLOT
      DTY           Y DELTA TIME SHEAR - FROM SEMBLANCE

*******************************************************************************
```




1600
1700
1800
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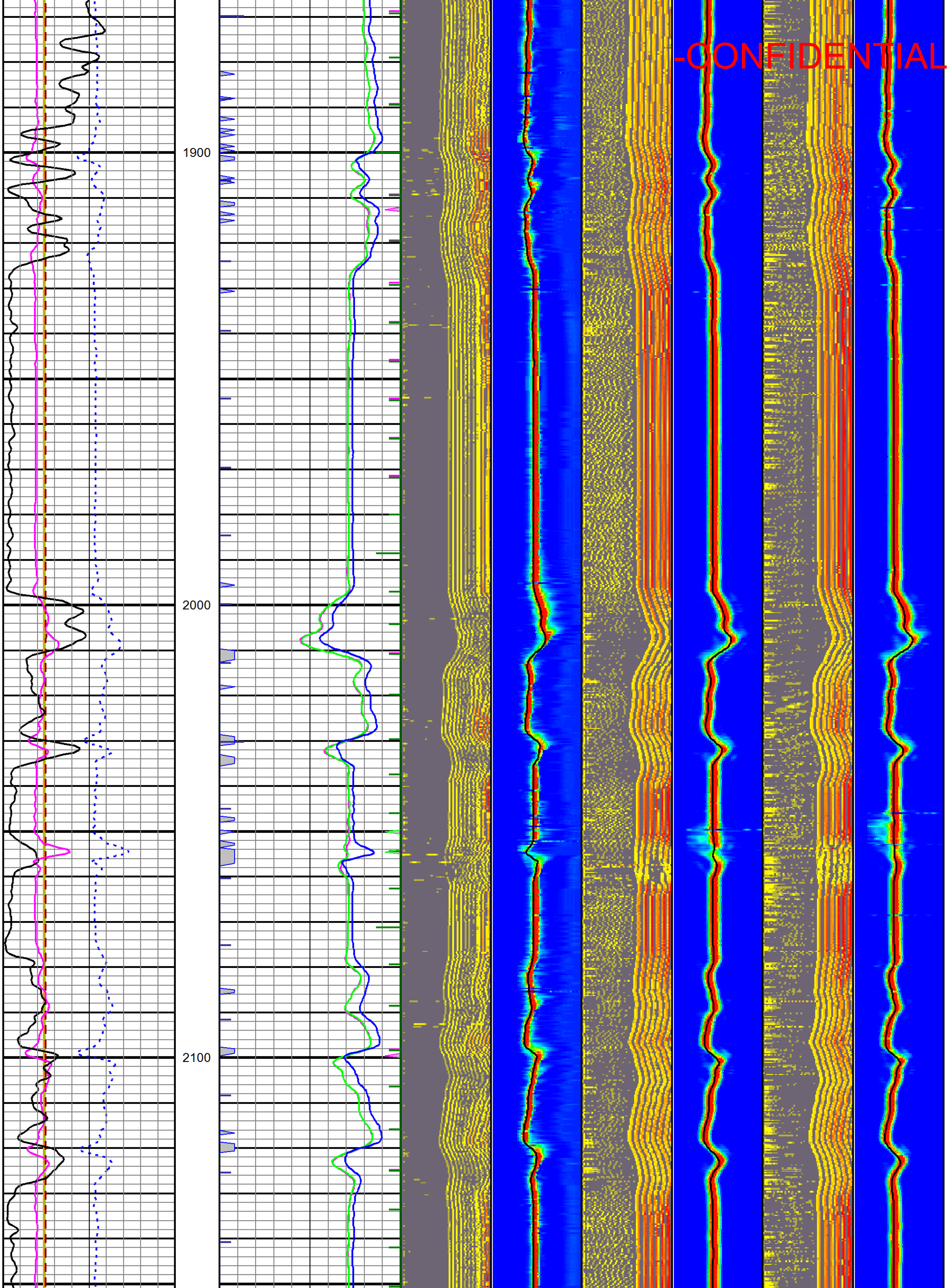
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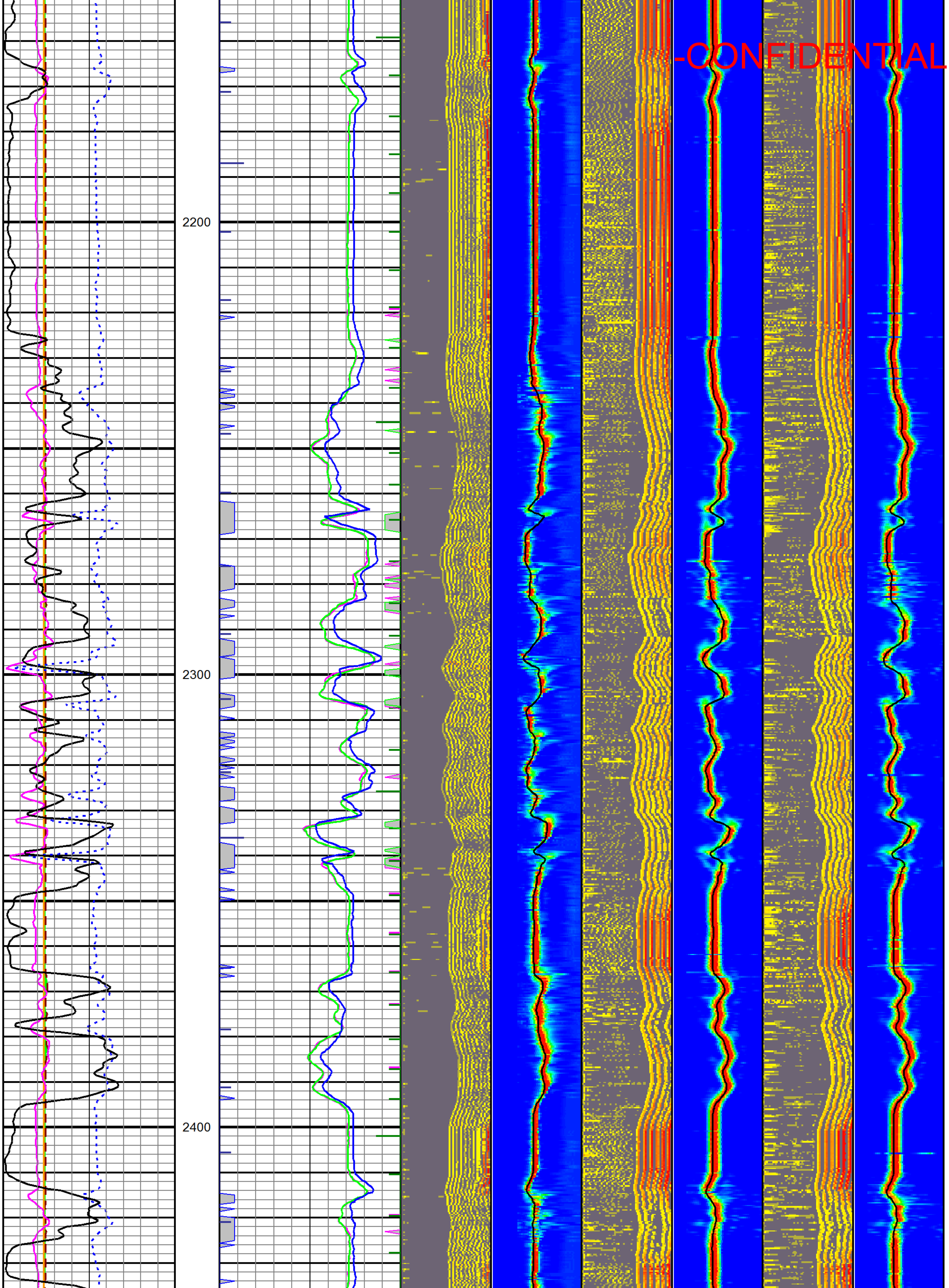
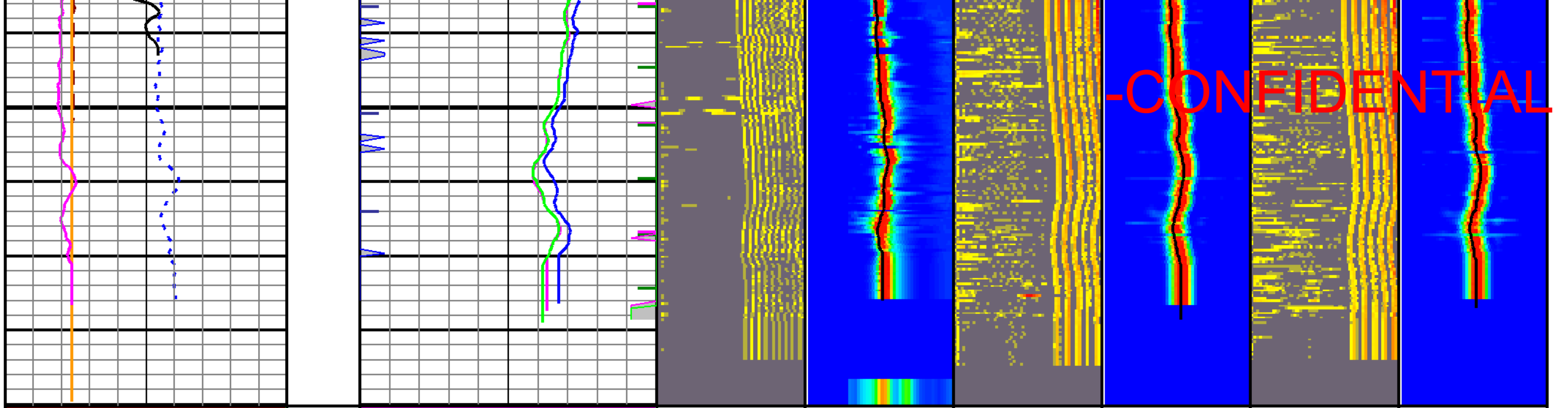
2000
2100


2200
2300
2400



Auxiliary Curves		Main Curves	Monopole Waveform	Monopole Semblance	XX Dipole Waveform	XX Dipole Semblance	YY Dipole Waveform	YY Dipole Semblance
Mud Cake	1:240	DTY Lower Quality	MWAVE 0 usec 1000	MSEM 0 us/f 140	DXWAVE 0 usec 2000	DXSEM 0 us/f 260	DYWAVE 0 usec 2000	DYSEM 0 us/f 260
Washout		DTP Lower Quality		DTC1 0 US/F 140		DTX 0 US/F 260		DTY 0 US/F 260
CLDC 0 in 16		DTX Lower Quality						
BIT SIZE 0 in 16		ITTY 1 msec 0						
POIS 0 0.5		ITTX 1 msec 0						
VPVSX 1.4 3.4		ITTP 0 msec 1						
Borehole Corrected Gamma 0 GAPI 150		DTYQ 12 flg 0						
		DTXQ 12 flg 0						
		DTPQ 0 flg 12						
		DTY 260 us/f 60						
		DTX 260 us/f 60						
		DTP 140 us/f 40						

COMPANY:	**Cargill, Inc.**
WELL:	**Cargill 18**
FIELD:	**Lansing**
COUNTY:	**Tompkins County**
STATE:	**U.S.A. / New York**

Weatherford®

MONOPOLE - DIPOLE ARRAY SEMBLANCE

Weatherford

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Photo Density Compensated Neutron Gamma Ray

COMPANY	Cargill, Inc.
WELL	Cargill 18
FIELD	Lansing
PROVINCE/COUNTY	Tompkins County
COUNTRY/STATE	U.S.A. / New York
LOCATION	X=820507.58, Y=937023.59
PERMIT NUMBER	Z/Elevation=784.16 WEL
SEC / TWP / RGE	
Other Services	Dual Laterolog, Cross Dipole, Data Pack, Caliper
API Number	
Permanent Datum	Ground Level, Elevation 748.16 feet
Log Measured From	GL
Drilling Measured From	GLL

Elevations:	feet
KB	752.16
DF	752.16
GL	748.16

Date	20-Aug-2013			
Run Number	Five			
Service Order	3540548			
Depth Driller	2486.00	feet		
Depth Logger	2488.00	feet		
First Reading	2488.00	feet		
Last Reading	30.00	feet		
Casing Driller	1554.00	feet		
Casing Logger	1553.00	feet		
Bit Size	3.780	inches		
Hole Fluid Type	Brine			
Density / Viscosity	8.60 lb/USg	27.00 sec/qt		
PH / Fluid Loss				
Sample Source	Flow Line			
Rm @ Measured Temp	0.049 @ 78.0	ohm-m		
Rmf @ Measured Temp	0.037 @ 78.0	ohm-m		
Rmc @ Measured Temp	0.073 @ 78.0	ohm-m		
Source Rmf / Rmc	Calc.	Calc.		
Rm @ BHT	0.049 @ 78.0	ohm-m		
Time Since Circulation	4 Hrs			
Max Recorded Temp	78.00	deg F		
Equipment / Base	13041	Muncy		
Recorded By	Nibras Nureldin			
Witnessed By	Patrick McGrath			

BOREHOLE RECORD

Last Edited: 20-AUG-2013 14:46

Bit Size inches	Depth From feet	Depth To feet
8.750	28.50	580.00
6.250	580.00	1553.00
3.780	1553.00	2488.00

CASING RECORD

Type	Size inches	Depth From feet	Shoe Depth feet	Weight pounds/ft
	10.750	0.00	28.00	42.00
	7.000	0.00	580.00	17.00
	4.500	0.00	1553.00	9.50

REMARKS

Software: WLS 13.06.9804

Tools Run 1: MBE, MBE,SHA, MCG, MDN, MPD, MFE,MUG,MDL,MLG,BHT

Hardware:
MDL - Two-1 Inch Standoffs

Density Matrix was ran on 2.71 gg/cc

Crew: Nibras Nureldin
Shane Glowcheski

Gamma ray spikes up at the bottom of the borehole because the gamma ray sub ran below the sources
3.75 inch casing was used to calculate annular hole volumes
Gamma ray was recorded to ground level

-CONFIDENTIAL-

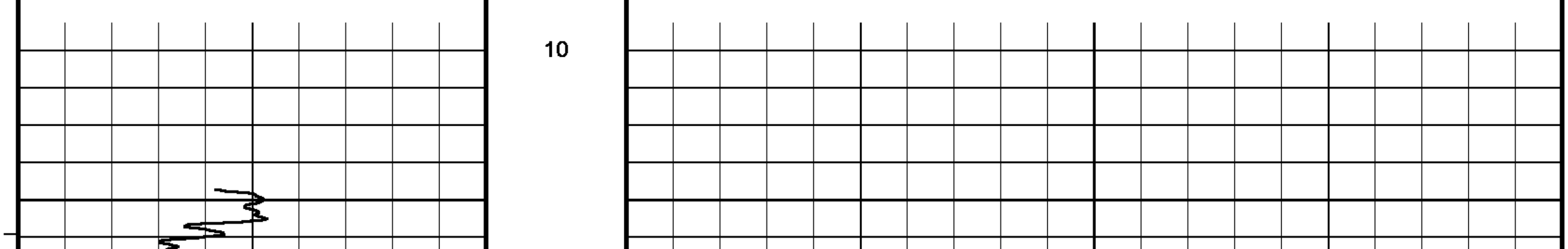
No Mud report was found on location.
100% Brine was added to the well that had 10% brine water in the well.

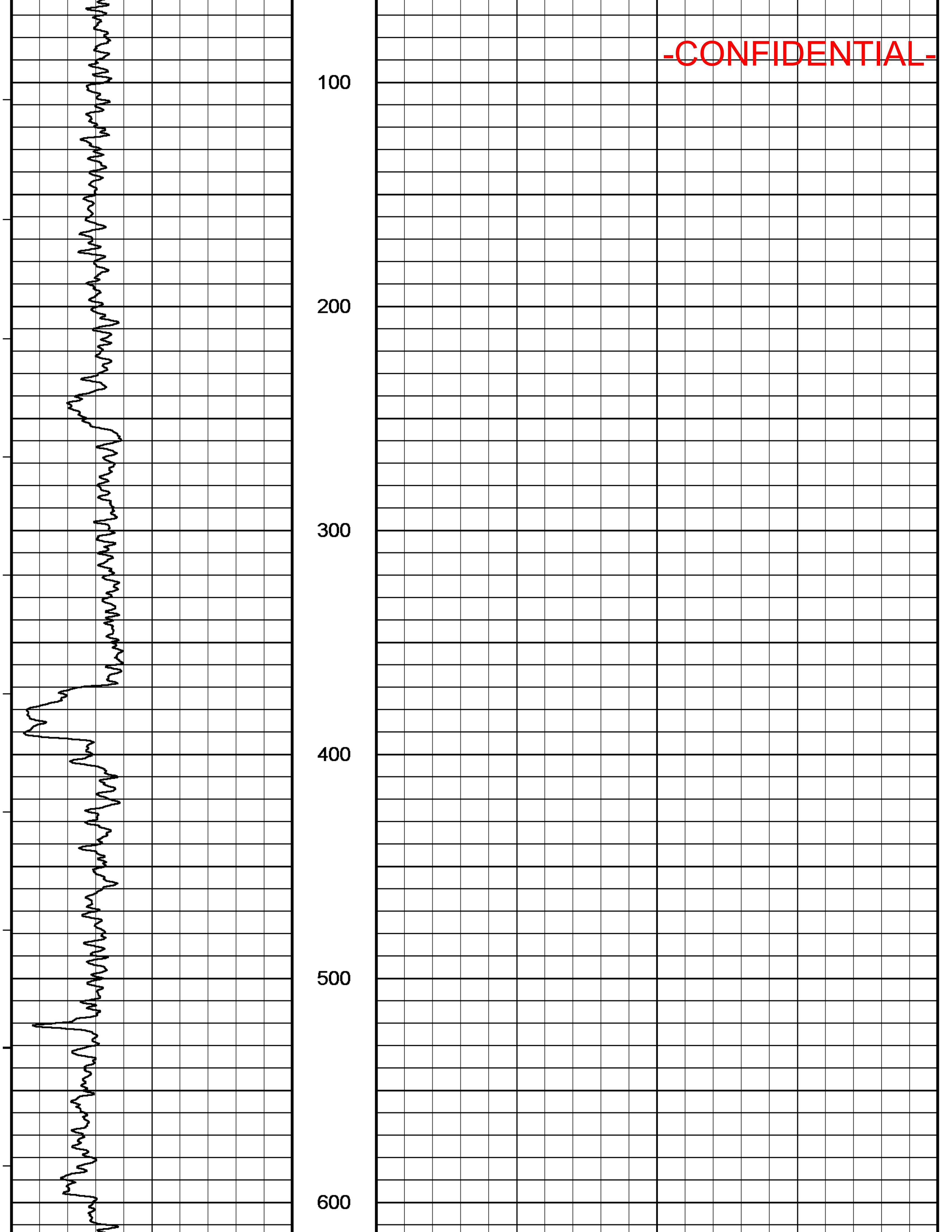
Mud Density is 9.5 lbs/USg

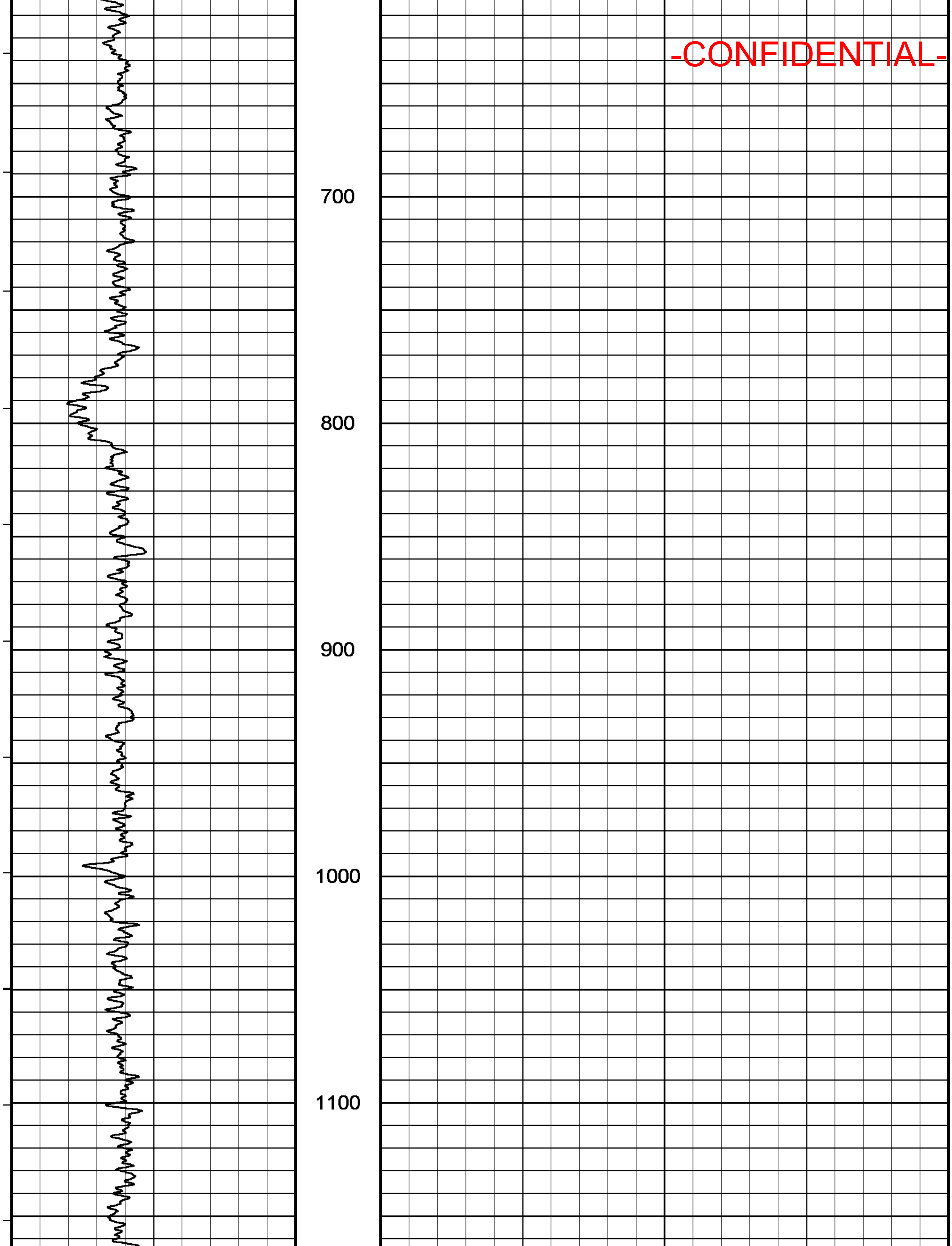
2 Inch Main Log

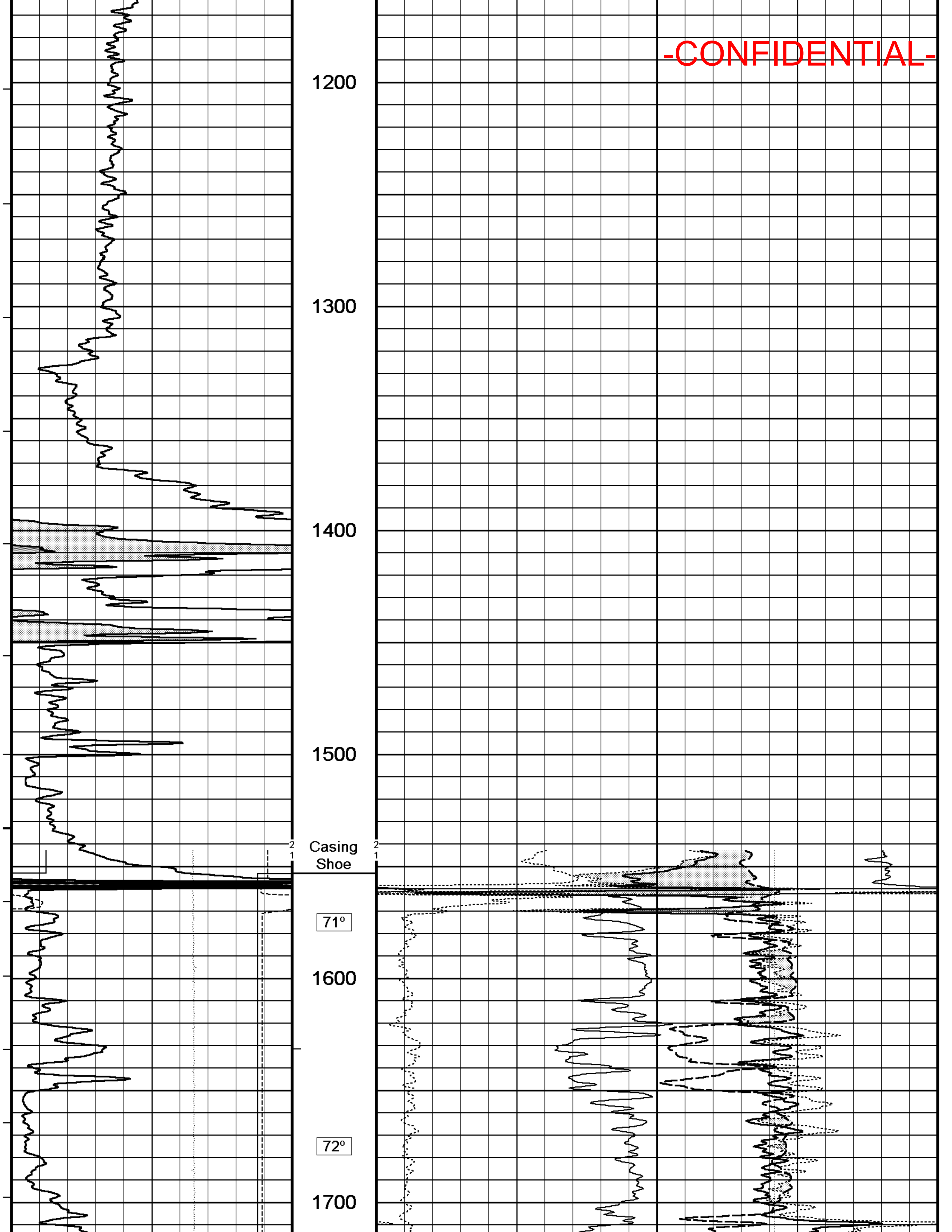
Depth Based Data - Maximum Sampling Increment 10.0cm
Plotted on 20-AUG-2013 15:37
Filename: C:\Logs\Cargill Inc\Cargill 18\...\Cargill Inc_Cargill 18_Run_5_Triple_3540548 Main Pass.dta
Recorded on 20-AUG-2013 13:39
System Versions: Logged with 13.06.9804 Plotted with 13.06.9804

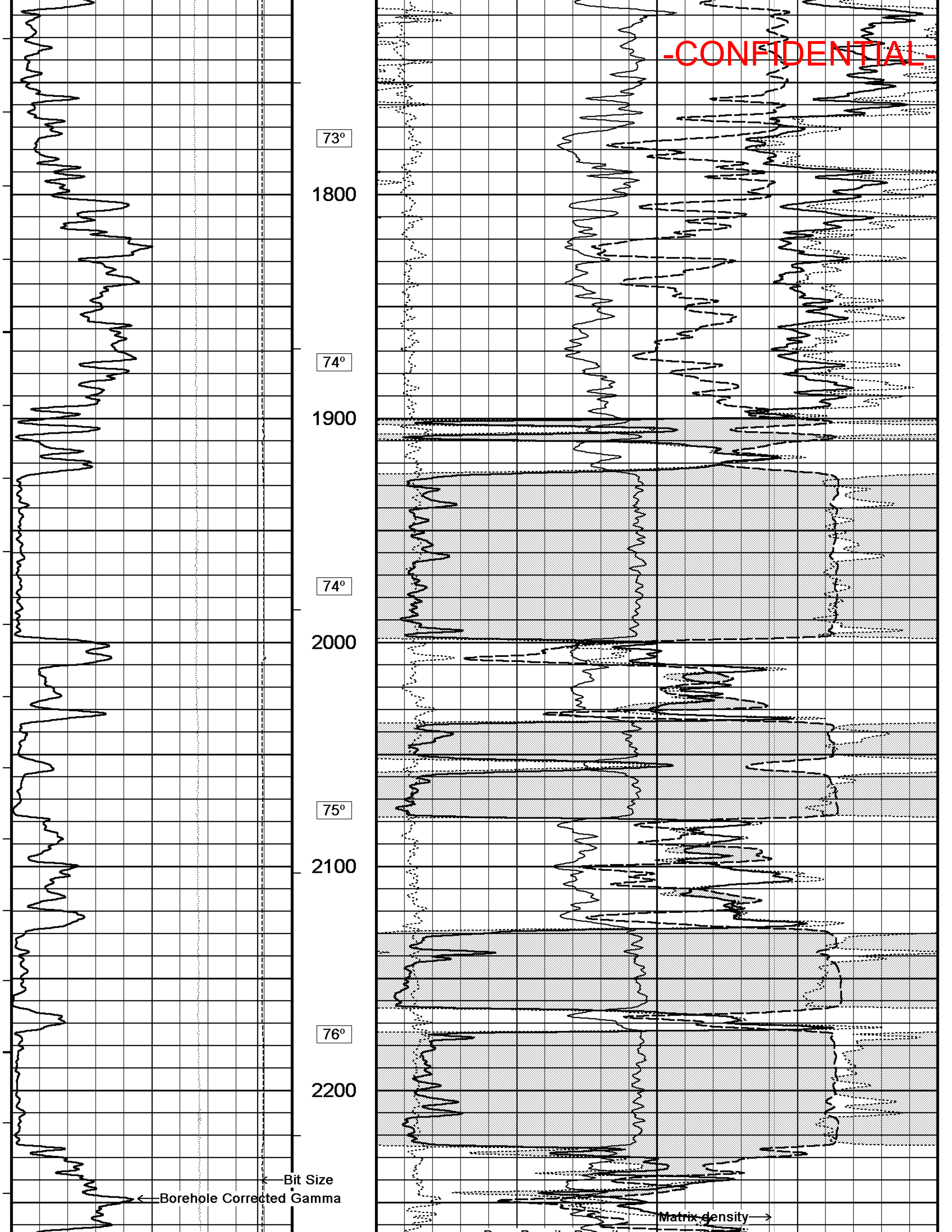
Track 1	Depth	Track 2
Timing Marks, every 60.0 sec	Depth in Feet	Limestone Neutron Por., percent: 30 / 20 / 10 / 0 / -10
Density Caliper, inches: 5 / 10 / 15	Borehole Temp in deg F	Compensated Density, grams/cc: 2 / 2.25 / 2.50 / 2.75 / 3
Borehole Corrected Gamma, API: 0 / 100 / 200; 200 / 300 / 400	HVI every 10 cu ft	PE, barns/electron: 0 / 2.50 / 5 / 7.50 / 10
Bit Size, inches: 5 / 10 / 15	Annular Integral every 10 cu ft	Base Density Porosity, percent: 30 / 20 / 10 / 0 / -10
DST Uphole Tension, pounds: 0 / 3000; 3000 / 6000	Replay Scale 1:600	Matrix density, grams/cc: 2 / 2.25 / 2.50 / 2.75 / 3
		Density Correction, grams/cc: -0.05 / 0.20 / 0.45

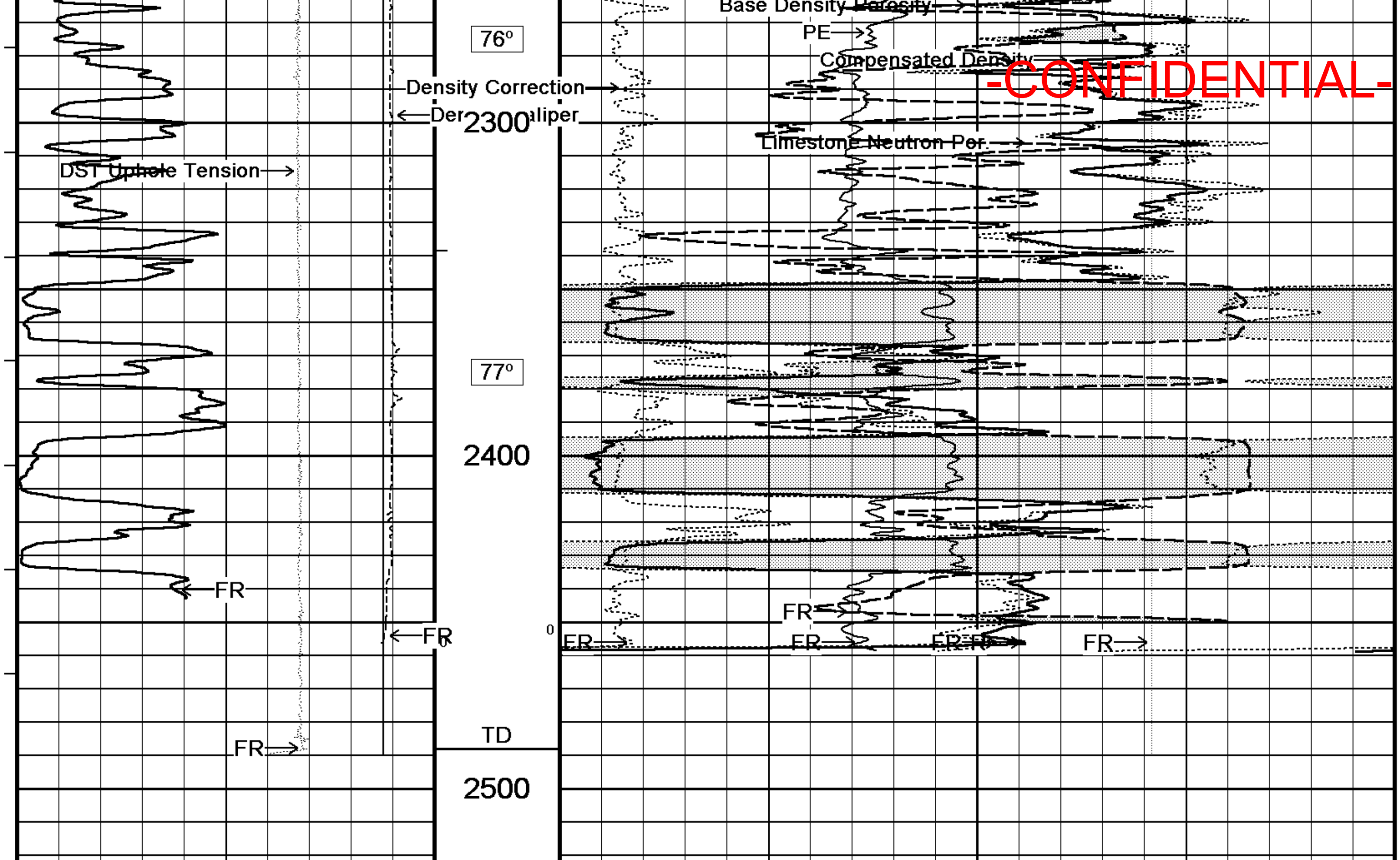



100
200
300
400
500
600


700
800
900
1000
1100


-CONFIDENTIAL-
1200
1300
1400
1500
Casing Shoe
71º
1600
72º
1700


-CONFIDENTIAL-
73°
1800
74°
1900
74°
2000
75°
2100
76°
2200
Bit Size
Borehole Corrected Gamma
Matrix density



Depth in Feet

Timing Marks
every 60.0 sec

Limestone Neutron Por.
percent
30 20 10 0 -10

Compensated Density
grams/cc
2 2.25 2.50 2.75 3

Density Caliper
inches
5 10 15

Borehole Temp in deg F

PE
barns/electron
0 2.50 5 7.50 10

Borehole Corrected Gamma
API
0 100 200
200 300 400

HVI every 10 cu ft

Base Density Porosity
percent
30 20 10 0 -10

Bit Size
inches
5 10 15

Annular Integral every 10 cu ft

Matrix density
grams/cc
2 2.25 2.50 2.75 3

DST Uphole Tension
pounds
0 3000
3000 6000

Replay Scale

Density Correction
grams/cc
-0.05 0.20 0.45

1:600

Depth Based Data - Maximum Sampling Increment 10.0cm
Filename: C:\Logs\Cargill Inc\Cargill 18\...\Cargill Inc_Cargill 18_Run_5_Triple_3540548 Main Pass.dta
System Versions: Logged with 13.06.9804 Plotted with 13.06.9804

Plotted on 20-AUG-2013 15:37
Recorded on 20-AUG-2013 13:39

-CONFIDENTIAL-

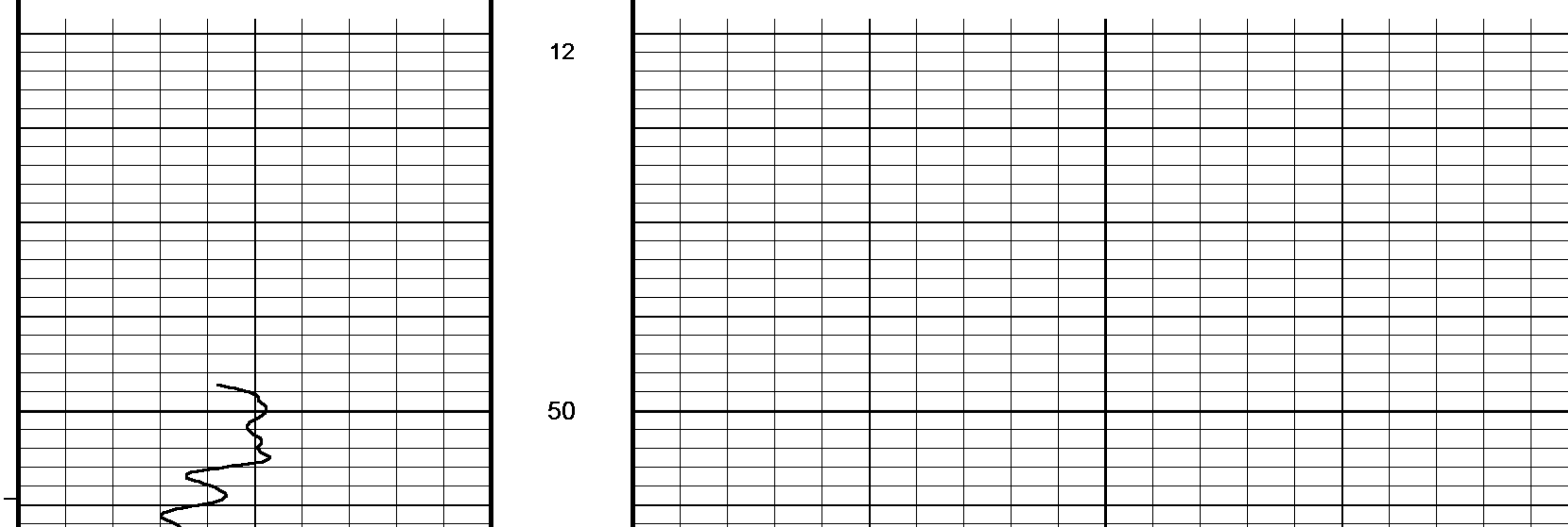
2 Inch Main Log

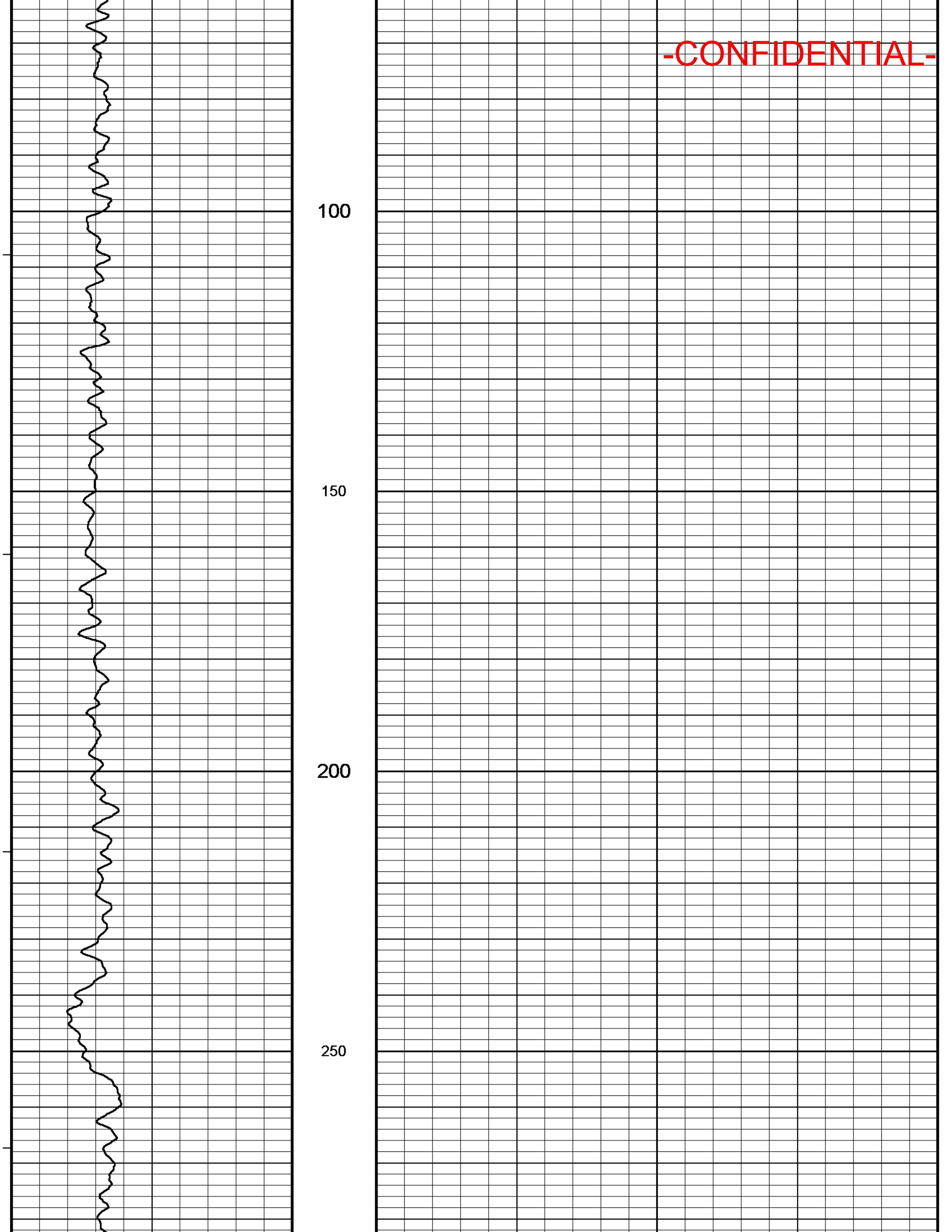
5 Inch Main Log

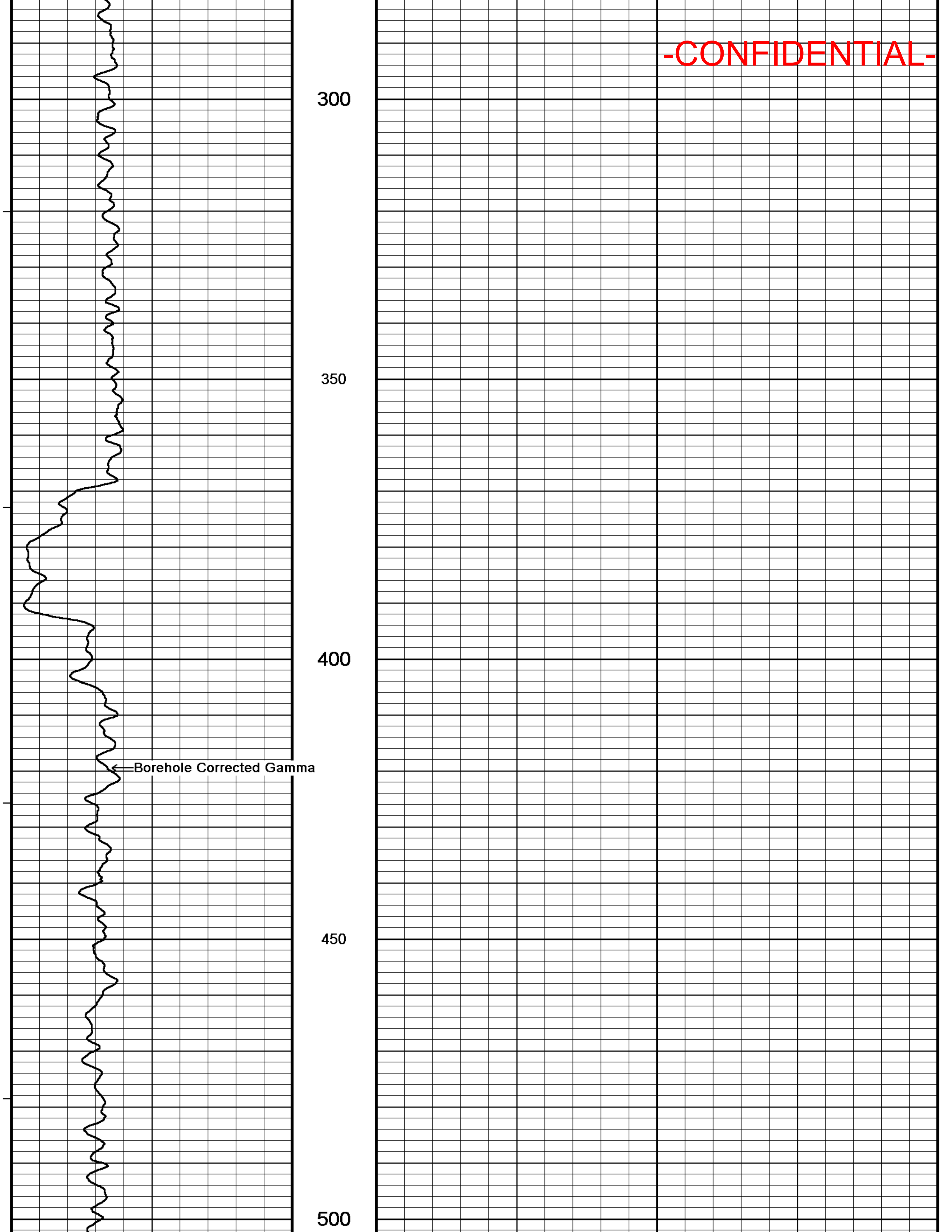
Depth Based Data - Maximum Sampling Increment 10.0cm
Filename: C:\Logs\Cargill Inc\Cargill 18\...\Cargill Inc_Cargill 18_Run_5_Triple_3540548 Main Pass.dta
System Versions: Logged with 13.06.9804 Plotted with 13.06.9804

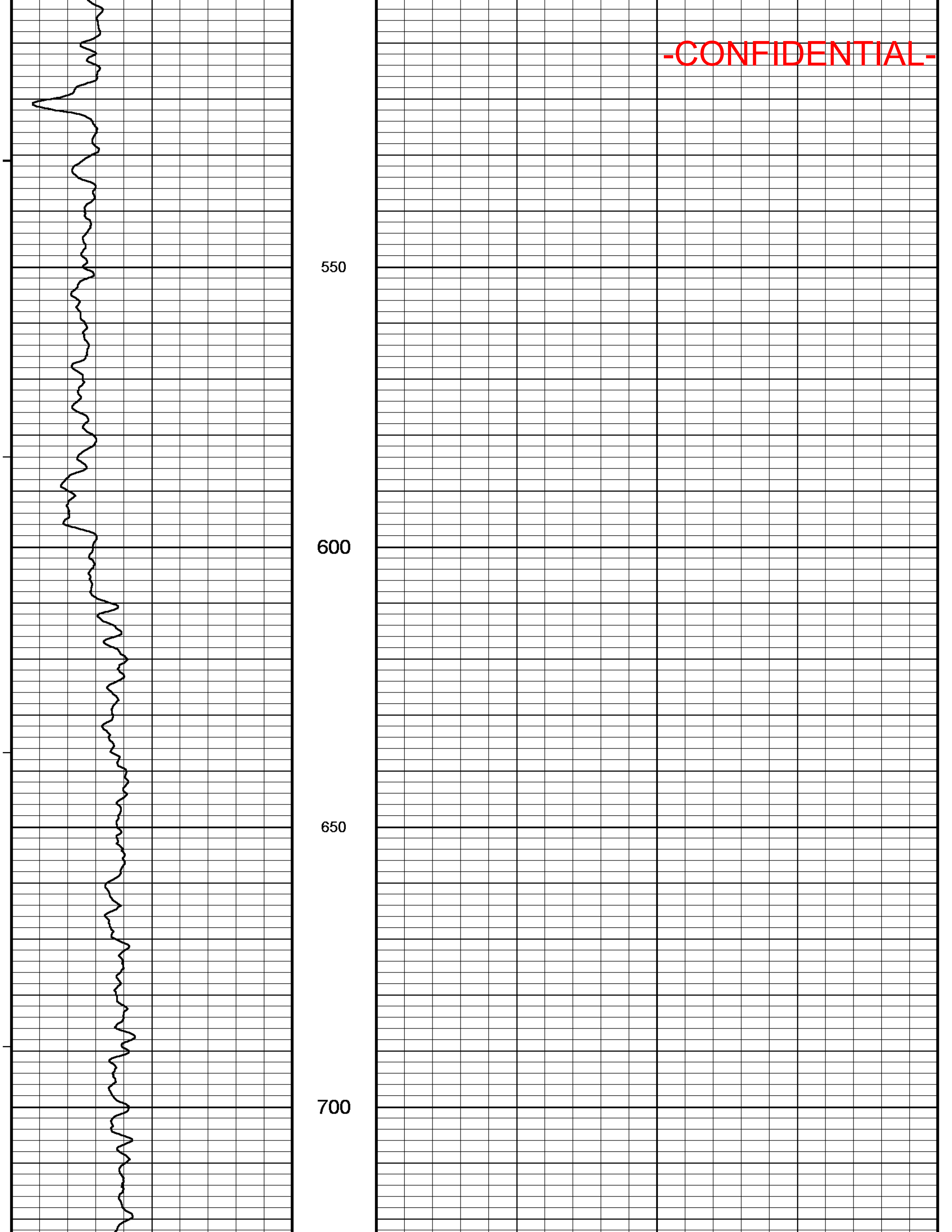
Plotted on 20-AUG-2013 15:37
Recorded on 20-AUG-2013 13:39

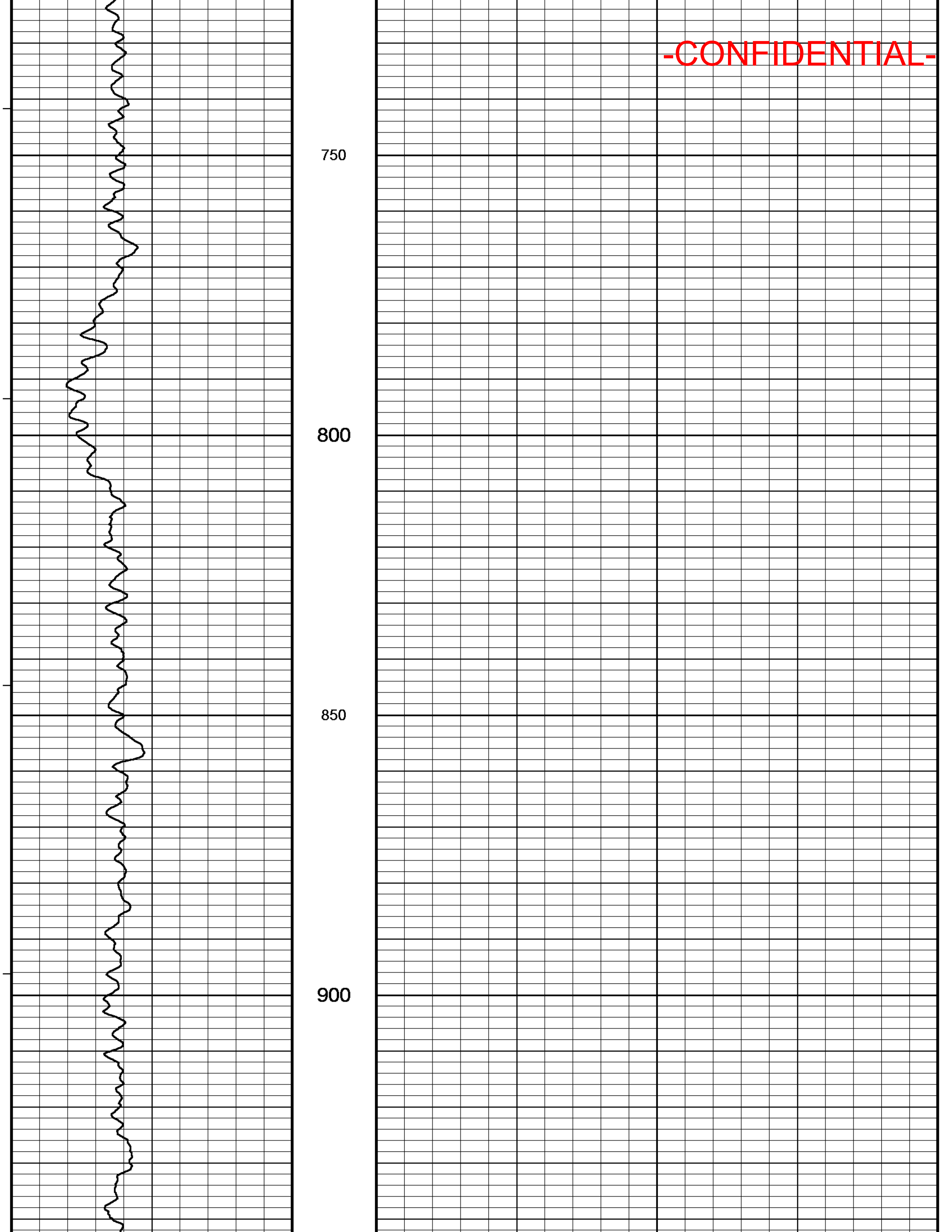
Track 1	Depth Track	Track 2-3
Timing Marks every 60.0 sec	Depth in Feet	Limestone Neutron Por. percent 30 20 10 0 -10
Density Caliper inches 5 10 15	Borehole Temp in deg F	Compensated Density grams/cc 2 2.25 2.50 2.75 3
Borehole Corrected Gamma API 0 100 200 200 300 400	HVI every 10 cu ft	PE barns/electron 0 2.50 5 7.50 10
Bit Size inches 5 10 15	Annular Integral every 10 cu ft	Base Density Porosity percent 30 20 10 0 -10
		Matrix density grams/cc 2 2.25 2.50 2.75 3
DST Uphole Tension pounds 0 3000 3000 6000	Replay Scale 1:240	Density Correction grams/cc -0.05 0.20 0.45

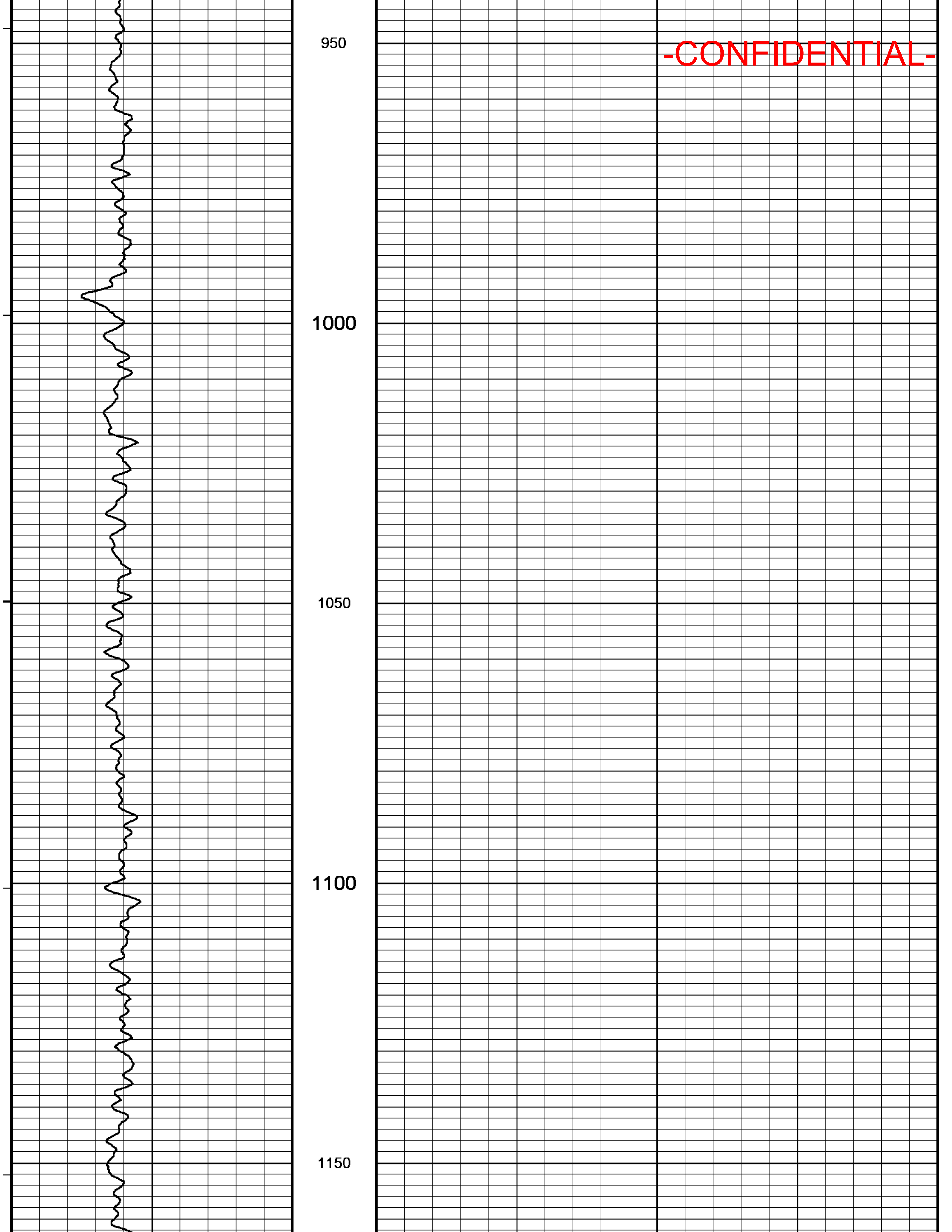


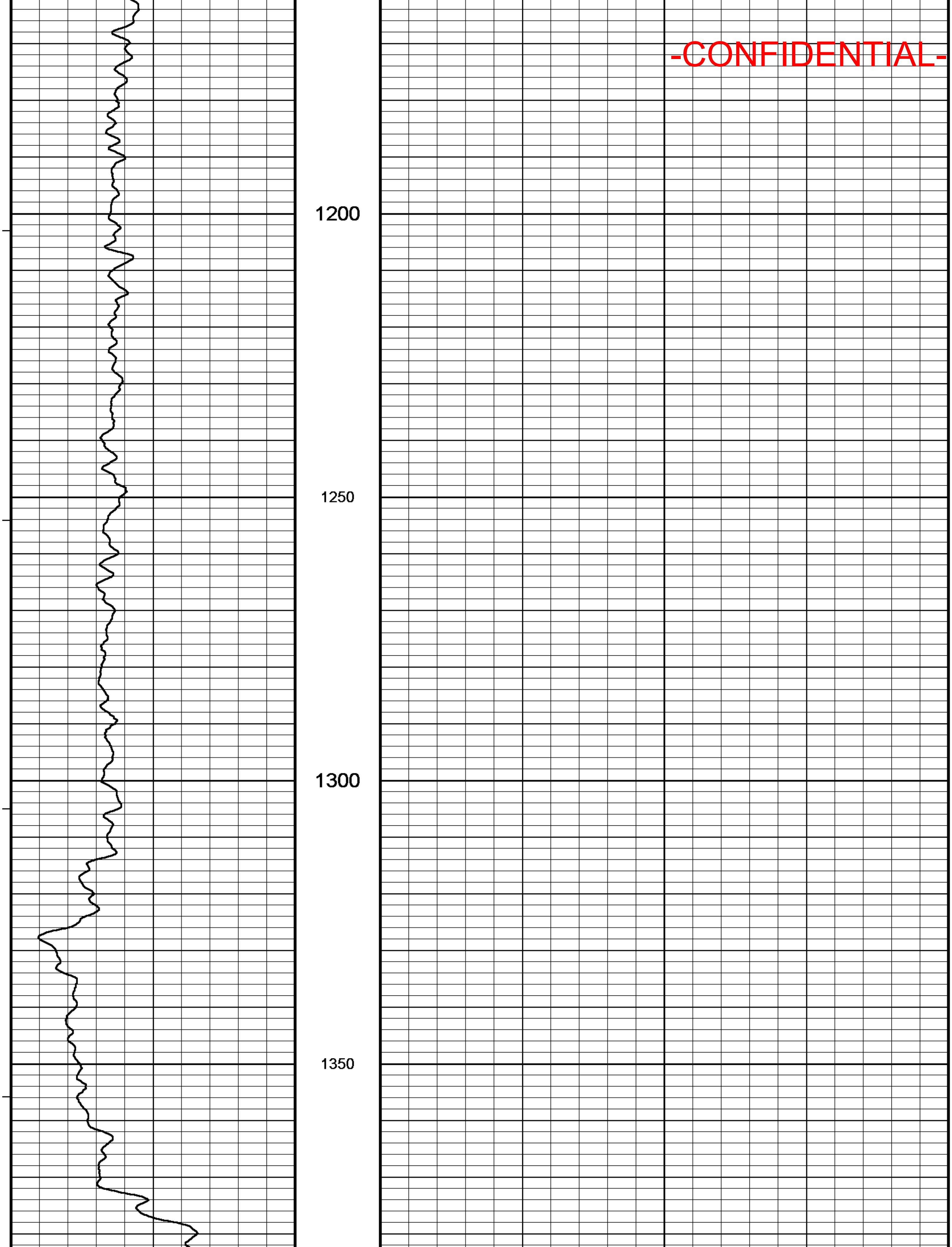

100
150
200
250

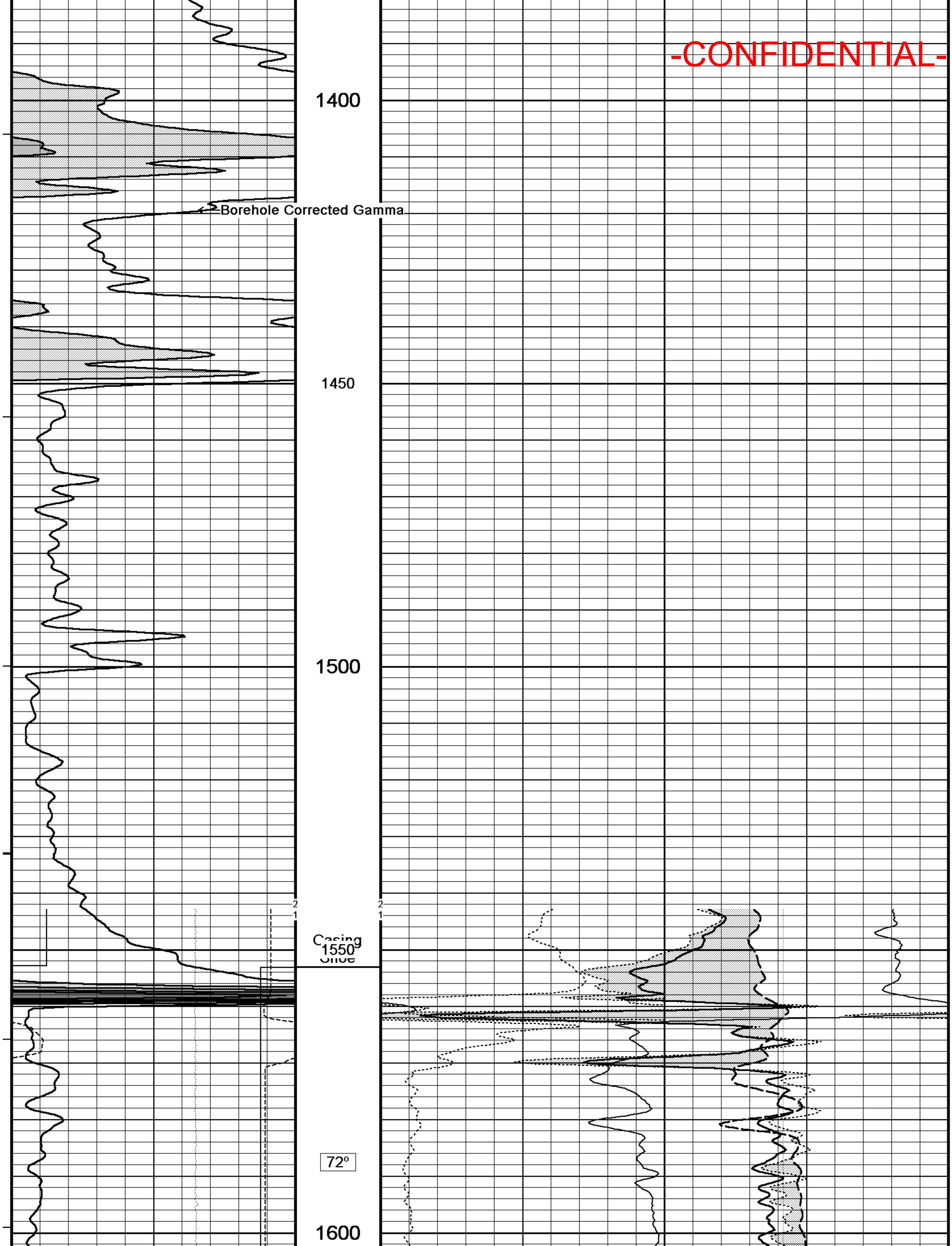

300
350
Borehole Corrected Gamma
400
450
500

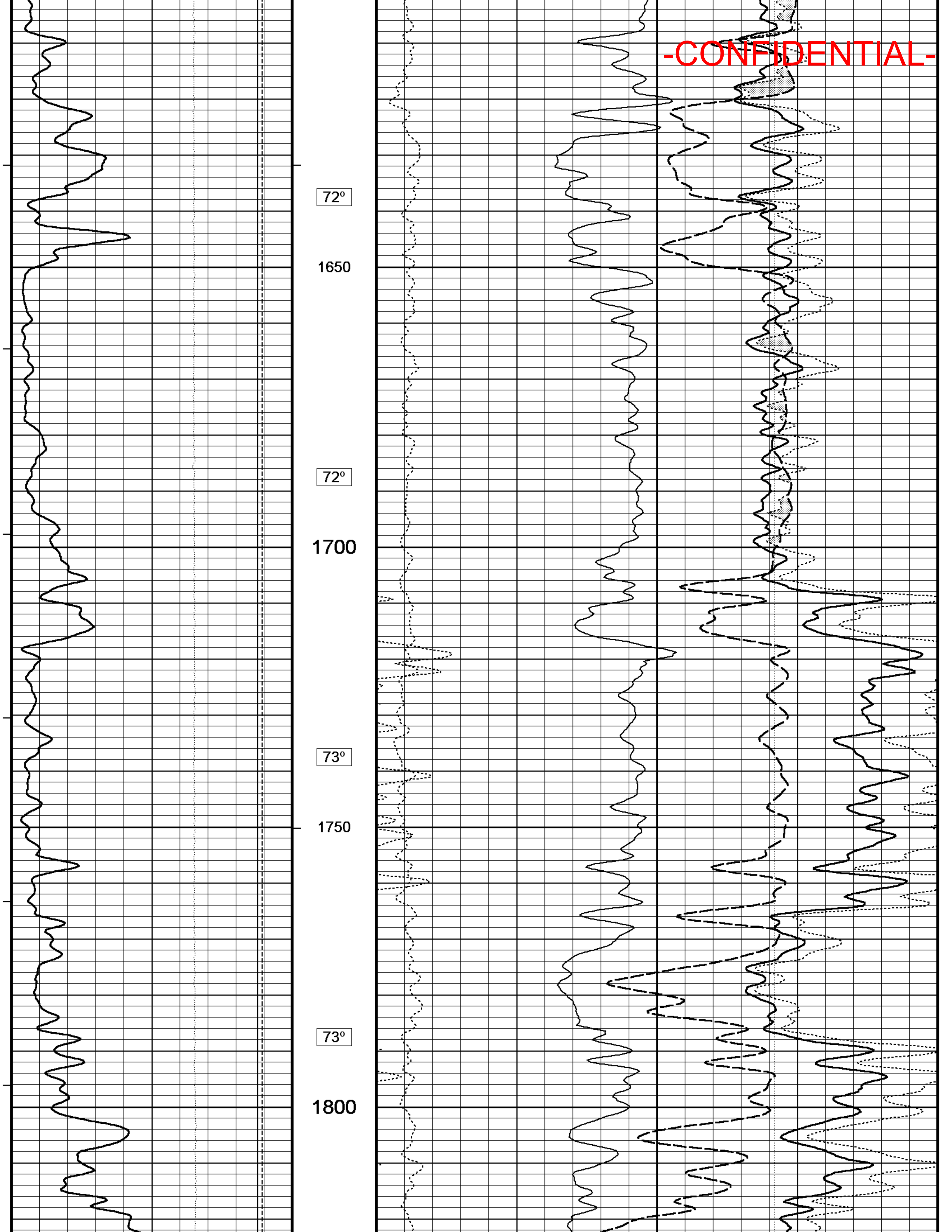

-CONFIDENTIAL-
550
600
650
700

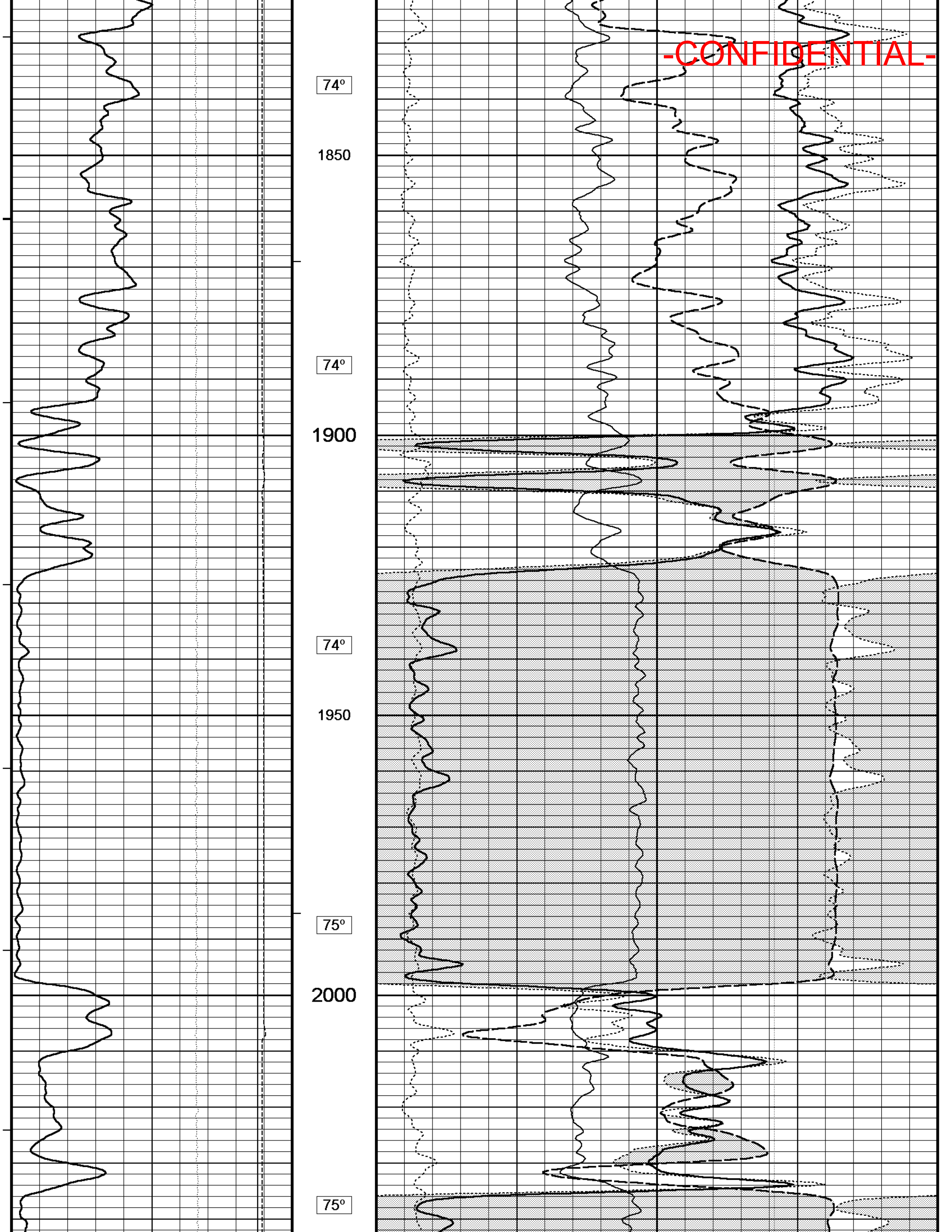

750
800
850
900

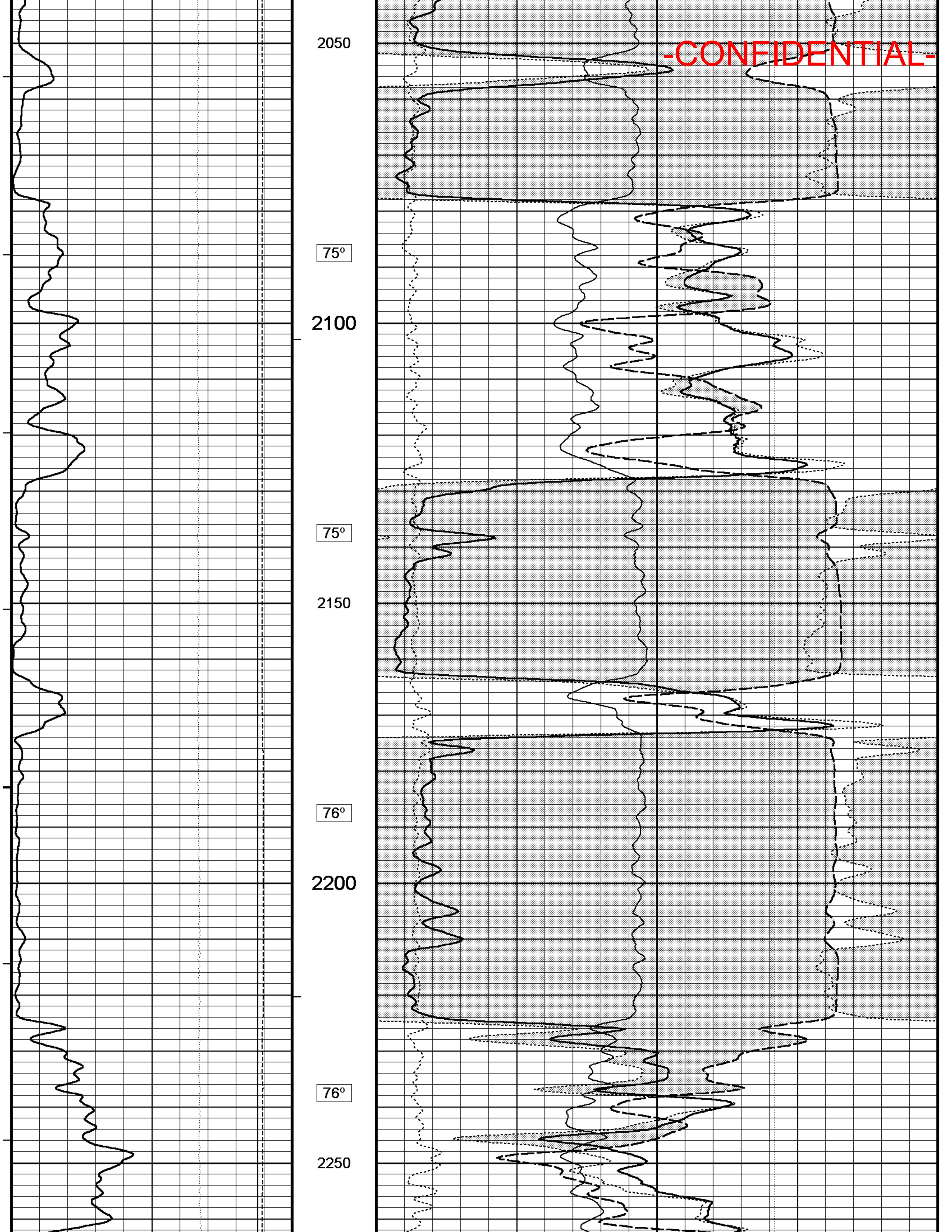

950
1000
1050
1100
1150

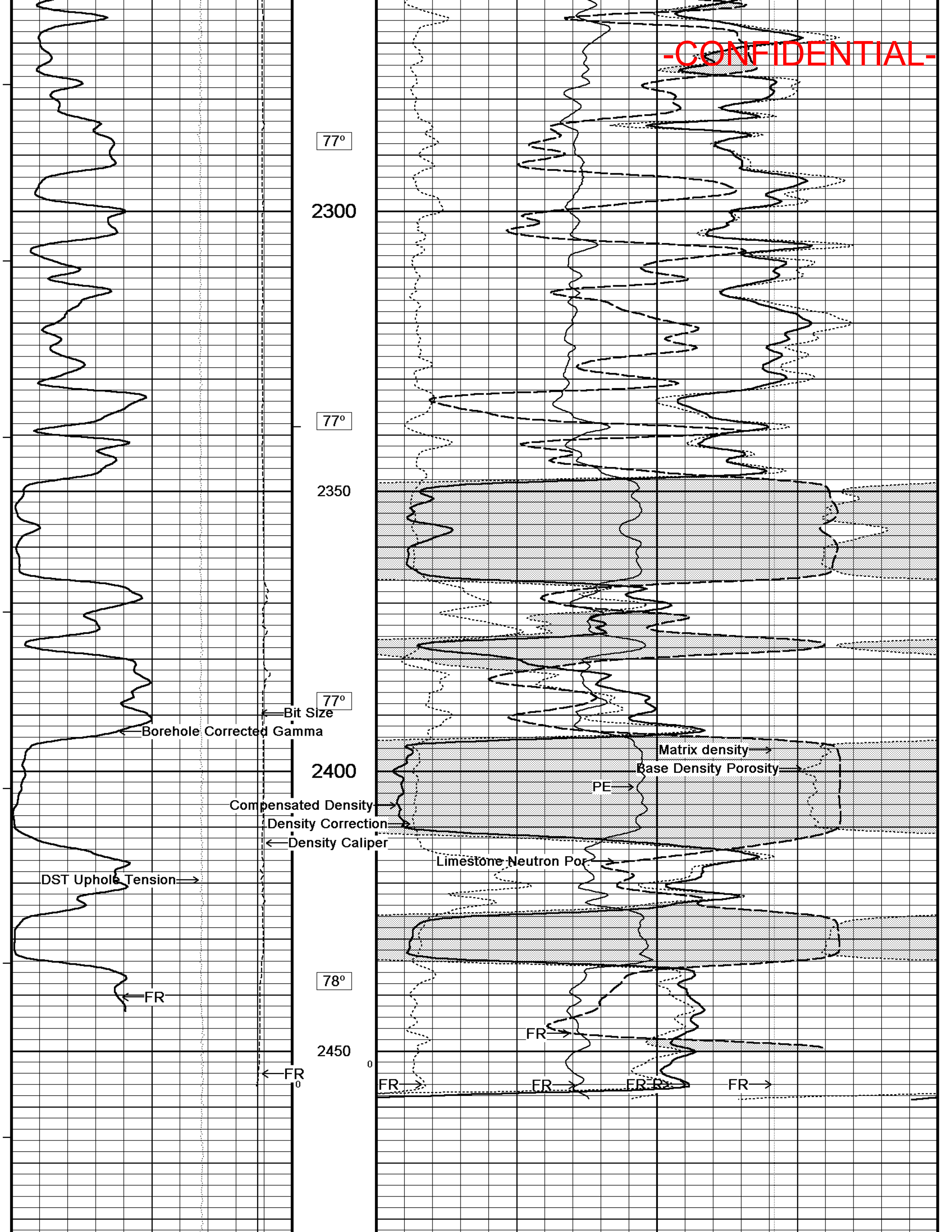

1200
1250
1300
1350


1400
Borehole Corrected Gamma
1450
1500
2
1
2
1
Casing Shoe
1550
72º
1600


72º
1650
72º
1700
73º
1750
73º
1800


-CONFIDENTIAL-
74°
1850
74°
1900
74°
1950
75°
2000
75°


-CONFIDENTIAL-
2050
75º
2100
75º
2150
76º
2200
76º
2250


-CONFIDENTIAL-
77º
2300
77º
2350
77º
Bit Size
Borehole Corrected Gamma
Matrix density
Base Density Porosity
2400
PE
Compensated Density
Density Correction
Density Caliper
Limestone Neutron Por.
DST Uphole Tension
78º
FR
FR
2450
0
FR
0
FR
FR
FR R
FR

FR

TD

2500

-CONFIDENTIAL-

Depth in Feet

Timing Marks
every 60.0 sec

Density Caliper
inches
5 10 15

Borehole Corrected Gamma
API
0 100 200
200 300 400

Bit Size
inches
5 10 15

DST Uphole Tension
pounds
0 3000
3000 6000

Borehole Temp in deg F

HVI every 10 cu ft

Annular Integral every 10 cu ft

Replay Scale 1:240

Limestone Neutron Por.
percent
30 20 10 0 -10

Compensated Density
grams/cc
2 2.25 2.50 2.75 3

PE
barns/electron
0 2.50 5 7.50 10

Base Density Porosity
percent
30 20 10 0 -10

Matrix density
grams/cc
2 2.25 2.50 2.75 3

Density Correction
grams/cc
-0.05 0.20 0.45

Depth Based Data - Maximum Sampling Increment 10.0cm
Filename: C:\Logs\Cargill Inc\Cargill 18\...\Cargill Inc_Cargill 18_Run_5_Triple_3540548 Main Pass.dta
System Versions: Logged with 13.06.9804 Plotted with 13.06.9804

Plotted on 20-AUG-2013 15:37
Recorded on 20-AUG-2013 13:39

5 Inch Main Log

5 Inch Repeat Section

Depth Based Data - Maximum Sampling Increment 10.0cm
Filename: C:\Logs\Cargill Inc\Cargill 1...\Cargill Inc_Cargill 18_Run_5_Triple_3540548 Repeat Pass.dta
System Versions: Logged with 13.06.9804 Plotted with 13.06.9804

Plotted on 20-AUG-2013 15:37
Recorded on 20-AUG-2013 12:52

Depth in Feet

Timing Marks
every 60.0 sec

Density Caliper
inches
5 10 15

Borehole Temp in

Limestone Neutron Por.
percent
30 20 10 0 -10

Compensated Density
grams/cc
2 2.25 2.50 2.75 3

deg F

PE

barns/electron

-CONFIDENTIAL-

0 2.50 5 7.50 10

Borehole Corrected Gamma

API

0 100 200

200 300 400

HVI every 10 cu ft

Base Density Porosity

percent

30 20 10 0 -10

Annular Integral every 10 cu ft

Bit Size

inches

5 10 15

Matrix density

grams/cc

2 2.25 2.50 2.75 3

DST Uphole Tension

pounds

0 3000

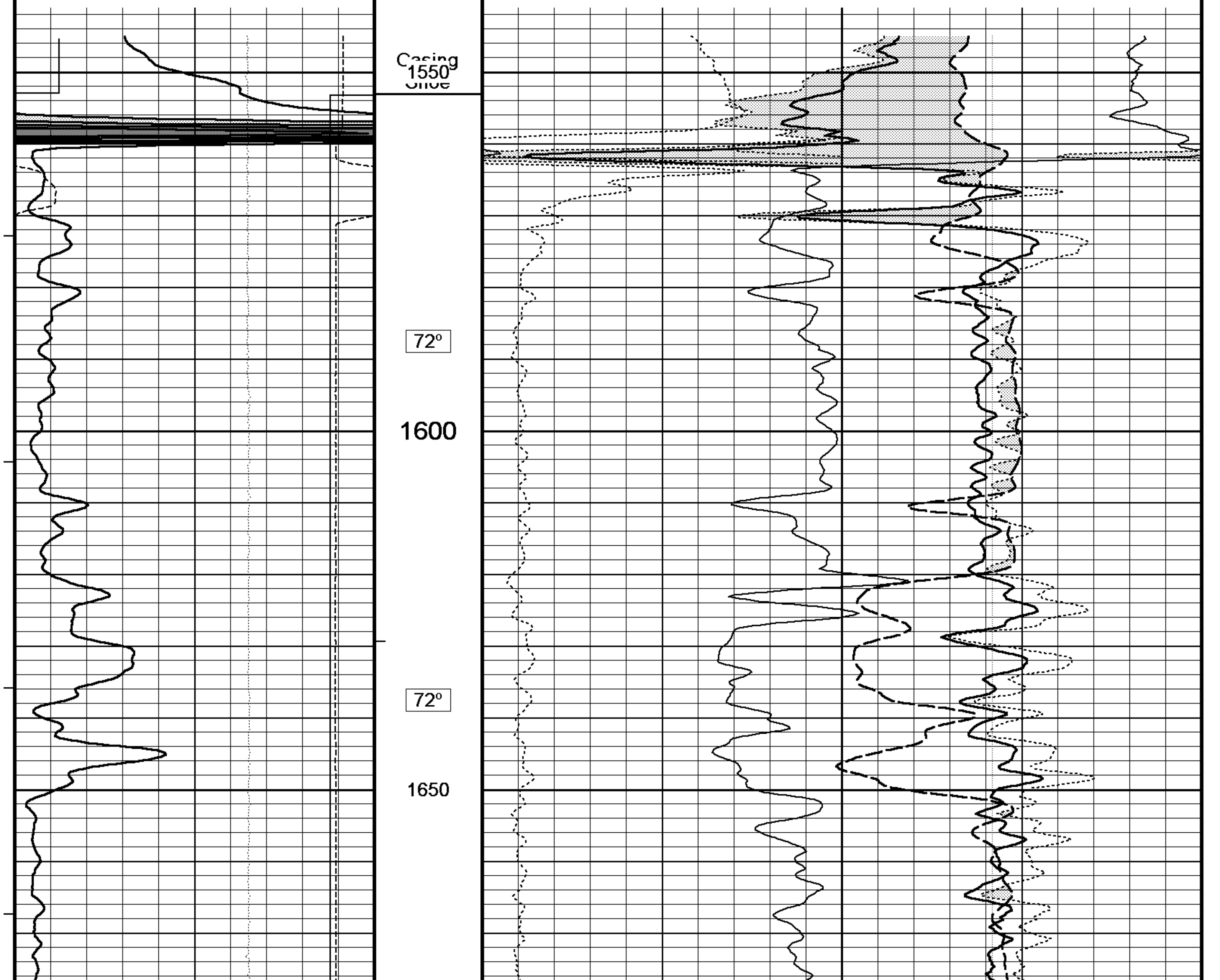
3000 6000

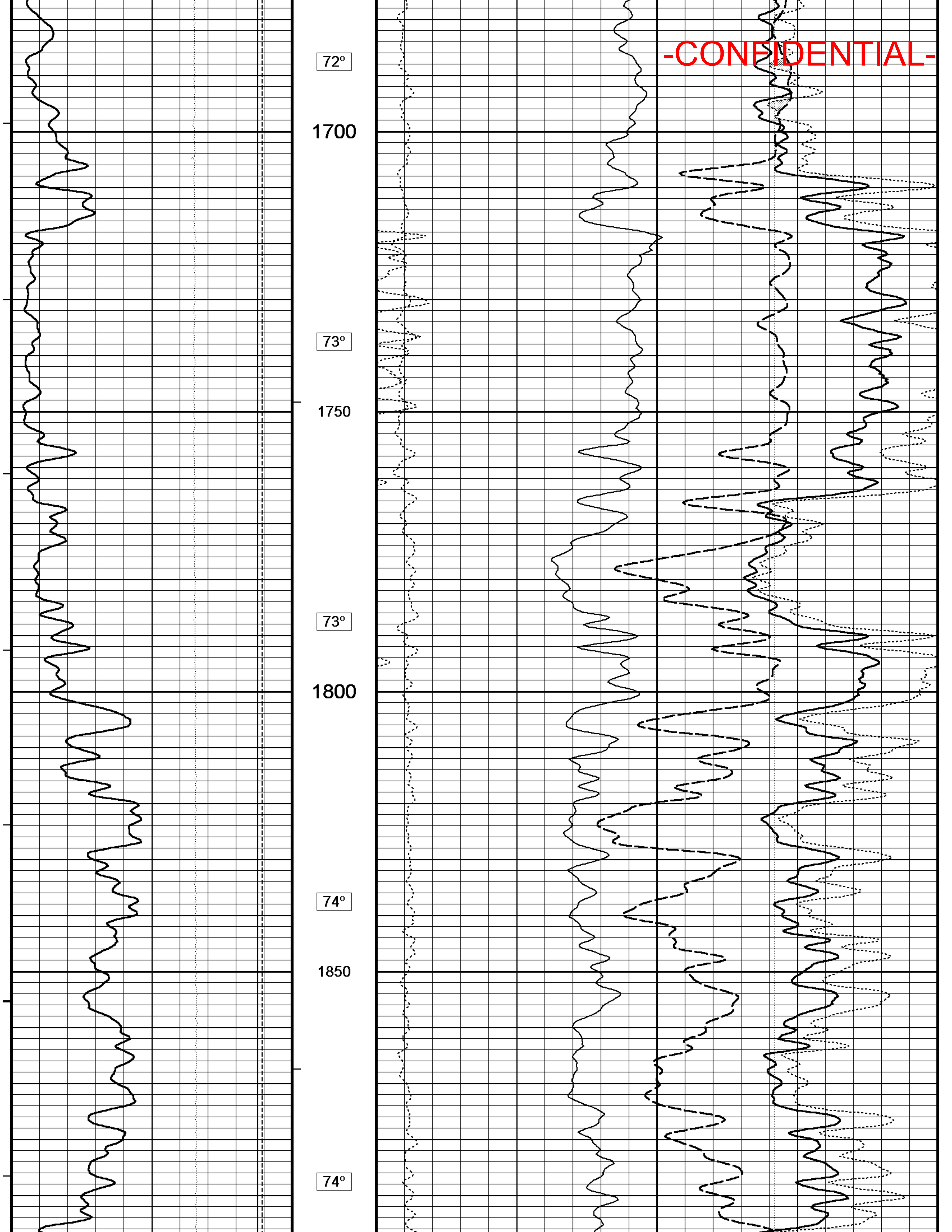
Replay Scale 1:240

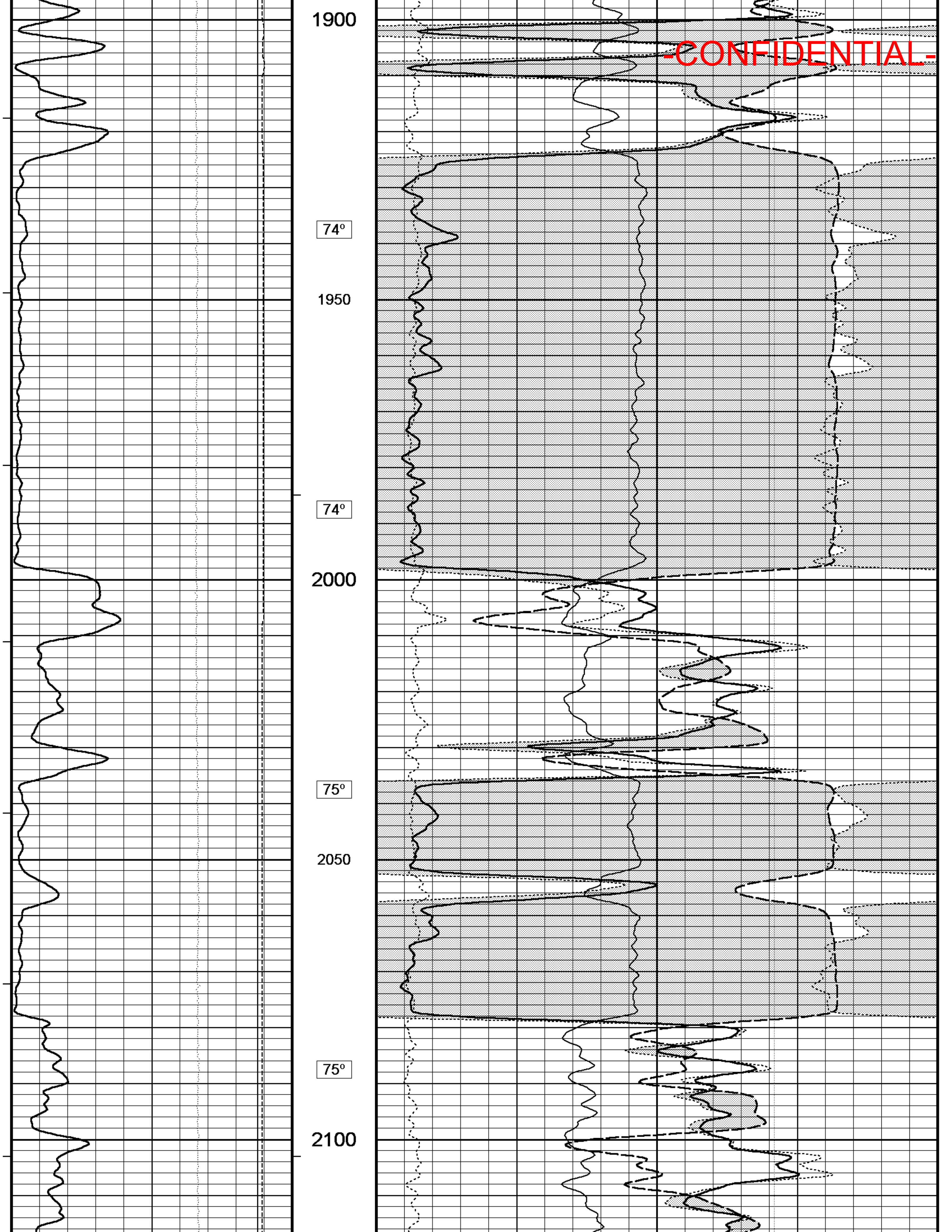
Density Correction

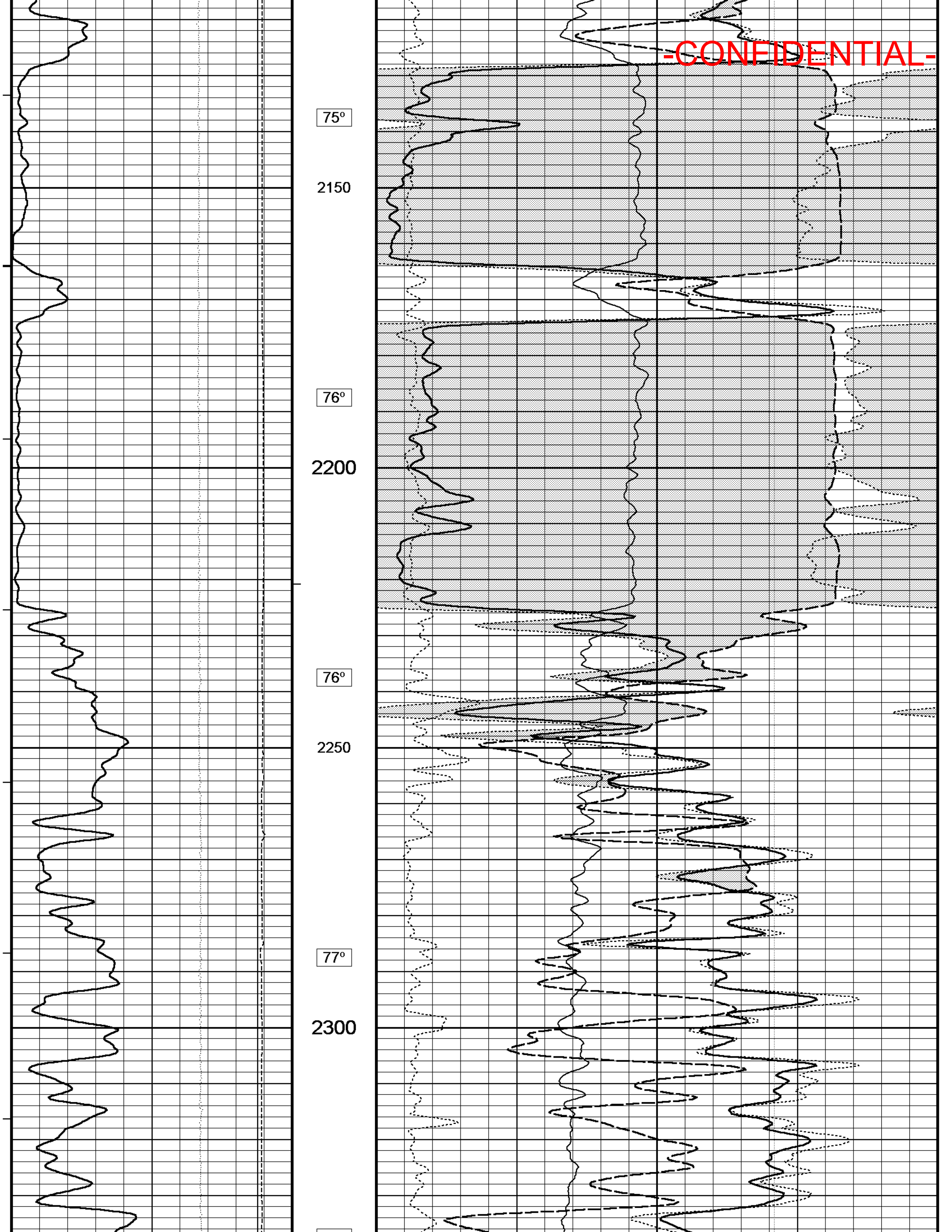
grams/cc

-0.05 0.20 0.45

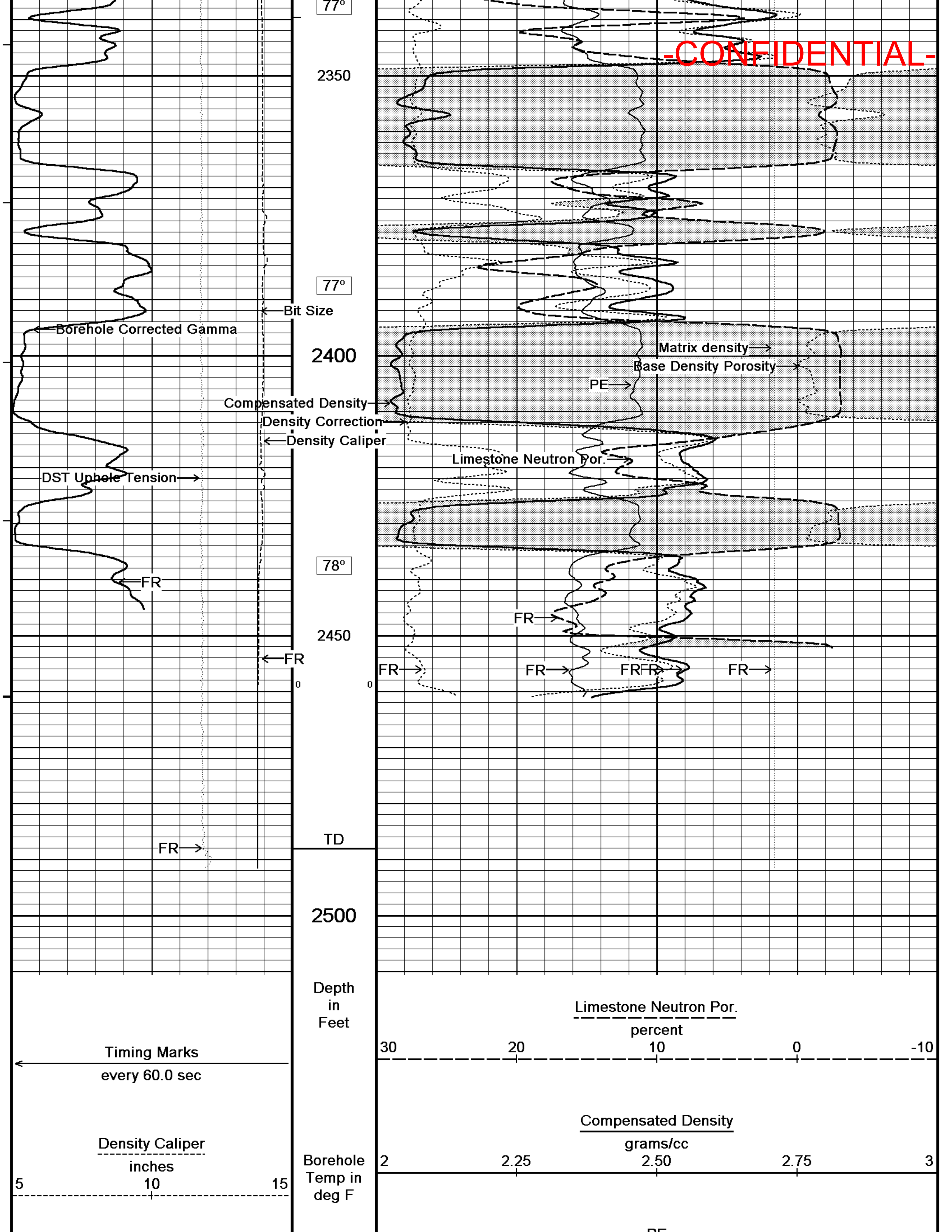



-CONFIDENTIAL-
72°
1700
73°
1750
73°
1800
74°
1850
74°


1900
-CONFIDENTIAL-
74°
1950
74°
2000
75°
2050
75°
2100



-CONFIDENTIAL-
75º
2150
76º
2200
76º
2250
77º
2300



-CONFIDENTIAL-
77º
2350
77º
Bit Size
Borehole Corrected Gamma
2400
Matrix density
Base Density Porosity
PE
Compensated Density
Density Correction
Density Caliper
Limestone Neutron Por.
DST Uphole Tension
78º
FR
2450
TD
2500
Depth in Feet
Limestone Neutron Por.
percent
30 20 10 0 -10
Timing Marks
every 60.0 sec
Compensated Density
grams/cc
2 2.25 2.50 2.75 3
Density Caliper
inches
5 10 15
Borehole Temp in deg F

Borehole Corrected Gamma

API

0 100 200

200 300 400

Bit Size

inches

5 10 15

DST Uphole Tension

pounds

0 3000

3000 6000

HVI every 10 cu ft

Annular Integral every 10 cu ft

Replay Scale 1:240

PE

barns/electron

0 2.50 5 7.50 10

-CONFIDENTIAL-

Base Density Porosity

percent

30 20 10 0 -10

Matrix density

grams/cc

2 2.25 2.50 2.75 3

Density Correction

grams/cc

-0.05 0.20 0.45

Depth Based Data - Maximum Sampling Increment 10.0cm — Plotted on 20-AUG-2013 15:37

Filename: C:\Logs\Cargill Inc\Cargill 1...\Cargill Inc_Cargill 18_Run_5_Triple_3540548 Repeat Pass.dta — Recorded on 20-AUG-2013 12:52

System Versions: Logged with 13.06.9804 Plotted with 13.06.9804

5 Inch Repeat Section

BEFORE SURVEY CALIBRATION

C:\Logs\Cargill Inc\Cargill 18\Run_5_Triple\3540548\Cargill Inc_Cargill 18_Run_5_Triple_3540548 Main Pass.dta

General Constants All 000

Last Edited on 20-AUG-2013,12:07

General Parameters		
Mud Resistivity	0.049	ohm-metres
Mud Resistivity Temperature	78.000	degrees F
Water Level	0.000	feet
Borehole Fluid Processing	Wet Hole	
Hole/Annular Volume and Differential Caliper Parameters		
HVOL Method	Single Caliper	
HVOL Caliper 1	Density Caliper	
HVOL Caliper 2	N/A	
Annular Volume Diameter	3.750	inches
Caliper for Differential Caliper	Density Caliper	
Rwa Parameters		
Porosity used	Base Density Porosity	
Resistivity used	Deep Laterolog	
RWA Constant A	0.610	
RWA Constant M	2.150	
SW/APOR Tool Source	0.000	

Gamma Calibration MCG-B 60

Field Calibration on 08-AUG-2013 13:15

	Measured	Calibrated (API)
Background	52	36
Calibrator (Gross)	2285	1575
Calibrator (Net)	2233	1539

Gamma Constants MCG-B 60

Last Edited on 20-AUG-2013,12:01

Gamma Calibrator Number	45	
Mud Density	1.05	gm/cc
Caliper Source for Processing	Density Caliper	
Tool Position	Eccentred	
Concentration of KCl		kppm

K Mud Type	Chloride	
K Mud Concentration	0.00	%

High Resolution Temperature Calibration MCG-B 60

-CONFIDENTIAL-

Field Calibration on 24-APR-2013,11:52

	Measured	Calibrated(Deg F)
Lower	60.00	60.00
Upper	101.00	100.00

High Resolution Temperature Constants MCG-B 60

Last Edited on 24-APR-2013,11:52

Pre-filter Length	11

Neutron Calibration MDN-A.B 80

Base Calibration on 03-AUG-2013,14:08
Field Check on 15-AUG-2013,17:46

Base Calibration

	Measured		Calibrated (cps)	
	Near	Far	Near	Far
	3504	108	3714	110
Ratio	32.559		33.764	

Field Calibrator at Base

	Calibrated (cps)	
	1457	2097
Ratio	0.695	

Field Check

	Calibrated (cps)
Ratio	0.696

Neutron Constants MDN-A.B 80

Last Edited on 20-AUG-2013,12:01

Neutron Source Id	P0197NN	
Neutron Jig Number	50656N	
Epithermal Neutron	No	
Caliper Source for Processing	Density Caliper	
Stand-off	0.00	inches
Mud Density	1.00	gm/cc
Limestone Sigma	7.10	cu
Sandstone Sigma	4.26	cu
Dolomite Sigma	4.70	cu
Formation Pressure Source	Constant Value	
Formation Pressure	0.00	kpsi
Temperature Source	Constant Value	
Temperature	68.00	degrees F
Mud Salinity	0.00	kppm
Salinity Correction	Not Applied	
Formation Fluid Salinity Source	Constant Value	
Formation Fluid Salinity	0.00	kppm
Barite Mud Correction	Not Applied	

Caliper Calibration MPD-A.A 20

Base Calibration on 08-AUG-2013 14:51
Field Calibration on 08-AUG-2013 14:56

Base Calibration

Reading No	Measured	Calibrator Size (in)
1	26159	6.03
2	36145	7.99
3	45639	9.85
4	56054	11.82
5	0	0.00
6	N/A	N/A

Field Calibration

Measured Caliper (in)	Actual Caliper (in)
7.94	7.99

Photo Density Calibration MPD-A.A 20

Base Calibration on 08-AUG-2013 14:28
Field Check on 20-AUG-2013,12:00

Density Calibration

Base Calibration

	Measured		Calibrated (sdu)	
	Near	Far	Near	Far
Reference 1	43016	15684	53453	19407
Reference 2	20273	2589	25381	2580

Field Check at Base

1289.4	1483.2	

Field Check

1287.5	1480.1

-CONFIDENTIAL-

PE Calibration

Base Calibration	WS	Measured WH	Ratio	Calibrated Ratio
Background	235	1141		
Reference 1	14607	42827	0.345	0.320
Reference 2	5562	20118	0.281	0.274

Field Check at Base

234.7	1141.3

Field Check

235.4	1137.5

Density Constants MPD-A.A 20 — Last Edited on 20-AUG-2013,12:00

Density Source Id	21145B	
Nylon Calibrator Number	DNC-D-520	
Aluminium Calibrator Number	DAC-D-520	
Density Shoe Profile	8 inch	
Caliper Source for Processing	Density Caliper	
PE Correction to Density	Not Applied	
Mud Density	1.05	gm/cc
Mud Density Z/A Multiplier	1.11	
Mud Filtrate Density	1.00	gm/cc
Dry Hole Mud Filtrate Density	0.70	gm/cc
DNCT	0.00	gm/cc
CRCT	0.00	gm/cc
Density Z/A Correction	Hybrid	

Matrix Density (gm/cc)	Depth (ft)
2.71	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	

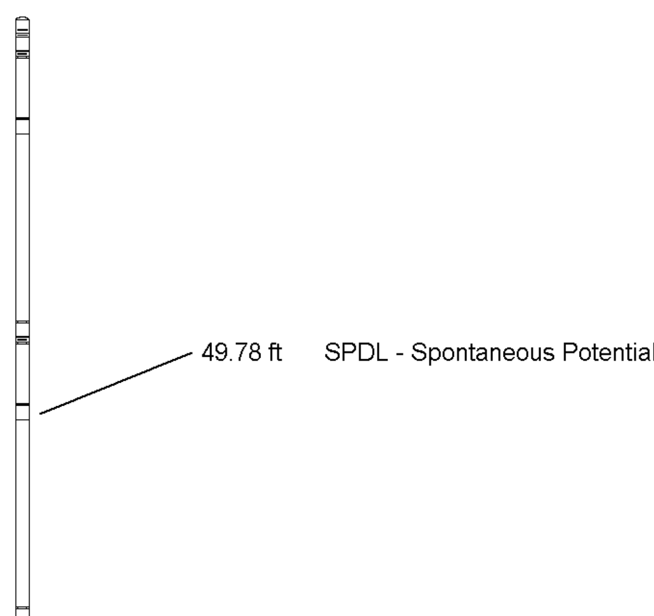
DOWNHOLE EQUIPMENT

C:\Logs\Cargill Inc\Cargill 18\Run_5_Triple\3540548\Cargill Inc_Cargill 18_Run_5_Triple_3540548 Main Pass.dta

3/8" Triple Cone Cable Head (MCB F B)
MCB-F.B 52 LG: 1.58 ft WT: 15.4 lb OD: 2.24 in

Compact Stiff Bridle Electrode Sub.
MBE-C.B 330 LG: 12.33 ft WT: 77.2 lb OD: 2.28 in

Compact Stiff Bridle Electrode Sub.
MBE-C.B 339 LG: 12.33 ft WT: 77.2 lb OD: 2.28 in



SHA-J.A Compact Swivel Head Adaptor
SHA-J.A 353 LG: 2.30 ft WT: 22.0 lb OD: 2.24 in

Compact Comms Gamma
MCG-B 60 LG: 8.70 ft WT: 63.9 lb OD: 2.24 in

Compact Neutron
MDN-A.B 80 LG: 5.04 ft WT: 50.7 lb OD: 2.24 in

Compact Density/Caliper
MPD-A.A 20 LG: 9.53 ft WT: 90.4 lb OD: 2.45 in

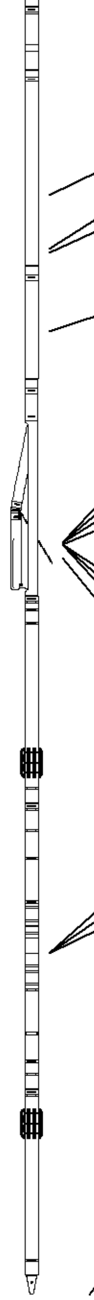
Compact Upper Guard sub
MUG-B.B 276 LG: 8.98 ft WT: 68.3 lb OD: 2.24 in

Compact Laterolog Electrode Sub.
MLE-C.K 236 LG: 12.34 ft WT: 92.6 lb OD: 2.24 in

Compact Lower Guard Sub.
MLG-B.A 195 LG: 8.00 ft WT: 55.1 lb OD: 2.24 in

Compact Pressure Bung
HFS 2 LG: 0.13 ft WT: 4.4 lb OD: 2.24 in

Total Length: 81.26 ft Weight: 617.3 lb



33.24 ft GGCE - Borehole Corrected Gamma
31.07 ft CCLG - Casing Collar Locator
30.34 ft CGXT - MCG External Temperature

26.79 ft NPRL - Limestone Neutron Por.

19.55 ft AVOL - Annular Volume
19.55 ft HVOL - Hole Volume
19.55 ft CLDC - Density Caliper
17.62 ft DCOR - Density Correction

17.62 ft MTXD - Matrix density
17.62 ft DPOR - Base Density Porosity
17.62 ft DEN - Compensated Density
17.56 ft PDPE - PE

0.00 ft DSLL - Shallow Laterolog
0.00 ft DDLL - Deep Laterolog
Tool Zero (14.32ft from bottom)

-14.32 ft SMTU - DST Uphole Tension
All measurements relative to tool zero.

COMPANY	Cargill, Inc.
WELL	Cargill 18
FIELD	Lansing
PROVINCE/COUNTY	Tompkins County
COUNTRY/STATE	U.S.A. / New York

Elevation Kelly Bushing	752.16	feet	First Reading	2488.00	feet
Elevation Drill Floor	752.16	feet	Depth Driller	2486.00	feet
Elevation Ground Level	748.16	feet	Depth Logger	2488.00	feet

Weatherford®

Photo Density
Compensated Neutron
Gamma Ray

-CONFIDENTIAL-

Weatherford

Dual Laterolog Gamma Ray

COMPANY	Cargill, Inc.
WELL	Cargill 18
FIELD	Lansing
PROVINCE/COUNTY	Tompkins County
COUNTRY/STATE	U.S.A. / New York
LOCATION	X=820507.58, Y=937023.59
PERMIT NUMBER	Z/Elevation=784.16 WEL

FIELD PRINT

SEC	TWP	RGE	Other Services	
			Photo Density	Data Pack
			Compensated Neutron	Caliper
			Cross Dipole	

API Number

Permanent Datum Ground Level, Elevation 748.16 feet

Log Measured From GL

Drilling Measured From GLL

Elevations:	feet
KB	752.16
DF	752.16
GL	748.16

Date	20-Aug-2013		
Run Number	Five		
Service Order	3540548		
Depth Driller	2486.00	feet	
Depth Logger	2488.00	feet	
First Reading	2488.00	feet	
Last Reading	30.00	feet	
Casing Driller	1554.00	feet	
Casing Logger	1553.00	feet	
Bit Size	3.780	inches	
Hole Fluid Type	Brine		
Density / Viscosity	8.60 lb/USg	27.00 sec/qt	
PH / Fluid Loss			
Sample Source	Flow Line		
Rm @ Measured Temp	0.049 @ 78.0	ohm-m	
Rmf @ Measured Temp	0.037 @ 78.0	ohm-m	
Rmc @ Measured Temp	0.073 @ 78.0	ohm-m	
Source Rmf / Rmc	Calc.	Calc.	
Rm @ BHT	0.049 @ 78.0	ohm-m	
Time Since Circulation	4 Hrs		
Max Recorded Temp	78.00	deg F	
Equipment / Base	13041	Muncy	
Recorded By	Nibras Nureldin		
Witnessed By	Patrick McGrath		

BOREHOLE RECORD

Last Edited: 20-AUG-2013 14:46

Bit Size (inches)	Depth From (feet)	Depth To (feet)
8.750	28.50	580.00
6.250	580.00	1553.00
3.780	1553.00	2488.00

CASING RECORD

Type	Size (inches)	Depth From (feet)	Shoe Depth (feet)	Weight (pounds/ft)
	10.750	0.00	28.00	42.00
	7.000	0.00	580.00	17.00
	4.500	0.00	1553.00	9.50

REMARKS

Software: WLS 13.06.9804

Tools Run 1: MBE, MBE,SHA, MCG, MDN, MPD, MFE,MUG,MDL,MLG,BHT

Hardware:

MDL - Two-1 Inch Standoffs

Density Matrix was ran on 2.71 gg/cc

Crew: Nibras Nureldin
Shane Glowcheski

Gamma ray spikes up at the bottom of the borehole because the gamma ray sub ran below the sources
3.75 inch casing was used to calculate annular hole volumes
Gamma ray was recorded to ground level

-CONFIDENTIAL-

No Mud report was found on location.
100% Brine was added to the well that had 10% brine water in the well.

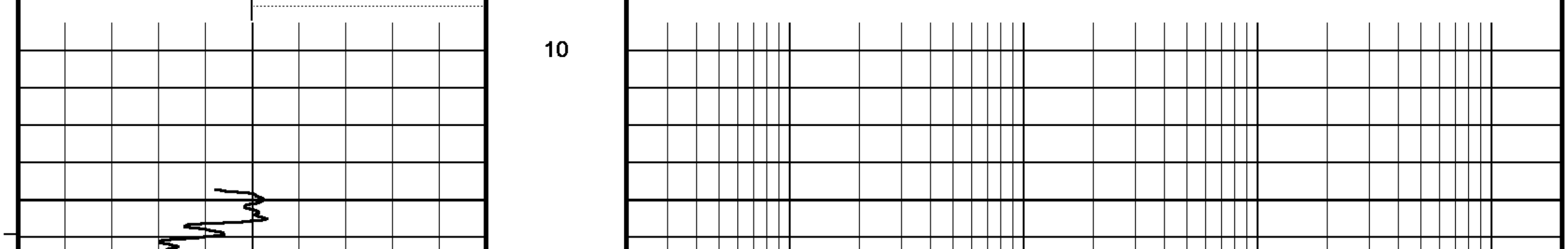
Mud Density is 9.5 lbs/USg

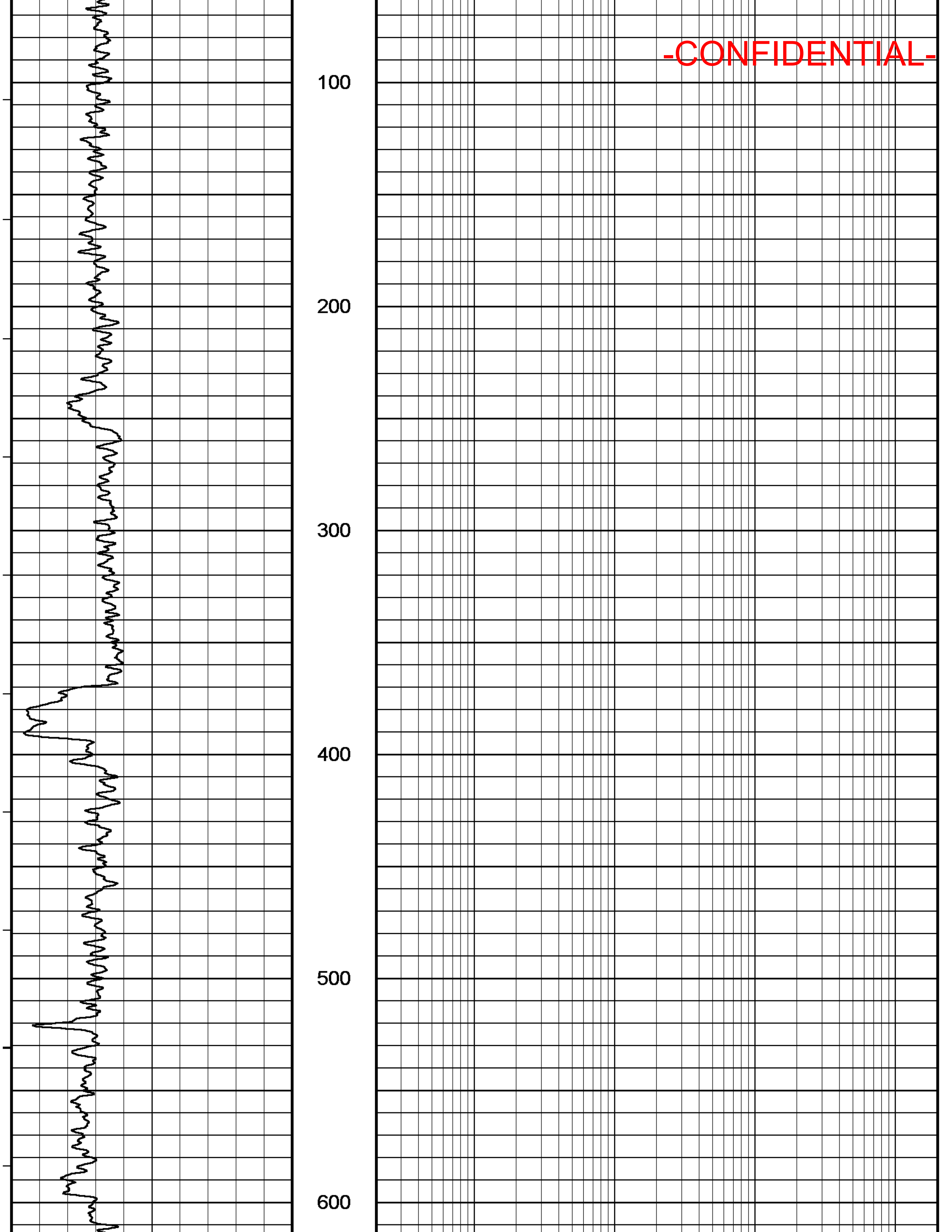
All interpretations are opinions based on inferences from electrical or other measurements and we cannot, and do not, guarantee the accuracy or correctness of any interpretations, and we shall not, except in the case of gross or wilful negligence on our part, be liable or responsible for any loss, costs, damages or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, agents or employees. These interpretations are also subject to our general terms and conditions in our price schedule.

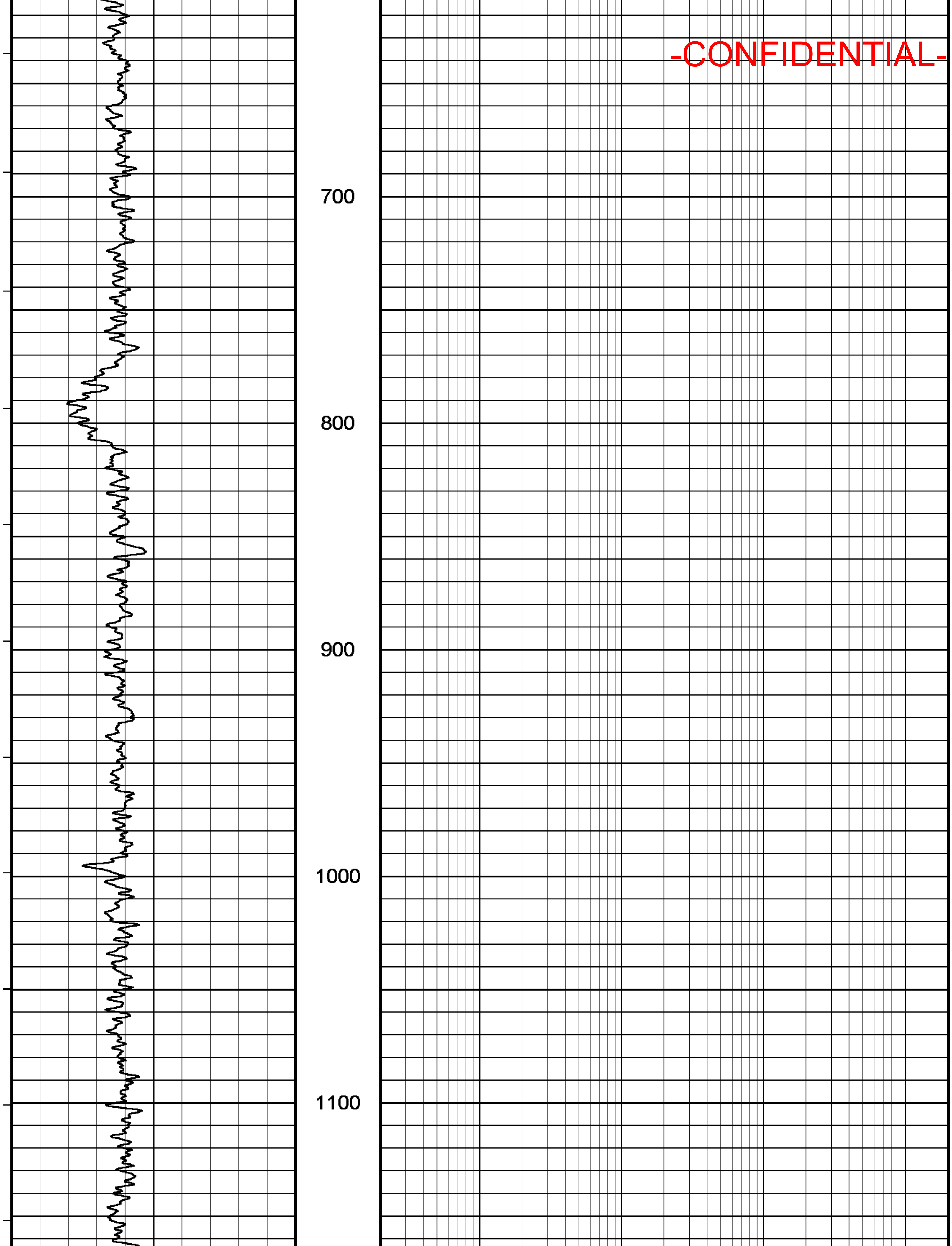
2 Inch Main Log

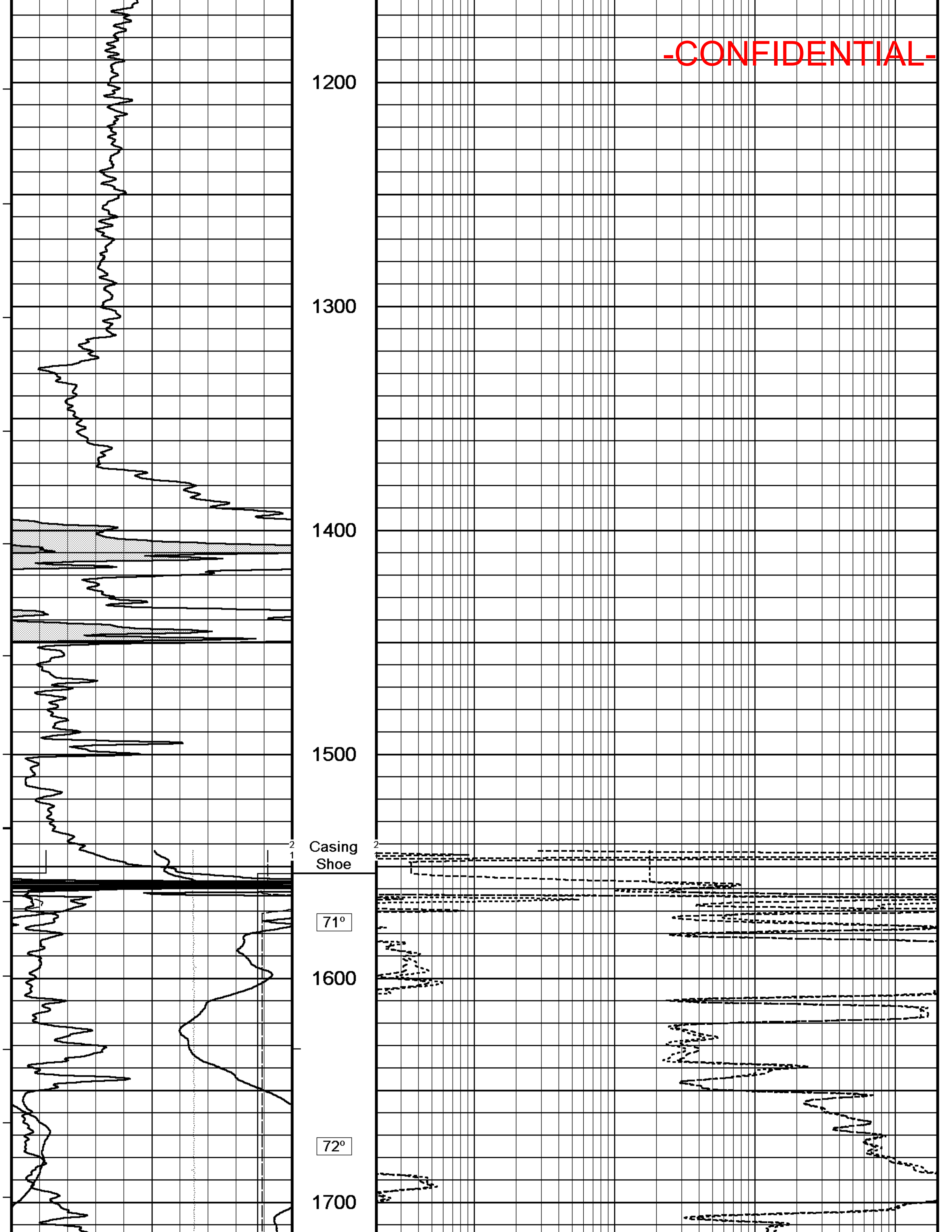
Depth Based Data - Maximum Sampling Increment 10.0cm — Plotted on 20-AUG-2013 15:38
Filename: C:\Logs\Cargill Inc\Cargill 18\...\Cargill Inc_Cargill 18_Run_5_Triple_3540548 Main Pass.dta — Recorded on 20-AUG-2013 13:39
System Versions: Logged with 13.06.9804 Plotted with 13.06.9804

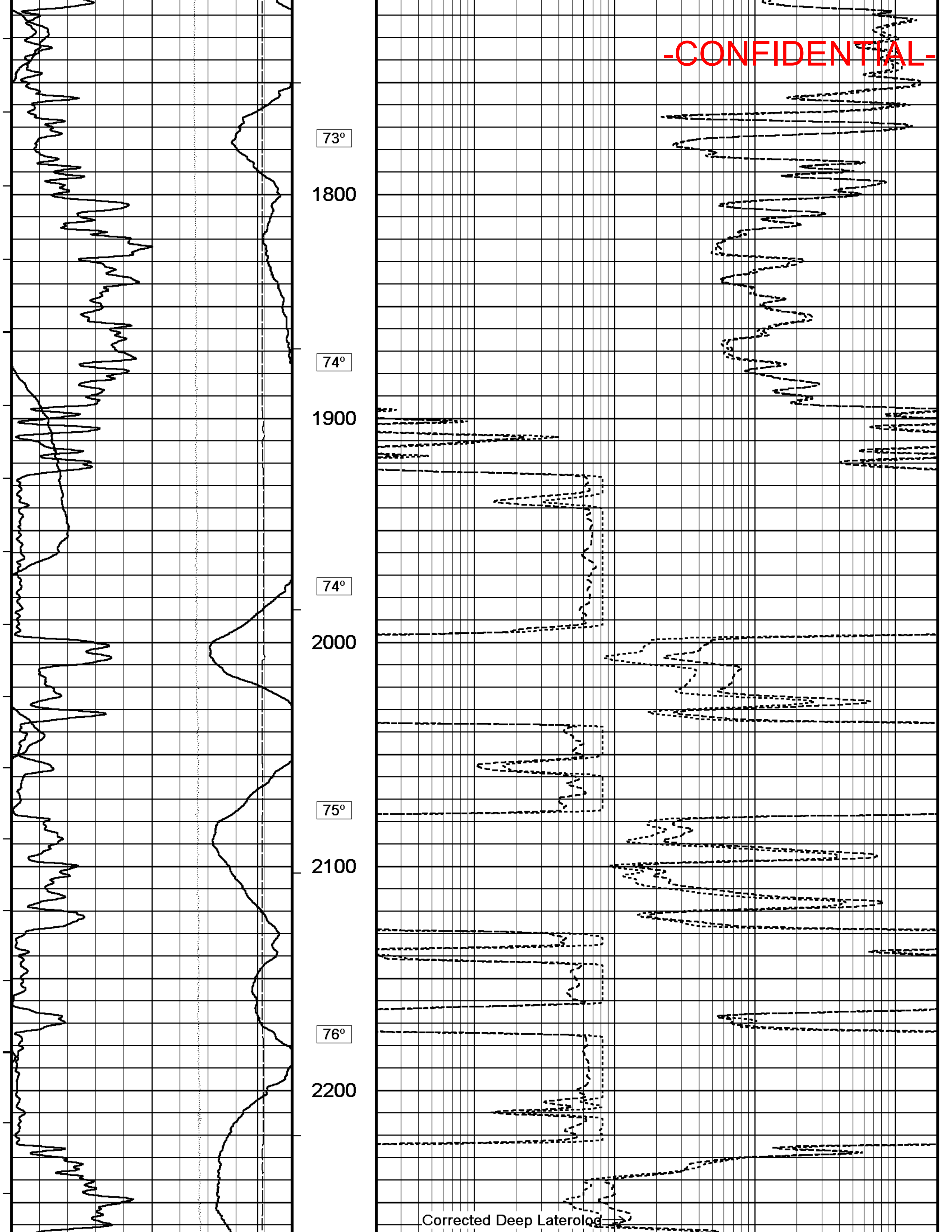
Track 1	Depth Track	Track 2/3
Timing Marks — every 60.0 sec	Depth in Feet	Corr. Shallow Laterolog — ohm metres — 0.20 to 2000 (1, 10, 100, 1000)
Density Caliper — inches — 5, 10, 15	Borehole Temp in deg F	
Borehole Corrected Gamma — API — 0, 100, 200; 200, 300, 400	HVI every 10 cu ft	
Bit Size — inches — 5, 10, 15	Annular Integral every 10 cu ft	Corrected Deep Laterolog — ohm metres — 0.20 to 2000 (1, 10, 100, 1000)
Spontaneous Potential — millivolts — − → | 15 | ← +		
DST Uphole Tension — pounds — 0, 3000; 3000, 6000	Replay Scale 1:600	

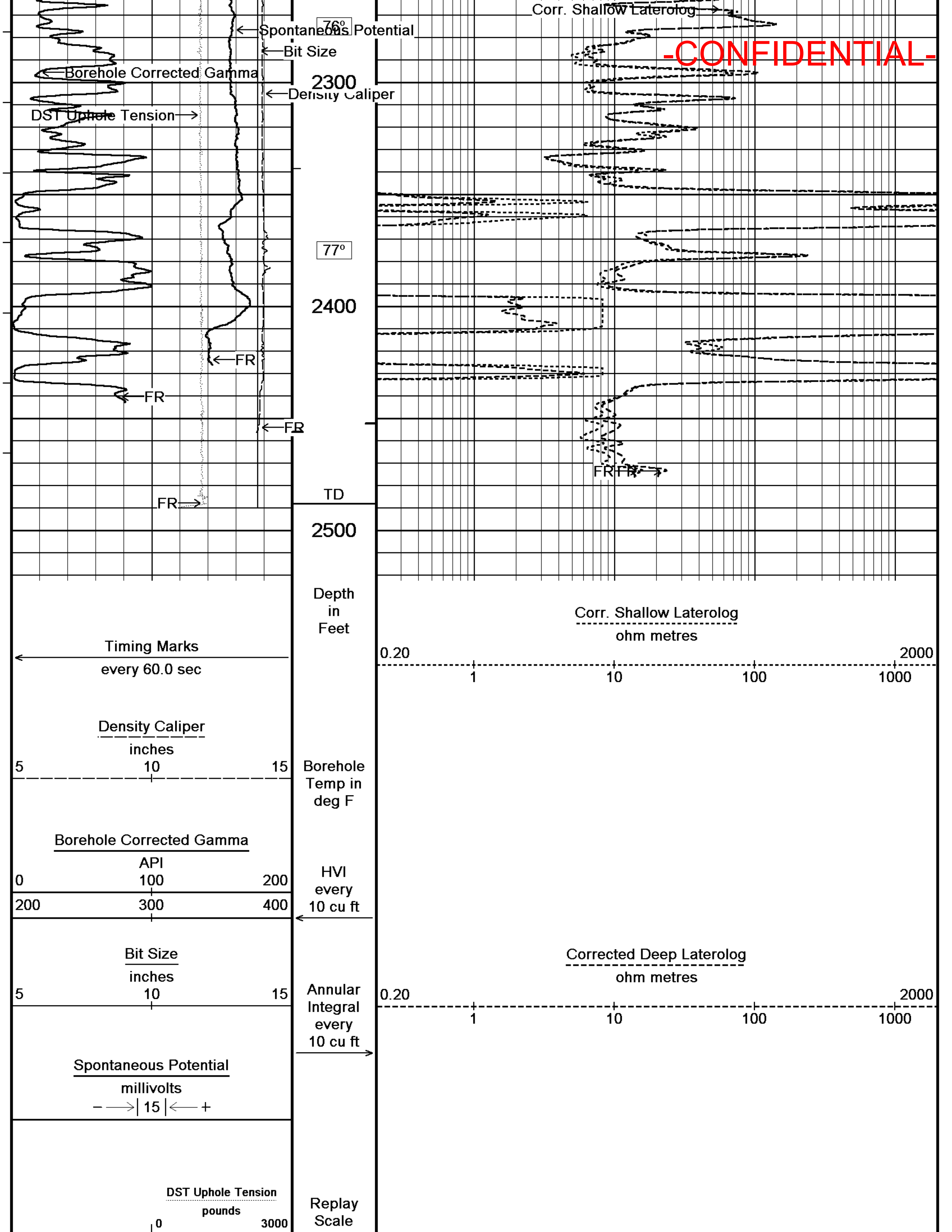



-CONFIDENTIAL-
100
200
300
400
500
600


700
800
900
1000
1100


-CONFIDENTIAL-
1200
1300
1400
1500
Casing
Shoe
71º
1600
72º
1700


73°
1800
74°
1900
74°
2000
75°
2100
76°
2200
Corrected Deep Laterolog



Corr. Shallow Laterolog
76°
Spontaneous Potential
Bit Size
-CONFIDENTIAL-
Borehole Corrected Gamma
2300
Density Caliper
DST Uphole Tension
77°
2400
FR
FR
FR
FR FR
FR
TD
2500
Depth in Feet
Timing Marks every 60.0 sec
Density Caliper inches
5 10 15
Borehole Temp in deg F
Borehole Corrected Gamma API
0 100 200
200 300 400
HVI every 10 cu ft
Bit Size inches
5 10 15
Annular Integral every 10 cu ft
Spontaneous Potential millivolts
15
DST Uphole Tension pounds
0 3000
Replay Scale
Corr. Shallow Laterolog ohm metres
0.20 2000
1 10 100 1000
Corrected Deep Laterolog ohm metres
0.20 2000
1 10 100 1000

3000 6000 1:600

Depth Based Data - Maximum Sampling Increment 10.0cm Plotted on 20-AUG-2013 15:38
Filename: C:\Logs\Cargill Inc\Cargill 18\...\Cargill Inc_Cargill 18_Run_5_Triple_3540548 Main Pass.dta Recorded on 20-AUG-2013 13:39
System Versions: Logged with 13.06.9804 Plotted with 13.06.9804

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2 Inch Main Log

5 Inch Main Log

Depth Based Data - Maximum Sampling Increment 10.0cm Plotted on 20-AUG-2013 15:38
Filename: C:\Logs\Cargill Inc\Cargill 18\...\Cargill Inc_Cargill 18_Run_5_Triple_3540548 Main Pass.dta Recorded on 20-AUG-2013 13:39
System Versions: Logged with 13.06.9804 Plotted with 13.06.9804

Timing Marks
every 60.0 sec

Density Caliper
inches
5 10 15

Borehole Corrected Gamma
API
0 100 200
200 300 400

Bit Size
inches
5 10 15

Spontaneous Potential
millivolts
– → | 15 | ← +

DST Uphole Tension
pounds
0 3000
3000 6000

Depth in Feet

Borehole Temp in deg F

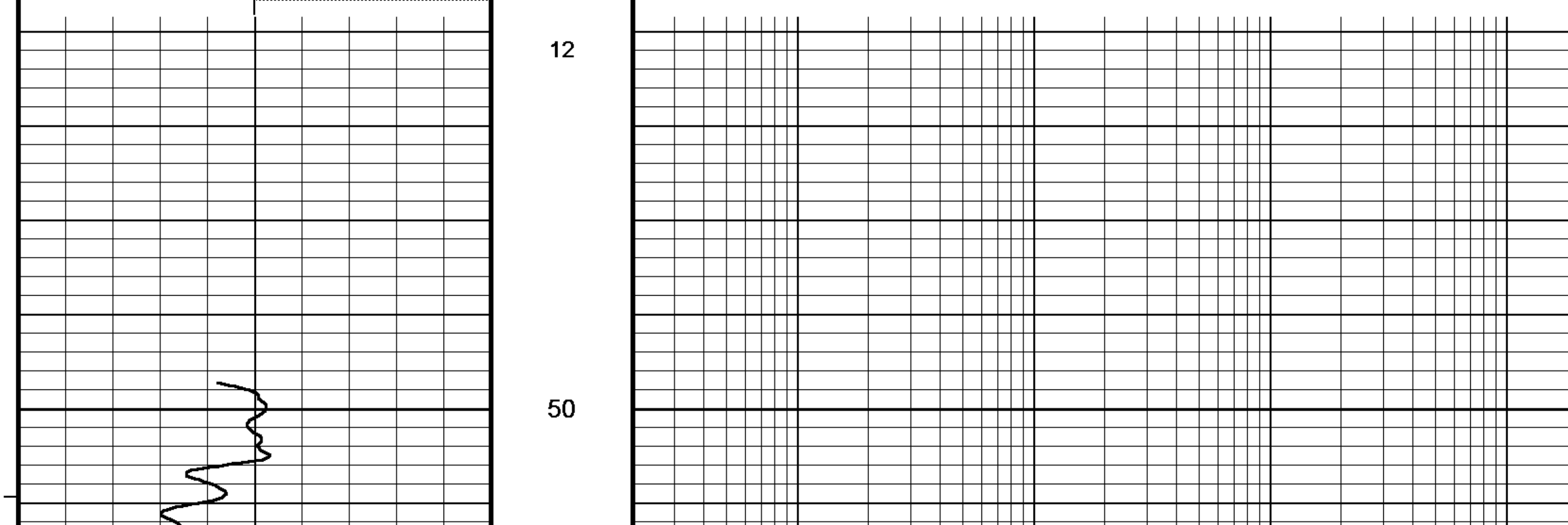
HVI every 10 cu ft

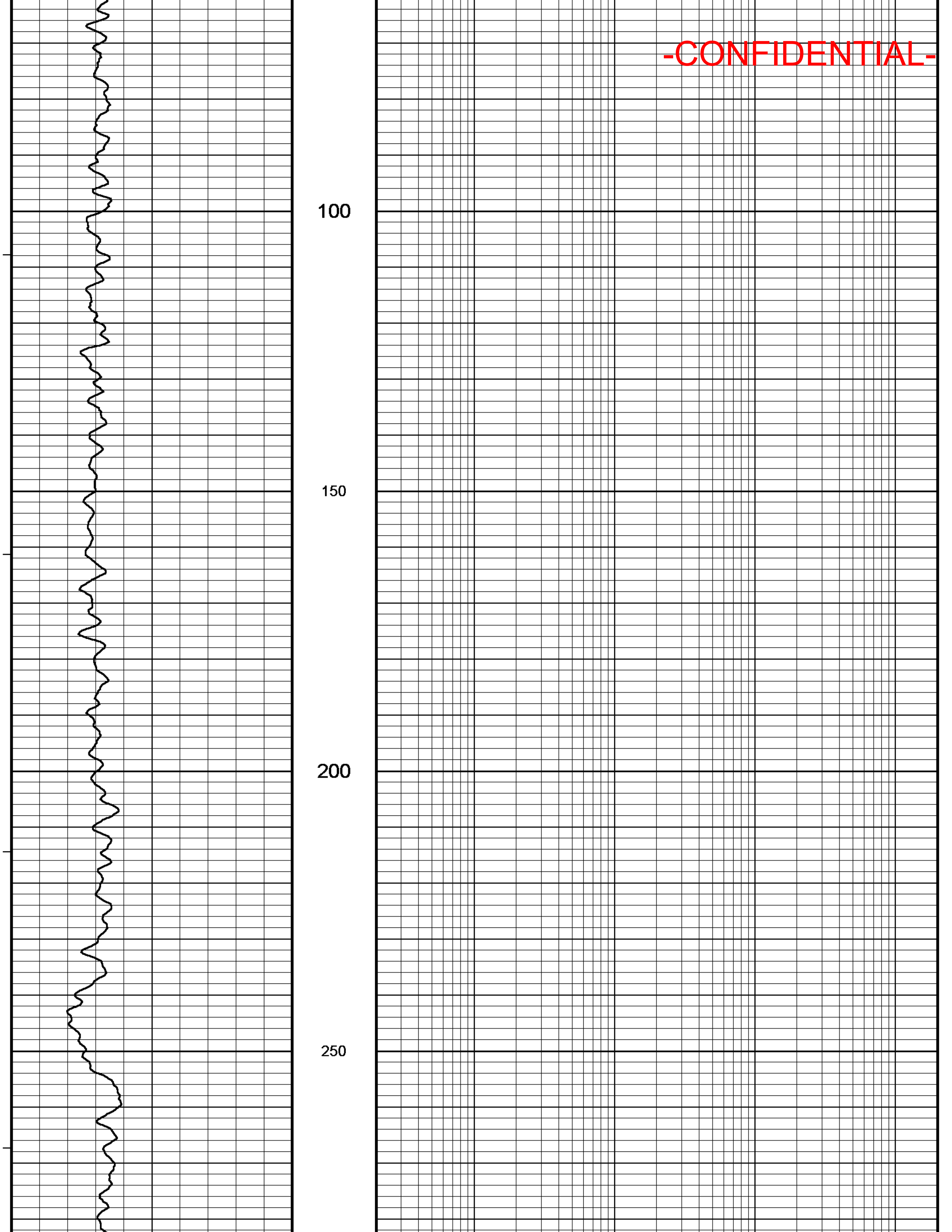
Annular Integral every 10 cu ft

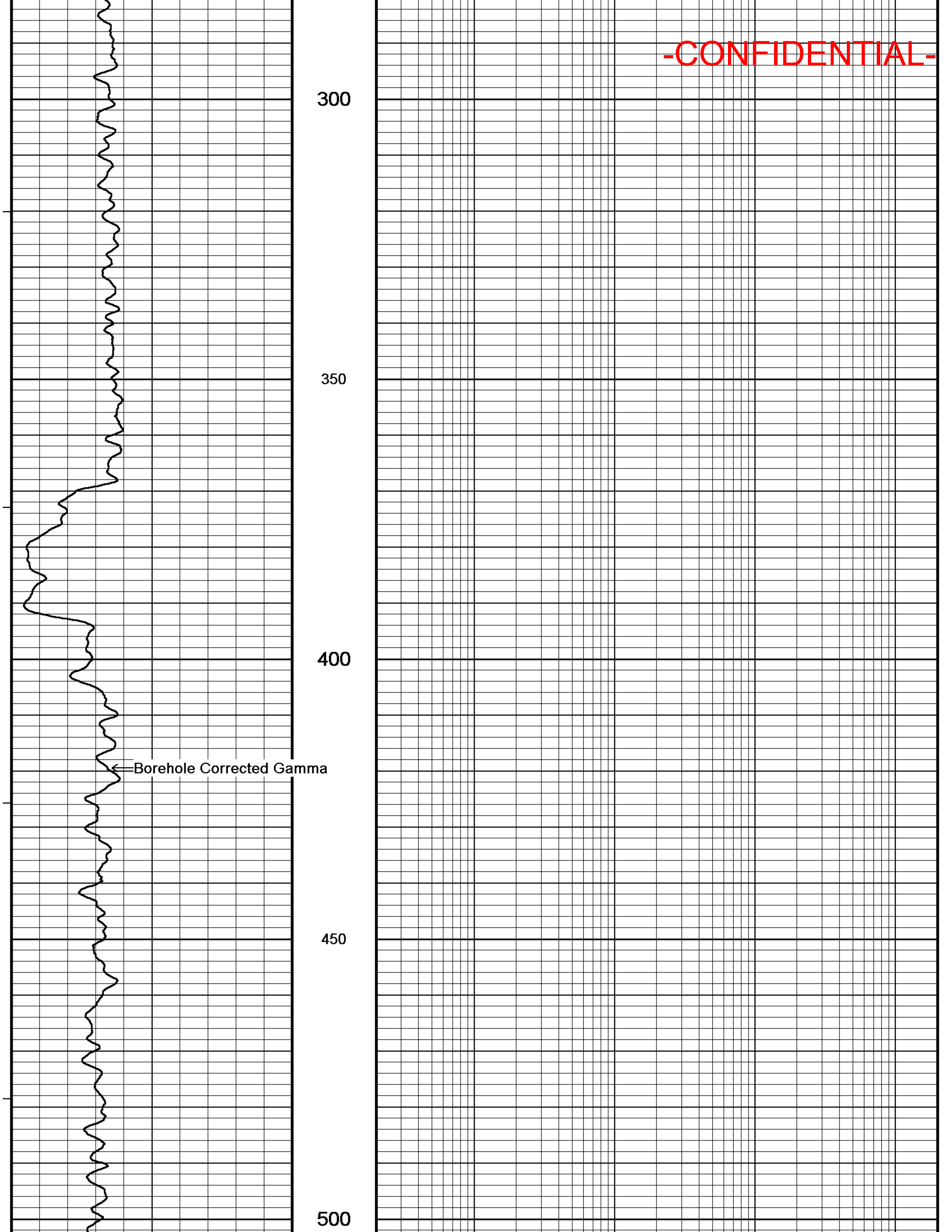
Replay Scale 1:240

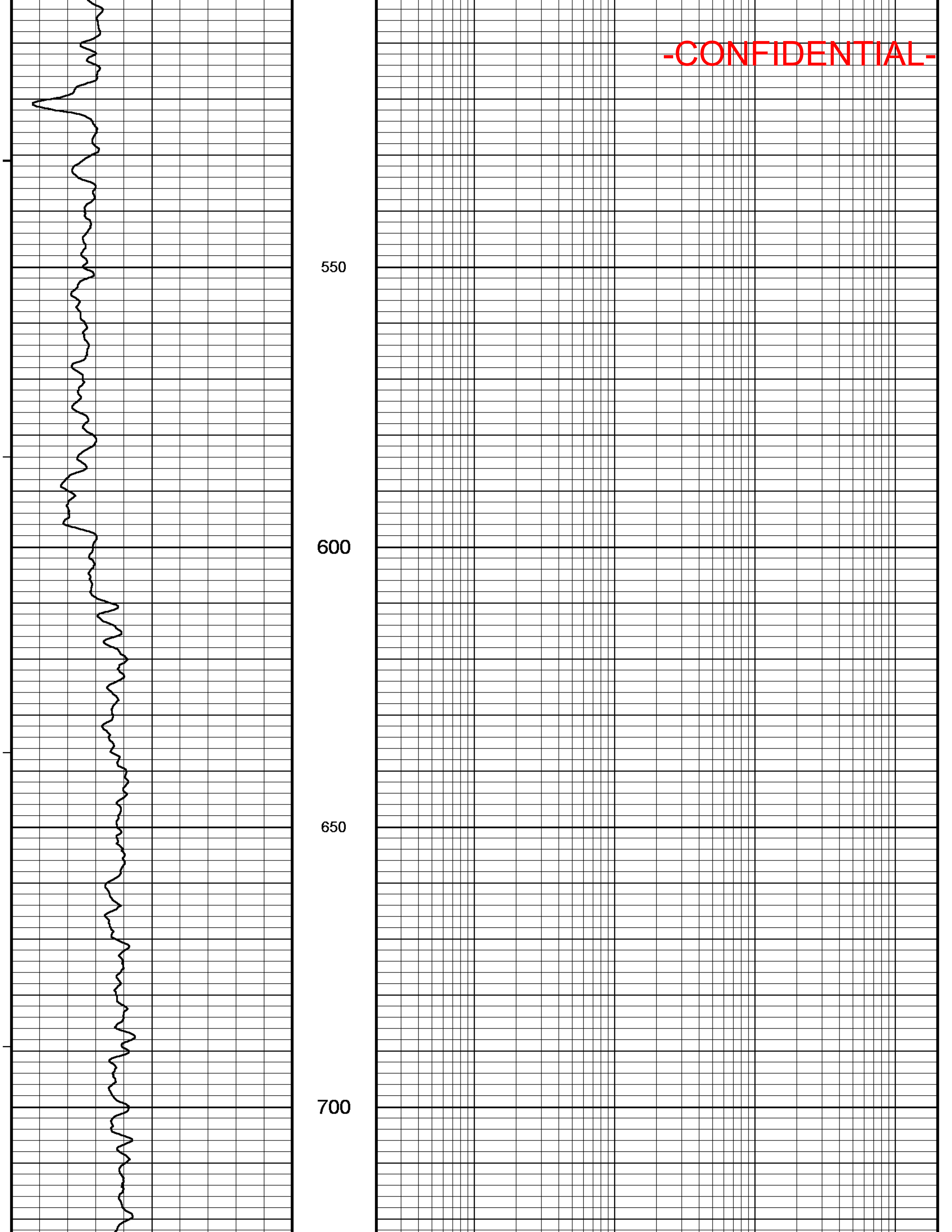
Corr. Shallow Laterolog
ohm metres
0.20 2000
1 10 100 1000

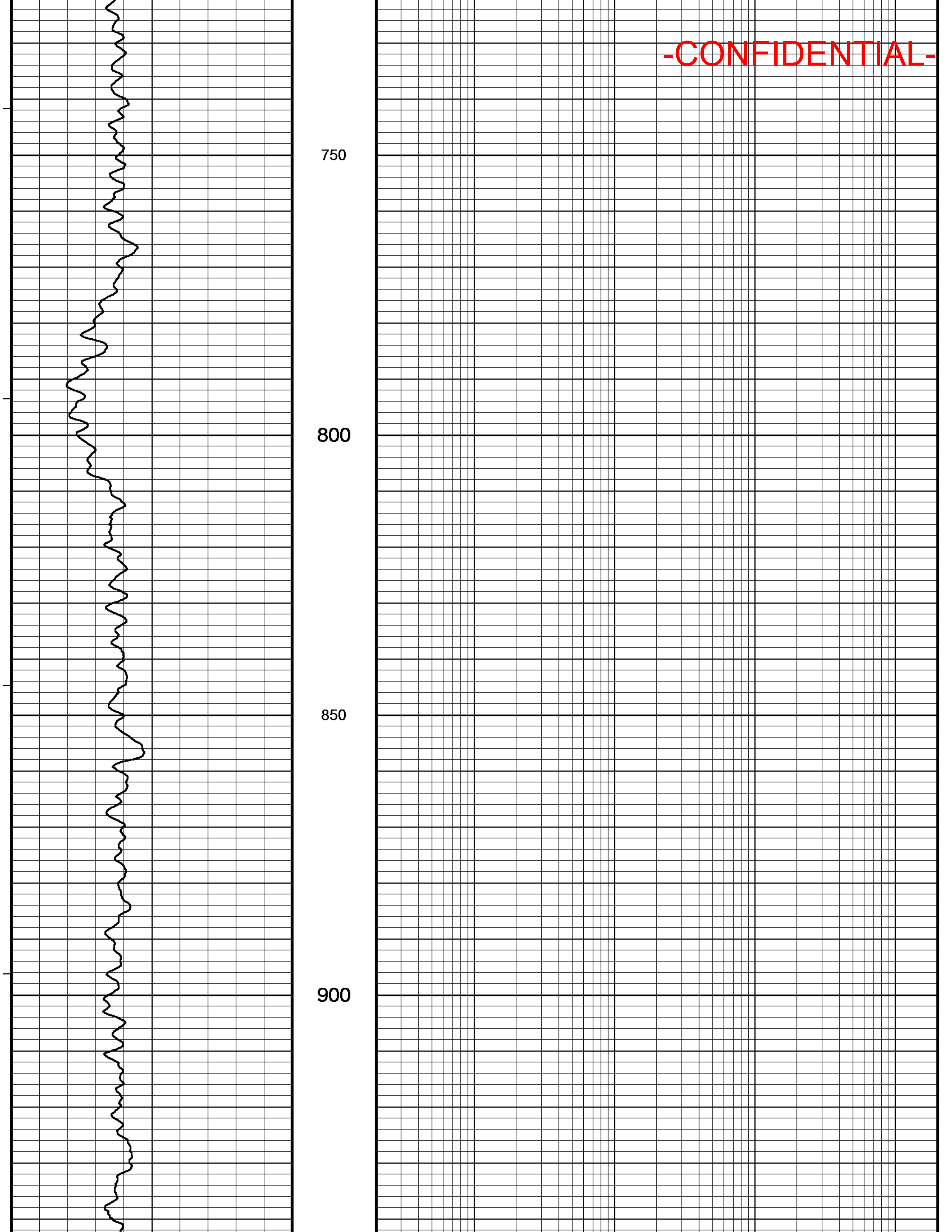
Corrected Deep Laterolog
ohm metres
0.20 2000
1 10 100 1000

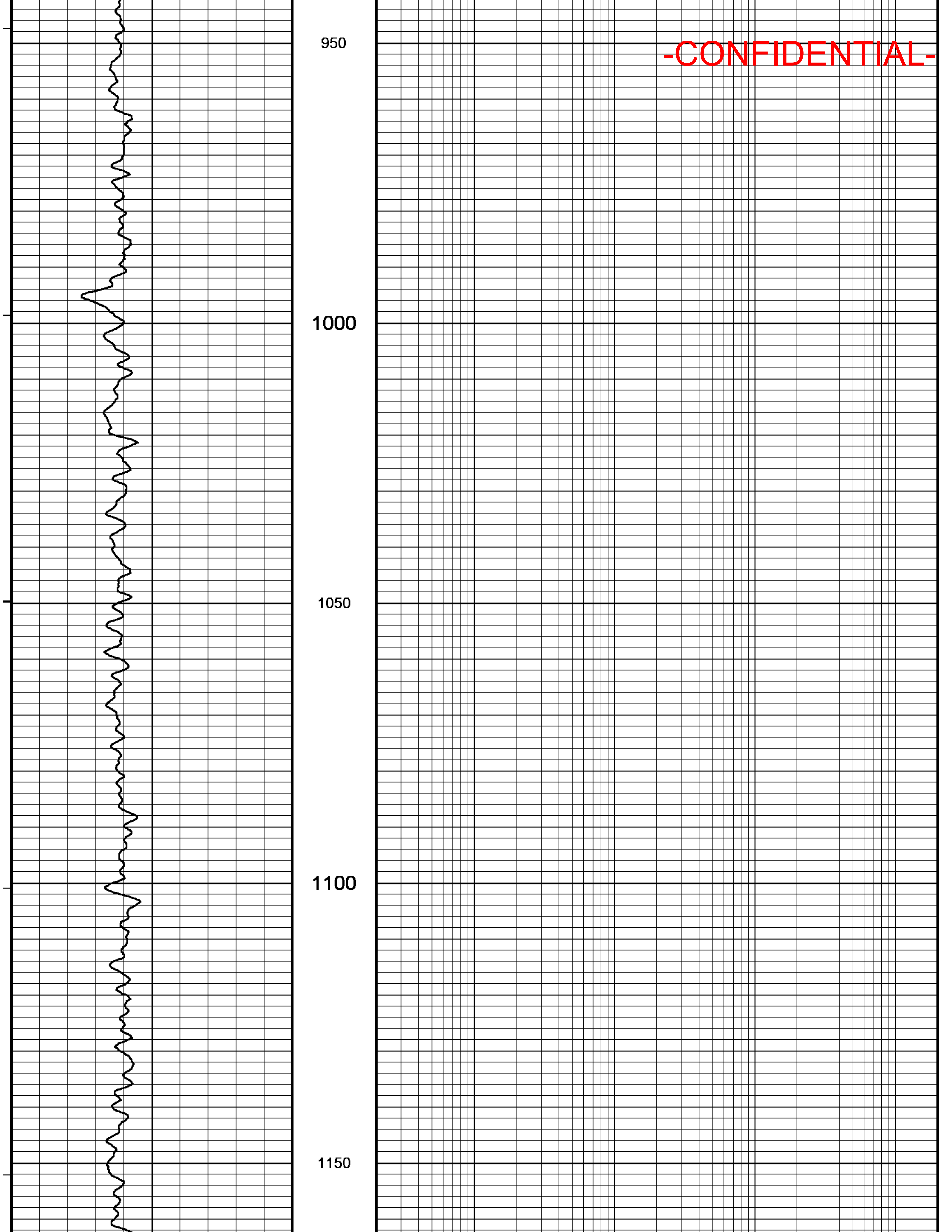


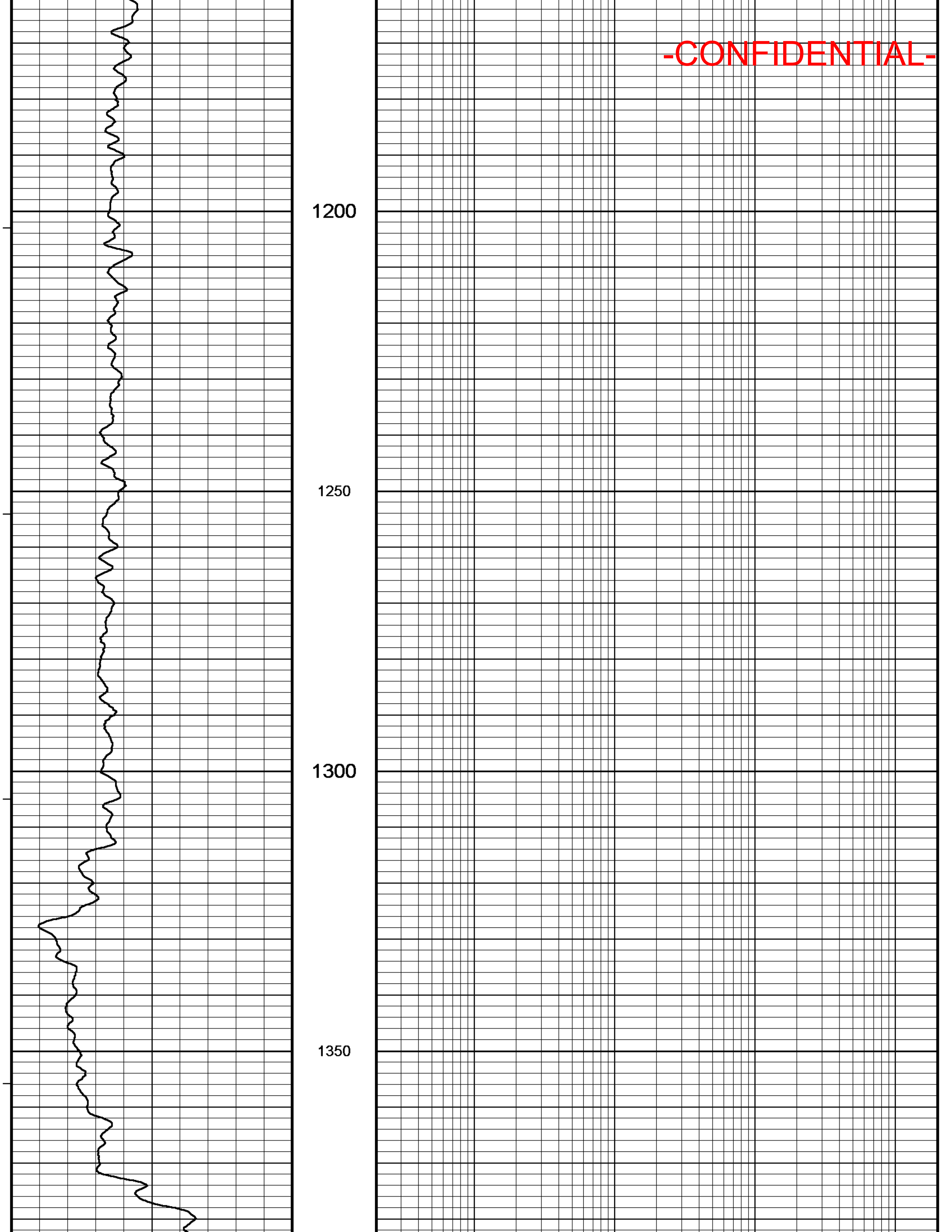

100
150
200
250


300
350
Borehole Corrected Gamma
400
450
500

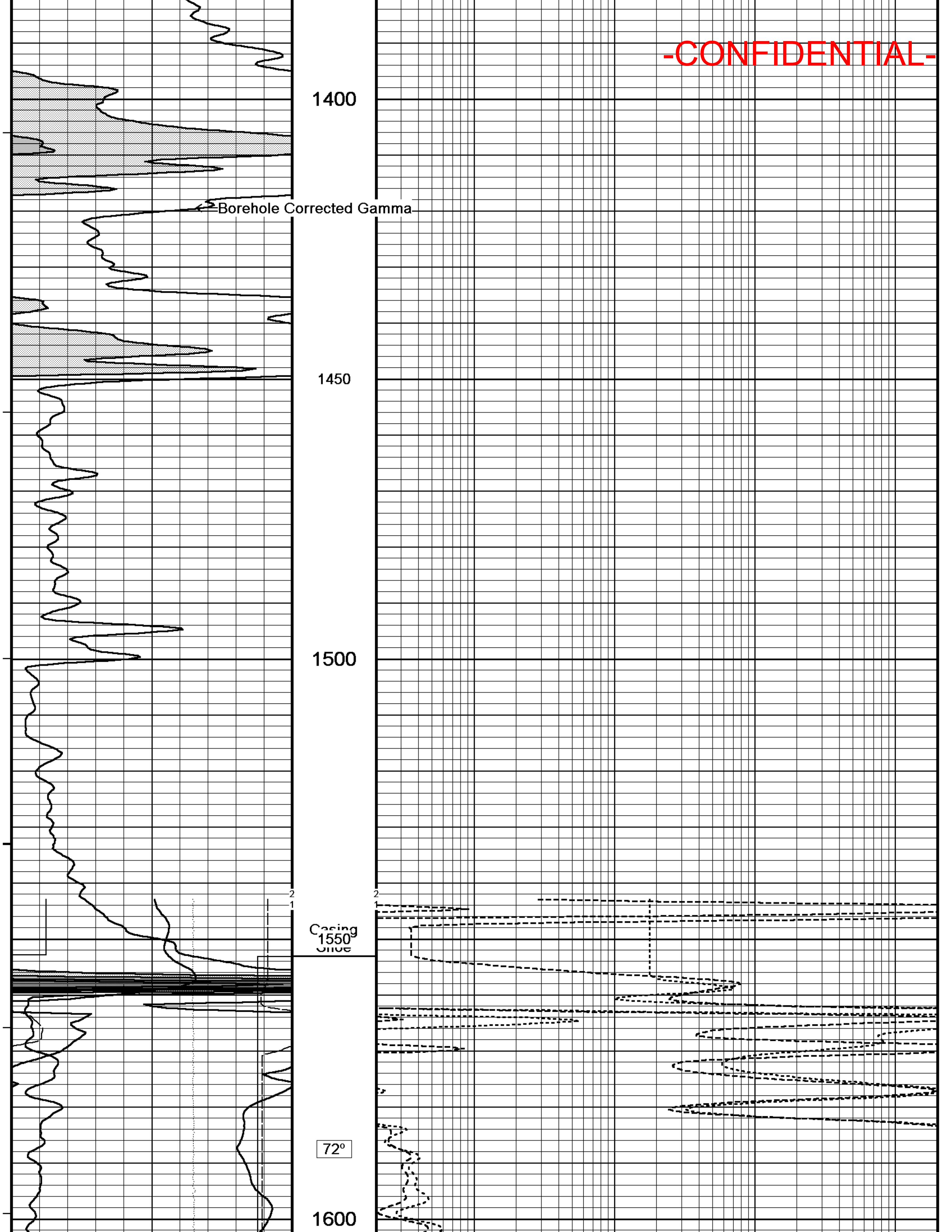

-CONFIDENTIAL-
550
600
650
700

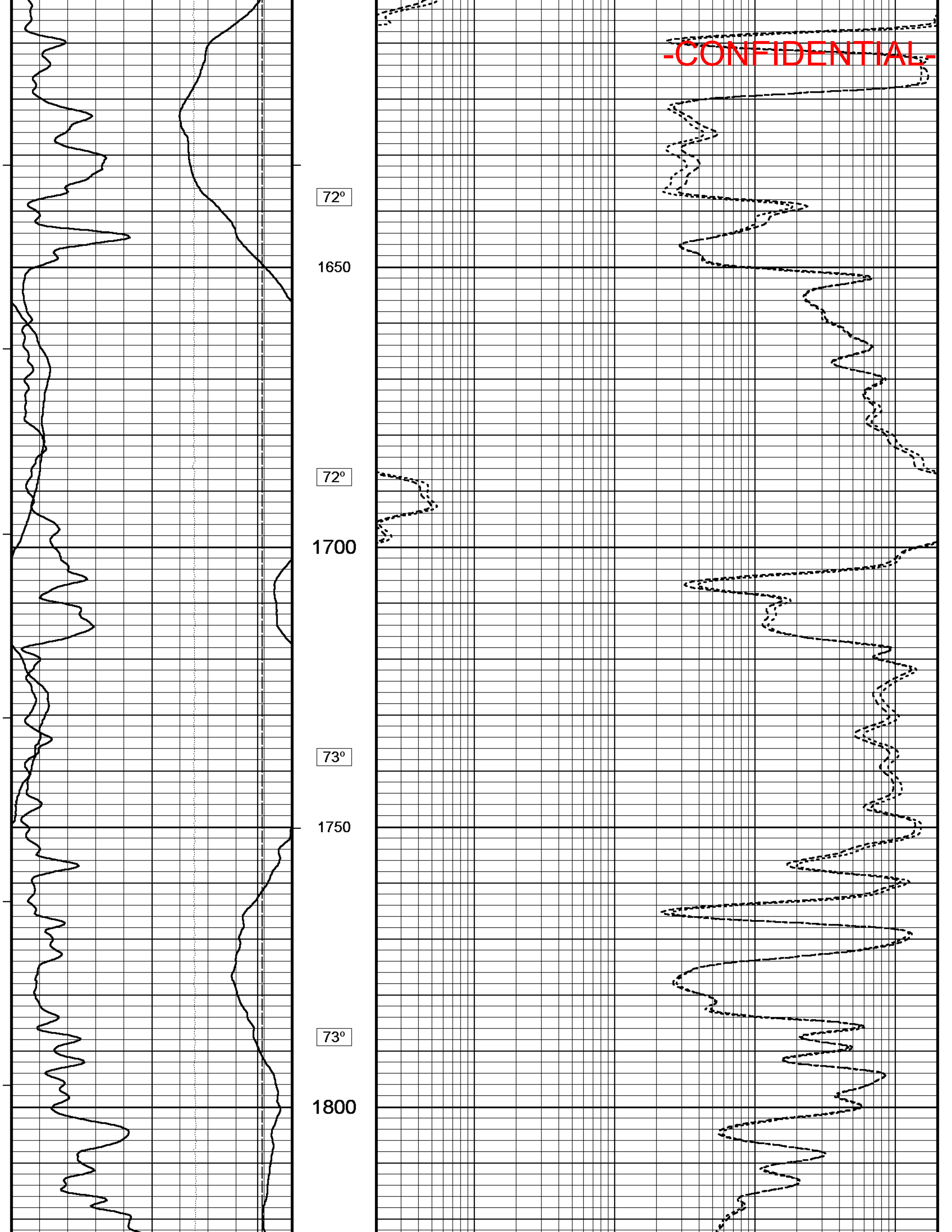

750
800
850
900

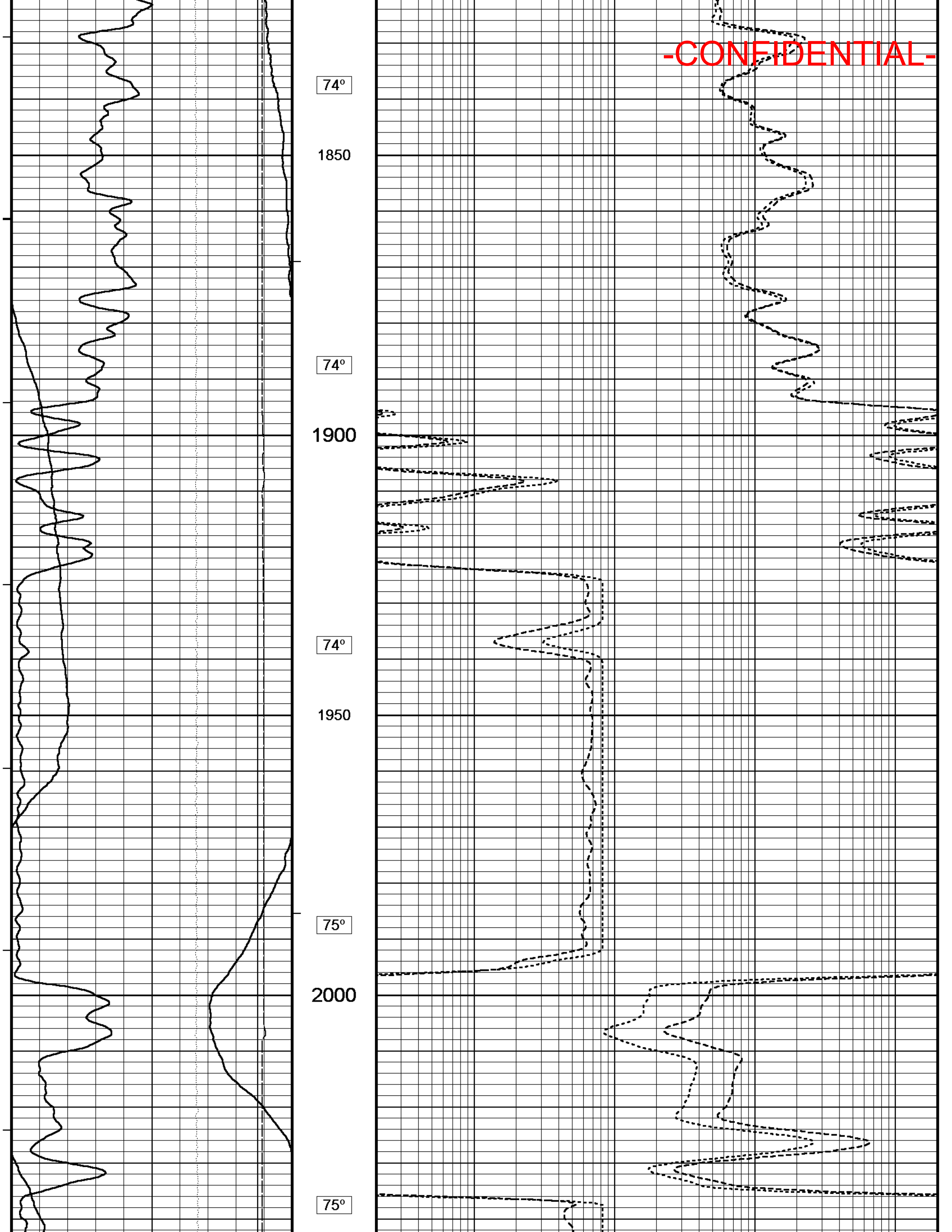

950
1000
1050
1100
1150

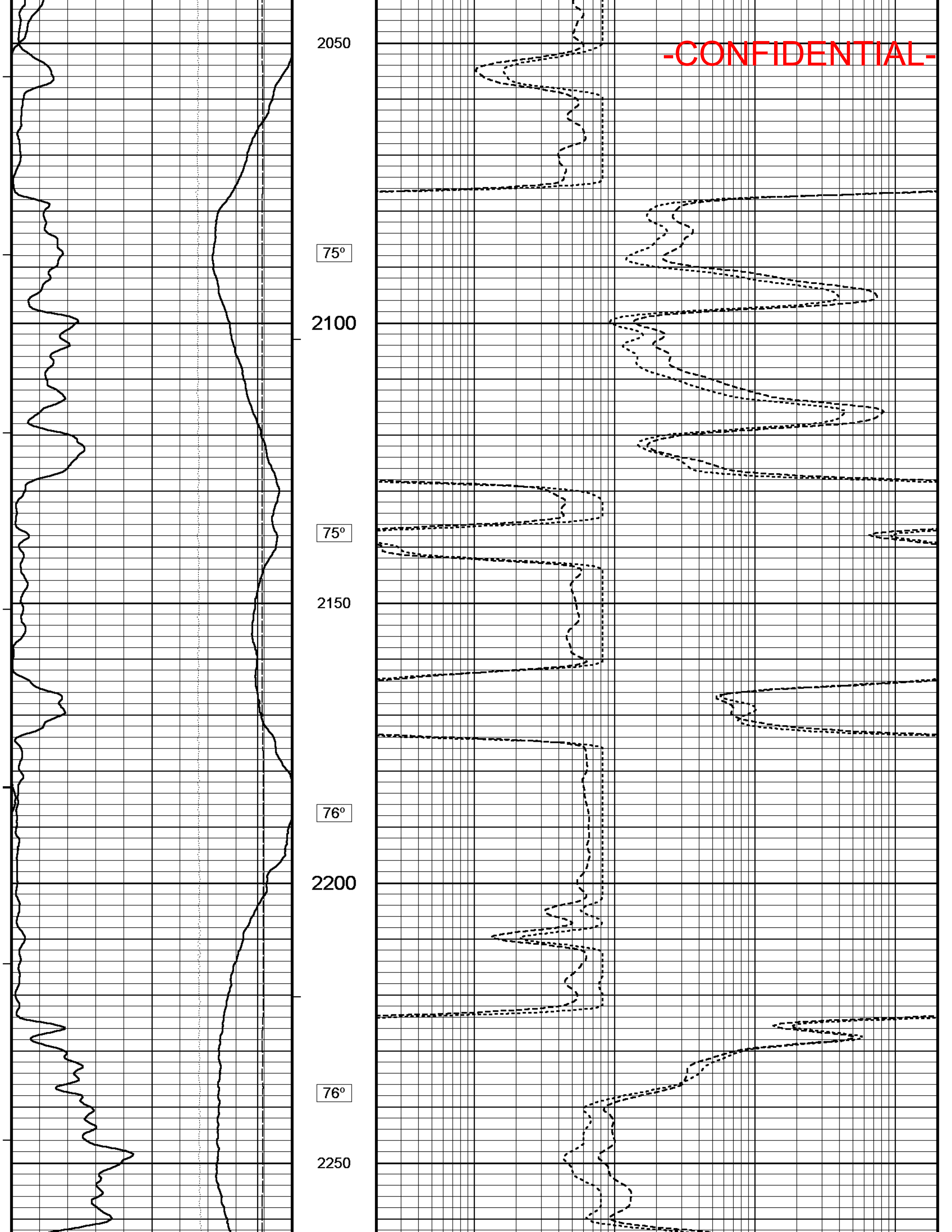

-CONFIDENTIAL-
1200
1250
1300
1350

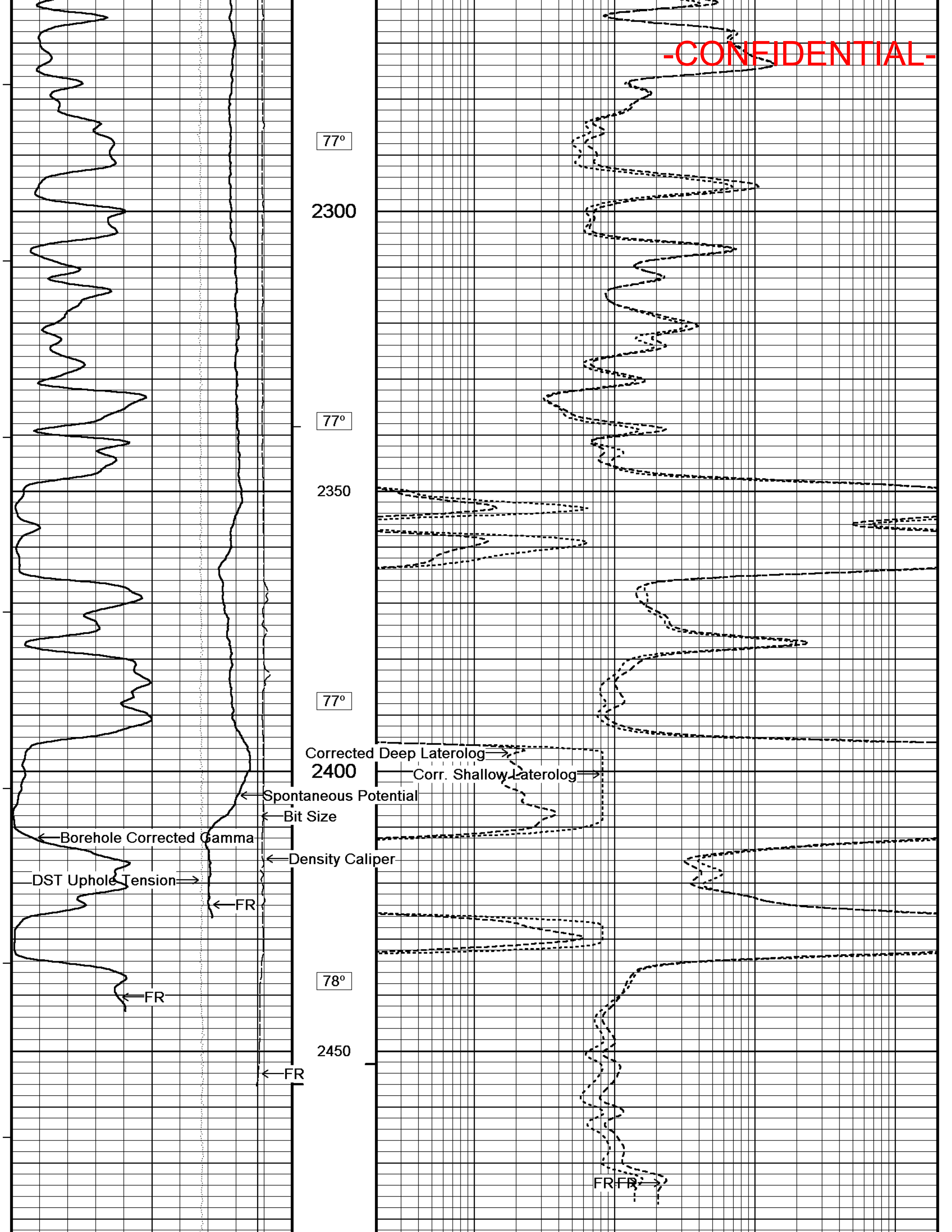
-CONFIDENTIAL-




-CONFIDENTIAL-
72º
1650
72º
1700
73º
1750
73º
1800


-CONFIDENTIAL-
74°
1850
74°
1900
74°
1950
75°
2000
75°


-CONFIDENTIAL-
2050
75º
2100
75º
2150
76º
2200
76º
2250


-CONFIDENTIAL-
77º
2300
77º
2350
77º
Corrected Deep Laterolog
2400
Corr. Shallow Laterolog
Spontaneous Potential
Bit Size
Borehole Corrected Gamma
Density Caliper
DST Uphole Tension
FR
78º
FR
2450
FR
FR FR

FR

TD

-CONFIDENTIAL-

2500

Depth in Feet

Corr. Shallow Laterolog
ohm metres
0.20 2000
1 10 100 1000

Timing Marks
every 60.0 sec

Density Caliper
inches
5 10 15

Borehole Temp in deg F

Borehole Corrected Gamma
API
0 100 200
200 300 400

HVI every 10 cu ft

Bit Size
inches
5 10 15

Corrected Deep Laterolog
ohm metres
0.20 2000
1 10 100 1000

Annular Integral every 10 cu ft

Spontaneous Potential
millivolts
– | 15 | +

DST Uphole Tension
pounds
0 3000
3000 6000

Replay Scale 1:240

Depth Based Data - Maximum Sampling Increment 10.0cm
Filename: C:\Logs\Cargill Inc\Cargill 18\...\Cargill Inc_Cargill 18_Run_5_Triple_3540548 Main Pass.dta
System Versions: Logged with 13.06.9804 Plotted with 13.06.9804

Plotted on 20-AUG-2013 15:38
Recorded on 20-AUG-2013 13:39

5 Inch Main Log

5 Inch Repeat Section

Depth Based Data - Maximum Sampling Increment 10.0cm
Filename: C:\Logs\Cargill Inc\Cargill 1...\Cargill Inc_Cargill 18_Run_5_Triple_3540548 Repeat Pass.dta
System Versions: Logged with 13.06.9804 Plotted with 13.06.9804

Plotted on 20-AUG-2013 15:38
Recorded on 20-AUG-2013 12:52

Depth in Feet

Corr. Shallow Laterolog
ohm metres
0.20 2000
1 10 100 1000

Timing Marks
every 60.0 sec

Density Caliper
inches
5 10 15

Borehole Temp in

deg F

-CONFIDENTIAL-

Borehole Corrected Gamma

API

0 100 200

200 300 400

HVI every 10 cu ft

Bit Size

inches

5 10 15

Corrected Deep Laterolog

ohm metres

0.20 2000

1 10 100 1000

Annular Integral every 10 cu ft

Spontaneous Potential

millivolts

– | 15 | +

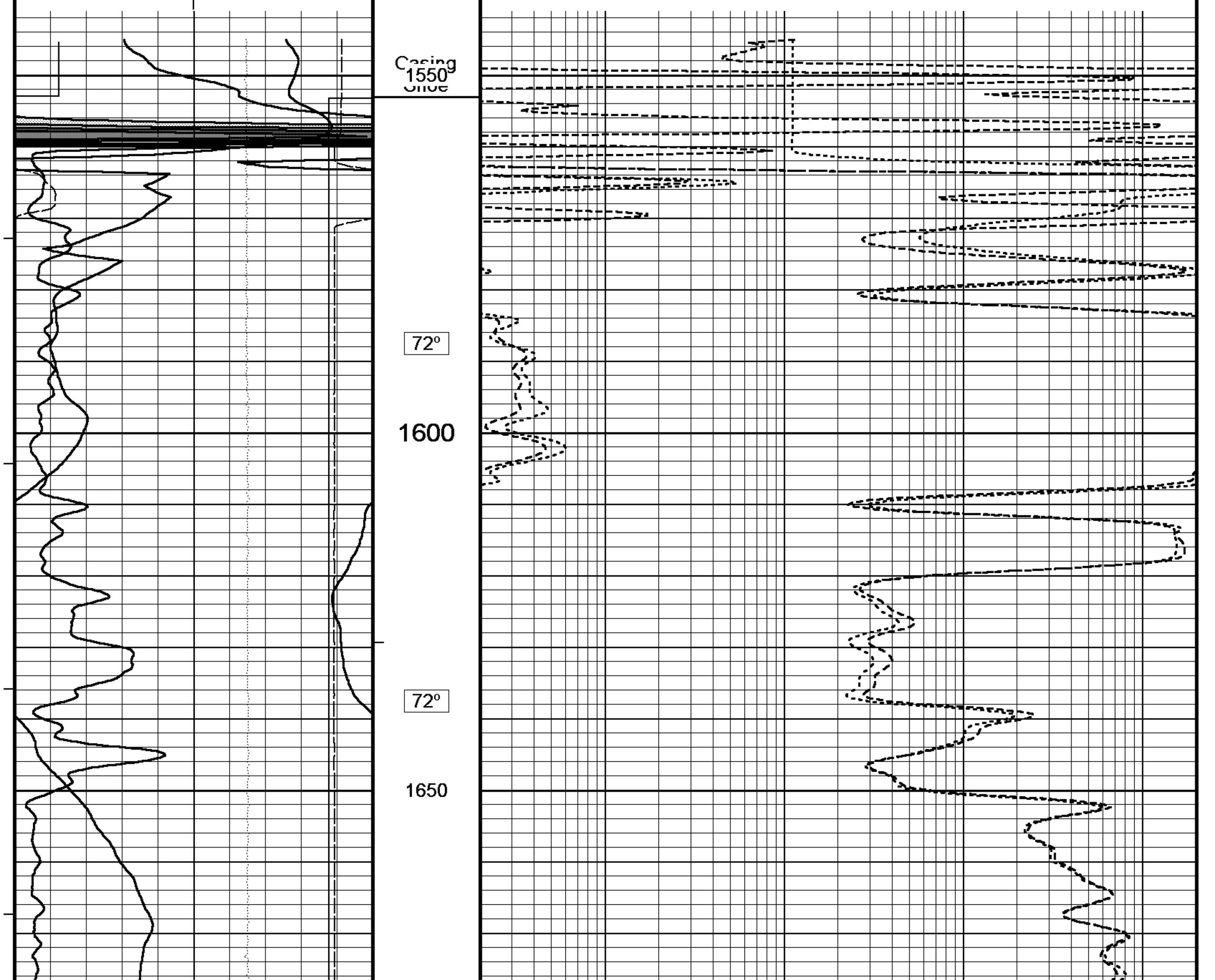
DST Uphole Tension

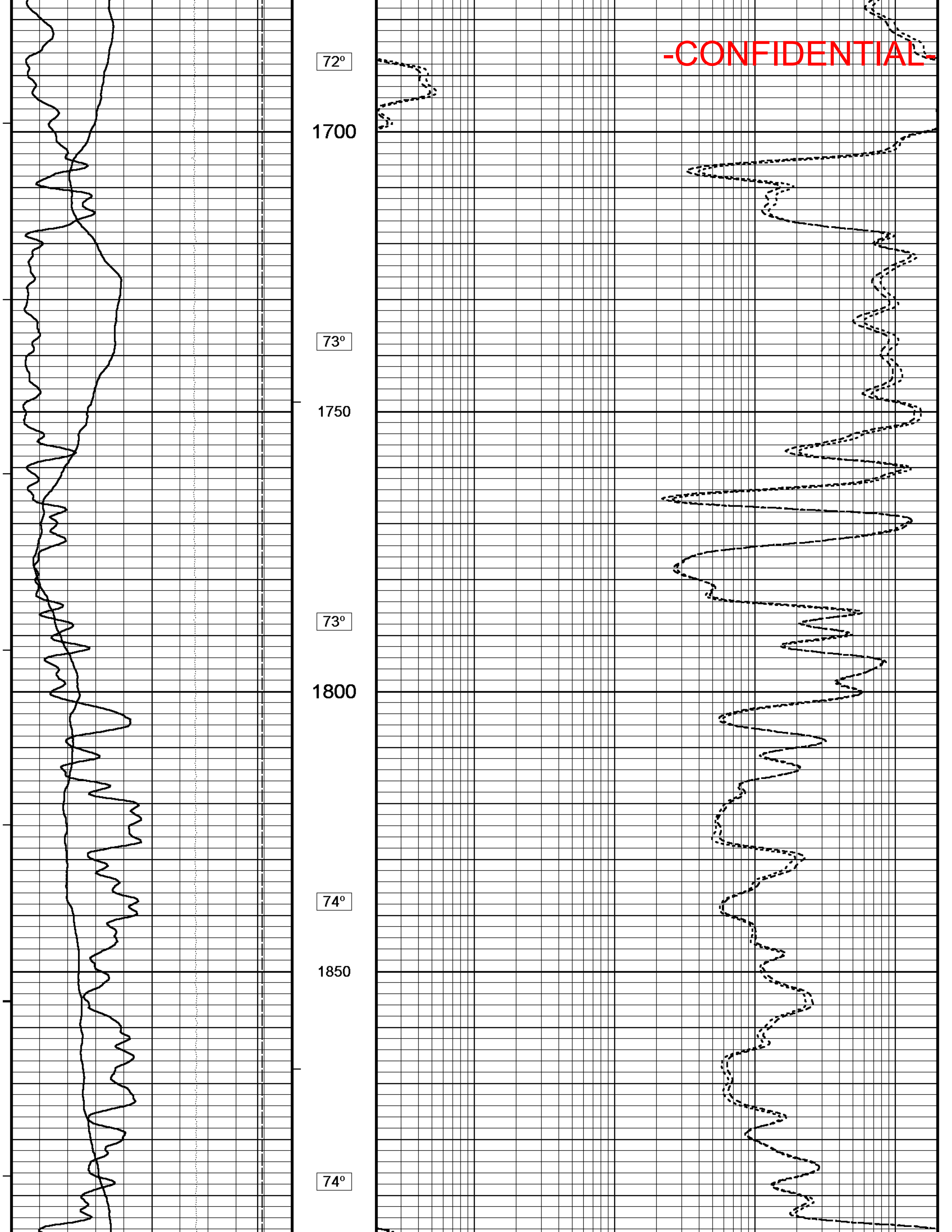
pounds

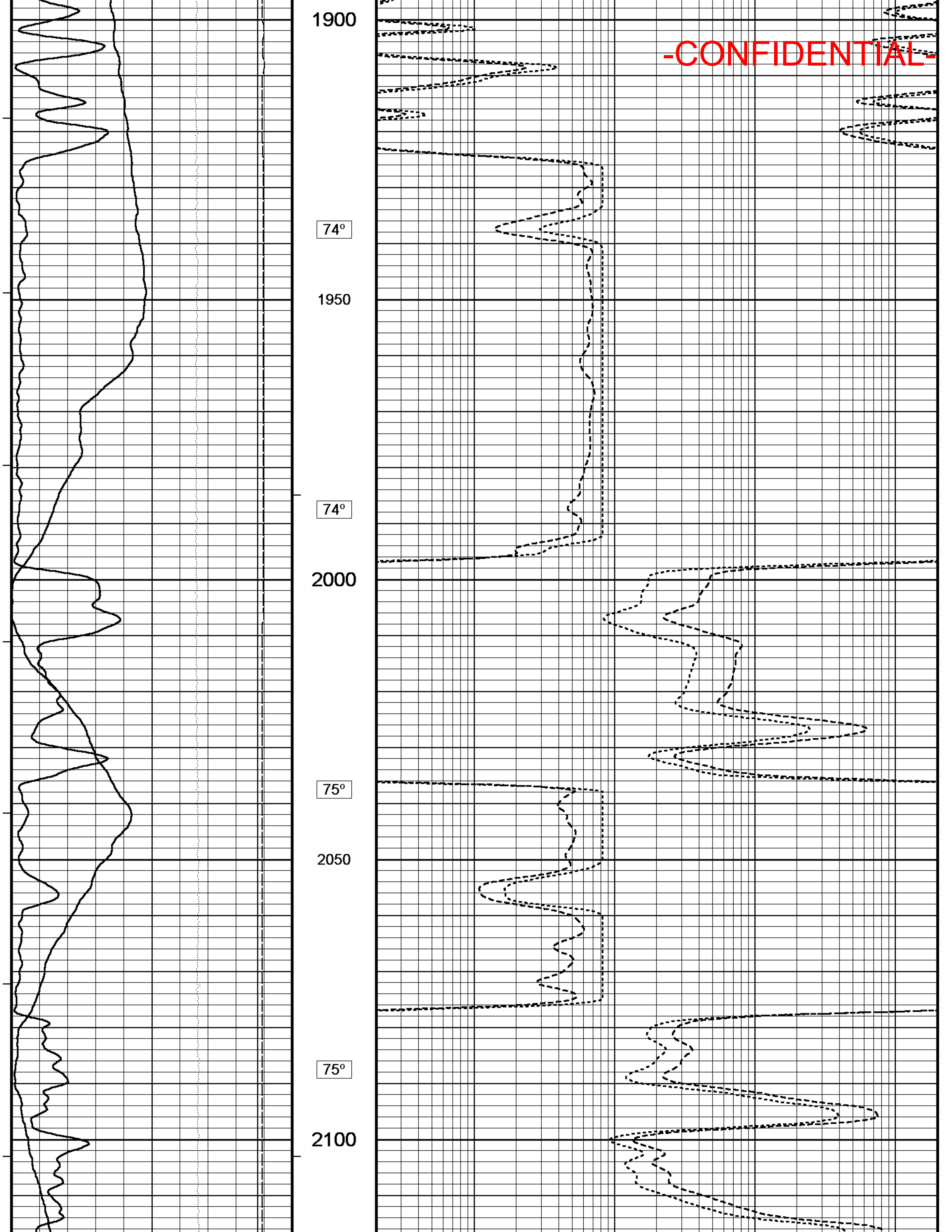
0 3000

3000 6000

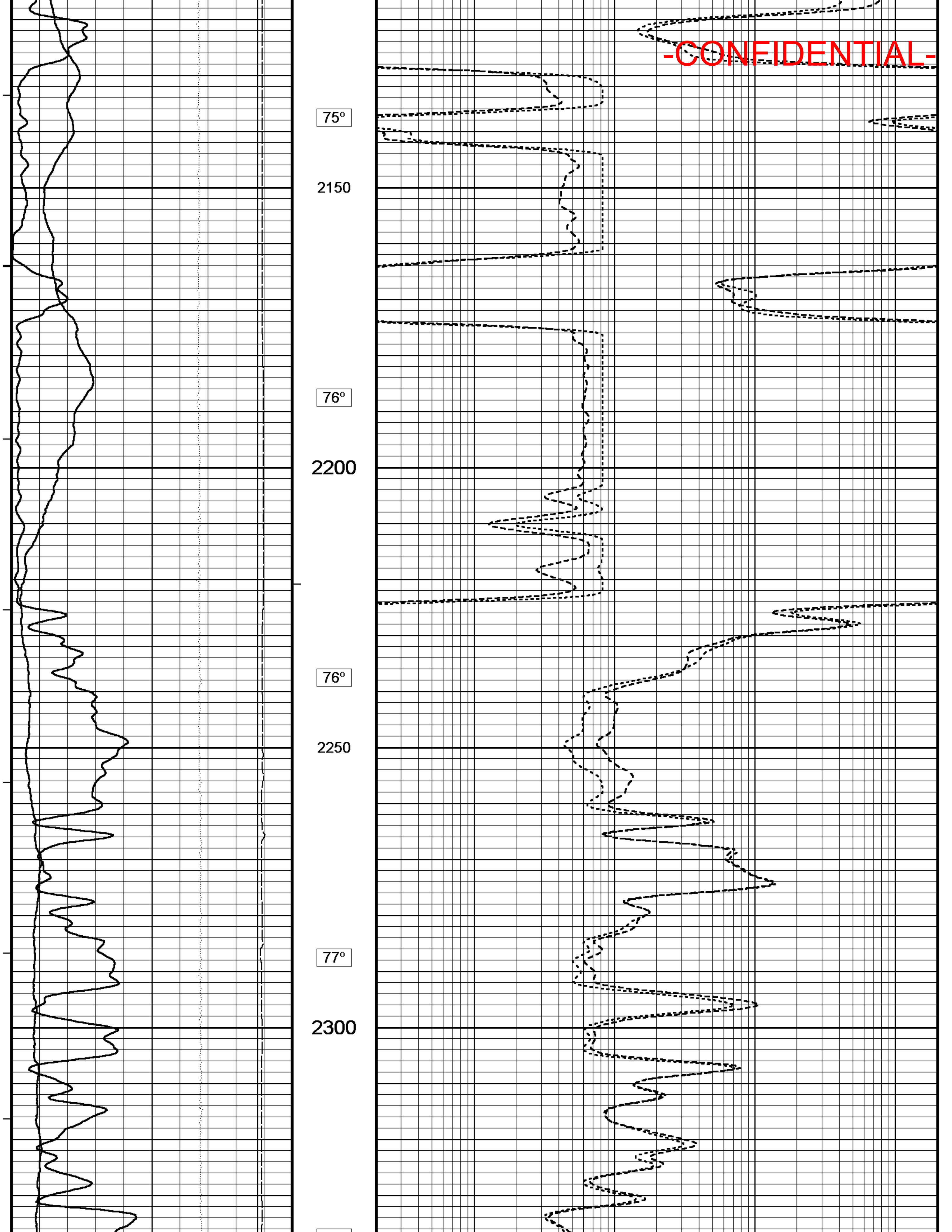
Replay Scale 1:240

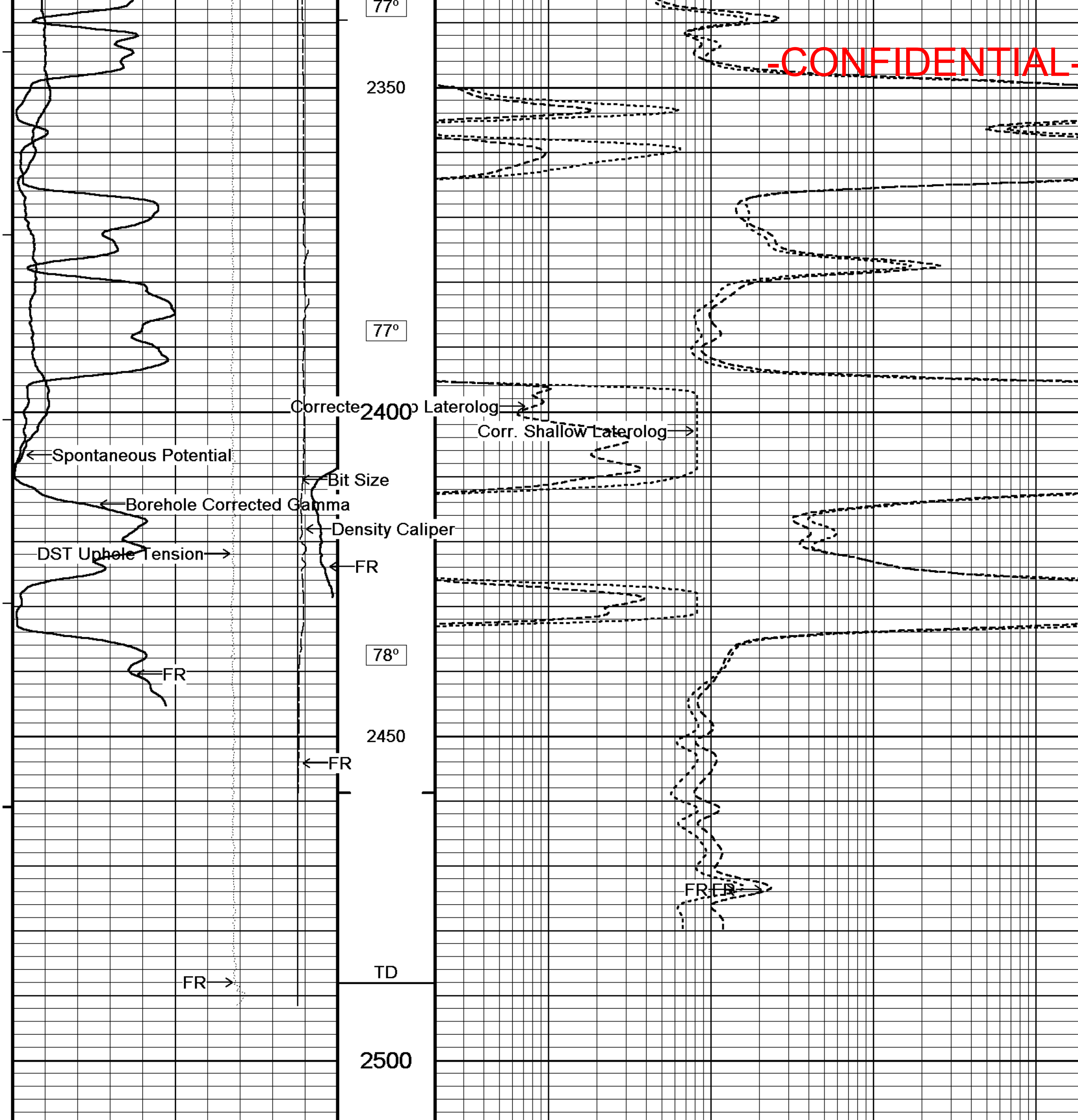



-CONFIDENTIAL-
72°
1700
73°
1750
73°
1800
74°
1850
74°



1900
-CONFIDENTIAL-
74°
1950
74°
2000
75°
2050
75°
2100


-CONFIDENTIAL-
75º
2150
76º
2200
76º
2250
77º
2300



Depth in Feet

Corr. Shallow Laterolog
ohm metres
0.20 2000
1 10 100 1000

Timing Marks
every 60.0 sec

Density Caliper
inches
5 10 15

Borehole Temp in deg F

Borehole Corrected Gamma

Borehole Corrected Gamma API 0 100 200 200 300 400	HVI every 10 cu ft	-CONFIDENTIAL-
Bit Size inches 5 10 15	Annular Integral every 10 cu ft	Corrected Deep Laterolog ohm metres 0.20 2000 1 10 100 1000
Spontaneous Potential millivolts – —>| 15 |<— +		
DST Uphole Tension pounds 0 3000 3000 6000	Replay Scale 1:240	

Depth Based Data - Maximum Sampling Increment 10.0cm — Plotted on 20-AUG-2013 15:38

Filename: C:\Logs\Cargill Inc\Cargill 1...\Cargill Inc_Cargill 18_Run_5_Triple_3540548 Repeat Pass.dta — Recorded on 20-AUG-2013 12:52

System Versions: Logged with 13.06.9804 Plotted with 13.06.9804

5 Inch Repeat Section

BEFORE SURVEY CALIBRATION

C:\Logs\Cargill Inc\Cargill 18\Run_5_Triple\3540548\Cargill Inc_Cargill 18_Run_5_Triple_3540548 Main Pass.dta

General Constants All 000

Last Edited on 20-AUG-2013,12:07

General Parameters		
Mud Resistivity	0.049	ohm-metres
Mud Resistivity Temperature	78.000	degrees F
Water Level	0.000	feet
Borehole Fluid Processing	Wet Hole	
Hole/Annular Volume and Differential Caliper Parameters		
HVOL Method	Single Caliper	
HVOL Caliper 1	Density Caliper	
HVOL Caliper 2	N/A	
Annular Volume Diameter	3.750	inches
Caliper for Differential Caliper	Density Caliper	
Rwa Parameters		
Porosity used	Base Density Porosity	
Resistivity used	Deep Laterolog	
RWA Constant A	0.610	
RWA Constant M	2.150	
SW/APOR Tool Source	0.000	

Gamma Calibration MCG-B 60

Field Calibration on 08-AUG-2013 13:15

	Measured	Calibrated (API)
Background	52	36
Calibrator (Gross)	2285	1575
Calibrator (Net)	2233	1539

Gamma Constants MCG-B 60

Last Edited on 20-AUG-2013,12:01

Gamma Calibrator Number	45	
Mud Density	1.05	gm/cc
Caliper Source for Processing	Density Caliper	
Tool Position	Eccentred	
Concentration of KCl		kppm

K Mud Type	Chloride	
K Mud Concentration	0.00	%

High Resolution Temperature Calibration MCG-B 60

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Field Calibration on 24-APR-2013,11:52

	Measured	Calibrated(Deg F)
Lower	60.00	60.00
Upper	101.00	100.00

High Resolution Temperature Constants MCG-B 60

Last Edited on 24-APR-2013,11:52

Pre-filter Length	11

Laterolog Calibration MLE-C.K 236

Base Calibration on 20-AUG-2013,12:00
Field Check on

Base Calibration

	Measured		Calibrated (ohm-m)	
Channel	Resistor 1	Resistor 2	Resistor 1	Resistor 2
Shallow	0.0	976.7	0.0	1284.4
Deep	0.0	988.0	0.0	795.7
Groningen	0.0	975.9	0.0	808.4

Channel	Base Check (ohm-m)	Field Check (ohm-m)
Shallow		0.0
Deep		0.0
Groningen		0.0

Laterolog Constants MLE-C.K 236

Last Edited on 20-AUG-2013,12:00

Squasher Start	40000	ohm-m
Shallow Laterolog K Factor	1.2844	
Deep Laterolog K Factor	0.7957	
Groningen Laterolog K Factor	0.8084	
Interference Rejection	60 Hz	
SP Connection	SP Bridle Electrode (Lower)	
Groningen Connection	Groningen Electrode (Upper)	

Borehole Correction Constants

Bridle Type	Standard	
Stand-off	0.50	inches
Caliper Source	Density Caliper	
Hole Size	N/A	inches
Mud Resistivity Source	Temperature Corrected	
Temp. for Rm Corr.	MCG External Temperature	

Apparent Porosity and Water Saturation Constants

Archie Constant (A)	1.00	
Cementation Exponent (M)	2.00	
Saturation Exponent (N)	2.00	
Saturation of Water for Apor	100.00	percent
Resistivity of Water for Apor and Sw	0.05	ohm-m
Resistivity of Mud Filtrate for Sw	0.00	ohm-m
Source for Rt	0.00	
Source for Rxo	0.00	

SP Calibration MLE-C.K 236

Field Calibration on 10-APR-2012 13:36

	Measured	Calibrated (mV)
Reference 1	109.7	100.5
Reference 2	-92.0	-100.8

Caliper Calibration MPD-A.A 20

Base Calibration on 08-AUG-2013 14:51
Field Calibration on 08-AUG-2013 14:56

Base Calibration

Reading No	Measured	Calibrator Size (in)
1	26159	6.03
2	36145	7.99
3	45639	9.85
4	56054	11.82
5	0	0.00
6	N/A	N/A

Field Calibration

Measured Caliper (in)	Actual Caliper (in)
7.94	7.99

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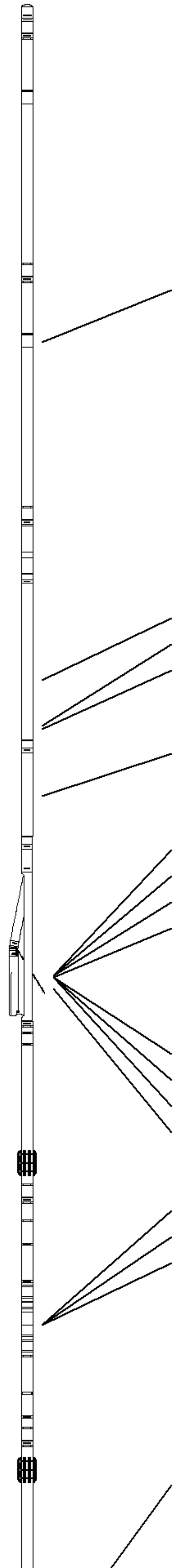
DOWNHOLE EQUIPMENT

C:\Logs\Cargill Inc\Cargill 18\Run_5_Triple\3540548\Cargill Inc_Cargill 18_Run_5_Triple_3540548 Main Pass.dta



3/8" Triple Cone Cable Head (MCB F B)
MCB-F.B 52 LG: 1.58 ft WT: 15.4 lb OD: 2.24 in

Compact Stiff Bridle Electrode Sub.
MBE-C.B 330 LG: 12.33 ft WT: 77.2 lb OD: 2.28 in

Compact Stiff Bridle Electrode Sub.
MBE-C.B 339 LG: 12.33 ft WT: 77.2 lb OD: 2.28 in

SHA-J.A Compact Swivel Head Adaptor
SHA-J.A 353 LG: 2.30 ft WT: 22.0 lb OD: 2.24 in

Compact Comms Gamma
MCG-B 60 LG: 8.70 ft WT: 63.9 lb OD: 2.24 in

Compact Neutron
MDN-A.B 80 LG: 5.04 ft WT: 50.7 lb OD: 2.24 in

Compact Density/Caliper
MPD-A.A 20 LG: 9.53 ft WT: 90.4 lb OD: 2.45 in

Compact Upper Guard sub
MUG-B.B 276 LG: 8.98 ft WT: 68.3 lb OD: 2.24 in

Compact Laterolog Electrode Sub.
MLE-C.K 236 LG: 12.34 ft WT: 92.6 lb OD: 2.24 in

Compact Lower Guard Sub.
MLG-B.A 195 LG: 8.00 ft WT: 55.1 lb OD: 2.24 in

Compact Pressure Bung
HFS 2 LG: 0.13 ft WT: 4.4 lb OD: 2.24 in

Total Length: 81.26 ft Weight: 617.3 lb

49.78 ft	SPDL - Spontaneous Potential
33.24 ft	GGCE - Borehole Corrected Gamma
31.07 ft	CCLG - Casing Collar Locator
30.34 ft	CGXT - MCG External Temperature
26.79 ft	NPRL - Limestone Neutron Por.
19.55 ft	AVOL - Annular Volume
19.55 ft	HVOL - Hole Volume
19.55 ft	CLDC - Density Caliper
17.62 ft	DCOR - Density Correction
17.62 ft	MTXD - Matrix density
17.62 ft	DPOR - Base Density Porosity
17.62 ft	DEN - Compensated Density
17.56 ft	PDPE - PE
0.00 ft	DSLL - Shallow Laterolog
0.00 ft	DDLL - Deep Laterolog
Tool Zero	(14.32ft from bottom)
-14.32 ft	SMTU - DST Uphole Tension

All measurements relative to tool zero.

Total Length: 81.26 ft Weight: 617.3 lb

COMPANY	Cargill, Inc.
WELL	Cargill 18
FIELD	Lansing
PROVINCE/COUNTY	Tompkins County
COUNTRY/STATE	U.S.A. / New York

Elevation Kelly Bushing	752.16	feet	First Reading	2488.00	feet
Elevation Drill Floor	752.16	feet	Depth Driller	2486.00	feet
Elevation Ground Level	748.16	feet	Depth Logger	2488.00	feet

Weatherford®

Dual Laterolog
Gamma Ray

CONFIDENTIAL

Weatherford®

COMPACT MONOPOLE / CROSS DIPOLE SEMBLANCE

Company	**Cargill, Inc.**
Well	**Cargill 18**
Field	**Lansing**
Prov / State	**U.S.A. / New York**
Country	**United States**

Location	**X=820507.58, Y=937023.59**	**Latitude**	Other Services
UWI / API NO.		**Longtitude**	
License	**31-109-26509-00**		

Permanent Datum MSL	Elevation	Elevations K.B.	752.16
Log Measured From GL 0.00	Above Permanent Datum	Elevations D.F.	752.16
Drill Measured From GLL		Elevations G.L.	748.16 FT

Date		22-May-2013				
Run Number		One				
Service Order		3531404				
Depth Driller		1550.00 FT				
Depth Logger		1553.00 FT				
First Reading		1553.00				
Last Reading		30.00 FT				
Casing Driller		590.00 FT				
Casing Logger		580.00 FT				
Bit Size		6.250 INCH				
Hole Fluid Type		Brine				
Density	Viscosity	9.500 LB/G	27.00			
pH	Fluid Loss					
Sample Source		Flow Line				
Rm @ Measured Temperature		0.054 OHMM @ 78.00 DEGF				
Rmf @ Measured Temperature		0.041 OHMM @ 78.00 DEGF				
RMC @ Measured Temperature		0.081 OHMM @ 78.00 DEGF				
Source Rmf	Source Rmc	Calc.	Calc.			
Rm @ BHT		0.054 OHMM @ 78.00 DEGF				
Time Since Circulation		4 Hrs				
Maximum Recorded Temperature		71.00 DEGF				
Equipment No.	Base Location	13041	Muncy			
Recorded By		Nibras Nureldin				
Witnessed By		Patrick McGrath				

Since well log interpretations are opinions based upon inferences from well logs, we cannot and do not guarantee the correctness or accuracy of any interpretation. Therefore we shall not be liable or responsible for any loss, damage, cost or expense incurred or sustained by anyone resulting from any interpretation.

Rig:		Remarks: Service Order # 3531404
Drilling Stopped		
Circulation Stopped	4 Hrs	
Tool on Bottom		
BHT	71.00 DEGF	

Equipment Data

Tool Type	Tool Type	Other

CXD MONOPOLE DIPOLE ARRAY SEMBLANCE

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DTPQ, DTXQ and DTYQ are flags for zones where the values of DTP, DTX and/or DTY may not be accurate. Caution should be excersised if DTP, DTX and DTY are used in analysis and interpretation where these flags occur. Any other curves that are dependent upon DTP, DTX and DTY should also be usec with caution. These include VPVSX, VPVSY, POIS, SPHI, ITTP, ITTX and ITTY.

Another flag of potentially inaccurate responses is the borehole rugosity as indicated by the caliper(s).

Poisson's Ratio:
POIS = (2-(DTX/DTP)^2)/(2*(1-(DTX/DTP)^2))

VPVX = DTX/DTP
VPVY = DTY/DTP

XX DIPOLE Shear Processing
Receiver levels:
R1, R2, R3, R4, R5, R6, R7, R8. First receiver offset 8.5 feet.
Frequency pre-filtered 3500 - 5000 Hz bell filter.
Slowness Configuration 60-360 usec/ft, peak from 85 to 190 usec/ft.
Corridor width: +200 -50
Semblance @ x16 resolution.

YY DIPOLE Shear Processing
Receiver levels:
R1, R2, R3, R4, R5, R6, R7, R8. First receiver offset 7.8 feet.
Frequency pre-filtered 3500 - 5000 Hz bell filter.
Slowness Configuration 60-360 usec/ft, peak from 85 to 200 usec/ft.
Corridor width: +200 -50
Semblance @ x16 resolution.

MONOPOLE Compressional Processing
Receiver levels:
R1, R2, R3, R4, R5, R6, R7, R8. First receiver offset 6.8 feet.
Frequency pre-filtered 5000 - 20000 Hz butterworth filter.
Slowness Configuration 40-240 usec/ft, peak from 45 to 95 usec/ft.
Corridor width: +50 -50
Semblance @x16 resolution.
****
ANALYST: C. RIVERA
PROGRAM: Petrolog 11.0.80.0 and Petrolog 10.7.1.6
****

****

Lithology / Shading Legend

Wash Out

Mud Cake

DT Lower Quality

Log Description

GGCE	Borehole Corrected Gamma
VPVX	VP/VX Ratio
POIS	Poissons Ratio
BIT	Bit size
CLDC	Density Caliper
DTP	Compressional Delta T
DTX	XX Dipole Shear Delta T
DTY	YY Dipole Shear Delta T

DTPQ	DTP Quality Flag
DTXQ	DTX Quality Flag
DTYQ	DTY Quality Flag
ITTP	Compressional Integration ticks
ITTX	Shear XX Integration ticks
ITTY	Shear YY Integration ticks

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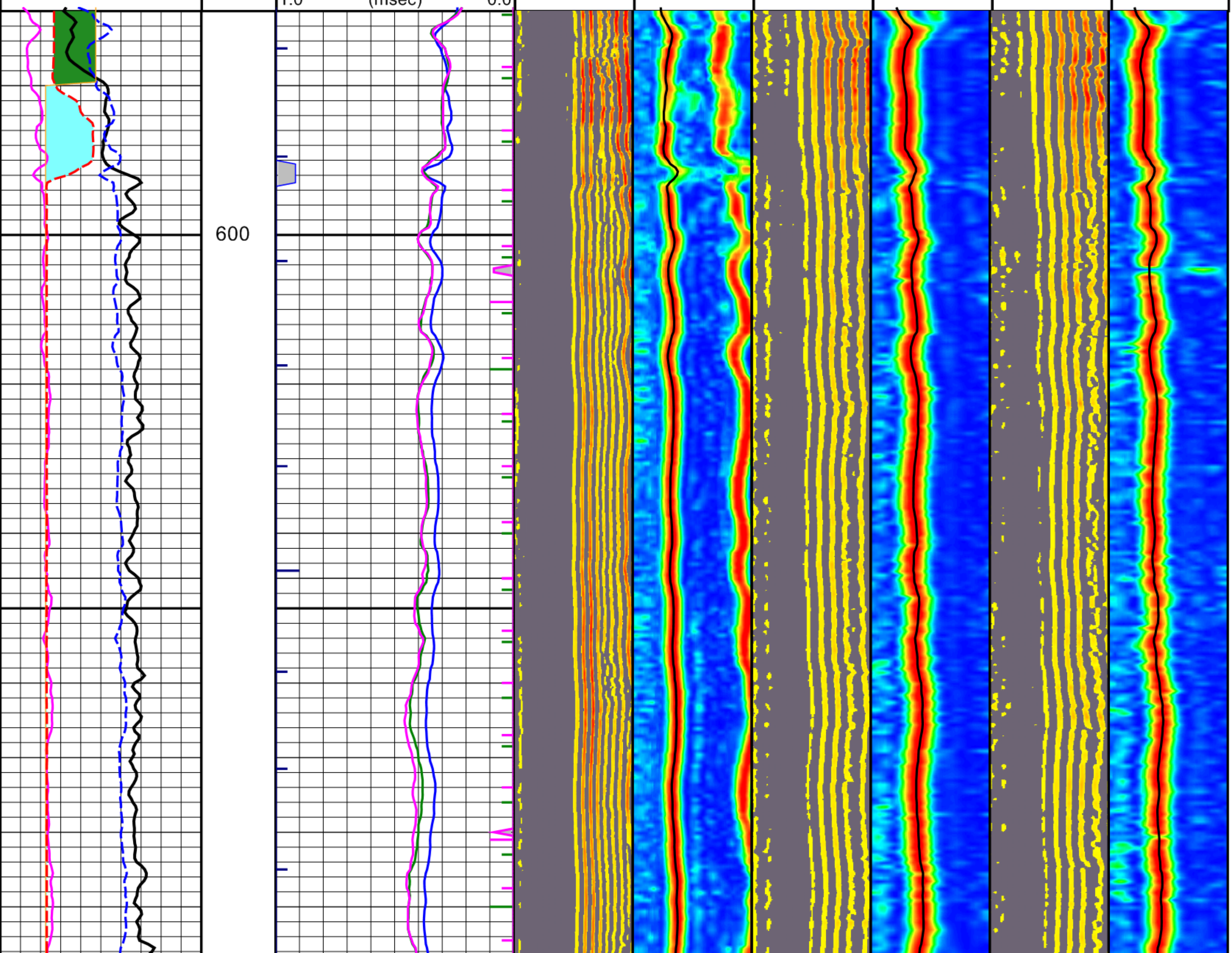
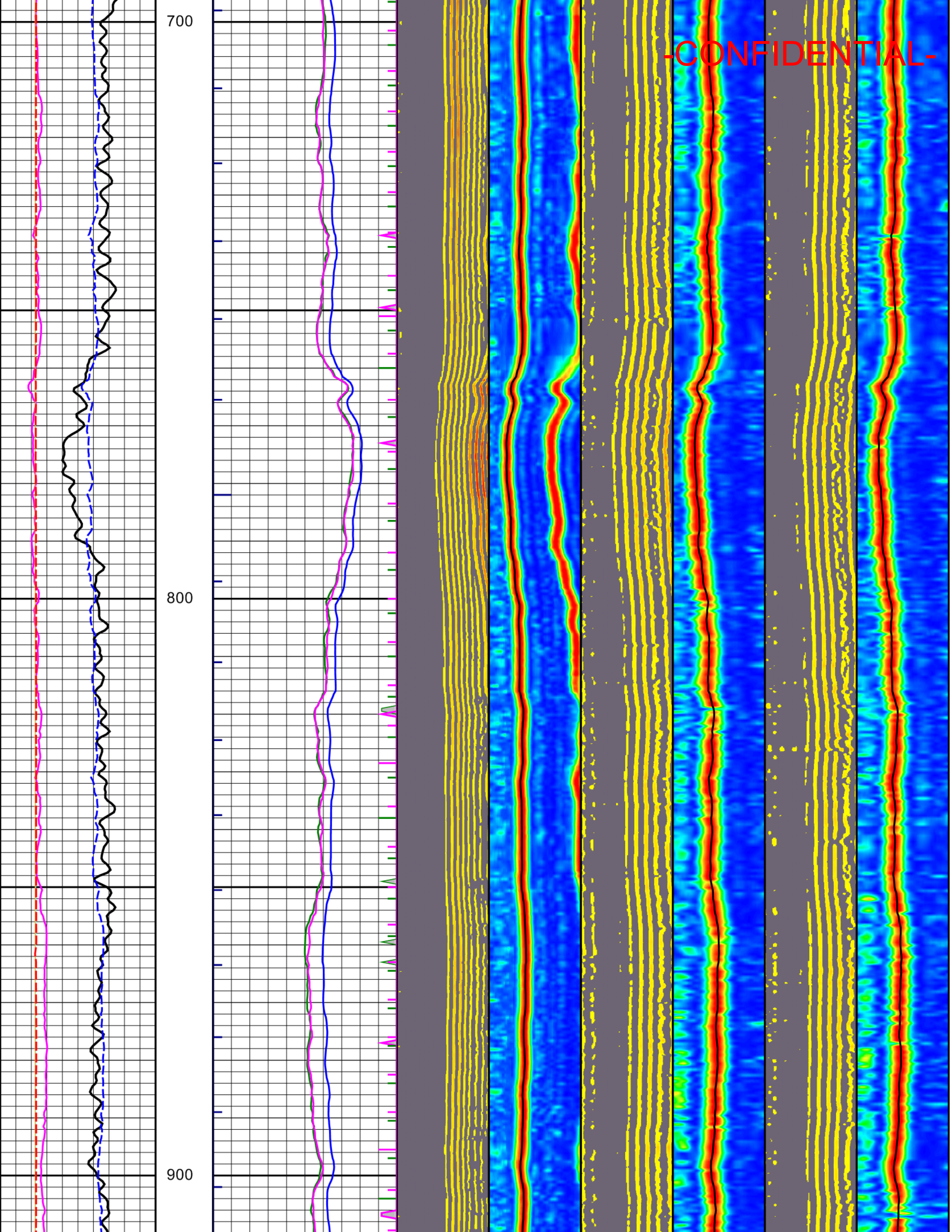
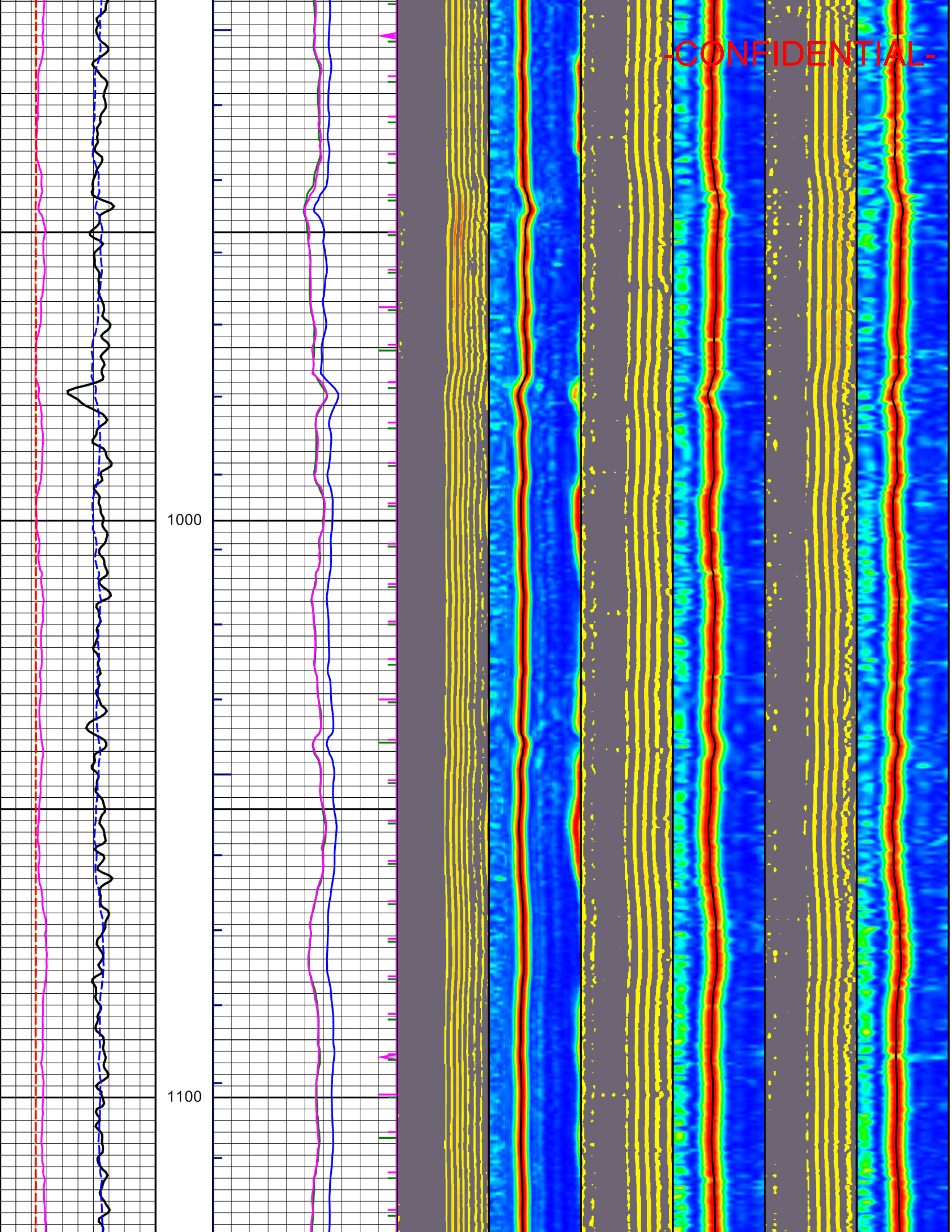
Auxiliary Curves	DEPT FT 1:240	Main Curves	Monopole Waveform	Monopole Semblance	Dipole XX Waveform	Dipole XX Semblance	Dipole YY Waveform	Dipole YY Semblance
GGCE 0.0 (api) 200.0		DTP 140.0 (us/f) 40.0	MR1A Image 0 1000	DTP 40.0 (us/ft) 140.0 MSPC Image 40 140	XR1A Image 0 2000	DTX 60.0 (us/ft) 260.0 XSPC Image 60 260	YR1B Image 0 2000	DTY 60.0 (us/ft) 260.0 YSPC Image 60 260
VPVX 1.4 (none) 3.4		DTX 260.0 (us/f) 60.0						
POIS 0.0 (none) 0.5		DTY 260.0 (us/f) 60.0						
BIT 4.0 (in) 14.0		DTPQ 0.0 (flg) 12.0						
CLDC 4.0 (in) 14.0		DTXQ 12.0 (flg) 0.0						
		DTYQ 12.0 (flg) 0.0						
		ITTP 0.0 (msec) 1.0						
		ITTX 1.0 (msec) 0.0						
		ITTY 1.0 (msec) 0.0						




700
800
900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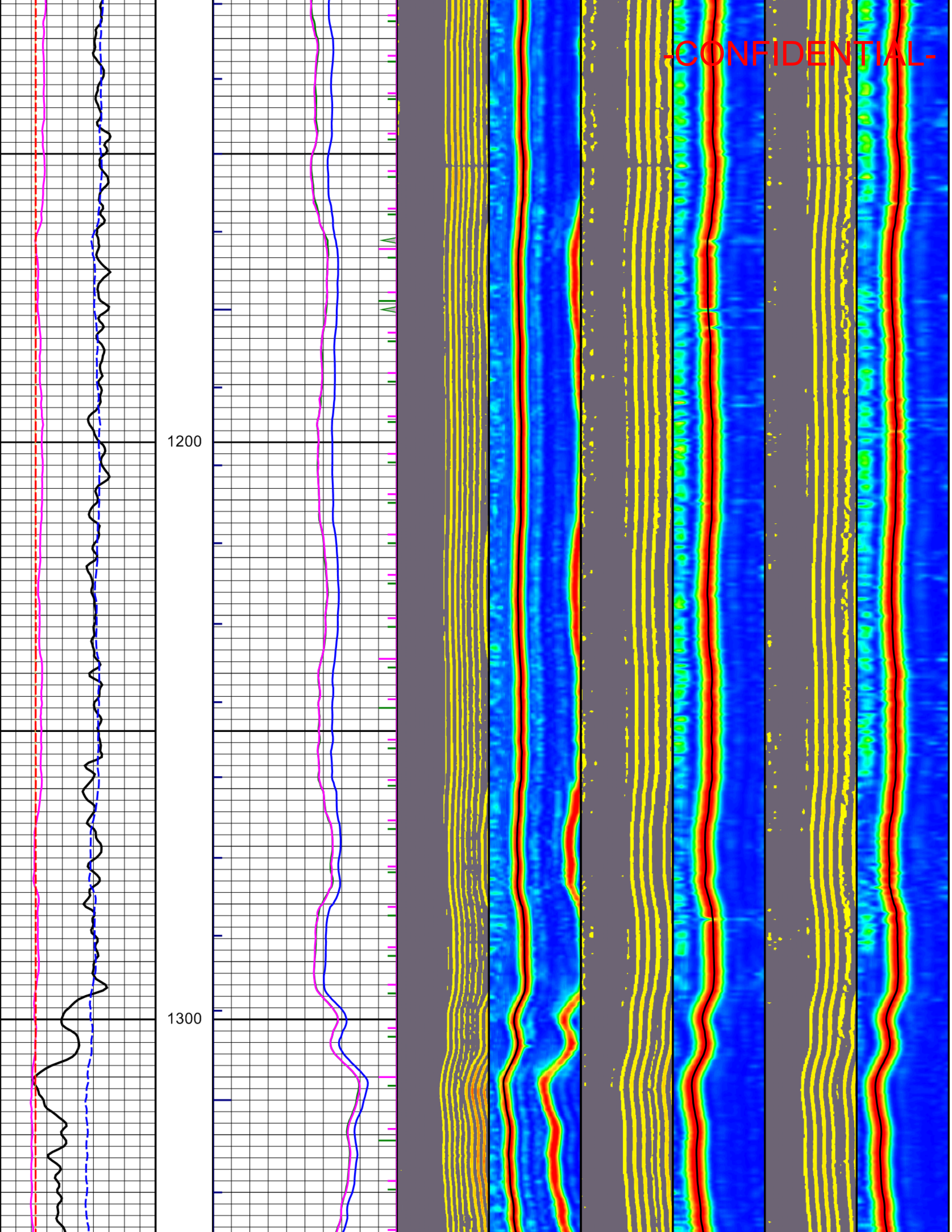
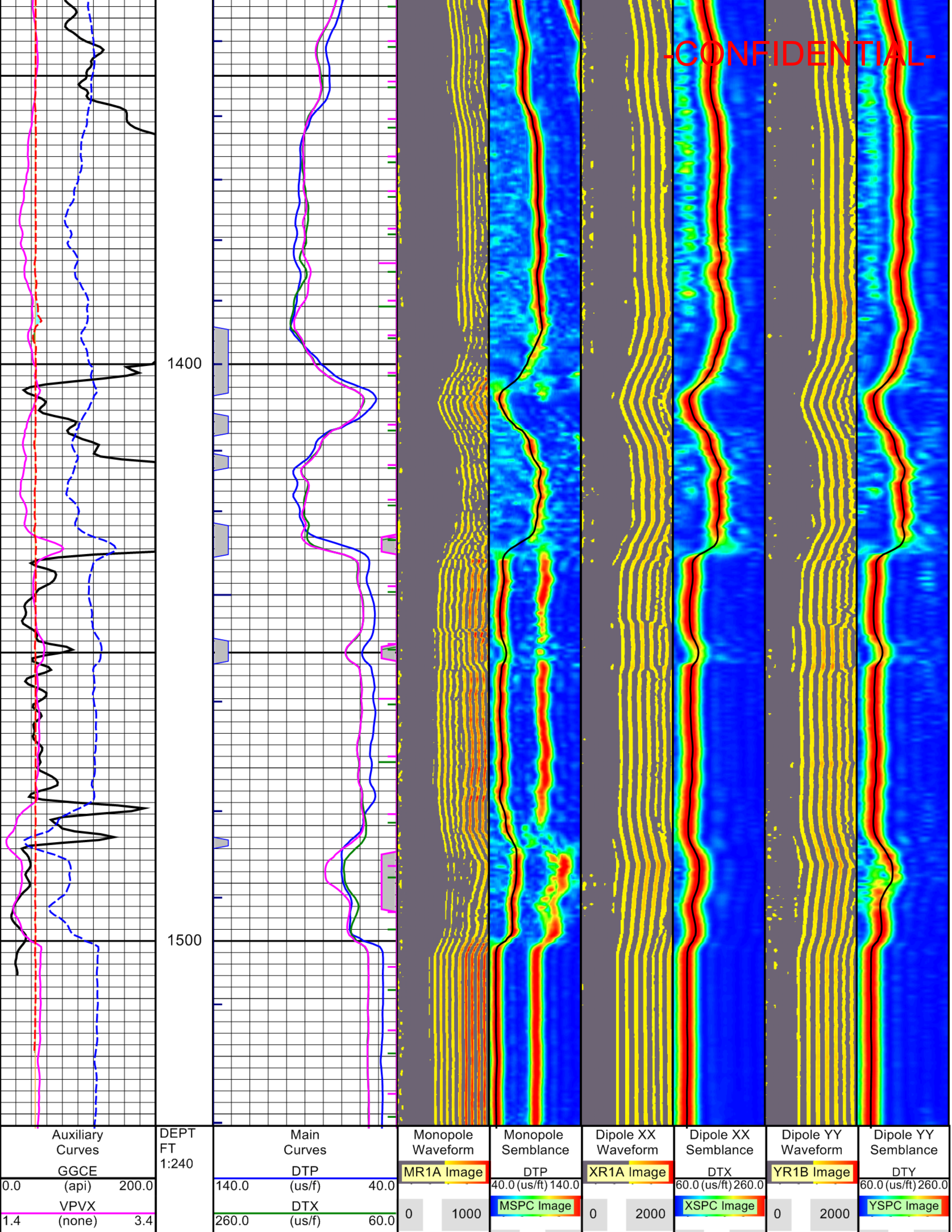
1000
1100


1200
1300


-CONFIDENTIAL-
1400
1500
Auxiliary Curves
GGCE
0.0 (api) 200.0
VPVX
1.4 (none) 3.4
DEPT FT 1:240
Main Curves
DTP
140.0 (us/f) 40.0
DTX
260.0 (us/f) 60.0
Monopole Waveform
MR1A Image
0 1000
Monopole Semblance
DTP
40.0 (us/ft) 140.0
MSPC Image
Dipole XX Waveform
XR1A Image
0 2000
Dipole XX Semblance
DTX
60.0 (us/ft) 260.0
XSPC Image
Dipole YY Waveform
YR1B Image
0 2000
Dipole YY Semblance
DTY
60.0 (us/ft) 260.0
YSPC Image

0.0	POIS (none)	0.5
4.0	BIT (in)	14.0
4.0	CLDC (in)	14.0

260.0	DTY (us/f)	60.0
0.0	DTPQ (flg)	12.0
12.0	DTXQ (flg)	0.0
12.0	DTYQ (flg)	0.0
0.0	ITTP (msec)	1.0
1.0	ITTX (msec)	0.0
1.0	ITTY (msec)	0.0

40 140

60 260

60 260

-CONFIDENTIAL-

Company	**Cargill, Inc.**
Well	**Cargill 18**
Field	**Lansing**
Prov. / State	**U.S.A. / New York**
Country	**United States**

Weatherford®

COMPACT MONOPOLE / CROSS DIPOLE
SEMBLANCE

Weatherford

-CONFIDENTIAL-

Dual Laterolog Gamma Ray

COMPANY	Cargill, Inc.
WELL	Cargill 18
FIELD	Lansing
PROVINCE/COUNTY	Tompkins County
COUNTRY/STATE	U.S.A. / New York
LOCATION	X=820507.58, Y=937023.59 Z/Elevation=784.16 WEL

FIELD PRINT

SEC	TWP	RGE

Other Services
Photo Density
Compensated Neutron
Cross Dipole
Data Pack
Caliper

API Number
Permit Number 31-109-26509-00

Permanent Datum Ground Level, Elevation 748.16 feet
Log Measured From GL
Drilling Measured From GLL

Elevations:	feet
KB	752.16
DF	752.16
GL	748.16

Date	22-May-2013		
Run Number	One		
Service Order	3531404		
Depth Driller	1550.00	feet	
Depth Logger	1553.00	feet	
First Reading	1553.00	feet	
Last Reading	30.00	feet	
Casing Driller	590.00	feet	
Casing Logger	580.00	feet	
Bit Size	6.250	inches	
Hole Fluid Type	Brine		
Density / Viscosity	9.50 lb/USg	27.00 sec/qt	
PH / Fluid Loss			
Sample Source	Flow Line		
Rm @ Measured Temp	0.054 @ 78.0	ohm-m	
Rmf @ Measured Temp	0.041 @ 78.0	ohm-m	
Rmc @ Measured Temp	0.081 @ 78.0	ohm-m	
Source Rmf / Rmc	Calc.	Calc.	
Rm @ BHT	0.054 @ 78.0	ohm-m	
Time Since Circulation	4 Hrs		
Max Recorded Temp	71.00	deg F	
Equipment / Base	13041	Muncy	
Recorded By	Nibras Nureldin		
Witnessed By	Patrick McGrath		

BOREHOLE RECORD

Last Edited: 22-MAY-2013 20:52

Bit Size inches	Depth From feet	Depth To feet
8.750	28.50	580.00
6.250	580.00	1553.00

CASING RECORD

Type	Size inches	Depth From feet	Shoe Depth feet	Weight pounds/ft
	10.750	0.00	28.00	42.00
	7.000	0.00	580.00	17.00

REMARKS

Software: WLS 13.05.9583

Tools Run 1: MBE, MBE,SHA, MCG, MDN, MPD, MFE,MUG,MDL,MLG,BHT

Hardware: MDN - Dual Eccentraliser
MDL - Two-1 Inch Standoffs
MPD - Two Roll over subs

Density Matrix was ran on 2.71 gg/cc

Crew: Nibras Nureldin
Bruce Clark
Gary Cronin
Sebastian Londono

Gamma ray spikes up at the bottom of the borehole because the gamma ray sub ran below the sources
4.5 inch casing was used to calculate annular hole volumes
Gamma ray was recorded to ground level

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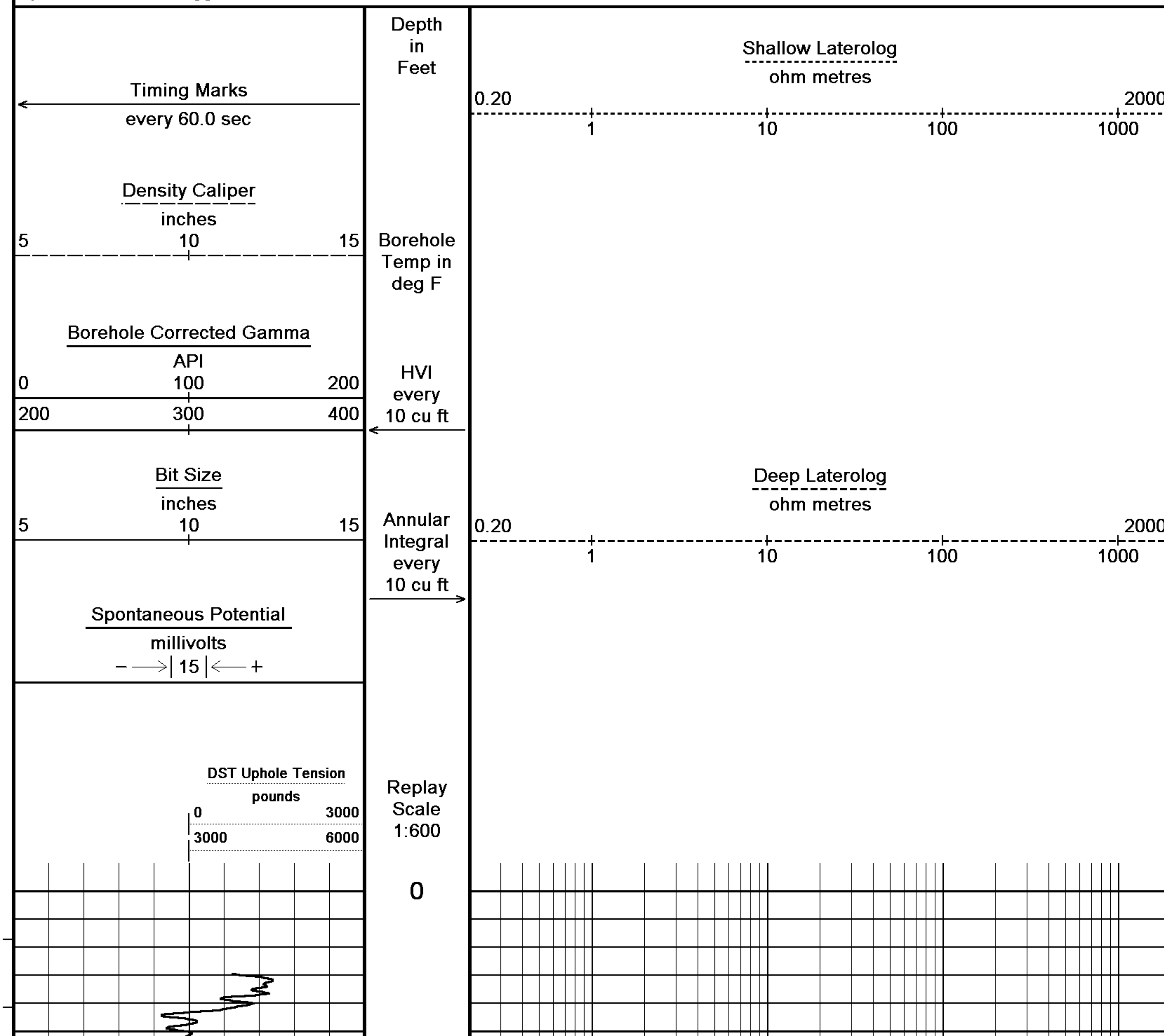
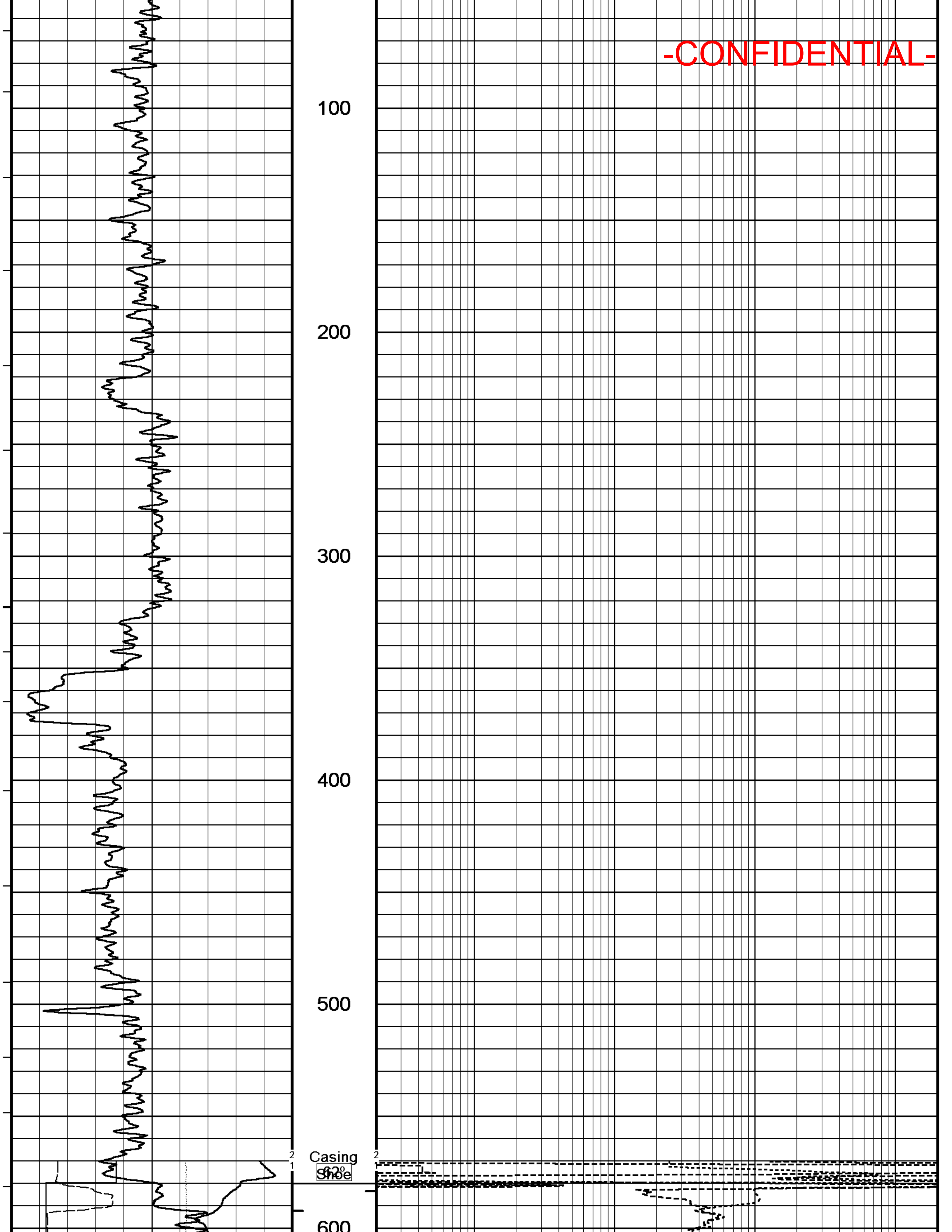
No Mud report was found on location.
100% Brine was added to the well that had 10% brine water in the well.

Mud Density is 9.5 lbs/USg

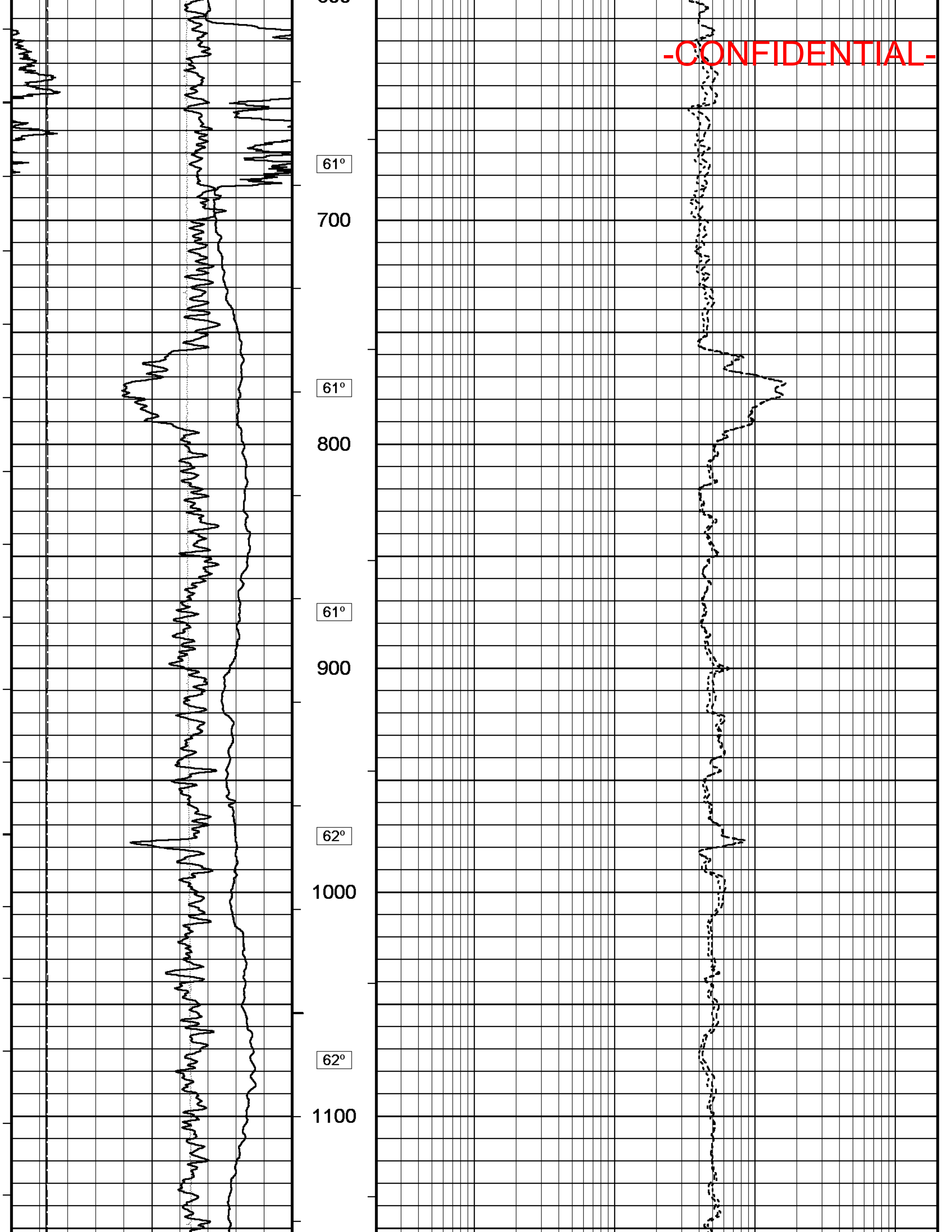
2 Inch Main Log

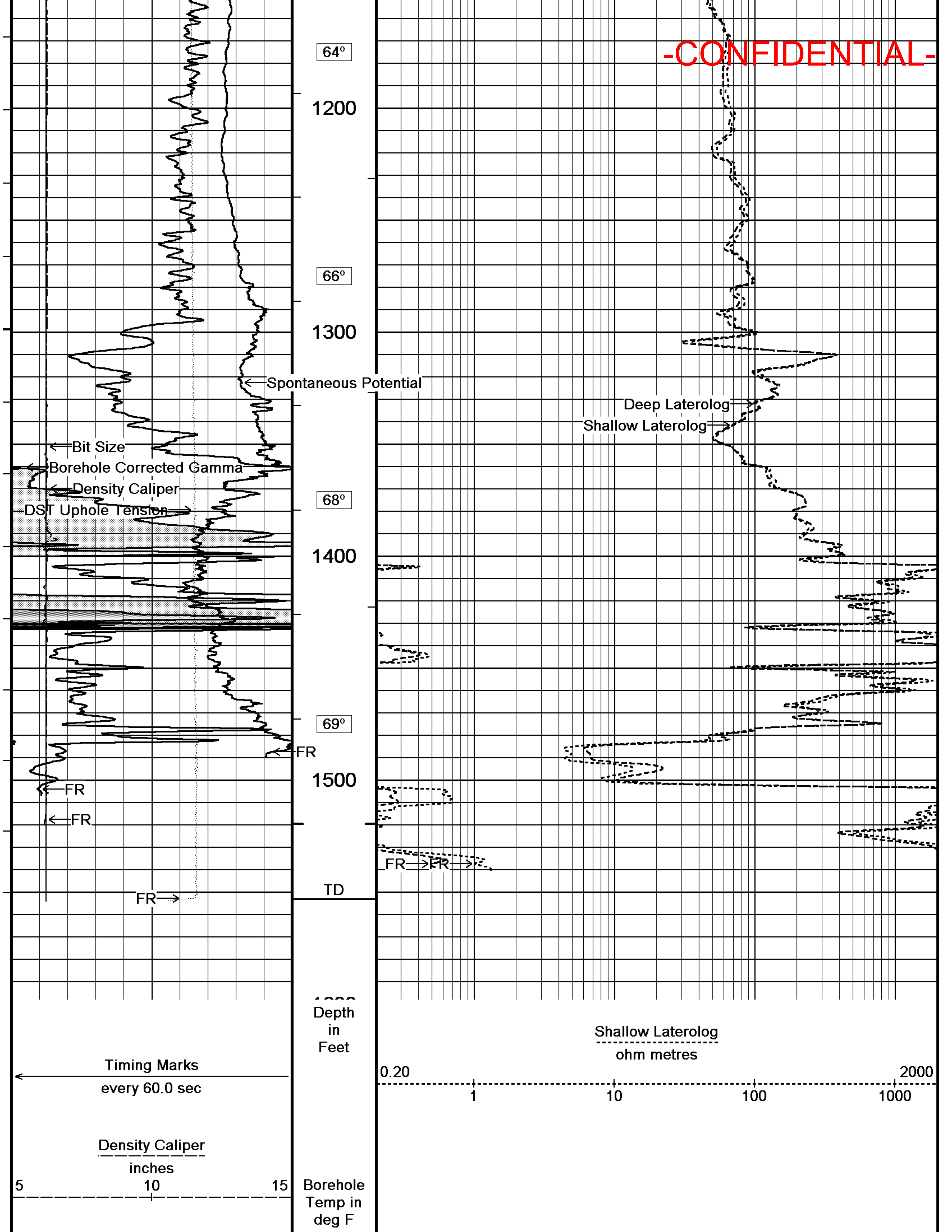
Depth Based Data - Maximum Sampling Increment 10.0cm — Plotted on 22-MAY-2013 22:26
Filename: C:\Logs\Cargill Inc\Cargill 18\...\Cargill Inc_Cargill 18_Run_3 Triple_3531404_Main Pass.dta
System Versions: Logged with 13.05.9583 Plotted with 13.05.9583





-CONFIDENTIAL-
100
200
300
400
500
2
1
Casing
62°
Shoe
2
1
600


-CONFIDENTIAL-
61°
700
61°
800
61°
900
62°
1000
62°
1100


-CONFIDENTIAL-
64°
1200
66°
1300
Spontaneous Potential
Deep Laterolog
Shallow Laterolog
Bit Size
Borehole Corrected Gamma
Density Caliper
68°
DST Uphole Tension
1400
69°
FR
1500
FR
FR
FR
FR
FR
TD
Depth in Feet
Shallow Laterolog
ohm metres
0.20
2000
1
10
100
1000
Timing Marks
every 60.0 sec
Density Caliper
inches
5
10
15
Borehole Temp in deg F

Borehole Corrected Gamma
API
0 100 200
200 300 400

HVI every 10 cu ft

-CONFIDENTIAL-

Bit Size
inches
5 10 15

Annular Integral every 10 cu ft

Deep Laterolog
ohm metres
0.20 2000
1 10 100 1000

Spontaneous Potential
millivolts
– ⟶| 15 |⟵ +

DST Uphole Tension
pounds
0 3000
3000 6000

Replay Scale 1:600

Depth Based Data - Maximum Sampling Increment 10.0cm Plotted on 22-MAY-2013 22:26
Filename: C:\Logs\Cargill Inc\Cargill 18\...\Cargill Inc_Cargill 18_Run_3 Triple_3531404_Main Pass.dta
System Versions: Logged with 13.05.9583 Plotted with 13.05.9583

↑ 2 Inch Main Log ↑

↓ 5 Inch Main Log ↓

Depth Based Data - Maximum Sampling Increment 10.0cm Plotted on 22-MAY-2013 22:26
Filename: C:\Logs\Cargill Inc\Cargill 18\...\Cargill Inc_Cargill 18_Run_3 Triple_3531404_Main Pass.dta
System Versions: Logged with 13.05.9583 Plotted with 13.05.9583

Depth in Feet

Timing Marks
every 60.0 sec

Shallow Laterolog
ohm metres
0.20 2000
1 10 100 1000

Density Caliper
inches
5 10 15

Borehole Temp in deg F

Borehole Corrected Gamma
API
0 100 200
200 300 400

HVI every 10 cu ft

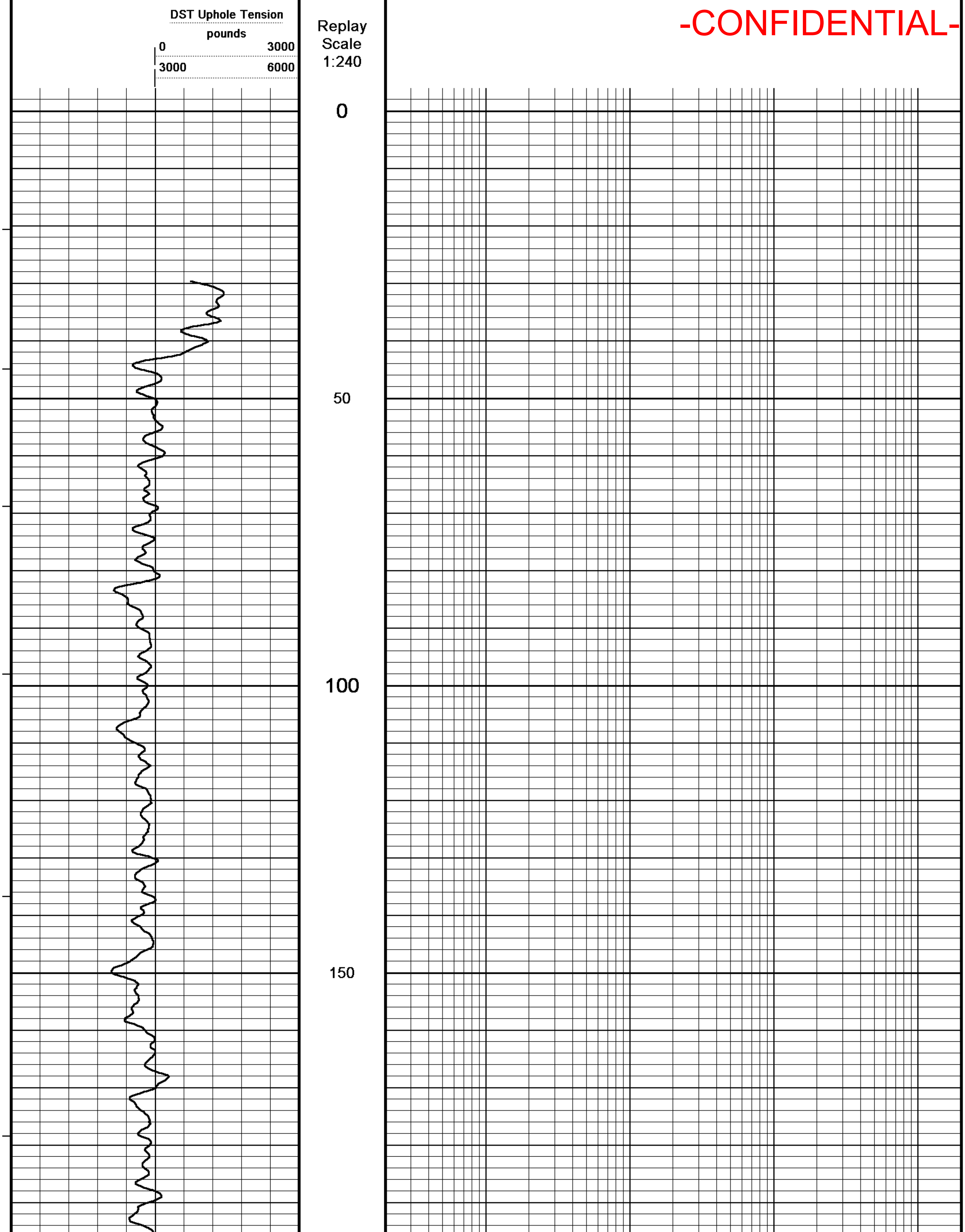
Bit Size
inches
5 10 15

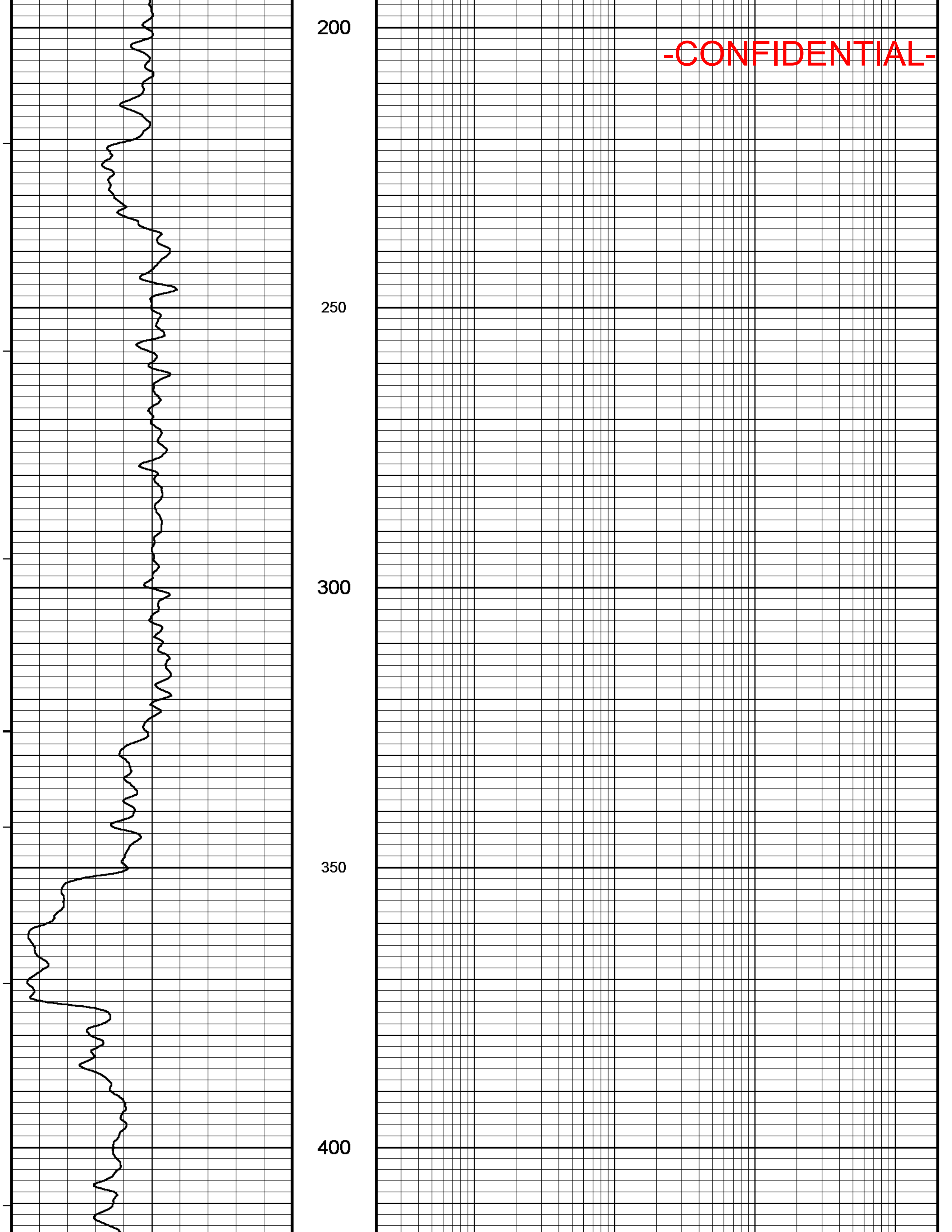
Deep Laterolog
ohm metres
0.20 2000
1 10 100 1000

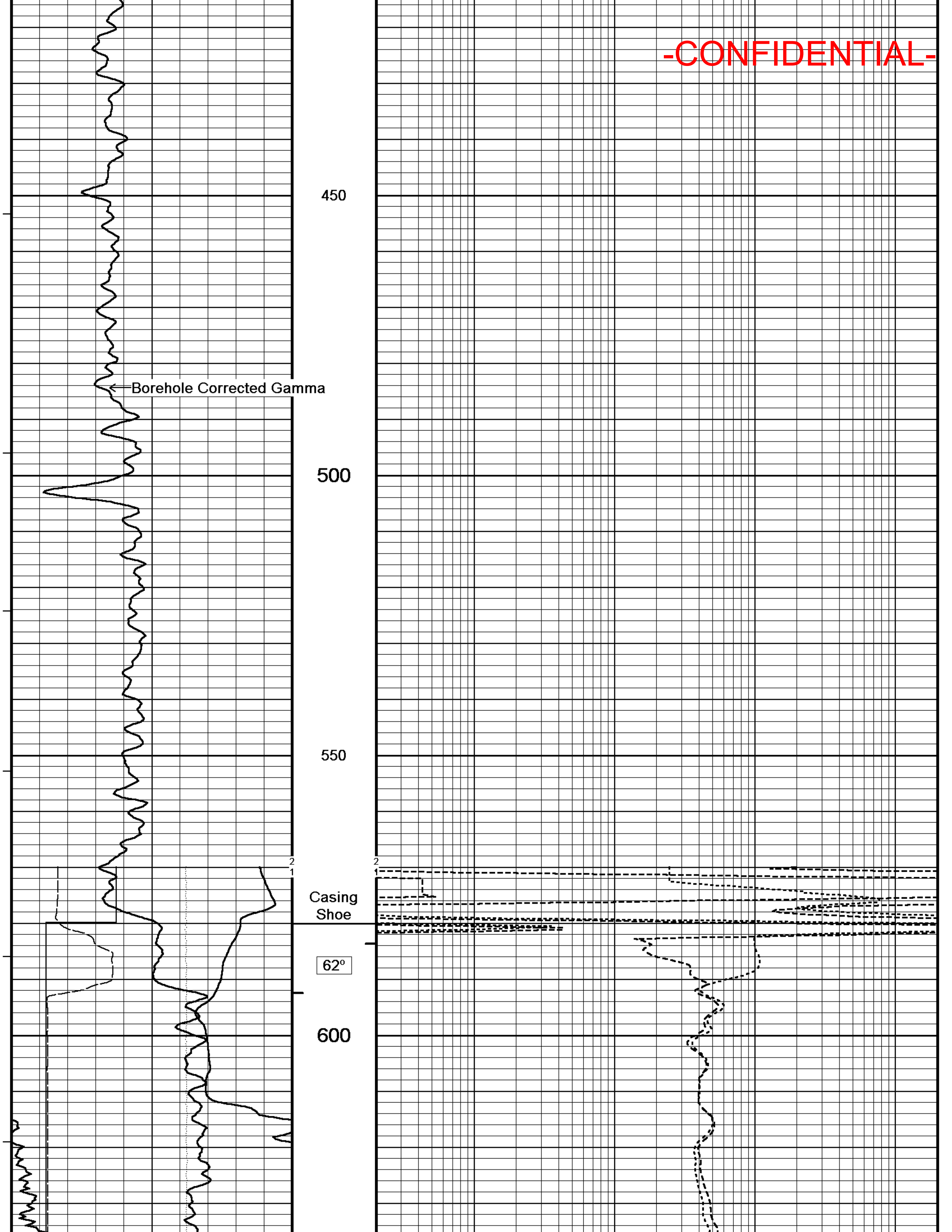
Annular Integral every 10 cu ft

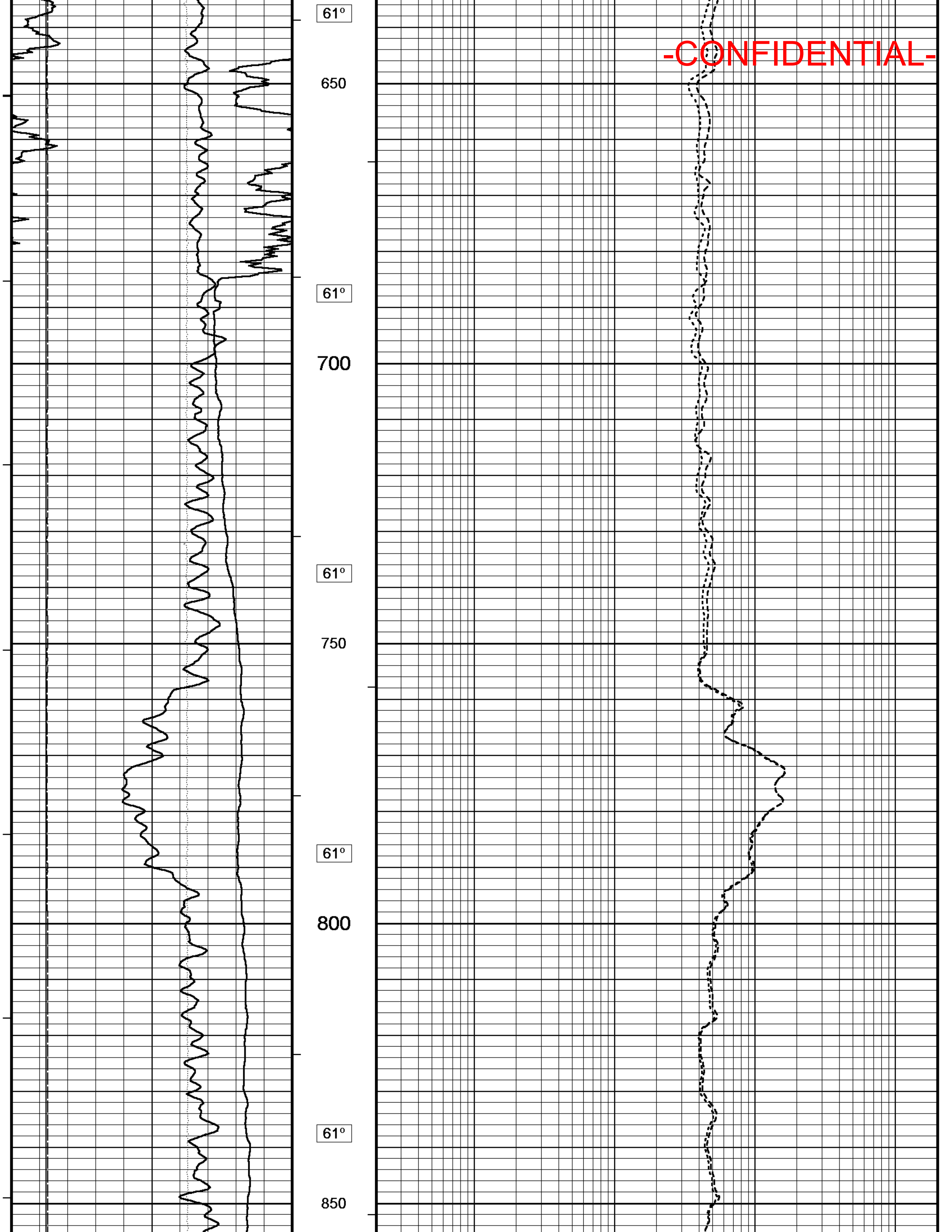
Spontaneous Potential
millivolts
– ⟶| 15 |⟵ +

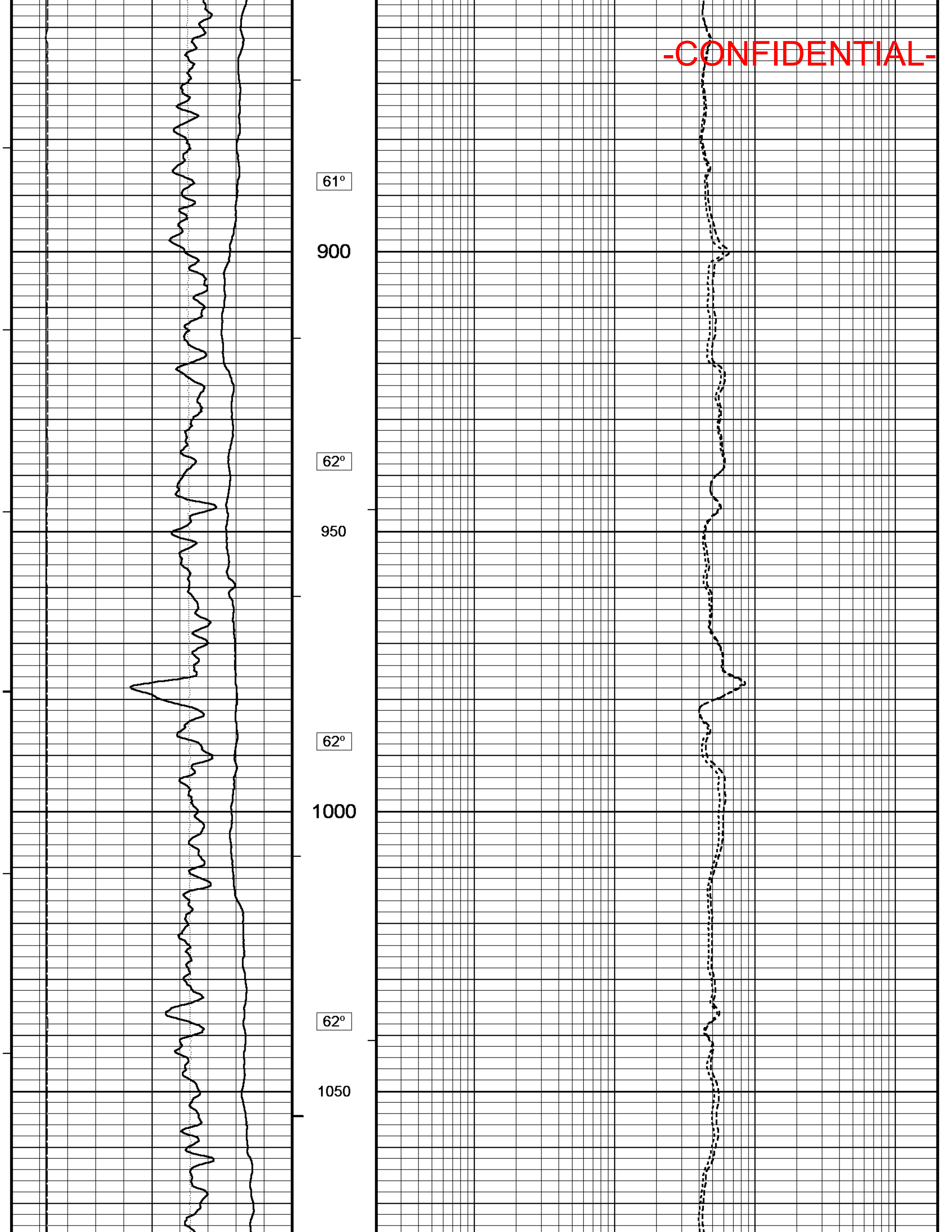
-CONFIDENTIAL-

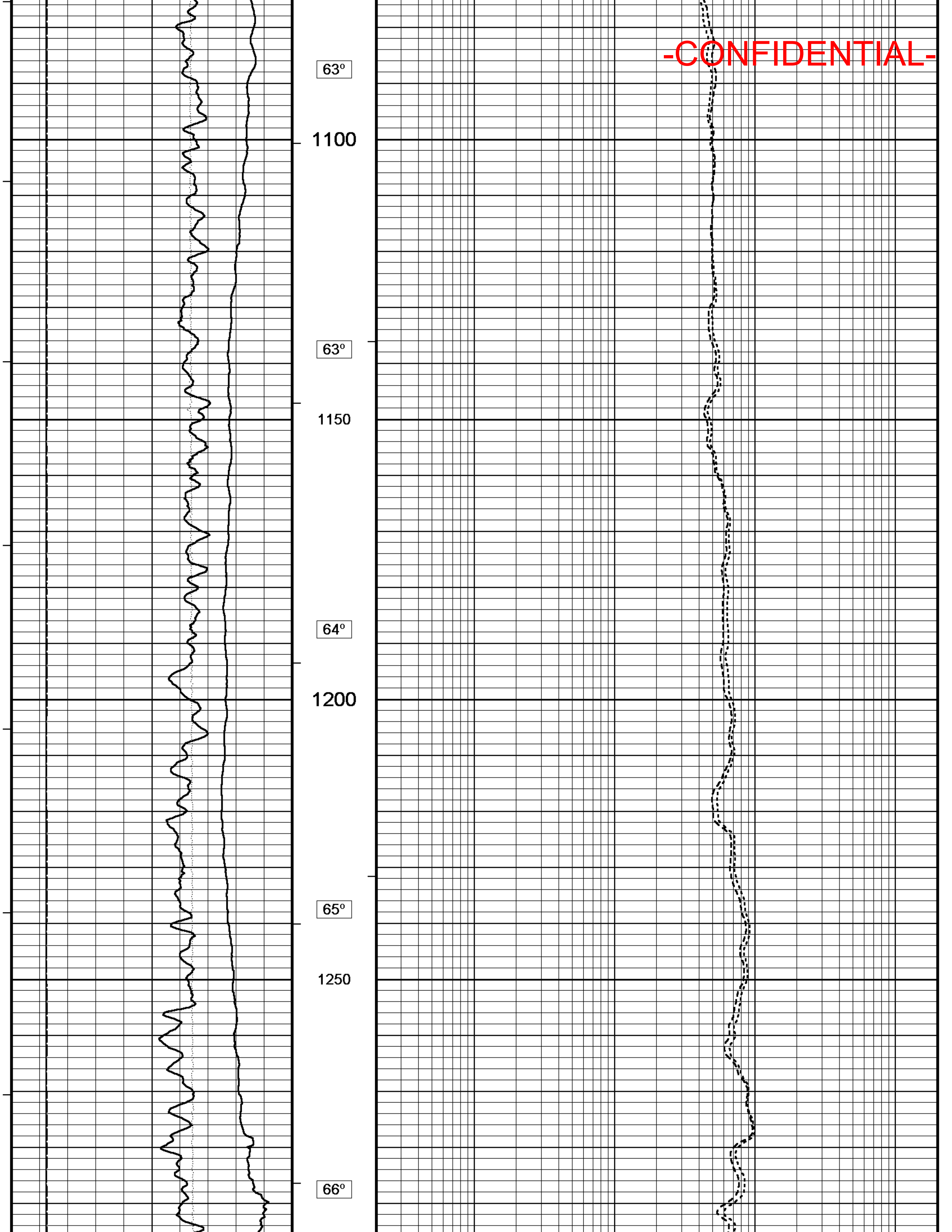


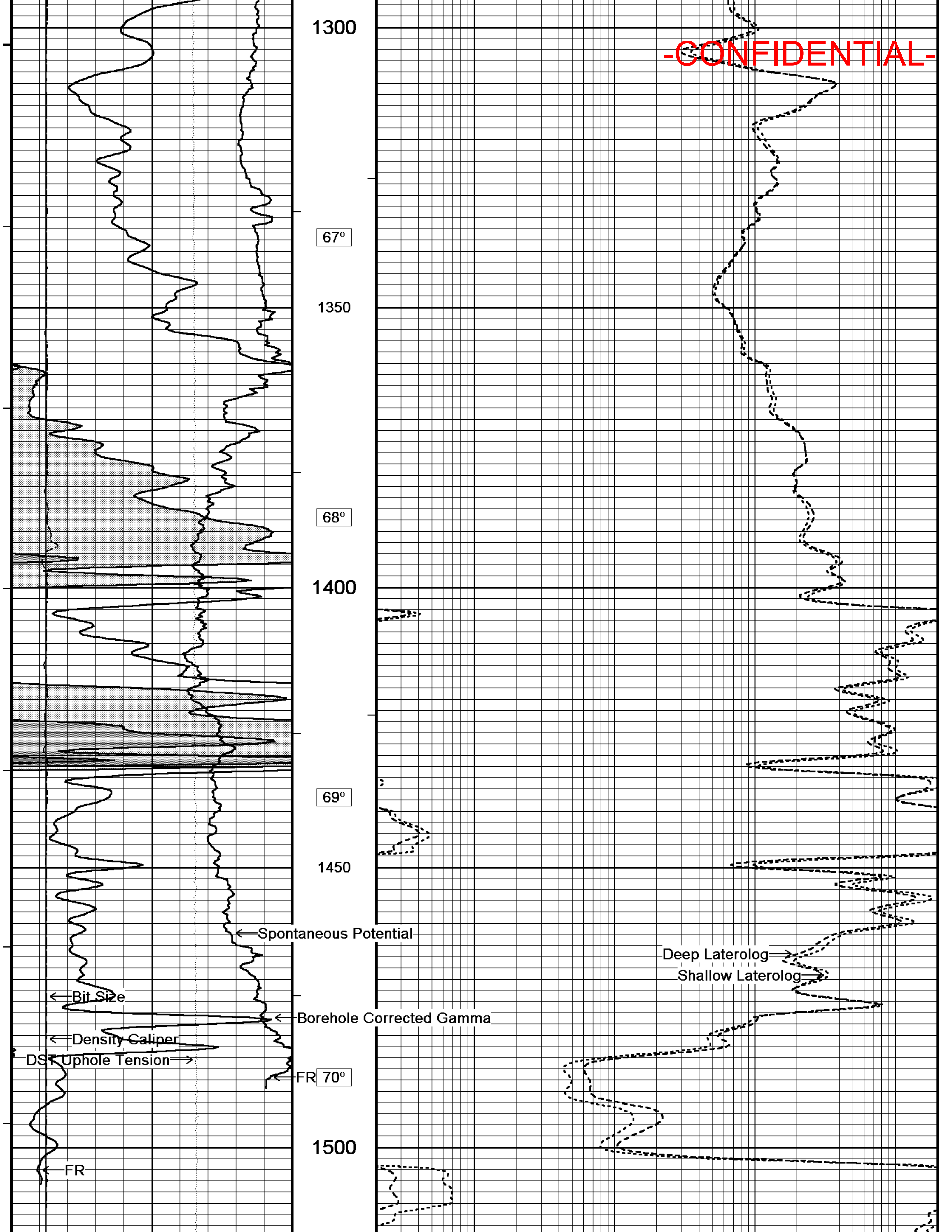

200
-CONFIDENTIAL-
250
300
350
400

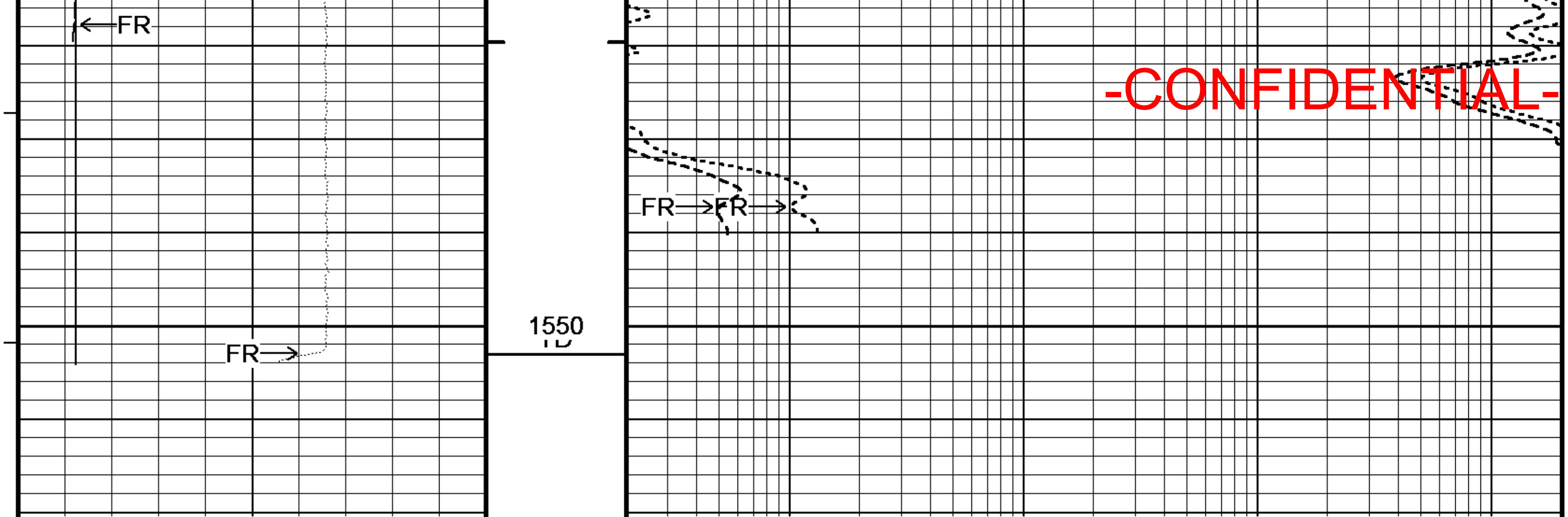

450
Borehole Corrected Gamma
500
550
2
1
2
1
Casing
Shoe
62º
600


61°
-CONFIDENTIAL-
650
61°
700
61°
750
61°
800
61°
850


-CONFIDENTIAL-
61°
900
62°
950
62°
1000
62°
1050


-CONFIDENTIAL-
63°
1100
63°
1150
64°
1200
65°
1250
66°


-CONFIDENTIAL-
1300
67º
1350
68º
1400
69º
1450
Spontaneous Potential
Deep Laterolog
Shallow Laterolog
Bit Size
Borehole Corrected Gamma
Density Caliper
DST Uphole Tension
FR
70º
1500
FR



Timing Marks
every 60.0 sec

Density Caliper
inches
5 10 15

Borehole Corrected Gamma
API
0 100 200
200 300 400

Bit Size
inches
5 10 15

Spontaneous Potential
millivolts
– | 15 | +

DST Uphole Tension
pounds
0 3000
3000 6000

Depth in Feet

Borehole Temp in deg F

HVI every 10 cu ft

Annular Integral every 10 cu ft

Replay Scale 1:240

Shallow Laterolog
ohm metres
0.20 2000
1 10 100 1000

Deep Laterolog
ohm metres
0.20 2000
1 10 100 1000

Depth Based Data - Maximum Sampling Increment 10.0cm
Plotted on 22-MAY-2013 22:26
Filename: C:\Logs\Cargill Inc\Cargill 18\...\Cargill Inc_Cargill 18_Run_3 Triple_3531404_Main Pass.dta
System Versions: Logged with 13.05.9583 Plotted with 13.05.9583

5 Inch Main Log

5 Inch Repeat Section

Depth Based Data - Maximum Sampling Increment 10.0cm
Plotted on 22-MAY-2013 22:26
Filename: C:\Logs\Cargill Inc\Cargill 1...\Cargill Inc_Cargill 18_Run_3 Triple_3531404_Repeat Pass.dta
System Versions: Logged with 13.05.9583 Plotted with 13.05.9583

Depth

Timing Marks
every 60.0 sec

Density Caliper
inches
5 10 15

Borehole Corrected Gamma
API
0 100 200
200 300 400

Bit Size
inches
5 10 15

Spontaneous Potential
millivolts
– | 15 | +

DST Uphole Tension
pounds
0 3000
3000 6000

in
Feet

Borehole
Temp in
deg F

HVI
every
10 cu ft

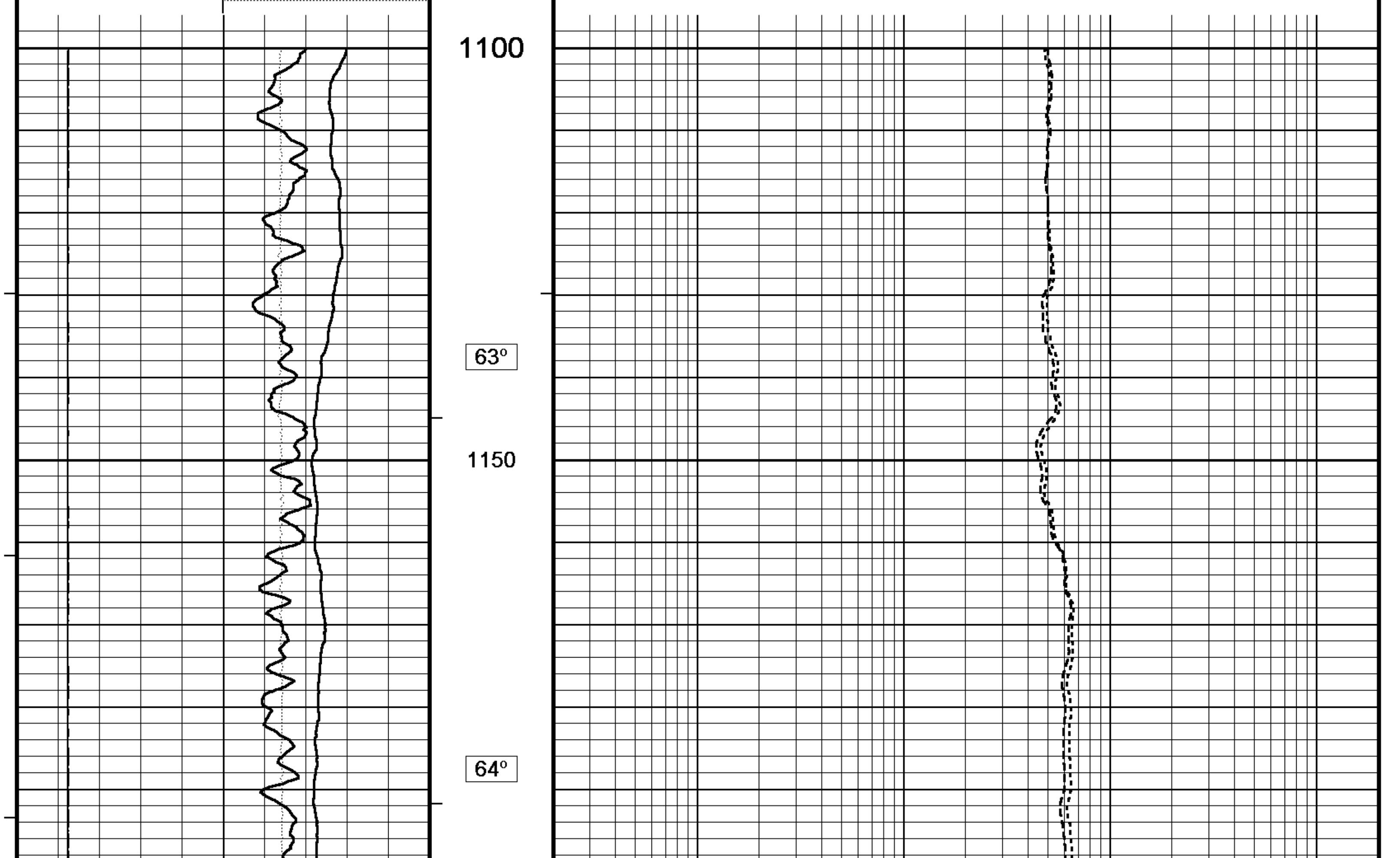
Annular
Integral
every
10 cu ft

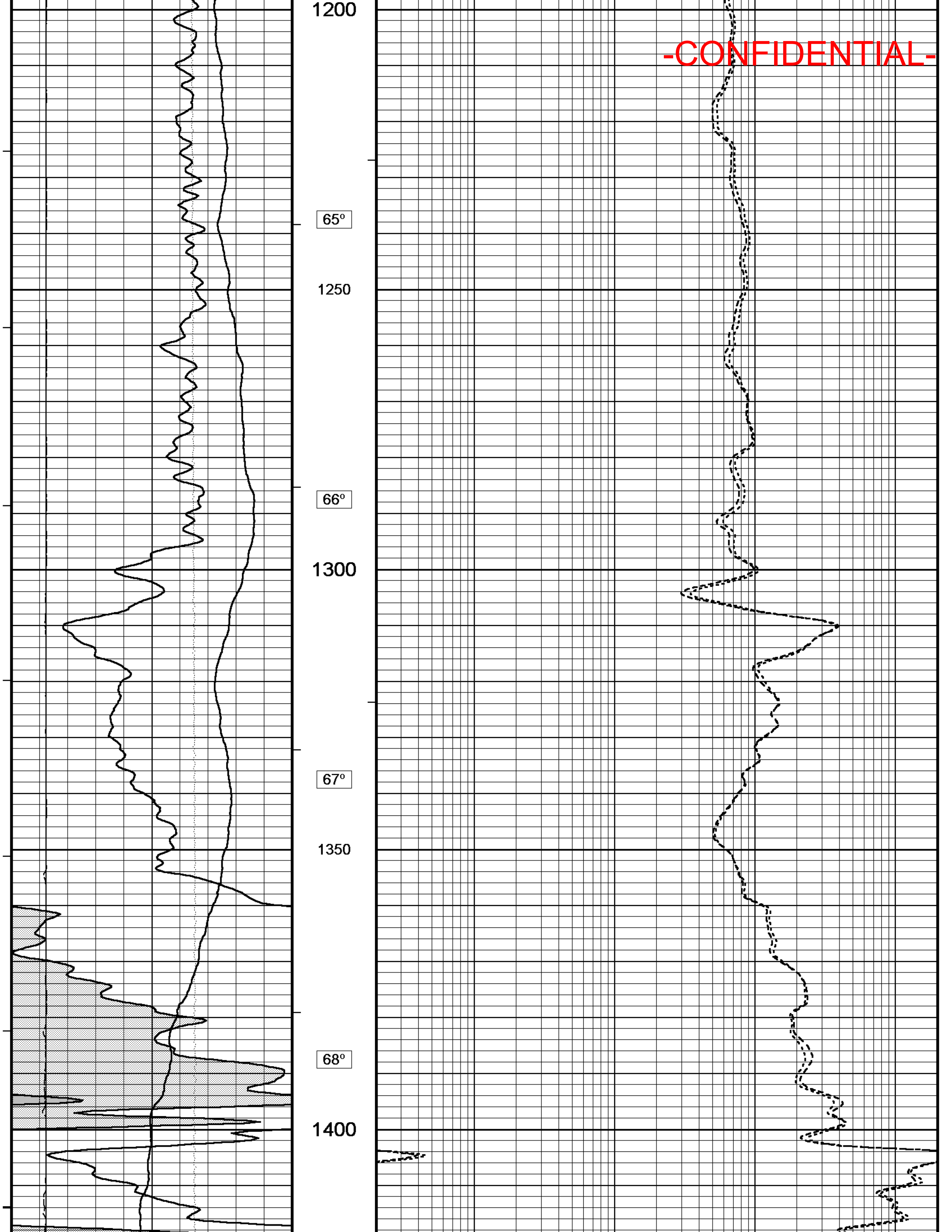
Replay
Scale
1:240

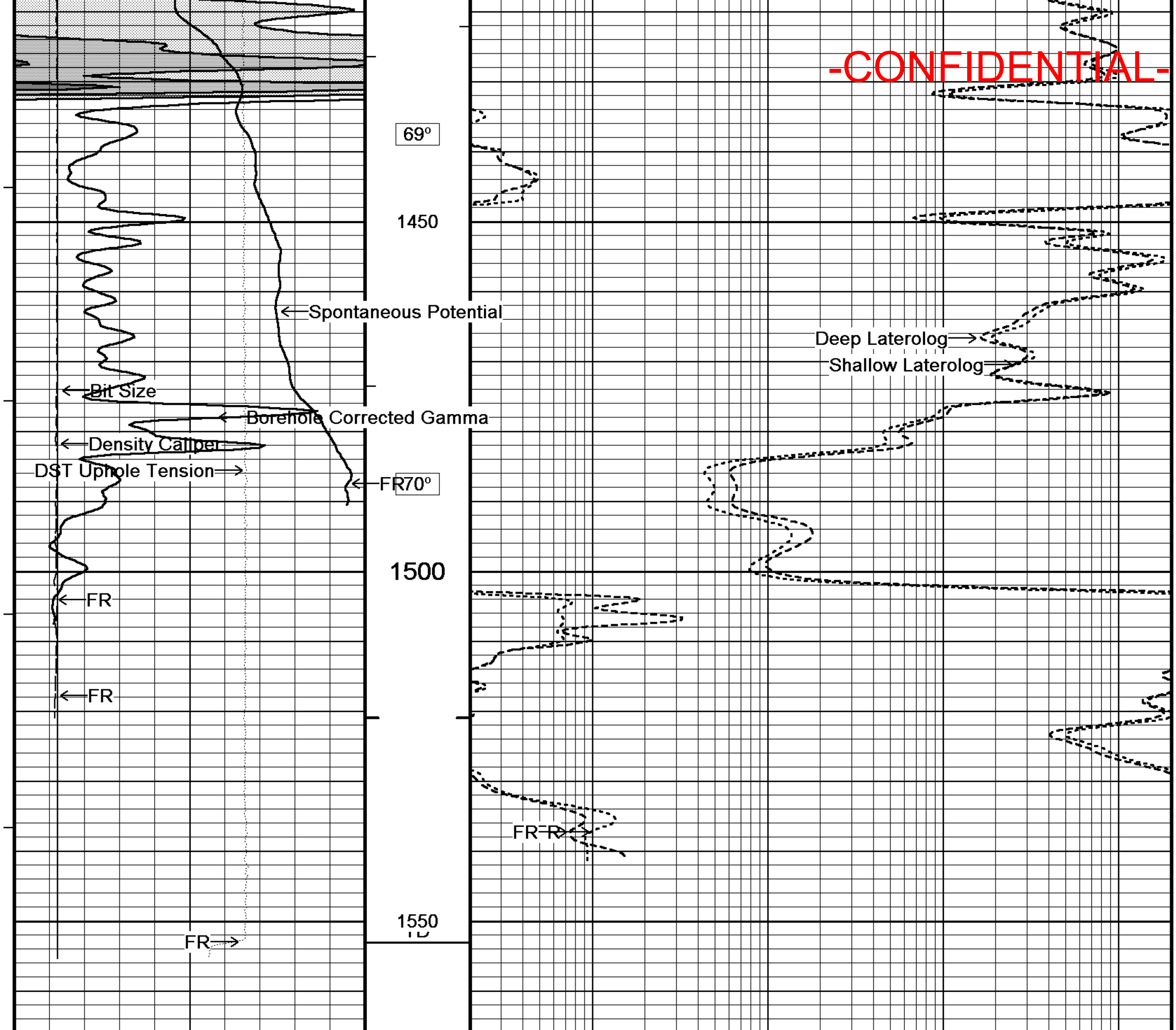
Shallow Laterolog
ohm metres
0.20 2000
1 10 100 1000

-CONFIDENTIAL-

Deep Laterolog
ohm metres
0.20 2000
1 10 100 1000




1200
-CONFIDENTIAL-
65°
1250
66°
1300
67°
1350
68°
1400



Timing Marks
every 60.0 sec

Depth in Feet

Shallow Laterolog
ohm metres
0.20 2000
1 10 100 1000

Density Caliper
inches
5 10 15

Borehole Temp in deg F

Borehole Corrected Gamma
API
0 100 200
200 300 400

HVI every 10 cu ft

Bit Size
inches

Deep Laterolog
ohm metres

5	10	15	Annular Integral every 10 cu ft →	0.20				2000
					1	10	100	1000

-CONFIDENTIAL-

Spontaneous Potential

millivolts

− ⟶| 15 |⟵ +

DST Uphole Tension

pounds

0	3000
3000	6000

Replay Scale 1:240

Depth Based Data - Maximum Sampling Increment 10.0cm

Plotted on 22-MAY-2013 22:26

Filename: C:\Logs\Cargill Inc\Cargill 1...\Cargill Inc_Cargill 18_Run_3 Triple_3531404_Repeat Pass.dta

System Versions: Logged with 13.05.9583 Plotted with 13.05.9583

5 Inch Repeat Section

BEFORE SURVEY CALIBRATION

C:\Logs\Cargill Inc\Cargill 18\Run_3 Triple\3531404\Cargill Inc_Cargill 18_Run_3 Triple_3531404_Main Pass.dta

General Constants All 000

Last Edited on 22-MAY-2013,15:40

General Parameters		
Mud Resistivity	0.054	ohm-metres
Mud Resistivity Temperature	78.000	degrees F
Water Level	0.000	feet
Borehole Fluid Processing	Water Level Switch	
Hole/Annular Volume and Differential Caliper Parameters		
HVOL Method	Single Caliper	
HVOL Caliper 1	Density Caliper	
HVOL Caliper 2	N/A	
Annular Volume Diameter	4.500	inches
Caliper for Differential Caliper	Density Caliper	
Rwa Parameters		
Porosity used	Base Density Porosity	
Resistivity used	Deep Laterolog	
RWA Constant A	0.610	
RWA Constant M	2.150	
SW/APOR Tool Source	0.000	

Gamma Calibration MCG-B 60

Field Calibration on 21-MAY-2013 09:51

	Measured	Calibrated (API)
Background	78	55
Calibrator (Gross)	2255	1594
Calibrator (Net)	2177	1539

Gamma Constants MCG-B 60

Last Edited on 18-MAY-2013,20:47

Gamma Calibrator Number	45	
Mud Density	1.03	gm/cc
Caliper Source for Processing	Density Caliper	
Tool Position	Eccentred	
Concentration of KCl		kppm
K Mud Type	Chloride	
K Mud Concentration	0.00	%

High Resolution Temperature Calibration MCG-B 60

Field Calibration on 24-APR-2013,11:52

	Measured	Calibrated(Deg F)
Lower	60.00	60.00
Upper	101.00	100.00

High Resolution Temperature Constants MCG-B 60 Last Edited on 24-APR-2013 11:52

High Resolution Temperature Constants MCG-B 60 | Last Edited on 24-APR-2013,11:52

Pre-filter Length 11

Laterolog Calibration MLE-C.K 233

-CONFIDENTIAL-

Base Calibration on 10-APR-2012 12:14
Field Check on

Base Calibration

Channel	Measured Resistor 1	Measured Resistor 2	Calibrated (ohm-m) Resistor 1	Calibrated (ohm-m) Resistor 2
Shallow	0.0	977.3	0.0	1284.4
Deep	0.0	984.3	0.0	795.7
Groningen	0.0	977.5	0.0	808.4

Channel	Base Check (ohm-m)	Field Check (ohm-m)
Shallow	47.3	0.0
Deep	29.1	0.0
Groningen	237.9	0.0

Laterolog Constants MLE-C.K 233

Last Edited on 22-MAY-2013,14:45

Squasher Start	40000	ohm-m
Shallow Laterolog K Factor	1.2844	
Deep Laterolog K Factor	0.7957	
Groningen Laterolog K Factor	0.8084	
Interference Rejection	60 Hz	
SP Connection	SP Bridle Electrode (Lower)	
Groningen Connection	Groningen Electrode (Upper)	

Borehole Correction Constants

Bridle Type	Standard	
Stand-off	0.50	inches
Caliper Source	Density Caliper	
Hole Size	N/A	inches
Mud Resistivity Source	Constant Value	
Temp. for Rm Corr.	N/A	

Apparent Porosity and Water Saturation Constants

Archie Constant (A)	1.00	
Cementation Exponent (M)	2.00	
Saturation Exponent (N)	2.00	
Saturation of Water for Apor	100.00	percent
Resistivity of Water for Apor and Sw	0.05	ohm-m
Resistivity of Mud Filtrate for Sw	0.00	ohm-m
Source for Rt	0.00	
Source for Rxo	0.00	

SP Calibration MLE-C.K 233

Field Calibration on 22-MAY-2013,15:39

	Measured	Calibrated (mV)
Reference 1	109.7	100.5
Reference 2	-92.0	-100.8

Caliper Calibration MPD-A.A 20

Base Calibration on 14-MAY-2013 15:42
Field Calibration on 21-MAY-2013 09:19

Base Calibration

Reading No	Measured	Calibrator Size (in)
1	25425	6.03
2	35728	7.99
3	45344	9.85
4	55749	11.82
5	0	0.00
6	N/A	N/A

Field Calibration

Measured Caliper (in)	Actual Caliper (in)
6.06	6.03

DOWNHOLE EQUIPMENT

C:\Logs\Cargill Inc\Cargill 18\Run_3 Triple\3531404\Cargill Inc_Cargill 18_Run_3 Triple_3531404_Main Pass.dta

-CONFIDENTIAL-

3/8" Triple Cone Cable Head (MCB F B)
MCB-F.B 52   LG: 1.58 ft   WT: 15.4 lb   OD: 2.24 in

Compact Stiff Bridle Electrode Sub.
MBE-C.B 328   LG: 12.33 ft   WT: 77.2 lb   OD: 2.28 in

Compact Stiff Bridle Electrode Sub.
MBE-C.B 329   LG: 12.33 ft   WT: 77.2 lb   OD: 2.28 in

SHA-J.A Compact Swivel Head Adaptor
SHA-J.A 353   LG: 2.30 ft   WT: 22.0 lb   OD: 2.24 in

Compact Comms Gamma
MCG-B 60   LG: 8.70 ft   WT: 63.9 lb   OD: 2.24 in

Compact Neutron
MDN-A.B 80   LG: 5.04 ft   WT: 50.7 lb   OD: 2.24 in

Compact Density/Caliper
MPD-A.A 20   LG: 9.53 ft   WT: 90.4 lb   OD: 2.45 in

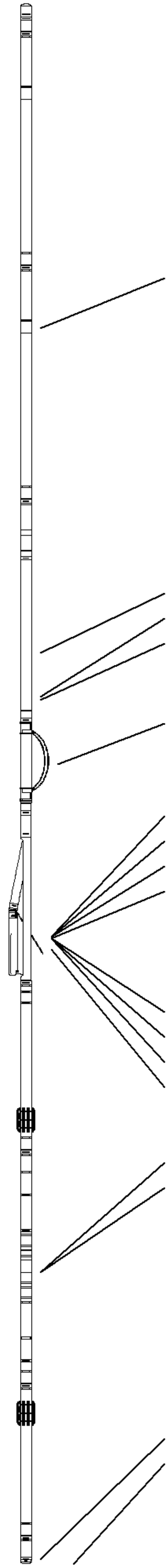
Compact Upper Guard sub
MUG-B.B 316   LG: 8.98 ft   WT: 68.3 lb   OD: 2.24 in

Compact Laterolog Electrode Sub.
MLE-C.K 233   LG: 12.34 ft   WT: 92.6 lb   OD: 2.24 in

Compact Lower Guard Sub.
MLG-A 36   LG: 8.00 ft   WT: 55.1 lb   OD: 2.24 in

Compact High Resolution Temperature
MHT-A 15   LG: 1.53 ft   WT: 13.2 lb   OD: 2.24 in

Total   Length: 82.65 ft   Weight: 626.1 lb



65.36 ft   SPDL - Spontaneous Potential

48.83 ft   GGCE - Borehole Corrected Gamma
46.65 ft   CCLG - Casing Collar Locator
45.92 ft   CGXT - MCG External Temperature

42.37 ft   NPRL - Limestone Neutron Por.

35.13 ft   AVOL - Annular Volume
35.13 ft   HVOL - Hole Volume
35.13 ft   CLDC - Density Caliper
33.20 ft   DCOR - Density Correction

33.20 ft   MTXD - Matrix density
33.20 ft   DPOR - Base Density Porosity
33.20 ft   DEN - Compensated Density
33.14 ft   PDPE - PE

15.58 ft   DSLL - Shallow Laterolog
15.58 ft   DDLL - Deep Laterolog

Tool Zero   (0.13ft from bottom)
-0.13 ft   SMTU - DST Uphole Tension
All measurements relative to tool zero.

COMPANY   Cargill, Inc.
WELL   Cargill 18

WELL	Cargill 16	
FIELD	Lansing	
PROVINCE/COUNTY	Tompkins County	-CONFIDENTIAL-
COUNTRY/STATE	U.S.A. / New York	

Elevation Kelly Bushing	752.16	feet	First Reading	1553.00	feet
Elevation Drill Floor	752.16	feet	Depth Driller	1550.00	feet
Elevation Ground Level	748.16	feet	Depth Logger	1553.00	feet

Weatherford®

Dual Laterolog

Gamma Ray

Weatherford

Photo Density
Compensated Neutron
Gamma Ray

COMPANY	Cargill, Inc.
WELL	Cargill 18
FIELD	Lansing
PROVINCE/COUNTY	Tompkins County
COUNTRY/STATE	U.S.A. / New York
LOCATION	X=820507.58, Y=937023.59 Z/Elevation=784.16 WEL

SEC	TWP	RGE	Other Services	
			Dual Laterolog	Data Pack
			Cross Dipole	Caliper

API Number
Permit Number 31-109-26509-00

Permanent Datum Ground Level, Elevation 748.16 feet
Log Measured From GL
Drilling Measured From GLL

Elevations:	feet
KB	752.16
DF	752.16
GL	748.16

Date	22-May-2013		
Run Number	One		
Service Order	3531404		
Depth Driller	1550.00 feet		
Depth Logger	1553.00 feet		
First Reading	1553.00 feet		
Last Reading	30.00 feet		
Casing Driller	590.00 feet		
Casing Logger	580.00 feet		
Bit Size	6.250 inches		
Hole Fluid Type	Brine		
Density / Viscosity	9.50 lb/USg	27.00 sec/qt	
PH / Fluid Loss			
Sample Source	Flow Line		
Rm @ Measured Temp	0.054 @ 78.0 ohm-m		
Rmf @ Measured Temp	0.041 @ 78.0 ohm-m		
Rmc @ Measured Temp	0.081 @ 78.0 ohm-m		
Source Rmf / Rmc	Calc.	Calc.	
Rm @ BHT	0.054 @ 78.0 ohm-m		
Time Since Circulation	4 Hrs		
Max Recorded Temp	71.00 deg F		
Equipment / Base	13041	Muncy	
Recorded By	Nibras Nureldin		
Witnessed By	Patrick McGrath		

BOREHOLE RECORD

Last Edited: 22-MAY-2013 20:52

Bit Size inches	Depth From feet	Depth To feet
8.750	28.50	580.00
6.250	580.00	1553.00

CASING RECORD

Type	Size inches	Depth From feet	Shoe Depth feet	Weight pounds/ft
	10.750	0.00	28.00	42.00
	7.000	0.00	580.00	17.00

REMARKS

Software: WLS 13.05.9583

Tools Run 1: MBE, MBE,SHA, MCG, MDN, MPD, MFE,MUG,MDL,MLG,BHT

Hardware: MDN - Dual Eccentraliser
MDL - Two-1 Inch Standoffs
MPD - Two Roll over subs

Density Matrix was ran on 2.71 gg/cc

Crew: Nibras Nureldin
Bruce Clark
Gary Cronin
Sebastian Londono

Gamma ray spikes up at the bottom of the borehole because the gamma ray sub ran below the sources
4.5 inch casing was used to calculate annular hole volumes
Gamma ray was recorded to ground level

-CONFIDENTIAL-

No Mud report was found on location.
100% Brine was added to the well that had 10% brine water in the well.

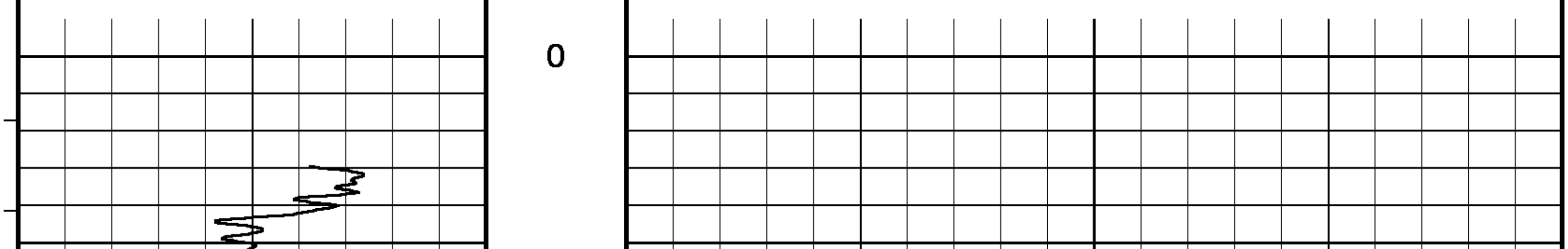
Mud Density is 9.5 lbs/USg

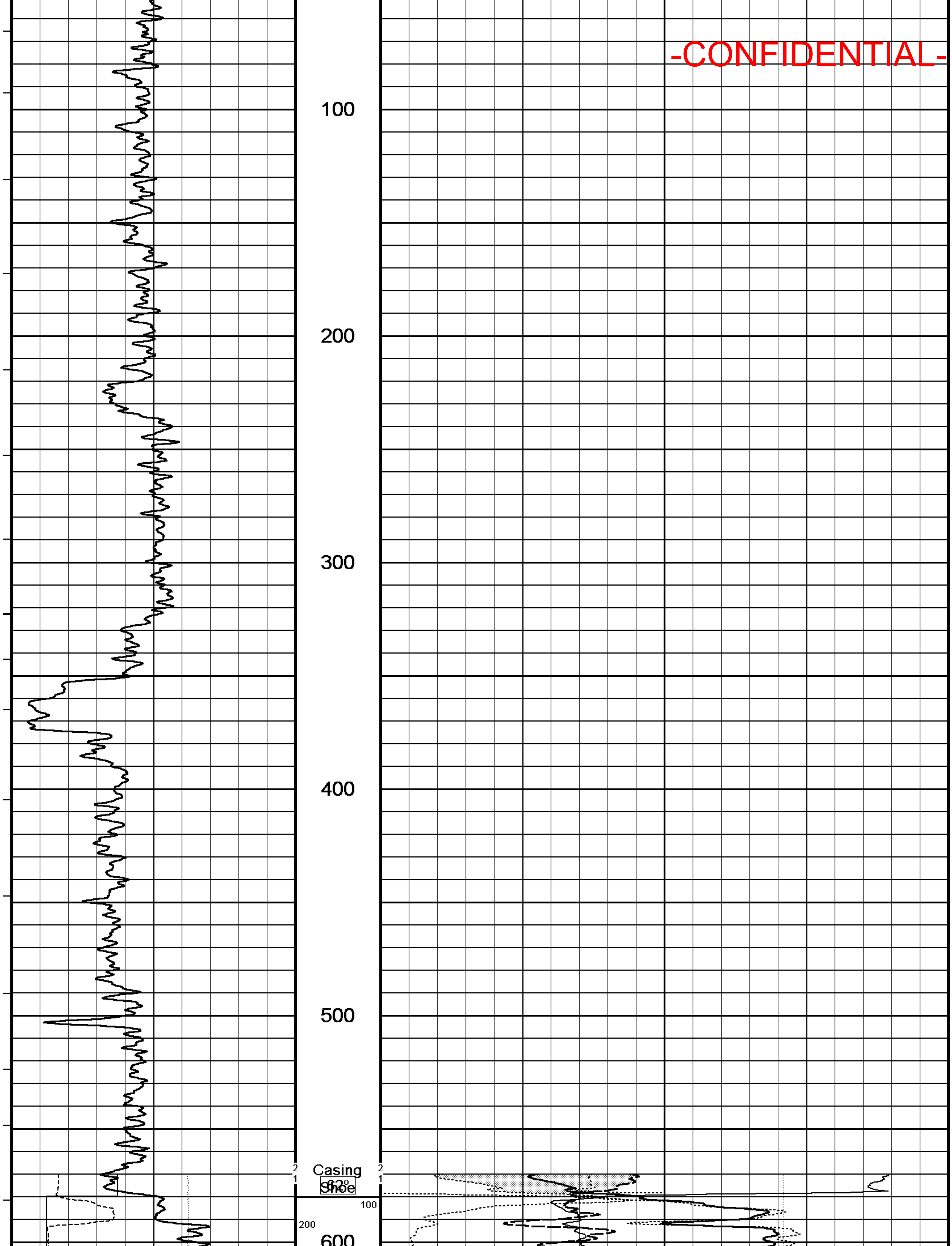
2 Inch Main Log

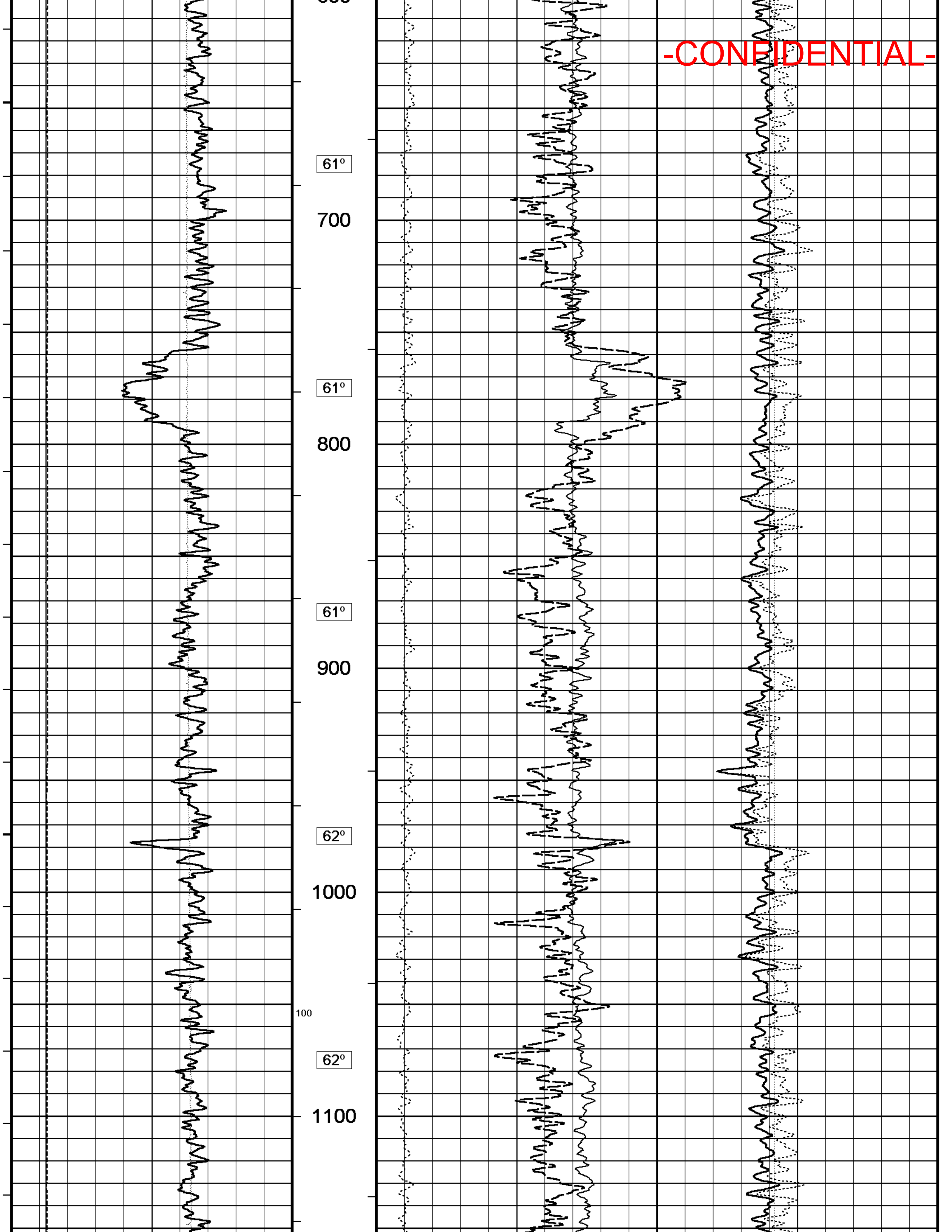
Depth Based Data - Maximum Sampling Increment 10.0cm
Plotted on 22-MAY-2013 23:12
Filename: C:\Logs\Cargill Inc\Cargill 18\...\Cargill Inc_Cargill 18_Run_3 Triple_3531404_Main Pass.dta
System Versions: Logged with 13.05.9583 Plotted with 13.05.9583

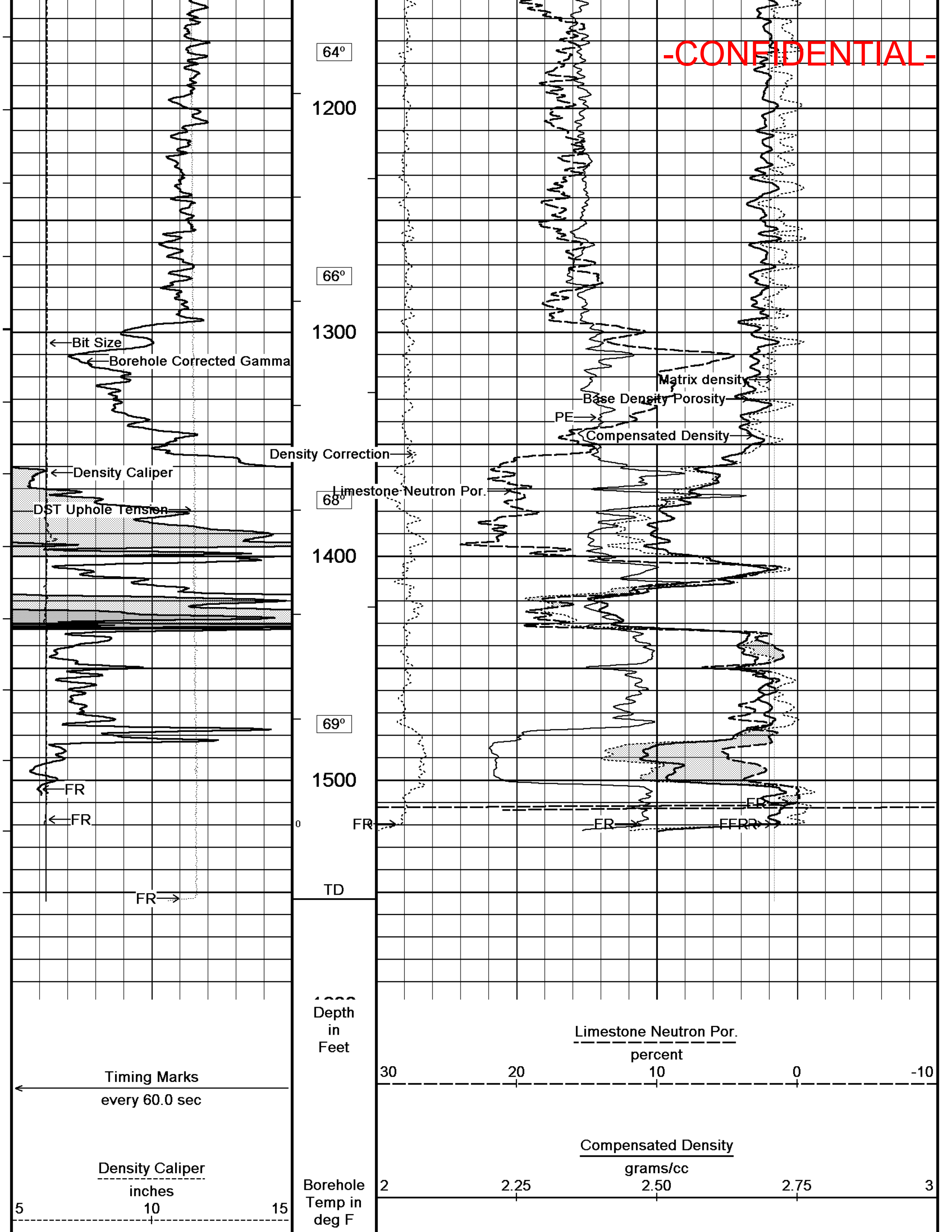
Timing Marks, every 60.0 sec	Depth in Feet	Limestone Neutron Por., percent: 30, 20, 10, 0, -10
Density Caliper, inches: 5, 10, 15	Borehole Temp in deg F	Compensated Density, grams/cc: 2, 2.25, 2.50, 2.75, 3
Borehole Corrected Gamma, API: 0, 100, 200; 200, 300, 400	HVI every 10 cu ft	PE, barns/electron: 0, 2.50, 5, 7.50, 10
Bit Size, inches: 5, 10, 15	Annular Integral every 10 cu ft	Base Density Porosity, percent: 30, 20, 10, 0, -10
		Matrix density, grams/cc: 2, 2.25, 2.50, 2.75, 3
DST Uphole Tension, pounds: 0, 3000; 3000, 6000	Replay Scale 1:600	Density Correction, grams/cc: -0.05, 0.20, 0.45

0




100
200
300
400
500
Casing
Shoe
62°
2
1
2
1
100
200
600


-CONFIDENTIAL-
61°
700
61°
800
61°
900
62°
1000
100
62°
1100



-CONFIDENTIAL-
64º
1200
66º
1300
Bit Size
Borehole Corrected Gamma
Matrix density
Base Density Porosity
PE
Compensated Density
Density Correction
Density Caliper
Limestone Neutron Por.
68º
DST Uphole Tension
1400
69º
1500
FR
FR
FR
FR
FFRR
FR
0
TD
FR
Depth
in
Feet
Timing Marks
every 60.0 sec
Density Caliper
inches
5
10
15
Borehole
Temp in
deg F
Limestone Neutron Por.
percent
30
20
10
0
-10
Compensated Density
grams/cc
2
2.25
2.50
2.75
3

PE
barns/electron
-CONFIDENTIAL-

0	2.50	5	7.50	10

Borehole Corrected Gamma
API
0 100 200
200 300 400

HVI every 10 cu ft

Base Density Porosity
percent
30 20 10 0 -10

Bit Size
inches
5 10 15

Annular Integral every 10 cu ft

Matrix density
grams/cc
2 2.25 2.50 2.75 3

DST Uphole Tension
pounds
0 3000
3000 6000

Replay Scale 1:600

Density Correction
grams/cc
-0.05 0.20 0.45

Depth Based Data - Maximum Sampling Increment 10.0cm Plotted on 22-MAY-2013 23:12
Filename: C:\Logs\Cargill Inc\Cargill 18\...\Cargill Inc_Cargill 18_Run_3 Triple_3531404_Main Pass.dta
System Versions: Logged with 13.05.9583 Plotted with 13.05.9583

2 Inch Main Log

5 Inch Main Log

Depth Based Data - Maximum Sampling Increment 10.0cm Plotted on 22-MAY-2013 23:12
Filename: C:\Logs\Cargill Inc\Cargill 18\...\Cargill Inc_Cargill 18_Run_3 Triple_3531404_Main Pass.dta
System Versions: Logged with 13.05.9583 Plotted with 13.05.9583

Depth in Feet

Limestone Neutron Por.
percent
30 20 10 0 -10

Timing Marks
every 60.0 sec

Compensated Density
grams/cc
2 2.25 2.50 2.75 3

Density Caliper
inches
5 10 15

Borehole Temp in deg F

PE
barns/electron
0 2.50 5 7.50 10

Borehole Corrected Gamma
API
0 100 200
200 300 400

HVI every 10 cu ft

Base Density Porosity
percent
30 20 10 0 -10

Annular Integral every 10 cu ft

Bit Size
inches
5 10 15

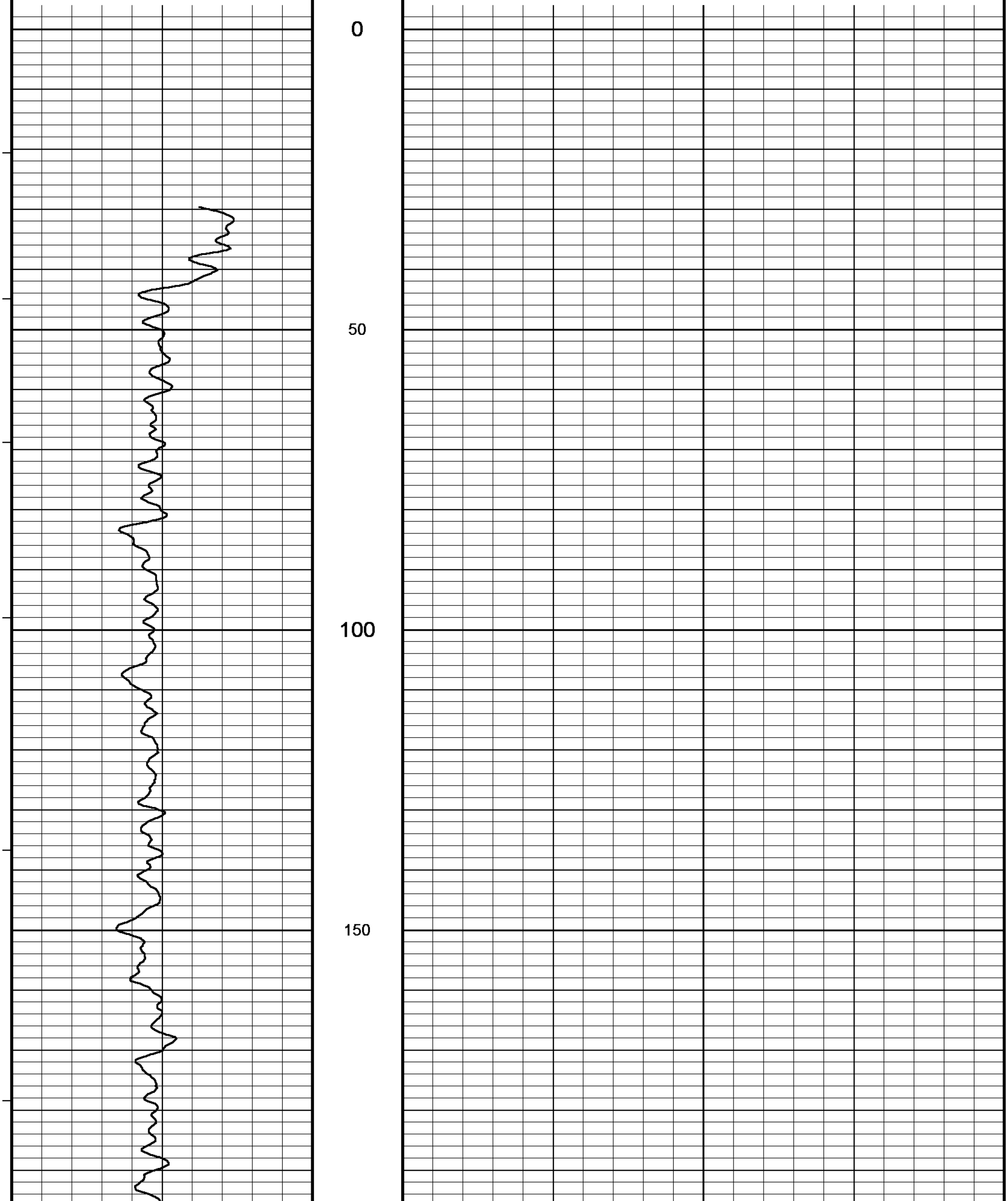
Matrix density
grams/cc
2 2.25 2.50 2.75 3

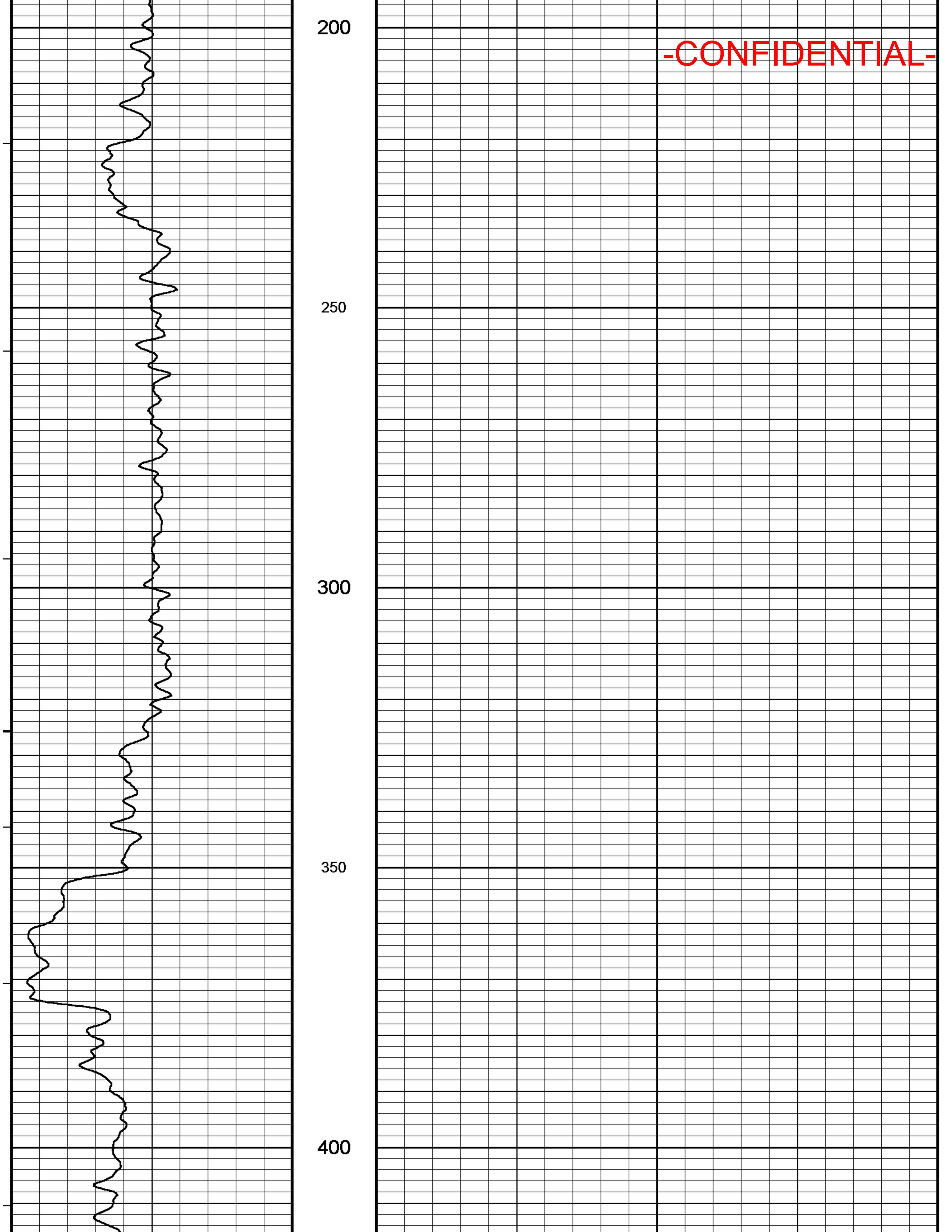
-CONFIDENTIAL-

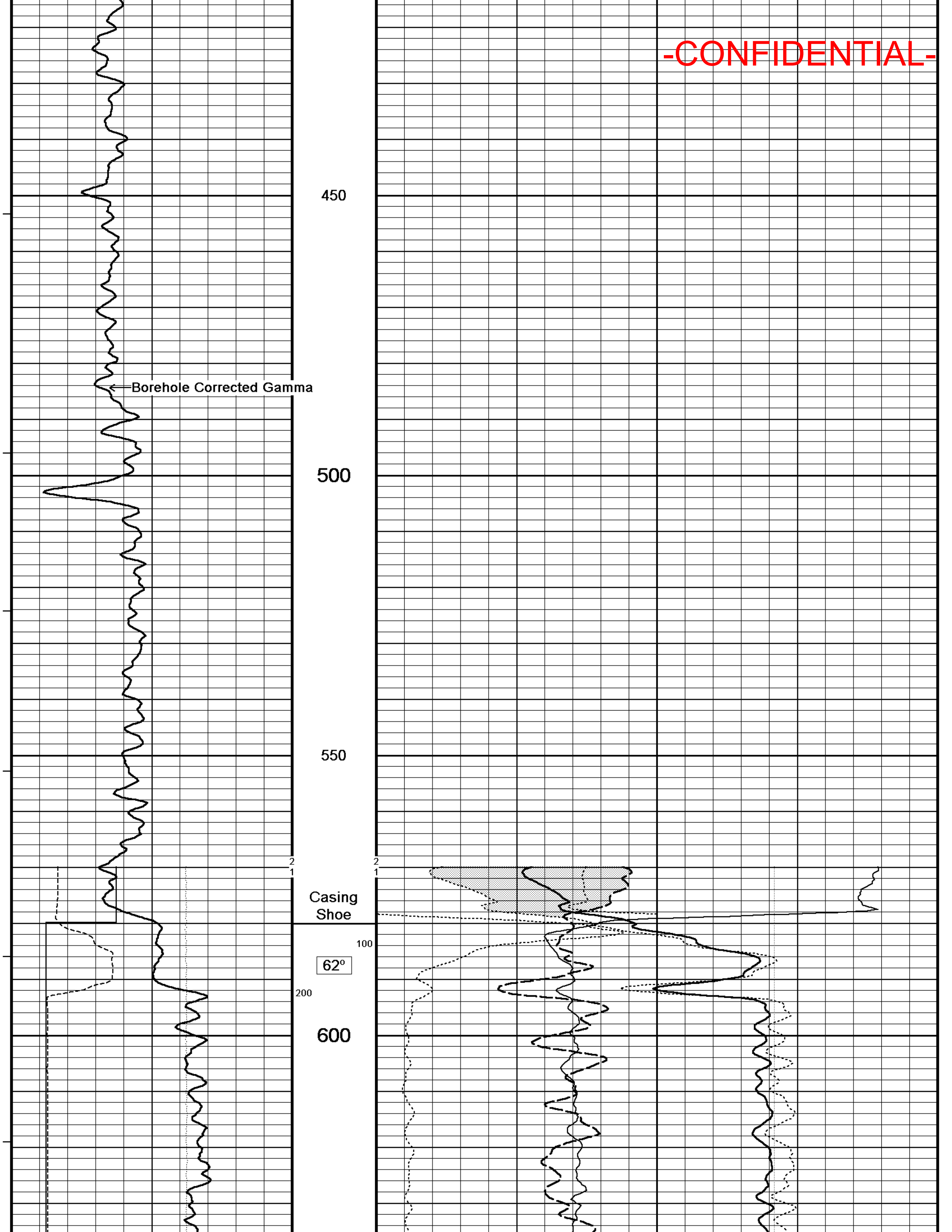
DST Uphole Tension
pounds
0 3000
3000 6000

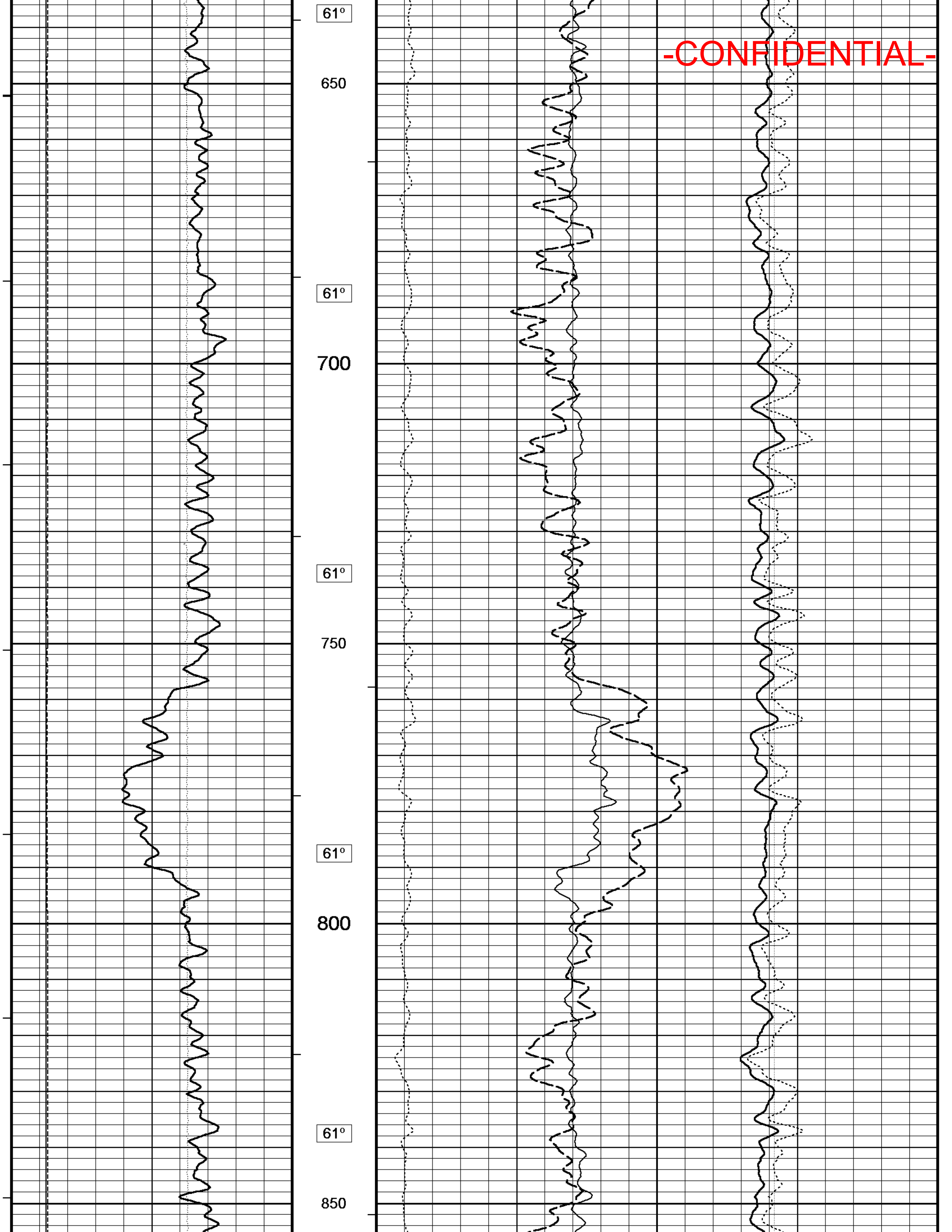
Replay
Scale
1:240

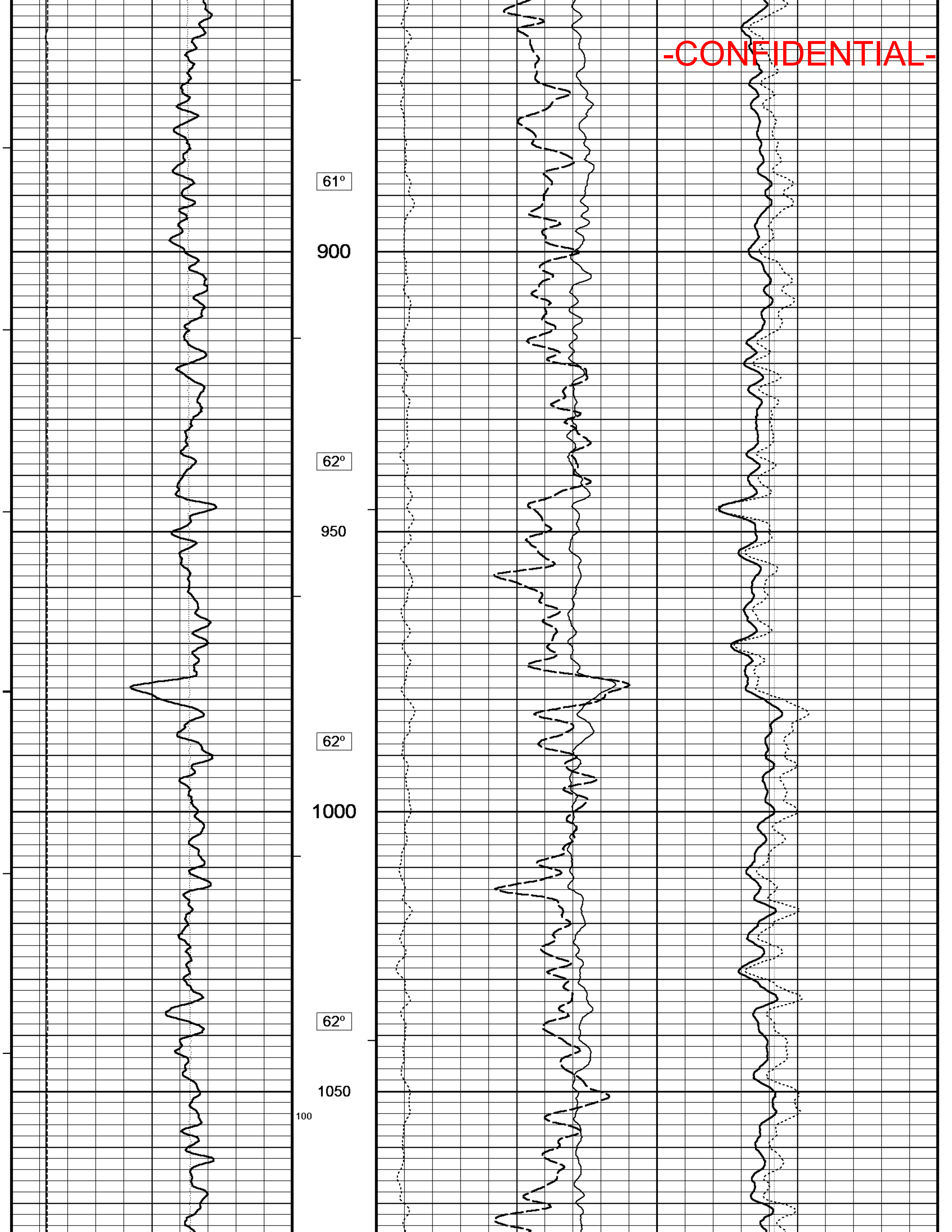
Density Correction
grams/cc
-0.05 0.20 0.45

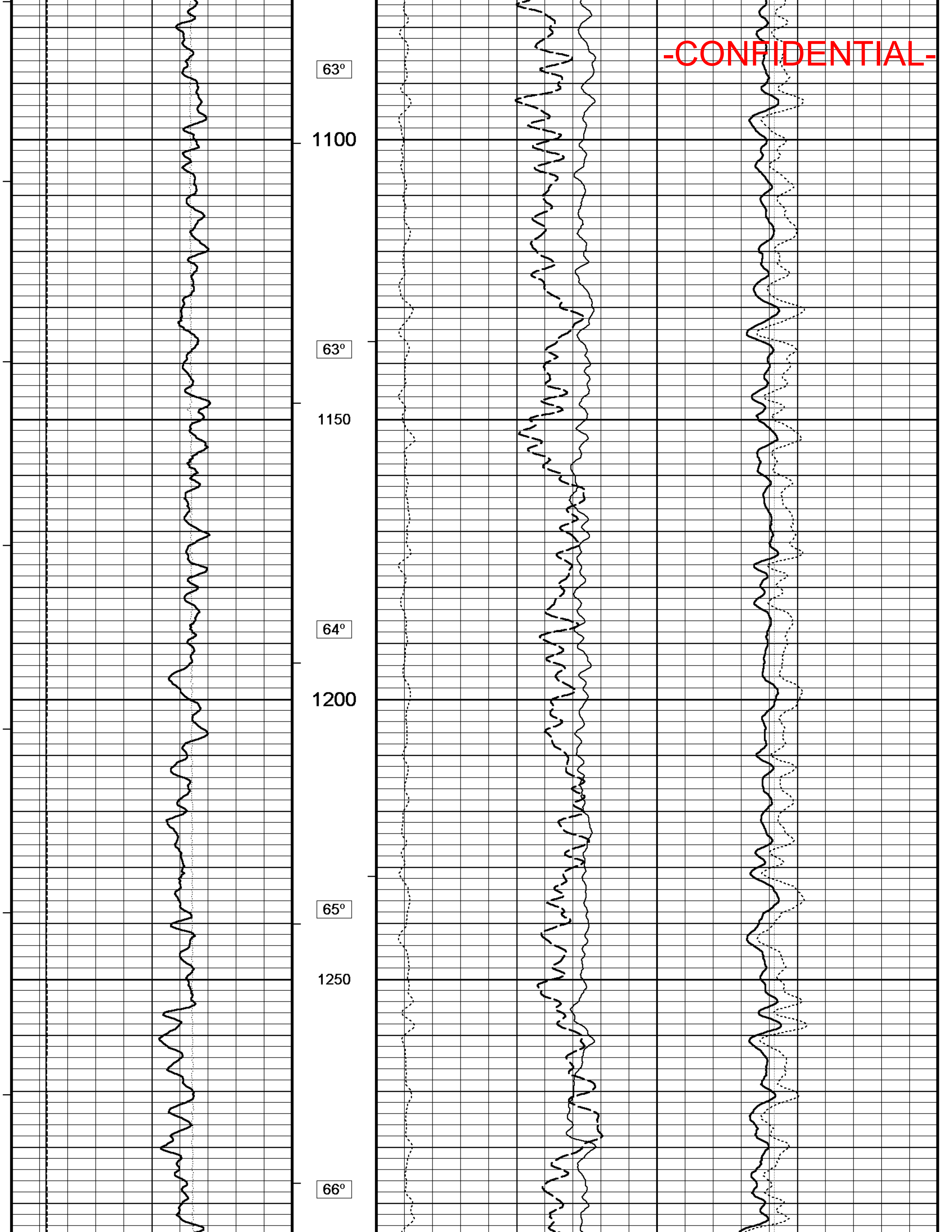


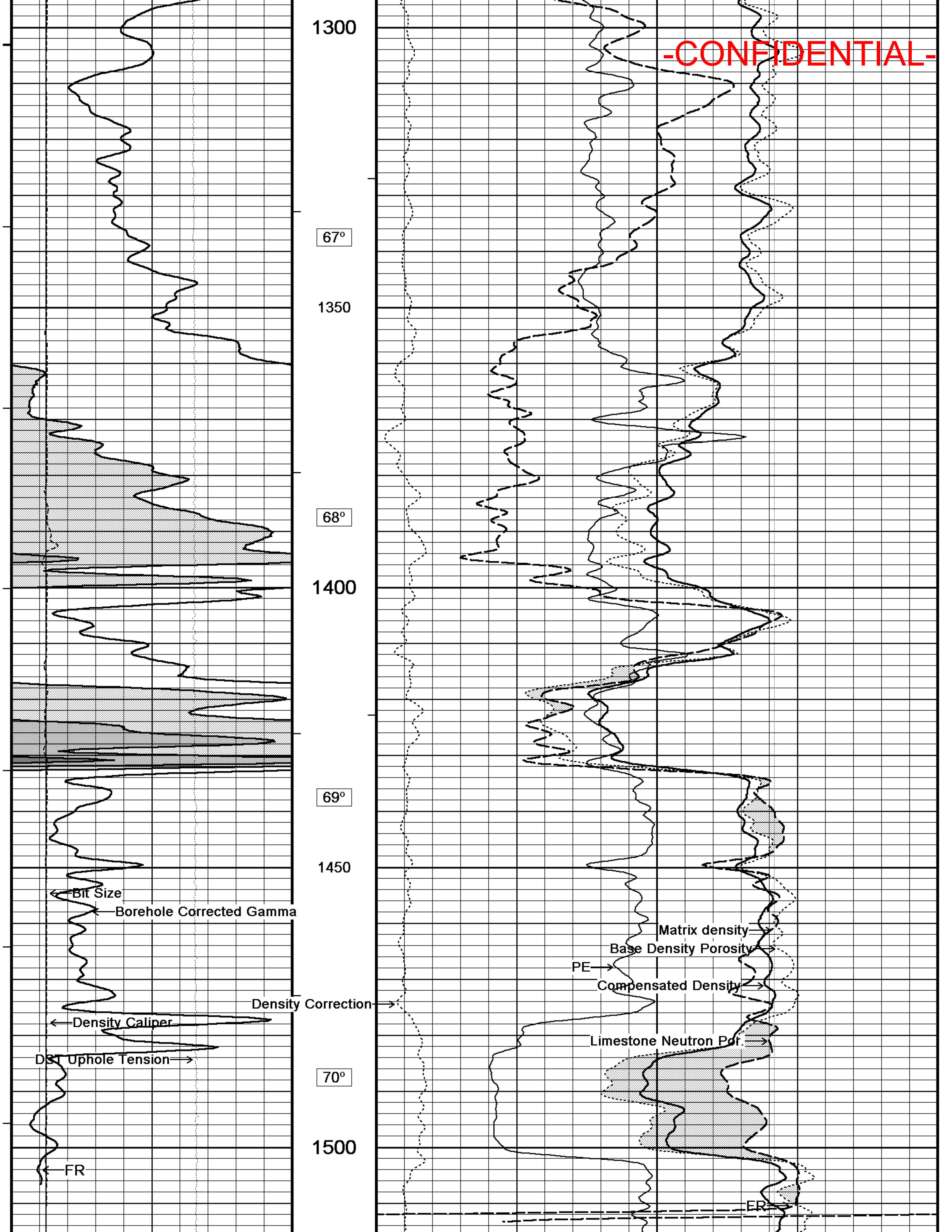

-CONFIDENTIAL-
200
250
300
350
400


-CONFIDENTIAL-
450
Borehole Corrected Gamma
500
550
2
1
2
1
Casing
Shoe
100
62º
200
600

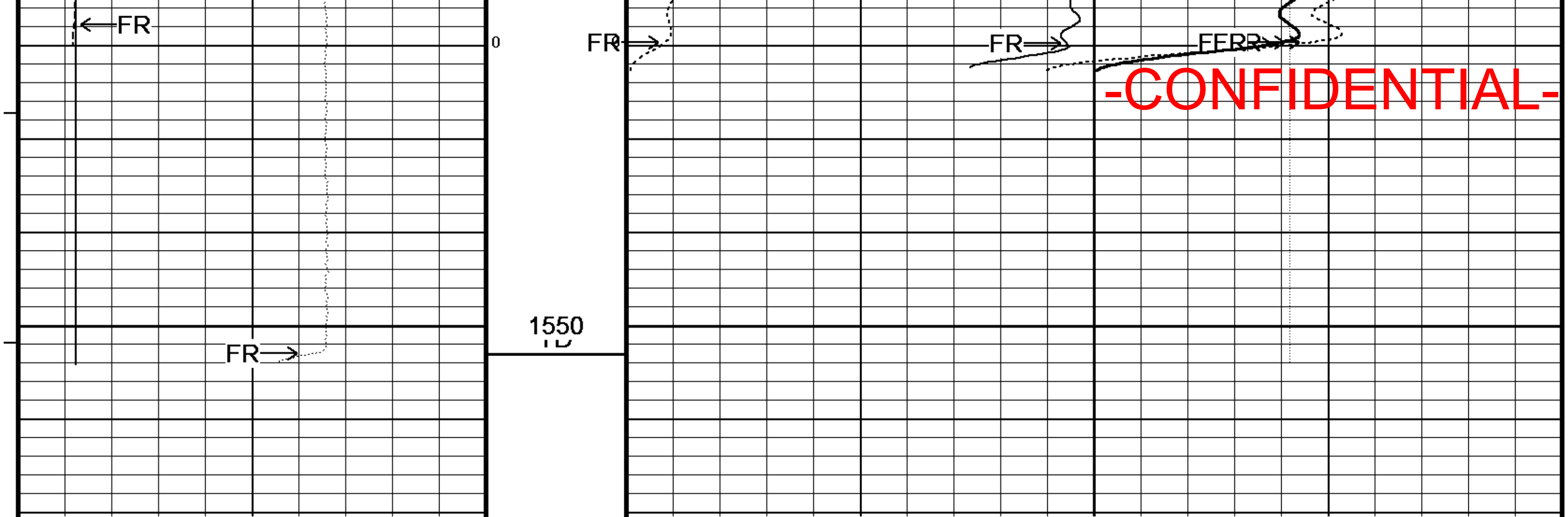

61°
650
61°
700
61°
750
61°
800
61°
850


-CONFIDENTIAL-
61°
900
62°
950
62°
1000
62°
1050
100


-CONFIDENTIAL-
63°
1100
63°
1150
64°
1200
65°
1250
66°



-CONFIDENTIAL-
1300
67°
1350
68°
1400
69°
1450
70°
1500
Bit Size
Borehole Corrected Gamma
Density Correction
Density Caliper
DST Uphole Tension
FR
Matrix density
Base Density Porosity
PE
Compensated Density
Limestone Neutron Por.
FR



Depth in Feet

Timing Marks
every 60.0 sec

Limestone Neutron Por.
percent
30 20 10 0 -10

Compensated Density
grams/cc
2 2.25 2.50 2.75 3

Density Caliper
inches
5 10 15

Borehole Temp in deg F

PE
barns/electron
0 2.50 5 7.50 10

Borehole Corrected Gamma
API
0 100 200
200 300 400

HVI every 10 cu ft

Base Density Porosity
percent
30 20 10 0 -10

Bit Size
inches
5 10 15

Annular Integral every 10 cu ft

Matrix density
grams/cc
2 2.25 2.50 2.75 3

DST Uphole Tension
pounds
0 3000
3000 6000

Replay Scale 1:240

Density Correction
grams/cc
-0.05 0.20 0.45

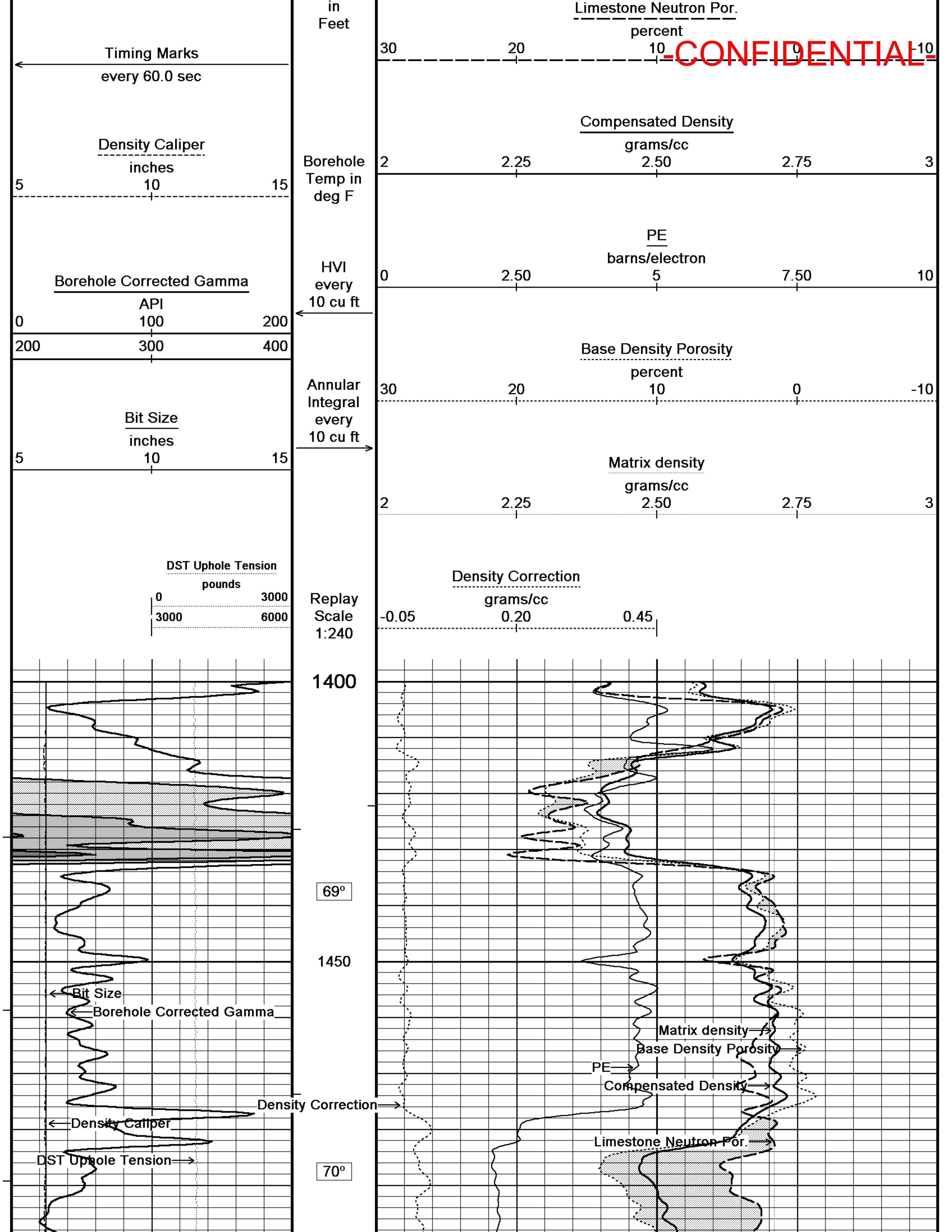
Depth Based Data - Maximum Sampling Increment 10.0cm
Plotted on 22-MAY-2013 23:12
Filename: C:\Logs\Cargill Inc\Cargill 18\...\Cargill Inc_Cargill 18_Run_3 Triple_3531404_Main Pass.dta
System Versions: Logged with 13.05.9583 Plotted with 13.05.9583

5 Inch Main Log

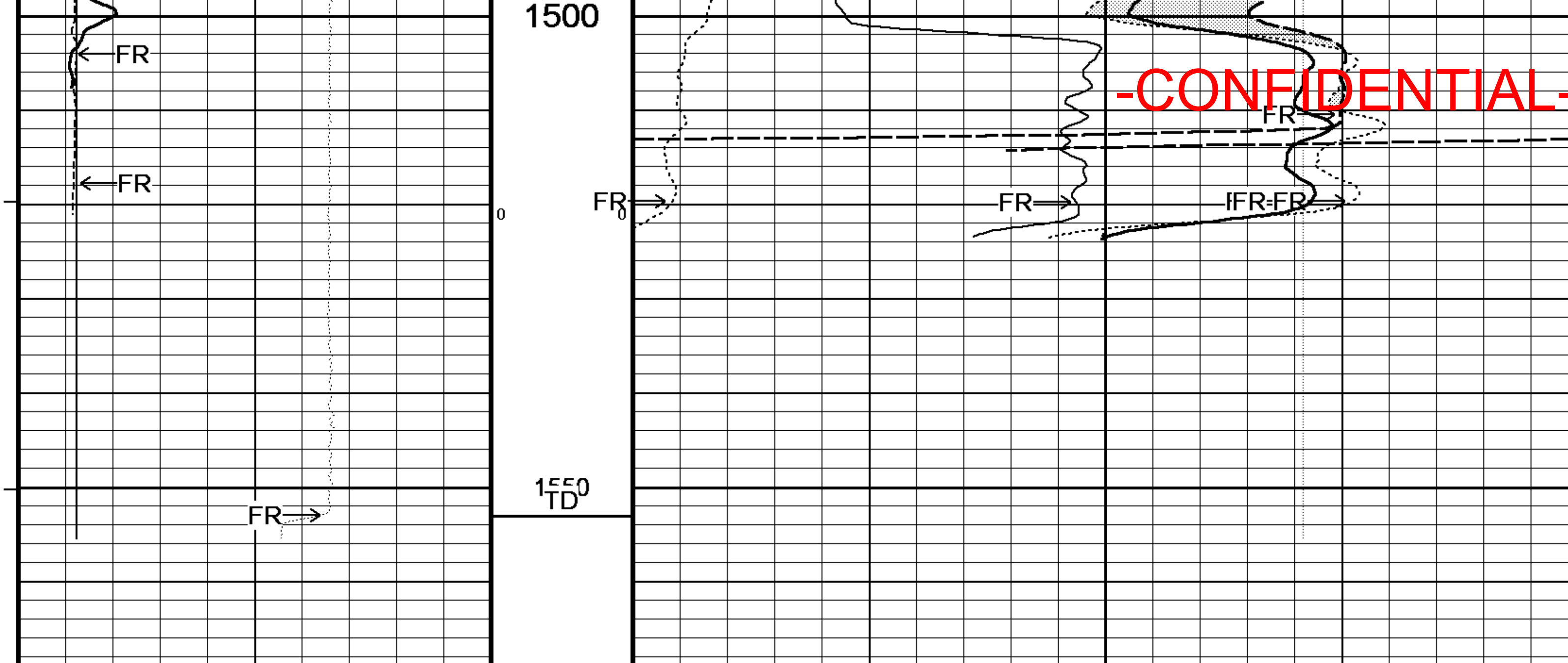
5 Inch Repeat Section

Depth Based Data - Maximum Sampling Increment 10.0cm
Plotted on 22-MAY-2013 23:12
Filename: C:\Logs\Cargill Inc\Cargill 1...\Cargill Inc_Cargill 18_Run_3 Triple_3531404_Repeat Pass.dta
System Versions: Logged with 13.05.9583 Plotted with 13.05.9583

Depth



Timing Marks
every 60.0 sec
Density Caliper
inches
5 10 15
Borehole Corrected Gamma
API
0 100 200
200 300 400
Bit Size
inches
5 10 15
DST Uphole Tension
pounds
0 3000
3000 6000
in
Feet
Borehole
Temp in
deg F
HVI
every
10 cu ft
Annular
Integral
every
10 cu ft
Replay
Scale
1:240
Limestone Neutron Por.
percent
30 20 10 0 -10
-CONFIDENTIAL-
Compensated Density
grams/cc
2 2.25 2.50 2.75 3
PE
barns/electron
0 2.50 5 7.50 10
Base Density Porosity
percent
30 20 10 0 -10
Matrix density
grams/cc
2 2.25 2.50 2.75 3
Density Correction
grams/cc
-0.05 0.20 0.45
1400
69º
1450
70º
Bit Size
Borehole Corrected Gamma
Density Correction
Density Caliper
DST Uphole Tension
Matrix density
Base Density Porosity
PE
Compensated Density
Limestone Neutron Por.



Depth in Feet

Borehole Temp in deg F

HVI every 10 cu ft

Annular Integral every 10 cu ft

Replay Scale 1:240

Timing Marks
every 60.0 sec

Density Caliper
inches
5 10 15

Borehole Corrected Gamma
API
0 100 200
200 300 400

Bit Size
inches
5 10 15

DST Uphole Tension
pounds
0 3000
3000 6000

Limestone Neutron Por.
percent
30 20 10 0 -10

Compensated Density
grams/cc
2 2.25 2.50 2.75 3

PE
barns/electron
0 2.50 5 7.50 10

Base Density Porosity
percent
30 20 10 0 -10

Matrix density
grams/cc
2 2.25 2.50 2.75 3

Density Correction
grams/cc
-0.05 0.20 0.45

Depth Based Data - Maximum Sampling Increment 10.0cm
Plotted on 22-MAY-2013 23:12
Filename: C:\Logs\Cargill Inc\Cargill 1...\Cargill Inc_Cargill 18_Run_3 Triple_3531404_Repeat Pass.dta
System Versions: Logged with 13.05.9583 Plotted with 13.05.9583

5 Inch Repeat Section

BEFORE SURVEY CALIBRATION

General Constants All 000

Last Edited on 22-MAY-2013,15:40

General Parameters		
Mud Resistivity	0.054	ohm-metres
Mud Resistivity Temperature	78.000	degrees F
Water Level	0.000	feet
Borehole Fluid Processing	Water Level Switch	
Hole/Annular Volume and Differential Caliper Parameters		
HVOL Method	Single Caliper	
HVOL Caliper 1	Density Caliper	
HVOL Caliper 2	N/A	
Annular Volume Diameter	4.500	inches
Caliper for Differential Caliper	Density Caliper	
Rwa Parameters		
Porosity used	Base Density Porosity	
Resistivity used	Deep Laterolog	
RWA Constant A	0.610	
RWA Constant M	2.150	
SW/APOR Tool Source	0.000	

Gamma Calibration MCG-B 60

Field Calibration on 21-MAY-2013 09:51

	Measured	Calibrated (API)
Background	78	55
Calibrator (Gross)	2255	1594
Calibrator (Net)	2177	1539

Gamma Constants MCG-B 60

Last Edited on 18-MAY-2013,20:47

Gamma Calibrator Number	45	
Mud Density	1.03	gm/cc
Caliper Source for Processing	Density Caliper	
Tool Position	Eccentred	
Concentration of KCl		kppm
K Mud Type	Chloride	
K Mud Concentration	0.00	%

High Resolution Temperature Calibration MCG-B 60

Field Calibration on 24-APR-2013,11:52

	Measured	Calibrated(Deg F)
Lower	60.00	60.00
Upper	101.00	100.00

High Resolution Temperature Constants MCG-B 60

Last Edited on 24-APR-2013,11:52

Pre-filter Length	11

Neutron Calibration MDN-A.B 80

Base Calibration on 24-APR-2013,12:07
Field Check on 21-MAY-2013 09:37

Base Calibration

	Measured		Calibrated (cps)	
	Near	Far	Near	Far
	3504	108	3714	110
Ratio	32.559		33.764	

Field Calibrator at Base

	Calibrated (cps)	
	1457	2097
Ratio	0.695	

Field Check

	Calibrated (cps)	
	1211	1819
Ratio	0.666	

Neutron Constants MDN-A.B 80

Last Edited on 22-MAY-2013,14:46

Neutron Source Id	P0197NN
Neutron Jig Number	50656N
Epithermal Neutron	No
Caliper Source for Processing	Density Caliper

Stand-off	0.00	inches
Mud Density	1.03	gm/cc
Limestone Sigma	7.10	cu
Sandstone Sigma	4.26	cu
Dolomite Sigma	4.70	cu
Formation Pressure Source	Constant Value	
Formation Pressure	0.00	kpsi
Temperature Source	Constant Value	
Temperature	68.00	degrees F
Mud Salinity	0.00	kppm
Salinity Correction	Not Applied	
Formation Fluid Salinity Source	Constant Value	
Formation Fluid Salinity	0.00	kppm
Barite Mud Correction	Not Applied	

Caliper Calibration MPD-A.A 20

Base Calibration on 14-MAY-2013 15:42
Field Calibration on 21-MAY-2013 09:19

Base Calibration

Reading No	Measured	Calibrator Size (in)
1	25425	6.03
2	35728	7.99
3	45344	9.85
4	55749	11.82
5	0	0.00
6	N/A	N/A

Field Calibration

Measured Caliper (in)	Actual Caliper (in)
6.06	6.03

Photo Density Calibration MPD-A.A 20

Base Calibration on 14-MAY-2013 15:29
Field Check on 21-MAY-2013 09:25

Density Calibration

Base Calibration	Measured Near	Measured Far	Calibrated (sdu) Near	Calibrated (sdu) Far
Reference 1	42764	15583	53453	19407
Reference 2	20333	2614	25381	2580
Field Check at Base	1286.4	1488.0		
Field Check	1293.4	1484.9		

PE Calibration

Base Calibration	Measured WS	Measured WH	Measured Ratio	Calibrated Ratio
Background	232	1140		
Reference 1	14360	42576	0.341	0.320
Reference 2	5518	20178	0.278	0.274
Field Check at Base	232.2	1139.7		
Field Check	235.9	1148.2		

Density Constants MPD-A.A 20

Last Edited on 15-MAY-2013,08:31

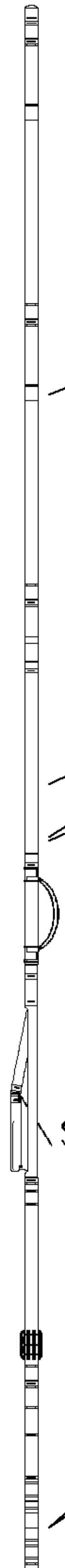
Density Source Id	21145B	
Nylon Calibrator Number	DNC-D-520	
Aluminium Calibrator Number	DAC-D-520	
Density Shoe Profile	8 inch	
Caliper Source for Processing	Density Caliper	
PE Correction to Density	Not Applied	
Mud Density	1.02	gm/cc
Mud Density Z/A Multiplier	1.11	
Mud Filtrate Density	1.00	gm/cc
Dry Hole Mud Filtrate Density	0.70	gm/cc
DNCT	0.00	gm/cc
CRCT	0.00	gm/cc
Density Z/A Correction	Hybrid	

Density Z/A Correction	Hybrid
Matrix Density (gm/cc)	**Depth (ft)**
2.71	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	

-CONFIDENTIAL-

DOWNHOLE EQUIPMENT

C:\Logs\Cargill Inc\Cargill 18\Run_3 Triple\3531404\Cargill Inc_Cargill 18_Run_3 Triple_3531404_Main Pass.dta



3/8" Triple Cone Cable Head (MCB F B)
MCB-F.B 52 LG: 1.58 ft WT: 15.4 lb OD: 2.24 in

Compact Stiff Bridle Electrode Sub.
MBE-C.B 328 LG: 12.33 ft WT: 77.2 lb OD: 2.28 in

Compact Stiff Bridle Electrode Sub.
MBE-C.B 329 LG: 12.33 ft WT: 77.2 lb OD: 2.28 in

65.36 ft SPDL - Spontaneous Potential

SHA-J.A Compact Swivel Head Adaptor
SHA-J.A 353 LG: 2.30 ft WT: 22.0 lb OD: 2.24 in

Compact Comms Gamma
MCG-B 60 LG: 8.70 ft WT: 63.9 lb OD: 2.24 in

48.83 ft GGCE - Borehole Corrected Gamma
46.65 ft CCLG - Casing Collar Locator
45.92 ft CGXT - MCG External Temperature

Compact Neutron
MDN-A.B 80 LG: 5.04 ft WT: 50.7 lb OD: 2.24 in

42.37 ft NPRL - Limestone Neutron Por.

Compact Density/Caliper
MPD-A.A 20 LG: 9.53 ft WT: 90.4 lb OD: 2.45 in

35.13 ft AVOL - Annular Volume
35.13 ft HVOL - Hole Volume
35.13 ft CLDC - Density Caliper
33.20 ft DCOR - Density Correction

Compact Upper Guard sub
MUG-B.B 316 LG: 8.98 ft WT: 68.3 lb OD: 2.24 in

33.20 ft MTXD - Matrix density
33.20 ft DPOR - Base Density Porosity
33.20 ft DEN - Compensated Density
33.14 ft PDPE - PE

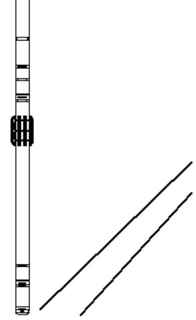
Compact Laterolog Electrode Sub.
MLE-C.K 233 LG: 12.34 ft WT: 92.6 lb OD: 2.24 in

15.58 ft DSLL - Shallow Laterolog
15.58 ft DDLL - Deep Laterolog

Compact Lower Guard Sub.
MLG-A 36   LG: 8.00 ft   WT: 55.1 lb   OD: 2.24 in

Compact High Resolution Temperature
MHT-A 15   LG: 1.53 ft   WT: 13.2 lb   OD: 2.24 in

Total   Length: 82.65 ft   Weight: 626.1 lb



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Tool Zero   (0.13ft from bottom)
-0.13 ft   SMTU - DST Uphole Tension
All measurements relative to tool zero.

COMPANY	Cargill, Inc.
WELL	Cargill 18
FIELD	Lansing
PROVINCE/COUNTY	Tompkins County
COUNTRY/STATE	U.S.A. / New York

Elevation Kelly Bushing	752.16	feet	First Reading	1553.00	feet
Elevation Drill Floor	752.16	feet	Depth Driller	1550.00	feet
Elevation Ground Level	748.16	feet	Depth Logger	1553.00	feet

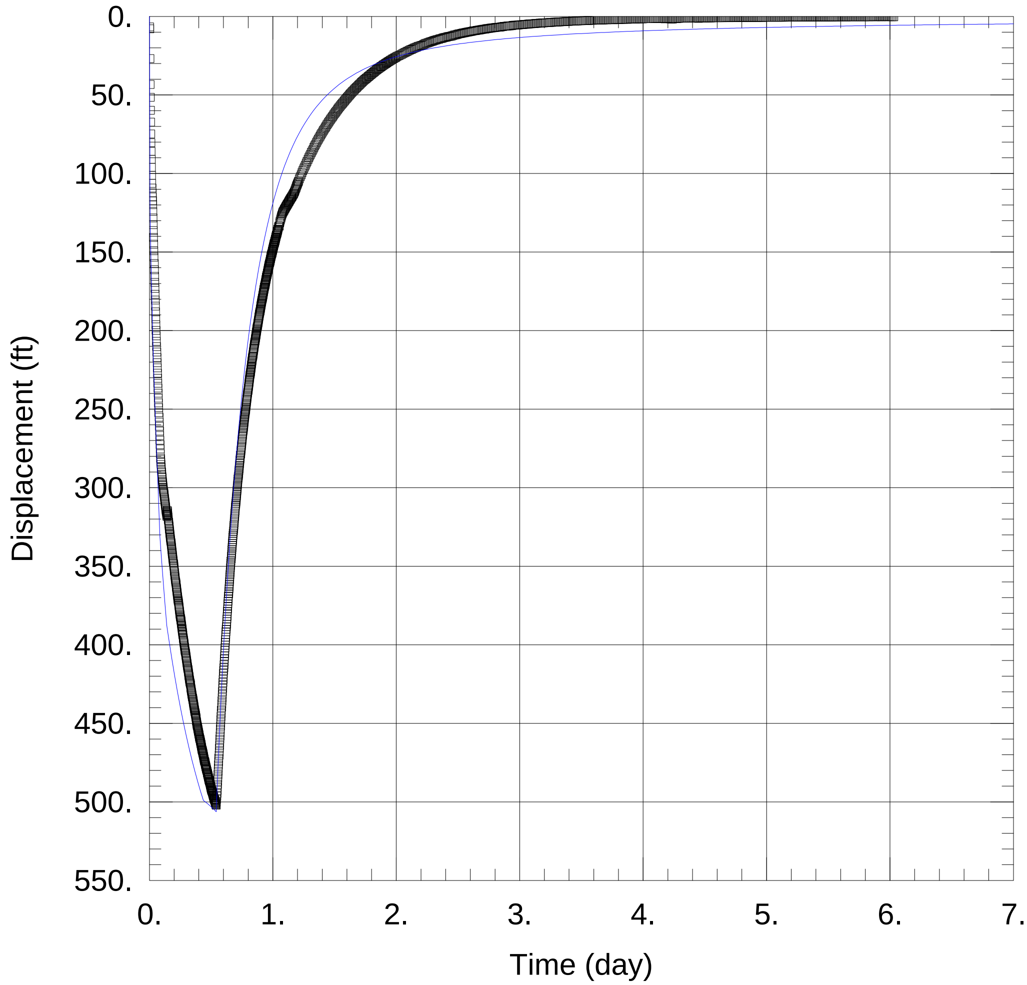
Weatherford®

Photo Density
Compensated Neutron
Gamma Ray

APPENDIX D

AQTESOLV SOLUTION DATA

-CONFIDENTIAL-



WELL TEST ANALYSIS

Data Set: C:\...\Corehole#18_DB (JDO)_DJG.aqt
Date: 11/12/13 Time: 16:28:06

PROJECT INFORMATION

Company: RESPEC
Client: Cargill De-Icing Technologies
Project: 2099
Location: Lansing, NY
Test Well: Corehole #18
Test Date: 6/27/13

AQUIFER DATA

Saturated Thickness: 50. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Corehole #18	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ Corehole #18	0	0

SOLUTION

Aquifer Model: Confined Solution Method: Dougherty-Babu

T = 0.9992 ft^2/day S = 5.0E-5
Kz/Kr = 1. Sw = 0.
r(w) = 0.2865 ft r(c) = 0.2865 ft

Data Set: C:\Users\david.gnage\Documents\PROJECTS\1803-03_Cargill_Cayuga\2099_Corehole Oversight\Repor
Date: 11/12/13
Time: 16:29:09

PROJECT INFORMATION

Company: RESPEC
Client: Cargill De-Icing Technologies
Project: 2099
Location: Lansing, NY
Test Date: 6/27/13
Test Well: Corehole #18

AQUIFER DATA

Saturated Thickness: 50. ft
Anisotropy Ratio (Kz/Kr): 1.

PUMPING WELL DATA

No. of pumping wells: 1

Pumping Well No. 1: Corehole #18

X Location: 0. ft
Y Location: 0. ft

Casing Radius: 0.2865 ft
Well Radius: 0.2865 ft

Fully Penetrating Well

No. of pumping periods: 9

Pumping Period Data

Time (day)	Rate (gal/min)	Time (day)	Rate (gal/min)
0.	30.	0.08542	3.5
0.004861	15.	0.141	3.
0.00625	10.	0.4375	2.75
0.007986	5.5	0.5417	0.
0.03264	4.5		

OBSERVATION WELL DATA

No. of observation wells: 1

Observation Well No. 1: Corehole #18

X Location: 0. ft
Y Location: 0. ft

Radial distance from Corehole #18: 0. ft

Fully Penetrating Well

No. of Observations: 1299

Observation Data

Time (day)	Displacement (ft)	Time (day)	Displacement (ft)
0.00139	6.64	0.9042	184.
0.00278	7.894	0.9056	183.4
0.00417	26.88	0.9069	182.9
0.00556	43.39	0.9083	182.3
0.00694	51.45	0.9097	181.7
0.00833	59.74	0.9111	181.1
0.00972	67.27	0.9125	180.5
0.01111	74.76	0.9139	179.9

Time (day)	Displacement (ft)	Time (day)	Displacement (ft)
0.0125	80.45	0.9153	179.3
0.01389	85.92	0.9167	178.7
0.01528	90.92	0.9181	178.2
0.01667	96.15	0.9194	177.6
0.01806	101.1	0.9208	177.
0.01944	106.3	0.9222	176.4
0.02083	109.3	0.9236	175.9
0.02222	112.4	0.925	175.3
0.02361	114.9	0.9264	174.7
0.025	117.3	0.9278	174.1
0.02639	119.8	0.9292	173.6
0.02778	124.1	0.9306	173.
0.02917	128.3	0.9319	172.5
0.03056	132.6	0.9333	172.1
0.03194	136.3	0.9347	171.4
0.03333	140.7	0.9361	170.8
0.03472	144.9	0.9375	170.4
0.03611	149.1	0.9389	169.8
0.0375	153.3	0.9403	169.3
0.03889	157.3	0.9417	168.7
0.04028	161.3	0.9431	168.2
0.04167	165.5	0.9444	167.6
0.04306	169.3	0.9458	167.2
0.04444	173.1	0.9472	166.5
0.04583	176.8	0.9486	166.1
0.04722	180.5	0.95	165.6
0.04861	184.4	0.9514	165.
0.05	188.1	0.9528	164.5
0.05139	192.6	0.9542	164.
0.05278	196.3	0.9556	163.5
0.05417	199.8	0.9569	162.9
0.05556	203.3	0.9583	162.4
0.05694	206.8	0.9597	161.9
0.05833	210.2	0.9611	161.4
0.05972	213.6	0.9625	160.9
0.06111	217.1	0.9639	160.5
0.0625	220.5	0.9653	159.9
0.06389	223.7	0.9667	159.4
0.06528	227.1	0.9681	158.9
0.06667	230.3	0.9694	158.4
0.06806	233.5	0.9708	157.9
0.06944	236.6	0.9722	157.5
0.07083	239.8	0.9736	156.9
0.07222	243.	0.975	156.5
0.07361	246.	0.9764	156.1
0.075	249.1	0.9778	155.6
0.07639	252.2	0.9792	155.1
0.07778	255.1	0.9806	154.6
0.07917	258.2	0.9819	154.2
0.08056	260.9	0.9833	153.8
0.08194	263.9	0.9847	153.2
0.08333	266.8	0.9861	152.7
0.08472	269.7	0.9875	152.3
0.08611	272.6	0.9889	151.9
0.0875	275.4	0.9903	151.4
0.08889	278.4	0.9917	151.
0.09028	281.4	0.9931	150.5
0.09167	282.2	0.9944	150.
0.09306	283.8	0.9958	149.6
0.09444	285.2	0.9972	149.2
0.09583	286.8	0.9986	148.7
0.09722	288.4	1.	148.3
0.09861	289.9	1.001	147.8
0.1	291.4	1.003	147.3
0.1014	292.8	1.004	146.9
0.1028	293.7	1.006	146.5

Time (day)	Displacement (ft)	Time (day)	Displacement (ft)
0.1042	294.9	1.007	146.1
0.1056	295.8	1.008	145.6
0.1069	296.8	1.01	145.2
0.1083	297.6	1.011	144.7
0.1097	298.6	1.013	144.3
0.1111	299.7	1.014	143.9
0.1125	300.6	1.015	143.5
0.1139	301.4	1.017	143.1
0.1153	302.4	1.018	142.7
0.1167	303.1	1.019	142.3
0.1181	304.	1.021	141.9
0.1194	304.8	1.022	141.4
0.1208	305.7	1.024	141.
0.1222	306.6	1.025	140.5
0.1236	307.5	1.026	140.1
0.125	308.3	1.028	139.6
0.1264	309.1	1.029	139.2
0.1278	310.	1.031	138.7
0.1292	310.7	1.032	138.3
0.1306	311.6	1.033	137.9
0.1319	312.4	1.035	137.5
0.1333	313.2	1.036	137.
0.1347	314.1	1.038	136.7
0.1361	315.	1.039	136.2
0.1375	315.8	1.04	135.8
0.1389	316.8	1.042	135.4
0.1403	317.6	1.045	134.4
0.1417	318.2	1.049	133.5
0.1431	317.2	1.052	133.5
0.1444	315.9	1.056	131.4
0.1458	314.6	1.059	130.4
0.1472	315.2	1.063	129.4
0.1486	316.4	1.066	128.4
0.15	317.6	1.069	127.5
0.1514	318.6	1.073	126.6
0.1528	319.8	1.076	125.6
0.1542	320.8	1.08	124.9
0.1556	321.9	1.083	124.4
0.1569	322.9	1.087	123.9
0.1583	324.	1.09	123.4
0.1597	324.9	1.094	122.9
0.1611	326.	1.097	122.4
0.1625	326.8	1.101	122.
0.1639	327.9	1.104	121.4
0.1653	328.7	1.108	121.
0.1667	329.5	1.111	120.5
0.1681	330.6	1.115	120.
0.1694	331.5	1.118	119.6
0.1708	332.3	1.122	119.1
0.1722	333.2	1.125	118.6
0.1736	334.	1.128	118.1
0.175	334.9	1.132	117.7
0.1764	335.8	1.135	117.2
0.1778	336.7	1.139	116.8
0.1792	337.6	1.142	116.3
0.1806	338.6	1.146	115.9
0.1819	339.5	1.149	115.4
0.1833	340.6	1.153	115.
0.1847	341.4	1.156	114.6
0.1861	342.1	1.16	114.
0.1875	343.1	1.163	113.5
0.1889	344.1	1.167	113.
0.1903	345.	1.17	112.5
0.1917	345.9	1.174	111.9
0.1931	346.7	1.177	111.3
0.1944	347.6	1.181	110.6

Time (day)	Displacement (ft)	Time (day)	Displacement (ft)
0.1958	348.4	1.184	109.7
0.1972	349.3	1.188	109.1
0.1986	350.3	1.191	108.3
0.2	351.5	1.194	107.6
0.2014	352.8	1.198	106.9
0.2028	353.5	1.201	106.2
0.2042	354.4	1.205	105.5
0.2056	355.4	1.208	104.8
0.2069	356.1	1.215	103.5
0.2083	357.1	1.222	102.1
0.2097	357.8	1.229	100.8
0.2111	358.7	1.236	99.55
0.2125	359.7	1.243	98.27
0.2139	360.4	1.25	97.02
0.2153	361.2	1.257	95.87
0.2167	362.	1.264	94.67
0.2181	363.1	1.271	93.36
0.2194	363.9	1.278	92.28
0.2208	364.6	1.285	91.12
0.2222	365.5	1.292	89.95
0.2236	366.4	1.299	88.85
0.225	367.2	1.306	87.73
0.2264	368.	1.313	86.6
0.2278	368.8	1.319	85.57
0.2292	369.6	1.326	84.47
0.2306	370.5	1.333	83.4
0.2319	371.2	1.34	82.36
0.2333	371.9	1.347	81.34
0.2347	372.6	1.354	80.31
0.2361	373.6	1.361	79.3
0.2375	374.3	1.368	78.32
0.2389	375.2	1.375	77.32
0.2403	376.1	1.382	76.37
0.2417	376.9	1.389	75.45
0.2431	377.8	1.396	74.5
0.2444	378.6	1.403	73.55
0.2458	379.4	1.41	72.64
0.2472	380.2	1.417	71.76
0.2486	381.	1.424	70.96
0.25	381.8	1.431	70.08
0.2514	382.6	1.438	69.14
0.2528	383.3	1.444	68.35
0.2542	384.	1.451	67.52
0.2556	384.7	1.458	66.65
0.2569	385.4	1.465	65.86
0.2583	386.3	1.472	65.06
0.2597	387.1	1.479	64.25
0.2611	387.9	1.486	63.46
0.2625	388.6	1.493	62.68
0.2639	389.4	1.5	61.91
0.2653	390.1	1.507	61.14
0.2667	390.9	1.514	60.4
0.2681	391.7	1.521	59.66
0.2694	392.4	1.528	58.95
0.2708	393.2	1.535	58.18
0.2722	393.9	1.542	57.51
0.2736	395.4	1.549	56.77
0.275	396.2	1.556	56.1
0.2764	396.9	1.563	55.5
0.2778	397.6	1.569	54.84
0.2792	398.3	1.576	54.17
0.2806	399.	1.583	53.49
0.2819	399.8	1.59	52.84
0.2833	400.5	1.597	52.19
0.2847	401.3	1.604	51.57
0.2861	402.	1.611	50.91

Time (day)	Displacement (ft)	Time (day)	Displacement (ft)
0.2875	402.7	1.618	50.26
0.2889	403.5	1.625	49.66
0.2903	404.1	1.632	49.05
0.2917	404.9	1.639	48.46
0.2931	405.6	1.646	47.85
0.2944	406.4	1.653	47.28
0.2958	407.1	1.66	46.71
0.2972	407.7	1.667	46.12
0.2986	408.5	1.674	45.58
0.3	409.2	1.681	45.05
0.3014	410.	1.688	44.51
0.3028	410.6	1.694	43.92
0.3042	411.4	1.701	43.41
0.3056	412.1	1.708	42.88
0.3069	412.8	1.715	42.34
0.3083	413.4	1.722	41.84
0.3097	414.2	1.729	41.33
0.3111	414.9	1.736	40.83
0.3125	415.6	1.743	40.32
0.3139	416.3	1.75	39.84
0.3153	417.1	1.757	39.35
0.3167	417.9	1.764	39.01
0.3181	418.7	1.771	38.41
0.3194	419.4	1.778	38.02
0.3208	420.	1.785	37.59
0.3222	420.7	1.792	37.11
0.3236	421.4	1.799	36.67
0.325	422.1	1.806	36.24
0.3264	422.7	1.813	35.81
0.3278	423.4	1.819	35.35
0.3292	423.9	1.826	34.94
0.3306	424.5	1.833	34.52
0.3319	425.1	1.84	34.1
0.3333	425.7	1.847	33.71
0.3347	427.1	1.854	33.26
0.3361	427.7	1.861	32.86
0.3375	428.3	1.868	32.49
0.3389	429.	1.875	32.06
0.3403	429.5	1.882	31.71
0.3417	430.1	1.889	31.32
0.3431	430.9	1.896	30.93
0.3444	431.4	1.903	30.56
0.3458	432.	1.91	30.21
0.3472	432.7	1.917	29.87
0.3486	433.3	1.924	29.5
0.35	434.	1.931	29.11
0.3514	434.6	1.938	28.79
0.3528	435.2	1.944	28.44
0.3542	435.9	1.951	28.09
0.3556	436.5	1.958	27.75
0.3569	437.2	1.965	27.4
0.3583	437.8	1.972	27.09
0.3597	438.4	1.979	26.81
0.3611	439.	1.986	26.45
0.3625	439.7	1.993	26.24
0.3639	440.5	2.	25.86
0.3653	440.9	2.01	25.34
0.3667	441.7	2.021	25.02
0.3681	442.2	2.031	24.56
0.3694	442.8	2.042	24.16
0.3708	443.4	2.052	23.72
0.3722	444.1	2.063	23.29
0.3736	444.8	2.073	22.86
0.375	445.3	2.083	22.5
0.3764	445.9	2.094	22.08
0.3778	446.5	2.104	21.67

Time (day)	Displacement (ft)	Time (day)	Displacement (ft)
0.3792	447.1	2.115	21.28
0.3806	448.4	2.125	20.92
0.3819	448.9	2.135	20.55
0.3833	449.5	2.146	20.16
0.3847	450.1	2.156	19.82
0.3861	450.8	2.167	19.5
0.3875	451.5	2.177	19.14
0.3889	452.1	2.188	18.87
0.3903	452.6	2.198	18.63
0.3917	453.2	2.208	18.35
0.3931	453.7	2.219	18.
0.3944	454.3	2.229	17.6
0.3958	454.9	2.24	17.21
0.3972	455.3	2.25	16.93
0.3986	455.9	2.26	16.62
0.4	456.4	2.271	16.34
0.4014	456.9	2.281	16.08
0.4028	457.5	2.292	15.8
0.4042	458.	2.302	15.5
0.4056	458.7	2.313	15.24
0.4069	459.1	2.323	14.97
0.4083	459.7	2.333	14.73
0.4097	460.2	2.344	14.48
0.4111	460.7	2.354	14.25
0.4125	461.2	2.365	14.06
0.4139	461.8	2.375	13.83
0.4153	462.2	2.385	13.53
0.4167	462.7	2.396	13.43
0.4181	463.2	2.406	13.21
0.4194	463.7	2.417	12.84
0.4208	464.3	2.427	12.8
0.4222	464.9	2.438	12.67
0.4236	465.4	2.448	12.48
0.425	466.	2.458	12.19
0.4264	466.6	2.469	11.89
0.4278	467.1	2.479	11.73
0.4292	467.6	2.49	11.53
0.4306	468.2	2.5	11.3
0.4319	468.6	2.51	11.02
0.4333	469.	2.521	10.96
0.4347	469.5	2.531	10.77
0.4361	470.	2.542	10.56
0.4375	470.5	2.552	10.42
0.4389	471.	2.563	10.22
0.4403	471.4	2.573	10.07
0.4417	472.	2.583	9.882
0.4431	472.6	2.594	9.701
0.4444	473.2	2.604	9.599
0.4458	473.6	2.615	9.458
0.4472	474.1	2.625	9.244
0.4486	474.4	2.635	9.141
0.45	474.9	2.646	8.985
0.4514	475.5	2.656	8.859
0.4528	476.	2.667	8.694
0.4542	476.4	2.677	8.558
0.4556	476.9	2.688	8.414
0.4569	477.4	2.698	8.28
0.4583	477.8	2.708	8.126
0.4597	478.2	2.719	8.106
0.4611	478.6	2.729	7.869
0.4625	479.	2.74	7.725
0.4639	479.5	2.75	7.644
0.4653	479.9	2.76	7.534
0.4667	480.5	2.771	7.389
0.4681	481.	2.781	7.283
0.4694	481.7	2.792	7.187

Time (day)	Displacement (ft)	Time (day)	Displacement (ft)
0.4708	481.8	2.802	7.059
0.4722	482.3	2.813	6.938
0.4736	482.8	2.823	6.832
0.475	483.3	2.833	6.863
0.4764	483.7	2.844	6.734
0.4778	484.2	2.854	6.536
0.4792	484.6	2.865	6.448
0.4806	485.1	2.875	6.289
0.4819	485.6	2.885	6.308
0.4833	486.	2.896	6.144
0.4847	486.3	2.906	6.024
0.4861	486.8	2.917	6.062
0.4875	487.2	2.927	6.002
0.4889	487.5	2.938	5.877
0.4903	488.	2.948	5.679
0.4917	488.5	2.958	5.577
0.4931	488.9	2.969	5.517
0.4944	489.4	2.979	5.536
0.4958	489.8	2.99	5.444
0.4972	490.3	3.	5.388
0.4986	490.8	3.01	5.288
0.5	491.3	3.021	5.228
0.5014	491.7	3.031	5.124
0.5028	492.1	3.042	5.084
0.5042	492.6	3.052	4.997
0.5056	492.9	3.063	4.931
0.5069	493.2	3.073	4.846
0.5083	493.5	3.083	4.786
0.5097	493.8	3.094	4.739
0.5111	494.3	3.104	4.675
0.5125	494.5	3.115	4.593
0.5139	494.9	3.125	4.526
0.5153	495.3	3.135	4.446
0.5167	495.7	3.146	4.403
0.5181	496.1	3.156	4.361
0.5194	496.5	3.167	4.275
0.5208	497.	3.177	4.268
0.5222	497.4	3.188	4.157
0.5236	497.9	3.198	4.122
0.525	498.3	3.208	4.068
0.5264	498.5	3.219	3.984
0.5278	498.7	3.229	3.939
0.5292	499.	3.24	3.89
0.5306	499.2	3.25	3.813
0.5319	499.7	3.26	3.795
0.5333	500.	3.271	3.726
0.5347	500.4	3.281	3.665
0.5361	500.8	3.292	3.648
0.5375	501.1	3.302	3.576
0.5389	501.5	3.313	3.528
0.5403	501.9	3.323	3.479
0.5417	502.	3.333	3.44
0.5431	500.3	3.344	3.375
0.5444	498.4	3.354	3.337
0.5458	496.4	3.365	3.311
0.5472	494.6	3.375	3.237
0.5486	492.7	3.385	3.223
0.55	490.8	3.396	3.177
0.5514	488.9	3.406	3.094
0.5528	486.8	3.417	3.064
0.5542	484.7	3.427	3.052
0.5556	482.7	3.438	2.997
0.5569	480.6	3.448	2.974
0.5583	478.6	3.458	2.92
0.5597	476.5	3.469	2.868
0.5611	474.4	3.479	2.833

Time (day)	Displacement (ft)	Time (day)	Displacement (ft)
0.5625	472.4	3.49	2.796
0.5639	470.3	3.5	2.804
0.5653	468.1	3.51	2.736
0.5667	466.1	3.521	2.725
0.5681	464.1	3.531	2.685
0.5694	462.2	3.542	2.655
0.5708	460.1	3.552	2.593
0.5722	458.	3.563	2.582
0.5736	455.9	3.573	2.495
0.575	453.9	3.583	2.529
0.5764	451.8	3.594	2.469
0.5778	449.7	3.604	2.444
0.5792	447.8	3.615	2.409
0.5806	445.8	3.625	2.345
0.5819	443.7	3.635	2.322
0.5833	441.8	3.646	2.322
0.5847	439.8	3.656	2.281
0.5861	437.8	3.667	2.288
0.5875	435.8	3.677	2.318
0.5889	433.8	3.688	2.2
0.5903	431.7	3.698	2.181
0.5917	429.9	3.708	2.164
0.5931	427.8	3.719	2.135
0.5944	425.9	3.729	2.121
0.5958	424.1	3.74	2.098
0.5972	422.1	3.75	2.061
0.5986	420.3	3.76	2.145
0.6	418.4	3.771	1.998
0.6014	416.4	3.781	1.972
0.6028	414.6	3.792	1.934
0.6042	412.7	3.802	2.059
0.6056	410.8	3.813	1.937
0.6069	409.1	3.823	1.874
0.6083	407.1	3.833	1.861
0.6097	405.4	3.844	1.878
0.6111	403.6	3.854	1.809
0.6125	401.9	3.865	1.9
0.6139	400.2	3.875	1.875
0.6153	398.5	3.885	1.774
0.6167	396.8	3.896	1.703
0.6181	395.1	3.906	1.68
0.6194	393.5	3.917	1.75
0.6208	391.8	3.927	1.7
0.6222	390.2	3.938	1.764
0.6236	388.5	3.948	1.599
0.625	386.9	3.958	1.568
0.6264	385.2	3.969	1.611
0.6278	383.6	3.979	1.558
0.6292	382.	3.99	1.563
0.6306	380.3	4.	1.539
0.6319	378.7	4.01	1.479
0.6333	377.2	4.021	1.505
0.6347	375.5	4.031	1.489
0.6361	373.9	4.042	1.495
0.6375	372.3	4.052	1.444
0.6389	370.7	4.063	1.512
0.6403	369.1	4.073	1.499
0.6417	367.6	4.083	1.405
0.6431	366.1	4.094	1.37
0.6444	364.4	4.104	1.349
0.6458	362.9	4.115	1.315
0.6472	361.4	4.125	1.451
0.6486	359.9	4.135	1.318
0.65	358.4	4.146	1.424
0.6514	356.9	4.156	1.32
0.6528	355.4	4.167	1.488

Time (day)	Displacement (ft)	Time (day)	Displacement (ft)
0.6542	354.	4.177	1.595
0.6556	352.4	4.188	1.286
0.6569	351.	4.198	1.28
0.6583	349.5	4.208	1.371
0.6597	348.1	4.219	1.61
0.6611	346.7	4.229	1.637
0.6625	345.2	4.24	1.701
0.6639	343.8	4.25	1.345
0.6653	342.5	4.26	1.478
0.6667	341.1	4.271	1.492
0.6681	339.7	4.281	1.264
0.6694	338.2	4.292	1.257
0.6708	336.9	4.302	1.207
0.6722	335.6	4.313	1.203
0.6736	334.2	4.323	1.18
0.675	333.	4.333	1.18
0.6764	331.6	4.344	1.043
0.6778	330.3	4.354	1.11
0.6792	328.9	4.365	1.164
0.6806	327.6	4.375	1.098
0.6819	326.3	4.385	1.106
0.6833	325.	4.396	1.131
0.6847	323.8	4.406	1.118
0.6861	322.4	4.417	1.062
0.6875	321.2	4.427	1.049
0.6889	319.9	4.438	1.159
0.6903	318.5	4.448	1.282
0.6917	317.3	4.458	1.031
0.6931	316.2	4.469	0.888
0.6944	314.9	4.479	0.969
0.6958	313.6	4.49	0.958
0.6972	312.4	4.5	0.963
0.6986	311.1	4.51	0.94
0.7	310.	4.521	0.941
0.7014	308.7	4.531	0.93
0.7028	307.6	4.542	0.921
0.7042	306.4	4.552	0.918
0.7056	305.3	4.563	0.887
0.7069	304.1	4.573	0.882
0.7083	302.8	4.583	0.916
0.7097	301.8	4.594	0.849
0.7111	300.5	4.604	0.867
0.7125	299.4	4.615	0.864
0.7139	298.3	4.625	0.838
0.7153	297.1	4.635	0.833
0.7167	295.9	4.646	0.833
0.7181	294.7	4.656	0.798
0.7194	293.7	4.667	0.791
0.7208	292.5	4.677	0.781
0.7222	291.4	4.688	0.779
0.7236	290.3	4.698	0.815
0.725	289.2	4.708	0.754
0.7264	288.	4.719	0.767
0.7278	287.1	4.729	0.791
0.7292	285.9	4.74	0.757
0.7306	284.8	4.75	0.743
0.7319	283.7	4.76	0.717
0.7333	282.6	4.771	0.738
0.7347	281.7	4.781	0.697
0.7361	280.6	4.792	0.701
0.7375	279.5	4.802	0.678
0.7389	278.5	4.813	0.727
0.7403	277.4	4.823	0.706
0.7417	276.4	4.833	0.69
0.7431	275.4	4.844	0.673
0.7444	274.4	4.854	0.688

Time (day)	Displacement (ft)	Time (day)	Displacement (ft)
0.7458	273.4	4.865	0.684
0.7472	272.3	4.875	0.653
0.7486	271.4	4.885	0.668
0.75	270.3	4.896	0.663
0.7514	269.3	4.906	0.611
0.7528	268.4	4.917	0.648
0.7542	267.4	4.927	0.621
0.7556	266.4	4.938	0.628
0.7569	265.4	4.948	0.607
0.7583	264.5	4.958	0.621
0.7597	263.4	4.969	0.628
0.7611	262.4	4.979	0.585
0.7625	261.6	4.99	0.583
0.7639	260.5	5.	0.557
0.7653	259.6	5.01	0.563
0.7667	258.6	5.021	0.577
0.7681	257.8	5.031	0.531
0.7694	256.8	5.042	0.562
0.7708	255.8	5.052	0.53
0.7722	254.9	5.063	0.559
0.7736	254.	5.073	0.527
0.775	253.1	5.083	0.568
0.7764	252.1	5.094	0.547
0.7778	251.3	5.104	0.521
0.7792	250.4	5.115	0.529
0.7806	249.5	5.125	0.562
0.7819	248.5	5.135	0.514
0.7833	247.7	5.146	0.51
0.7847	246.9	5.156	0.485
0.7861	245.9	5.167	0.47
0.7875	245.	5.177	0.47
0.7889	244.1	5.188	0.477
0.7903	243.4	5.198	0.479
0.7917	242.5	5.208	0.486
0.7931	241.6	5.219	0.452
0.7944	240.9	5.229	0.472
0.7958	239.9	5.24	0.398
0.7972	239.2	5.25	0.46
0.7986	238.3	5.26	0.449
0.8	237.4	5.271	0.401
0.8014	236.6	5.281	0.417
0.8028	235.8	5.292	0.413
0.8042	234.9	5.302	0.413
0.8056	234.1	5.313	0.439
0.8069	233.3	5.323	0.397
0.8083	232.5	5.333	0.432
0.8097	231.6	5.344	0.408
0.8111	230.9	5.354	0.421
0.8125	230.	5.365	0.376
0.8139	229.2	5.375	0.424
0.8153	228.3	5.385	0.398
0.8167	227.6	5.396	0.386
0.8181	226.8	5.406	0.371
0.8194	226.1	5.417	0.331
0.8208	225.3	5.427	0.335
0.8222	224.5	5.438	0.335
0.8236	223.7	5.448	0.352
0.825	223.	5.458	0.328
0.8264	222.2	5.469	0.341
0.8278	221.4	5.479	0.335
0.8292	220.7	5.49	0.313
0.8306	219.9	5.5	0.328
0.8319	219.1	5.51	0.345
0.8333	218.4	5.521	0.32
0.8347	217.6	5.531	0.333
0.8361	216.9	5.542	0.305

Time (day)	Displacement (ft)	Time (day)	Displacement (ft)
0.8375	216.2	5.552	0.292
0.8389	215.3	5.563	0.345
0.8403	214.6	5.573	0.287
0.8417	213.9	5.583	0.316
0.8431	213.2	5.594	0.281
0.8444	212.4	5.604	0.301
0.8458	211.6	5.615	0.277
0.8472	211.1	5.625	0.303
0.8486	210.2	5.635	0.276
0.85	209.6	5.646	0.315
0.8514	208.8	5.656	0.261
0.8528	208.1	5.667	0.29
0.8542	207.4	5.677	0.287
0.8556	206.7	5.688	0.293
0.8569	206.	5.698	0.268
0.8583	205.3	5.708	0.265
0.8597	204.7	5.719	0.302
0.8611	204.	5.729	0.288
0.8625	203.3	5.74	0.277
0.8639	202.7	5.75	0.26
0.8653	202.	5.76	0.268
0.8667	201.2	5.771	0.272
0.8681	200.6	5.781	0.23
0.8694	199.9	5.792	0.279
0.8708	199.3	5.802	0.216
0.8722	198.5	5.813	0.263
0.8736	197.9	5.823	0.236
0.875	197.2	5.833	0.257
0.8764	196.6	5.844	0.215
0.8778	195.9	5.854	0.198
0.8792	195.3	5.865	0.201
0.8806	194.7	5.875	0.249
0.8819	194.	5.885	0.216
0.8833	193.4	5.896	0.177
0.8847	192.7	5.906	0.206
0.8861	192.1	5.917	0.19
0.8875	191.4	5.927	0.215
0.8889	190.7	5.938	0.204
0.8903	190.2	5.948	0.202
0.8917	189.6	5.958	0.198
0.8931	189.	5.969	0.211
0.8944	188.3	5.979	0.188
0.8958	187.8	5.99	0.239
0.8972	187.1	6.	0.198
0.8986	186.5	6.01	0.228
0.9	185.9	6.021	0.23
0.9014	185.3	6.031	0.204
0.9028	184.7		

SOLUTION

Pumping Test
Aquifer Model: Confined
Solution Method: Dougherty-Babu

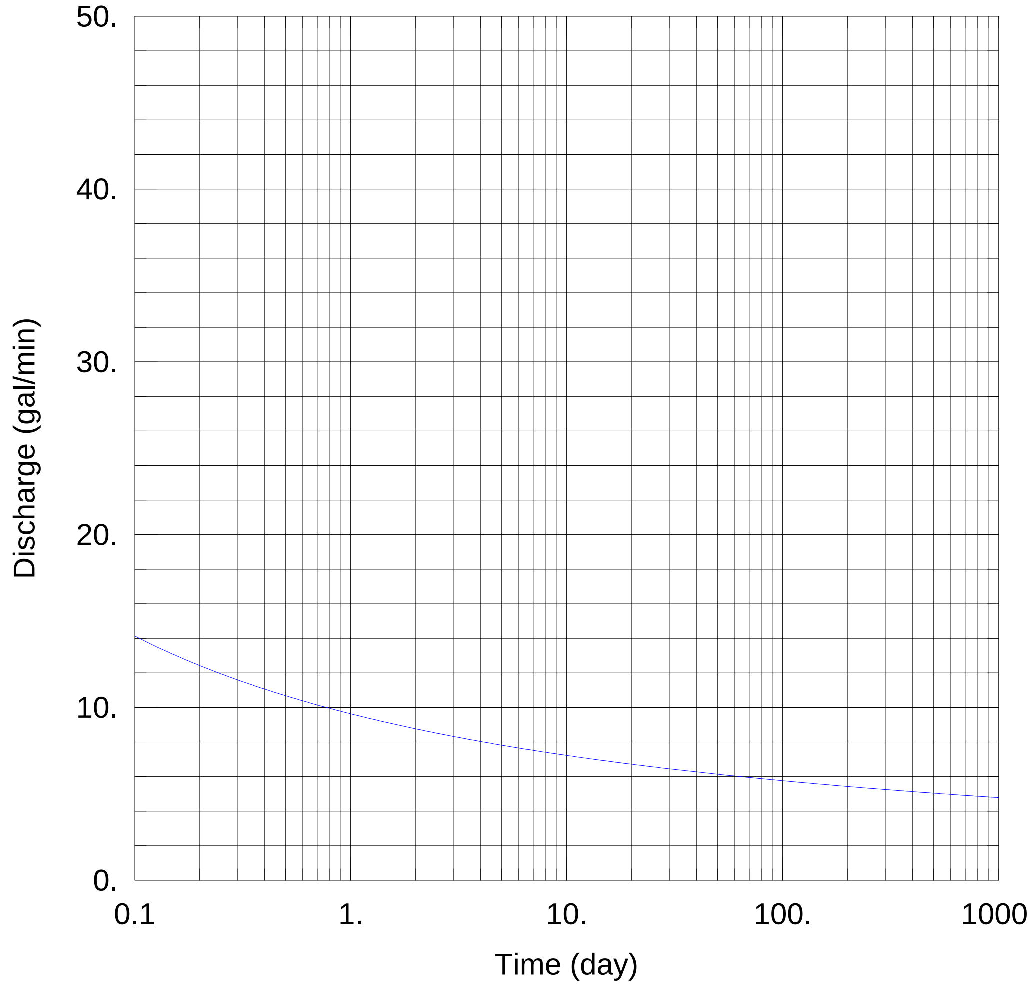
VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	0.9992	ft^2/day
S	5.0E-5	
Kz/Kr	1.	
Sw	0.	
r(w)	0.2865	ft
r(c)	0.2865	ft

K = T/b = 0.01998 ft/day (7.05E-6 cm/sec)
Ss = S/b = 1.0E-6 1/ft

-CONFIDENTIAL-



WELL TEST ANALYSIS

Data Set: C:\...\Constant-Head Inflow.aqt
Date: 11/12/13 Time: 16:40:11

PROJECT INFORMATION

Company: RESPEC
Client: Cargill
Location: Cayuga

AQUIFER DATA

Saturated Thickness: 50. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Corehole	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
Corehole	0	0

SOLUTION

Aquifer Model: Confined

Solution Method: Hurst-Clark-Brauer

T = 0.9992 ft^2/day
Sw = 0.
r(c) = 9. ft

S = 5.0E-5
r(w) = 9. ft

-CONFIDENTIAL-

Data Set: C:\Users\david.gnage\Documents\PROJECTS\1803-03_Cargill_Cayuga\2099_Corehole Oversight\Repor
Date: 11/12/13
Time: 16:40:50

PROJECT INFORMATION

Company: RESPEC
Client: Cargill
Location: Cayuga

AQUIFER DATA

Saturated Thickness: 50. ft
Anisotropy Ratio (Kz/Kr): 0.1

PUMPING WELL DATA

No. of pumping wells: 1

Pumping Well No. 1: Corehole

X Location: 0. ft
Y Location: 0. ft

Casing Radius: 9. ft
Well Radius: 9. ft

Fully Penetrating Well

No. of pumping periods: 3

Pumping Period Data

Time (day)	Rate (gal/min)	Time (day)	Rate (gal/min)
0.1	15.	1.	15.
0.5	15.		

OBSERVATION WELL DATA

No. of observation wells: 1

Observation Well No. 1: Corehole

X Location: 0. ft
Y Location: 0. ft

Radial distance from Corehole: 0. ft

Fully Penetrating Well

Constant head: 979. ft

No. of Observations: 3

Observation Data

Time (day)	Displacement (ft)	Time (day)	Displacement (ft)
0.	0.	0.	0.
0.	0.		

SOLUTION

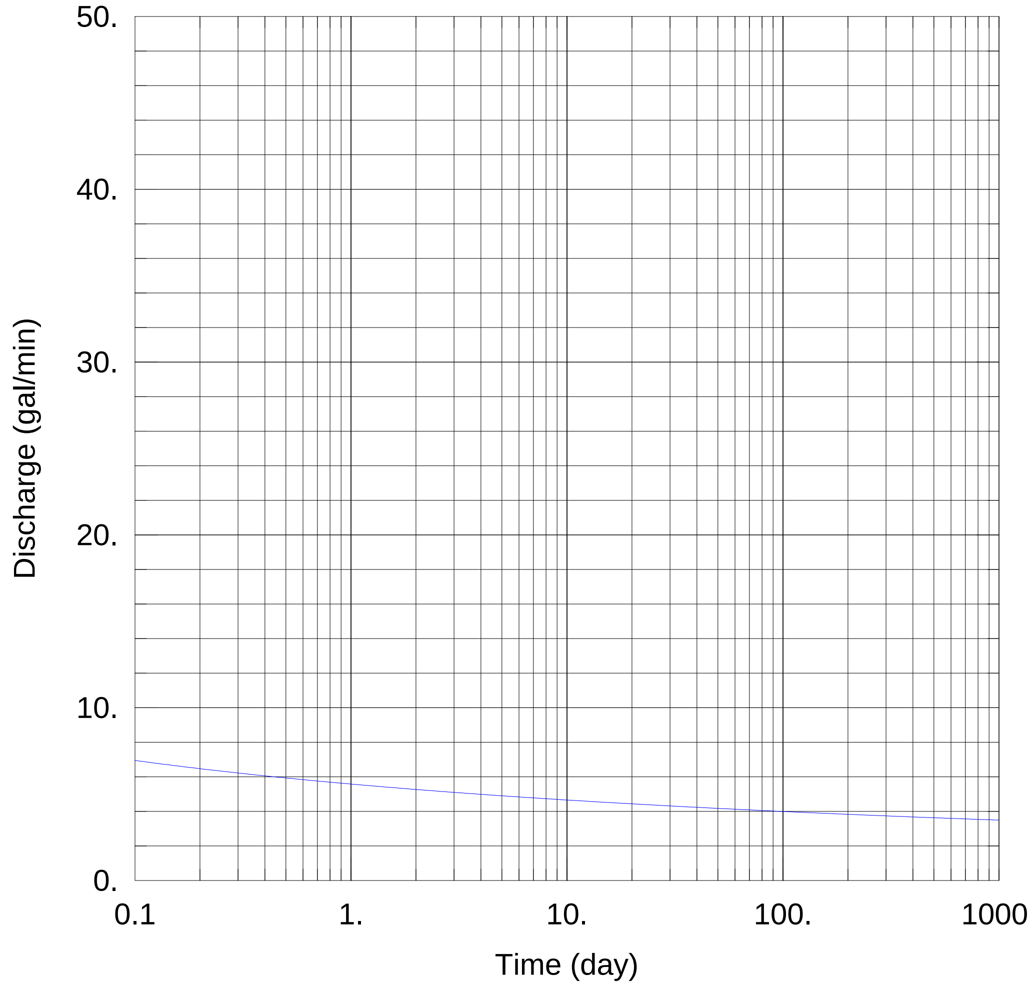
Constant-Head Test
Aquifer Model: Confined
Solution Method: Hurst-Clark-Brauer

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	0.9992	ft^2/day
S	5.0E-5	
Sw	0.	
r(w)	9.	ft
r(c)	9.	ft

K = T/b = 0.01998 ft/day (7.05E-6 cm/sec)
Ss = S/b = 1.0E-6 1/ft



WELL TEST ANALYSIS

Data Set: C:\...\Constant-Head Inflow_18inch.aqt
Date: 11/12/13 Time: 16:43:59

PROJECT INFORMATION

Company: RESPEC
Client: Cargill
Location: Cayuga

AQUIFER DATA

Saturated Thickness: 50. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Corehole	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
Corehole	0	0

SOLUTION

Aquifer Model: Confined

Solution Method: Hurst-Clark-Brauer

T = 0.9992 ft^2/day
Sw = 0.
r(c) = 0.75 ft

S = 5.0E-5
r(w) = 0.75 ft

-CONFIDENTIAL-

Data Set: C:\Users\david.gnage\Documents\PROJECTS\1803-03_Cargill_Cayuga\2099_Corehole Oversight\Repor
Date: 11/12/13
Time: 16:44:21

PROJECT INFORMATION

Company: RESPEC
Client: Cargill
Location: Cayuga

AQUIFER DATA

Saturated Thickness: 50. ft
Anisotropy Ratio (Kz/Kr): 0.1

PUMPING WELL DATA

No. of pumping wells: 1

Pumping Well No. 1: Corehole

X Location: 0. ft
Y Location: 0. ft

Casing Radius: 0.75 ft
Well Radius: 0.75 ft

Fully Penetrating Well

No. of pumping periods: 3

Pumping Period Data

Time (day)	Rate (gal/min)	Time (day)	Rate (gal/min)
0.1	15.	1.	15.
0.5	15.		

OBSERVATION WELL DATA

No. of observation wells: 1

Observation Well No. 1: Corehole

X Location: 0. ft
Y Location: 0. ft

Radial distance from Corehole: 0. ft

Fully Penetrating Well

Constant head: 979. ft

No. of Observations: 3

Observation Data

Time (day)	Displacement (ft)	Time (day)	Displacement (ft)
0.	0.	0.	0.
0.	0.		

SOLUTION

Constant-Head Test
Aquifer Model: Confined
Solution Method: Hurst-Clark-Brauer

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	0.9992	ft^2/day
S	5.0E-5	
Sw	0.	
r(w)	0.75	ft
r(c)	0.75	ft

K = T/b = 0.01998 ft/day (7.05E-6 cm/sec)
Ss = S/b = 1.0E-6 1/ft