



GRANDVIEW RESERVE METROPOLITAN DISTRICT NO. 1 - WELLS LFH-1 AND A-1 DRAFT WELL COMPLETION REPORT

Prepared for:

Melody Homes, Inc.

June 21, 2024

Project Number

4053HRG02

The technical material in this report was prepared by or under the supervision and direction of the undersigned, whose seal as a Professional Engineer is affixed below.

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SECTION 1: INTRODUCTION

This report summarizes the well construction activities associated with Melody Homes, Inc. (Melody) and the Grandview Reserve Metropolitan District No. 1 (District) drilling of well LFH-1 and well A-1. The report includes documentation regarding the well permitting, geologic conditions encountered, drilling progression, well construction, well development, and aquifer testing for well LFH-1 and well A-1. Water quality sampling was completed near the end of each of the constant rate pumping test events for each well, and the results of the sampling events from the wells will be submitted to Melody under separate cover. Well LFH-1 (Well Permit No. 88240-F) was completed in the Laramie-Fox Hills Aquifer of the Upper Black Squirrel Creek Designated Basin (UBSCDB) area of the regional Denver Basin aquifer system.. Well A-1 (Well Permit No. 88211-F) was completed in the Arapahoe Aquifer of the UBSCDB area of the regional Denver Basin aquifer system. The Arapahoe aquifer is not differentiated into an upper portion and lower portion as it is in other areas of the Denver Basin aquifer system. **Table 1** presents the well permit information for the wells.

Hydro Resources (Hydro) was contracted by the District for the drilling, construction, development, and testing of well LFH-1 and well A-1. Standard electric logs were run for collection of geophysical data to include resistivity, gamma ray, and spontaneous potential and a caliper log, neutron porosity, and dual compensated density log of the borehole were completed by Midwest Wireline. Lithologic, geologic, and hydrogeologic analyses along with construction observation were performed by LRE Water (LRE). As of the date of this report, the well pumping equipment has not been selected or installed. **Figure 1** provides the location of the wells.

SECTION 2: PROJECT TIMELINE

The following is the project timeline:

- June 2023: Well permits received from the Colorado Division of Water Resources (CDWR)
- September 2023: Hydro selected as the drilling contractor.
- October 2023: Well pad prepared.
- January 2024 through June 2024: LFH-1 and A-1 well drilling, construction, development, aquifer testing, and water quality sampling.

SECTION 3: WELL PERMITTING

Prior to well construction, the District filed Well Construction Permit Applications with the CDWR. The CDWR issued permits in June 2023 under permit numbers 88240-F (well LFH-1) and 88211-F (well A-1).

Based on geophysical data, the Laramie-Fox Hills aquifer is within the LFH-1 (88240-F) permitted interval from 2,025 to 2,294 feet below ground surface (ft-bgs) and the Arapahoe aquifer is with the A-1 (88211-F) permitted interval of 1,190 to 1,705 ft-bgs.

Appendix A contains the final permits and well completion reports for well LFH-1 and well A-1. **Table 1** includes the permit details and coordinates for the wells.

SECTION 4: GEOLOGY

Standard geophysical logs to include gamma ray, resistivity, spontaneous potential, bulk density, caliper, and density porosity, were obtained from the borehole prior to construction of well LFH-1. Neutron porosity with a sandstone, limestone, and dolomite matrix was also obtained from the borehole. **Appendix B** presents the geophysical log results from the borehole for well LFH-1 through the entire drilled interval. The geophysical logs obtained from well LFH-1 were also used for interpretation of the aquifer intervals for well A-1 as discussed above, and as authorized by CDWR.

Geology and lithology of each borehole was determined from samples collected during drilling and from interpretation of the geophysical logs. Grab samples were collected from the shaker plate by Hydro at 10 foot intervals, bagged, labeled, and stored for logging. The samples were logged by LRE and provided estimates of grain size distribution of sand, silt, clay, shale, and coal in the samples along with a visual description of color and gradation. The lithologic logs are included in **Appendix C**. In general, the samples from the lower extents of the boreholes above the Laramie-Fox Hills (well LFH-1) and Arapahoe (well A-1) aquifers were often composed of or contaminated with mixed clays introduced by sluffing within the borehole and clay/mud production at the drill bit, compromising the accuracy of the lithologic log. The geophysical logs provide confirmation of the aquifer tops and bottoms, as well as the presence of sandstone, siltstone, claystone or shale within the aquifer matrix. The ground surface elevation of the well site is approximately 6,973 feet mean sea level (ft-msl).

Geologic interpretation of the Laramie-Fox Hills aquifer interval (LFH-1):

The ground surface elevation for well LFH-1 is approximately 6,973 feet mean sea level (ft-msl). The Laramie formation represents a confining zone between the Arapahoe and

the Laramie-Fox Hills aquifers, and is located approximately 1,705 to 2,031 ft-bgs, around 326 feet in thickness. This confining zone is defined by dark gray clay and mudstone, with coal seams present from approximately 2,014 to 2,024 ft-bgs. The base of the Fox Hills formation, representing the base of the Laramie-Fox Hills aquifer, is characterized by dark gray clay with relatively low resistivity. The approximate 263-foot-thick Laramie-Fox Hills aquifer interval showed one thick sandstone package and several thin sandstone packages of high resistivity separated by thinner intervals of siltstone, claystone, and shale. Qualitatively, these results appeared typical of the Denver Basin Laramie-Fox Hills aquifer. In general, the geophysical indicators of resistivity, gamma ray, and porosity show that the Laramie-Fox Hills aquifer has productive aquifer material.

Geologic interpretation of the Arapahoe aquifer interval (A-1):

The ground surface elevation for well A-1 is approximately 6,973 feet mean sea level (ft-msl). The confining bed between the overlying Denver aquifer and the Arapahoe aquifer is located approximately 1,166 to 1,189 ft bgs, approximately 23 feet thick, and is defined by dark gray sandy clay. The lower confining bed starting at about 1,710 ft-bgs is characterized by dark gray, low resistivity, flaky mudstone and dark gray clay. The approximate 515-foot-thick Arapahoe aquifer interval showed several moderately-thick sandstone packages of high resistivity separated by thick intervals of siltstone, claystone, and shale. Qualitatively, these results appeared typical of the Denver Basin Arapahoe aquifer in this area. In general, the geophysical indicators of resistivity, gamma ray, and porosity show that the Arapahoe aquifer has less productive aquifer material compared to the Laramie-Fox Hills aquifer.

SECTION 5: WELL CONSTRUCTION

5.1 BOREHOLE DRILLING

Well LFH-1:

- **Surface Casing Borehole:** The drilling and completion of the surface casing, a 24-inch outside diameter (OD) steel, 0.375-inch wall surface casing, from the ground surface to a depth of 40 feet. The boring for the surface casing was advanced with a solid auger drill rig with a 36-inch diameter bit. The surface casing was cemented in place after being placed and centralized in the borehole.
- **Production Well Borehole:** For Well LFH-1, Hydro advanced a 17.5-inch diameter borehole using a Challenger 320 reverse rotary drilling rig, utilizing a flooded

reverse circulation drilling technique. The borehole was kept open during drilling and well casing placement by maintaining a positive hydraulic head in the boring at the ground surface with drilling mud. A drilling mud program was developed by Hydro's mud engineer and implemented according to plan for protection of the borehole integrity during drilling and completion operations. Drilling penetration rates varied from approximately 3 to 152 feet per day during drilling of the Well LFH-1 borehole, generally slowing with depth.

Borehole depths were limited to the bottom of the geologically-identified Laramie-Fox Hills aquifer interval.

Well A-1:

- **Surface Casing Borehole:** The drilling and completion of the surface casing, a 20-inch outside diameter (OD) steel, 0.375-inch wall surface casing, from the ground surface to a depth of 40 feet. The boring for the surface casing was advanced with a solid auger drill rig with a 32-inch diameter bit. The surface casing was cemented in place after being placed and centralized in the borehole.
- **Production Well Borehole:** For well A-1, Hydro advanced a 14-3/4-inch diameter borehole using a Challenger 320 reverse rotary drilling rig, utilizing a flooded reverse circulation drilling technique. The borehole was kept open during drilling and well casing placement by maintaining a positive hydraulic head in the boring at the ground surface with drilling mud. A drilling mud program was developed by Hydro's mud engineer and implemented according to plan for protection of the borehole integrity during drilling and completion operations. Drilling penetration rates varied from approximately 54 to 232 feet per day during drilling of the well A-1 borehole.

Borehole depths were limited to the bottom of the geologically-identified Arapahoe aquifer interval.

5.2 WELL CONSTRUCTION

After drilling, Hydro constructed the wells according to the final screen designs prepared by LRE. The well construction is summarized as follows:

Well LFH-1: Well LFH-1 was constructed to the final screen design by placing 10.75-inch (OD) blank, plain end, carbon steel well casing and 10.75-inch (OD), Type 304L, 0.02 inch (i.e. "20 slot") slotted, stainless steel, wire wrapped screen in 10 and 20 foot lengths into the borehole according to the screen schedule. Each casing length was welded

together as the casing was being placed. A 10.75-inch OD dissimilar metal connector, also called a dielectric coupler (10.75-inch OD low carbon steel by Type 304L stainless steel), was installed to minimize the long-term effects of corrosion potential induced by the connection of the two casing strings. The casing string screen was hung, in tension, above the bottom of the borehole and centralized in minimum 50-foot intervals to allow for a rathole at the bottom of the boring and for gravel packing purposes.

Sigmund Lidner (SiLi) beads 450708R (2.0 mm to 2.4 mm) were placed from the bottom of the borehole at well LFH-1 to 15 feet above the screen to 2,029 ft-bgs. SiLi Beads were used due to their greater sphericity and smoothness, which enhances well efficiency and long-term well performance and for easier well rehabilitation in the future. On top of the glass bead filter pack, a sand plug of approximately 5 feet of 8/12 mesh size silica sand was placed to seat the cement grout. All filter material was placed by tremie pipe in the annular space. The well was grouted in place via tremie in the annulus from the top of the aquifer to the ground surface.

Well A-1: Well A-1 was constructed to the final screen design by placing 8.625-inch (OD) blank, plain end, carbon steel well casing, 8.625-inch, 0.312-inch wall, American Petroleum Institute (API) Range 3 (40 foot length), Type 304L stainless steel blank casing, API Range 3 (40 foot length), and 8.625-inch (OD), Type 304L, 0.040 inch (i.e. "40 slot") slotted, stainless steel, wire wrapped screen in 5, 10 and 20 foot lengths into the borehole according to the screen schedule. Each casing length was welded together as the casing was being placed. A 8.625-inch OD dissimilar metal connector, also called a dielectric coupler (8.625-inch OD low carbon steel by Type 304L stainless steel), was installed to minimize the long-term effects of corrosion potential induced by the connection of the two casing strings. The casing string screen was hung, in tension, above the bottom of the borehole and centralized in minimum 50-foot intervals to allow for a rathole at the bottom of the boring and for gravel packing purposes.

Sigmund Lidner (SiLi) beads 450708R (2.0 mm to 2.4 mm) were placed from the bottom of the borehole at well A-1 to 25 feet above the screen, at 1,200 ft-bgs. SiLi Beads were used due to their greater sphericity and smoothness, which enhances well efficiency and long-term well performance and for easier well rehabilitation in the future. On top of the glass bead filter pack, a sand plug of 10 feet of 8/12 mesh size silica sand was placed to seat the cement grout. All filter material was placed by tremie pipe in the annular space. The well was grouted in place via tremie in the annulus from the top of the aquifer to the ground surface.

5.3 WELL CONSTRUCTION DETAILS

The suite of geophysical information led to a determination of the depth intervals for well construction of wells LFH-1 and A-1. The wells were designed so that they are only screened across the Laramie-Fox Hills aquifer (well LFH-1) and the Arapahoe aquifer (well A-1). The filter pack intervals (glass beads, gravel, and fine sand) were aligned to ensure that production from the wells are limited to the permitted aquifer intervals. The screened intervals were selected by balancing cost, static water level measurements, and the presence of significant sandstone packages observed in the geologic and geophysical logging. Additionally, the aquifer depth intervals were adjusted in consultation with the Colorado Division of Water Resources (DWR) to ensure that the permitted intervals were aligned with the DWR interpretation of the aquifer depth intervals. For well LFH-1, the screened interval was chosen to maximize the coverage of the permitted Laramie-Fox Hills aquifer interval. For well A-1, information provided by the geophysical logs resulted in a larger permitted Arapahoe aquifer interval than initially expected. Screen material available on site at time of well construction could not span the entire permitted interval, so the screened interval was chosen to maximize coverage of packages identified by the geophysical logs, leaving a 40-foot section of blank, stainless steel casing within the permitted interval spanning zones with limited aquifer production potential identified by geophysical and lithological logs.

A summary of well LFH-1 and well A-1 well construction details are presented in **Table 2**. **Appendix D** contains the as-built construction diagrams for the well.

5.4 WELL VIDEO LOG REVIEW

Wells LFH-1 and A-1 were video-logged at the end of the project to inspect the casing welds, current condition of the screens, and to verify well construction details. All welds inspected from the video logs appear to be satisfactory. Video review of the logs revealed some drilling mud intrusion or debris in the well screens and sumps as follows:

Well LFH-1: The bottom section of the screen has minor blockage from 2273.22 – 2283.23 ft below top of casing (btoc). Debris present in bottom portion of sump from 2287.9 – 2294.9 ft btoc.

Well A-1: The screen section from 1250.37 – 1648.23 ft btoc has intermittent minor blockage. The screen section from 1648.23 – 1687.96 ft btoc (the bottom of the screen) has minor to moderate blockage of the screen, likely resulting from low or no flow portions of the aquifer.

The video logs and resulting observations completed after aquifer testing activities suggest no additional development will be necessary prior to pump installation. The minor

to moderate screen blockage noted in well A-1 is likely a result of a low or no production zone in the Arapahoe aquifer.

As a standard practice, if the permanent well pumps are pulled in the future, the wells should be video logged again and reviewed for further well intervention and rehabilitation purposes.

SECTION 6: WELL DEVELOPMENT

Well development is the process of breaking down the drilling mud used during drilling and lifting out the residual mud and fines accumulated in the completed well. This process is accomplished by initially pumping and agitating the well to remove fine-grained material adjacent to the well, in the well screen, in the filter pack, and along the well bore-aquifer interface to improve well production. The wells were developed in phases.

- The initial “heavies” (i.e. heavy mud and formation material produced during development) were reverse airlifted out for approximately 12 hours and disposed of off-site by Hydro.
- Initial development consisted of swabbing for 17 hours (well LFH-1) and for 25.5 hours (well A-1). During this process, sodium hypochlorite was added, after which the chemicals were allowed to sit for 33 hours (well LFH-1) and 23.5 hours (well A-1).
- Next, Hydro jetted the wells for 16.75 hours (well LFH-1) and 22 hours (well A-1). A combination of water and NW-220 was used during this process, after which the chemicals were left to set for 8 hours.
- The final phase of development consisted of conventional airlifting. Airlifting progressed for 28 hours for well LFH-1 and 22 hours for well A-1.

All water produced during development was disposed of off-site by Hydro.

SECTION 7: AQUIFER TESTING

Aquifer testing was conducted at well LFH-1 and well A-1 following well development. The aquifer tests included an 8-hour duration, 4-step, step-drawdown tests (step test) and multi-day constant rate tests. Discharge from the aquifer tests were discharged into a nearby field through a dewatering pump bag, as authorized by the Colorado Department of Public Health and Environment-Water Quality Control Division (CDPHE-WQCD) discharge permit obtained by Hydro.

8.1 STEP-DRAWDOWN TEST

Step testing consists of pumping the well at successively higher rates (i.e. steps). The purpose of step testing is to determine the rate for a constant rate test and evaluate non-linear well losses which affect the well efficiency.

Well LFH-1: Pumping rates for each step of testing at well LFH-1 are presented in **Table 3**. For the test, the initial step was set based on experience within the Denver Basin and indications of possible well production from the well development process. Drawdown for successive steps was based on the results from the previous step, and the capacity of the pump. After step 3, the pump malfunctioned, prematurely ending the test. As a result, LRE instructed Hydro to perform a separate 2-hour step rate test once the pump was replaced, at a production rate of 150 gallons per minute (gpm), averaging 149 gpm, to test the pump prior to the constant rate test and to evaluate the aquifer response at the higher rate. **Figure 2** presents the step testing results for well LFH-1 as drawdown over time. **Table 3** presents the Specific Capacity (SpC) results for well LFH-1, calculated as the pumping rate in gallons per minute divided by the drawdown at the end of the step.

Well A-1: Pumping rates for each step of testing at well A-1 are presented in **Table 3**. For the test, the initial step was set based on experience within the Denver Basin and indications of possible well production from the well development process. Drawdown for successive steps was based on the results from the previous step, and the capacity of the pump. During step 3, at a production rate of 125 gpm (averaging 124 gpm), drawdown in the well failed to reach a steady state, indicating that further increase in production rate in step 4 would not be feasible during the step rate test. As a result, LRE instructed Hydro end the step rate test at the conclusion of step 3, at 6 hours. **Figure 3** presents the step testing results for well A-1 as drawdown over time. **Table 3** presents the Specific Capacity (SpC) results for well A-1, calculated as the pumping rate in gallons per minute divided by the drawdown at the end of the step.

8.2 CONSTANT RATE TEST

Constant rate aquifer tests of 72-hours were completed at well LFH-1 and well A-1. However, due to aquifer response at the selected rate which resulted in excessive water level drawdown during the course of each test, the final constant rate tests for each well were 62.75 hours long (well LFH-1) and 62.5 hours long (well A-1). The details of the constant rate test at each well are detailed below.

Well LFH-1: A production rate of 200 gallons per minute (gpm) was targeted for the planned 72-hour constant rate test at well LFH-1. The average production rate was 199 gpm for the first 45.25 hours, at which time the water level reached the minimum net positive suction head (NPSH) above the pump, defined by Hydro as 65 feet above the

pump intake. In response, LRE instructed Hydro to reduce the pumping rate to 175 gpm. The new average production rate was 161 gpm for the next 17.5 hours. The test concluded at 62.75 total hours, and shut down prematurely due to mechanical issues with the generator. **Figure 4** is a graphical presentation of the recovery response results observed at well LFH-1 after the testing was completed. **Table 4** presents the pumping rates, duration, and SpC calculated for the LFH-1 constant rate test.

Well A-1: A production rate of 100 gallons per minute (gpm) was targeted for the planned 72-hour constant rate test at well LFH-1. The average production rate was 99 gpm for the first 9.25 hours, at which time the water level reached the minimum NPSH above the pump, defined by Hydro as 30 feet above the pump intake. In response, LRE instructed Hydro to reduce the pumping rate to 75 gpm. The new average production rate was 75 gpm for the next 13.5 hours, at which point the water level again reached the minimum NPSH. LRE instructed Hydro to reduce the pumping rate to 50 gpm. The new average production rate was 50 gpm for the next 39.75 hours. The test concluded at 62.5 total hours. **Figure 5** is a graphical representation of the recovery response results observed at well A-1 after the testing was completed. **Table 4** presents the pumping rates, duration, and SpC at the end of the well A-1 constant rate test.

8.3 AQUIFER TEST INTERPRETATION

The first step in the aquifer test analysis was to interpret the aquifer test results using the Theis (1935) analytical equation. The pumping phase data were used to interpret the step rate test results for each well, while the recovery data were used to interpret the constant rate test results. The reasoning for the approach to the analysis was due to the constant rate testing response, excessive drawdown observed during the tests, and the required flowrate reductions that were required in an attempt to stabilize drawdown during the testing.

The pumping phase of the well LFH-1 step rate test resulted in a transmissivity (T) value of approximately 88 ft²/day and a storage coefficient of 0.035. The recovery data from the constant rate test indicated a transmissivity (T) value of approximately 97.5 ft²/day. The pumping phase of the well A-1 step rate test resulted in a transmissivity (T) value of approximately 29.5 ft²/day and a storage coefficient of 0.07. The recovery data from the constant rate test indicated a transmissivity (T) value of approximately 27.5 ft²/day.

During aquifer testing, each well exhibited behavior indicative of highly stratified aquifer production, where it is likely that there are discrete, highly productive water-bearing zones in the upper portions of each aquifer, overlying zones of lower or no production zones.

Results of the aquifer testing indicate well LFH-1 can be pumped at a rate of up to 150 gpm while maintaining the drawdown in the screen at 50% (or less) of the total screen length for up to two weeks. This rate is the basis for the pump design criteria.

Results of the aquifer testing indicate well AR-1 can be pumped at a rate of up to 50 gpm while maintaining the drawdown in the screen at 50% (or less) of the total screen length. This rate is the basis for the pump design criteria.

SECTION 9: PUMP DESIGN CRITERIA

The results of the aquifer testing provided the design criteria for pump sizing. The pump intake is planned to be set to maximize available drawdown and well yield. **Table 5** summarizes the design safe yields. The pump design criteria are summarized in **Table 6**.

SECTION 10: WATER QUALITY

Water quality samples from well A-1 were collected on April 24, 2024 at 0800 hours, approximately 43-hours into the constant rate test by LRE staff. Water quality samples from well LFH-1 were collected on May 30, 2024 at 0800 hours, approximately 44-hours into the constant rate test by LRE staff.

Water quality results for well LFH-1 and well A-1 are currently pending. This report will be updated once the water quality data analysis is completed.

Tables

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Table 1: Well Coordinates and Permit Summary

Well	NAD 83 State Plane Colorado Central FIPS 502 (feet)		Aquifer	Permit Number	DWR Permitted Interval (ft-bgs)
	Latitude	Longitude			
LFH-1	38.9828	-104.5658	Laramie-Fox Hills	88240-F	2025-2294
A-1	38.9828	-104.5658	Arapahoe	88211-F	1190-1705

Table 2: Summary of Well Construction

Well	Borehole Diameter (inches)	Well Outside Diameter (inches)	Stainless Screen Intervals (ft bgs)	Stainless Steel Blank Intervals (ft bgs)	Carbon Steel Blank Intervals (ft bgs)	Dielectric Coupler (ft bgs)	SiLi Bead Interval (ft bgs)	Silica Transition Sand Interval (ft bgs)	Grout Interval (ft bgs)
LFH-1	17.5	10.375	2033-2281	NA	+2-2031	2031-2033	2029-2294	2029-2034	0-2034
A-1	14.75	8.625	1219-1288 1328-1688	1288-1328	+2-1217	1217-1219	1200-1716.5	1190-1200	0-1190



Table 3: Step Rate Test Summary

Well	Step #	Duration (hours)	Average Pumping Rate (gpm)	SpC (gpm/ft)
LFH-1	1	2	51	0.73
	2	2	76	0.74
	3	2	103	0.70
	1A	2	149	0.73
A-1	1	2	68	0.31
	2	2	102	0.32
	3	2	124	0.22

Table 4: Constant Rate Test Summary

Well	Duration (hours)	Pumping Rate (gpm)	SpC (gpm/ft)
LFH-1	45.25	199	0.38
	17.5	161	NA
A-1	9.25	99	0.19
	13.5	75	NA
	39.75	50	NA

Table 5: Estimated Well Yields

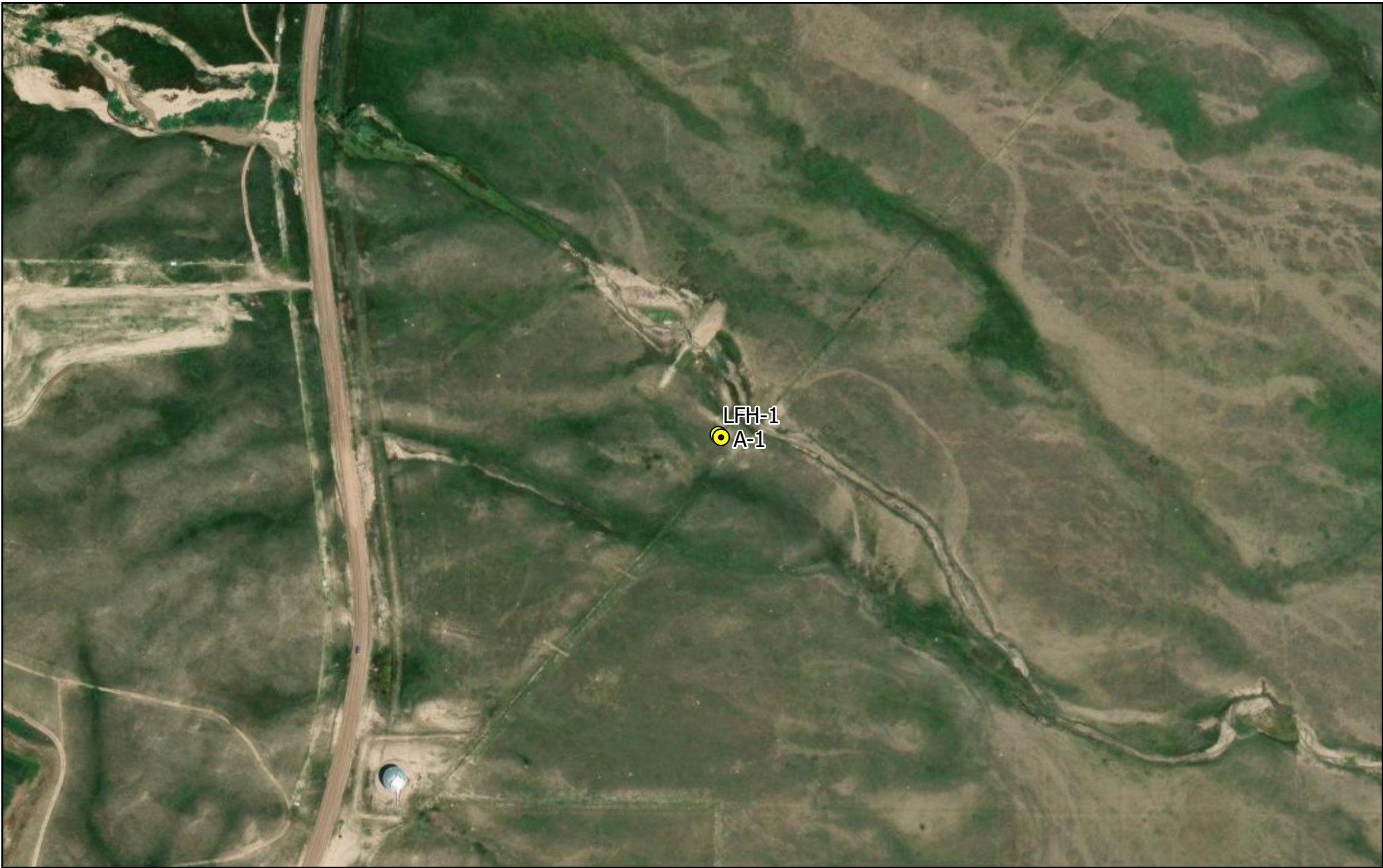
Well	Safe Yield (gpm)
LFH-1	125-150
A-1	30-50

Table 6: Submersible Pump Design Criteria

Well	Pump Model	Horsepower (HP)	Design Rate (GPM)	Pump Intake (ft-bgs)	Design Head (ft)	Stages
LFH-1	TBD	115	150	2265	2276	TBD
A-1	TBD	30	50	1645	1600	TBD

Figures

Figure 1: Site Map



**FIGURE 1 - SITE VICINITY MAP
WELLS LFH-1 AND A-1**

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Figure 2: Well LFH-1 Step Test Results

LFH-1 Step Test

Drawdown Calibration $T = 88\text{ft}^2/\text{day}$ $S = 0.035$

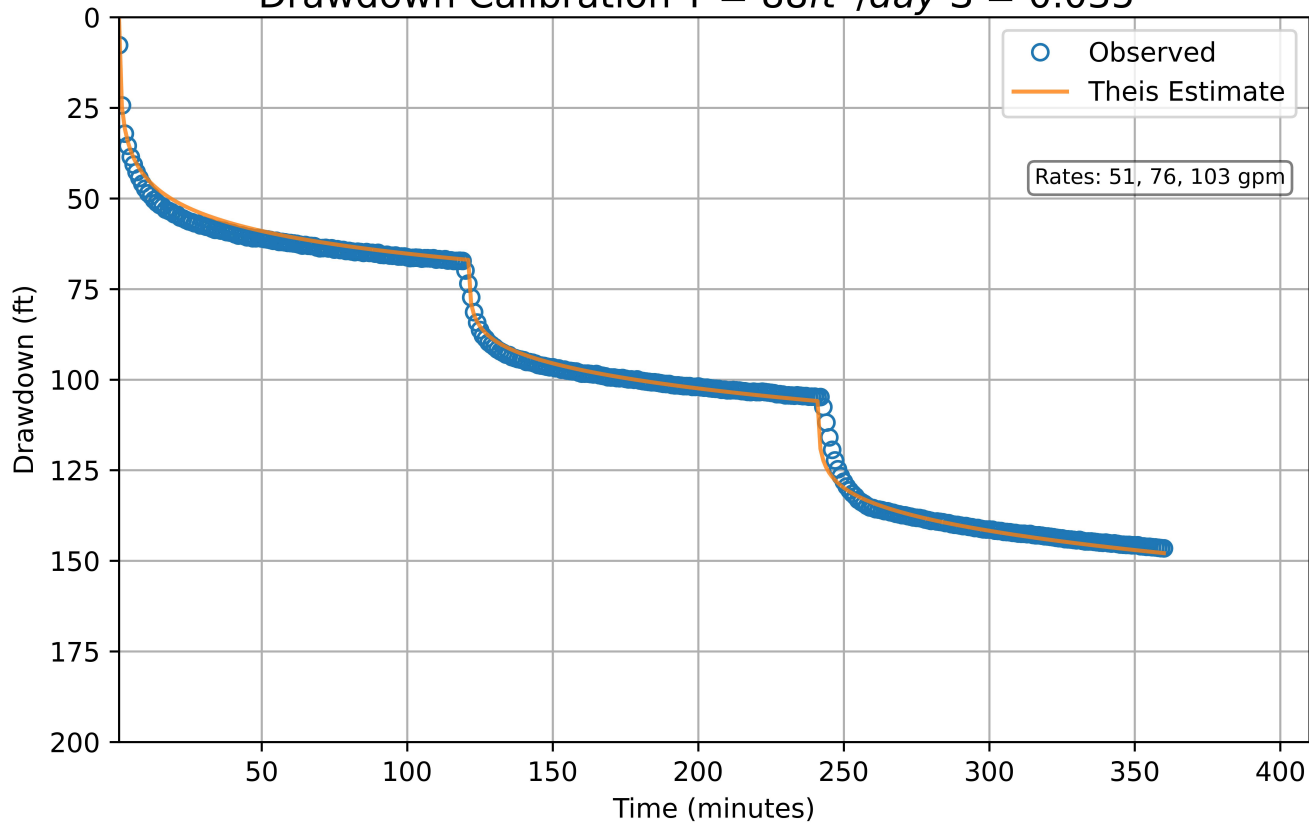


Figure 3: Well A-1 Step Test Results

A-1 Step Test

Drawdown Calibration $T = 29.5 \text{ ft}^2/\text{day}$ $S = 0.07$

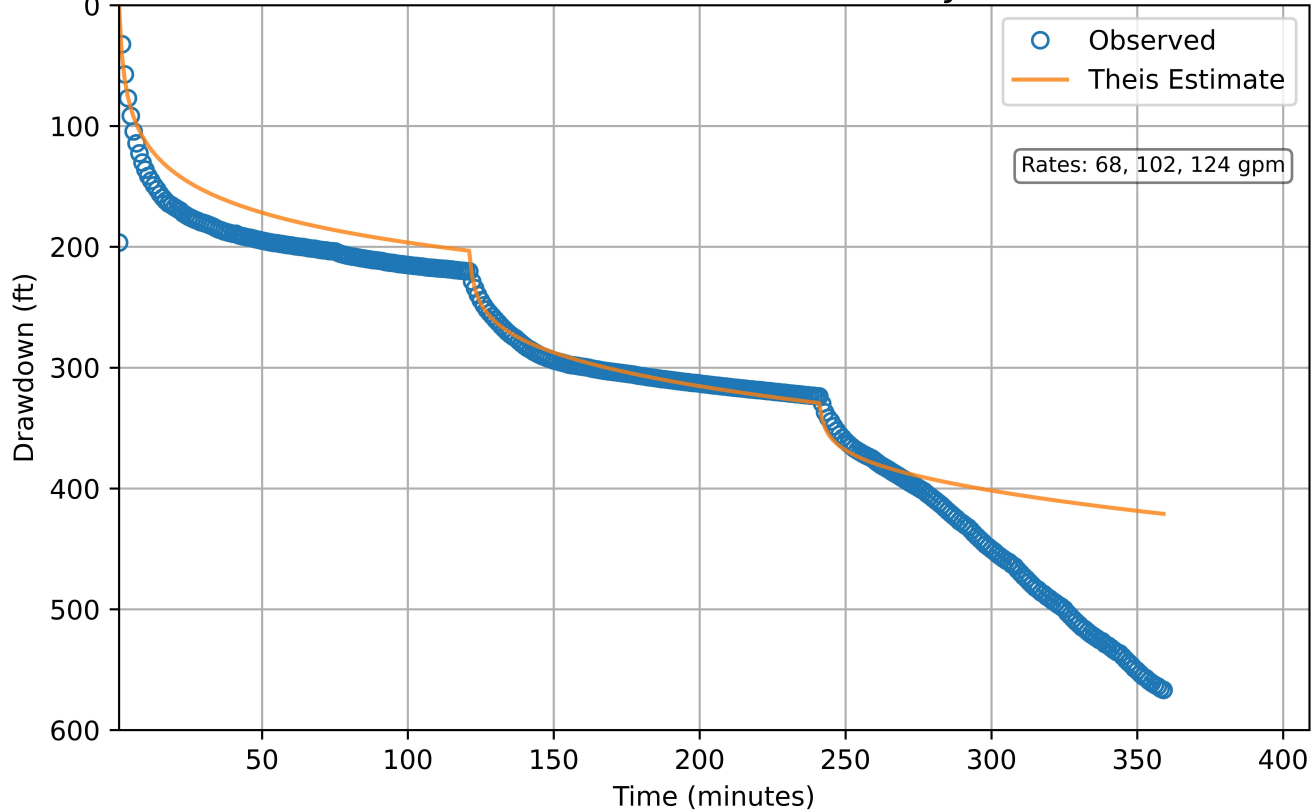


Figure 4: Well LFH-1 Constant Rate Test Results Recovery Calibration

LF-1 Constant Rate Test

Recovery Calibration $T = 97.5 \text{ ft}^2/\text{day}$ $S/S' = 1.15$

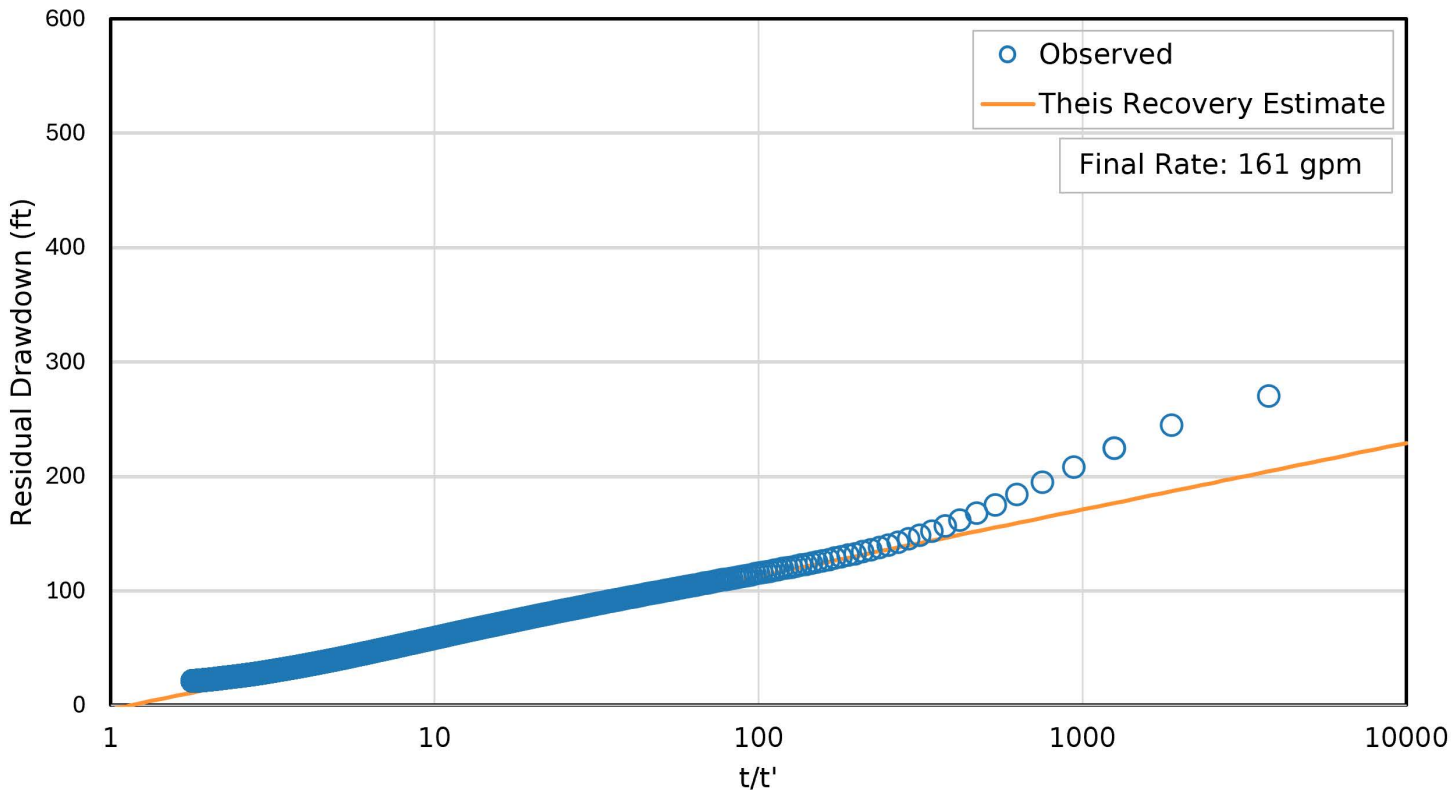
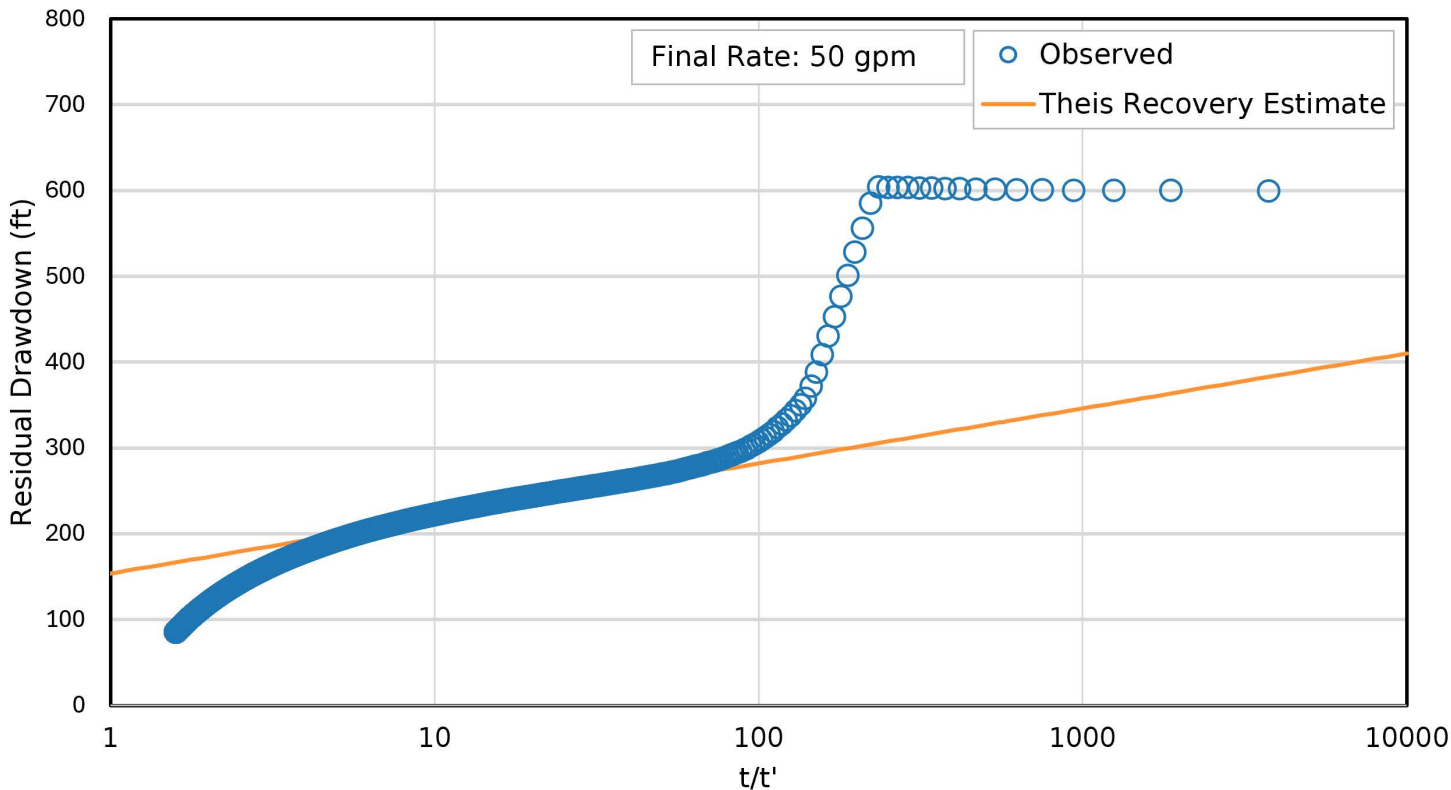


Figure 5: Well A-1 Constant Rate Test Results Recovery Calibration

A-1 Constant Rate Test

Recovery Calibration $T = 27.5 \text{ ft}^2/\text{day}$ $S/S' = 0.004$



Appendices

Appendix A: Final DWR Well Permit and Well Construction Report



ORIGINAL PERMIT APPLICANT(S)

GRANDVIEW RESERVE METROPOLITAN DISTRICT NO. 1
 (PAUL HOWARD)

APPROVED WELL LOCATION

Water Division: 2 Water District: 10
 Designated Basin: UPPER BLACK SQUIRREL CREEK
 Management District: UPPER BLACK SQUIRREL
 County: EL PASO
 Parcel Name: N/A
 Physical Address: N/A

NE 1/4 NW 1/4 Section 28 Township 12.0 S Range 64.0 W Sixth P.M.

UTM COORDINATES (Meters, Zone:13, NAD83)

Easting: 537607.1 Northing: 4314958.4

PERMIT TO CONSTRUCT A NEW WELL

ISSUANCE OF THIS PERMIT DOES NOT CONFER A WATER RIGHT
CONDITIONS OF APPROVAL

- 1) This well shall be used in such a way as to cause no material injury to existing water rights. The issuance of this permit does not ensure that no injury will occur to another vested water right or preclude another owner of a vested water right from seeking relief in a civil court action.
- 2) The construction of this well shall be in compliance with the Water Well Construction Rules 2 CCR 402-2, unless approval of a variance has been granted by the State Board of Examiners of Water Well Construction and Pump Installation Contractors in accordance with Rule 18.
- 3) Approved pursuant to CRS 37-90-107(7) and the Findings and Orders of the Colorado Ground Water Commission dated July 22, 2004 for Determination of Water Right No. 510-BD, December 3, 2008 for Determination of Water Right No. 510-BD Amendment No. 1, and September 26, 2022 for Determination of Water Right No. 510-BD Amendment No. 2.
- 4) The pumping rate of this well shall not exceed 150 GPM.
- 5) The allowed average annual amount of groundwater that may be withdrawn by this well under this permit may not exceed 1,312.5 acre-feet, subject to the conditions of the above referenced Findings and Orders, including but not limited to the allowed maximum annual amount of withdrawal.
- 6) The total amount of groundwater that may be withdrawn by this well under this permit may not exceed a volume of 131,250 acre-feet, subject to the conditions of the above referenced Findings and Orders.
- 7) The use of groundwater from this well is limited to domestic, livestock watering, lawn irrigation, commercial, industrial, replacement, augmentation and municipal use by Four-Way Ranch Metropolitan District and the Woodman Hills Metropolitan District; and all municipal purposes by the Grandview Reserve Metropolitan District No. 1 including: domestic, agricultural, stock watering, irrigation, commercial, industrial, manufacturing, fire protection, power generation, wetlands, piscatorial, and wildlife, either directly or after storage. The place of use shall be limited to the 8,095-acre land area and the service area of the Woodman Hills Metropolitan District within the Upper Black Squirrel Creek Designated Groundwater Basin claimed in the above described Order of the Commission dated December 3, 2008 for Amendment No. 1.
- 8) **CONDITION REVOKED ON 01/30/2024 REPLACED BY CONDITION #9.**
 Production from this well is limited to the Laramie-Fox Hills aquifer which is located approximately 2,025 feet below ground surface and extends to a depth of approximately 2,290 feet. In accordance with Rule 10.4.8 of the Water Well Construction Rules, plain steel casing must be installed and grouted from the top of the permitted production zone up to at least ten feet above the base of the surface casing, or to the depth required by Rule 10.5.2.1, if no surface casing is installed. (NOTE: If coals and/or carbonaceous shales are encountered in the borehole, plain casing and grout should be installed through these intervals to exclude poor quality water from entering the well.)

- 9) **CONDITION REVOKED ON 02/12/2024 REPLACED BY CONDITION #10.**
 Production from this well is limited to the Laramie-Fox Hills aquifer, which is located approximately 2,025 feet below land surface and extends to a depth of approximately 2,290 feet. Total drilled depth must not exceed 2,320 feet below ground surface to accommodate a sump/rathole at the bottom of the well. Plain casing must be installed and grouted to prevent the withdrawal of groundwater from other aquifers and the movement of groundwater between aquifers. In accordance with Rule 10.4.8 of the Water Well Construction Rules, plain steel casing must be installed and grouted from the top of the permitted production zone up to at least ten feet above the base of the surface casing, or to the depth required by Rule 10.5.2.1, if no surface casing is installed. (NOTE: If coals and/or carbonaceous shales are encountered in the borehole, plain casing and grout should be installed through these intervals to exclude poor quality water from entering the well.)
- 10) **CONDITION REVOKED ON 02/14/2024 REPLACED BY CONDITION #11.**
 Production from this well is limited to the Laramie-Fox Hills aquifer, which is located approximately 2,025 feet below land surface and extends to a depth of approximately 2,294 feet. Total drilled depth must not exceed 2,324 feet below ground surface to accommodate a sump/rathole at the bottom of the well. Plain casing must be installed and grouted to prevent the withdrawal of groundwater from other aquifers and the movement of groundwater between aquifers. In accordance with Rule 10.4.8 of the Water Well Construction Rules, plain steel casing must be installed and grouted from the top of the permitted production zone up to at least ten feet above the base of the surface casing, or to the depth required by Rule 10.5.2.1, if no surface casing is installed. (NOTE: If coals and/or carbonaceous shales are encountered in the borehole, plain casing and grout should be installed through these intervals to exclude poor quality water from entering the well.)
- 11) Production from this well is limited to the Laramie-Fox Hills aquifer, which is located approximately 2,025 feet below land surface and extends to a depth of approximately 2,294 feet. Total drilled depth must not exceed 2,335 feet below ground surface to accommodate a sump/rathole at the bottom of the well. Plain casing must be installed and grouted to prevent the withdrawal of groundwater from other aquifers and the movement of groundwater between aquifers. In accordance with Rule 10.4.8 of the Water Well Construction Rules, plain steel casing must be installed and grouted from the top of the permitted production zone up to at least ten feet above the base of the surface casing, or to the depth required by Rule 10.5.2.1, if no surface casing is installed. (NOTE: If coals and/or carbonaceous shales are encountered in the borehole, plain casing and grout should be installed through these intervals to exclude poor quality water from entering the well.)
- 12) The owner shall mark the well in a conspicuous location with the well permit number and name of aquifer as appropriate, and shall take necessary means and precautions to preserve these markings.
- 13) A totalizing flow meter or Commission approved measuring device must be installed on this well and maintained in good working order. Permanent records of all diversions must be maintained by the well owner (collected at least annually) and submitted to the Upper Black Squirrel Creek Ground Water Management District and the Ground Water Commission upon request.
- 14) The entire length of the hole shall be geophysically logged as required by Rule 9 of the Statewide Nontributary Ground Water Rules prior to installing casing.
- 15) This well shall be constructed within 200 feet of the location specified on this permit. This well shall not be located within 600 feet of another large-capacity well completed in the Laramie-Fox Hills aquifer.
- 16) No more than 98% of the groundwater withdrawn annually shall be consumed. The Commission may require well owners to demonstrate periodically that no more than 98% of the water withdrawn is being consumed.
- 17) **ADVANCE NOTICE REQUIRED** - Pursuant to Construction Rule 6.2.2.1 (2 CCR 402-2), licensed or private drillers and pump installers must provide advance notification (by 11:59 pm the day before) to the State Engineer prior to each of the following for this well: the start of well construction, the initial installation of the first permanent pump, and the initial installation of a cistern connected to the water well supply system. Any change in the date of construction/installation must be re-noticed prior to the activity (by 11:59 pm the day before). Information regarding the notification process and a link to the electronic notification form can be found on the Division of Water Resources website at dwr.colorado.gov

NOTE: This well is withdrawing water from a non-renewable aquifer. While the withdrawals from this aquifer are administered based on a 100 year aquifer life, water level declines may prevent this well from diverting the permitted amounts for that 100 years.

NOTE: This well is located within the Upper Black Squirrel Creek Ground Water Management District where local District Rules apply which may further limit the withdrawal and use of designated ground water as authorized under this permit.

NOTE: This permit will expire on the expiration date unless the well is constructed by that date. A Well Construction and Yield Estimate Report (GWS-31) must be submitted to the Division of Water Resources to verify the well has been constructed. A one-time extension of the expiration date may be available. Contact the DWR for additional information or refer to the extension request form (GWS-64). Upon installation of the pump, a Pump Installation and Production Equipment Test Report (GWS-32) must be submitted to the Division of Water Resources. In addition, a Notice of Commencement of Beneficial Use (GWS-19) must be filed with the Division of Water Resources by the well owner within 30-days after first commencement of use. Forms are available at: dwr.colorado.gov



Date Issued: 6/27/2023

Expiration Date: 6/27/2024

Issued By WENLI DICKINSON

WELL PERMIT NUMBER 88240-F

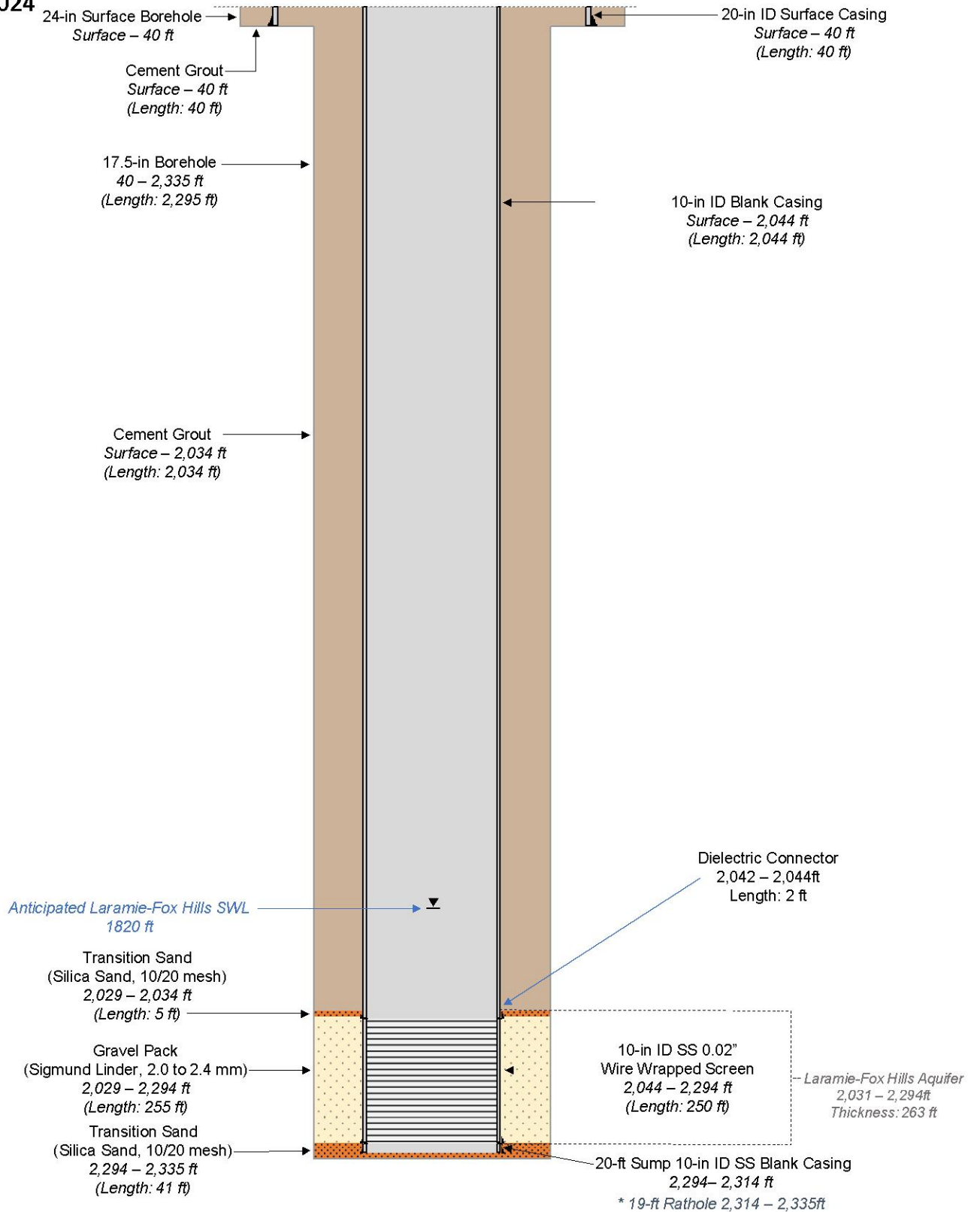
RECEIPT NUMBER 10027734

PERMIT HISTORY

02-14-2024	PERMIT AMENDMENT (CONDITIONS)
02-12-2024	PERMIT AMENDMENT (CONDITIONS)
01-30-2024	PERMIT AMENDMENT (CONDITIONS)

Well Permit 88240-F

Grandview GR-LFH-1
Final Design Revisions
February 14, 2024
LRE Water



Well Permit 88240-F

4053HRG02



Well Name: Grandview LFH-1

Northing: 4314958.4

Easting: 537607.1

Logging Date: 3/3/2024

Depth [FEET]	Lithology %				Description
	Sand	Shale	Coal	Claystone/ Mudstone	
0					*No samples taken during surface casing installation.
10					*No samples taken during surface casing installation.
20					*No samples taken during surface casing installation.
30					*No samples taken during surface casing installation.
40					*No samples taken during surface casing installation.
50	30			70	Tan to brown sandy clay, loose, moderately sorted sand, small pieces of dark gray mudstone.
60	98			<2	Coarse, tan quart-rich sand, well sorted.
70	90			10	Poorly sorted medium to coarse sand, tan to gray grains, quartz, grains up to 1 cm, moist, angular grains.
80	90			10	Poorly sorted gravelly sands, pink to gray quartz and feldspars, moist sub-angular to sub-rounded.
90	90			10	Same as above.
100	40			60	Gray sandy clay, loose, moist, sand grains fine to v. coarse, up to 4 mm.
110	60			40	Light gray clayey sand, sand grains v. fine, dry.
120	40			60	Brown sandy clay, soft, moist, medium plasticity, fine to v. fine sand, trace mica present.
130	30			70	Brown sandy clay, stiff, moist, high plasticity, fine to medium sand grains.
140	90			10	Light gray moderately sorted sand, loose and in clumps up to 2 cm, easy to crumble, dry, v. fine to coarse grains.
150	40			60	Brown sandy clay, soft, moist, medium plasticity, sand grains fine to medium.
160	70			30	Light gray moderately sorted sand w/gray sandy clay clumps, fine to medium sands, moist clay.
170	50			50	Same as above, with more clay.
180	70			30	Light gray well sorted sand in large clumps to 3 cm, with clay matrix. Fine to coarse sand.
190	40			60	Brown sandy clay, soft, moist, medium plasticity, fine to medium sand grains.

200	80			20	Orange to tan clayey sand, poorly sorted, v. fine to coarse sand, weathering present, angular grains.
210	80			20	Same as above.
220	80			20	Gray sand and gravel, sub-rounded and poorly sorted, moist, clay present in matrix.
230	80			20	Same as above.
240	50			50	Light gray well sorted sand and gray, soft clay. Sand v. fine to fine, dry, clay has medium plasticity, moist.
250	70			30	Gray clayey sand, moderately sorted, sand grains fine to medium with some coarse grains, moist.
260	80			20	Gray sand, moderately sorted, fine to coarse, v. moist, sub-rounded grains.
270	50			50	Light gray well sorted sand and gray, sort clay, sand v. fine to fine, dry, clay medium plasticity and moist.
280	40			60	Gray clay with friable mudstone pieces, medium plasticity, sand grains v. fine to coarse.
290	60			40	Gray clayey sand, moderately sorted, fine to coarse sand, moist.
300	80			20	Gray sand, moderately sorted, fine to coarse, moist, sub-angular grains.
310	30			70	Dark, gray clay w/friable mudstone pieces to 2 mm, clay is medium stiff with medium to high plasticity, sand v. fine, gray.
320	10			90	Dark gray clay w/friable mudstone pieces to 1 cm, clay is medium stiff, medium to high plasticity, moist.
330	10			90	Dark gray clay, friable mudstone pieces, soft and sticky, high plasticity, moist.
340	20			80	Same as above, w/more sand present.
350	20			80	Same as above.
360	20			80	Same as above.
370	20			80	Same as above.
380	25			75	Dark gray sandy clay, soft, medium plasticity, friable mudstone pieces present, fine grained sand.
390	35			65	Dark gray sandy clay, soft, medium plasticity, fine to medium sand grains, moist.
400	35			65	Same as above.
410	25			75	Brown clay w/hard mudstone pieces to 1 cm, clay soft w/medium plasticity, fine sand grains.
420	20			80	Brown clay w/coal, clay is soft, medium plasticity, v. fine sand.
430	40			60	Brwon clay and gray fine well sorted sand, soft clay w/ medium plasticity.
440	70			30	Sandy shale, friable, present in angular pieces to 1 cm, v. fine sand grains, some soft brown clay present.

450	25			75	Black shale w/large claystone pieces to 2 cm, friable, v. fine sand present.
460	20			80	Light brown crumbly clay, low plasticity, pieces of mudstone/claystone to 2 mm.
470	90			10	Gray silty sand, moist, loose, well sorted, mica present, v. fine to medium grains.
480	80			20	Same as above w/more clay content.
490	20			80	Brown clay w/mudstone pieces to 2 cm, soft, moderate plasticity.
500	20			80	Brown clay w/crumbly claystone/mudstone pieces to 2 cm, low plasticity, soft clay.
510	20			80	Same as above.
520	10			90	Dark brown clay, high plasticity, w/crumbly mudstone pieces to 2 mm, soft.
530	10			90	Same as above.
540	20			80	Same as above, w/ more sand content.
550	30			70	Crumbly dark gray to black sandy clay, clay is soft and medium plasticity, v. fine to fine sand grains, mica present.
560	20			80	Dark brown clay, soft w/high plasticity, some friable shale pieces to 5 mm, v. fine sand present.
570	20			80	Dark brown clay, medium plasticity, w/ mudstone pieces to 2 mm, v. fine to fine sand.
580	70			30	Gray to light gray silty sand, low plasticity, sand is well sorted, v. fine to fine grained, clumps of dry-packed sand present.
590	70			30	Same as above.
600	20			80	Dark brown clay, soft and high plasticity, friable claystone pieces present to 1.5 cm, sand v. fine w/some mica present.
610	30			70	Dark brown sandy clay, soft, medium plasticity, sand v. fine, some packets of dry, powdery, packed sand.
620	30	40		30	Black coal w/shale, pieces of fine-grained sandstone present to 3 cm, dry.
630	5			95	Dark gray clay, medium stiff and plasticity, w/gray claystone pieces to 1 cm, hard.
640	5			95	Dark gray clay, medium stiff and plasticity, few hard claystone pieces to 1 cm, clay in 5 mm clumps.
650	15			75	Gray shale, friable, in pieces to 1 cm, w/ dark gray medium stiff clay, medium plasticity, v. fine to fine sand.
660	50			50	Gray fine sand w/flaky shale, gray to dark gray up to 3 cm, sand present in dry clumps.
670	10			90	Dark gray clay, medium stiff and high plasticity, w/ gray mudstone pieces to 1 cm, friable.
680	10			90	Dark gray mudstone pieces to 1 cm, friable, dry, some v. fine to fine sand, some dry dark gray clay.

690	<2			98	Dark gray clay , medium stiff and plasticity, few hard but flaky gray claystone pieces.
700	<2			98	Same as above.
710	30			70	Dark gray sandy clay, soft w/low plasticity, v. fine sand grains.
720	20			80	Same as above w/ more clay content.
730	70			30	Fine gray sand in dry clumps to 2.5 cm. Some clumps of dark gray sandy clay to 2 cm.
740	50			50	Hard gray sandstone w/mica, dark gray sandy clay, soft and low plasticity, few hard tan claystone pieces to 3 cm.
750	70			30	Fine gray sand in dry clumps to 1 cm, some soft sandy clay, dark gray w/ low plasticity.
760	50			50	Same as above w/ more clay content.
770	60			40	Dark gray clayey sand, moist, w/ some gray hard claystone pieces to 1 cm.
780	20			80	Dark gray stiff clay, low plasticity w/some hard gray claystone pieces to 1 cm.
790	90			10	V. fine gray sandstone in 1-2 mm pieces (some to 2 cm), dry, sandstone is easily powdered.
800	30			70	V. fine gray sandstone in 1-2 mm pieces and dark gray mudstone pieces 1-2 mm.
810	20			80	Dark gray mudstone in <1 mm pieces and dry gray clumps of clay, v. low plasticity, crumbly, v. fine sand present.
820			90	10	Lignite coal with gray to light gray mudstone pieces to 2 mm. Coal is dull, black w/dark brown streak, lightweight.
830	90			10	V. fine clayey sand in clumps to 5 cm, easily crumbles, moist to dry.
840	80			20	Same as above w/more clay content.
850	5			95	Dark gray clay, medium stiff and medium plasticity, pieces of claystone present to 1 cm.
860	40			60	Dark gray sandy clay, soft and low plasticity, sand is gray and v. fine.
870	60			40	Gray to dark gray clayey sand w/pieces of black vitreous mudstone (coal?).
880	<2			98	Dark brown clay, medium stiff and high plasticity, present in small clay pieces 1-2 mm.
890	<2			98	Same as above.
900	<2			98	Same as above w/friable gray to dark gray mudstone pieces to 1 cm.
910	<2			98	Same as above.
920	<2			98	Same as above w/more mudstone pieces.

930	20			80	Dark gray clay, stiff w/ medium plasticity, hard mudstone/claystone pieces to 1 cm present, v. fine sand present in 1 cm clumps.
940	10			90	Dark gray to black mudstone, friable, present in large clumps to 8 cm.
950	98			<2	Gray sand, v. fine, present in large clumps and rounded pebble-sized clumps to 1 cm, dry.
960	98			<2	Same as above.
970	80			20	Gray v. fine sand in clumps to 1 cm, w/ dark gray clay and mudstone pieces to 5 mm, dry and loose.
980	98			<2	Gray sand, v. fine, present in large clumps to 5 cm and round pebble-sized clumps to 1 cm, dry.
990	15			85	Dark brown clay, medium stiff and plasticity, some v. fine sand present, some small mudstone pieces to 2 mm present.
1000	15			85	Same as above.
1010	50			50	Dark brown clay, medium stiff and plasticity, w/large clumps of powdery sand to 5 cm, gray v. fine sand, dry.
1020	15			85	Dark brown crumbly mudstone pieces to 3 cm, dry, some v. fine sand present.
1030	80			20	Gray v. fine sand in clumps to 3 cm, dry, some clay content present.
1040	30			70	Dark brown stiff clay, medium plasticity w/clumps of v. fine gray sand to 2 cm and crumbly gray mudstone to 2 cm.
1050	40			60	Dark gray sandy clay, low plasticity and medium stiff, sand present in gray clumps to 3 cm, dry.
1060	30			70	Dry sandy clay clumps to 2 cm, gray, some soft sandy clay present, clumps are dry and powdery.
1070	40			60	Same as above w/more sand.
1080	50			50	Gray v. fine sand in hard clumps to 2 cm, w/dark brown sandy clay clumps, low plasticity and soft.
1090	90			10	Gray v. fine sand (maybe sandstone) in large clumps to 3 cm made up of small pebble-sized clumps to 1 cm, dry, some clayey sand clumps present.
1100	98			<2	Sandstone, hard, fine to v. fine grained, gray, present in rounded pebbles to 3 cm.
1110	40			60	V. dry sandy clay, gray, v. fine sand, some powdery sand clumps present to 2 cm.
1120	40			60	Dark gray sandy clay, low plasticity, med. Stiff, w/ clayey sand, dry, gray.
1130	20			80	Dark gray clay, stiff and medium plasticity, moist, w/ clumps of dried out clay, some brown sand clumps present.
1140	20			80	Same as above.
1150	10			90	Gray to brown claystone present in large flat pieces to 6 cm, hard but able to break by hand.

1160	40			60	Gray sandy clay and v. fine gray sand in clumps to 1 cm, moderate stiff and high plasticity.
1170	10			90	Dark gray clay, medium stiff and plasticity, some claystone pieces to 1 cm present.
1180	10			90	Same as above.
1190	50			50	Dark gray sandy clay and v. fine sand, dry, medium stiff and plasticity.
1200	50			50	Gray soft sandstone pieces to 4 cm and sandy clay clumps, low plasticity, stiff.
1210	15			85	Dry gray clay, crumbly and present in clumps to 3 cm, some v. fine sand present.
1220	25			75	Same as above, more sand content.
1230	15			85	Dark gray clay, stiff w/high plasticity, some sand, v. fine, some clay is moist, some in dry clumps.
1240	15			85	Same as above.
1250			90	10	Coal, black, some powdery, some w/clay.
1260	90			10	Gray fine sand, well sorted w/some clay content. Moist and loose.
1270	65			35	Gray fine sand in 1-2 cm clumps, some sandy clay clumps 1-2 cm, few claystone pieces to 2 cm, hard.
1280			80	20	Coal, black w/clay content.
1290	<2			98	Dark gray v. stiff clay, medium plasticity, moist w/dry clumps.
1300	<2			98	Same as above, clay is softer.
1310	<2			98	Dark gray clay, medium stiff, high plasticity, moist.
1320	10			90	Dark gray clay, dry, some fine sand.
1330	<2			98	Dark gray clay, medium stiff, high plasticity, moist.
1340	<2			98	Dark gray to black clay, soft, high plasticity, moist.
1350	<2			98	Same as above.
1360	95			5	Fine well sorted, sand, "beach sand", gray, moist.
1370	95			5	Gray to light gray dry sand, loose, some white powdery sand-sized grains present, gypsum or other evaporite?
1380	95			5	Same as above.
1390	10			90	Dark gray clay, medium stiff, high plasticity, moist, some minor v. fine sand.
1400	10			90	Same as above.
1410	10			90	Same as above, but drier.
1420	20			80	Same as above, more sand content.

1430	10			90	Same as above, less sand.
1440	20			80	Same as above, more sand.
1450	25			75	Gray sandy clay, dry, crumbly, sand fine to v. fine.
1460	60			40	Rounded sandstone clumps to 2 cm, gray, w/clumps of hard dry clay.
1470	15			85	Sticky gray clay, moist, soft, high plasticity, some fine sand present.
1480	20			80	Sticky gray clay, moist, w/hard dry gray clay, more fine sand than above.
1490	90			10	Dark gray sand, wet and loose, clay in matrix.
1500	10			90	Dark gray clay, moist, stiff w/high plasticity.
1510	10			90	Same as above, with some mudstone pieces to 2 mm.
1520	5			95	Sticky dark gray clay, sift, high plasticity, low sand content, wet.
1530	10			90	Same as above, more sand.
1540	10			90	Same as above.
1550	15			85	Same as above, more sand.
1560	5			95	Gray clay, very wet, soft, high plasticity, low sand.
1570	50			50	Gray clay, wet, soft w/ gray sand, "beach sand", well sorted and fine grained.
1580	70			30	Gray well sorted sand, loose, wet, some clay in matrix.
1590	30			70	Gray sandy clay, wet, soft, some clumps of sand to 2 cm, sand grains are fine and well sorted.
1600	30			70	Same as above.
1610	5			95	Sticky gray clay, soft, high plasticity, wet.
1620	5			95	Same as above.
1630	80			20	Gray clayey sand, in clumps to 2 cm, crumbles easily, fine-grained to medium grained.
1640	40			60	Gray sandy clay, hard and stiff, sand is medium grained.
1650	40			60	Same as above.
1660	80			20	Gray fine to medium sand in clumps to 1 cm, dry and powders easily, some dark gray soft clay.

1670	80			20	Gray clayey sand, dry, easily powdered clumps, fine to coarse grains.
1680	20			80	Dark gray stiff clay in 2 mm clumps, fine sand grains present.
1690	35			65	Dark gray stiff clay in clumps w/friable sandstone pieces to 3 cm, sand medium grained and gray, clay medium plasticity.
1700	30			70	Dark gray flaky mudstone in pieces to 2 cm, fine gray sandy matrix.
1710	20			80	Dark gray clay, medium stiff, high plasticity, fine gray sand present.
1720	20			80	Same as above.
1730	10			90	Same as above, less sand.
1740	40			60	Dark gray clay, stiff, high plasticity, large pieces of friable sandstone, gray to 3 cm, fine to medium grained.
1750	40			60	Dark gray mudstone in pieces to 3 cm, friable w/chunks of hard sandstone, medium grained, gray.
1760	20			80	Dark gray soft sandy clay, high plasticity, fine grained sand.
1770	60			40	Fine to medium clayey sand, gray, dry, crumbly, some dark gray clay chunks.
1780	20			80	Dark gray stiff clay, medium plasticity, sand is fine-grained.
1790	20			80	Dark gray sandy clay, dry and crumbly, medium plasticity, fine grained sand.
1800	80			20	Light gray fine sandstone in pieces 1 mm to 2 cm, friable, some dark gray clay, medium stiff, high plasticity.
1810	15			85	Dark gray clay, medium stiff and high plasticity, fine sand in matrix.
1820	15			85	Same as above.
1830	20			80	Same as above, w/minor fine ss pieces to 1 cm, crumbly.
1840	10			90	Same as above, w/no ss, less sand.
1850	10			90	Dark gray soft clay, high plasticity, w/pieces of friable dark gray mudstone to 2 cm.
1860	20			80	Dark gray friable mudstone/claystone in pieces to 4 cm, some pieces angular, some pebble-sized, soft gray clay present.
1870	40			60	Dark gray clay medium stiff and plasticity w/pieces of friable dark gray shale, lots of fine tan sand in matrix.
1880	20			80	Friable dark gray mudstone in rounded pieces to 2 cm, fine sand, and dark gray clay, stiff and medium plasticity.
1890	60			40	Fine brown sand w/pieces of dark gray, hard shale.
1900	10			90	Stiff dark gray clay in pieces 1-2 mm, trace fine sandstone pieces to 1 cm.

1910	10			90	Dark gray clay, soft, some dry and crumbly large clumps to 6 cm, mudstone pieces present to 2 cm.
1920	20			80	Same as above.
1930	80			20	Rounded gray pieces of sandstone 1 to 3 cm, fine to medium grains, some rounded pieces of claystone.
1940	10			90	Very stiff dark gray clay, present in clumps to 3 cm.
1950	10			90	Same as above, medium stiff.
1960	10			90	Soft gray clay, medium plasticity, w/pieces of dark gray friable shale and mudstone, 0.5 to 1 cm.
1970	<2			98	Dark gray to black soft clay, high plasticity, w/pieces of friable black shale.
1980	<2			98	Dark gray soft clay and small pieces of very friable shale, 1-2 mm.
1990	<2			98	Soft dark gray clay, medium plasticity w/pieces of friable mudstone to 2 cm.
2000	10			90	Medium stiff gray clay, some dry, pieces of mudstone to 1 cm, fine sand.
2010	10			90	Same as above.
2020			60	40	Lignite coal, dull, w/black soft clay.
2030	20		40	40	Soft black clay, moist, coal in flat pieces to 3 cm w/shiny luster, fine dark sand.
2040	80			20	Fine dark gray sand, moist, clay in matrix.
2050	70			30	Soft friable light gray sandstone in rounded pebbles to 2 cm, w/soft clayey dark gray sand, fine grained.
2060	70			30	Soft v. fine light gray sandstone in pieces to 4 cm, rounded w/some claystone, hard and flat to 4 cm.
2070	80			20	Soft gray to light gray fine sand, w/fine sandstone pieces to 3 cm, some clay in matrix.
2080	80			20	Same as above w/trace hard gray claystone pieces to 3 cm.
2090	80			20	Same as above.
2100	90			10	V. fine brown sand, moist, some clay in matrix.
2110	10			90	Soft gray clay, moist, medium plasticity, fine sand present.
2120	10			90	Same as above.
2130	10			90	Same as above.
2140	5			95	Same as above.

2150	40			60	Tan to gray sandy clay, low plasticity, fine tan sand.
2160	30			70	Same as above, less sand.
2170	30			70	Same as above.
2180	10			90	Soft gray clay, medium plasticity, fine sand present.
2190	<2			98	Dark gray soft clay, high plasticity, moist, some small mudstone pieces present 1-2 mm.
2200	<2			98	Same as above.
2210	10			90	Dark gray soft clay, high plasticity and friable black mudstone pieces to 2 cm, fine sand.
2220	20			80	Same as above w/more sand.
2230	10			90	Soft gray clay, high plasticity and sticky w/large shale pieces to 10 cm, friable and flaky.
2240	<2			98	Sticky soft dark gray clay, wet w/dark gray friable mudstone pieces.
2250	10			90	Dark gray sticky clay, high plasticity, soft, pieces of friable mudstone present to 0.5 mm.
2260	20			80	Dark gray sandy clay, low plasticity, sand medium grained, large pieces of shale present to 2 cm.
2270	20			80	Dark gray medium stiff clay, high plasticity, large pieces of hard sandstone present to 2 cm.
2280	20			80	Same as above.
2290	10			90	Dark gray medium stiff clay, high plasticity w/small friable pieces of shale.
2300	50			50	Dark gray soft clay, high plasticity w/coarse quartz sand, pieces of sandstone present to 1 cm.
2310	10			90	Dark gray, sticky clay, medium stiff, pieces of friable mudstone to 1 cm.
2320	10			90	Same as above. TD = 2320 ft.



ORIGINAL PERMIT APPLICANT(S)

GRANDVIEW RESERVE METROPOLITAN DISTRICT NO. 1
 (PAUL HOWARD)

APPROVED WELL LOCATION

Water Division: 2 Water District: 10
 Designated Basin: UPPER BLACK SQUIRREL CREEK
 Management District: UPPER BLACK SQUIRREL
 County: EL PASO
 Parcel Name: N/A
 Physical Address: N/A

NE 1/4 NW 1/4 Section 28 Township 12.0 S Range 64.0 W Sixth P.M.

UTM COORDINATES (Meters, Zone:13, NAD83)

Easting: 537609.0 Northing: 4314956.6

PERMIT TO CONSTRUCT A NEW WELL

ISSUANCE OF THIS PERMIT DOES NOT CONFER A WATER RIGHT
CONDITIONS OF APPROVAL

- 1) This well shall be used in such a way as to cause no material injury to existing water rights. The issuance of this permit does not ensure that no injury will occur to another vested water right or preclude another owner of a vested water right from seeking relief in a civil court action.
- 2) The construction of this well shall be in compliance with the Water Well Construction Rules 2 CCR 402-2, unless approval of a variance has been granted by the State Board of Examiners of Water Well Construction and Pump Installation Contractors in accordance with Rule 18.
- 3) Approved pursuant to CRS 37-90-107(7) and the Findings and Orders of the Colorado Ground Water Commission dated July 22, 2004 for Determination of Water Right No. 511-BD, December 3, 2008 Determination of Water Right No. 511-BD Amendment No. 1, and September 26, 2022 for Determination of Water Right No. 511-BD Amendment No. 2.
- 4) The pumping rate of this well shall not exceed 100 GPM.
- 5) **CONDITION REVOKED ON 03/14/2024 REPLACED BY CONDITION #6.**
 Production from this well is restricted to the Arapahoe aquifer, which corresponds to the interval between 1,210 feet and 1,675 feet below the ground surface.
- 6) Production from this well is limited to the Arapahoe aquifer, which is located 1,190 feet below land surface and extends to a depth of 1,705 feet. Total drilled depth must not exceed 1,745 feet below ground surface to accommodate a sump/rathole at the bottom of the well. In the event a sand unit is encountered in the interval below the base of the Arapahoe aquifer, the sand interval and intervening shale below the base of the Laramie-Fox Hills aquifer must be grouted in a manner sufficient to prevent communication between the Arapahoe and Laramie-Fox Hills aquifers. Plain casing must be installed and grouted to prevent the withdrawal of groundwater from other aquifers and the movement of groundwater between aquifers.
- 7) The allowed average annual amount of groundwater that may be withdrawn by this well under this permit may not exceed 1,400 acre-feet, subject to the conditions of Determination of Water Right no. 511-BD and Amendment No. 2 including but not limited to the allowed maximum annual amount of withdrawal.
- 8) The total amount of groundwater that may be withdrawn by this well under this permit may not exceed a volume of 140,000 acre-feet, subject to the conditions of Determination of Water Right no. 511-BD and Amendment No. 2.
- 9) The use of groundwater from this well is limited to domestic, livestock watering, lawn irrigation, commercial, industrial, replacement, augmentation and municipal use by Four-Way Ranch Metropolitan District and the Woodman Hills Metropolitan District; and all municipal purposes by the Grandview Reserve Metropolitan District No. 1 including: domestic, agricultural, stock watering, irrigation, commercial, industrial, manufacturing, fire protection, power generation, wetlands, piscatorial, and wildlife, either directly or after storage. The place of use shall be limited to the 8,095-acre land area and the service area of the Woodman Hills Metropolitan District within the Upper Black Squirrel Creek Designated Groundwater Basin claimed in the above described Order of the Commission dated December 3, 2008 for Amendment No. 1.
- 10) No more than 98% of the groundwater withdrawn annually shall be consumed. The Commission may require well owners to demonstrate periodically that no more than 98% of the water withdrawn is being consumed.
- 11) The owner shall mark the well in a conspicuous location with the well permit number and name of aquifer as appropriate, and shall take necessary means and precautions to preserve these markings.

- 12) **CONDITION REVOKED ON 02/23/2024 REPLACED BY CONDITION #12.**
The entire length of the hole shall be geophysically logged as required by Rule 9 of the Statewide Nontributary Ground Water Rules prior to installing casing.
- 13) This well is located within 1,320 feet of an existing well constructed under permit no. 88240-F, for which an acceptable geophysical log is available. Pursuant to Rule 9A of the Statewide Nontributary Ground Water Rules the geophysical logging requirement can be waived.
- 14) A totalizing flow meter or Commission approved measuring device must be installed on this well and maintained in good working order. Permanent records of all diversions must be maintained by the well owner (collected at least annually) and submitted to the Upper Black Squirrel Creek Ground Water Management District and the Ground Water Commission upon request.
- 15) This well shall be constructed within 200 feet of the location specified on this permit. This well shall not be located within 600 feet of another large-capacity well completed in the Arapahoe aquifer.
- 16) **ADVANCE NOTICE REQUIRED** - Pursuant to Construction Rule 6.2.2.1 (2 CCR 402-2), licensed or private drillers and pump installers must provide advance notification (by 11:59 pm the day before) to the State Engineer prior to each of the following for this well: the start of well construction, the initial installation of the first permanent pump, and the initial installation of a cistern connected to the water well supply system. Any change in the date of construction/installation must be re-noticed prior to the activity (by 11:59 pm the day before). Information regarding the notification process and a link to the electronic notification form can be found on the Division of Water Resources website at dwr.colorado.gov

NOTE: This well is withdrawing water from a non-renewable aquifer. While the withdrawals from this aquifer are administered based on a 100 year aquifer life, water level declines may prevent this well from diverting the permitted amounts for that 100 years.

NOTE: This well is located within the Upper Black Squirrel Creek Ground Water Management District where local District Rules apply which may further limit the withdrawal and use of designated ground water as authorized under this permit.

NOTE: This well will be completed in a Type 1 aquifer overlain by multiple confining layers and must be constructed with solid steel casing and grouted in accordance with Well Construction Rule 10.4.5.2 (2 CCR 402-2).

NOTE: This permit will expire on the expiration date unless the well is constructed by that date. A Well Construction and Yield Estimate Report (GWS-31) must be submitted to the Division of Water Resources to verify the well has been constructed. A one-time extension of the expiration date may be available. Contact the DWR for additional information or refer to the extension request form (GWS-64). Upon installation of the pump, a Pump Installation and Production Equipment Test Report (GWS-32) must be submitted to the Division of Water Resources. In addition, a Notice of Commencement of Beneficial Use (GWS-19) must be filed with the Division of Water Resources by the well owner within 30-days after first commencement of use. Forms are available at: dwr.colorado.gov



Date Issued: 6/22/2023

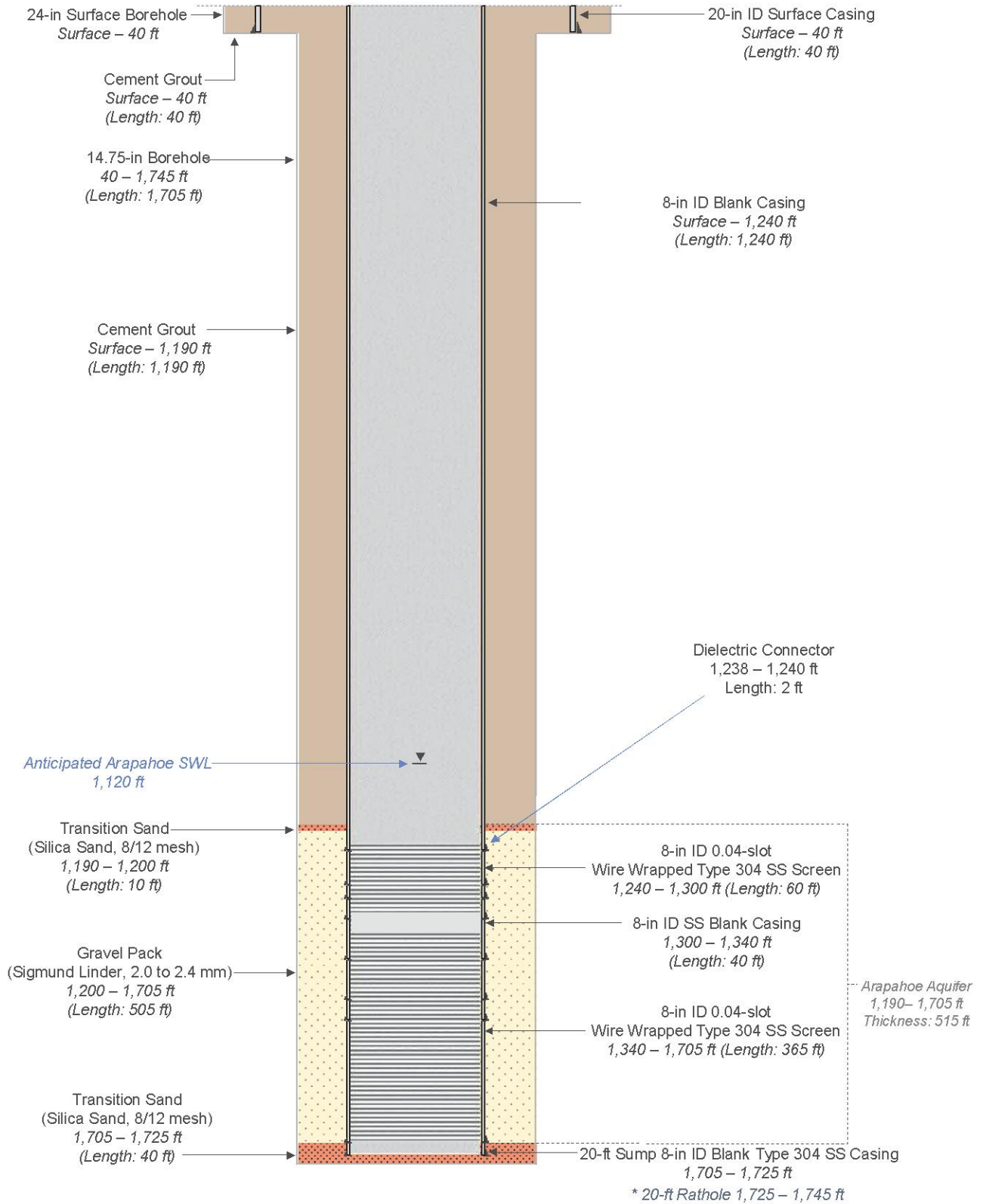
Expiration Date: N/A

Issued By WENLI DICKINSON

PERMIT HISTORY

- 03-14-2024 PERMIT AMENDMENT (CONDITIONS)
- 02-23-2024 GEOPHYSICAL LOG WAIVED

Grandview GR-A-1
Updated Design Revisions
3/18/2024
LRE Water





Well Name: Grandview A-1

Northing: 4314956.6

Easting: 537609.0

Logging Date: 3/26/2024

Depth [FEET]	Lithology %				Description
	Sand	Shale	Coal	Claystone/ Mudstone	
0					*No samples taken during surface casing installation.
10					*No samples taken during surface casing installation.
20					*No samples taken during surface casing installation.
30					*No samples taken during surface casing installation.
40					*No samples taken during surface casing installation.
50	95			5	Coarse, quartz-rich sand to fine gravel, loose, dry, moderately well-sorted, gray.
60	95			5	Same as above, wetter.
70	95			5	Same as above.
80	95			5	Same as above.
90	70			30	Fine, well sorted sand w/rounded clumps of packed clay, gray.
100	95			5	Fine, well sorted sand, gray, moist, like beach sand.
110	95			5	Same as above.
120	10			90	Sticky brown clay w/friable pieces of mudstone to 2 mm and round clumps of dry clay. Medium plasticity.
130	10			90	Same as above, stiffer clay.
140	35			65	Dark gray sandy clay, sticky, medium plasticity and soft. Sand is coarse, well sorted.
150					Sample missing.
160					Sample missing.
170	30			70	Tan sandy clay, high plasticity, soft, sand is coarse, moderately sorted, moist.
180	30			70	Same as above with dried out clumps of sandy clay.
190	30			70	Same as above, clay is stiffer.
200	30			70	Same as above.

210	60			40	Tan clayey sand, med-coarse, well sorted sand, moist.
220	50			50	Friable coarse sandstone, gray and round clumps of sandy clay, tan, soft, moderate plasticity.
230	35			65	Tan sandy clay, medium stiff, moderate plasticity, sand is coarse, well sorted.
240	65			35	Friable fine to medium sandstone with stiff tan sandy clay, moderate plasticity.
250	65			35	Same as above.
260	65			35	Same as above.
270	5			95	Dry, light gray clay in angular clumps to 2 cm.
280	5			95	Same as above.
290	5			95	Same as above.
300	98			<2	Loose coarse sand, well sorted, gray, moist.
310	98			<2	Same as above.
320	98			<2	Same as above, coarser.
330	98			<2	Same as above.
340	<2			98	Dry gray mudstone, in angular pieces up 2 cm, friable.
350	<2			98	Same as above, wetter.
360	<2			98	Hard gray mudstone in small angular pieces from 1-5 mm.
370	<2			98	Same as above.
380	15			85	Dark gray to black shale and hard gray mudstone. Some clumps of brown sandy clay.
390	5			95	Soft gray mudstone, some soft clay, dry and wet mudstone split throughout.
400	10			90	Same as above, more sand.
410	45			55	Stiff sandy clay, low plasticity, dark gray, fine sand.
420	10			90	Brown clay, soft and moist mixed in with dry pieces, ~1-2 mm, Some fine sand in matrix.
430	10			90	Moderately stiff brown clay, high plasticity, some fine sand in matrix, moist.
440	10			90	Sticky soft brown clay, high plasticity, w/mudstone pieces 1-2 mm, fine sand in matrix, moist.
450	5			95	Sticky soft brown clay, moist with clumps of dry tan clay, easily powdered.
460	40			60	Soft, dark gray sandy clay, low plasticity, moist, sand is fine, well sorted.

470	5			95	Stiff dark brown clay w/friable mudstone pieces 1-2 mm, clay has high plasticity.
480	<2			98	Friable, massive dark brown mudstone in pieces 1 mm to 3 cm.
490	<2			98	Stiff dark brown clay, high plasticity, w/pieces of mudstone 1-2 mm.
500	<2			98	Same as above.
510	<2			98	Same as above, more mudstone.
520	15			85	Stiff dark brown clay and hard mudstone in pieces to 5 mm. Few rounded fine grained sandstone pieces.
530	5			95	Crumbly dark brown mudstone, pieces 1 mm to 3 cm.
540	<2			98	Gray to dark gray mudstone/claystone, friable, massive. Some black crumbly shale.
550			10	90	Same as above, with some lignite coal.
560			10	90	Same as above.
570					Missing sample.
580	10			90	Soft friable brown mudstone in 1-2 mm pieces w/few hard claystone pieces to 3 cm.
590	10			90	Same as above.
600	10			90	Stiff gray clay, medium plasticity w/mudstone pieces to 2 cm, sand in matrix, fine.
610	5			95	Hard mudstone in blocky pieces to 3 cm, dark gray.
620	10			90	Same as above, w/large pieces of mudstone to 5 cm.
630	10			90	Same as above.
640	10			90	Same as above.
650	10			90	Same as above.
660	15			85	Stiff dark gray clay with angular mudstone pieces to 2 cm and fine sand in matrix.
670	15			85	Same as above.
680	10			90	Stiff, medium plasticity clay, dark gray, medium sand in matrix.
690	10			90	Stiff dark gray clay, w/crumbly mudstone pieces to 3 cm.
700	20			80	Rounded clumps of fine sandy clay, gray, easily crumbled.
710	40			60	Same as above, w/rounded hard sandstone clumps, medium grained.
720	40			60	Same as above.

730	60			40	Dark gray clayey sand, fine, moist, w/pieces of angular gray to black mudstone to 2 cm.
740	60			40	Same as above.
750	90			10	Fine, light gray sand, dry, well sorted, in easily crumbled clumps to 5 cm.
760	20			80	Dry, light gray clay in easily crumbled clumps to 5 cm, medium sand present.
770	20			80	Same as above.
780					Sample missing.
790	20			80	Gray, friable mudstone and coarse sand, gray.
800	<2			98	Sticky, soft dark brown clay, high plasticity.
810	5			95	Same as above, less sticky.
820	<2			98	Same as above, sticky.
830	<2			98	Same as above, with some large round and flat mudstone/claystone pieces to 5 cm.
840	15			85	Dark brown sandy clay with mudstone pieces to 3 cm, clay is sticky, high plasticity.
850	15			85	Same as above, no large mudstone pieces.
860	15			85	Same as above.
870	40			60	Stiff dark brown clay and hard rounded sandstone pieces to 5 cm.
880	40			60	Same as above.
890	5			95	Sticky dark brown clay, high plasticity with rounded friable mudstone pieces.
900	5			95	Same as above.
910	5			95	Same as above.
920	70			30	Dark brown clayey sand, moist and cohesive.
930	15			85	Soft sandy clay, brown, clumps of dark brown clay, high plasticity.
940	10			90	Stiff dark brown clay, with clumps of friable mudstone in rounded pieces. High plasticity clay.
950	10			90	Same as above.
960	20			80	Wet sandy clay, gray w/friable mudstone pieces to 2 cm, clumps of fine sandstone, easily powdered.
970	10			90	Same as above, with hard mudstone pieces to 5 cm.

980	25			75	Dark gray mudstone in angular pieces 1 mm to 2 cm, resembles an angular gravel.
990	25			75	Sandy clay, dark brown, soft, medium plasticity, pieces of hard mudstone to 3 cm, rounded.
1000	80			20	Soft sandstone in easily crumbled gray rounded clumps, w/some dark brown soft clay and mudstone pieces to 1 cm.
1010	20			80	Very stiff brown clay in large round clumps to 8 cm with large flat pieces of sandstone to 5 cm.
1020	15			85	Sticky brown clay with large flat, friable mudstone pieces to 5 cm and some fine sand present.
1030	15			85	Dark brown sticky clay, high plasticity with fine sand present.
1040	15			85	Same as above.
1050	5			95	Sticky dark brown clay, high plasticity with large pieces of hard mudstone to 3 cm.
1060	5			95	Same as above with mudstone pieces to 10 cm.
1070	5			95	Same as above.
1080	5			95	Same as above.
1090	5			95	Same as above.
1100	10			90	Soft dark brown clay, high plasticity, fine sand in matrix.
1110	<2			98	Sticky dark brown clay, high plasticity and soft, moist.
1120	<2			98	Same as above but stiff clay.
1130	<2			98	Soft, sticky dark brown clay, medium plasticity.
1140	5			95	Sticky gray clay, soft and medium plasticity.
1150	<2			98	Same as above, wet.
1160	<2			98	Same as above, wet.
1170	<2			98	Same as above with mudstone pieces to 1 cm.
1180	10			90	Sticky dark brown clay, medium stiff, high plasticity, sand in matrix.
1190	10			90	Same as above.
1200	15			85	Soft, wet clay, dark brown w/angular mudstone pieces to 1 cm and sand in matrix.
1210	85			15	Gray gravel w/clay, rounded pieces 0.5-2 cm, wet, sand present.
1220	60			40	Coarse sand/gravel and clay, gray, with large mudstone pieces to 2 cm, wet.

1230	70			30	Gray coarse sand, angular, poorly sorted, w/clay in matrix, wet.
1240	10			90	Sticky gray clay, very high plasticity, mudstone pieces present.
1250	35			65	Sticky, sandy gray clay, wet w/angular mudstone pieces to 1 cm.
1260	35			65	Same as above.
1270	35			65	Same as above.
1280	5			95	Dark gray soft clay, medium plasticity and friable black shale. Trace fine to medium sand present.
1290	5			95	Dark gray soft clay and gray to black mudstone pieces up to 3 cm, hard.
1300	<2			98	Dark brown medium stiff clay, high plasticity w/large dark brown mudstone pieces to 3 cm.
1310	<2			98	Same as above.
1320	<2			98	Same as above w/higher proportion of mudstone.
1330	5			95	Dry brown clay in crumbly pieces to 2 cm, trace sand present.
1340	<2			98	Brown mudstone, friable, with very stiff dark brown clay. Mudstone in pieces to 3 cm.
1350	10			90	Dark brown stiff clay, high plasticity w/pieces of dry sandy clay, light brown.
1360	10			90	Same as above.
1370	10			90	Same as above.
1380	15			85	Same as above, more sandy clay.
1390	15			85	Dark brown sandy clay, stiff, medium plasticity, w/large pieces of black, friable mudstone to 3 cm.
1400	15			85	Same as above.
1410	15			85	Dark brown sandy clay, stiff medium plasticity, w/pieces of crumbly, rounded light brown mudstone to 2 cm.
1420	10			90	Dark brown high plasticity, medium stiff clay, w/trace crumbly light gray sandstone.
1430	5			95	Same as above w/no trace sandstone.
1440	5			95	Same as above, but clay is drier.
1450	5			95	Same as above.
1460	5			95	Dark gray sticky clay, medium plasticity w/large pieces of gray, hard mudstone to 3 cm.
1470	5			95	Same as above, slightly more fine sand.
1480	15			85	Same as above, more fine sand.

1490	35			65	Brown sandy clay w/rounded pieces of fine gray sandstone.
1500	40			60	Brown medium stiff clay w/fine tan sand.
1510	40			60	Same as above.
1520	5			95	Brown clay, medium stiff, high plasticity. Pieces of hard gray mudstone.
1530	5			95	Same as above, clay is drier.
1540	50			50	Sandy clay, brown, soft, medium plasticity, w/tan sand, fine.
1550	5			95	Stiff, medium plasticity brown clay w/pieces of black mudstone to 1 cm.
1560	80			20	Tan to brown clayey sand, moist and cohesive. Some large hard mudstone pieces to 3 cm.
1570	60			40	Gray sandy clay w/sand in matrix, moist.
1580	15			85	Gray sandy clay, sticky, moist, small pieces of friable mudstone to 1 cm.
1590	20			80	Same as above w/more sand.
1600	10			90	Gray sticky clay, low plasticity, wet, w/large pieces of black mudstone to 3 cm, flat and friable.
1610	10			90	Same as above.
1620	10			90	Brown clay, stiff, high plasticity, w/fine sand in matrix.
1630	5			95	Gray sticky clay, soft, high plasticity, minimal fine sand in matrix.
1640	5			95	Same as above w/pieces of hard gray mudstone to 3 cm.
1650	15			85	Gray sandy clay, wet, low plasticity, soft.
1660	25			75	Same as above, more sand, coarse sand in matrix.
1670	5			95	Stiff brown clay, high plasticity, thin friable black mudstone/shale.
1680	10			90	Same as above, more sand.
1690	20			80	Sandy clay, wet, low plasticity, gray.
1700	30			70	Gray sandy clay, soft, medium plasticity, w/some crumbly gray sandstone.
1710	10			90	Stiff brown clay, high plasticity, w/fine sand.
1720	5			95	Gray clay, sticky, low plasticity, wet.

1730	<2			98	Same as above w/very large mudstone pieces to 10 cm.
1740	<2			98	Gray sticky clay w/pieces of hard mudstone to 2 cm.
1745	<2			98	Same as above. TD = 1745'.



STATE OF COLORADO

DWR - DNR, Permitsonline <dnr_dwrpermitsonline@state.co.us>

Grandview A-1

Jim Hale <jhale@hydroresources.com>

Mon, May 13, 2024 at 4:06 PM

To: "dwrpermitsonline@state.co.us" <dwrpermitsonline@state.co.us>

Attached is the Grandview A-1 well completion report. The well design was from the logs on the LFH well 60' away.

Thanks

Jim Hale

Drilling Manager



13027 County Rd. 18 Unit C

Fort Lupton, Colorado 80621

Cell: (775) 304-3809 Office: (303) 857-7540

jhale@hydroresources.com

3 attachments

Grandview A-1 well completion report.pdf
2245K

Grandview A-1 Final Design.pdf
651K

GR-A-1.pdf
585K

Appendix B: Well LFH-1 Geophysical Data



MIDWEST WIRELINE

DUAL INDUCTION LOG

Company **Hydro Resources**
 Well **Grandview Upper Black Squirrel**
 Field
 County **El Paso** State **Colorado**

Location: API #: **NE 1/4 NW 1/4**
 SEC 28 TWP 12S RGE 64 W
 Permanent Datum Ground Level Elevation
 Log Measured From Ground Level
 Drilling Measured From Ground Level
 Other Services
CNL/CDL

Date	2/12/2024
Run Number	One
Depth Driller	2321
Depth Logger	2318
Bottom Logged Interval	2317
Top Log Interval	0
Casing Driller	24 @ 32
Casing Logger	
Bit Size	17.5
Type Fluid in Hole	Chemical
Salinity, ppm CL	200
Density / Viscosity	9.0 30
pH / Fluid Loss	7.0 11.2
Source of Sample	FLOWLINE
Rm @ Meas. Temp	@
Rmt @ Meas. Temp	@
Rmc @ Meas. Temp	@
Source of Rmf / Rmc	CHARTS
Rm @ BHT	@
Operating Rig Time	2 Hours
Max Rec. Temp. F	
Equipment Number	110
Location	HAYS
Recorded By	D. Schmidt
Witnessed By	Kevin Whittemore

<<< Fold Here >>>

All interpretations are opinions based on inferences from electrical or other measurements and Midwest Wireline LLC cannot and does not guarantee the accuracy or correctness of any interpretation, and Midwest Wireline LLC will not 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.

Comments

N/A DENOTES NOT AVAILABLE OR NON-APPLICABLE.

Permit #88240-F

SO# 2879

Log Measured From: Ground Level Ft. Above Permanent Datum

THANK YOU FOR USING MIDWEST WIRELINE LLC
785-625-3858

Your Midwest Wireline Crew

Engineer: D. Schmidt
 Operator:
 Operator:
 Operator:

This Log Record Was Witnessed By

Primary Witness: Kevin Whittemore
 Secondary Witness:
 Secondary Witness:
 Secondary Witness:

Course	Offset (ft)	Schematic	Description	Length (ft)	C.D. (in)	Weight (lb)
--------	-------------	-----------	-------------	-------------	-----------	-------------

Sensor	Offset (ft)	Schematic	Description	Length (ft)	O.D. (in)	Weight (lb)	
GR	32.65		GR-M&W (105)	3.00	3.50	50.00	
CNLSC CNSSC	29.55 28.80		CNT-M&W (210)	5.00	3.50	100.00	
			MWLith-STEP LITHO Short (701-01)	8.40	5.00	250.00	
LCAL	20.63						
LLW8N	20.63						
LLW7N	20.63						
LLW6N	20.63						
LLW5N	20.63						
LLW4N	20.63						
LLW3N	20.63						
LLW2N	20.63						
LLW1N	20.63						
LSLOCK	20.38						
LLLOCK	20.38						
PELTMPR	20.38						
LSHVNG	20.38						
LLHVNG	20.38						
LSW8N	20.13						
LSW7N	20.13						
LSW6N	20.13			DIL-M&W (504 HT)	18.25	3.50	220.00
LSW5N	20.13						
LSW4N	20.13						
LSW3N	20.13						
LSW2N	20.13						
LSW1N	20.13						
RLL3F	15.50						
RLL3	15.50						
CILD	8.33						
CILM	4.50						
SP	0.20						

Dataset: hydro_grandview upper black squirrel.db: field/well/stack/pass2.12
 Total length: 34.65 ft
 Total weight: 620.00 lb
 O.D.: 5.00 in

Log Variables

DatabaseC:\ProgramData\Warrior\Data\hydro_grandview_upper_black_squirrel.db
 Dataset field/well/stack/pass2.12/_vars_

Top - Bottom

BOREID in 17.5	BOTTEMP degF 100	CASEOD in 10	CASETHCK in 0	FLUIDDEN g/cc 1	MATRXDEN g/cc 2.71	NPORSEL Limestone	PERFS No
SNDERR mmho/m 0	SNDERRM mmho/m 0	SPSHIFT mV 15	SRFTEMP degF 30	SZCOR Off	TDEPTH ft 2318		

Variable Description

BOREID : Borehole I.D.
 BOTTEMP : Bottom Hole Temperature
 CASEOD : Casing O.D.
 CASETHCK : Casing Thickness
 FLUIDDEN : Fluid Density
 MATRXDEN : Matrix Density
 NPORSEL : Neutron Porosity Curve Select

PERFS : Perforation Flag
 SNDERR : Deep Sonde Error Correction
 SNDERRM : Medium Sonde Error Correction
 SPSHIFT : S.P. Baseline Offset
 SRFTEMP : Surface Temperature
 SZCOR : CN Size Cor. ?
 TDEPTH : Total Depth



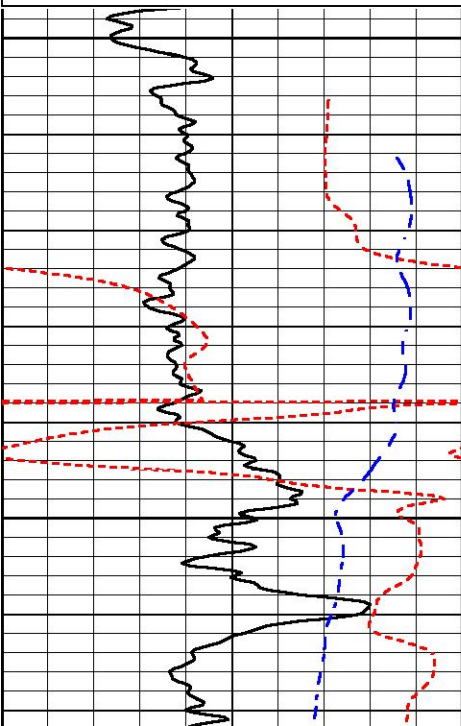
DETAIL SECTION

MAIN PASS

Database File hydro_grandview_upper_black_squirrel.db
 Dataset Pathname stack/pass2.12
 Presentation Format _dil
 Dataset Creation Mon Feb 12 09:05:52 2024
 Charted by Depth in Feet scaled 1:240

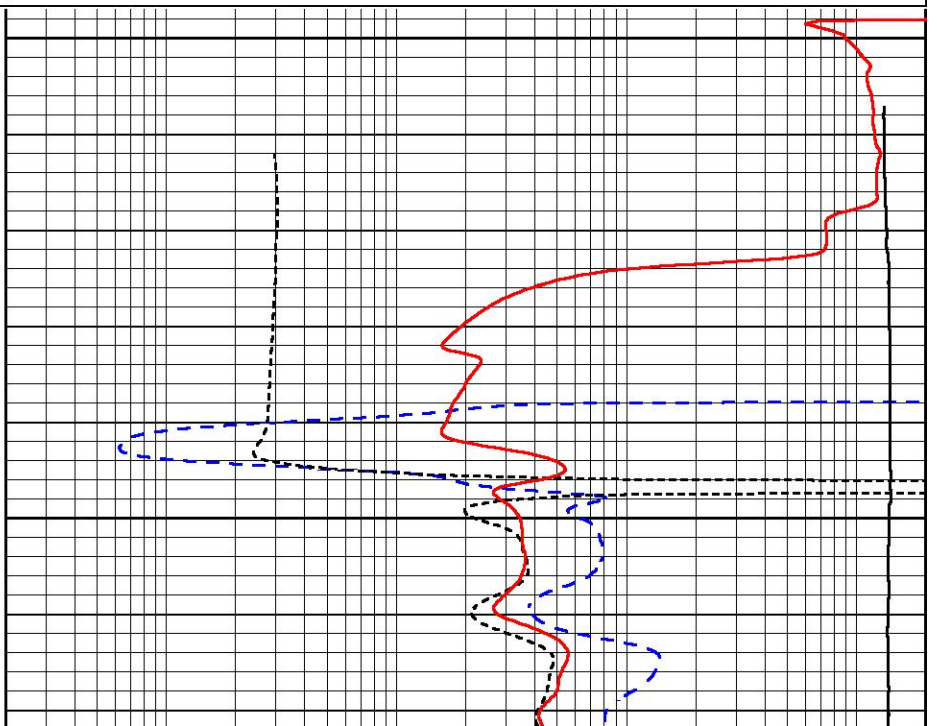
0	Gamma Ray (GAPI)	150
50	RXORT	250
-200	SP (mV)	0

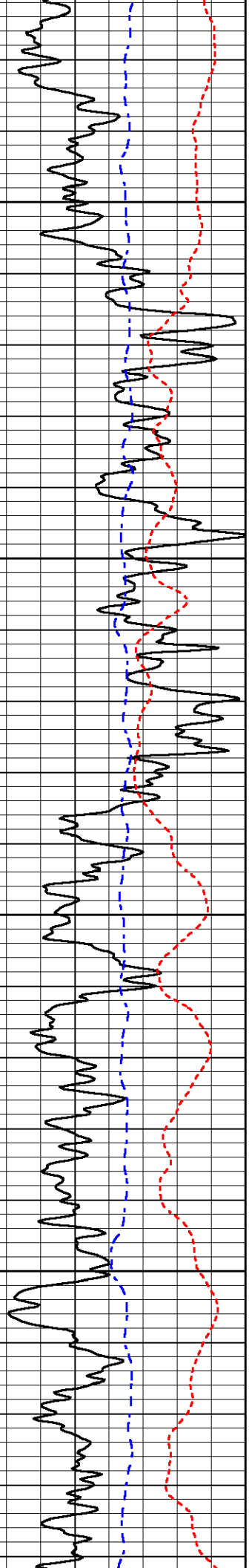
0.2	Deep Resistivity (Ohm-m)	2000
0.2	Medium Resistivity (Ohm-m)	2000
0.2	RLL3 (Ohm-m)	2000
10000	Line Tension (lb)	0



0

50



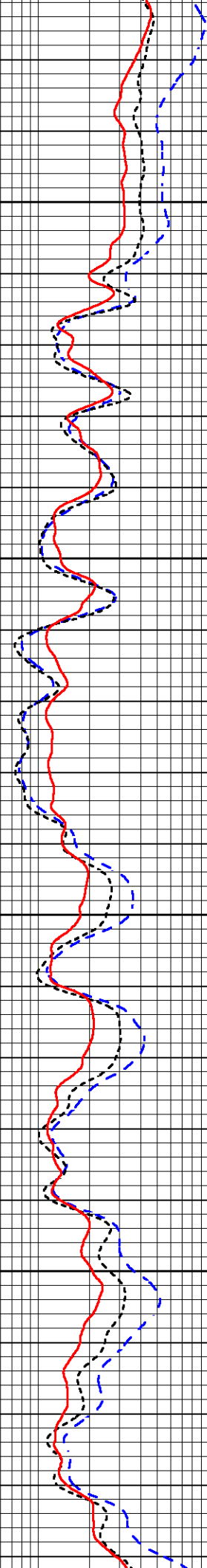


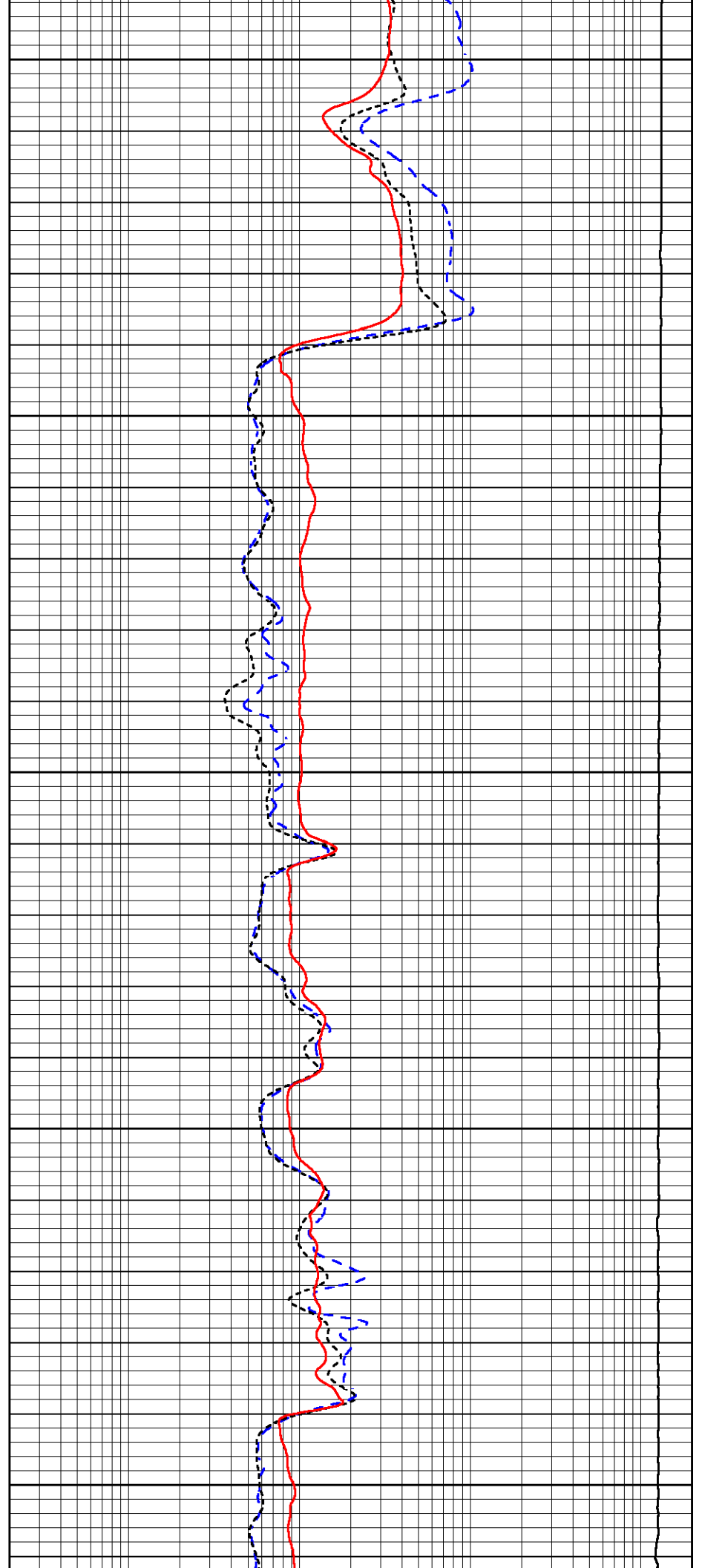
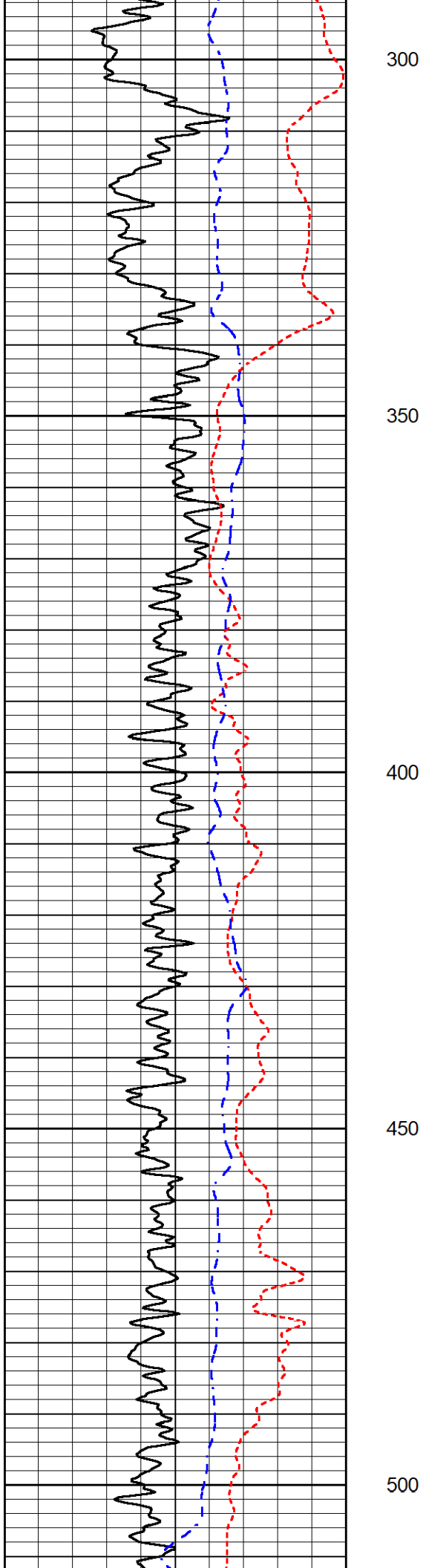
100

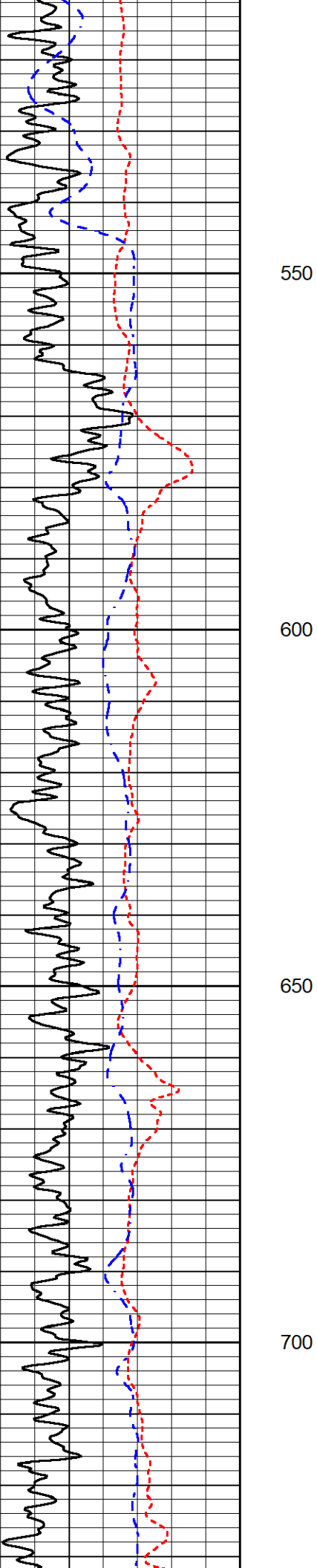
150

200

250





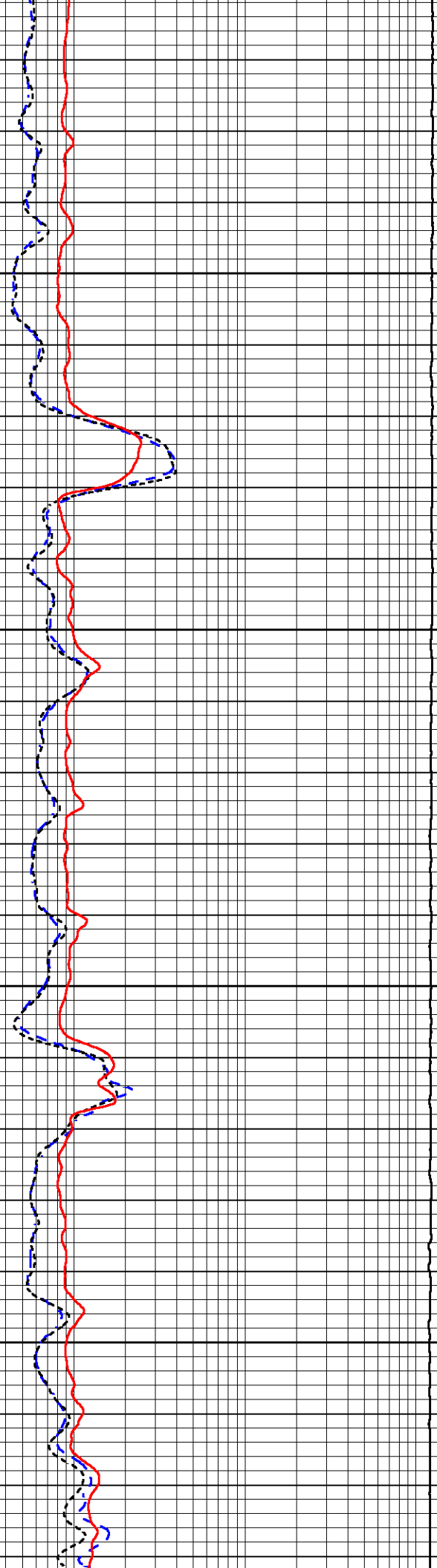


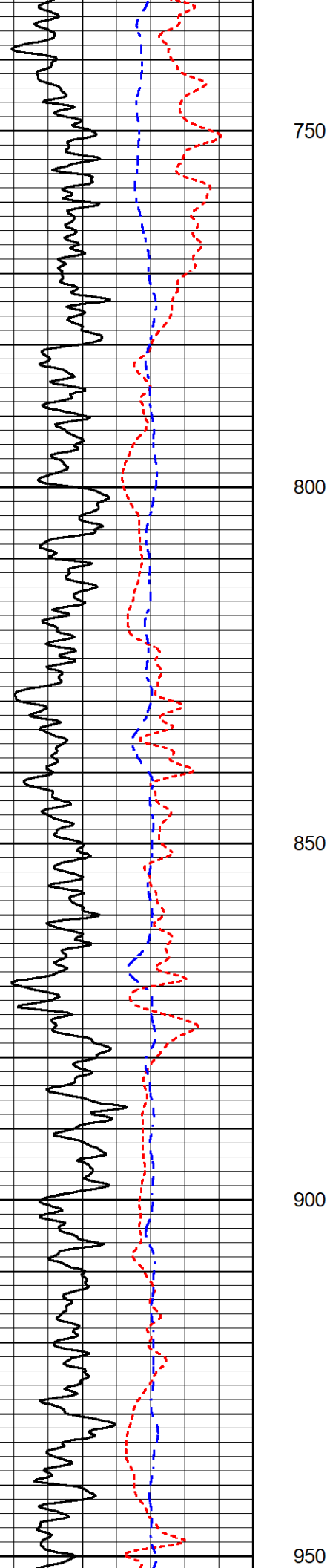
550

600

650

700





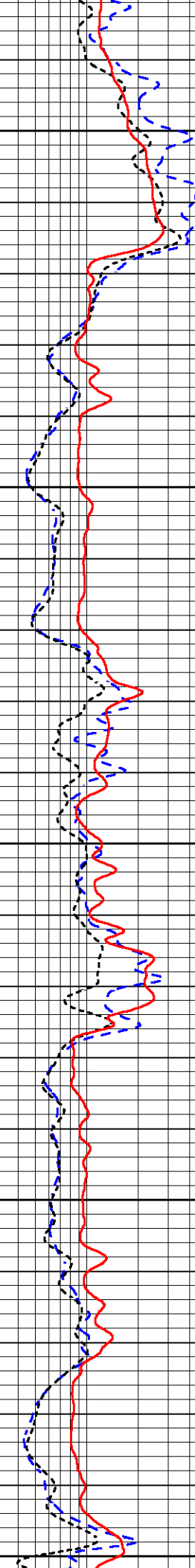
750

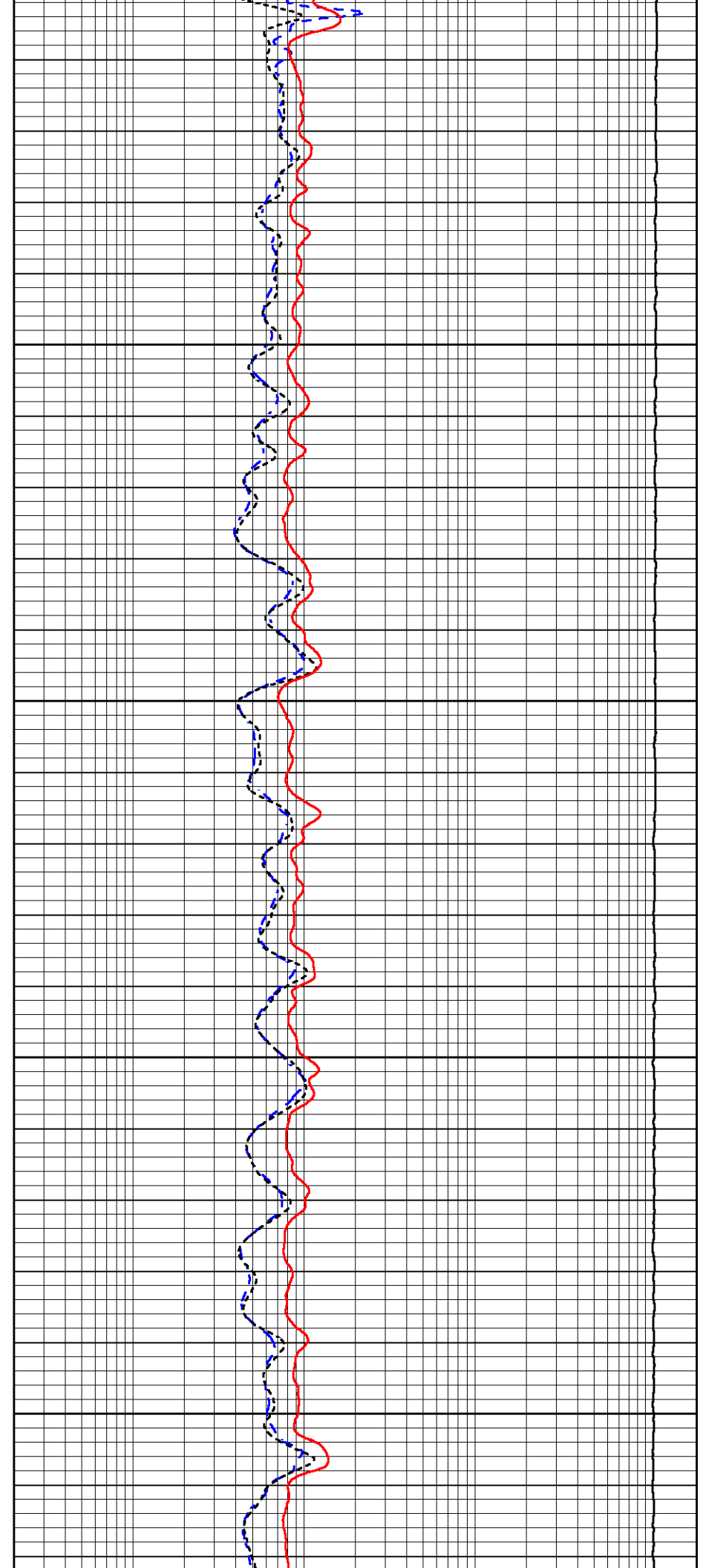
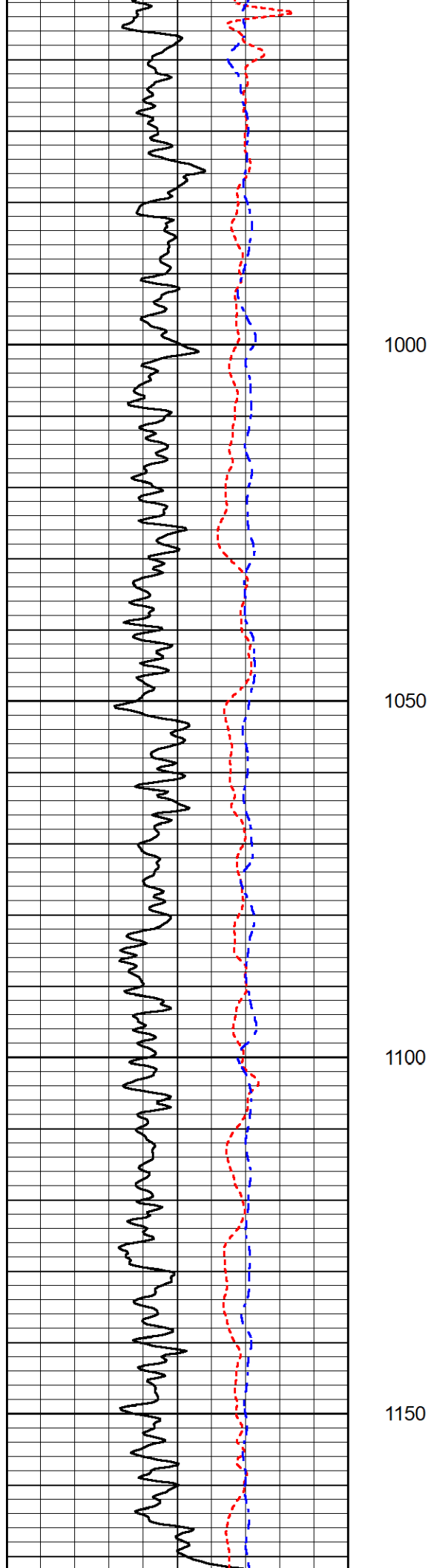
800

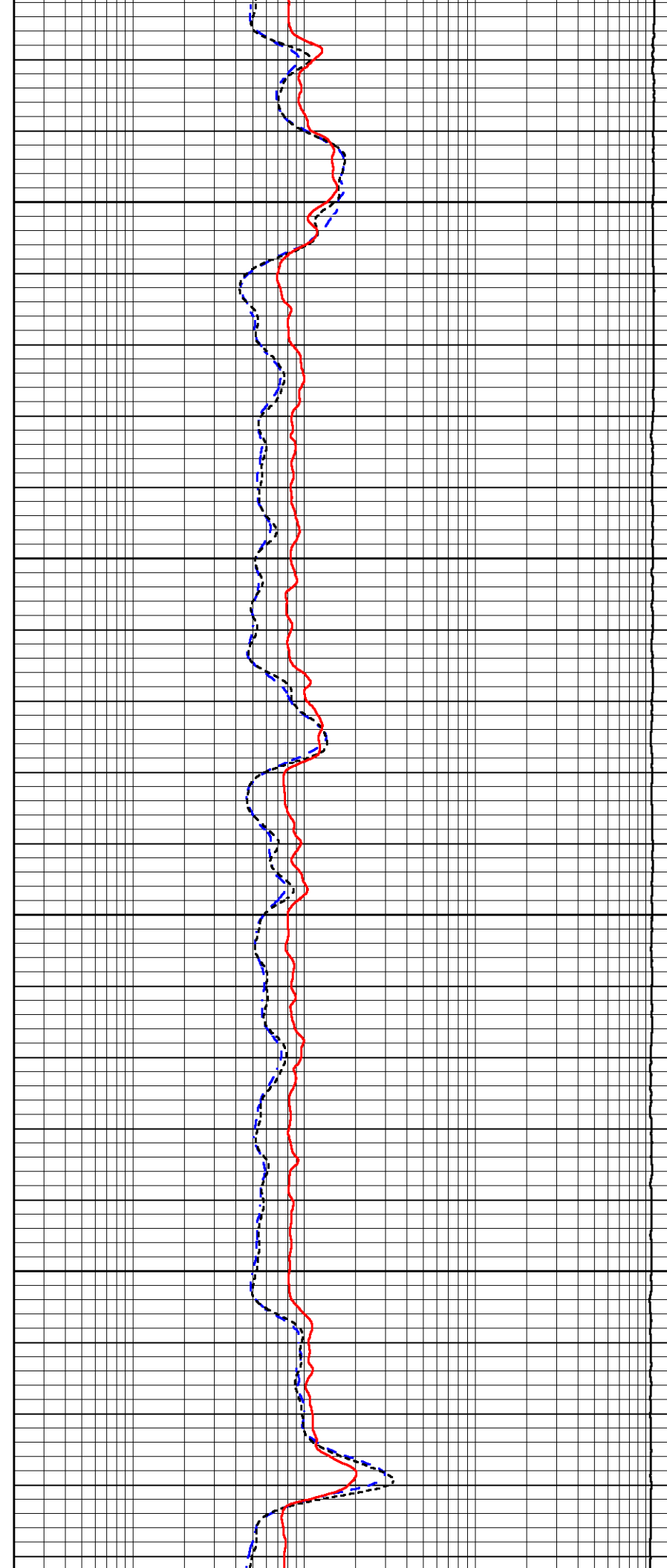
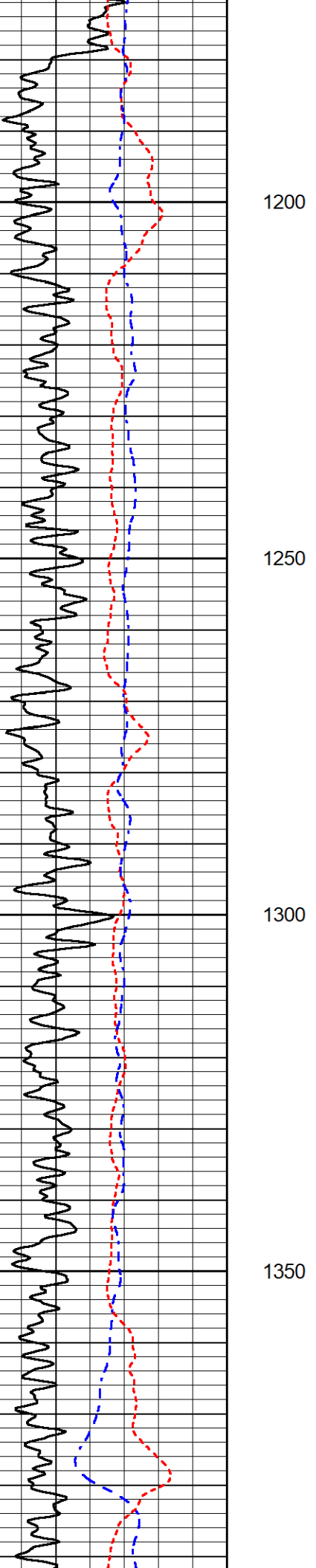
850

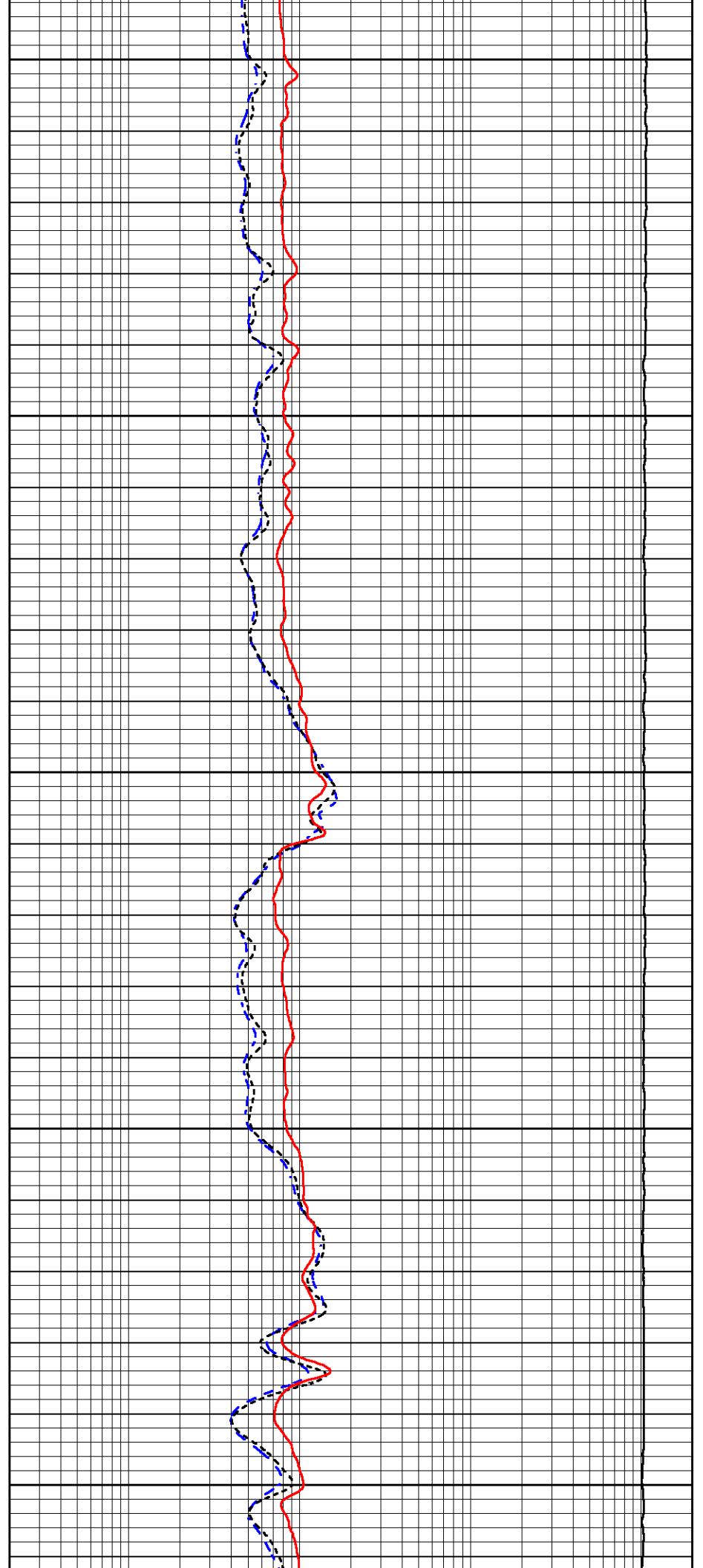
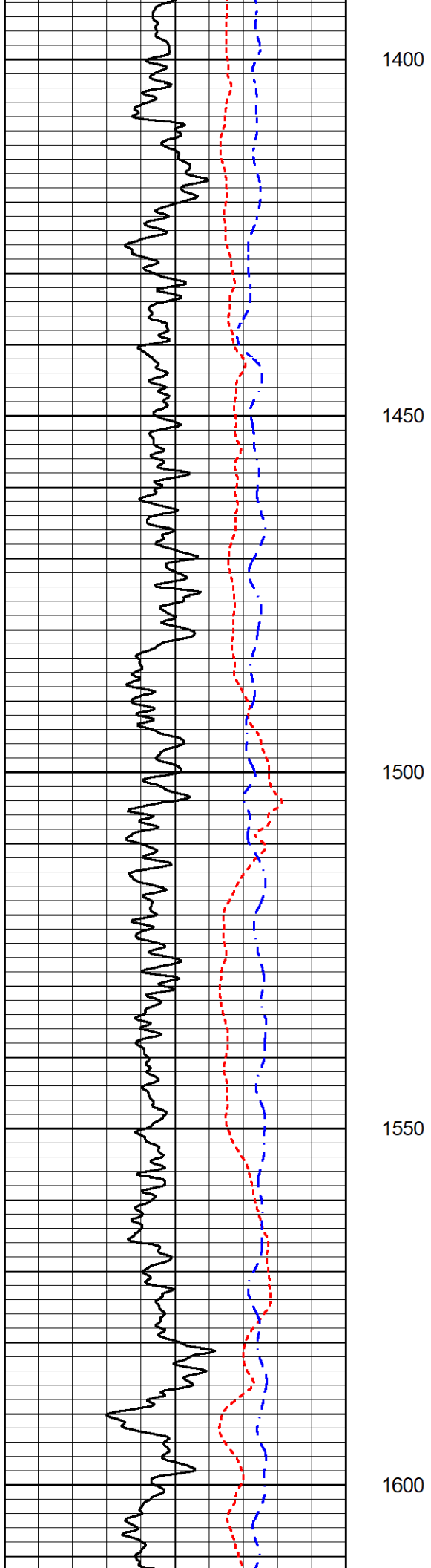
900

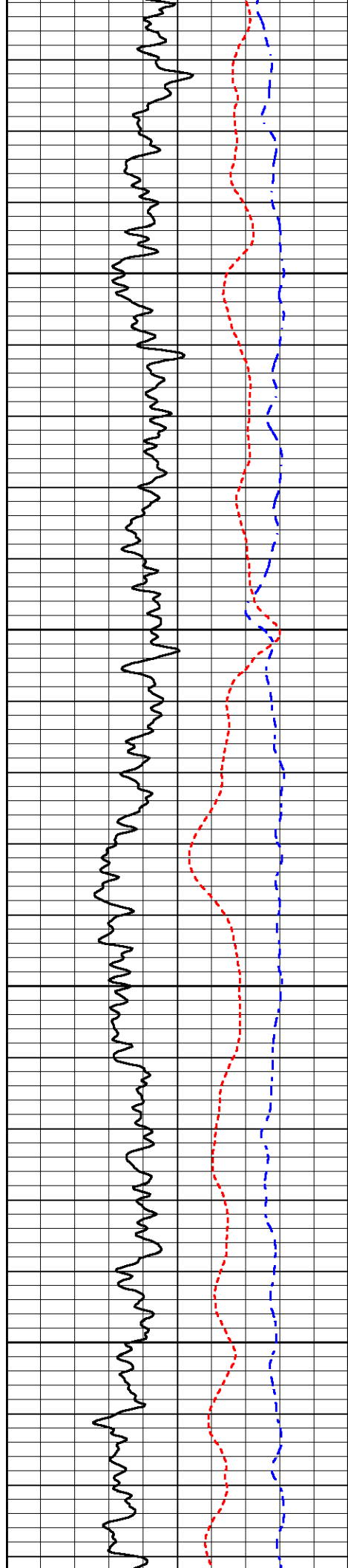
950









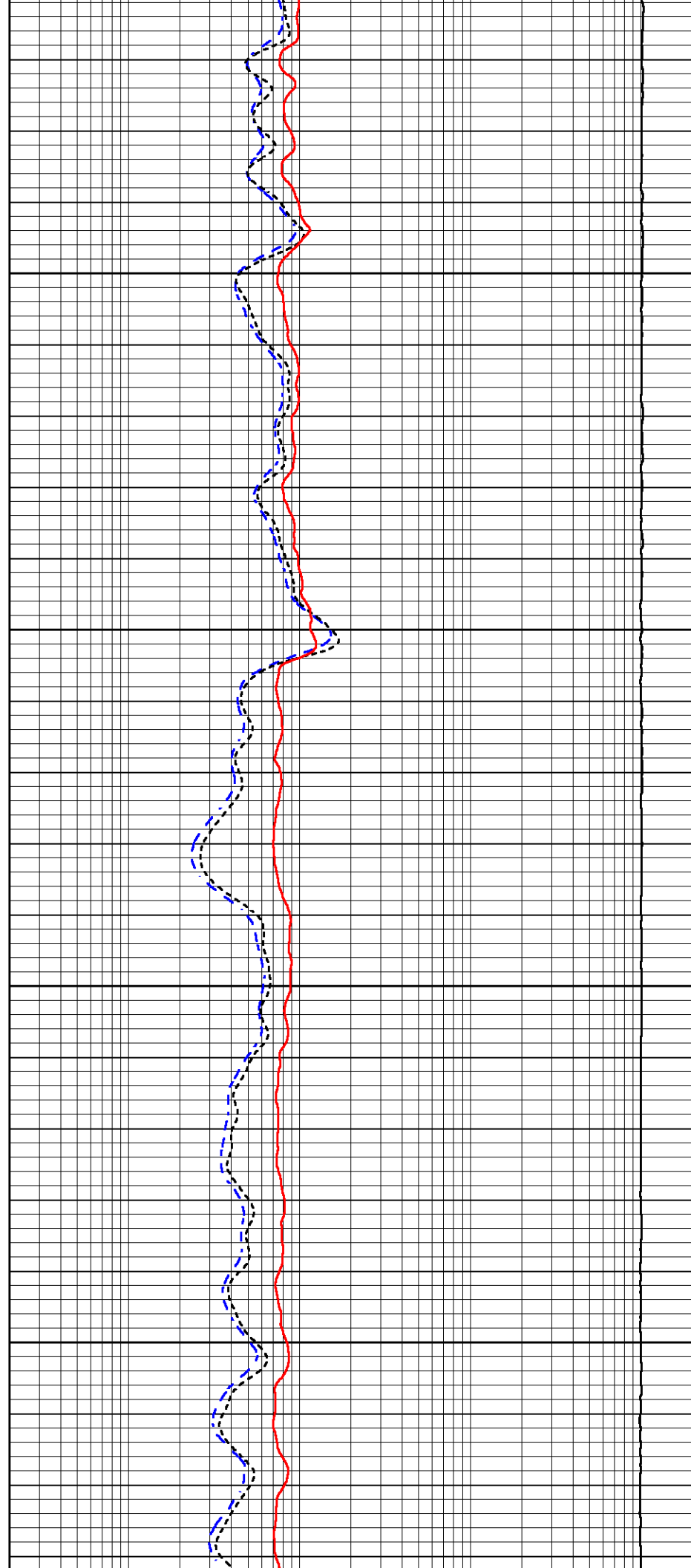


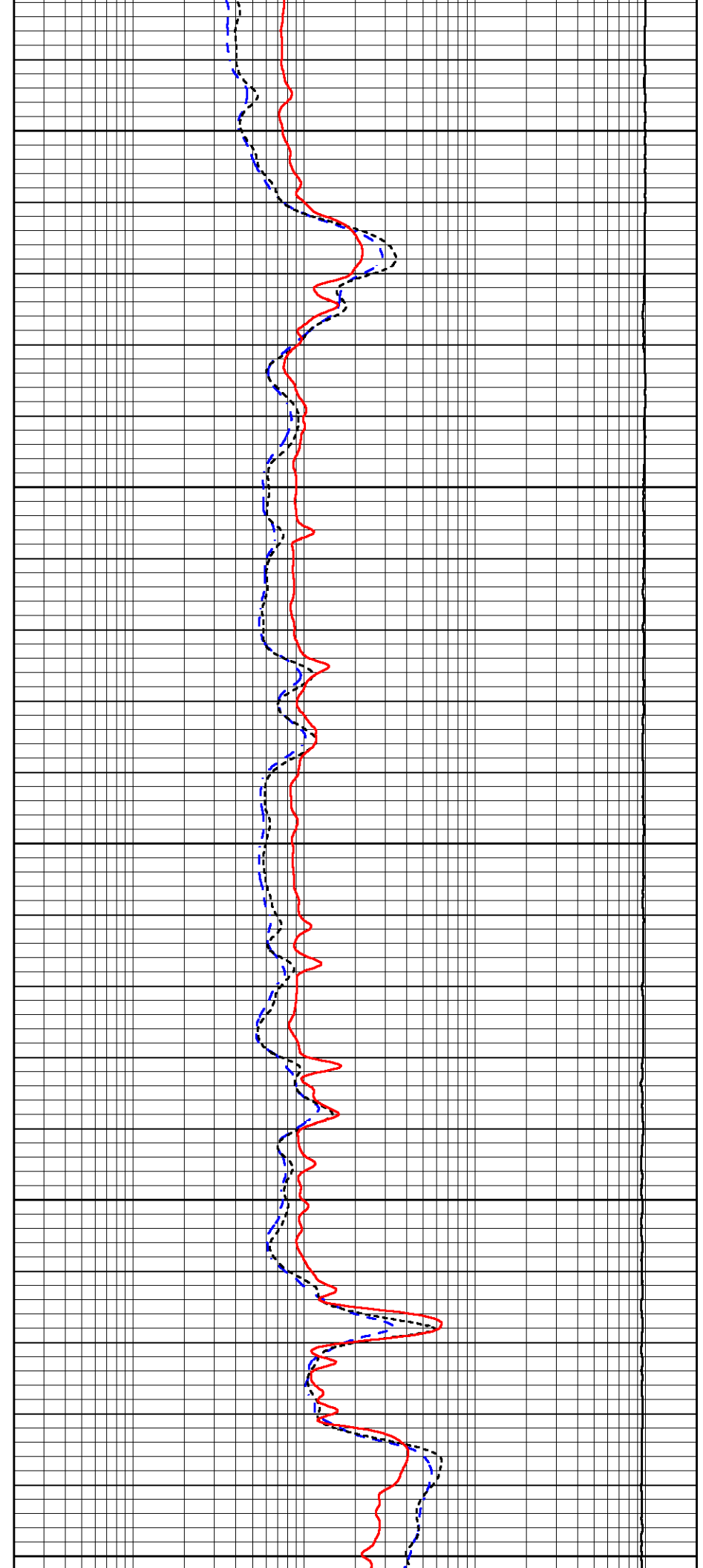
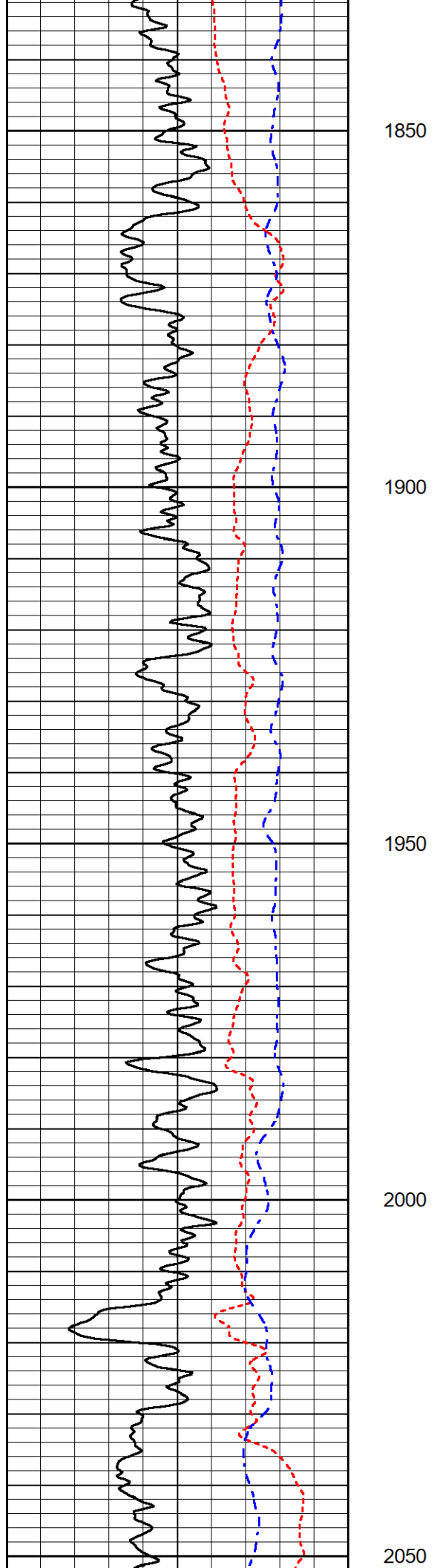
1650

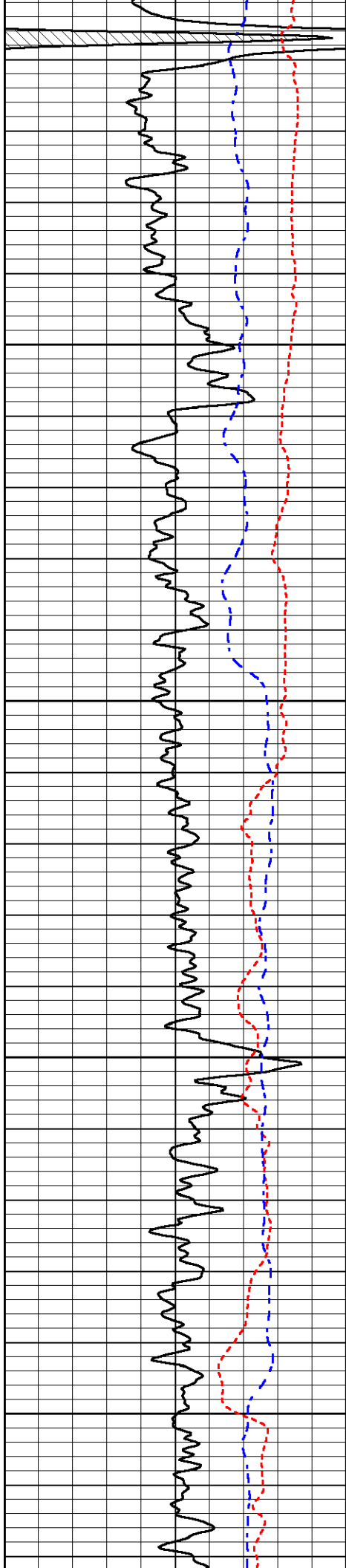
1700

1750

1800





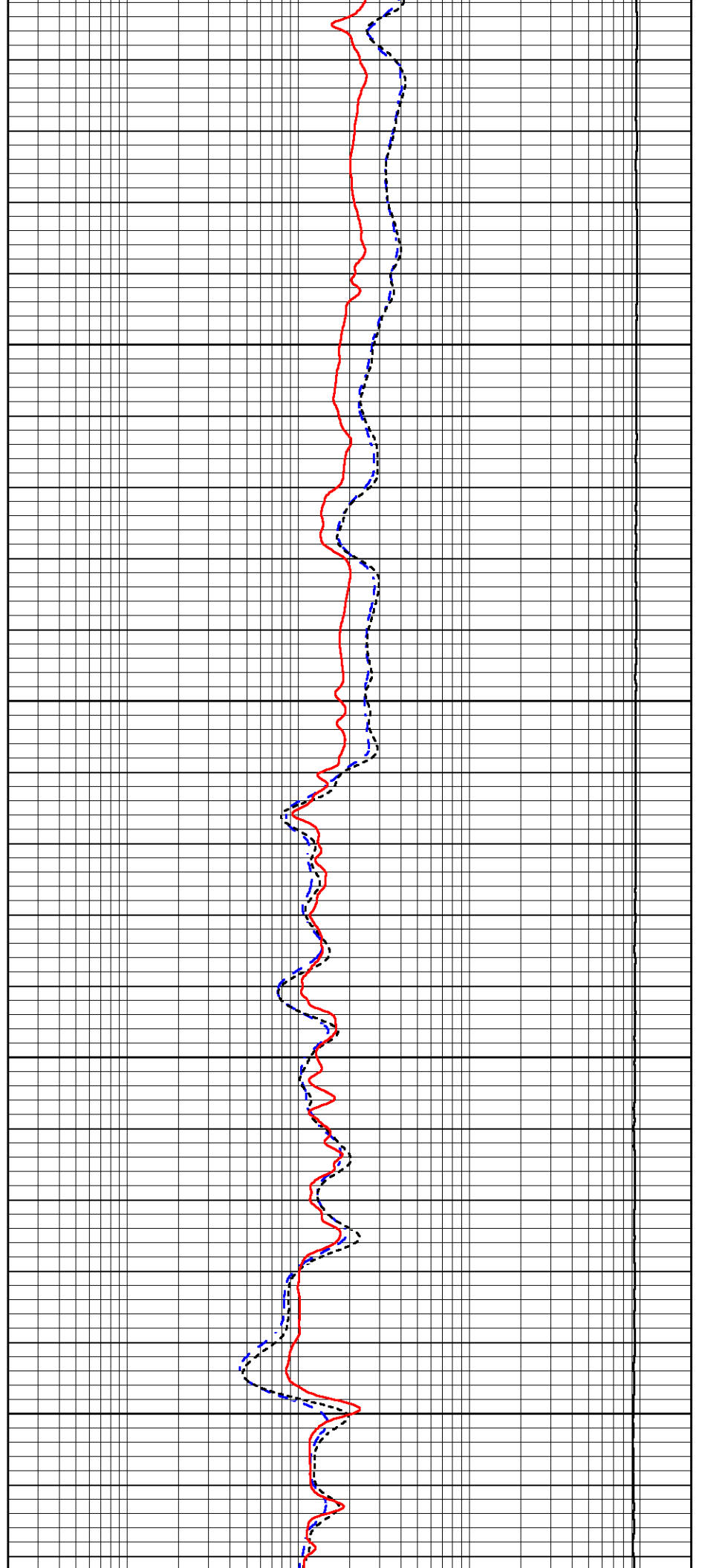


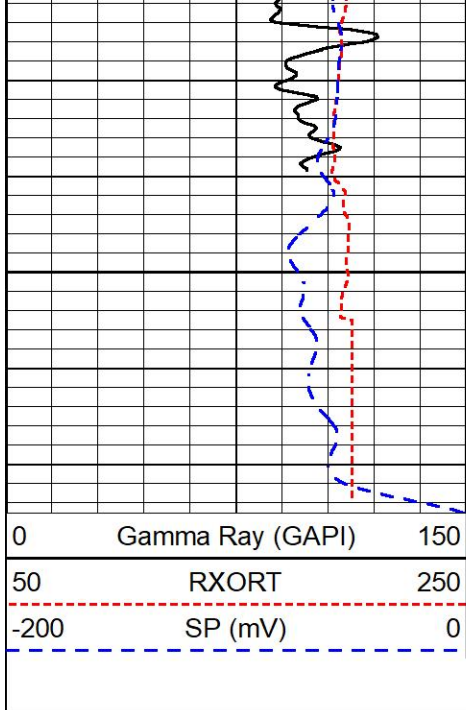
2100

2150

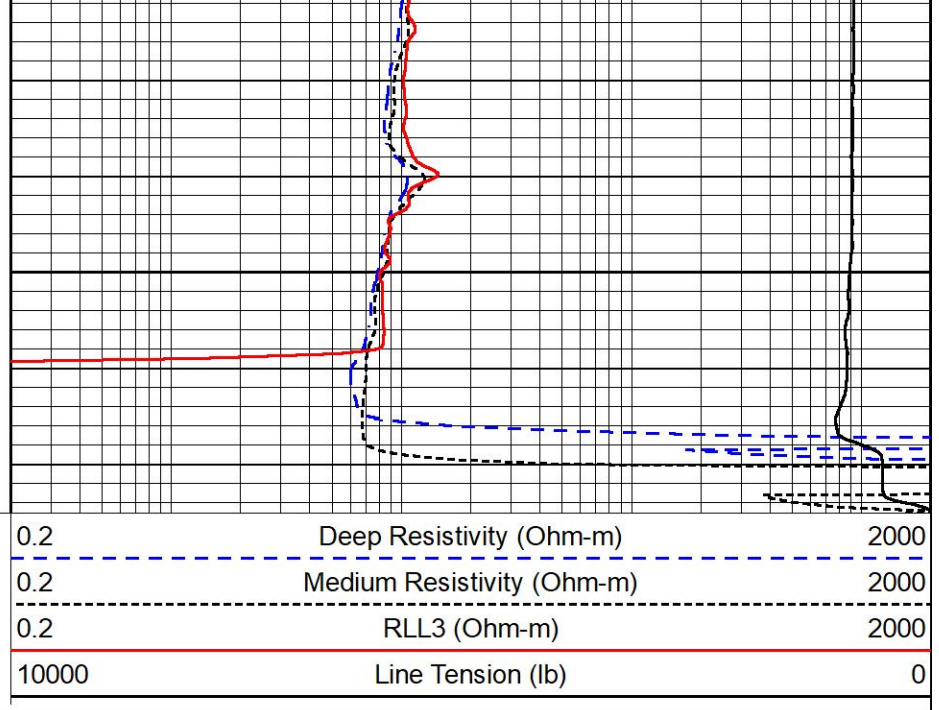
2200

2250





2300

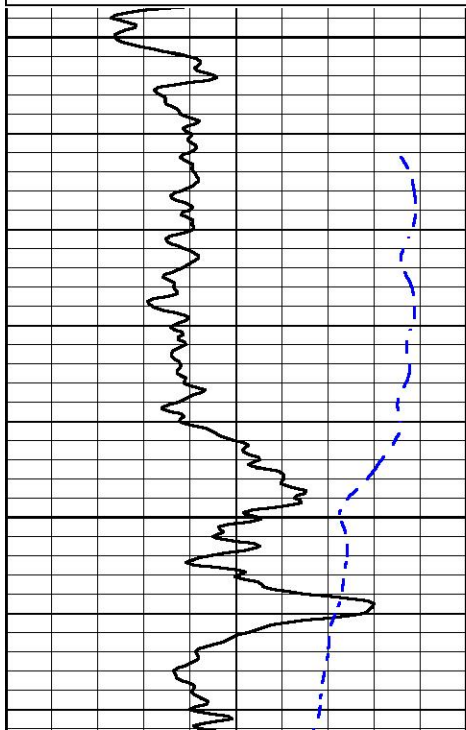
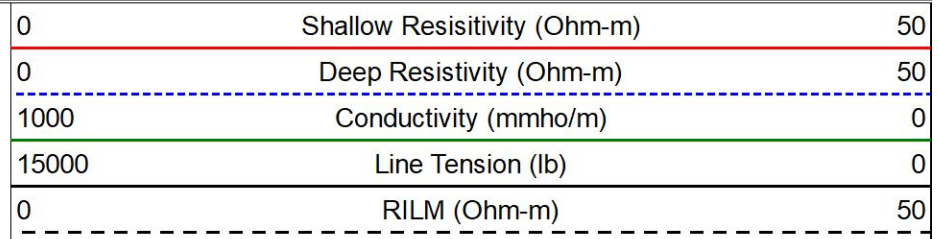
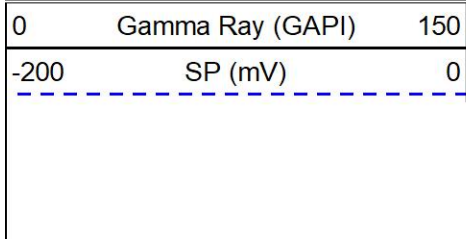


MIDWEST WIRELINE

DETAIL SECTION

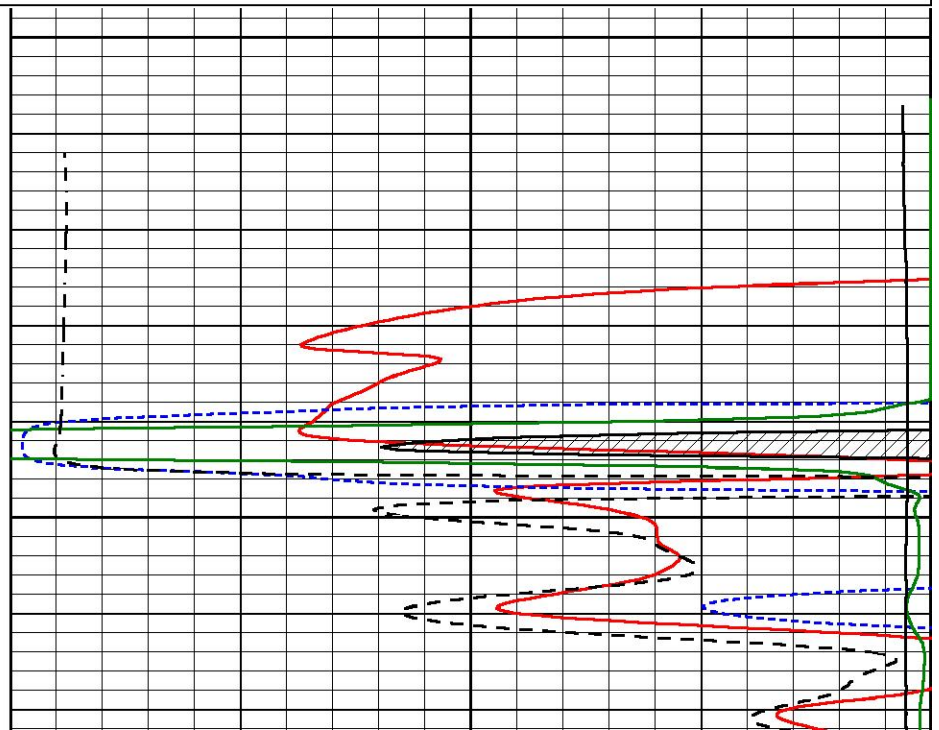
MAIN PASS

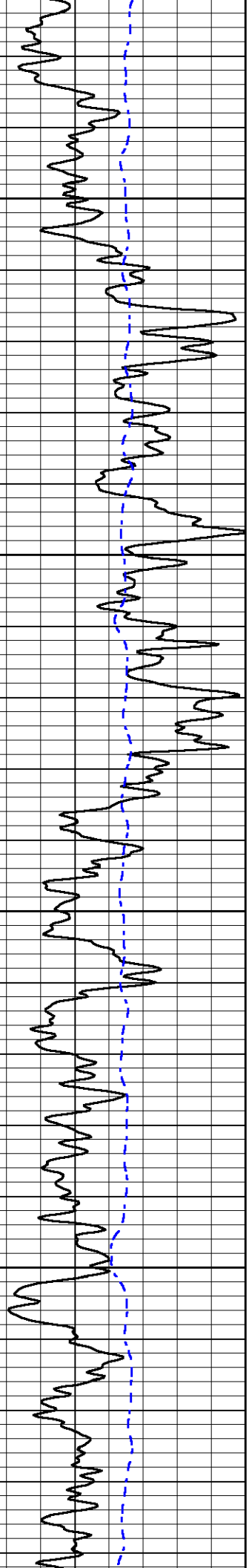
Database File hydro_grandview upper black squirrel.db
 Dataset Pathname stack/pass2.12
 Presentation Format dilhydro
 Dataset Creation Mon Feb 12 09:05:52 2024
 Charted by Depth in Feet scaled 1:240



0

50



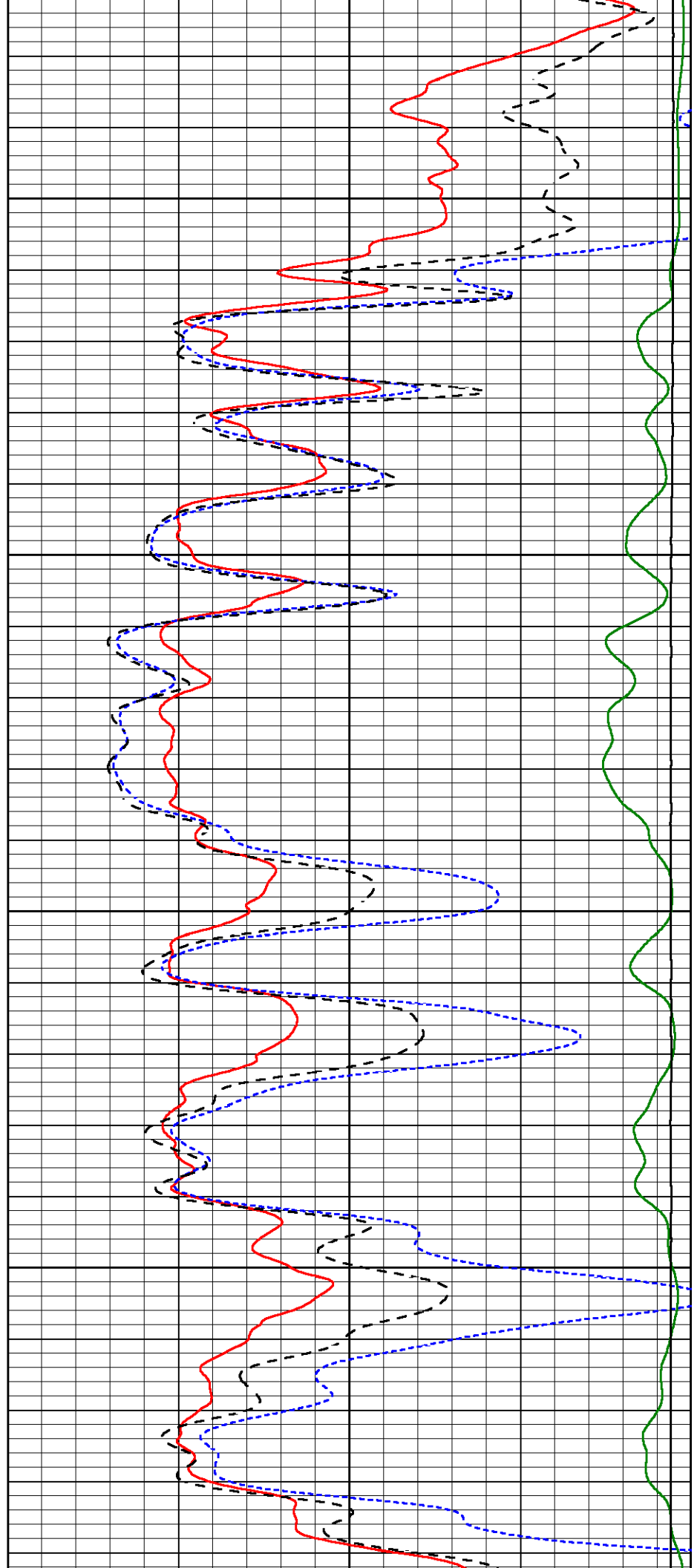


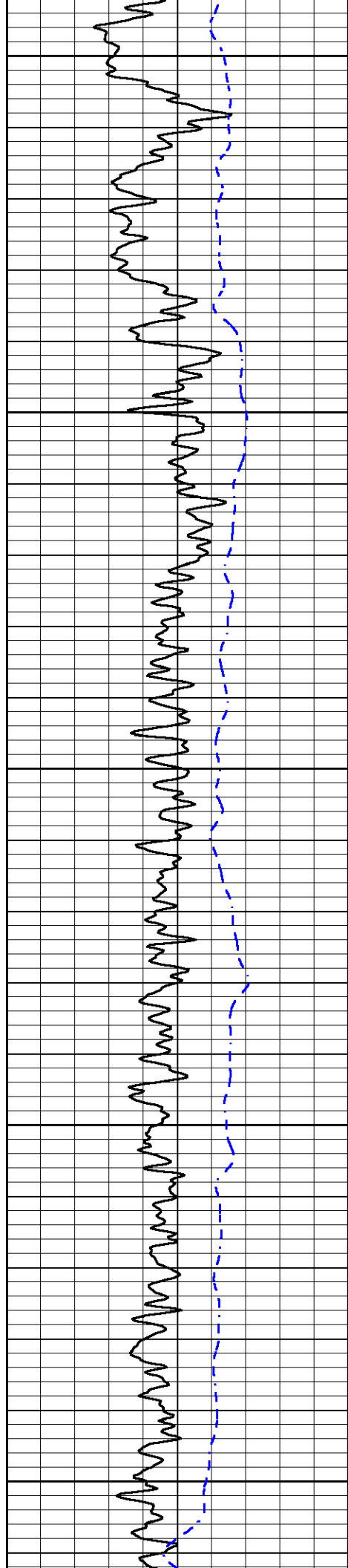
100

150

200

250





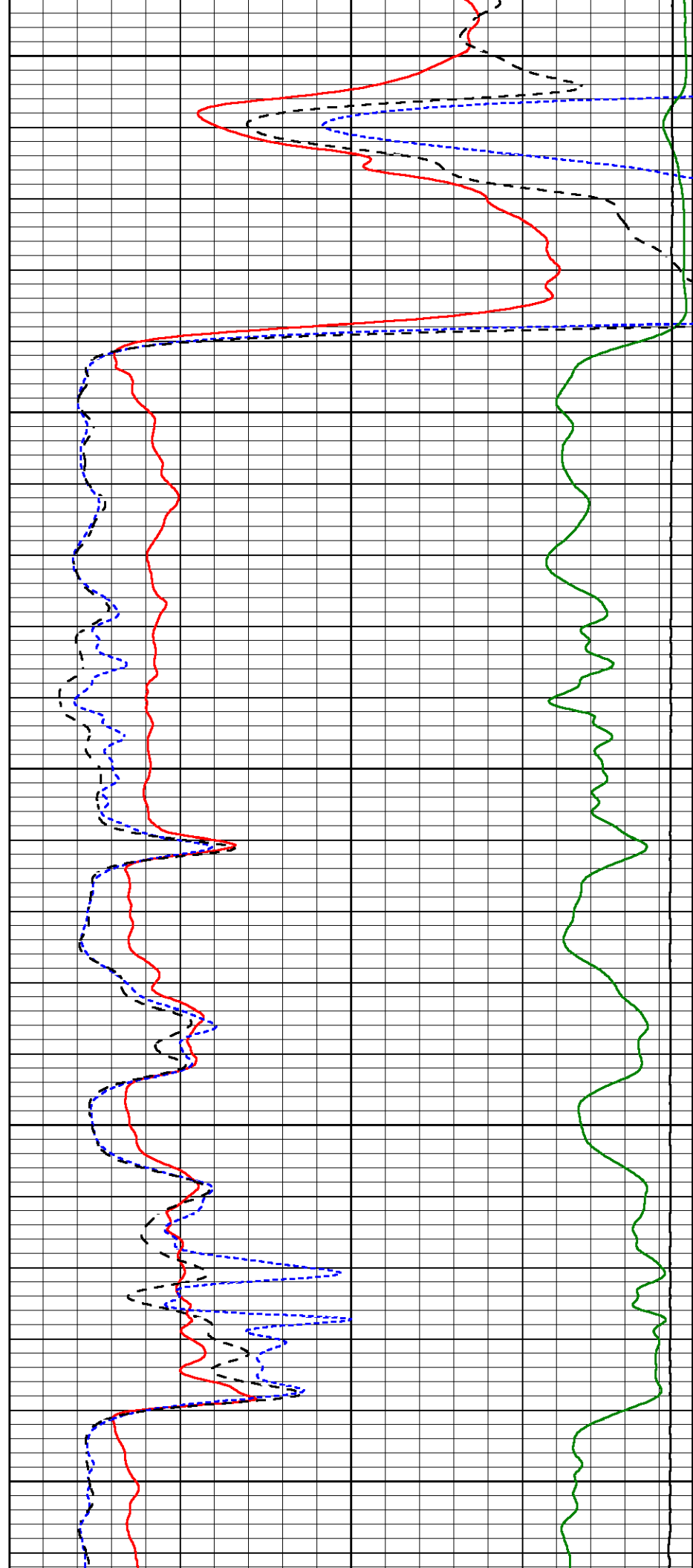
300

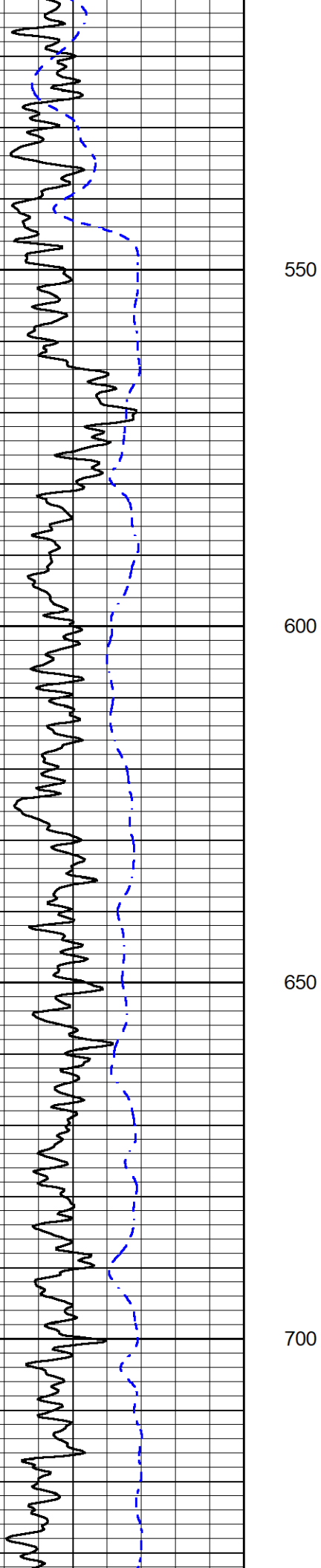
350

400

450

500



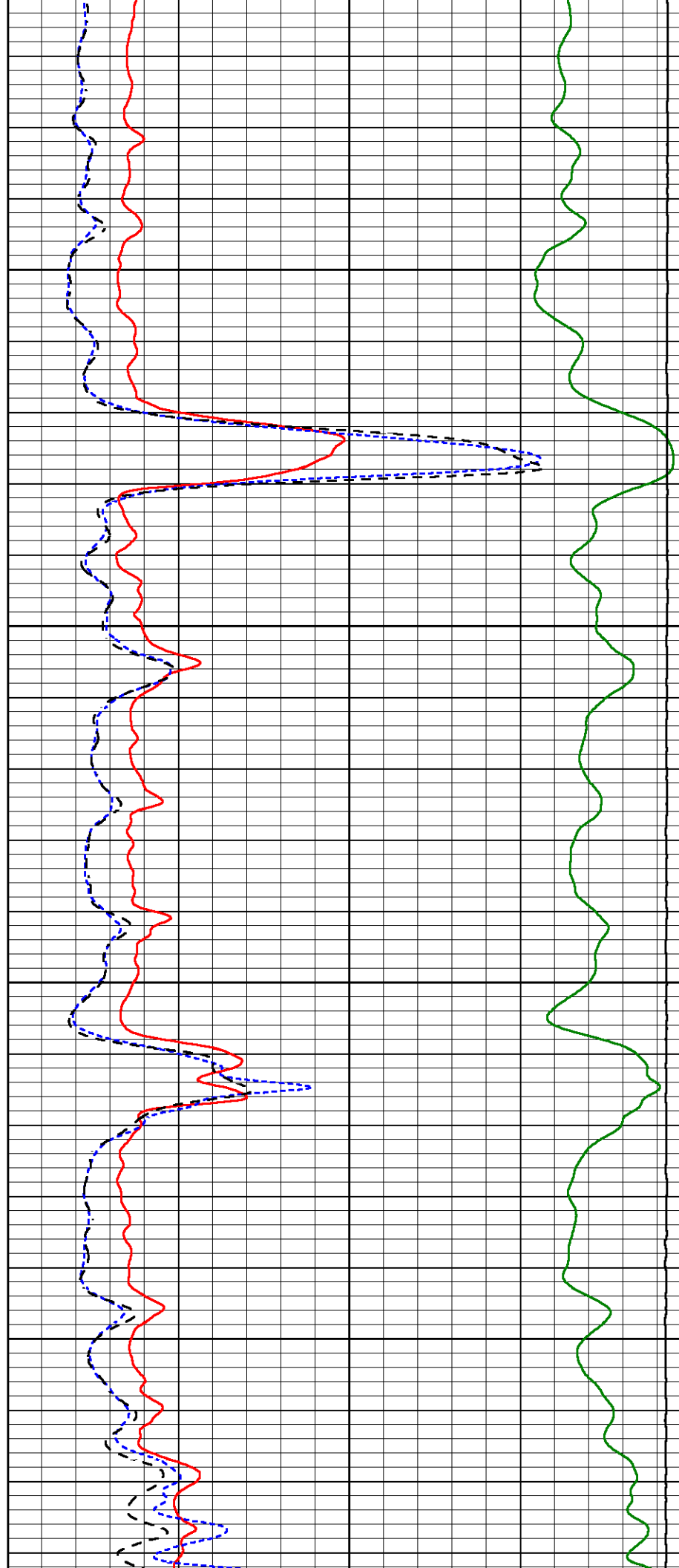


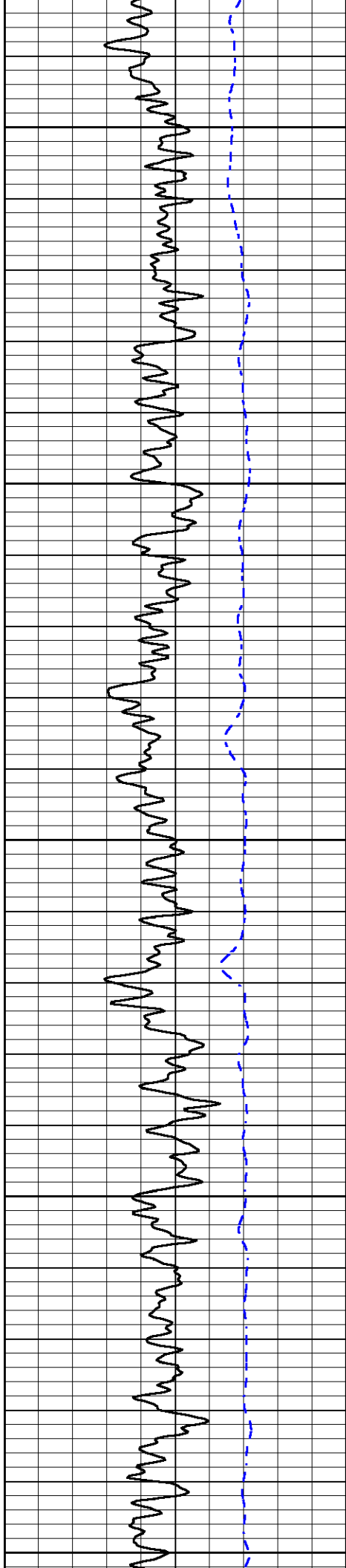
550

600

650

700





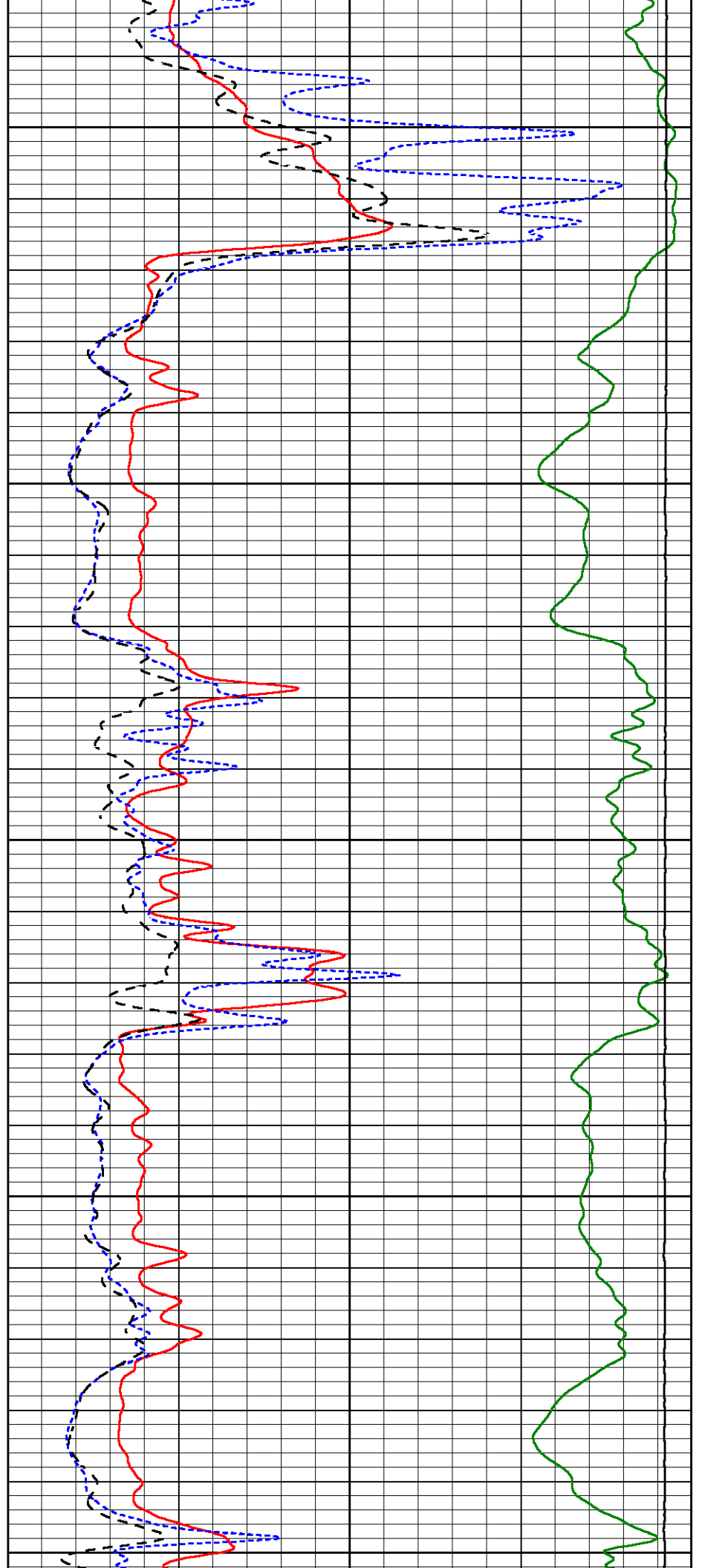
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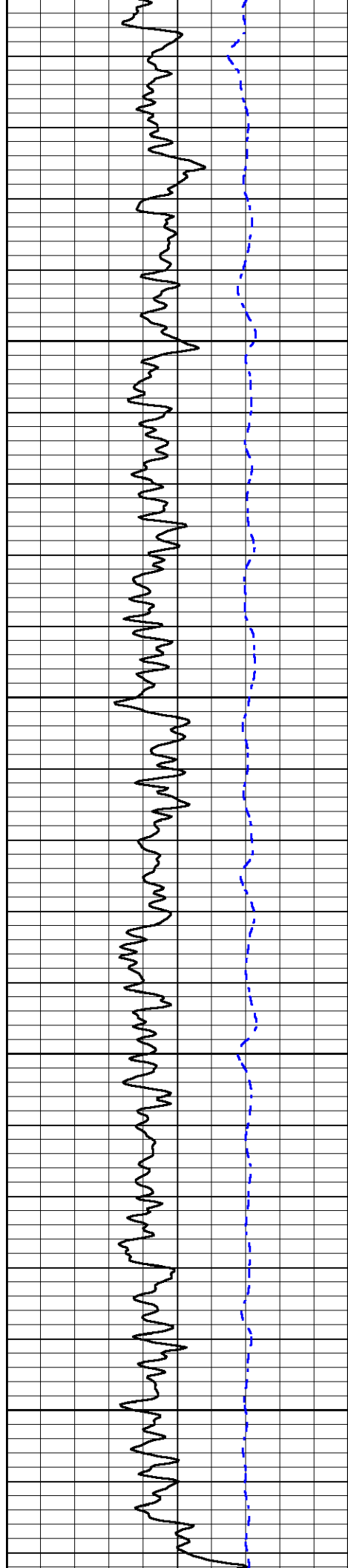
800

850

900

950



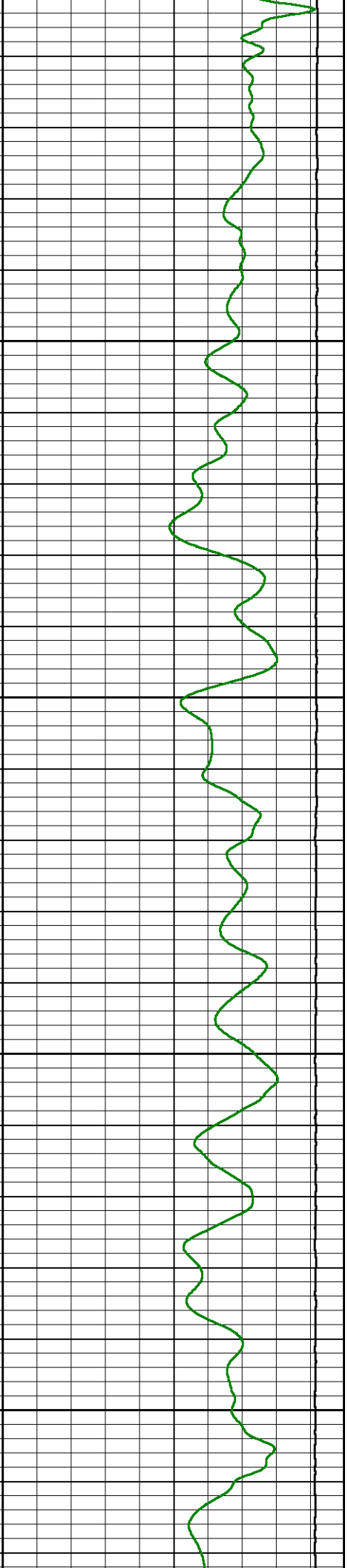
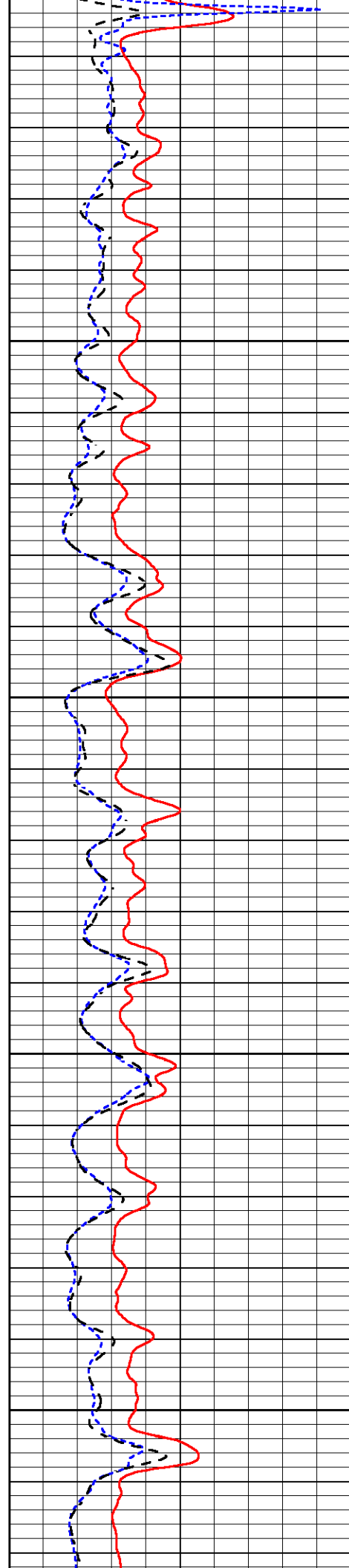


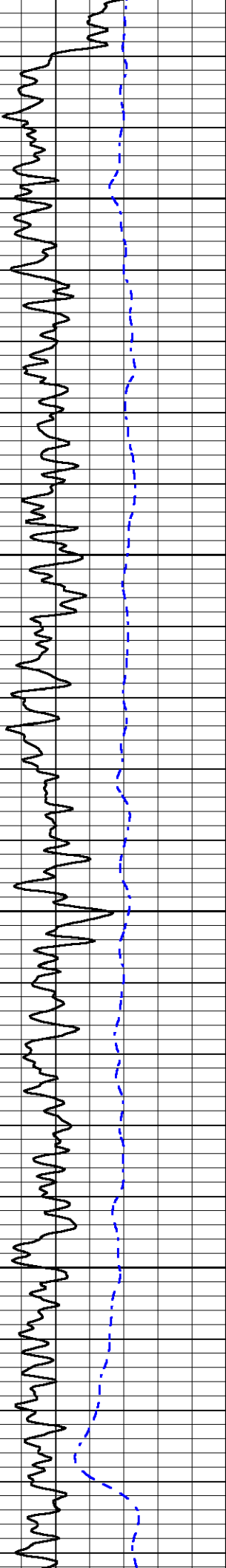
1000

1050

1100

1150



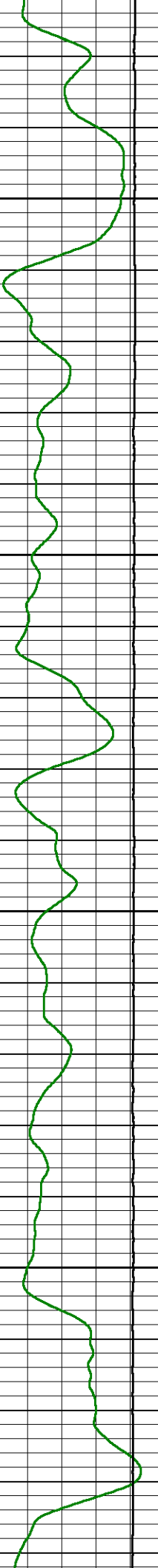
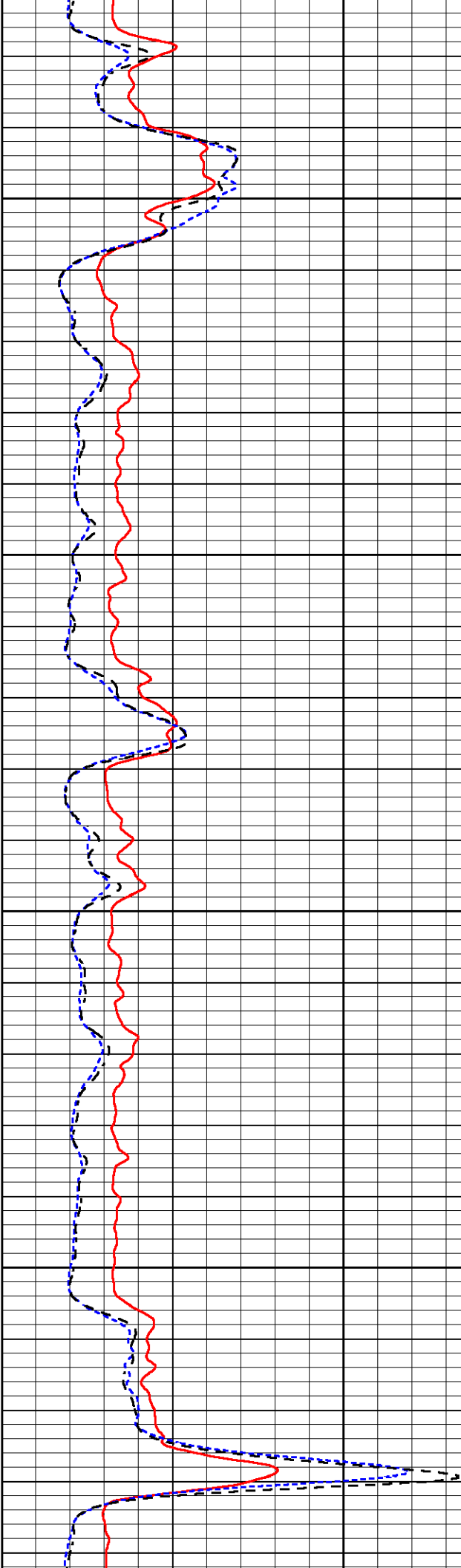


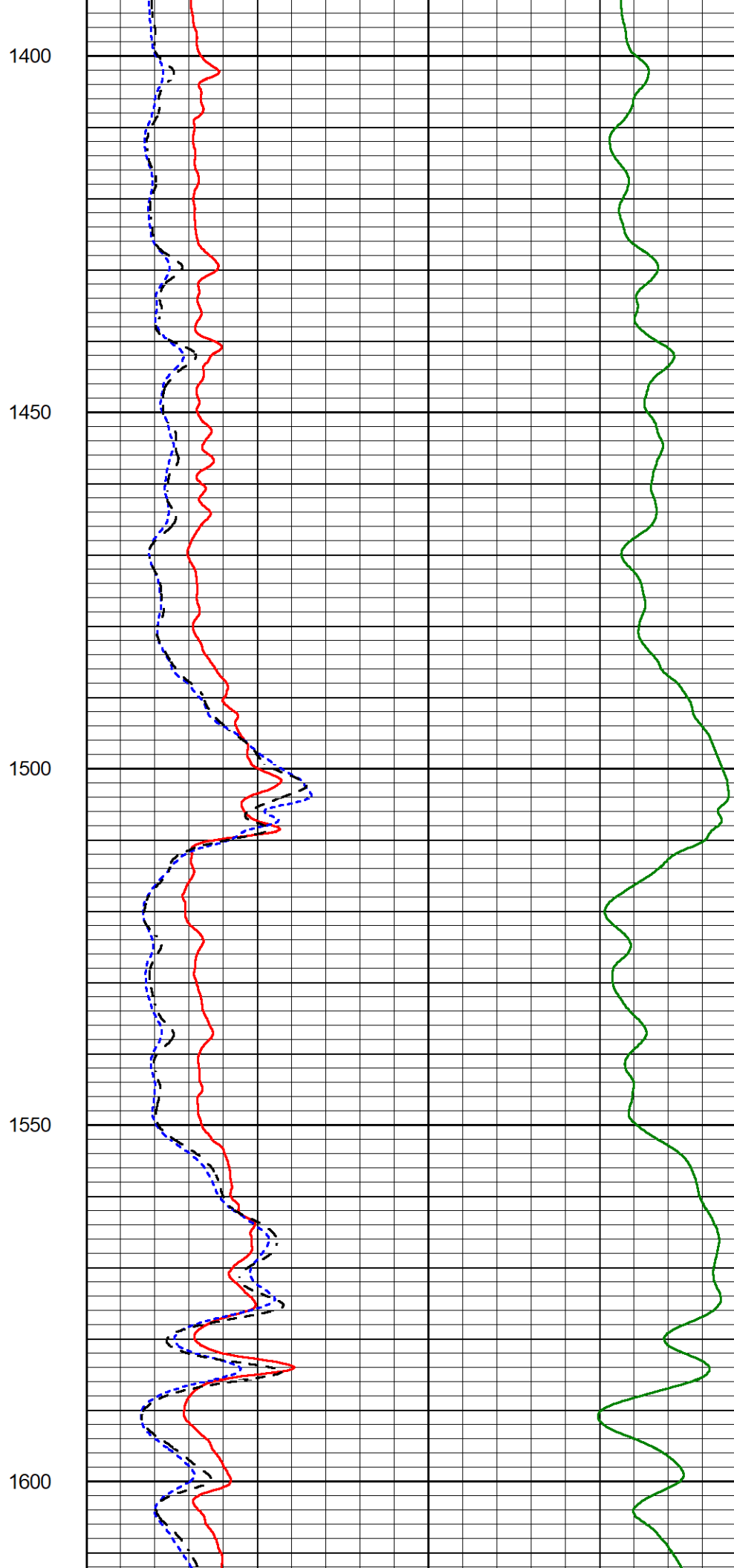
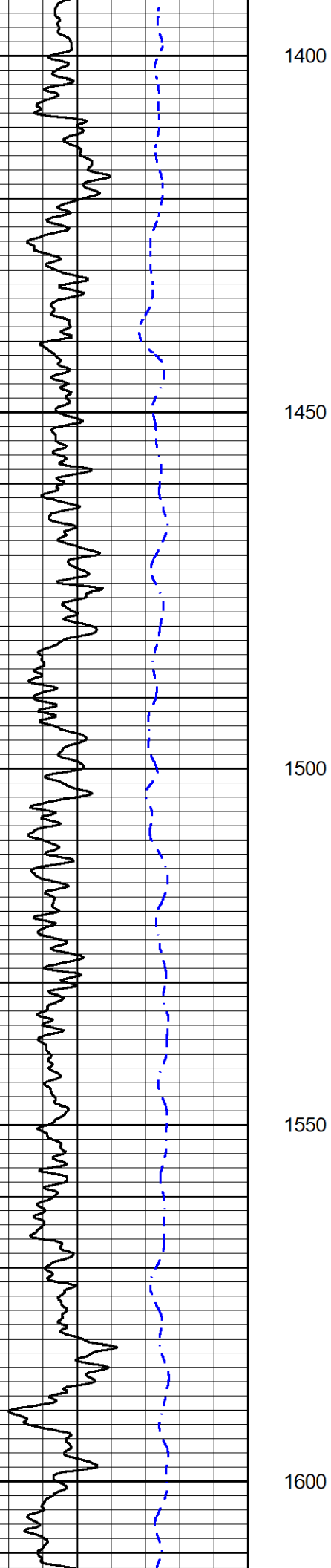
1200

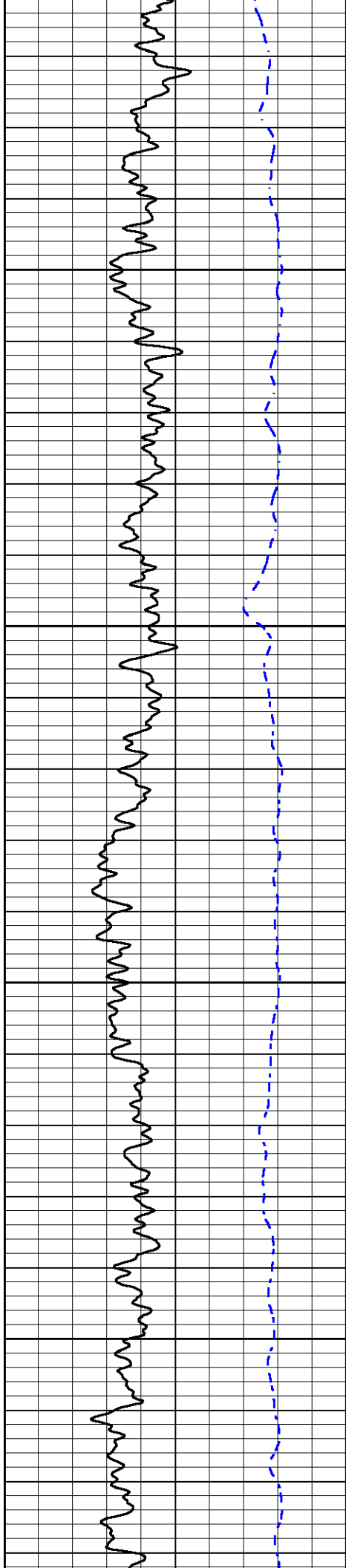
1250

1300

1350





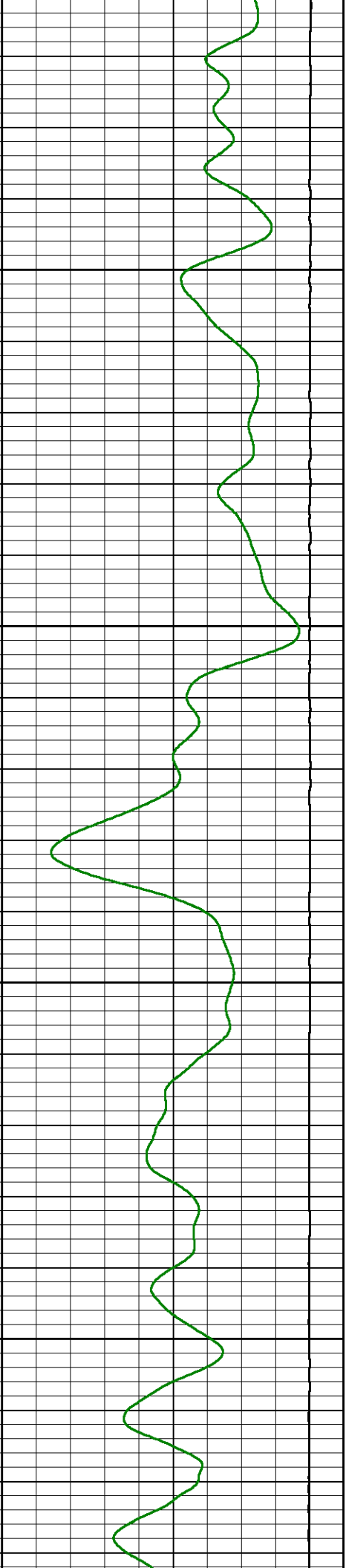
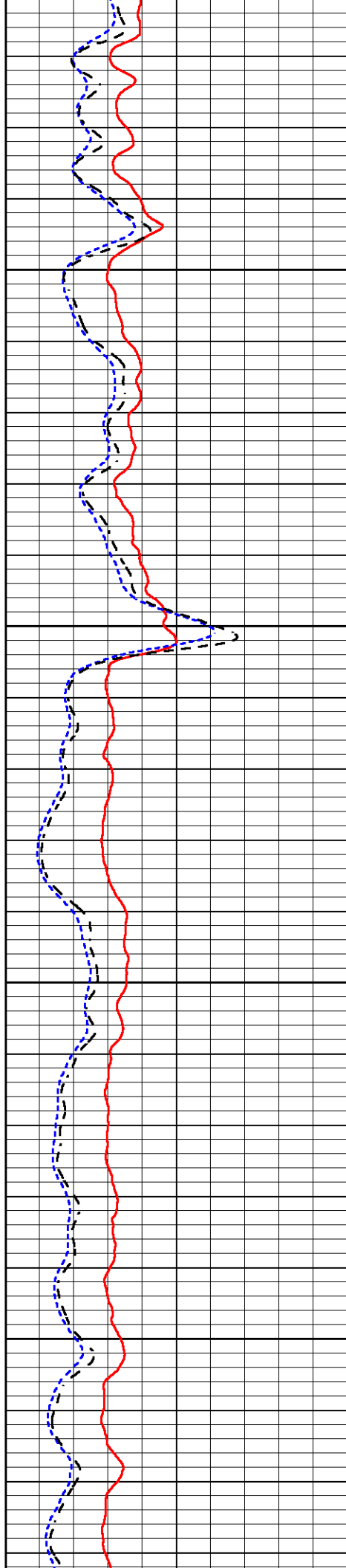


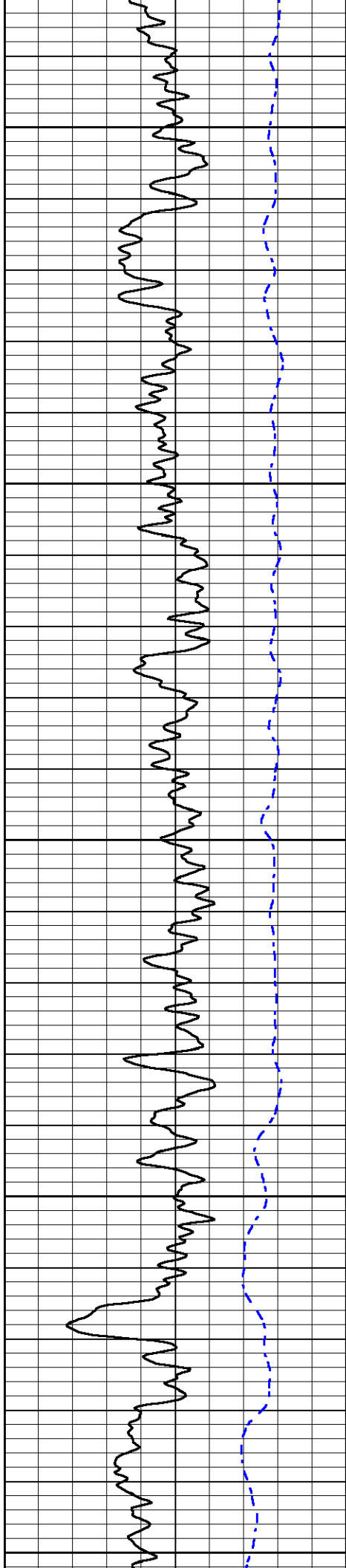
1650

1700

1750

1800





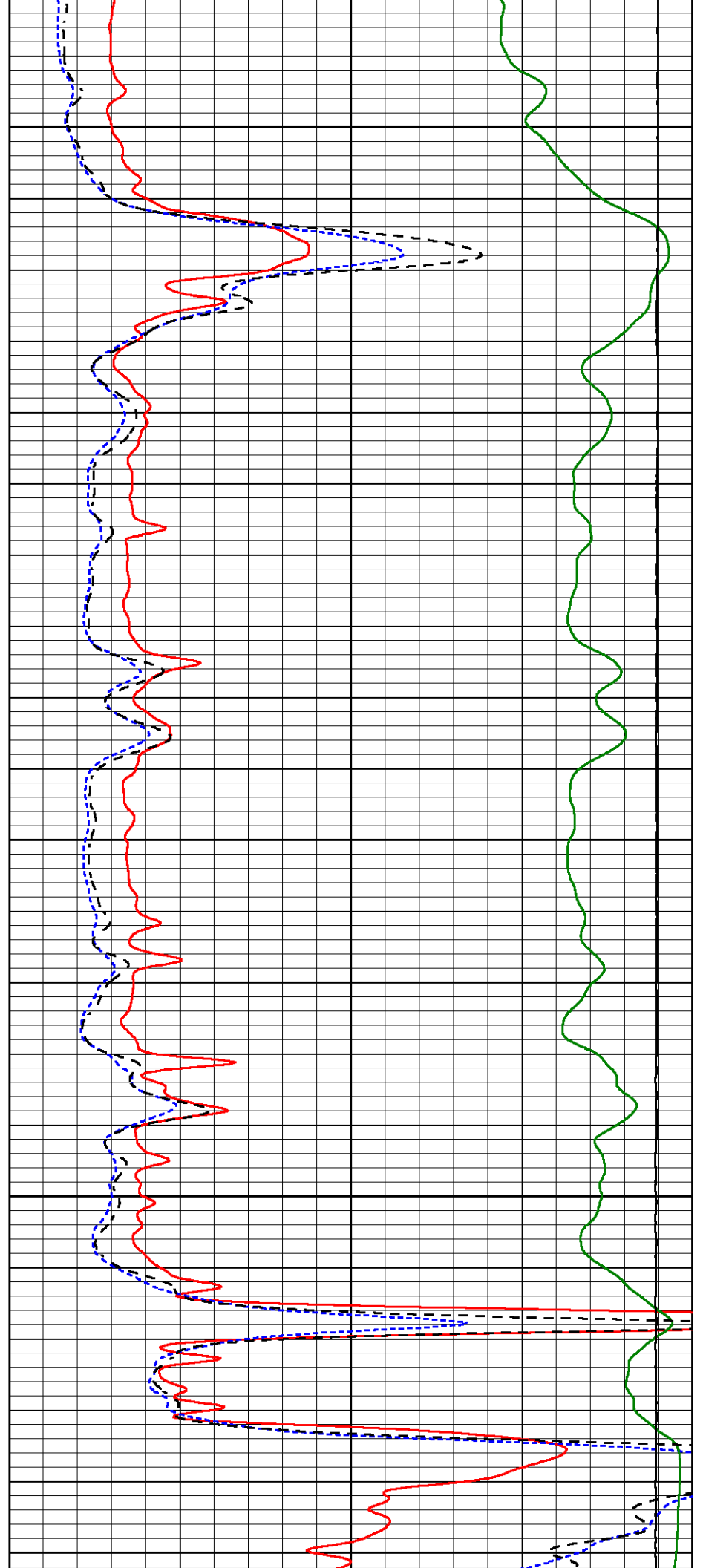
1850

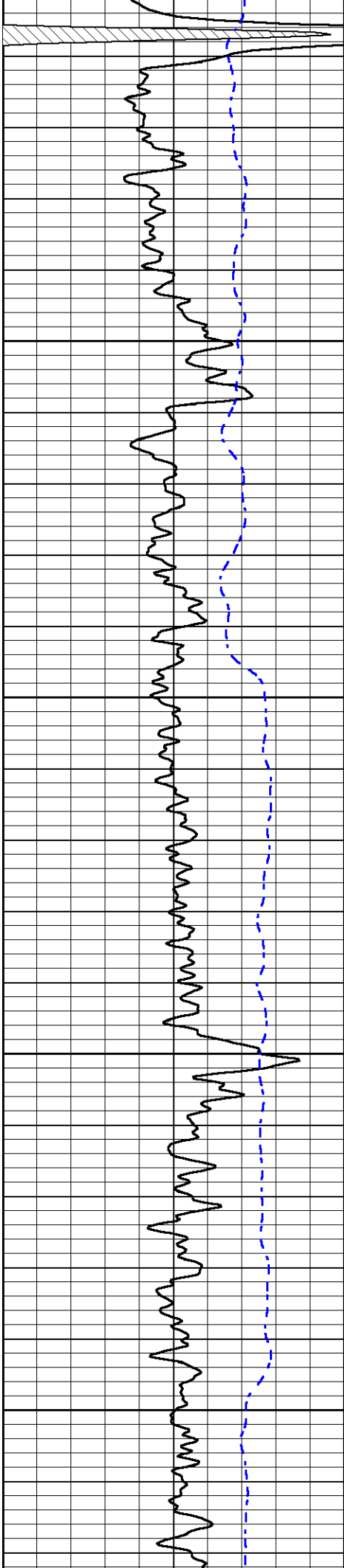
1900

1950

2000

2050



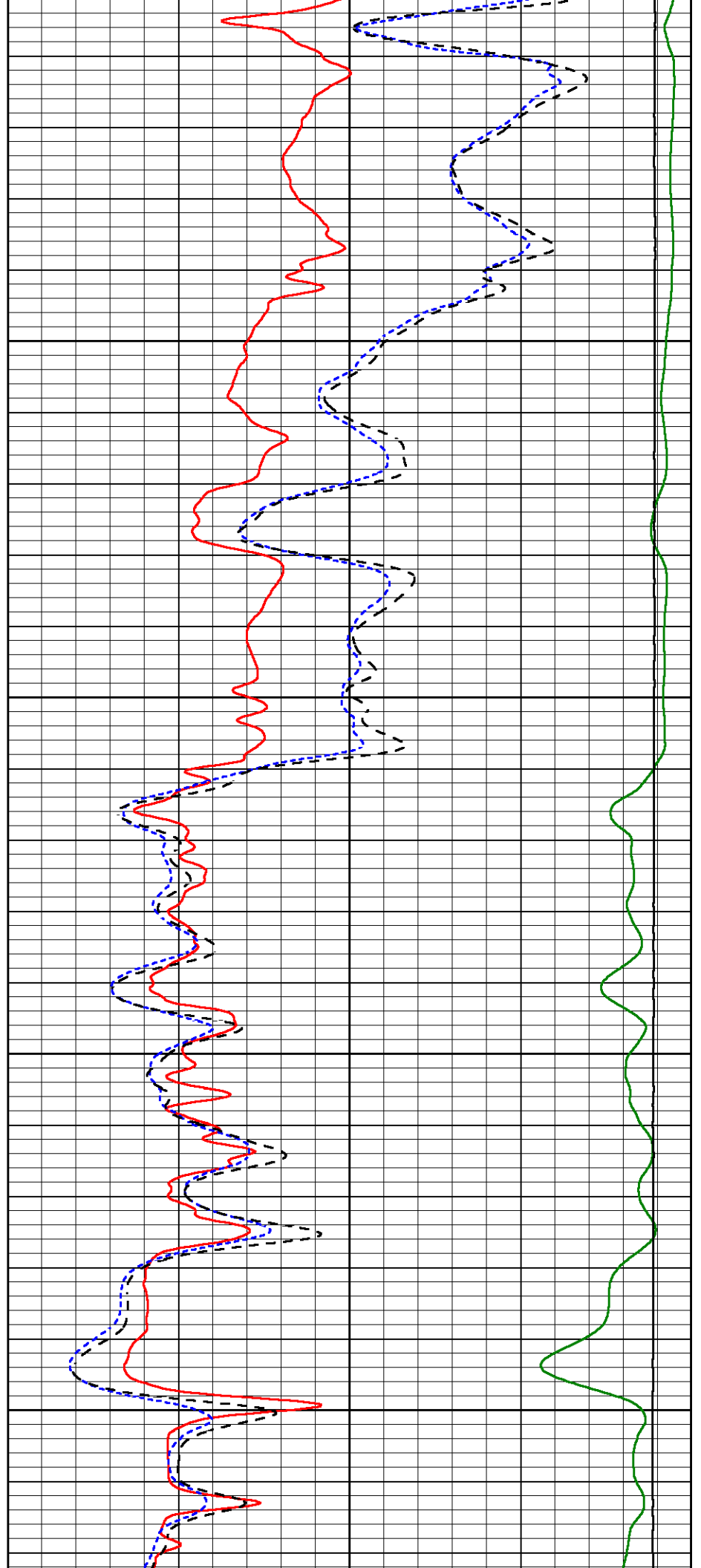


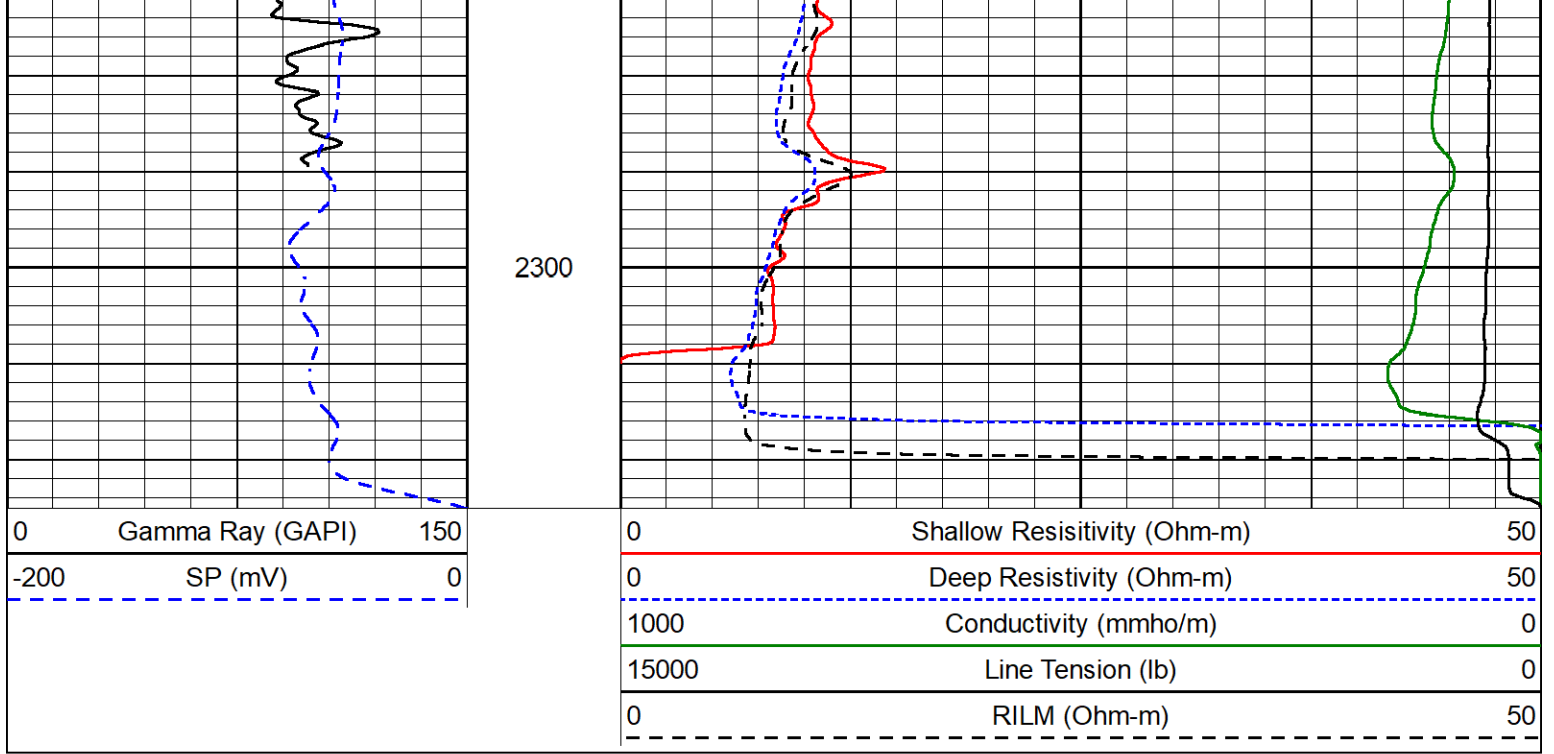
2100

2150

2200

2250





Calibration Report

Database File hydro_grandview upper black squirrel.db
 Dataset Pathname stack/pass2.12
 Dataset Creation Mon Feb 12 09:05:52 2024

Dual Induction Calibration Report

Serial-Model: 504 HT-M&W
 Surface Cal Performed: Sun Jan 28 10:54:35 2024

Loop:	Readings		References			Results	
	Air	Loop	Air	Loop	mmho/m	m	b
Deep	178.615	710.235	0.000	255.800	mmho/m	1.350	-9.000
Medium	161.982	1441.110	0.000	255.800	mmho/m	0.950	-44.000

LITHODENSITY Calibration Report

Serial Number: 701-01
 Tool Model: STEP LITHO Short
 Performed: Fri Dec 15 13:02:54 2023

Source:

	Win1	Win2	Win3	Win4	Win5	Win6	Win7	Win8	
Background:									
SS:	50	53	200	252	23	67	44	1	cps
LS:	78	88	332	424	48	131	87	3	cps

Aluminum:

SS:	1069	1323	3068	2763	51	72	47	3	cps
LS:	1171	2261	4196	1923	57	133	82	6	cps

Magnesium:

SS:	1756	2109	4999	4049	59	72	48	5	cps
LS:	4803	8914	16228	6562	125	123	85	17	cps

Aluminum+Iron:

SS:	682	909	2535	2363	47	72	47	3	cps
-----	-----	-----	------	------	----	----	----	---	-----

LS: 682 1582 3537 1707 57 132 82 5 cps

	Density Actual	Calibrated		PE Actual	Calibrated	Quality
Background:						
SS:						0.201
LS:						0.203
Aluminum:						
SS:	2.6000	2.6000	g/cc			0.208
LS:	2.6000	2.6000	g/cc			0.236
Magnesium:						
SS:	1.6800	1.6800	g/cc	2.5700	2.5700	0.205
LS:	1.6800	1.6800	g/cc	2.5700	2.5700	0.183
Aluminum+Iron:						
SS:					6.1800	0.210
LS:					6.1800	0.234

Caliper:	Reference:	Reading:
Small Ring:	6.0 in	0.2
Large Ring:	32.0 in	0.8
Gain:	41.487	
Offset:	-8.500	

Compensated Neutron Calibration Report

Serial Number: 210
Tool Model: M&W

CALIBRATION

Detector	Readings	Target	Normalization
Short Space	6240.00 cps	1000.00 cps	1.6025
Long Space	460.00 cps	1000.00 cps	1.9500

Gamma Ray Calibration Report

Serial Number: 105
Tool Model: M&W
Performed: Sat Oct 21 23:48:19 2023

Calibrator Value: 500.0 GAPI

Background Reading: 24.0 cps
Calibrator Reading: 637.0 cps

Sensitivity: 0.6000 GAPI/cps



MIDWEST WIRELINE

Company Hydro Resources
Well Grandview Upper Black Squirrel
Field
County El Paso
State Colorado



MIDWEST WIRELINE

**DUAL COMPENSATED
POROSITY W/PE**

Company **Hydro Resources**
Well **Grandview Upper Black Squirrel**
Field
County **El Paso** State **Colorado**

Company **Hydro Resources**
Well **Grandview Upper Black Squirrel**
Field
County **El Paso**
State **Colorado**

Location: API #: **NE 1/4 NW 1/4**
SEC 28 TWP 12S RGE 64 W
Permanent Datum Ground Level Elevation
Log Measured From Ground Level
Drilling Measured From Ground Level

Other Services
Elevation
K.B.
D.F.
G.L.

Date	2/12/2024						
Run Number	One						
Type Log	CNL/CDL						
Depth Driller	2321						
Depth Logger	2318						
Bottom Logged Interval	2297						
Top Logged Interval	0						
Type Fluid In Hole	Chemical						
Salinity, PPM CL	200						
Density	9.0						
Level	Full						
Max. Rec. Temp. F							
Operating Rig Time	2 Hours						
Equipment -- Location	110 Hays						
Recorded By	D. Schmidt						
Witnessed By	Kevin Whittemore						
Borehole Record							
Run No.	Bit	From	To	Size	Wgt.	Casing Record	
One		0	32	24		From	To
Two	17.5	32	TD			0	32

<<< Fold Here >>>

All interpretations are opinions based on inferences from electrical or other measurements and Midwest Wireline Services, LLC cannot and does not guarantee the accuracy or correctness of any interpretation, and Midwest Wireline Services, LLC will not 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.

Comments

N/A DENOTES NOT AVAILABLE OR NON-APPLICABLE.

Permit #88240-F

SO# 2879

Log Measured From: Ground Level Ft. Above Permanent Datum

THANK YOU FOR USING MIDWEST WIRELINE LLC
785-625-3858

Your Midwest Wireline Crew

Engineer: D. Schmidt
Operator:
Operator:
Operator:

This Log Record Was Witnessed By

Primary Witness: Kevin Whittemore
Secondary Witness:
Secondary Witness:
Secondary Witness:

Sensor	Offset (ft)	Schematic	Description	Length (ft)	O.D. (in)	Weight (lb)	
GR	32.65		GR-M&W (105)	3.00	3.50	50.00	
CNLSC CNSSC	29.55 28.80		CNT-M&W (210)	5.00	3.50	100.00	
				MWLith-STEP LITHO Short (701-01)	8.40	5.00	250.00
LCAL	20.63						
LLW8N	20.63						
LLW7N	20.63						
LLW6N	20.63						
LLW5N	20.63						
LLW4N	20.63						
LLW3N	20.63						
LLW2N	20.63						
LLW1N	20.63						
LSLOCK	20.38						
LLLOCK	20.38						
PELTMPR	20.38						
LSHVNG	20.38						
LLHVNG	20.38						
LSW8N	20.13						
LSW7N	20.13						
LSW6N	20.13						
LSW5N	20.13						
LSW4N	20.13						
LSW3N	20.13						
LSW2N	20.13						
LSW1N	20.13						
RLL3F	15.50						
RLL3	15.50						
CILD	8.33						
CILM	4.50						
SP	0.20						
			DIL-M&W (504 HT)	18.25	3.50	220.00	

Dataset: hydro_grandview upper black squirrel.db: field/well/stack/pass2.12
 Total length: 34.65 ft
 Total weight: 620.00 lb
 O.D.: 5.00 in

Log Variables

DatabaseC:\ProgramData\Warrior\Data\hydro_grandview_upper_black_squirrel.db
 Dataset field/well/stack/pass2.12/_vars_

Top - Bottom

BOREID in 17.5	BOTTEMP degF 100	CASEOD in 10	CASETHCK in 0	FLUIDDEN g/cc 1	MATRXDEN g/cc 2.71	NPORSEL Limestone	PERFS No
SNDERR mmho/m 0	SNDERRM mmho/m 0	SPSHIFT mV 15	SRFTEMP degF 30	SZCOR Off	TDEPTH ft 2318		

Variable Description

BOREID : Borehole I.D.
 BOTTEMP : Bottom Hole Temperature
 CASEOD : Casing O.D.
 CASETHCK : Casing Thickness
 FLUIDDEN : Fluid Density
 MATRXDEN : Matrix Density
 NPORSEL : Neutron Porosity Curve Select

PERFS : Perforation Flag
 SNDERR : Deep Sonde Error Correction
 SNDERRM : Medium Sonde Error Correction
 SPSHIFT : S.P. Baseline Offset
 SRFTEMP : Surface Temperature
 SZCOR : CN Size Cor. ?
 TDEPTH : Total Depth

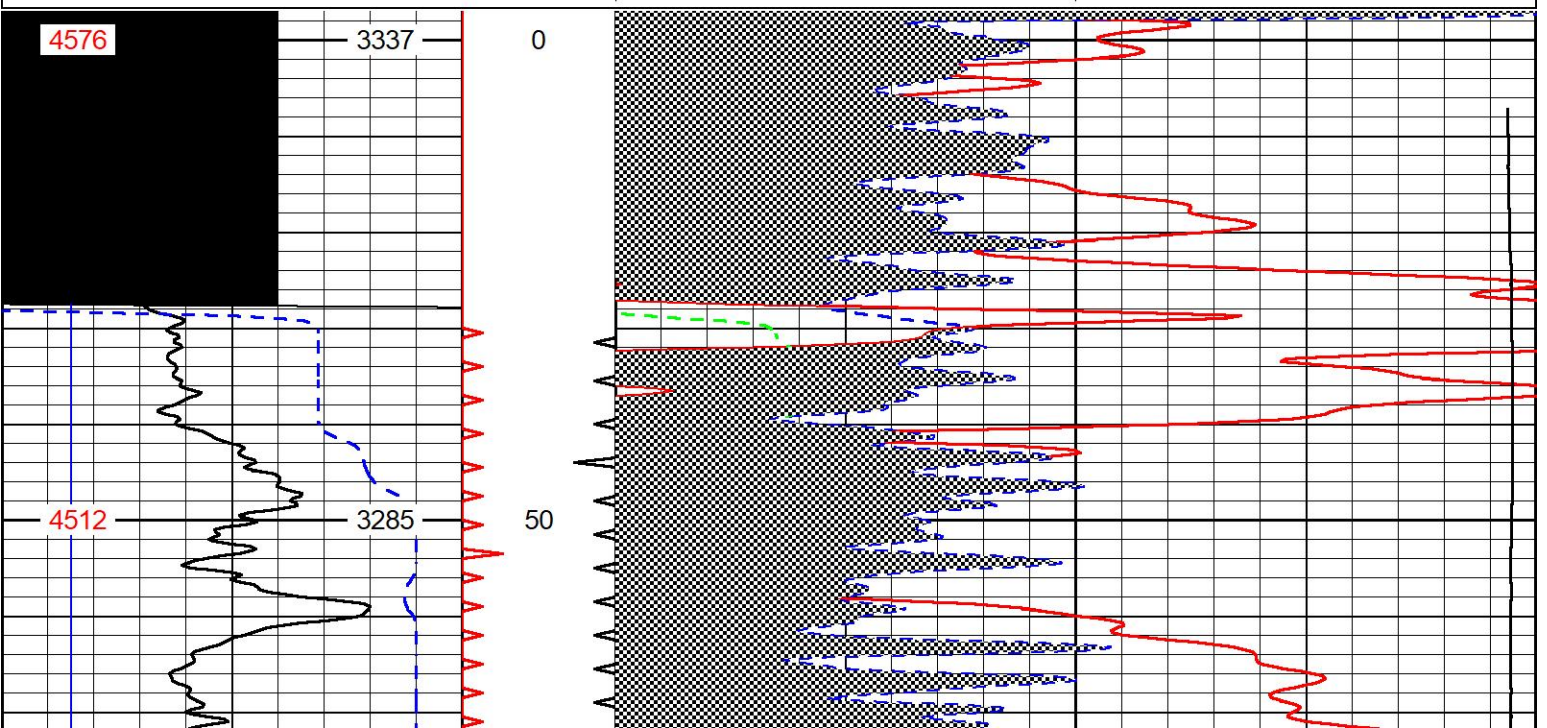


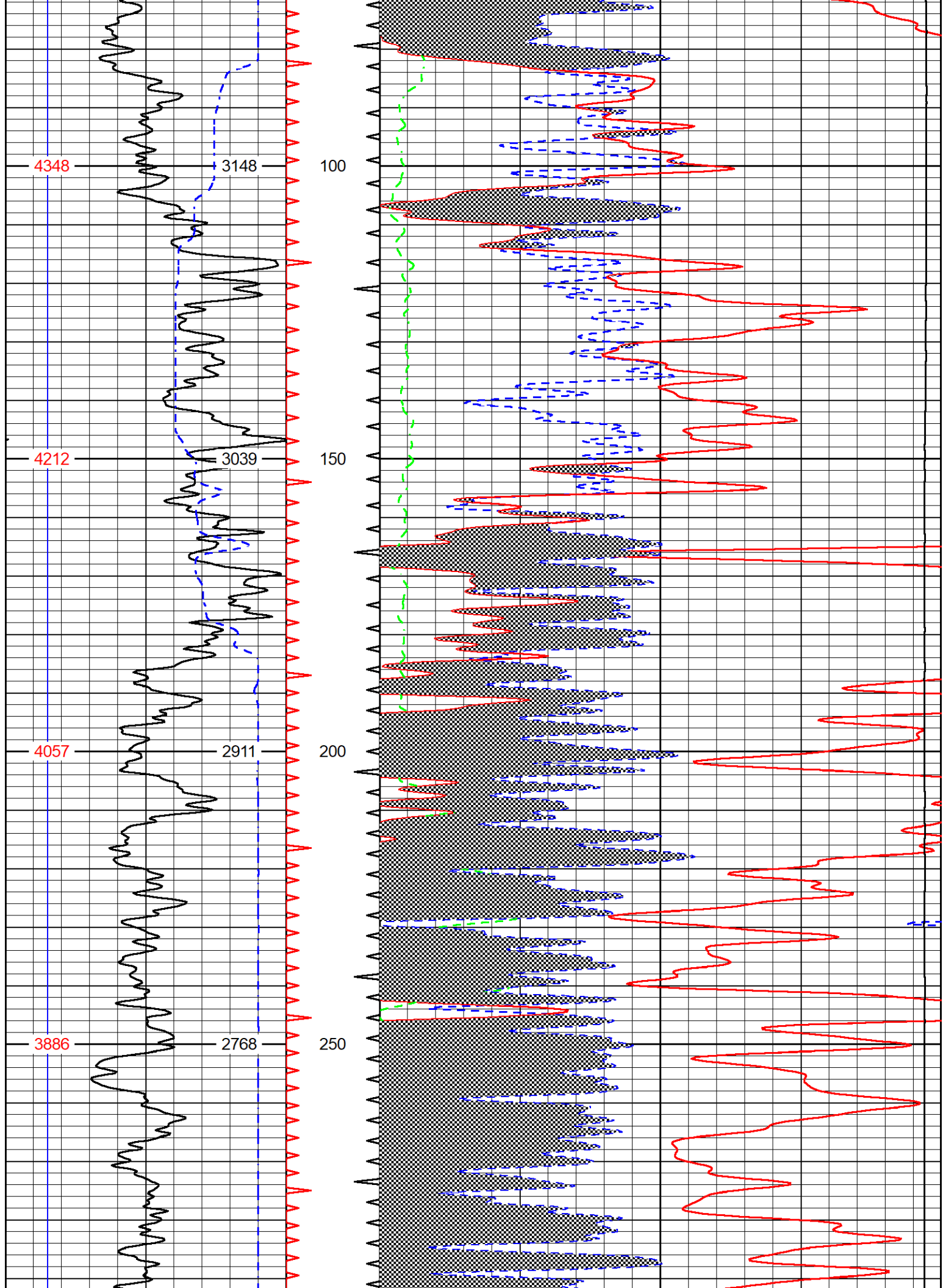
DETAIL SECTION

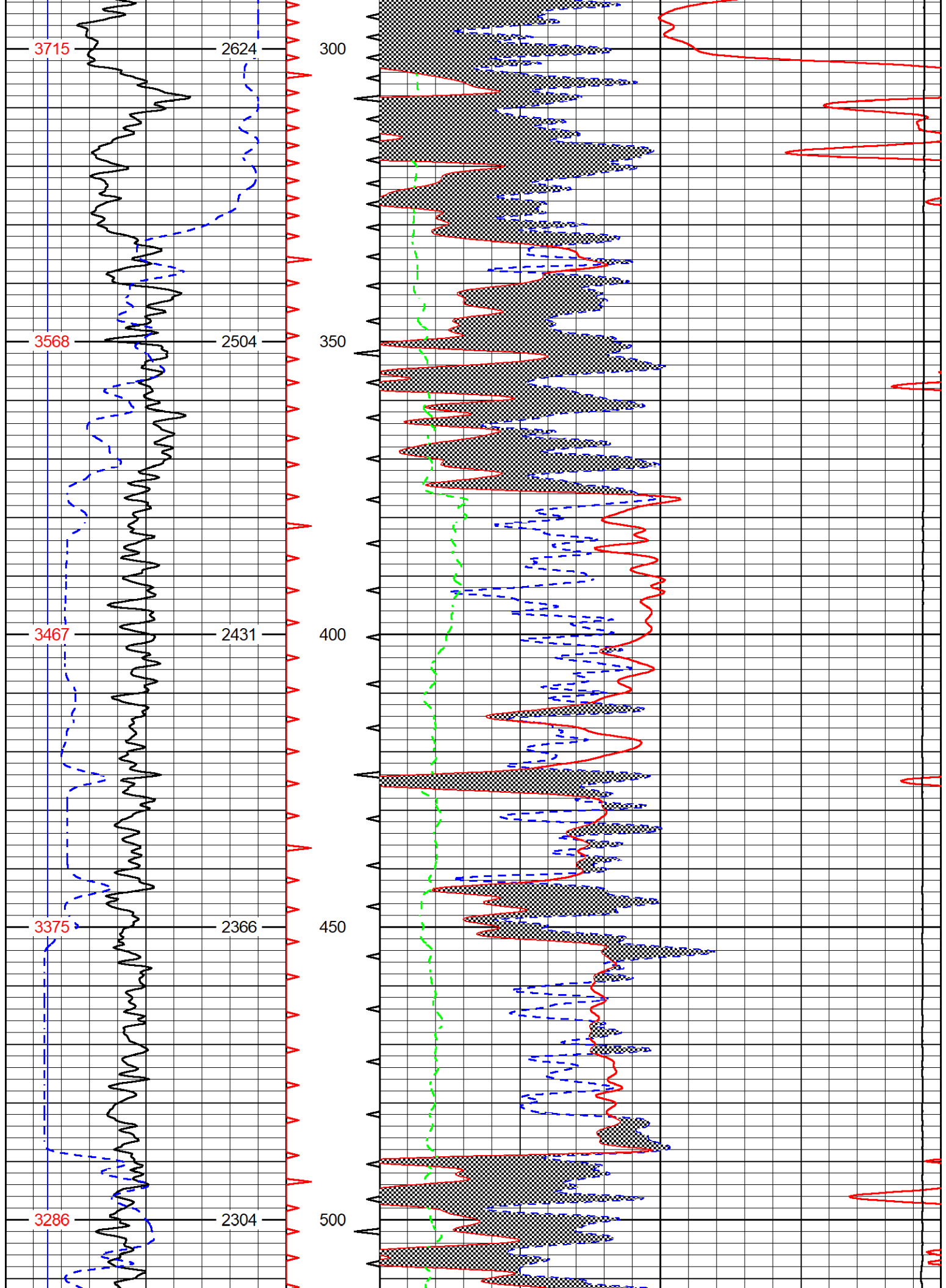
MAIN PASS

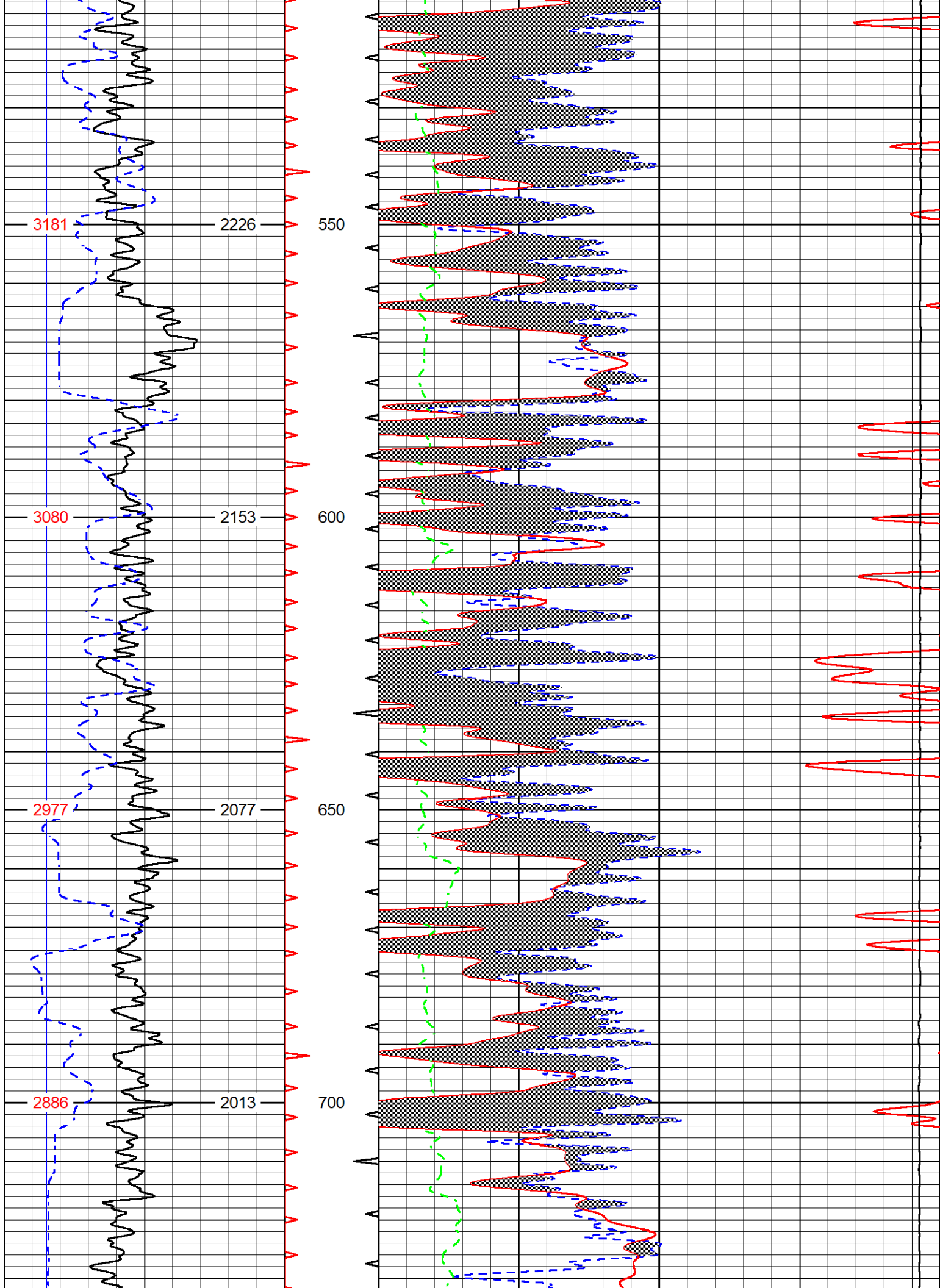
Database File hydro_grandview_upper_black_squirrel.db
 Dataset Pathname stack/pass2.12
 Presentation Format CNDLHY~1
 Dataset Creation Mon Feb 12 09:05:52 2024
 Charted by Depth in Feet scaled 1:240

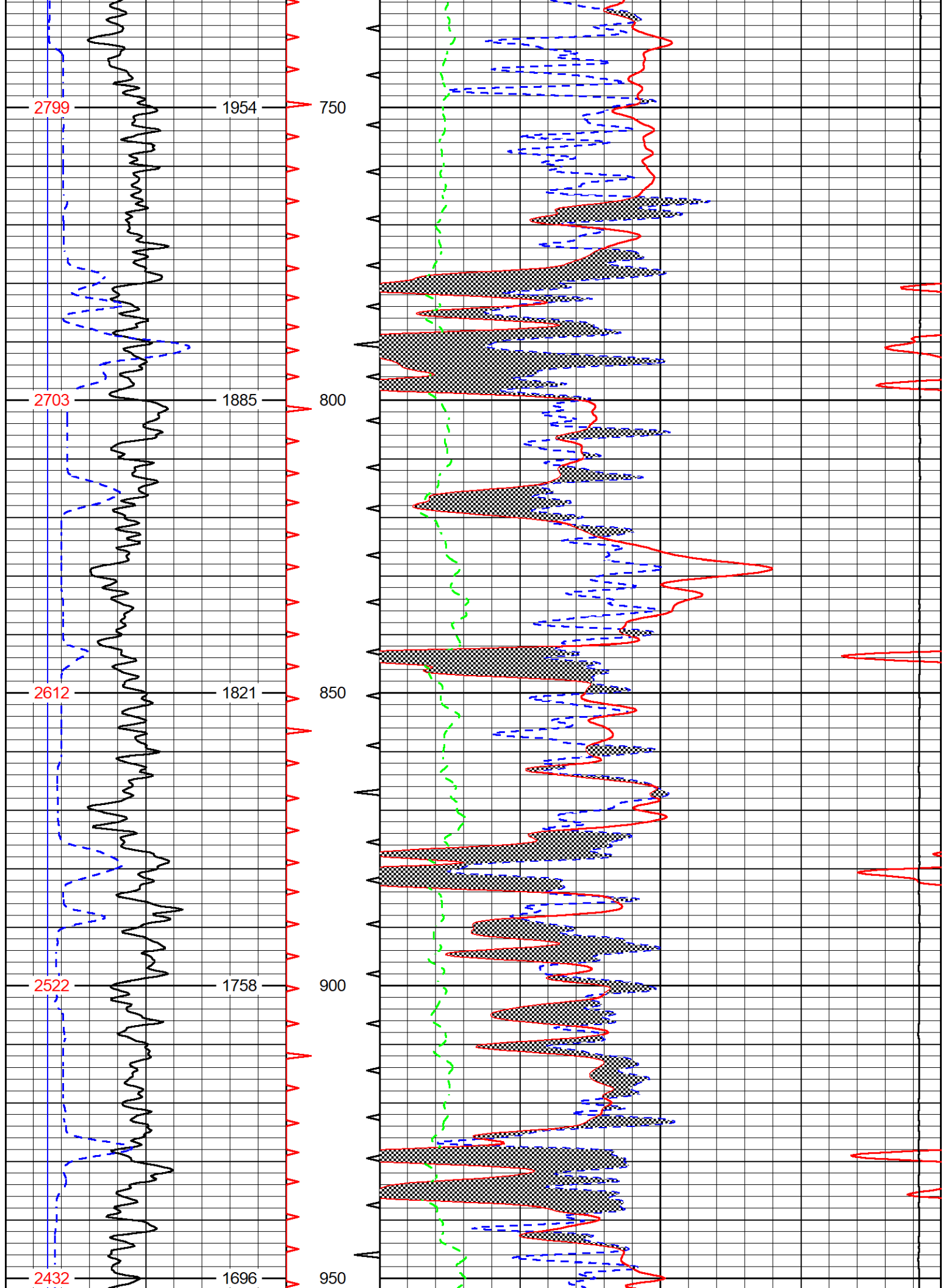
0	GAMMA RAY (GAPI)	150	60	CNPOR (pu)	0
16	lcal (in)	26	60	COMP DENSITY POROSITY (pu)	0
16	BIT SIZE (in)	26	15000	LINE TENSION (lb)	0
			0	PE	10

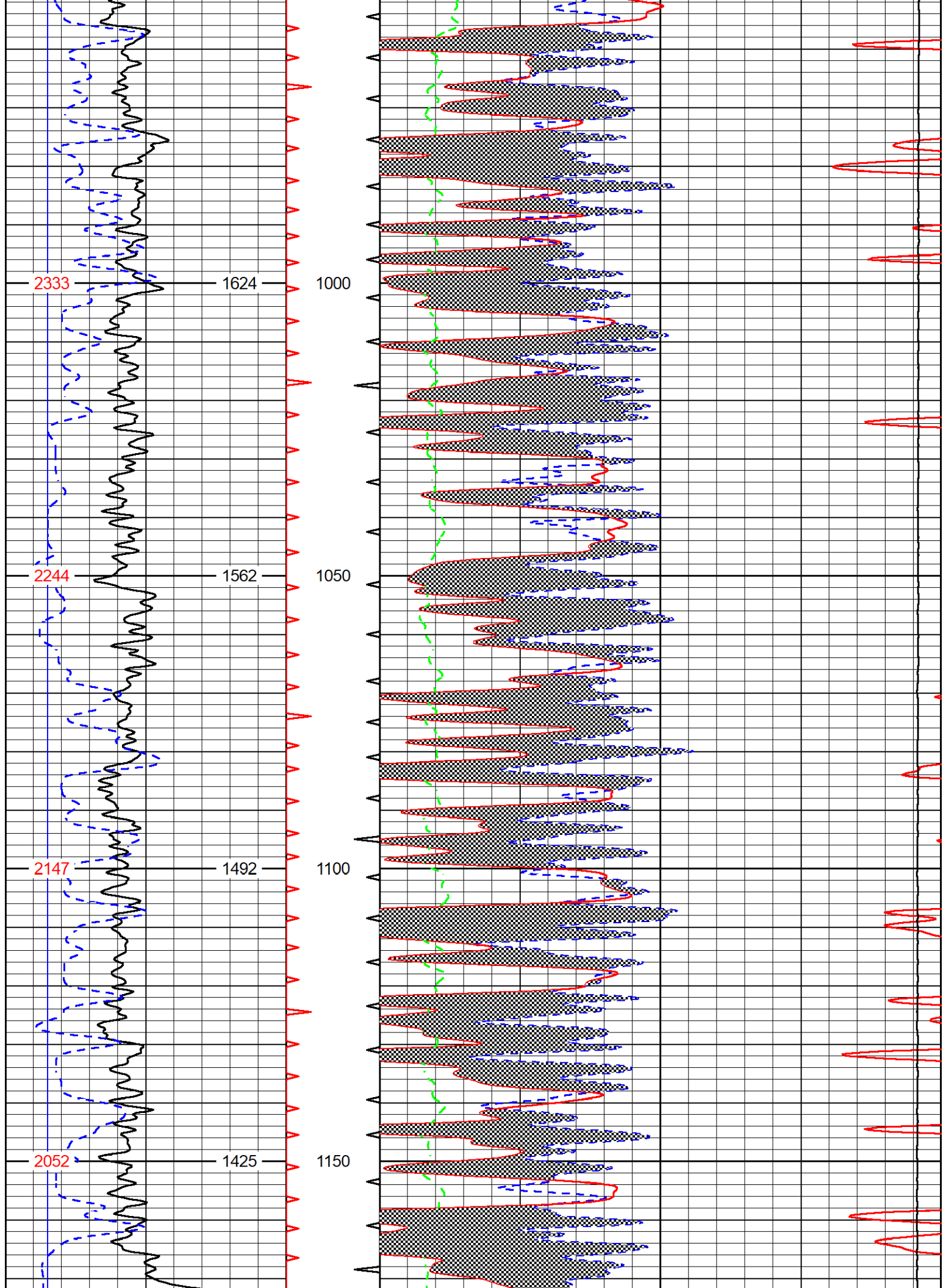


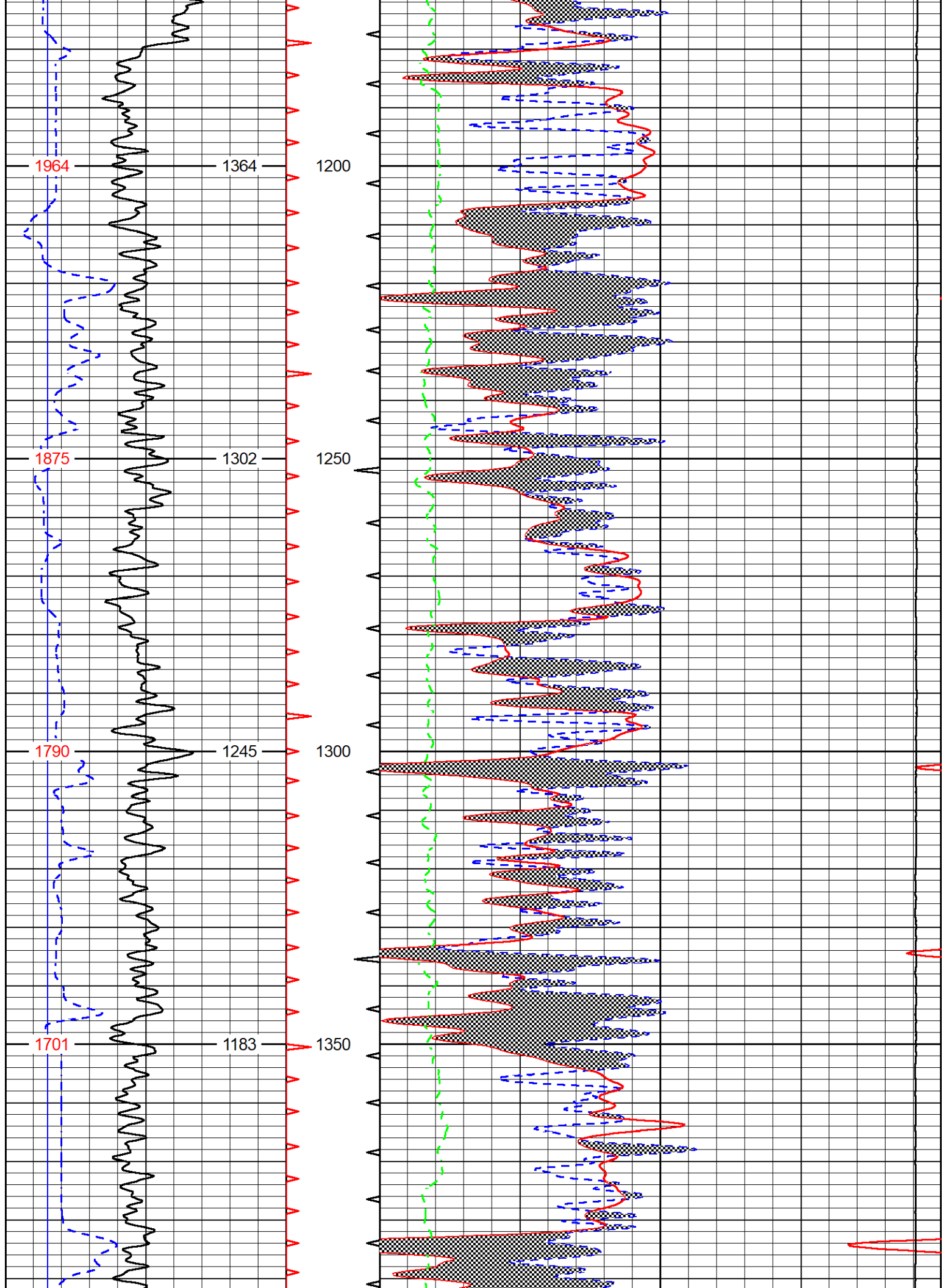


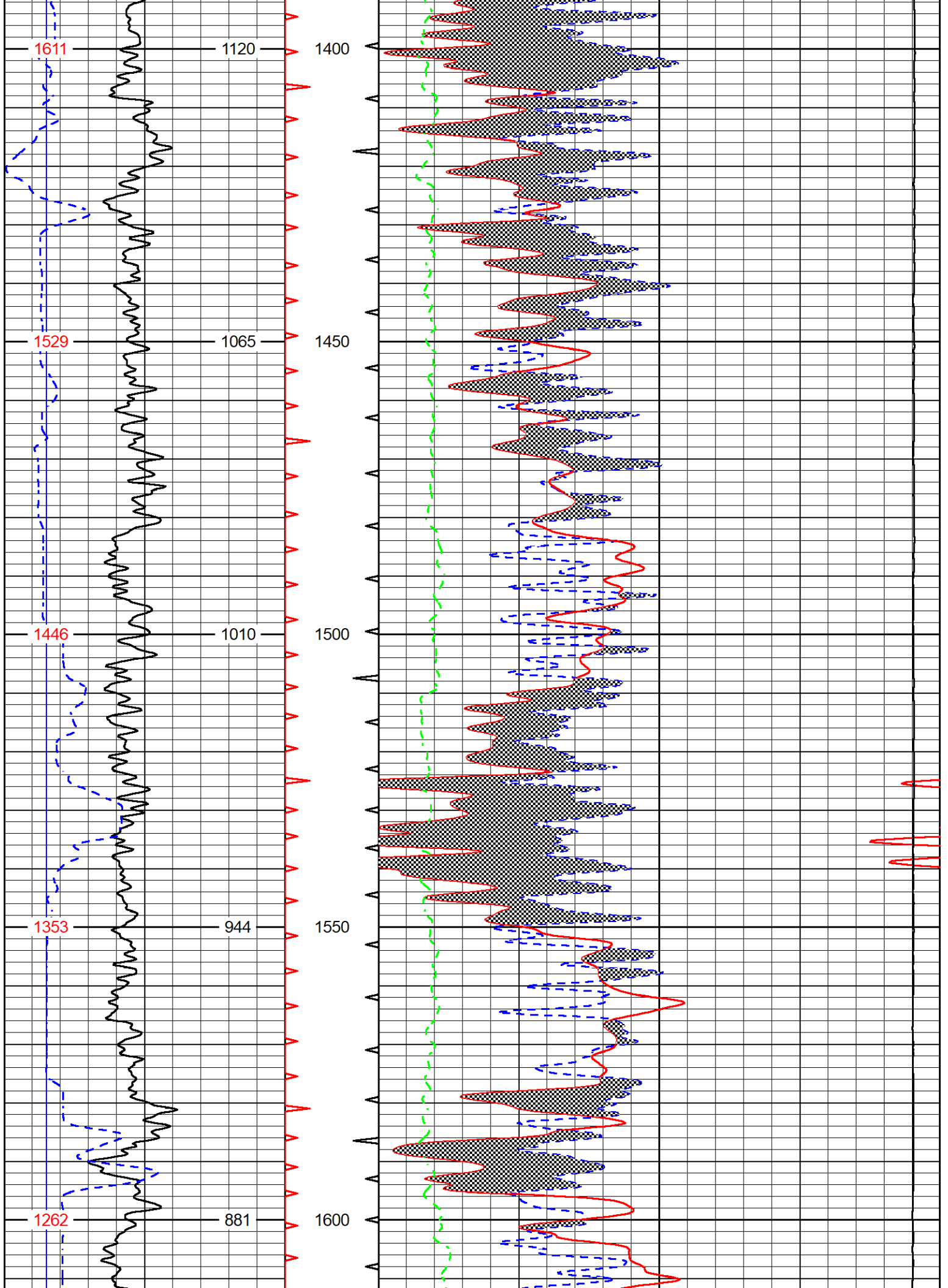


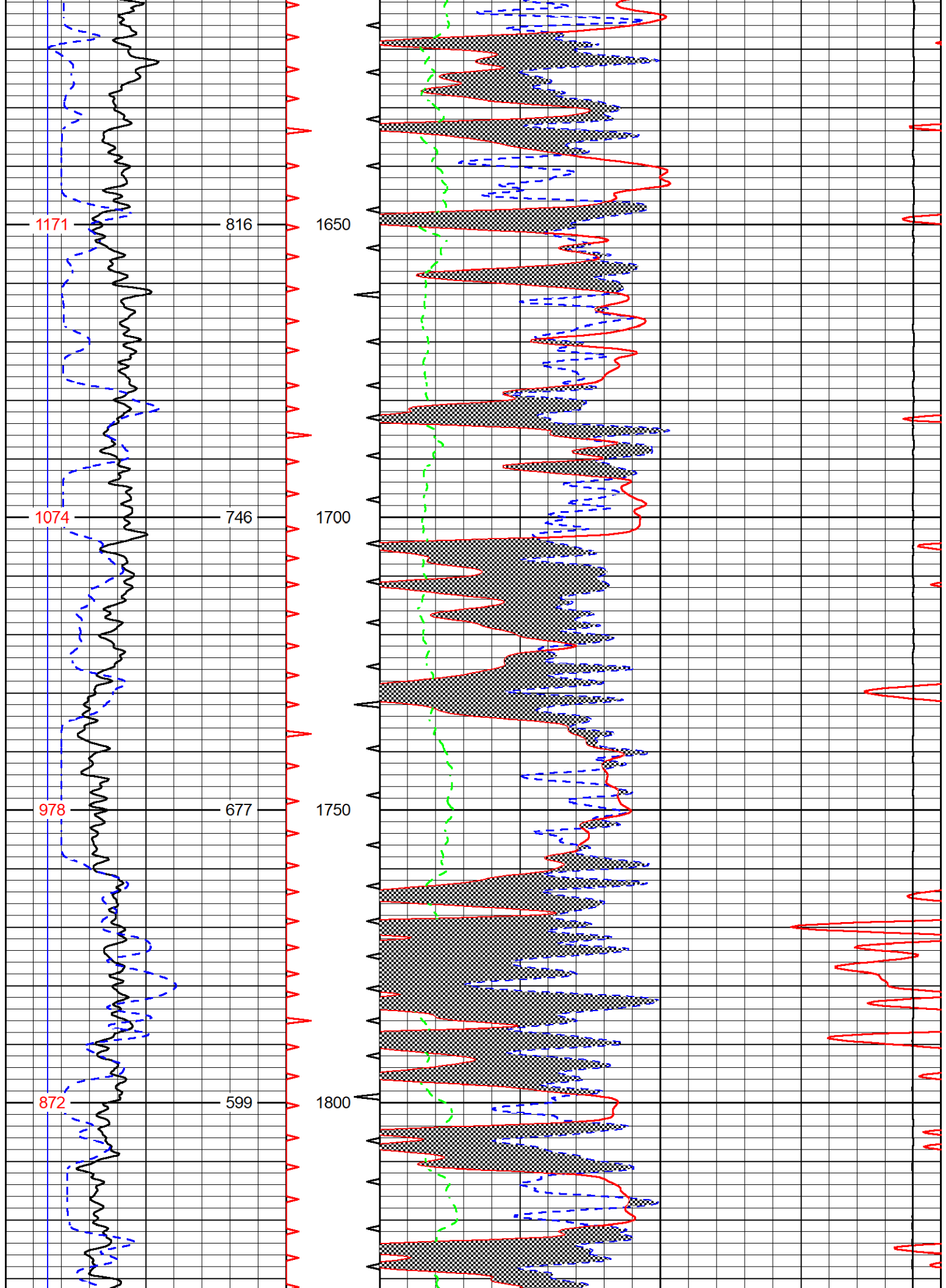


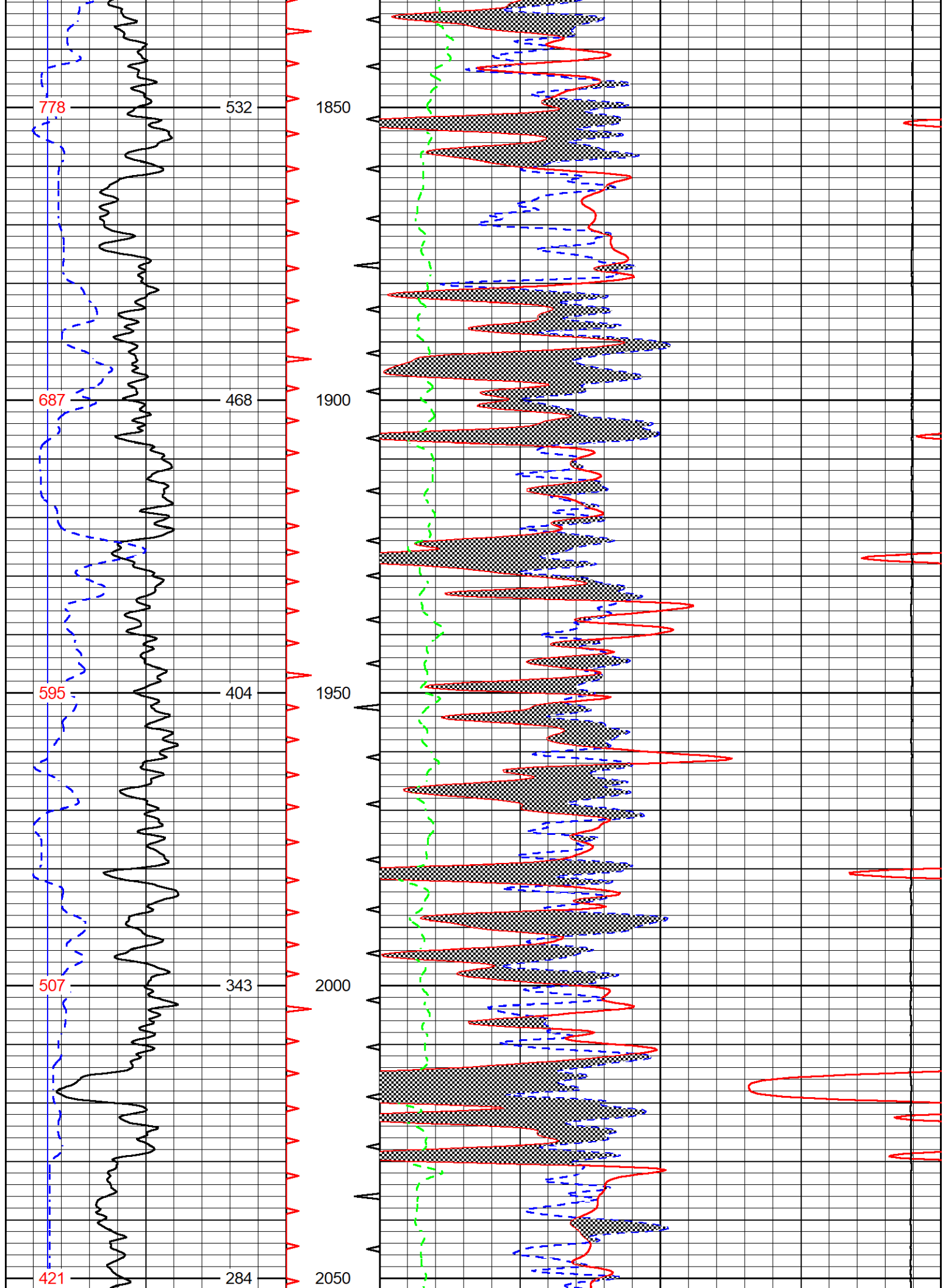


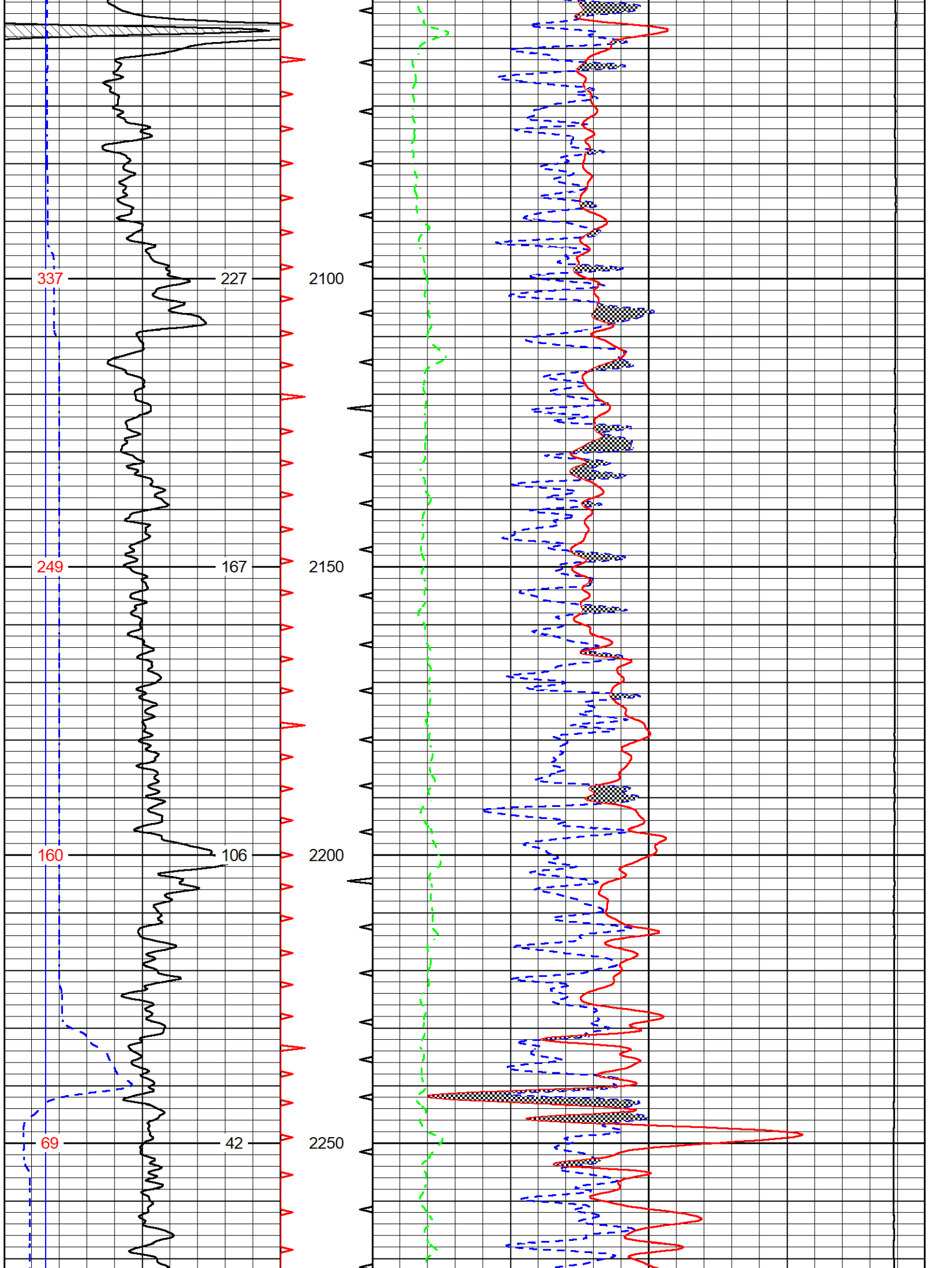


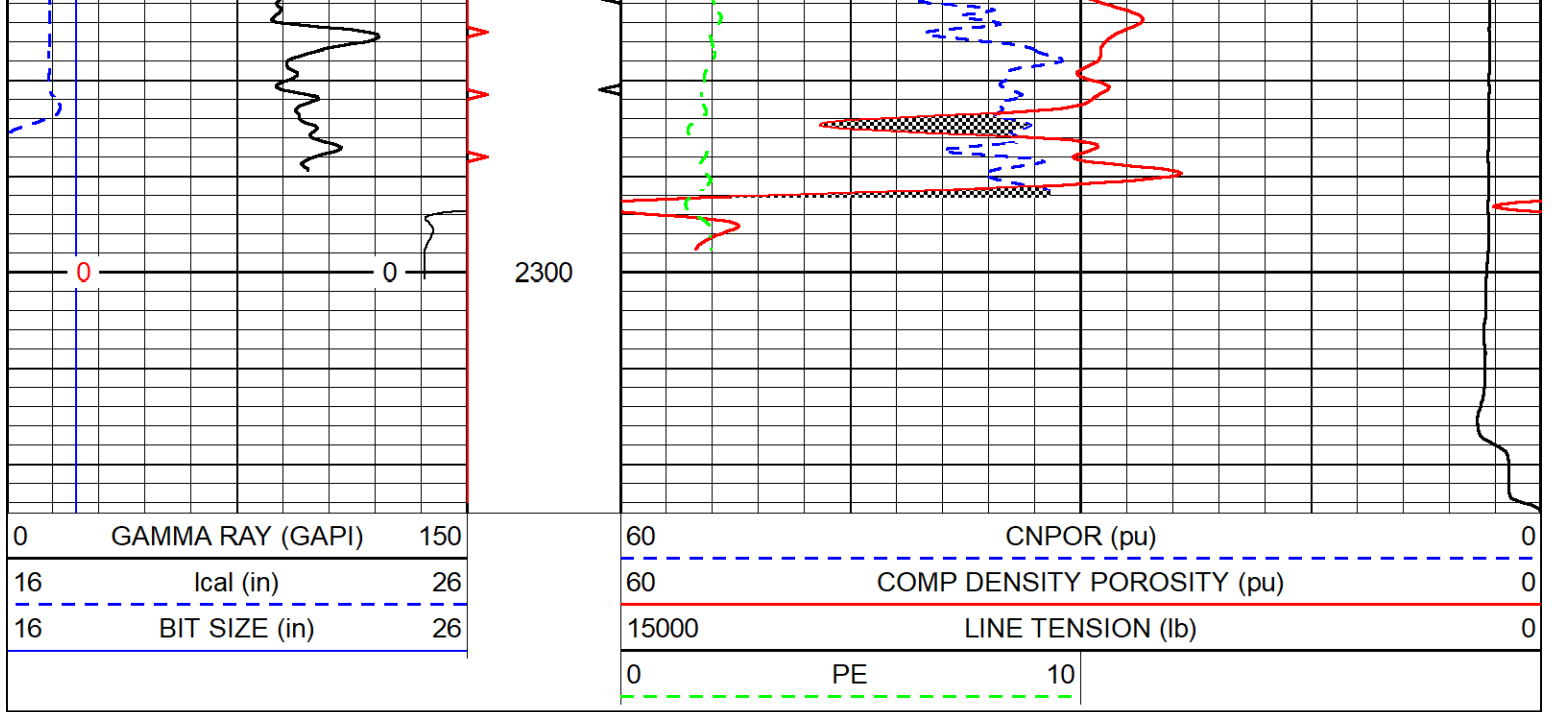












Calibration Report

Database File hydro_grandview upper black squirrel.db
 Dataset Pathname stack/pass2.12
 Dataset Creation Mon Feb 12 09:05:52 2024

Dual Induction Calibration Report

Serial-Model: 504 HT-M&W
 Surface Cal Performed: Sun Jan 28 10:54:35 2024

Loop:	Readings		References			Results	
	Air	Loop	Air	Loop	mmho/m	m	b
Deep	178.615	710.235	0.000	255.800	mmho/m	1.350	-9.000
Medium	161.982	1441.110	0.000	255.800	mmho/m	0.950	-44.000

LITHODENSITY Calibration Report

Serial Number: 701-01
 Tool Model: STEP LITHO Short
 Performed: Fri Dec 15 13:02:54 2023

Source:

	Win1	Win2	Win3	Win4	Win5	Win6	Win7	Win8	
Background:									
SS:	50	53	200	252	23	67	44	1	cps
LS:	78	88	332	424	48	131	87	3	cps
Aluminum:									
SS:	1069	1323	3068	2763	51	72	47	3	cps
LS:	1171	2261	4196	1923	57	133	82	6	cps
Magnesium:									
SS:	1756	2109	4999	4049	59	72	48	5	cps
LS:	4803	8914	16228	6562	125	123	85	17	cps
Aluminum+Iron:									
SS:	682	909	2535	2363	47	72	47	3	cps
LS:	682	1582	3537	1707	57	132	82	5	cps

	Density			PE		
	Actual	Calibrated		Actual	Calibrated	Quality
Background:						
SS:						0.201
LS:						0.203
Aluminum:						
SS:	2.6000	2.6000	g/cc			0.208
LS:	2.6000	2.6000	g/cc			0.236
Magnesium:						
SS:	1.6800	1.6800	g/cc	2.5700	2.5700	0.205
LS:	1.6800	1.6800	g/cc	2.5700	2.5700	0.183
Aluminum+Iron:						
SS:					6.1800	0.210
LS:					6.1800	0.234

Caliper:	Reference:	Reading:
Small Ring:	6.0 in	0.2
Large Ring:	32.0 in	0.8
Gain:	41.487	
Offset:	-8.500	

Compensated Neutron Calibration Report

Serial Number:	210
Tool Model:	M&W

CALIBRATION				
Detector	Readings	Target		Normalization
Short Space	6240.00 cps	1000.00 cps		1.6025
Long Space	460.00 cps	1000.00 cps		1.9500

Gamma Ray Calibration Report

Serial Number:	105
Tool Model:	M&W
Performed:	Sat Oct 21 23:48:19 2023
Calibrator Value:	500.0 GAPI
Background Reading:	24.0 cps
Calibrator Reading:	637.0 cps
Sensitivity:	0.6000 GAPI/cps

 <p align="center">MIDWEST WIRELINE</p>	Company	Hydro Resources
	Well	Grandview Upper Black Squirrel
	Field	
	County	El Paso
	State	Colorado

Appendix C: Lithologic Sample Logs for Wells LFH-1 and A-1



Well Name: Grandview LFH-1

Northing: 4314958.4

Easting: 537607.1

Logging Date: 3/3/2024

Depth [FEET]	Lithology %				Description
	Sand	Shale	Coal	Claystone/ Mudstone	
0					*No samples taken during surface casing installation.
10					*No samples taken during surface casing installation.
20					*No samples taken during surface casing installation.
30					*No samples taken during surface casing installation.
40					*No samples taken during surface casing installation.
50	30			70	Tan to brown sandy clay, loose, moderately sorted sand, small pieces of dark gray mudstone.
60	98			<2	Coarse, tan quart-rich sand, well sorted.
70	90			10	Poorly sorted medium to coarse sand, tan to gray grains, quartz, grains up to 1 cm, moist, angular grains.
80	90			10	Poorly sorted gravelly sands, pink to gray quartz and feldspars, moist sub-angular to sub-rounded.
90	90			10	Same as above.
100	40			60	Gray sandy clay, loose, moist, sand grains fine to v. coarse, up to 4 mm.
110	60			40	Light gray clayey sand, sand grains v. fine, dry.
120	40			60	Brown sandy clay, soft, moist, medium plasticity, fine to v. fine sand, trace mica present.
130	30			70	Brown sandy clay, stiff, moist, high plasticity, fine to medium sand grains.
140	90			10	Light gray moderately sorted sand, loose and in clumps up to 2 cm, easy to crumble, dry, v. fine to coarse grains.
150	40			60	Brown sandy clay, soft, moist, medium plasticity, sand grains fine to medium.
160	70			30	Light gray moderately sorted sand w/gray sandy clay clumps, fine to medium sands, moist clay.
170	50			50	Same as above, with more clay.
180	70			30	Light gray well sorted sand in large clumps to 3 cm, with clay matrix. Fine to coarse sand.
190	40			60	Brown sandy clay, soft, moist, medium plasticity, fine to medium sand grains.

200	80			20	Orange to tan clayey sand, poorly sorted, v. fine to coarse sand, weathering present, angular grains.
210	80			20	Same as above.
220	80			20	Gray sand and gravel, sub-rounded and poorly sorted, moist, clay present in matrix.
230	80			20	Same as above.
240	50			50	Light gray well sorted sand and gray, soft clay. Sand v. fine to fine, dry, clay has medium plasticity, moist.
250	70			30	Gray clayey sand, moderately sorted, sand grains fine to medium with some coarse grains, moist.
260	80			20	Gray sand, moderately sorted, fine to coarse, v. moist, sub-rounded grains.
270	50			50	Light gray well sorted sand and gray, sort clay, sand v. fine to fine, dry, clay medium plasticity and moist.
280	40			60	Gray clay with friable mudstone pieces, medium plasticity, sand grains v. fine to coarse.
290	60			40	Gray clayey sand, moderately sorted, fine to coarse sand, moist.
300	80			20	Gray sand, moderately sorted, fine to coarse, moist, sub-angular grains.
310	30			70	Dark, gray clay w/friable mudstone pieces to 2 mm, clay is medium stiff with medium to high plasticity, sand v. fine, gray.
320	10			90	Dark gray clay w/friable mudstone pieces to 1 cm, clay is medium stiff, medium to high plasticity, moist.
330	10			90	Dark gray clay, friable mudstone pieces, soft and sticky, high plasticity, moist.
340	20			80	Same as above, w/more sand present.
350	20			80	Same as above.
360	20			80	Same as above.
370	20			80	Same as above.
380	25			75	Dark gray sandy clay, soft, medium plasticity, friable mudstone pieces present, fine grained sand.
390	35			65	Dark gray sandy clay, soft, medium plasticity, fine to medium sand grains, moist.
400	35			65	Same as above.
410	25			75	Brown clay w/hard mudstone pieces to 1 cm, clay soft w/medium plasticity, fine sand grains.
420	20			80	Brown clay w/coal, clay is soft, medium plasticity, v. fine sand.
430	40			60	Brwon clay and gray fine well sorted sand, soft clay w/ medium plasticity.
440	70			30	Sandy shale, friable, present in angular pieces to 1 cm, v. fine sand grains, some soft brown clay present.

450	25			75	Black shale w/large claystone pieces to 2 cm, friable, v. fine sand present.
460	20			80	Light brown crumbly clay, low plasticity, pieces of mudstone/claystone to 2 mm.
470	90			10	Gray silty sand, moist, loose, well sorted, mica present, v. fine to medium grains.
480	80			20	Same as above w/more clay content.
490	20			80	Brown clay w/mudstone pieces to 2 cm, soft, moderate plasticity.
500	20			80	Brown clay w/crumbly claystone/mudstone pieces to 2 cm, low plasticity, soft clay.
510	20			80	Same as above.
520	10			90	Dark brown clay, high plasticity, w/crumbly mudstone pieces to 2 mm, soft.
530	10			90	Same as above.
540	20			80	Same as above, w/ more sand content.
550	30			70	Crumbly dark gray to black sandy clay, clay is soft and medium plasticity, v. fine to fine sand grains, mica present.
560	20			80	Dark brown clay, soft w/high plasticity, some friable shale pieces to 5 mm, v. fine sand present.
570	20			80	Dark brown clay, medium plasticity, w/ mudstone pieces to 2 mm, v. fine to fine sand.
580	70			30	Gray to light gray silty sand, low plasticity, sand is well sorted, v. fine to fine grained, clumps of dry-packed sand present.
590	70			30	Same as above.
600	20			80	Dark brown clay, soft and high plasticity, friable claystone pieces present to 1.5 cm, sand v. fine w/some mica present.
610	30			70	Dark brown sandy clay, soft, medium plasticity, sand v. fine, some packets of dry, powdery, packed sand.
620	30	40		30	Black coal w/shale, pieces of fine-grained sandstone present to 3 cm, dry.
630	5			95	Dark gray clay, medium stiff and plasticity, w/gray claystone pieces to 1 cm, hard.
640	5			95	Dark gray clay, medium stiff and plasticity, few hard claystone pieces to 1 cm, clay in 5 mm clumps.
650	15			75	Gray shale, friable, in pieces to 1 cm, w/ dark gray medium stiff clay, medium plasticity, v. fine to fine sand.
660	50			50	Gray fine sand w/flaky shale, gray to dark gray up to 3 cm, sand present in dry clumps.
670	10			90	Dark gray clay, medium stiff and high plasticity, w/ gray mudstone pieces to 1 cm, friable.
680	10			90	Dark gray mudstone pieces to 1 cm, friable, dry, some v. fine to fine sand, some dry dark gray clay.

690	<2			98	Dark gray clay , medium stiff and plasticity, few hard but flaky gray claystone pieces.
700	<2			98	Same as above.
710	30			70	Dark gray sandy clay, soft w/low plasticity, v. fine sand grains.
720	20			80	Same as above w/ more clay content.
730	70			30	Fine gray sand in dry clumps to 2.5 cm. Some clumps of dark gray sandy clay to 2 cm.
740	50			50	Hard gray sandstone w/mica, dark gray sandy clay, soft and low plasticity, few hard tan claystone pieces to 3 cm.
750	70			30	Fine gray sand in dry clumps to 1 cm, some soft sandy clay, dark gray w/ low plasticity.
760	50			50	Same as above w/ more clay content.
770	60			40	Dark gray clayey sand, moist, w/ some gray hard claystone pieces to 1 cm.
780	20			80	Dark gray stiff clay, low plasticity w/some hard gray claystone pieces to 1 cm.
790	90			10	V. fine gray sandstone in 1-2 mm pieces (some to 2 cm), dry, sandstone is easily powdered.
800	30			70	V. fine gray sandstone in 1-2 mm pieces and dark gray mudstone pieces 1-2 mm.
810	20			80	Dark gray mudstone in <1 mm pieces and dry gray clumps of clay, v. low plasticity, crumbly, v. fine sand present.
820			90	10	Lignite coal with gray to light gray mudstone pieces to 2 mm. Coal is dull, black w/dark brown streak, lightweight.
830	90			10	V. fine clayey sand in clumps to 5 cm, easily crumbles, moist to dry.
840	80			20	Same as above w/more clay content.
850	5			95	Dark gray clay, medium stiff and medium plasticity, pieces of claystone present to 1 cm.
860	40			60	Dark gray sandy clay, soft and low plasticity, sand is gray and v. fine.
870	60			40	Gray to dark gray clayey sand w/pieces of black vitreous mudstone (coal?).
880	<2			98	Dark brown clay, medium stiff and high plasticity, present in small clay pieces 1-2 mm.
890	<2			98	Same as above.
900	<2			98	Same as above w/friable gray to dark gray mudstone pieces to 1 cm.
910	<2			98	Same as above.
920	<2			98	Same as above w/more mudstone pieces.

930	20			80	Dark gray clay, stiff w/ medium plasticity, hard mudstone/claystone pieces to 1 cm present, v. fine sand present in 1 cm clumps.
940	10			90	Dark gray to black mudstone, friable, present in large clumps to 8 cm.
950	98			<2	Gray sand, v. fine, present in large clumps and rounded pebble-sized clumps to 1 cm, dry.
960	98			<2	Same as above.
970	80			20	Gray v. fine sand in clumps to 1 cm, w/ dark gray clay and mudstone pieces to 5 mm, dry and loose.
980	98			<2	Gray sand, v. fine, present in large clumps to 5 cm and round pebble-sized clumps to 1 cm, dry.
990	15			85	Dark brown clay, medium stiff and plasticity, some v. fine sand present, some small mudstone pieces to 2 mm present.
1000	15			85	Same as above.
1010	50			50	Dark brown clay, medium stiff and plasticity, w/large clumps of powdery sand to 5 cm, gray v. fine sand, dry.
1020	15			85	Dark brown crumbly mudstone pieces to 3 cm, dry, some v. fine sand present.
1030	80			20	Gray v. fine sand in clumps to 3 cm, dry, some clay content present.
1040	30			70	Dark brown stiff clay, medium plasticity w/clumps of v. fine gray sand to 2 cm and crumbly gray mudstone to 2 cm.
1050	40			60	Dark gray sandy clay, low plasticity and medium stiff, sand present in gray clumps to 3 cm, dry.
1060	30			70	Dry sandy clay clumps to 2 cm, gray, some soft sandy clay present, clumps are dry and powdery.
1070	40			60	Same as above w/more sand.
1080	50			50	Gray v. fine sand in hard clumps to 2 cm, w/dark brown sandy clay clumps, low plasticity and soft.
1090	90			10	Gray v. fine sand (maybe sandstone) in large clumps to 3 cm made up of small pebble-sized clumps to 1 cm, dry, some clayey sand clumps present.
1100	98			<2	Sandstone, hard, fine to v. fine grained, gray, present in rounded pebbles to 3 cm.
1110	40			60	V. dry sandy clay, gray, v. fine sand, some powdery sand clumps present to 2 cm.
1120	40			60	Dark gray sandy clay, low plasticity, med. Stiff, w/ clayey sand, dry, gray.
1130	20			80	Dark gray clay, stiff and medium plasticity, moist, w/ clumps of dried out clay, some brown sand clumps present.
1140	20			80	Same as above.
1150	10			90	Gray to brown claystone present in large flat pieces to 6 cm, hard but able to break by hand.

1160	40			60	Gray sandy clay and v. fine gray sand in clumps to 1 cm, moderate stiff and high plasticity.
1170	10			90	Dark gray clay, medium stiff and plasticity, some claystone pieces to 1 cm present.
1180	10			90	Same as above.
1190	50			50	Dark gray sandy clay and v. fine sand, dry, medium stiff and plasticity.
1200	50			50	Gray soft sandstone pieces to 4 cm and sandy clay clumps, low plasticity, stiff.
1210	15			85	Dry gray clay, crumbly and present in clumps to 3 cm, some v. fine sand present.
1220	25			75	Same as above, more sand content.
1230	15			85	Dark gray clay, stiff w/high plasticity, some sand, v. fine, some clay is moist, some in dry clumps.
1240	15			85	Same as above.
1250			90	10	Coal, black, some powdery, some w/clay.
1260	90			10	Gray fine sand, well sorted w/some clay content. Moist and loose.
1270	65			35	Gray fine sand in 1-2 cm clumps, some sandy clay clumps 1-2 cm, few claystone pieces to 2 cm, hard.
1280			80	20	Coal, black w/clay content.
1290	<2			98	Dark gray v. stiff clay, medium plasticity, moist w/dry clumps.
1300	<2			98	Same as above, clay is softer.
1310	<2			98	Dark gray clay, medium stiff, high plasticity, moist.
1320	10			90	Dark gray clay, dry, some fine sand.
1330	<2			98	Dark gray clay, medium stiff, high plasticity, moist.
1340	<2			98	Dark gray to black clay, soft, high plasticity, moist.
1350	<2			98	Same as above.
1360	95			5	Fine well sorted, sand, "beach sand", gray, moist.
1370	95			5	Gray to light gray dry sand, loose, some white powdery sand-sized grains present, gypsum or other evaporite?
1380	95			5	Same as above.
1390	10			90	Dark gray clay, medium stiff, high plasticity, moist, some minor v. fine sand.
1400	10			90	Same as above.
1410	10			90	Same as above, but drier.
1420	20			80	Same as above, more sand content.

1430	10			90	Same as above, less sand.
1440	20			80	Same as above, more sand.
1450	25			75	Gray sandy clay, dry, crumbly, sand fine to v. fine.
1460	60			40	Rounded sandstone clumps to 2 cm, gray, w/clumps of hard dry clay.
1470	15			85	Sticky gray clay, moist, soft, high plasticity, some fine sand present.
1480	20			80	Sticky gray clay, moist, w/hard dry gray clay, more fine sand than above.
1490	90			10	Dark gray sand, wet and loose, clay in matrix.
1500	10			90	Dark gray clay, moist, stiff w/high plasticity.
1510	10			90	Same as above, with some mudstone pieces to 2 mm.
1520	5			95	Sticky dark gray clay, sift, high plasticity, low sand content, wet.
1530	10			90	Same as above, more sand.
1540	10			90	Same as above.
1550	15			85	Same as above, more sand.
1560	5			95	Gray clay, very wet, soft, high plasticity, low sand.
1570	50			50	Gray clay, wet, soft w/ gray sand, "beach sand", well sorted and fine grained.
1580	70			30	Gray well sorted sand, loose, wet, some clay in matrix.
1590	30			70	Gray sandy clay, wet, soft, some clumps of sand to 2 cm, sand grains are fine and well sorted.
1600	30			70	Same as above.
1610	5			95	Sticky gray clay, soft, high plasticity, wet.
1620	5			95	Same as above.
1630	80			20	Gray clayey sand, in clumps to 2 cm, crumbles easily, fine-grained to medium grained.
1640	40			60	Gray sandy clay, hard and stiff, sand is medium grained.
1650	40			60	Same as above.
1660	80			20	Gray fine to medium sand in clumps to 1 cm, dry and powders easily, some dark gray soft clay.

1670	80			20	Gray clayey sand, dry, easily powdered clumps, fine to coarse grains.
1680	20			80	Dark gray stiff clay in 2 mm clumps, fine sand grains present.
1690	35			65	Dark gray stiff clay in clumps w/friable sandstone pieces to 3 cm, sand medium grained and gray, clay medium plasticity.
1700	30			70	Dark gray flaky mudstone in pieces to 2 cm, fine gray sandy matrix.
1710	20			80	Dark gray clay, medium stiff, high plasticity, fine gray sand present.
1720	20			80	Same as above.
1730	10			90	Same as above, less sand.
1740	40			60	Dark gray clay, stiff, high plasticity, large pieces of friable sandstone, gray to 3 cm, fine to medium grained.
1750	40			60	Dark gray mudstone in pieces to 3 cm, friable w/chunks of hard sandstone, medium grained, gray.
1760	20			80	Dark gray soft sandy clay, high plasticity, fine grained sand.
1770	60			40	Fine to medium clayey sand, gray, dry, crumbly, some dark gray clay chunks.
1780	20			80	Dark gray stiff clay, medium plasticity, sand is fine-grained.
1790	20			80	Dark gray sandy clay, dry and crumbly, medium plasticity, fine grained sand.
1800	80			20	Light gray fine sandstone in pieces 1 mm to 2 cm, friable, some dark gray clay, medium stiff, high plasticity.
1810	15			85	Dark gray clay, medium stiff and high plasticity, fine sand in matrix.
1820	15			85	Same as above.
1830	20			80	Same as above, w/minor fine ss pieces to 1 cm, crumbly.
1840	10			90	Same as above, w/no ss, less sand.
1850	10			90	Dark gray soft clay, high plasticity, w/pieces of friable dark gray mudstone to 2 cm.
1860	20			80	Dark gray friable mudstone/claystone in pieces to 4 cm, some pieces angular, some pebble-sized, soft gray clay present.
1870	40			60	Dark gray clay medium stiff and plasticity w/pieces of friable dark gray shale, lots of fine tan sand in matrix.
1880	20			80	Friable dark gray mudstone in rounded pieces to 2 cm, fine sand, and dark gray clay, stiff and medium plasticity.
1890	60			40	Fine brown sand w/pieces of dark gray, hard shale.
1900	10			90	Stiff dark gray clay in pieces 1-2 mm, trace fine sandstone pieces to 1 cm.

1910	10			90	Dark gray clay, soft, some dry and crumbly large clumps to 6 cm, mudstone pieces present to 2 cm.
1920	20			80	Same as above.
1930	80			20	Rounded gray pieces of sandstone 1 to 3 cm, fine to medium grains, some rounded pieces of claystone.
1940	10			90	Very stiff dark gray clay, present in clumps to 3 cm.
1950	10			90	Same as above, medium stiff.
1960	10			90	Soft gray clay, medium plasticity, w/pieces of dark gray friable shale and mudstone, 0.5 to 1 cm.
1970	<2			98	Dark gray to black soft clay, high plasticity, w/pieces of friable black shale.
1980	<2			98	Dark gray soft clay and small pieces of very friable shale, 1-2 mm.
1990	<2			98	Soft dark gray clay, medium plasticity w/pieces of friable mudstone to 2 cm.
2000	10			90	Medium stiff gray clay, some dry, pieces of mudstone to 1 cm, fine sand.
2010	10			90	Same as above.
2020			60	40	Lignite coal, dull, w/black soft clay.
2030	20		40	40	Soft black clay, moist, coal in flat pieces to 3 cm w/shiny luster, fine dark sand.
2040	80			20	Fine dark gray sand, moist, clay in matrix.
2050	70			30	Soft friable light gray sandstone in rounded pebbles to 2 cm, w/soft clayey dark gray sand, fine grained.
2060	70			30	Soft v. fine light gray sandstone in pieces to 4 cm, rounded w/some claystone, hard and flat to 4 cm.
2070	80			20	Soft gray to light gray fine sand, w/fine sandstone pieces to 3 cm, some clay in matrix.
2080	80			20	Same as above w/trace hard gray claystone pieces to 3 cm.
2090	80			20	Same as above.
2100	90			10	V. fine brown sand, moist, some clay in matrix.
2110	10			90	Soft gray clay, moist, medium plasticity, fine sand present.
2120	10			90	Same as above.
2130	10			90	Same as above.
2140	5			95	Same as above.

2150	40			60	Tan to gray sandy clay, low plasticity, fine tan sand.
2160	30			70	Same as above, less sand.
2170	30			70	Same as above.
2180	10			90	Soft gray clay, medium plasticity, fine sand present.
2190	<2			98	Dark gray soft clay, high plasticity, moist, some small mudstone pieces present 1-2 mm.
2200	<2			98	Same as above.
2210	10			90	Dark gray soft clay, high plasticity and friable black mudstone pieces to 2 cm, fine sand.
2220	20			80	Same as above w/more sand.
2230	10			90	Soft gray clay, high plasticity and sticky w/large shale pieces to 10 cm, friable and flaky.
2240	<2			98	Sticky soft dark gray clay, wet w/dark gray friable mudstone pieces.
2250	10			90	Dark gray sticky clay, high plasticity, soft, pieces of friable mudstone present to 0.5 mm.
2260	20			80	Dark gray sandy clay, low plasticity, sand medium grained, large pieces of shale present to 2 cm.
2270	20			80	Dark gray medium stiff clay, high plasticity, large pieces of hard sandstone present to 2 cm.
2280	20			80	Same as above.
2290	10			90	Dark gray medium stiff clay, high plasticity w/small friable pieces of shale.
2300	50			50	Dark gray soft clay, high plasticity w/coarse quartz sand, pieces of sandstone present to 1 cm.
2310	10			90	Dark gray, sticky clay, medium stiff, pieces of friable mudstone to 1 cm.
2320	10			90	Same as above. TD = 2320 ft.



Well Name: Grandview A-1

Northing: 4314956.6

Easting: 537609.0

Logging Date: 3/26/2024

Depth [FEET]	Lithology %				Description
	Sand	Shale	Coal	Claystone/ Mudstone	
0					*No samples taken during surface casing installation.
10					*No samples taken during surface casing installation.
20					*No samples taken during surface casing installation.
30					*No samples taken during surface casing installation.
40					*No samples taken during surface casing installation.
50	95			5	Coarse, quartz-rich sand to fine gravel, loose, dry, moderately well-sorted, gray.
60	95			5	Same as above, wetter.
70	95			5	Same as above.
80	95			5	Same as above.
90	70			30	Fine, well sorted sand w/rounded clumps of packed clay, gray.
100	95			5	Fine, well sorted sand, gray, moist, like beach sand.
110	95			5	Same as above.
120	10			90	Sticky brown clay w/friable pieces of mudstone to 2 mm and round clumps of dry clay. Medium plasticity.
130	10			90	Same as above, stiffer clay.
140	35			65	Dark gray sandy clay, sticky, medium plasticity and soft. Sand is coarse, well sorted.
150					Sample missing.
160					Sample missing.
170	30			70	Tan sandy clay, high plasticity, soft, sand is coarse, moderately sorted, moist.
180	30			70	Same as above with dried out clumps of sandy clay.
190	30			70	Same as above, clay is stiffer.
200	30			70	Same as above.

210	60			40	Tan clayey sand, med-coarse, well sorted sand, moist.
220	50			50	Friable coarse sandstone, gray and round clumps of sandy clay, tan, soft, moderate plasticity.
230	35			65	Tan sandy clay, medium stiff, moderate plasticity, sand is coarse, well sorted.
240	65			35	Friable fine to medium sandstone with stiff tan sandy clay, moderate plasticity.
250	65			35	Same as above.
260	65			35	Same as above.
270	5			95	Dry, light gray clay in angular clumps to 2 cm.
280	5			95	Same as above.
290	5			95	Same as above.
300	98			<2	Loose coarse sand, well sorted, gray, moist.
310	98			<2	Same as above.
320	98			<2	Same as above, coarser.
330	98			<2	Same as above.
340	<2			98	Dry gray mudstone, in angular pieces up 2 cm, friable.
350	<2			98	Same as above, wetter.
360	<2			98	Hard gray mudstone in small angular pieces from 1-5 mm.
370	<2			98	Same as above.
380	15			85	Dark gray to black shale and hard gray mudstone. Some clumps of brown sandy clay.
390	5			95	Soft gray mudstone, some soft clay, dry and wet mudstone split throughout.
400	10			90	Same as above, more sand.
410	45			55	Stiff sandy clay, low plasticity, dark gray, fine sand.
420	10			90	Brown clay, soft and moist mixed in with dry pieces, ~1-2 mm, Some fine sand in matrix.
430	10			90	Moderately stiff brown clay, high plasticity, some fine sand in matrix, moist.
440	10			90	Sticky soft brown clay, high plasticity, w/mudstone pieces 1-2 mm, fine sand in matrix, moist.
450	5			95	Sticky soft brown clay, moist with clumps of dry tan clay, easily powdered.
460	40			60	Soft, dark gray sandy clay, low plasticity, moist, sand is fine, well sorted.

470	5			95	Stiff dark brown clay w/friable mudstone pieces 1-2 mm, clay has high plasticity.
480	<2			98	Friable, massive dark brown mudstone in pieces 1 mm to 3 cm.
490	<2			98	Stiff dark brown clay, high plasticity, w/pieces of mudstone 1-2 mm.
500	<2			98	Same as above.
510	<2			98	Same as above, more mudstone.
520	15			85	Stiff dark brown clay and hard mudstone in pieces to 5 mm. Few rounded fine grained sandstone pieces.
530	5			95	Crumbly dark brown mudstone, pieces 1 mm to 3 cm.
540	<2			98	Gray to dark gray mudstone/claystone, friable, massive. Some black crumbly shale.
550			10	90	Same as above, with some lignite coal.
560			10	90	Same as above.
570					Missing sample.
580	10			90	Soft friable brown mudstone in 1-2 mm pieces w/few hard claystone pieces to 3 cm.
590	10			90	Same as above.
600	10			90	Stiff gray clay, medium plasticity w/mudstone pieces to 2 cm, sand in matrix, fine.
610	5			95	Hard mudstone in blocky pieces to 3 cm, dark gray.
620	10			90	Same as above, w/large pieces of mudstone to 5 cm.
630	10			90	Same as above.
640	10			90	Same as above.
650	10			90	Same as above.
660	15			85	Stiff dark gray clay with angular mudstone pieces to 2 cm and fine sand in matrix.
670	15			85	Same as above.
680	10			90	Stiff, medium plasticity clay, dark gray, medium sand in matrix.
690	10			90	Stiff dark gray clay, w/crumbly mudstone pieces to 3 cm.
700	20			80	Rounded clumps of fine sandy clay, gray, easily crumbled.
710	40			60	Same as above, w/rounded hard sandstone clumps, medium grained.
720	40			60	Same as above.

730	60			40	Dark gray clayey sand, fine, moist, w/pieces of angular gray to black mudstone to 2 cm.
740	60			40	Same as above.
750	90			10	Fine, light gray sand, dry, well sorted, in easily crumbled clumps to 5 cm.
760	20			80	Dry, light gray clay in easily crumbled clumps to 5 cm, medium sand present.
770	20			80	Same as above.
780					Sample missing.
790	20			80	Gray, friable mudstone and coarse sand, gray.
800	<2			98	Sticky, soft dark brown clay, high plasticity.
810	5			95	Same as above, less sticky.
820	<2			98	Same as above, sticky.
830	<2			98	Same as above, with some large round and flat mudstone/claystone pieces to 5 cm.
840	15			85	Dark brown sandy clay with mudstone pieces to 3 cm, clay is sticky, high plasticity.
850	15			85	Same as above, no large mudstone pieces.
860	15			85	Same as above.
870	40			60	Stiff dark brown clay and hard rounded sandstone pieces to 5 cm.
880	40			60	Same as above.
890	5			95	Sticky dark brown clay, high plasticity with rounded friable mudstone pieces.
900	5			95	Same as above.
910	5			95	Same as above.
920	70			30	Dark brown clayey sand, moist and cohesive.
930	15			85	Soft sandy clay, brown, clumps of dark brown clay, high plasticity.
940	10			90	Stiff dark brown clay, with clumps of friable mudstone in rounded pieces. High plasticity clay.
950	10			90	Same as above.
960	20			80	Wet sandy clay, gray w/friable mudstone pieces to 2 cm, clumps of fine sandstone, easily powdered.
970	10			90	Same as above, with hard mudstone pieces to 5 cm.

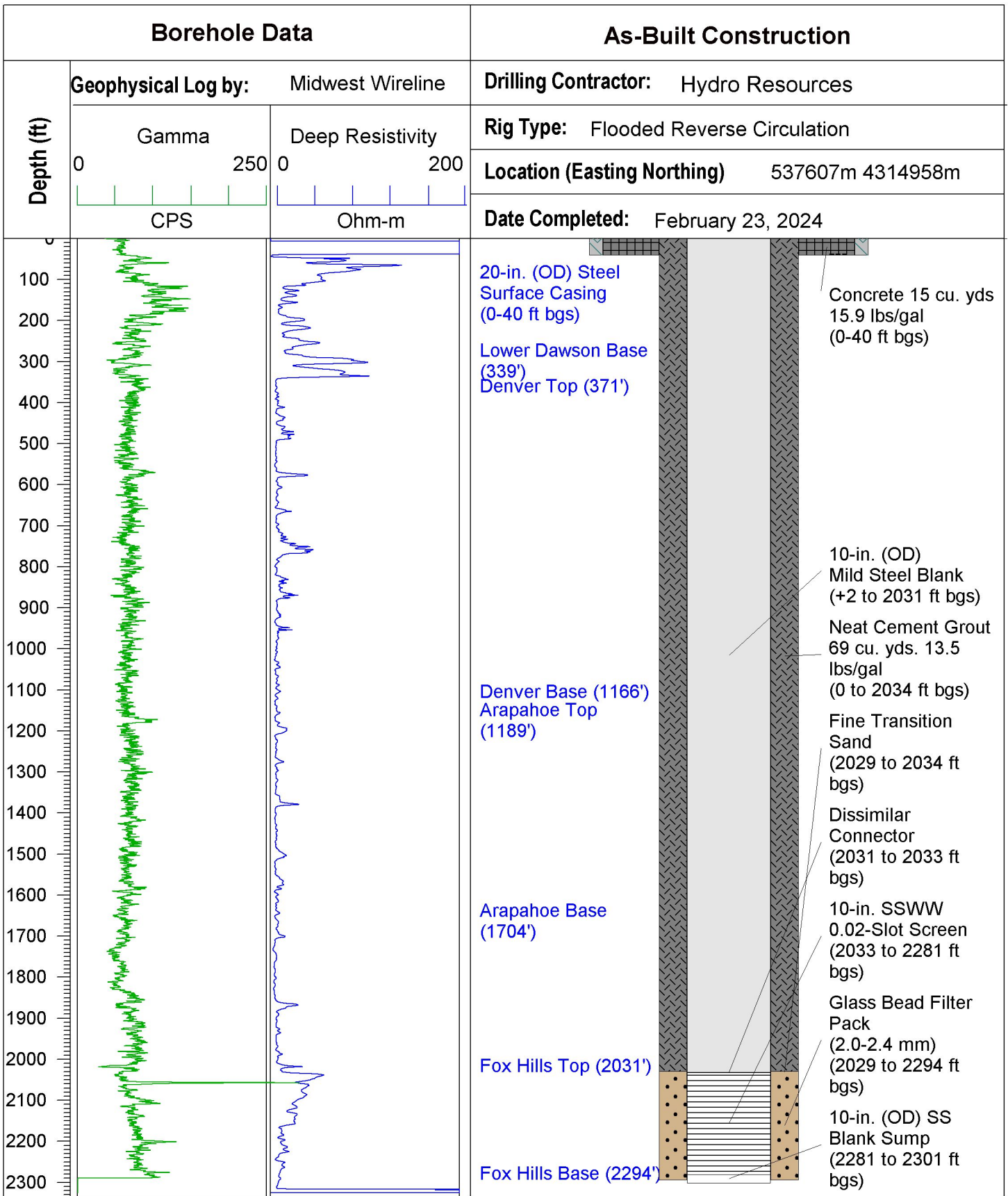
980	25			75	Dark gray mudstone in angular pieces 1 mm to 2 cm, resembles an angular gravel.
990	25			75	Sandy clay, dark brown, soft, medium plasticity, pieces of hard mudstone to 3 cm, rounded.
1000	80			20	Soft sandstone in easily crumbled gray rounded clumps, w/some dark brown soft clay and mudstone pieces to 1 cm.
1010	20			80	Very stiff brown clay in large round clumps to 8 cm with large flat pieces of sandstone to 5 cm.
1020	15			85	Sticky brown clay with large flat, friable mudstone pieces to 5 cm and some fine sand present.
1030	15			85	Dark brown sticky clay, high plasticity with fine sand present.
1040	15			85	Same as above.
1050	5			95	Sticky dark brown clay, high plasticity with large pieces of hard mudstone to 3 cm.
1060	5			95	Same as above with mudstone pieces to 10 cm.
1070	5			95	Same as above.
1080	5			95	Same as above.
1090	5			95	Same as above.
1100	10			90	Soft dark brown clay, high plasticity, fine sand in matrix.
1110	<2			98	Sticky dark brown clay, high plasticity and soft, moist.
1120	<2			98	Same as above but stiff clay.
1130	<2			98	Soft, sticky dark brown clay, medium plasticity.
1140	5			95	Sticky gray clay, soft and medium plasticity.
1150	<2			98	Same as above, wet.
1160	<2			98	Same as above, wet.
1170	<2			98	Same as above with mudstone pieces to 1 cm.
1180	10			90	Sticky dark brown clay, medium stiff, high plasticity, sand in matrix.
1190	10			90	Same as above.
1200	15			85	Soft, wet clay, dark brown w/angular mudstone pieces to 1 cm and sand in matrix.
1210	85			15	Gray gravel w/clay, rounded pieces 0.5-2 cm, wet, sand present.
1220	60			40	Coarse sand/gravel and clay, gray, with large mudstone pieces to 2 cm, wet.

1230	70			30	Gray coarse sand, angular, poorly sorted, w/clay in matrix, wet.
1240	10			90	Sticky gray clay, very high plasticity, mudstone pieces present.
1250	35			65	Sticky, sandy gray clay, wet w/angular mudstone pieces to 1 cm.
1260	35			65	Same as above.
1270	35			65	Same as above.
1280	5			95	Dark gray soft clay, medium plasticity and friable black shale. Trace fine to medium sand present.
1290	5			95	Dark gray soft clay and gray to black mudstone pieces up to 3 cm, hard.
1300	<2			98	Dark brown medium stiff clay, high plasticity w/large dark brown mudstone pieces to 3 cm.
1310	<2			98	Same as above.
1320	<2			98	Same as above w/higher proportion of mudstone.
1330	5			95	Dry brown clay in crumbly pieces to 2 cm, trace sand present.
1340	<2			98	Brown mudstone, friable, with very stiff dark brown clay. Mudstone in pieces to 3 cm.
1350	10			90	Dark brown stiff clay, high plasticity w/pieces of dry sandy clay, light brown.
1360	10			90	Same as above.
1370	10			90	Same as above.
1380	15			85	Same as above, more sandy clay.
1390	15			85	Dark brown sandy clay, stiff, medium plasticity, w/large pieces of black, friable mudstone to 3 cm.
1400	15			85	Same as above.
1410	15			85	Dark brown sandy clay, stiff medium plasticity, w/pieces of crumbly, rounded light brown mudstone to 2 cm.
1420	10			90	Dark brown high plasticity, medium stiff clay, w/trace crumbly light gray sandstone.
1430	5			95	Same as above w/no trace sandstone.
1440	5			95	Same as above, but clay is drier.
1450	5			95	Same as above.
1460	5			95	Dark gray sticky clay, medium plasticity w/large pieces of gray, hard mudstone to 3 cm.
1470	5			95	Same as above, slightly more fine sand.
1480	15			85	Same as above, more fine sand.

1490	35			65	Brown sandy clay w/rounded pieces of fine gray sandstone.
1500	40			60	Brown medium stiff clay w/fine tan sand.
1510	40			60	Same as above.
1520	5			95	Brown clay, medium stiff, high plasticity. Pieces of hard gray mudstone.
1530	5			95	Same as above, clay is drier.
1540	50			50	Sandy clay, brown, soft, medium plasticity, w/tan sand, fine.
1550	5			95	Stiff, medium plasticity brown clay w/pieces of black mudstone to 1 cm.
1560	80			20	Tan to brown clayey sand, moist and cohesive. Some large hard mudstone pieces to 3 cm.
1570	60			40	Gray sandy clay w/sand in matrix, moist.
1580	15			85	Gray sandy clay, sticky, moist, small pieces of friable mudstone to 1 cm.
1590	20			80	Same as above w/more sand.
1600	10			90	Gray sticky clay, low plasticity, wet, w/large pieces of black mudstone to 3 cm, flat and friable.
1610	10			90	Same as above.
1620	10			90	Brown clay, stiff, high plasticity, w/fine sand in matrix.
1630	5			95	Gray sticky clay, soft, high plasticity, minimal fine sand in matrix.
1640	5			95	Same as above w/pieces of hard gray mudstone to 3 cm.
1650	15			85	Gray sandy clay, wet, low plasticity, soft.
1660	25			75	Same as above, more sand, coarse sand in matrix.
1670	5			95	Stiff brown clay, high plasticity, thin friable black mudstone/shale.
1680	10			90	Same as above, more sand.
1690	20			80	Sandy clay, wet, low plasticity, gray.
1700	30			70	Gray sandy clay, soft, medium plasticity, w/some crumbly gray sandstone.
1710	10			90	Stiff brown clay, high plasticity, w/fine sand.
1720	5			95	Gray clay, sticky, low plasticity, wet.

1730	<2			98	Same as above w/very large mudstone pieces to 10 cm.
1740	<2			98	Gray sticky clay w/pieces of hard mudstone to 2 cm.
1745	<2			98	Same as above. TD = 1745'.

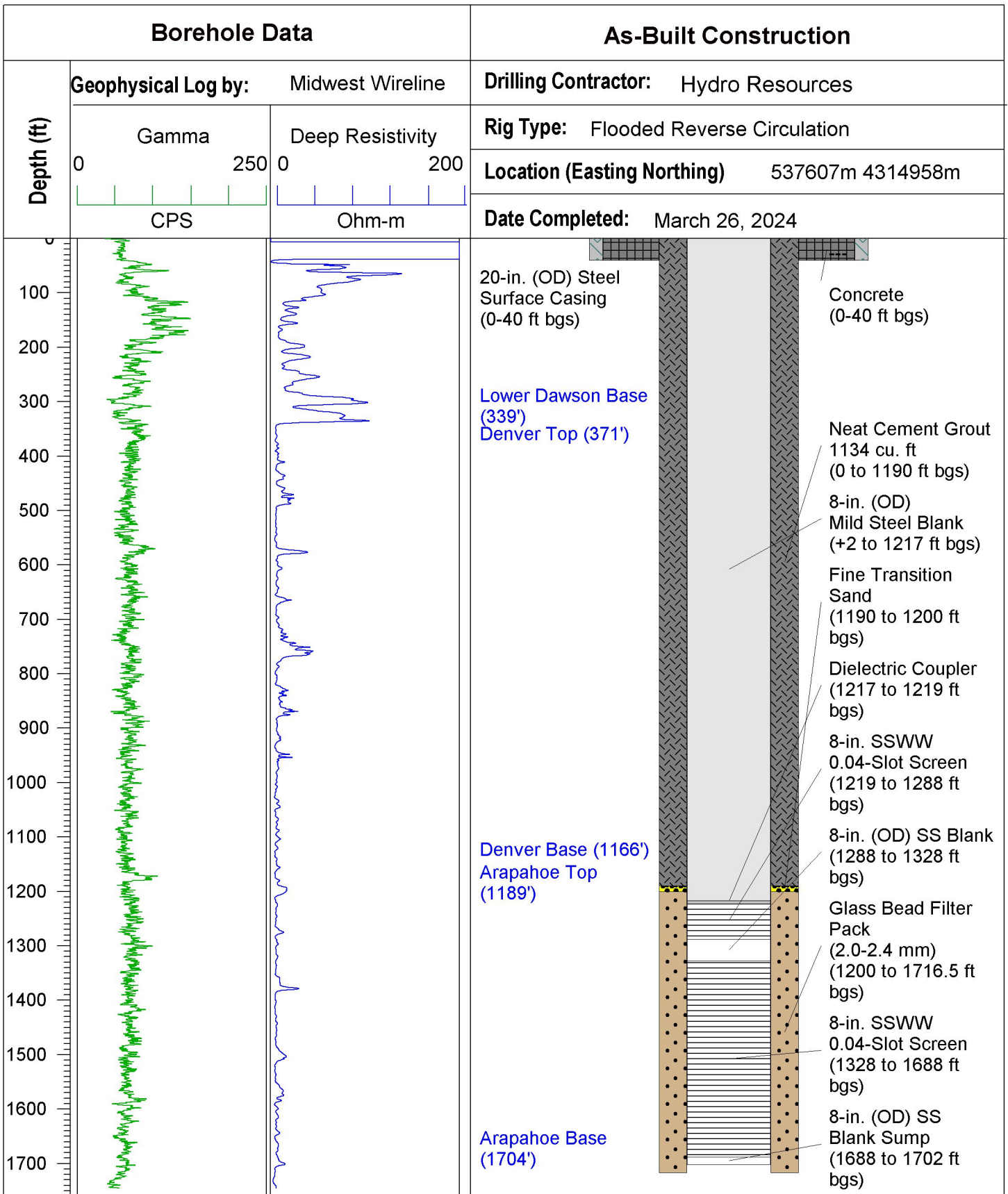
Appendix D: As-Built Well Construction Data for Wells LFH-1 and A-1



Drawn By: Gus Womeldorph
Reviewed By: Justin Korkus
4/3/2024

Grandview Reserve
LFH Well (LF-1)
As-built Construction Diagram





Drawn By: Gus Womeldorph
 Reviewed By: Justin Korkus
 4/8/2024

Grandview Reserve
Arapahoe Well (A-1)
As-built Construction Diagram



Appendix E: Pump Design Criteria and Equipment Submittal

ENGINEER: J. Korkus, PE - LRE Water
 DATE: 13-Jun-24
 PROJECT: HR Green Grandview -LFH-1 Production Well

Estimated Pump Power Requirements

User-Specified Data Input

Q - Flow	150	gallons per minute
Operating Pressure @ Surface	30	lbs/in2
Depth to Pump	2264	ft
Column Pipe Diameter	5	inch
Column Pipe Material	Low Carbon Steel	
Casing Inner Diameter	10	inches
Static Water Level	1685	ft bgs
Additional Drawdown Considerations	250	ft
Aquifer Transmissivity	729	gpd/ft
Aquifer Storativity	0.001	
Pumping Target Duration	365	days
Temperature (Whole Numbers)	60	degrees F
Pump Efficiency	75%	
Well Efficiency	75%	

Required Power	115	Hp
	86	Kw

Calculated Parameters

Q - Flow	0.33	cfs
Velocity	2.45	ft/s
Column Pipe Roughness Height	0.00015092	ft
Aquifer Transmissivity	97.49	ft^2/day
Kinematic Viscosity	0.00001210	ft^2/s
Density	62.33077030	slug/ft^3
Specific Weight	62.35018053	lb/ft^3
Reynold's Number	84424.07	
Operating Pressure @ Surface	4320.00	lbs/ft2
Casing Radius	0.42	ft
Q - Flow	28877.01	ft^3/day
Theis Coefficient	23.57	
Theis - u	0.00	
Cooper-Jacob Integral	8.34	
Drawdown in Wellbore	511.99	ft
Wellbore Waterlevel*	2196.99	ft bgs
Available Drawdown	67.01	ft
Relative Roughness	0.000362	
Friction Factor	0.02030	
Friction Loss	9.98	ft
TDH	2276.36	ft
Water Horsepower	86.60	horsepower
Brake Horsepower	115.47	horsepower
Power Requirement	86.11	kilowatts

TDH Components

Energy Head	0.0933	ft	Percentage of Total TDH	0%
Elevation Head	2196.9938	ft		97%
Pressure Head	69.2861	ft		3%
Friction Loss	9.9841	ft		0%

ENGINEER: J. Korkus, PE - LRE Water
 DATE: 13-Jun-24
 PROJECT: HR Green Grandview -A1 Production Well

Estimated Pump Power Requirements

User-Specified Data Input

Q - Flow	50	gallons per minute
Operating Pressure @ Surface	30	lbs/in2
Depth to Pump	1645	ft
Column Pipe Diameter	3	inch
Column Pipe Material	Low Carbon Steel	
Casing Inner Diameter	8	inches
Static Water Level	970	ft bgs
Additional Drawdown Considerations	255	ft
Aquifer Transmissivity	206	gpd/ft
Aquifer Storativity	0.001	
Pumping Target Duration	365	days
Temperature (Whole Numbers)	60	degrees F
Pump Efficiency	75%	
Well Efficiency	75%	

Required Power	27	Hp
	20	Kw

Calculated Parameters

Q - Flow	0.11	cfs
Velocity	2.27	ft/s
Column Pipe Roughness Height	0.00015092	ft
Aquifer Transmissivity	27.50	ft^2/day
Kinematic Viscosity	0.00001210	ft^2/s
Density	62.33077030	slug/ft^3
Specific Weight	62.35018053	lb/ft^3
Reynold's Number	46902.26	
Operating Pressure @ Surface	4320.00	lbs/ft2
Casing Radius	0.33	ft
Q - Flow	9625.67	ft^3/day
Theis Coefficient	27.86	
Theis - u	0.00	
Cooper-Jacob Integral	7.98	
Drawdown in Wellbore	551.41	ft
Wellbore Waterlevel*	1521.41	ft bgs
Available Drawdown	123.59	ft
Relative Roughness	0.000604	
Friction Factor	0.02320	
Friction Loss	11.29	ft
TDH	1602.07	ft
Water Horsepower	20.37	horsepower
Brake Horsepower	27.16	horsepower
Power Requirement	20.25	kilowatts

TDH Components

Energy Head	0.0800	ft	Percentage of Total TDH	0%
Elevation Head	1521.4123	ft		95%
Pressure Head	69.2861	ft		4%
Friction Loss	11.2948	ft		1%

Appendix F: Water Quality Results