

**STATE OF NEW MEXICO**  
**ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT**  
**OIL CONSERVATION COMMISSION**

**BEFORE THE OIL CONSERVATION COMMISSION**

**Santa Fe, New Mexico**

**Submitted by: Goodnight Midstream Permian, LLC**

**Hearing Date: September 23, 2024**

**Case Nos. 23614-23617, 23775, 24018 – 24020, 24025, 24123**

**MCBEATH TESTIMONY AND EXHIBIT PACKET**

**PART 1 OF 5**

**STATE OF NEW MEXICO  
DEPARTMENT OF ENERGY, MINERALS AND NATURAL RESOURCES  
OIL CONSERVATION DIVISION**

**APPLICATIONS OF GOODNIGHT MIDSTREAM  
PERMIAN, LLC FOR APPROVAL OF  
SALTWATER DISPOSAL WELLS,  
LEA COUNTY, NEW MEXICO**

**CASE NOS. 23614-23617**

**APPLICATION OF GOODNIGHT MIDSTREAM  
PERMIAN, LLC TO AMEND ORDER NO. R-22026/SWD-2403  
TO INCREASE THE APPROVED INJECTION RATE  
IN ITS ANDRE DAWSON SWD #1,  
LEA COUNTY, NEW MEXICO**

**CASE NO. 23775**

**APPLICATIONS OF EMPIRE NEW MEXICO LLC  
TO REVOKE INJECTION AUTHORITY,  
LEA COUNTY, NEW MEXICO**

**CASE NOS. 24018-24020, 24025**

**APPLICATION OF GOODNIGHT PERMIAN  
MIDSTREAM, LLC FOR APPROVAL OF A  
SALTWATER DISPOSAL WELL,  
LEA COUNTY, NEW MEXICO**

**DIVISION CASE NO. 22626  
ORDER NO. R-22869-A  
COMMISSION CASE NO. 24123**

**SELF-AFFIRMED STATEMENT OF JOHN C. MCBEATH, P.E.**

1. My name is John C. McBeath, P.E. I am a consulting petroleum engineer and founding partner of Austin Consulting Petroleum Engineers Inc (“ACPE”), a petroleum engineering consulting firm located in Austin, Texas. ACPE provides a wide range of petroleum engineering services to oil and gas stakeholders from large corporations to individuals, including for example reservoir engineering studies, economic evaluations, regulatory consulting, reserve



determination, fair market value analysis, reservoir simulation, log analysis and operational investigations.

2. I graduated from the University of Texas at Austin in 1987 earning a Bachelor of Science in Petroleum Engineering. I have over 35 years of experience as a petroleum engineer, and I am licensed as a professional engineer in Texas, California, Wyoming, Pennsylvania, Louisiana and Kansas. I have testified before the Texas Railroad Commission, the Wyoming Conservation Commission and in numerous litigation matters. Several of the matters in which I have testified have involved the analysis of alleged interaction of injection or disposal with production. Attached as **Goodnight Exhibit F-1** is a copy of my curriculum vitae. I have not previously testified before the New Mexico Oil Conservation Division. I believe my credentials, my experience and my analyses and review of the information in this matter qualify me to testify as an expert in petroleum and reservoir engineering.

3. I have been asked to review the available data and information relating to the applications filed by Goodnight Midstream (“GM”) in these cases. I have conducted a study of this information and this, along with my experience, forms the basis of my opinions expressed herein. I understand that Empire, through their witnesses, will file testimony concurrent with the filing of my and other GM witnesses’ testimony. I have made a good faith effort to anticipate Empire’s testimony based on the information I have, but I reserve the right to revise or expand my testimony or to respond to new assertions, allegations or testimony of Empire or its witnesses.

4. Specifically, I have been asked to evaluate and provide testimony on (1) general requirements for undertaking residual oil enhanced recovery projects; (2) evaluating and assessing Empire’s plans to conduct a residual oil zone (“ROZ”) enhanced recovery project in the San Andres within the Eunice Monument South Unit (“EMSU”); (3) assess the economic feasibility of

Empire's proposed ROZ project in the San Andres; and (4) to evaluate and assess potential impacts from injection of produced water in the San Andres on EMSU operations.

5. I have considered the following data and information in forming my opinions:
  - a. Data and information produced by Goodnight Midstream ("GM") in this matter.
  - b. Data and information produced by Empire in this matter.
  - c. Well data obtained from the NMOCD website.
  - d. Well logs obtained from the NMOCD website.
  - e. Well data obtained from subscription service Enverus.
  - f. Previously filed testimony of both Empire's and Goodnight's witnesses provided by Attorneys.
  - g. Discussions with Goodnight Midstream personnel.
  - h. Discussions with Netherland Sewell & Associates ("NSAI").
  - i. Testimony of Goodnight Midstream's witnesses.

### **Summary of Opinions**

- a. Goodnight Midstream's Ernie Banks, Ryno, Sosa and Andre Dawson wells are cased and cemented to provide isolation between their disposal operations in the San Andres aquifer and Empire's production activities in the Grayburg.
- b. The status of the EMSU water supply wells is relevant to this dispute. The EMSU 457 is temporarily abandoned and to be converted to a Grayburg producer. Although records are not completed, a similar recompletion may be planned for both the EMSU 458 and 459. The EMSU 460 and 461 wells were plugged and abandoned in 2002. The EMSU 462 well was converted to a Grayburg producer in 2014.

- c. A review of the wellbore information for the EMSU WSW wells shows that they were cased and cemented, temporality abandoned or plugged and abandoned to provide isolation between the San Andres aquifer and the producing Grayburg intervals.
- d. Historic water supply well information confirms the San Andres tops used by Goodnight and that prior operators considered the San Andres to be a prolific water producer.
- e. Empire's Nutech log analyses derived oil saturations are overstated and do not conform with well production tests on the EMSU 660, EMSU 746 or EMSU 658 wells.
- f. The petrophysical model developed by James A. Davidson (NSAI) and its resulting oil saturations are rigorous, reliable and do conform with the well production tests on the EMSU 660, EMSU 746 or EMSU 658 wells. His model is also validated by comparison with Seminole San Andres Unit data.
- g. The allegation that the San Andres reservoir pressure was depleted by 18.5% by April 1986, suggesting that the San Andres is therefore in pressure communication with the overlying Grayburg, is unfounded.
- h. Empire's CO<sub>2</sub> plan is very general in nature and lacks the rigor and detail normally seen to justify such large-scale projects and investments. Empire's claim of a viable ROZ project in the San Andres aquifer is not supported by the required diligent, detailed, reliable analyses.

#### **Potential Impacts to EMSU Operations: Well Integrity**

6. It is my understanding that Empire alleges that GM's wells located aerially within and in close proximity to their EMSU could impact their existing and future production operations. As part of my analysis of that allegation, I have reviewed the GM disposal well casing and

cementing records for its existing wells inside the EMSU to assess the mechanical isolation between the San Andres aquifer<sup>1</sup> used by GM for disposal and Empire's shallower Grayburg producing zones. **Goodnight Exhibit F-2** is a map showing the location of the GM wells. My review of the GM well cement bond logs follows:

- a. Log measurements showing low amplitudes, uniform radial sector readings and attenuated variable density log ("VDL") waveforms for GM's Ernie Banks 1 well (30-025-50633) indicate that the injection is contained within the perforated interval in the San Andres aquifer. Similar log readings occur in the Grayburg and even shallower portions of the log. **Goodnight Exhibit F-3** contains the Radial Cement Bond log run on the Ernie Banks 1 well on January 12, 2023.
- b. Log measurements showing low amplitudes, uniform radial sector readings and attenuated VDL waveforms for GM's Ryno SWD 1 well<sup>2</sup> (30-025-43901) indicate that the injection is contained within the perforated interval in the San Andres aquifer. Over 1000 feet of similar log readings occur in the Grayburg and even shallower portions of the log. **Goodnight Exhibit F-4** contains the Radial Cement Bond log for the Ryno SWD #1 (previously named Snyder SWD #1) run on August 13, 2018.
- c. Log measurements from 4,550 – 3,200 feet showing low amplitudes, uniform radial sector readings and attenuated variable density log ("VDL") waveforms for GM's Sosa 17 2 well (30-025-47947) indicate that the injection is contained

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<sup>1</sup> There is a controversy in this matter about the depth of the Grayburg-San Andres interface. Unless otherwise noted, the term San Andres used in this testimony means the San Andres aquifer used by Goodnight Midstream for water disposal.

<sup>2</sup> Previous named Snyder SWD #1

within the San Andres aquifer. **Goodnight Exhibit F-5** contains the Radial Cement Bond log run on the Sosa 17 2 well on March 11, 2021.

- d. Log measurements from 4,335 – 2,970 feet showing low amplitudes, uniform radial sector readings and attenuated variable density log (“VDL”) waveforms for GM’s Andre Dawson 1 well (30-025-50634) indicate that the injection is contained within the San Andres aquifer. **Goodnight Exhibit F-6** contains the Radial Cement Bond log run on the Dawson 1 well on December 28, 2022.

7. My review of the cement bond logs for GM disposal wells confirms that the wells have long continuous intervals of well-bonded cement between GM’s disposal zones and Empire’s Grayburg producing zones. Based on that review, as detailed above, it is my opinion that GM’s disposal wells are cased and cemented to provide hydraulic isolation between GM’s disposal into the San Andres aquifer and Empire’s current and future production activities in the Grayburg.

8. In the late 1980’s several wells were drilled by the then current EMSU operators into the San Andres aquifer formation for use as water supply wells (“WSW”) for waterflood operations. These wells are the EMSU 457, 458, 459, 460, 461 and 462. For purposes of this matter, it is important to note that the EMSU 460 and 461 wells were both plugged in 2002. Based on very recent NMOCD filings made by Empire, the EMSU 462 well was converted to a Grayburg producer in January 2014. As part of that operation, a cast iron bridge plug (“CIBP”) was set in the 8 5/8” casing at 4,281 feet and an additional string of 5½” production casing was run and cemented to surface with 575 sacks of cement. Empire’s recent filings containing details of this work are included as **Exhibit Goodnight F-7**. The EMSU 457 well is currently temporarily abandoned, and a permit has been filed with the NMOCD to recomplete the well into the Grayburg formation. This suggests to me that Empire recognizes that the lower intervals are not productive

of hydrocarbons and are focusing their producing efforts in the Grayburg zones above. This information is shown in **Goodnight Exhibit F-8**. I also found recent indications of similar planned activities for the EMSU 458 and 459 but have been unable to locate the NMOCD filings for those two wells. If I obtain additional information related to those wells, I will amend this testimony summary to include a discussion of that information. **Goodnight Exhibit F-9 through F-14** contains the NMOCD well files for the six WSWs.

9. Additional specific observations from the well files on these San Andres WSWs follow below:

- a. I was able to locate a cement bond log for the EMSU 457. **Exhibit Goodnight F-15**. The cement bond log shows good to very good bond from DV tool at 4,034 feet to 3,500 feet, indicating isolation from San Andres formation to Empires Grayburg operations. As noted above the well has been temporarily abandoned and is to be converted to a Grayburg producer, providing additional isolation between the San Andres and the Grayburg. Additional cementing details are show at page 11 on the EMSU WSW 457 well file.
- b. I could not locate the cement bond log for the EMSU 458, however the well file contained information regarding the cementing of the 8 5/8" casing which was set at 5000 ft with a DV tool at 3866 ft. The casing show was cemented with 215 sacks of cement and the second stage was cemented with 1000 sacks of cement. Cementing details from EMSU WSW 458 well file page 6.
- c. The EMSU 459 well was cased with 8 5/8" casing set at 4,275 feet. The casing was cemented with 800 sacks of cement with 64 sacks of cement circulated to surface. This information is from the EMSU WSW 459 well file page 9.

- d. The EMSU 460 well was equipped with 8 5/8" casing run to 4,350 feet and cemented with 750 sacks. The top of cement was measured at 700 ft. by temperature. As noted above the well was plugged and abandoned in 2002. The cementing information is from EMSU 460 page 21 and the plugging information is from pages 1 through 8.
- e. The EMSU 461 well was equipped with 8 5/8" casing run to 4,200 feet and cemented to surface with 700 sacks. Fifty-eight sacks were circulated to surface during the cementing job. As noted above the well was plugged and abandoned in 2002. The casing and cementing information is from the EMSU WSW 461 well file page 24 and the plugging information is from pages 1 through 9.
- f. The EMSU 462 well was equipped with 4,325 feet of 8 5/8" casing cemented to surface (128 sacks circulated to surface) with 850 sacks. The wellfile contains details of converting the well to a Grayburg producer. The cementing data is from EMSU 462 WSW well file page 7 and the conversion information is from pages 25 through 36.

10. In addition, I note numerous examples in the NMOCD well files of San Andres formation tops picked for these WSWs reported by the then current operator that generally conform with the top of the San Andres identified by Goodnight Midstream. The tops identified in these wells are generally consistent with their intended use as water supply wells. (SPE 17221) Conversely, shallower wells either producing from or injecting into the Grayburg intervals would have focused their top picks on the best hydrocarbon zones present.

- a. EMSU 457, San Andres top 4,232 feet, pages 4, 6, and 21, (Empire's San Andres top 4,097 feet)

- b. EMSU 458, San Andres top 4,050 feet.
- c. EMSU 459, San Andres top 4,120 feet.
- d. EMSU 460, San Andres top 4,276 feet.
- e. EMSU 461, San Andres top 4,002 feet.
- f. EMSU 462, San Andres top 4,200 feet.

### **Evaluation of Petrophysical Interpretations**

11. I have reviewed the log displays showing the petrophysical analyses performed by Nutech for Empire. I have considered Nutech's description of their work product contained in the previously filed testimony, log displays provided on or about July 1, 2024 (Bates OCD 23614 00326 through 00390) and digital .las files for eight of the ten analyzed wells provided on or about July 31, 2024. I reviewed the log displays as well as the digital log data and performed additional summaries and log calculations. These calculations and summaries are included as **Exhibit Goodnight F-16**.

12. **Nutech's oil saturations determined by log analysis identify continuous oil saturations at depths they identify as San Andres and even at depths correlative to the San Andres aquifer used by GM for disposal. Based on the following discussion of production tests for wells and intervals that Nutech evaluated, it is my opinion that their oil saturations are wildly optimistic.**

13. The most instructive well to demonstrate this is the EMSU 660. Nutech evaluation of this well shows largely continuous oil saturation from intervals that they identify as the San Andres from 3,955 feet to the bottom of the log at 4,320 feet. The interval from 4,150 feet to 4,320 feet has even more robust oil saturations and very low mobile water saturations. The bottom 50



feet of this log is approximately correlative to the San Andres aquifer used by GM for disposal and by EMSU operators for waterflood water supply, as well as disposal (EMSU SWD #1 30-025-04484). When the EMSU 660 well was drilled by XTO in late 2005, the zones that were evaluated by Nutech were individually isolated and swabbed to test their production characteristics. On December 14, 2005, the interval from 4,216 to 4,239 feet (perforations 4,216-4,220 and 4,237-4,239 feet) produced 25 barrels of water (“BW”) and no oil in 6 swab runs. Nutech’s analysis shows these zones containing 64-69% oil and between 10-15% free water. The interval from 4,180 to 4,184 feet produced 41 BW and no oil in 5 swab runs. Nutech’s analysis shows this zone contains 69% oil and 9% free water. The interval from 4,170 to 4,174 feet produced 39 BW and no oil in 5 swab runs. Nutech’s analysis shows this zone contains 73% oil and 7% free water. The interval from 4,152 to 4,158 feet produced 20 BW and no oil in 5 swab runs. Nutech’s analysis shows this zone contains 68% oil and 12% free water. The interval from 4,126 to 4,130 feet produced 19 BW and no oil in 4 swab runs. Nutech’s analysis shows this zone contains 71.4% oil and 6% free water. In total, these zones produced 144 BW and no oil in 25 swabbing runs.

14. After the above-described swab tests, XTO then pulled the testing and swabbing set up and ran a submersible pump to a depth of 4,028 feet to test the entire perforated interval of 4,126 – 4,239 feet. Over the next three days XTO reported that the commingled intervals produced 7 barrels of oil (“BO”) and 3,357 BW, a water cut of 99.8%. Not surprisingly, these zones were abandoned, and the well was completed uphole in the Grayburg formation. **Exhibit Goodnight F-17** is a summary of XTO’s reports of perforating, swabbing and testing the individual and combined intervals in the EMSU 660 well.

Nutech’s EMSU 660 analyses are summarized in the table below:

|                  |                |       |
|------------------|----------------|-------|
| 4,126-4,130 feet | oil saturation | 71.4% |
|------------------|----------------|-------|

|                  |                      |
|------------------|----------------------|
| 4,152-4,158 feet | oil saturation 68.7% |
| 4,170-4,174 feet | oil saturation 72.9% |
| 4,180-4,184 feet | oil saturation 66.4% |
| 4,216-4,220 feet | oil saturation 64.0% |
| 4,237-4,239 feet | oil saturation 71.0% |

15. Another important well for assessing the reliability of Nutech's log analyses is the EMSU 746. This well was drilled in August and September of 2005 by XTO. Five- and one-half inch (5-1/2") production casing was set at 5,455 feet. The formation tops for the San Andres and Glorieta were reported at 4,036 and 5,288 feet, respectively. On September 19, 2005 the well was perforated from 5,130 – 5,138 feet, 5,100 – 5,110 feet, 5,030 – 5,050 feet and 4,990 – 5,000 feet. According to the XTO reported tops all perforations were in the San Andres formation. The open intervals produced 110 BW and no gas over 2 days. A CIBP was set at 4,755 feet to abandon the intervals. On September 23, 2005 the well was perforated in the "Upper San Andres" from 4,320 -4,340 feet, 4,280 – 4,300 feet and 4,100 – 4,110 feet.<sup>3</sup> These perforated intervals produced 300 BW in 2 days under swabbing. On October 18, 2005 XTO ran a submersible pump and tested the zones, producing no oil and 1,287 BW. The lower zones were abandoned by setting a CIBP at 4,210 feet. Additional shallower perforations were added. The San Andres perforations from 4,100 – 4,100 feet which were still above the newly placed CIBP were isolated and swab tested producing 100% water. XTO's completion activities for the EMSU 746 are shown in **Exhibit Goodnight F-18**. Nutech's calculated oil saturations for the San Andres intervals that produced no oil are as follows:

|                    |                      |
|--------------------|----------------------|
| 4,100 – 4,110 feet | 73.3% oil saturation |
|--------------------|----------------------|

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<sup>3</sup> Perforation depth 4,280 feet inferred from number of perforations in perforated intervals above and below.

|                    |                      |
|--------------------|----------------------|
| 4,280 – 4,300 feet | 71.4% oil saturation |
| 4,320 – 4,340 feet | 67.9% oil saturation |
| 4,990 – 5,000 feet | 44.9% oil saturation |
| 5,030 – 5,050 feet | 63.4% oil saturation |
| 5,100 – 5,110 feet | 53.1% oil saturation |
| 5,130 – 5,138 feet | 34.3% oil saturation |

16. In late 2005, XTO drilled the EMSU 658 well and set 5-1/2" casing at 4,375 feet. The San Andres top was reported at 3,949 feet. The following intervals were perforated: 4,174 – 4,186 feet, 4,144 – 4,153 feet, 4,125 – 4,130 feet, 4,074 – 4,084 feet, 4,018 – 4,030 feet and 3,995 – 4,004 feet. According to the XTO's formation tops, all of these perforations are in the San Andres formation. XTO reported that over a two-day period, 565 BW and no oil was recovered by 117 swab runs. There is some conflicting information in the public filings relating to this well, but at most the zones described above produced 2 BO and 1856 BW during a 24 test most likely conducted using an ESP. XTO's completion activities for the EMSU 658 are shown in **Exhibit Goodnight F-19**. Nutech's analyses of these zones is:

|                    |                      |
|--------------------|----------------------|
| 3,995 – 4,004 feet | 56.8% oil saturation |
| 4,018 – 4,030 feet | 62.0% oil saturation |
| 4,074 – 4,084 feet | 69.6% oil saturation |
| 4,125 – 4,130 feet | 68.6% oil saturation |
| 4,144 – 4,153 feet | 67.8% oil saturation |
| 4,174 – 4,186 feet | 70.1% oil saturation |

17. **The fact that the EMSU 660 produced tiny amounts of oil and almost all water from zones that Nutech shows as having high oil saturations and low mobile water saturations demonstrates their calculations are inaccurate and unreliable. The EMSU 746 produced no oil from San Andres zones that Nutech determined as having oil saturations ranging from 67.9% to 73.3%. As discussed above the EMSU 658 well produced at most minor amounts of oil from zones that the Nutech analysis show as containing high oil saturations.**

18. In addition, Nutech's determinations also show high oil saturations in the San Andres aquifer. The WSWs produced over 340 million barrels of water with no reported oil. **Nutech oil saturations are too high to fit with the standard definition of ROZ used by Empire's experts, so the fact that supposed high oil saturations would not flow cannot be explained. Saturations of oil at these levels would have been mobile and would have produced along with the water. Since there was little or no oil production, these calculated oil saturation values are incorrect.**

19. I have been provided the Self-Affirmed Statement of James A. Davidson dated August 16, 2024. I have also had several virtual meetings with Dr. Davidson regarding the methods and details used in his petrophysical study of the San Andres formation in the EMSU area. Based on my review of his study, and my own experiences with carbonate log analyses, I find it to be a thorough and rigorous analysis. Importantly, it incorporates site specific data and honors zone by zone differences within San Andres formations. As discussed above, Nutech's calculated oil saturations do not conform to known production information. As part of my analysis and study I reviewed the saturations determined by Mr. Davidson over the same intervals. The

table below compares the Nutech and Davidson analyses in the tested intervals in the EMSU 660, EMSU 746 and EMSU 658 wells.

| <b>EMSU 660</b>  | Nutech oil saturation | NSAI oil saturation |
|------------------|-----------------------|---------------------|
| 4,126-4,130 feet | 71.4%                 | 13.8%               |
| 4,152-4,158 feet | 68.7%                 | 12.6%               |
| 4,170-4,174 feet | 72.9%                 | 17.7%               |
| 4,180-4,184 feet | 66.4%                 | 14.6%               |
| 4,216-4,220 feet | 64.0%                 | 10.6%               |
| 4,237-4,239 feet | 71.0%                 | 12.0%               |

| <b>EMSU 746</b>    | Nutech oil saturation | NSAI oil saturation |
|--------------------|-----------------------|---------------------|
| 4,100 – 4,110 feet | 73.3%                 | 24.6%               |
| 4,280 – 4,300 feet | 71.4%                 | 9.2%                |
| 4,320 – 4,340 feet | 67.9%                 | 10.6%               |
| 4,990 – 5,000 feet | 44.9%                 | 5.7%                |
| 5,030 – 5,050 feet | 63.4%                 | 16.3%               |
| 5,100 – 5,110 feet | 53.1%                 | 11.6%               |
| 5,130 – 5,138 feet | 34.3%                 | 6.9%                |

| <b>EMSU 658</b>    | Nutech oil saturation | NSAI oil saturation |
|--------------------|-----------------------|---------------------|
| 3,995 – 4,004 feet | 56.8%                 | 41.1%               |
| 4,018 – 4,030 feet | 62.0%                 | 14.0%               |

|                    |       |       |
|--------------------|-------|-------|
| 4,074 – 4,084 feet | 69.6% | 16.0% |
| 4,125 – 4,130 feet | 68.6% | 11.6% |
| 4,144 – 4,153 feet | 67.8% | 13.8% |
| 4,174 – 4,186 feet | 70.1% | 10.7% |

As shown above, the NSAI log analyses show much lower oil saturations than the Nutech analyses. The NSAI oil saturations are much more consistent with the reported testing of intervals in these wells, intervals that produced almost all water. I also believe that Mr. Davidson's validation of his petrophysical model to Seminole San Andres Unit well data and his calculations based on the Nutech model validate and confirm his results as much more accurate and reliable. **Setting aside all the potential conformance and high variability in the permeabilities and the presence of significant karsting, GM's San Andres disposal zone does not contain average oil saturations deemed necessary for a feasible or successful ROZ EOR project based on Melzer and Trentham's own criteria.**

#### **Evaluation of Impact of Produced Water on EMSU Operations**

20. I also reviewed the October 26, 2023, written testimony and exhibits of Mr. William West from cases 23614, 23615, 23616 and 23617. For purposes of this testimony, I have assumed his forthcoming testimony will be similar.

21. Mr. West relies upon his assertion that the San Andres pressure was 18.5% depleted as of April 8, 1986. This calculation is based on the comparison of a single repeat formation tester ("RFT") measurement and an "original" reservoir pressure calculated by Mr. West. It is also based on Mr. West's contention that the RFT measurement was in fact made in the San Andres. The San

Andres top listed on Mr. West's Figure G-4 is 3,975. The EMSU 211 well was drilled by Chevron with a reported Grayburg top of 3,637 feet. Using Mr. West's San Andres top of 3,975 feet would make the Grayburg formation only 300 feet thick rather than the 490 feet identified at the unitization hearing. Using the Grayburg thickness of 490 feet from the EMSU unitization hearing, along with the Chevron Grayburg top of 3,637 feet, places the San Andres top at 4,127 feet. Additionally, the EMSU 211 well is about equal distance from WSW's EMSU 457, 458 and 459 whose tops for the San Andres are 4,232 feet, 4,050 feet and 4,120 feet, respectively. This means the EMSU 211 RFT measurement at 4,006 feet was in the Grayburg and is irrelevant for assessing the pressure in the San Andres. Additionally, Mr. West asserts that his pressure assessment was made before any water was produced from the San Andres water supply wells. NMOCD records show that the EMSU 457 wells produced during a test on October 11, 1985.

22. In paragraph 15 of his testimony, Mr. West describes Empire Exhibit G-15 that purports to estimate areas impacted by GM's SWD activity in the EMSU area. Mr. West includes estimates for current conditions as of July 1, 2023, and future estimates extending through 1, 5, 10, and 20 years of additional injection. Mr. West provides no basis or example calculation for how these estimates were derived, but appears to limit the thickness available for injection by using a net-to-gross ratio ("NTG") of 50%. No support of log analysis for this generalization is given, and likely underestimates the overall NTG for the SWD injection intervals given that GM reported "no returns" during drilling over most of the injection intervals for each of their SWD wells.

23. Similarly, although no supporting calculations are provided, it also appears that Mr. West further limits the available pore volume by assuming that injected flow into the available porosity will be limited by residual oil saturations of 30% and connate water saturations of 30%.

Other than severely overestimated oil saturations from logs provided by Nutech, no support for these calculation inputs are discussed or provided.

24. Mr. West also inflates the area influenced by the injection wells by assuming equal volumes of formation water will be uniformly displaced through “piston-like” displacement, and then assumes that this formation water will migrate through undefined faults or pathways to reach the overlying Grayburg reservoir.

25. Mr. West further inflates his area calculations for future injection by assuming any new wells will operate at maximum allowable volumes over the 20-year forecast period as shown in Exhibit G-17 through Exhibit G-20.

26. Mr. West also refers to the EMSU 278 well in his October 2023 testimony. I am aware of a recent OCD filing by Empire to plug that well back to the Grayburg formation, so that well is no longer an issue.

27. I reserve the right to provide additional testimony regarding the area of influence of GM’s injection wells, should he provide additional support for these assumptions and calculations or if he provides new or revised work.

### **Evaluation of Empire’s Proposed Plans to Conduct a ROZ Project**

28. Soon after my initial involvement in this matter, I was asked to assist Goodnight Midstream’s Attorneys in their attempts to obtain information from Empire relating to their claim that a CO<sub>2</sub> project was planned for an alleged ROZ zone in the San Andres formation. I provided specific language related to these requests based on my experience reviewing and analyzing existing and proposed CO<sub>2</sub> EOR projects. I expected to receive detailed studies covering numerous important issues relating to the viability of a CO<sub>2</sub> project in the alleged San Andres ROZ. However,



Empire only provided a single document entitled “Eunice Monument & Arrowhead Field CO<sub>2</sub> Development Plan” authored by Darrell W. Davis.

29. **Empire’s CO<sub>2</sub> plan is very general in nature and lacks the rigor and detail normally seen to justify such large-scale projects and investments.** For example, in NMOCD Case No. 11,650 related to the Central Vacuum Unit, an engineering witness for the applicant Texaco Exploration and Production detailed their efforts noting reservoir characterization, geological interpretations, reservoir simulation, facility design, balloting of working interest partners, and corporate approvals of the required investments. Empire’s plan contains none of those details. **Empire’s plan mainly focusses on CO<sub>2</sub> flooding of portions of the Grayburg formation that had already been subject to waterflooding. ROZ is discussed in a single paragraph.** It is also interesting to note that Empire’s definition of an ROZ in this document does not fit with the high oil saturations determined by Nutech and discussed in paragraphs 12. – 17, above.

30. Empire discusses the importance of achieving miscibility to the CO<sub>2</sub> EOR process but is apparently relying only on a general miscibility correlation for oil with gravity different than the oil produced from the EMSU. The gold standard for determining minimum miscibility pressure (“MMP”) is a slim tube laboratory test performed on multiple actual field samples. The importance of achieving miscibility was highlighted in an exhibit to NMOCD Case No. 11,650 and attached here as **Exhibit Goodnight F-20**. As shown on that exhibit, the recovery efficiency can approach 100% when full miscibility is achieved but is as low as 10% when the oil and CO<sub>2</sub> are immiscible. In the transition from immiscible to miscible pressures, the recovery efficiency varies by a factor of 3. **Without undertaking critical laboratory testing, or other validation of**

**a MMP correlation, Empire's assumptions on miscibility and, therefore their estimated recovery factors, are not reliable.**

31. Additionally, the plan only includes capital expenses for CO<sub>2</sub> recycle compression without treatment of the recycle stream. Contaminated CO<sub>2</sub> will have a different miscibility than pure CO<sub>2</sub> with potentially countervailing effects of individual contaminants. There is no discussion of this important issue in the document.

32. I also expected to see more rigorous estimates of oil production and CO<sub>2</sub> utilization than reliance on generalized curves from a published paper. Field-specific analyses such as reservoir compositional simulation are standard tools used in the assessment and planning of CO<sub>2</sub> EOR projects. These models allow various injection schemes and well placement to be tested before real dollars are expended.

33. In the EMSU unitization hearing working interest owner Exxon presented testimony and evidence contesting the fairness of the tract participation formula. In the order approving the EMSU, the NMOCD made reference to this controversy and limited the use of the formula to a certain volume of recovered oil. Undoubtedly, this issue must be addressed before a tertiary operation can be commenced. I am not aware of any Empire application for approval of a tertiary project and possible changes to the tract participation formula. I also observe that no rigorous, detailed economic evaluation of Grayburg CO<sub>2</sub> flood or any ROZ CO<sub>2</sub> flood is included.

**34. Empire's claim of a viable ROZ project in the San Andres aquifer is not supported by the required diligent, detailed, reliable analyses.**

**Conclusion**

35. Goodnight's disposal wells are cased and cemented to provide isolation from Empire's production activities. The EMSU WSWs are cased and cemented to also provide isolation and the status of several of those wells provides additional separation. Those same WSWs provide San Andres tops from the original operator that agree with Goodnight's San Andres tops. Nutech's log analysis and results are in conflict with actual production tests. Dr. Davidson's petrophysical model and resulting oil saturations fit with actual production tests. The assertion that the San Andres was depleted by Grayburg production is based on unreliable assumptions. Empire's claim of a San Andres ROZ project that cannot coexist with Goodnight's disposal activities is not supported by the required diligent, detailed or reliable analyses.

36. I affirm under penalty of perjury under the laws of the State of New Mexico that the foregoing statements are true and correct. I understand that this self-affirmed statement will be used as written testimony in this case. This statement is made on the date next to my signature below.

John C. McBeath, P.E.  
John C. McBeath, P.E.

August 23, 2024  
Date

**RESUME OF JOHN C. MCBEATH, P.E.**

**EDUCATION**

Bachelor of Science Degree in Petroleum Engineering from the University of Texas at Austin, December 1987

**EMPLOYMENT**

1. Austin Consulting Petroleum Engineers Inc
2. FTI Platt Sparks
3. Platt, Sparks & Associates Consulting Petroleum Engineers, Inc.
2. Miller Consulting, Inc.
3. The Cadmus Group (Project)
4. Schlumberger Technical Services, Inc.
5. Summer 1987, University of Texas Petroleum Engineering Department
6. Summer 1984, oil field roustabout, Marathon Oil Company

**EXPERIENCE SUMMARY**

Date: December 2020 to Present  
Employer: Austin Consulting Petroleum Engineers Inc  
Location: Austin, Texas  
Title: Consulting Petroleum Engineer and Vice President  
Duties: Professional petroleum engineering services including: reservoir engineering studies, log analysis, reserve determination, economic analysis, fair market value determinations, reservoir simulation, enhanced oil recovery studies and operational investigations relating to both litigation and regulatory matters as well as client advisory projects.

Date: December 2018 to November 2020  
Employer: FTI Platt Sparks  
Location: Austin, Texas  
Title: Senior Managing Director  
Duties: Professional petroleum engineering services including: reservoir engineering studies, log analysis, reserve determination, economic analysis, fair market value determinations, reservoir simulation, enhanced oil recovery studies and operational investigations relating to both litigation and regulatory matters as well as client advisory projects. Member of FTI's Energy, Power and Products Committee facilitating cross segment collaboration.

BEFORE THE OIL CONSERVATION COMMISSION  
Santa Fe, New Mexico  
Exhibit No. F-1  
Submitted by: Goodnight Midstream Permian, LLC  
Hearing Date: September 23, 2024  
Case Nos. 23614-23617, 23775,  
24018 – 24020, 24025, 24123

Date: October 31, 2014 to December 13, 2018  
Employer: FTI Platt Sparks  
Location: Austin, Texas  
Title: Managing Director  
Duties: Professional petroleum engineering services including: reservoir engineering studies, log analysis, reserve determination, economic analysis, fair market value determinations, reservoir simulation, enhanced oil recovery studies and operational investigations. Experience also includes CO<sub>2</sub> EOR issues, damage analysis, lease royalty provision analysis, technical aspects of class certification issues and presentation of testimony at mediation and in Court.

Date: January 1996 to October 31, 2014  
Employer: Platt, Sparks & Associates, Consulting Petroleum Engineers, Inc.  
Location: Austin, Texas  
Title: Vice President  
Duties: Professional petroleum engineering services including: reservoir engineering studies, log analysis, reserve determination, economic analysis, fair market value determinations, reservoir simulation, enhanced oil recovery studies and operational investigations. Experience also includes CO<sub>2</sub> EOR issues, damage analysis, lease royalty provision analysis, technical aspects of class certification issues and presentation of testimony at mediation and in Court.

Date: May 1994 to December 1995  
Employer: Miller Consulting, Inc.  
Location: Austin, Texas  
Title: Petroleum Engineer  
Duties: Responsible for projects pertaining to Texas oil & gas regulatory matters. Duties included preparation of New Field Discoveries, Injection/Disposal Well and NGPA "Tight Gas" Applications. Prepared exhibits for Texas RRC hearings which includes Temporary Field Rules, Permanent Field Rules and Rule 10 Commingling Applications. Tasks also include completing and filing Drilling Permits, Completion Papers and TNRCC Surface Casing Letters, as well as many other RRC forms. Assisted clients in obtaining information from the RRC, TNRCC, Secretary of State, General Land Office, as well as other State Agencies. Monitored RRC hearings and Statewide Conference for various clients.

Date: September 1993 to February 1994  
Employer: The Cadmus Group  
Location: Austin, Texas  
Title: Petroleum Engineer  
Duties: Responsible for auditing more than fifty Texas Natural Resource Conservation Commission Injections well files and logs for Environmental Protection Agency Region VI. Project included an evaluation of the mechanical integrity of the wells at the time of permitting and review of the quality of the subsequent testing of the wells.

Date: January 1988 to August 1992  
Employer: Schlumberger Technical Services  
Location: Kuwait, Egypt, Pakistan, Sultanate of Oman  
Title: Senior Field Engineer  
Duties: Geophysical well logging of exploration and development wells drilled by various International and National Oil Companies. Performed open-hole, cased hole, perforating and auxiliary logging services. Responsible for one-man-location, duties included personnel management, client interfacing, maintaining and testing radioactive material and high explosives. Trained engineers for high pressure, production and H<sub>2</sub>S environment logging jobs. Produced a joint Shell-Schlumberger safety training video.

**PROFESSIONAL**

|  |               |
|--|---------------|
| Licensed Professional Engineer in Texas,       | No. 87813     |
| Licensed Professional Engineer in Wyoming,     | No. PE 9396   |
| Licensed Professional Engineer in California,  | No. P 1818    |
| Licensed Professional Engineer in Pennsylvania | No. PE 091214 |
| Licensed Professional Engineer in Louisiana    | No. 44713     |
| Licensed Professional Engineer in Kansas       | No. 28689     |
| MLE (Model Law Engineer)                       | NCEES         |

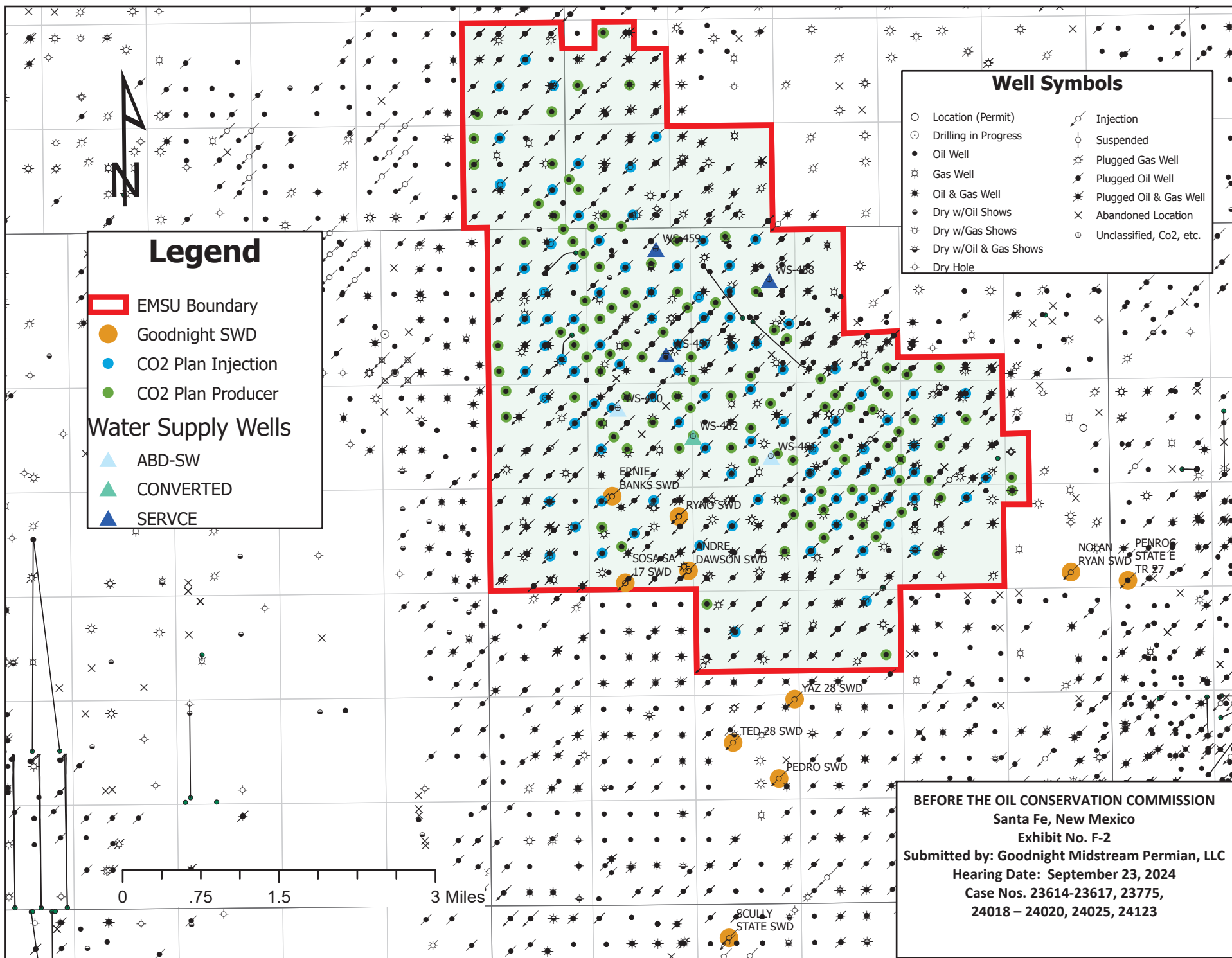
Past Officer of the Society of Petroleum Engineers of AIME (SPE), Austin Chapter  
Technical Editor, SPE Reservoir Evaluation & Engineering Editorial Review Committee  
2000 - 2004

Society of Petrophysicists and Well Log Analysts  
Society of Petroleum Evaluation Engineers  
Society of Petroleum Engineers

**PERSONAL INFORMATION**

Name in Full: John Campbell McBeath  
Birth Date: December 27, 1964  
Place of Birth: Perth, Australia  
Family: Wife, Andrea; Children, Callum & Auden







**API**  
 877.766.4767  
 10000 W. 14th Street, Suite 100  
 Denver, CO 80202

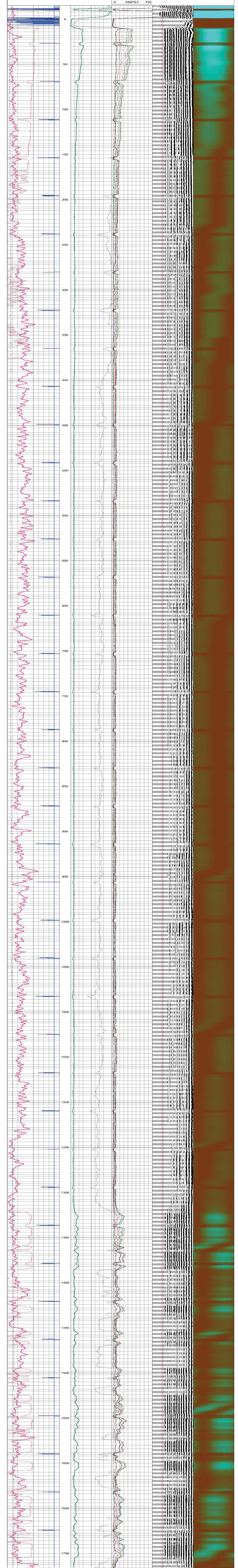
**API**  
 877.766.4767  
 10000 W. 14th Street, Suite 100  
 Denver, CO 80202

**API**  
 877.766.4767  
 10000 W. 14th Street, Suite 100  
 Denver, CO 80202

BEFORE THE OIL CONSERVATION COMMISSION  
 State of New Mexico  
 Exhibit No. 63  
 Submitted by: **Geological Milestones Petroleum, LLC**  
 Hearing Date: September 23, 2024  
 Case Nos. 2416, 2417, 2475,  
 2483 - 2420, 2421, 2422

**API** **MAIN PASS ( 1000 P.S.I.)**

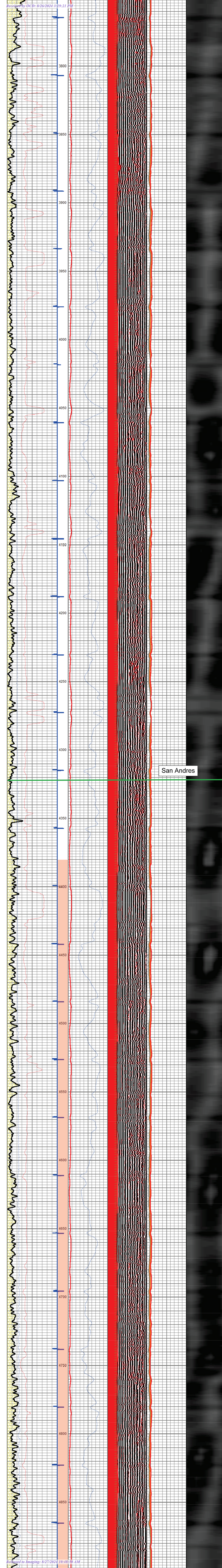
| Well Name | Well ID | Well Type | Well Status | Well Depth | Well Completion | Well Completion Date |
|-----------|---------|-----------|-------------|------------|-----------------|----------------------|
| ...       | ...     | ...       | ...         | ...        | ...             | ...                  |





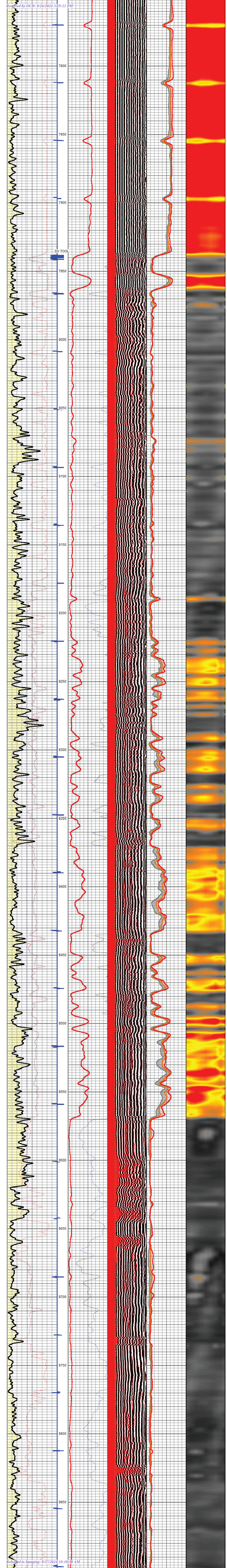






San Andres









**Radial Cement Bond  
Gamma Ray Collar  
Log**

|                        |   |           |                       |
|------------------------|---|-----------|-----------------------|
| Company                | Cambrian Management   | Country   |                       |
| Well                   | Sosa 17 SWD #2  |           |                       |
| Field                  | SWD; San Andres   |           |                       |
| County                 | Lea   |           |                       |
| State                  | New Mexico  |           |                       |
| Location:              | 470' FSL & 1815' FWL<br>Section 17, Township 21S, Range 36E<br>SEC 17 TWP 21S RGE 36E |           | Other Services<br>CNL |
| Permanent Datum        | Ground Level  | Elevation | 3648'                 |
| Log Measured From      | Kelly Bushing   |           | 18' APD               |
| Drilling Measured From | Kelly Bushing   |           |                       |
| Date                   | 03-11-2021  |           |                       |

|                        |                |  |  |
|------------------------|----------------|--|--|
| Run Number             | One            |  |  |
| Depth Driller          | 5445'          |  |  |
| Depth Logger           | 5390'          |  |  |
| Bottom Logged Interval | 5385'          |  |  |
| Top Log Interval       | Surface        |  |  |
| Open Hole Size         | -              |  |  |
| Type Fluid             | Water          |  |  |
| Density / Viscosity    | -              |  |  |
| Max. Recorded Temp.    | -              |  |  |
| Estimated Cement Top   | 1200'          |  |  |
| Time Well Ready        | 2:00 PM        |  |  |
| Time Logger on Bottom  | See Log        |  |  |
| Equipment Number       | WL-8012        |  |  |
| Location               | Midland, Texas |  |  |
| Recorded By            | Coby Kirk      |  |  |
| Witnessed By           | David Hines    |  |  |

| Borehole Record |         |         |       | Tubing Record |        |      |    |
|-----------------|---------|---------|-------|---------------|--------|------|----|
| Run Number      | Bit     | From    | To    | Size          | Weight | From | To |
| One             | 17 1/2" | Surface | 1349' |               |        |      |    |
| Two             | 12 1/4" | 1349'   | 5445' |               |        |      |    |

|                   |           |            |           |        |
|-------------------|-----------|------------|-----------|--------|
| Logging Record    | Size      | Mgt/ft     | Top       | Bottom |
| Surface String    | 13 3/8"   | 48# J-55   | Surface   | 1349'  |
| Production String | 9 5/8"    | 40# HCL-80 | Surface   | 5445'  |
| Line              | D.V. Tool | 3022"      | D.V. Tool | 4550'  |

<<< Fold Here >>>

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

**Comments**

\*\*\*\*\*Thank You For Choosing The Wireline Group\*\*\*\*\*

Corrected Back To D.V. Tool

Correction Plus 8'

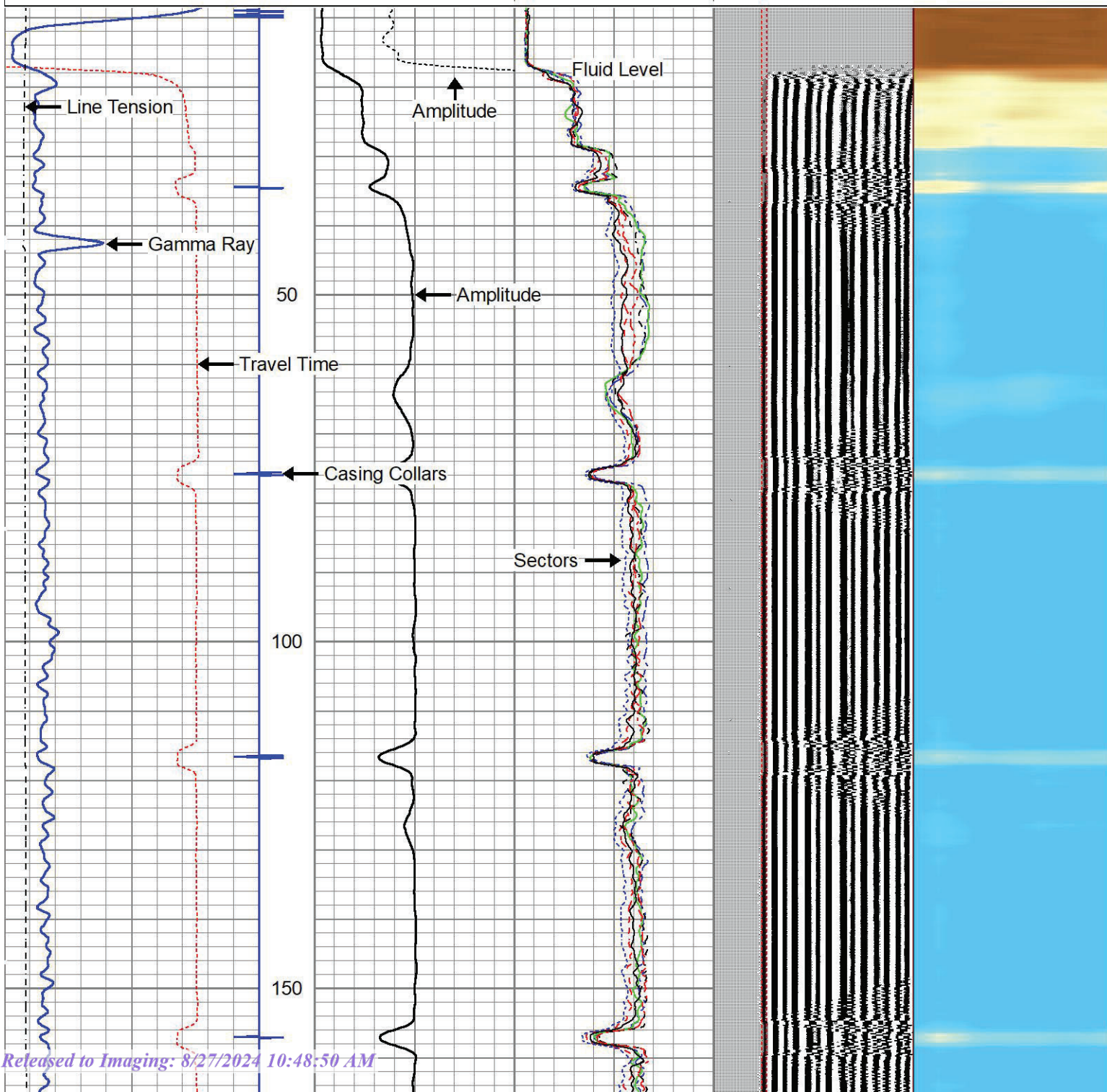
**BEFORE THE OIL CONSERVATION COMMISSION**  
 Santa Fe, New Mexico  
 Exhibit No. F-5  
 Submitted by: Goodnight Midstream Permian, LLC  
 Hearing Date: September 23, 2024  
 Case Nos. 23614-23617, 23775,  
 24018 – 24020, 24025, 24123



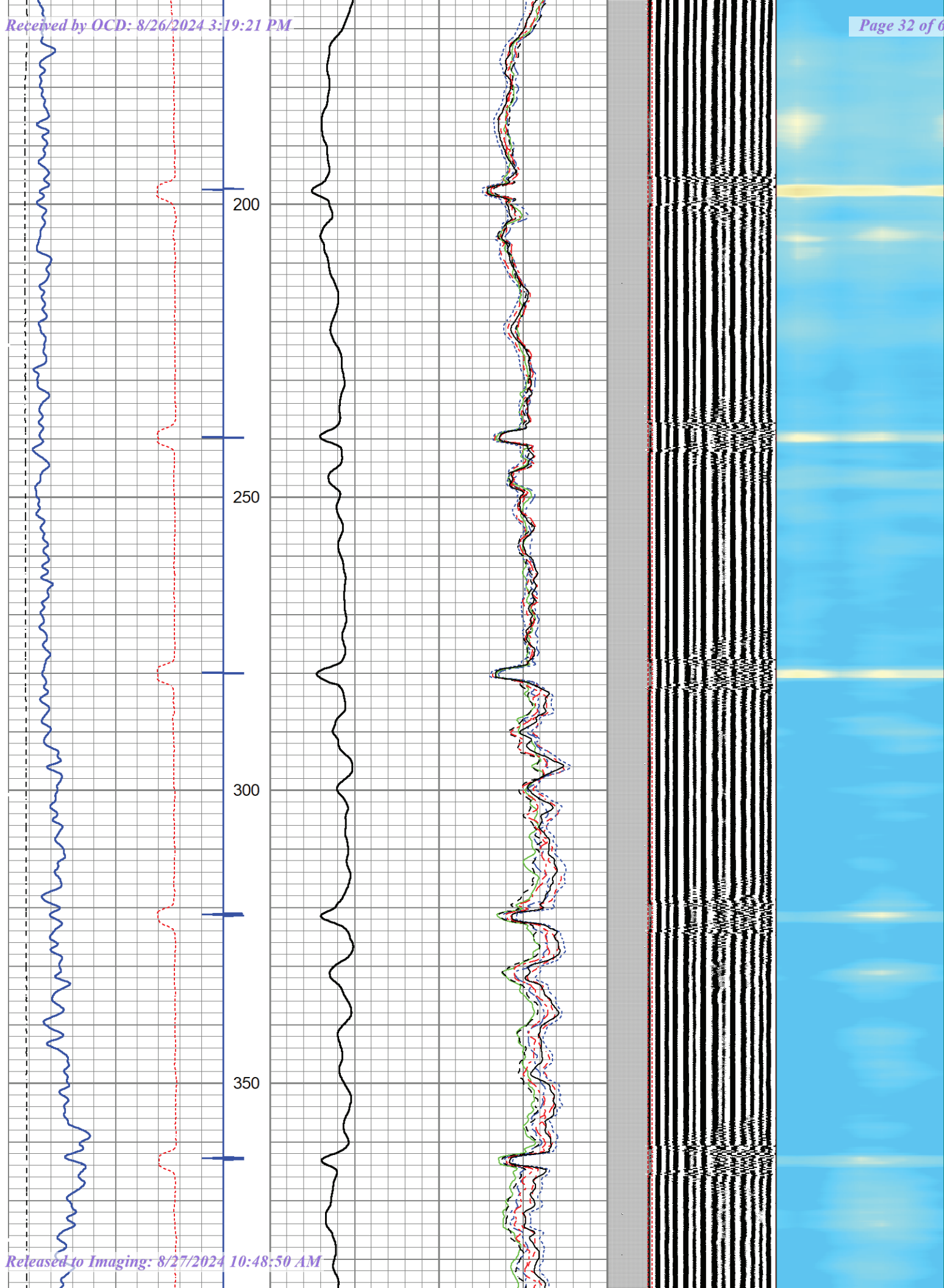
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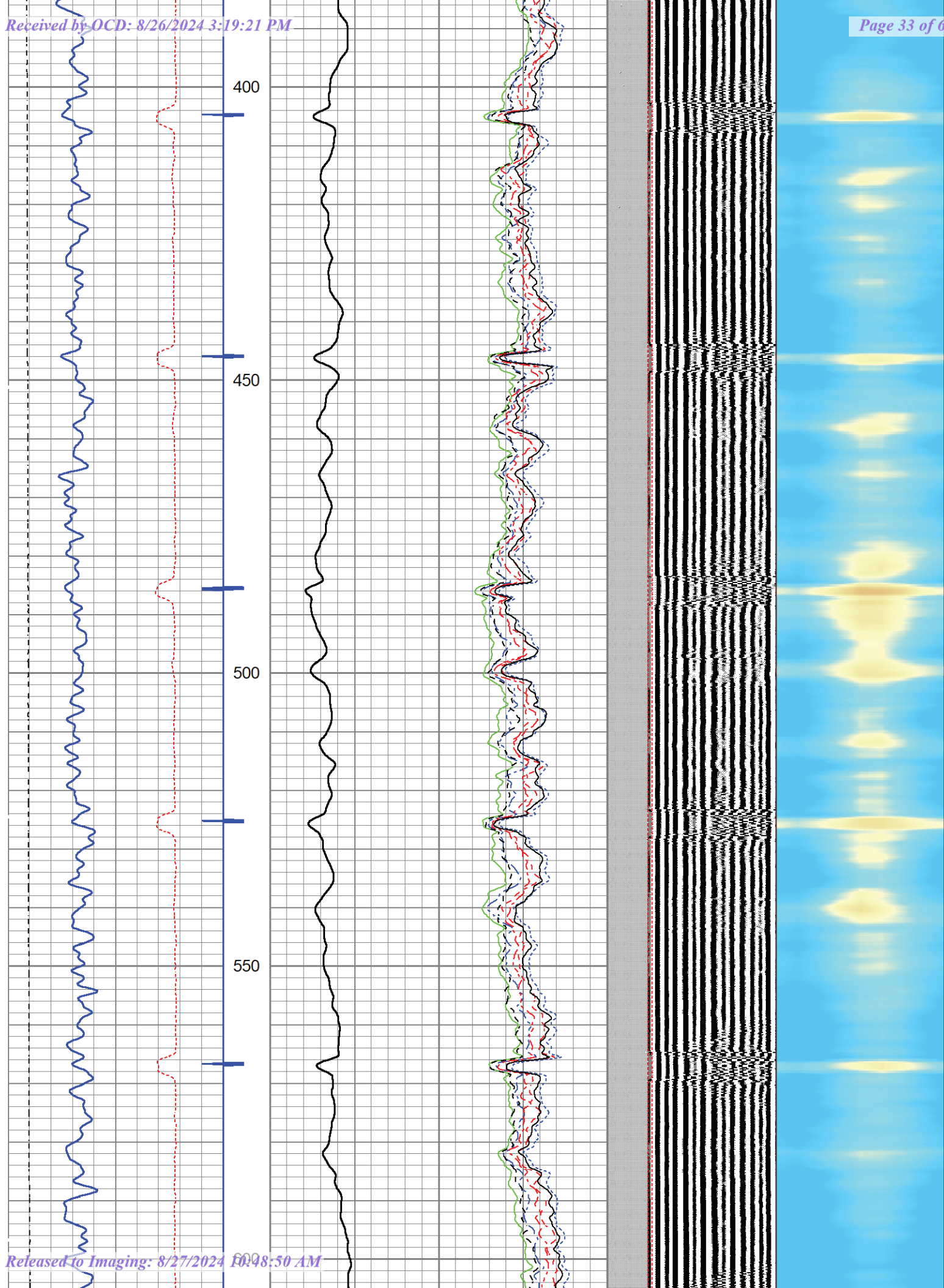
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 Presentation Format rbl9625  
 Dataset Creation Thu Mar 11 20:21:25 2021  
 Charted by Depth in Feet scaled 1:240

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|-----|-----------|------|---------------------|----------------|-----|----|-------|-----|----------------|------------|------|------------|
| 406 | TT (usec) | 306  | 0                   | Amplitude (mV) | 100 | -5 | AMPS2 | 150 | 200            | VDL (usec) | 1200 | Cement Map |
| 0   | GR (GAPI) | 150  | Amplified Amplitude |                |     | -5 | AMPS3 | 150 | Free Pipe Gate |            |      |            |
| 0   | LTEN (lb) | 3000 | 0                   | (mV)           | 10  | -5 | AMPS4 | 150 |                |            |      |            |
|     |           | CCL  |                     |                |     | -5 | AMPS5 | 150 |                |            |      |            |
|     |           |      |                     |                |     | -5 | AMPS6 | 150 |                |            |      |            |
|     |           |      |                     |                |     | -5 | AMPS7 | 150 |                |            |      |            |
|     |           |      |                     |                |     | -5 | AMPS8 | 150 |                |            |      |            |
|     |           |      |                     |                |     | -5 | AMPS1 | 150 |                |            |      |            |

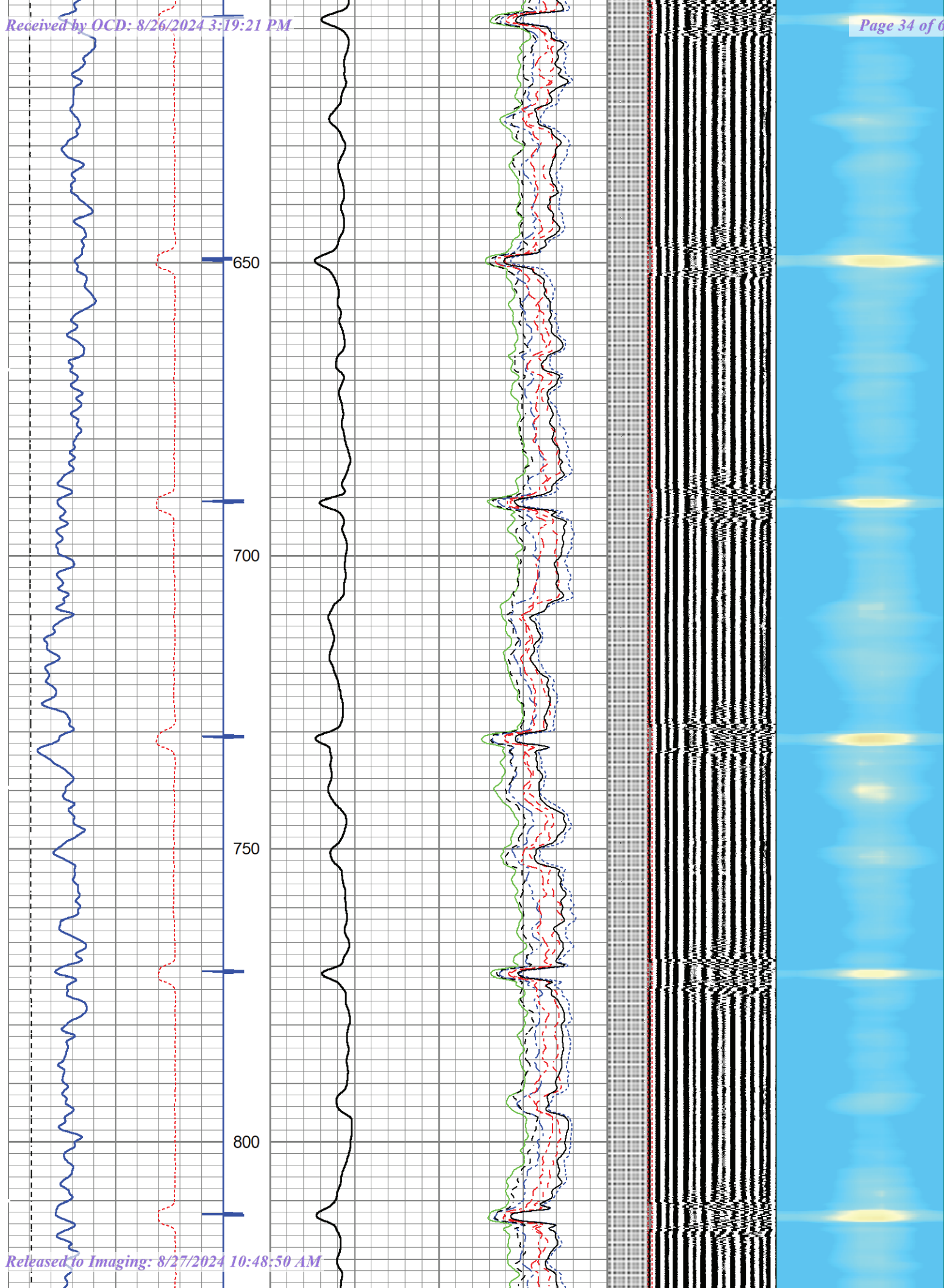




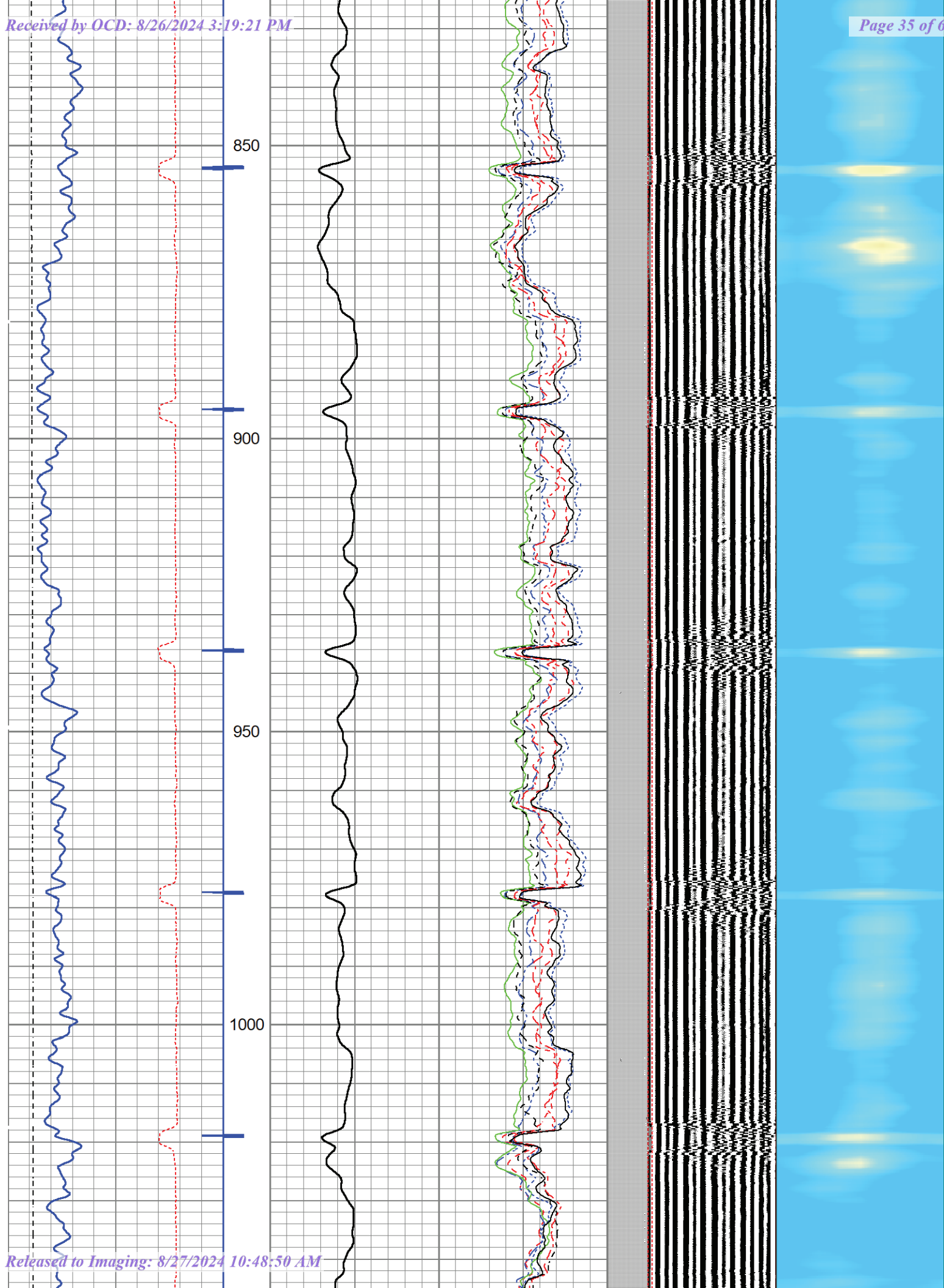


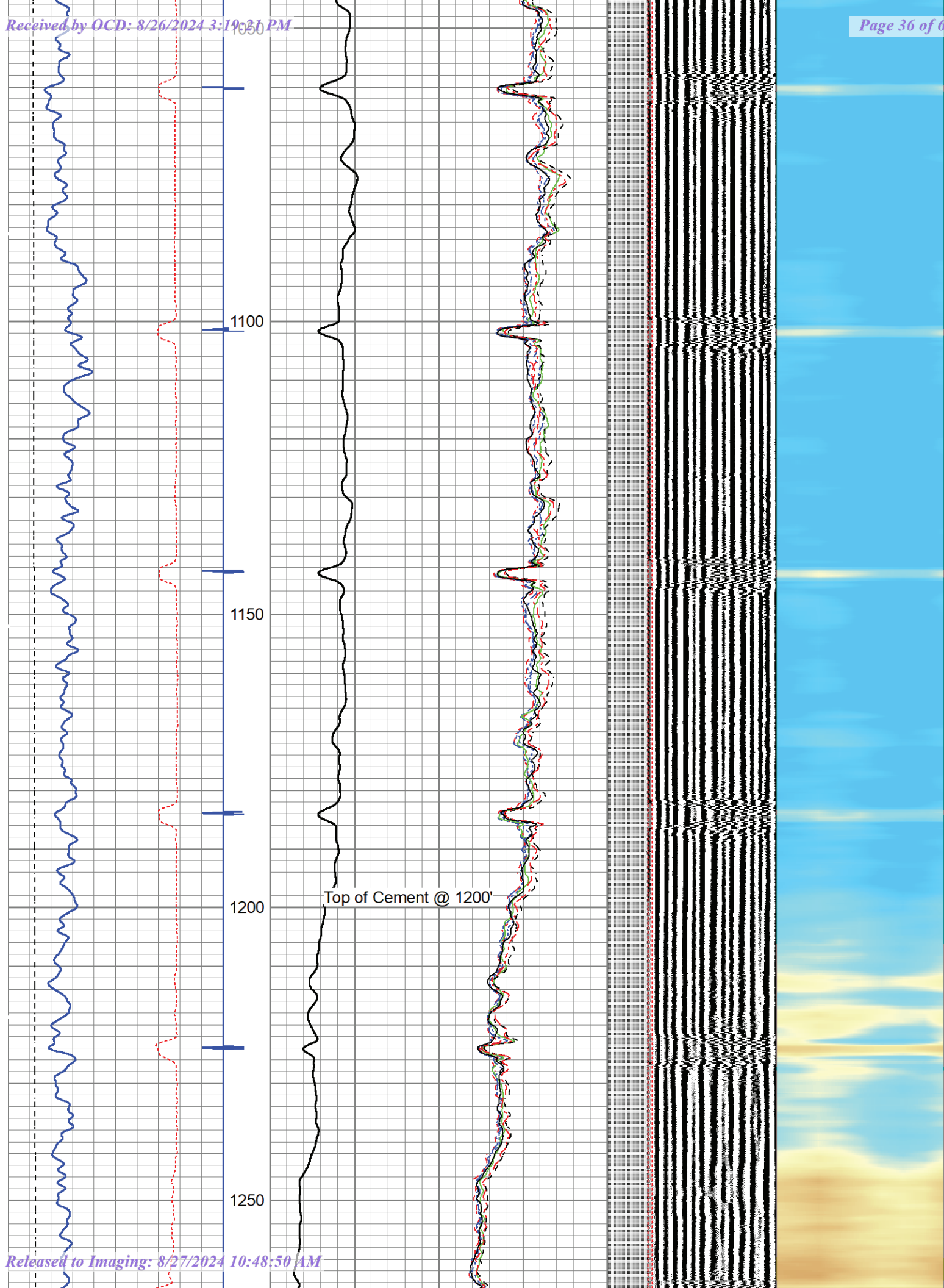




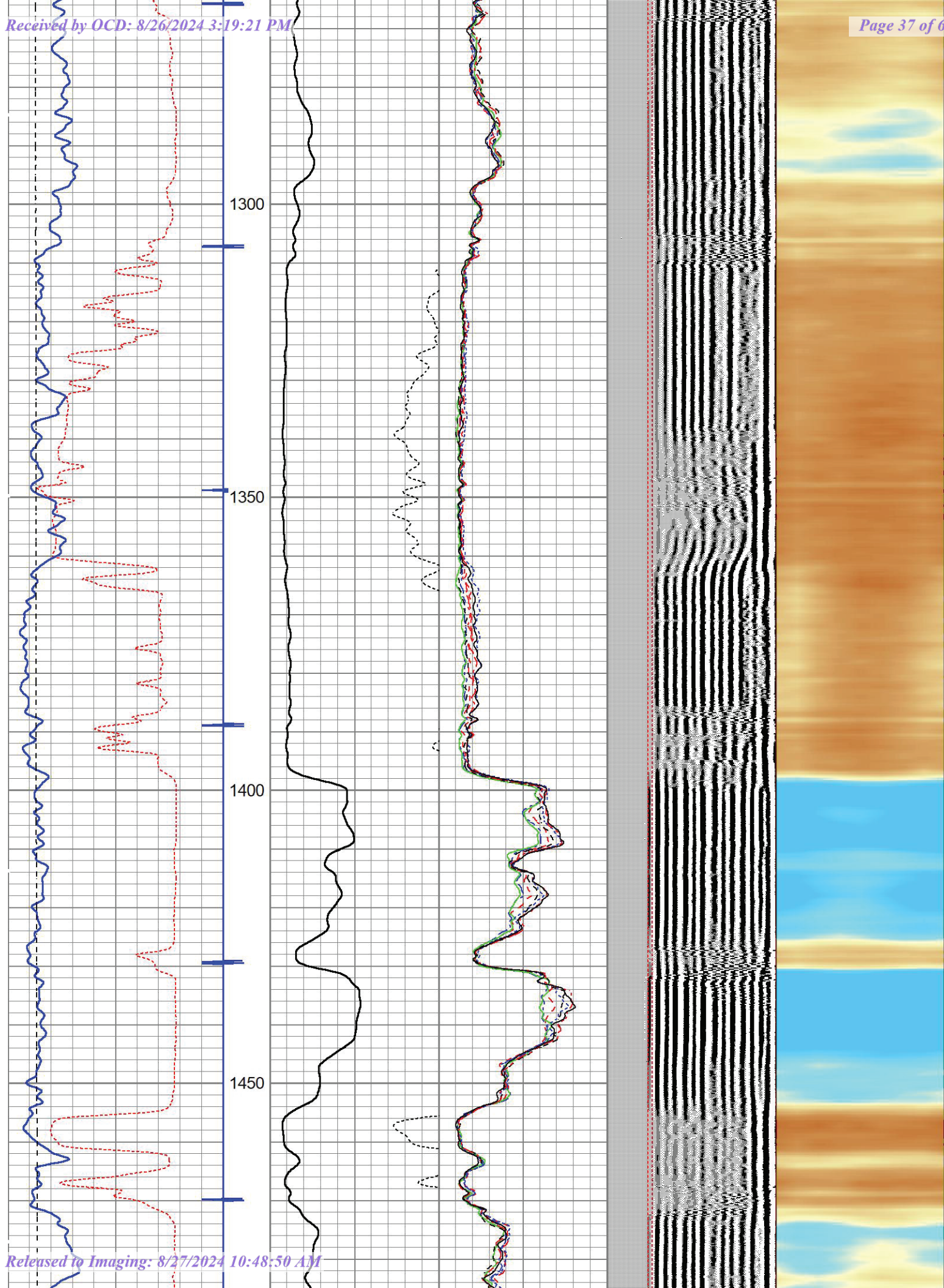




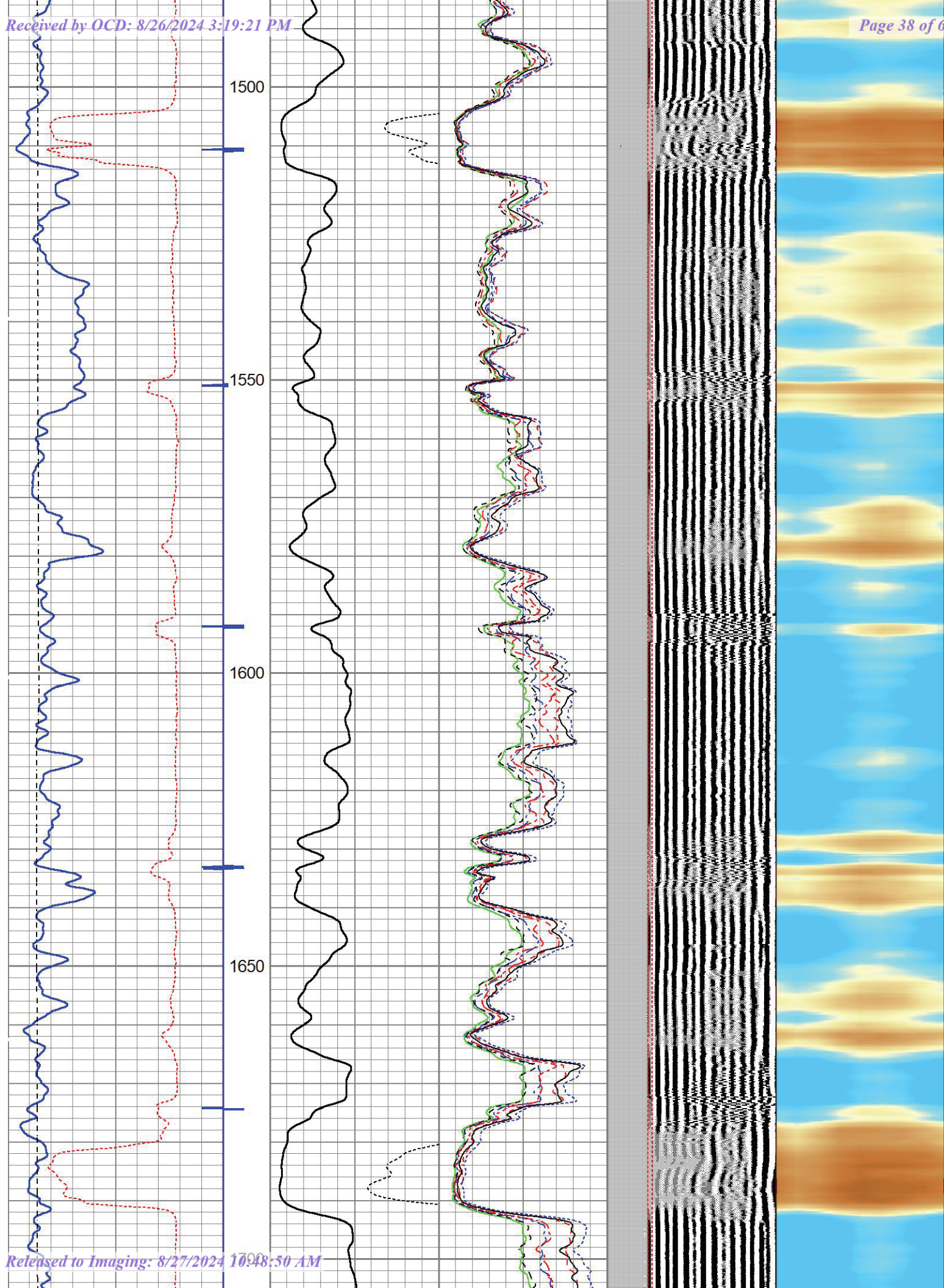




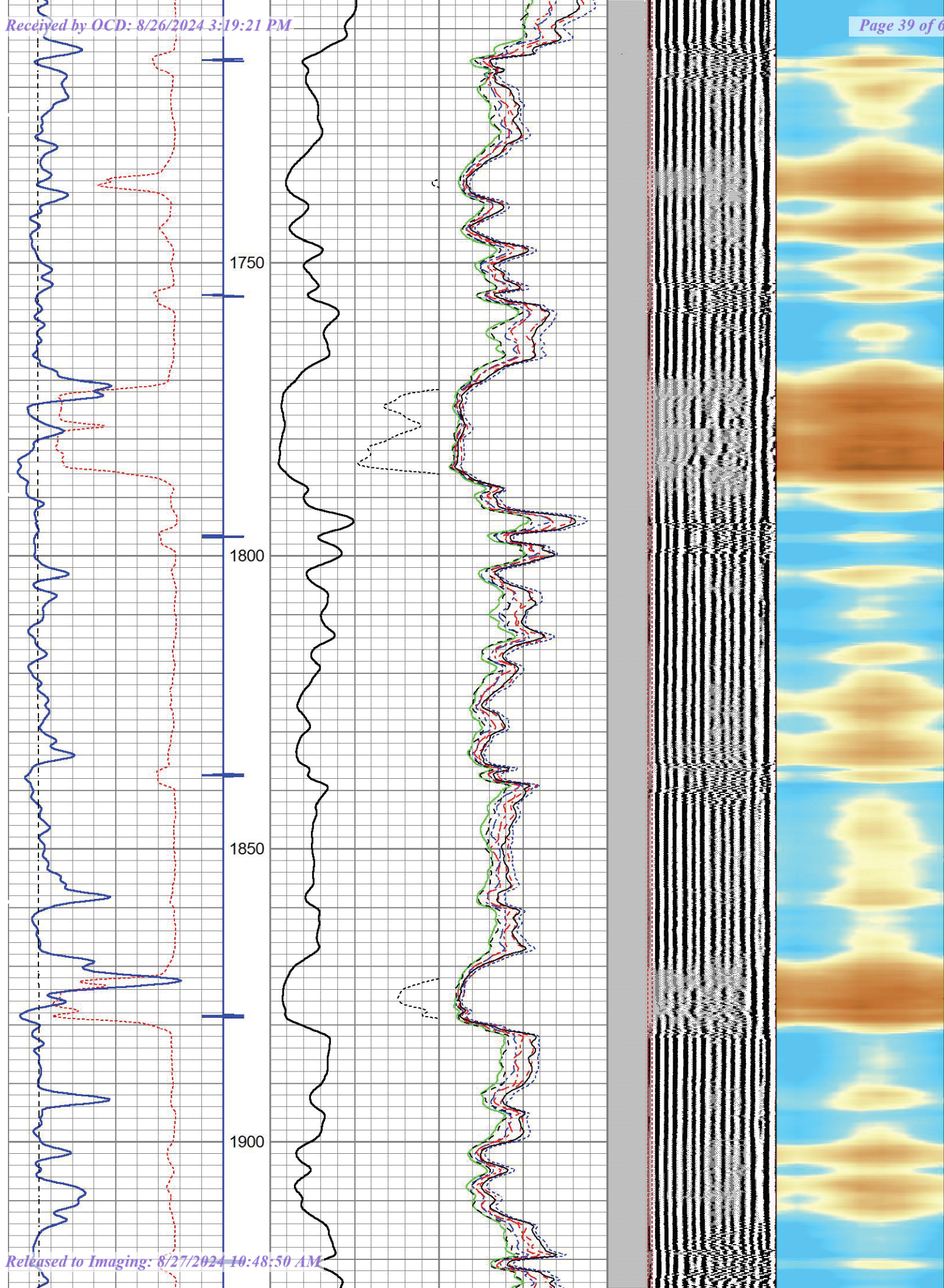




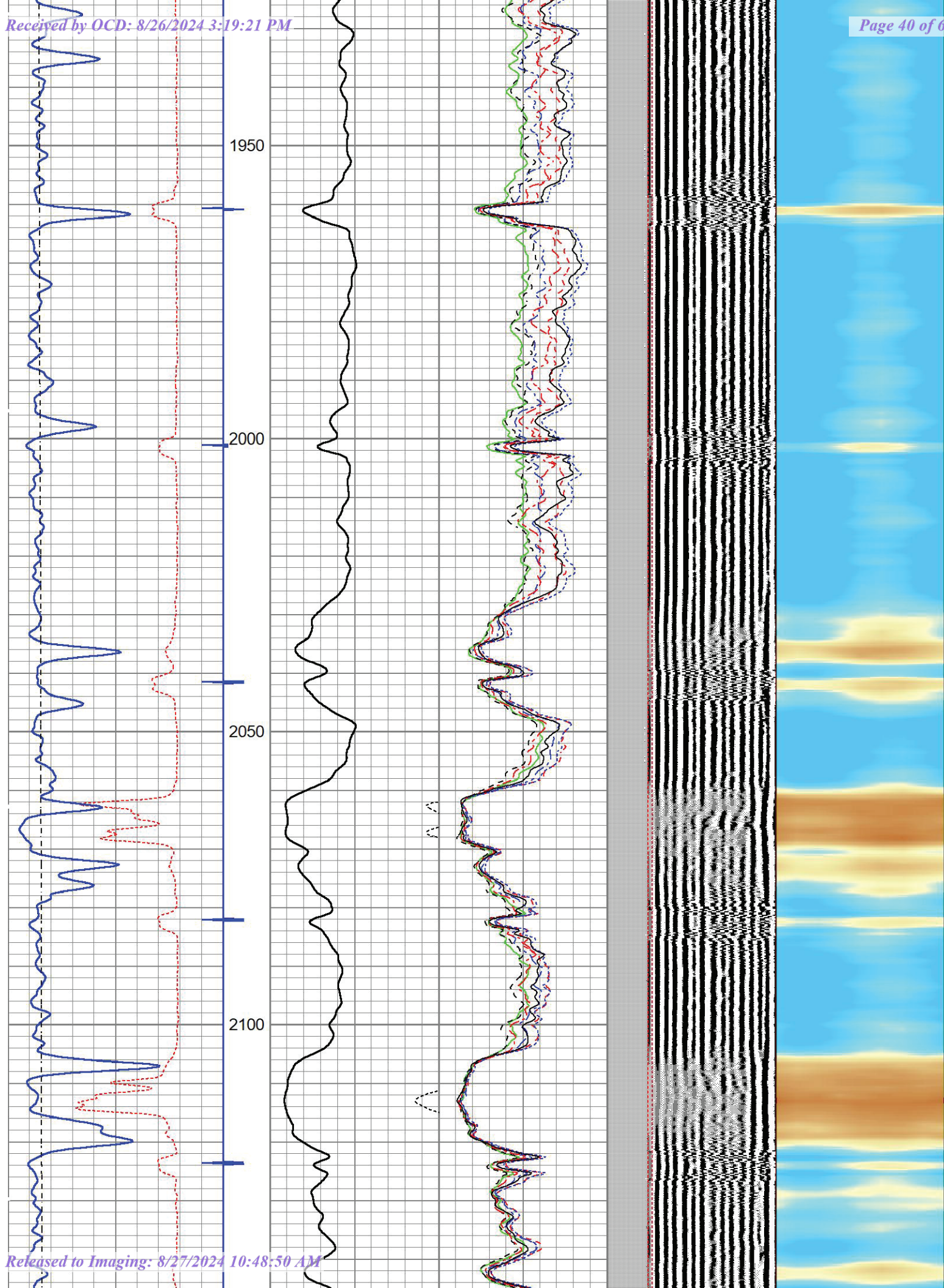




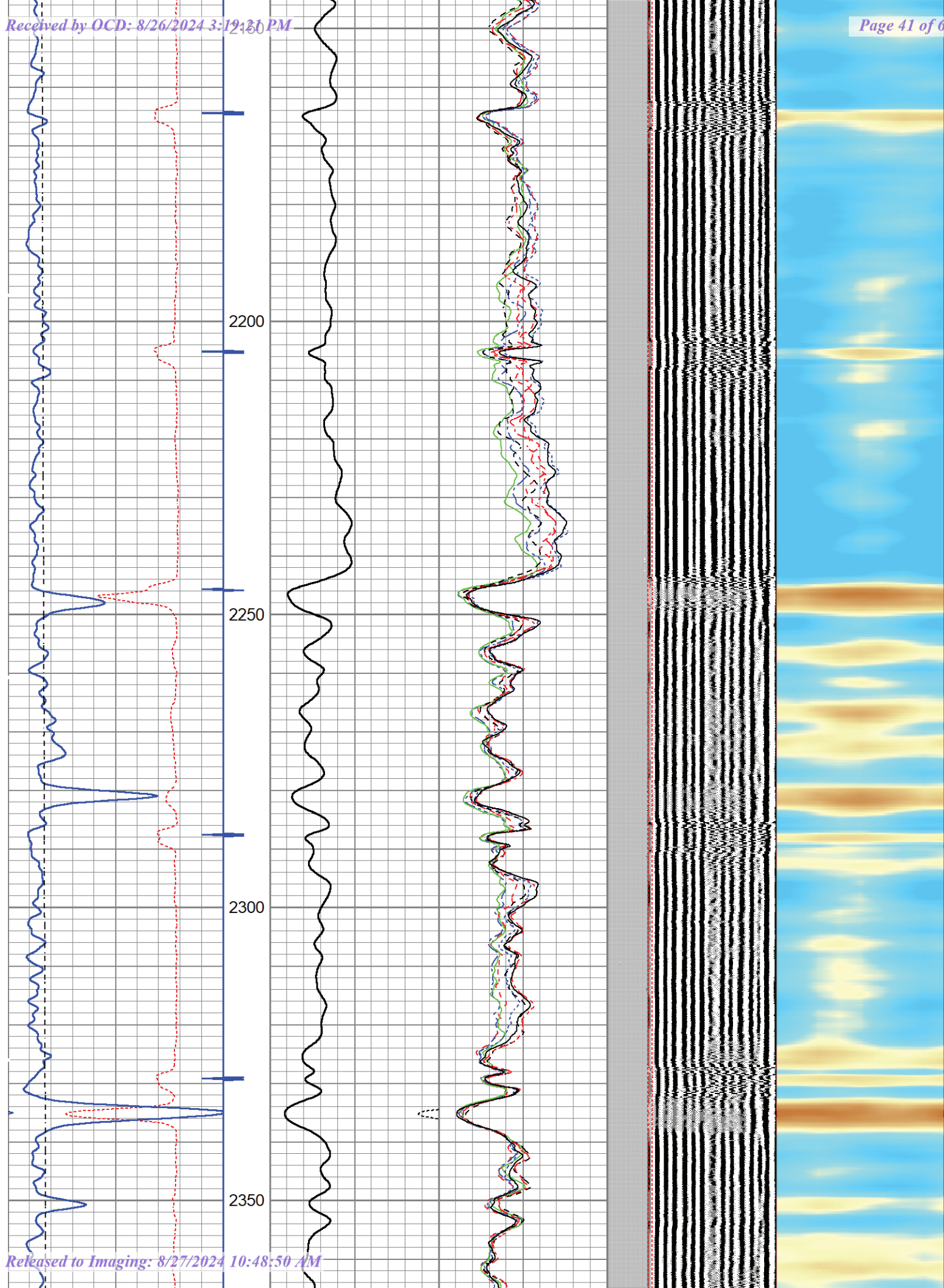


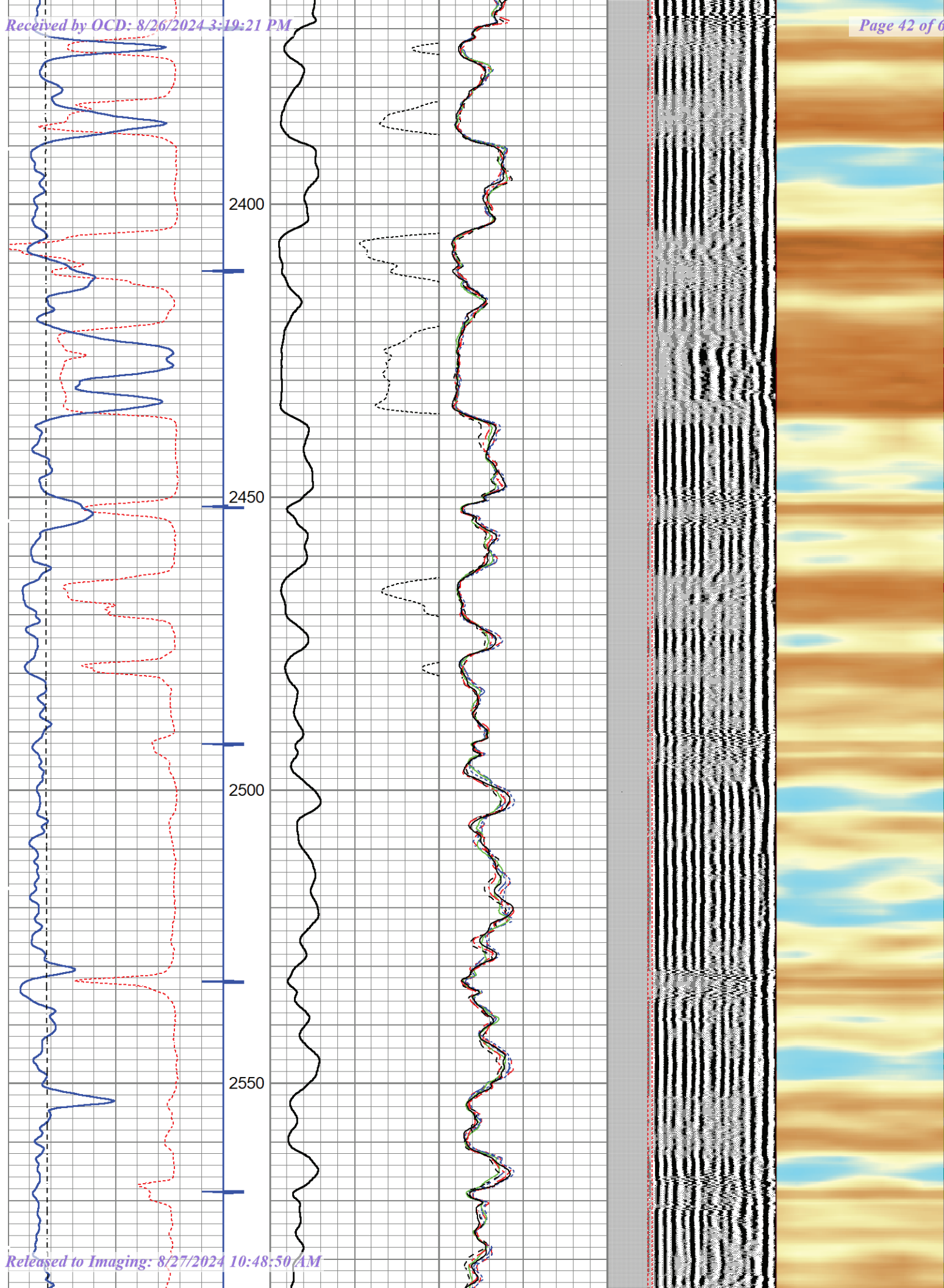




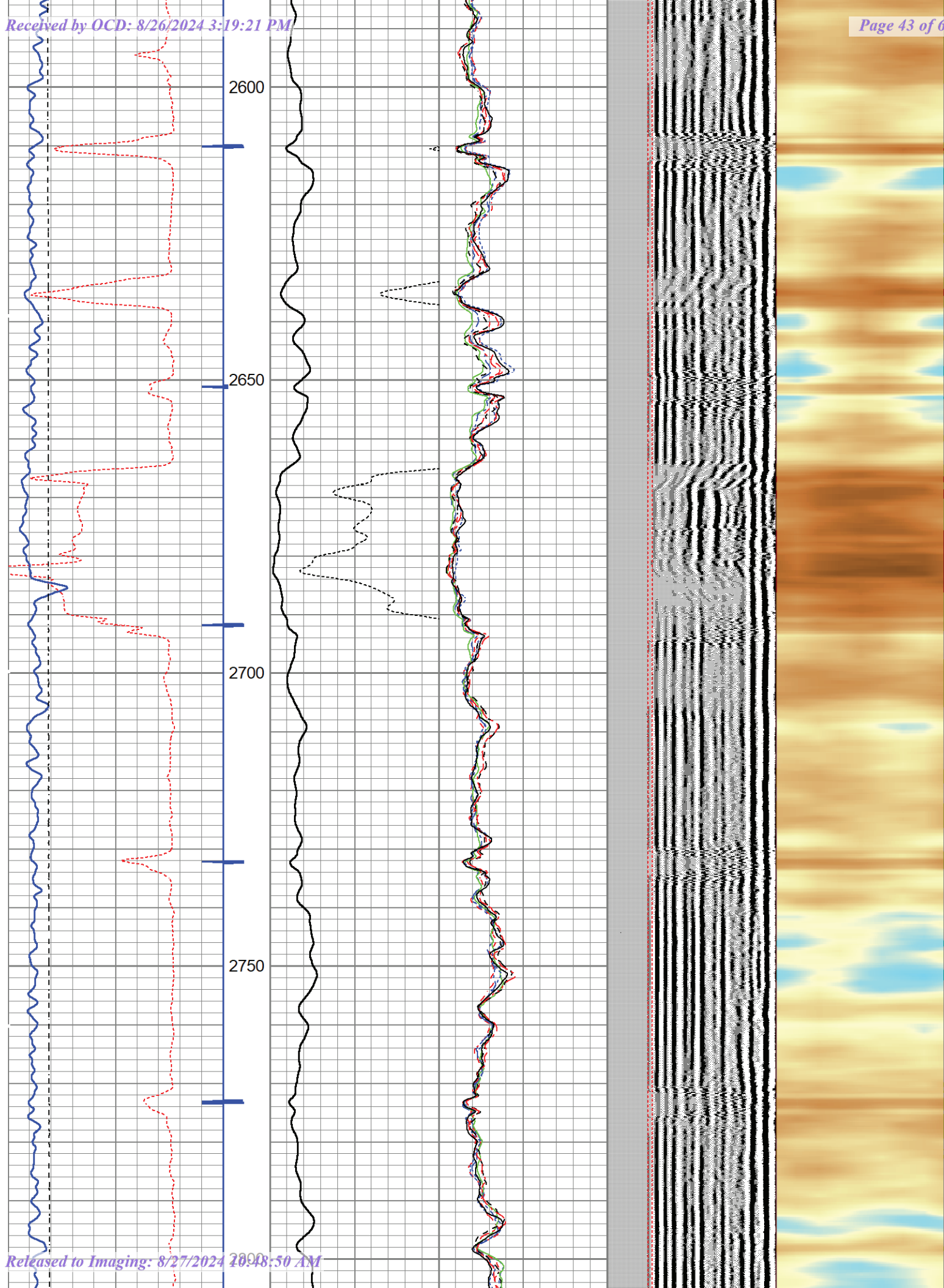




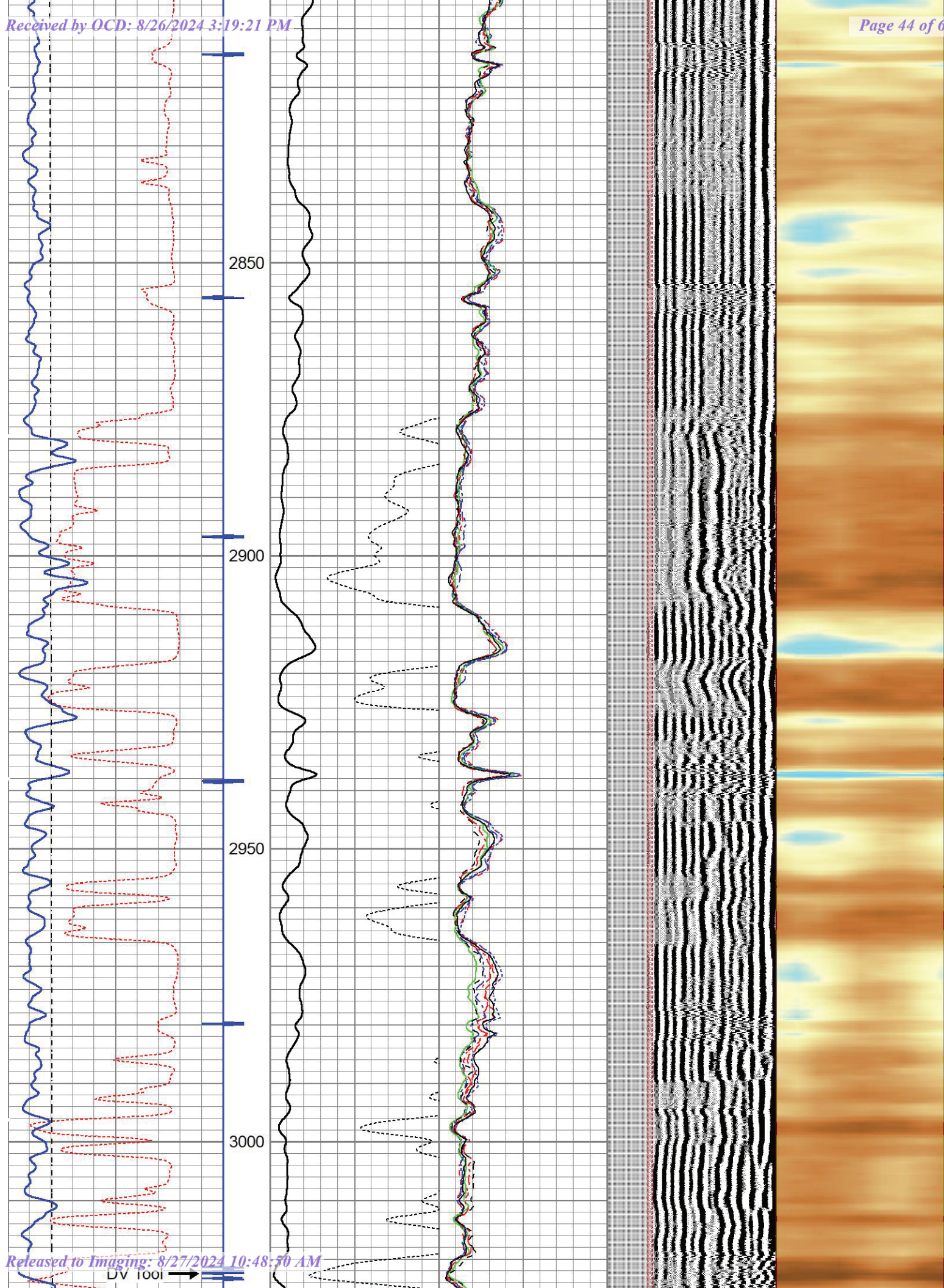




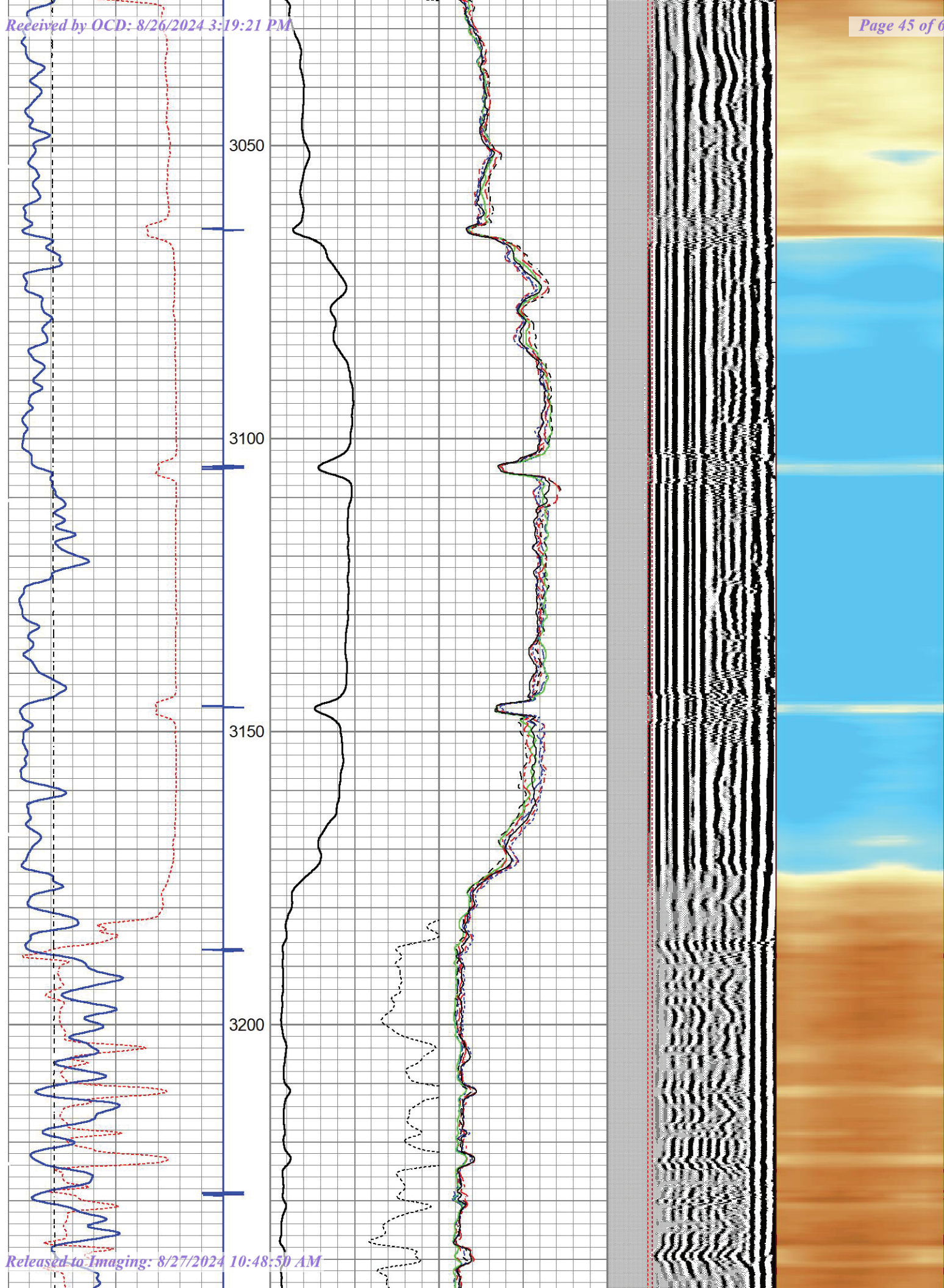




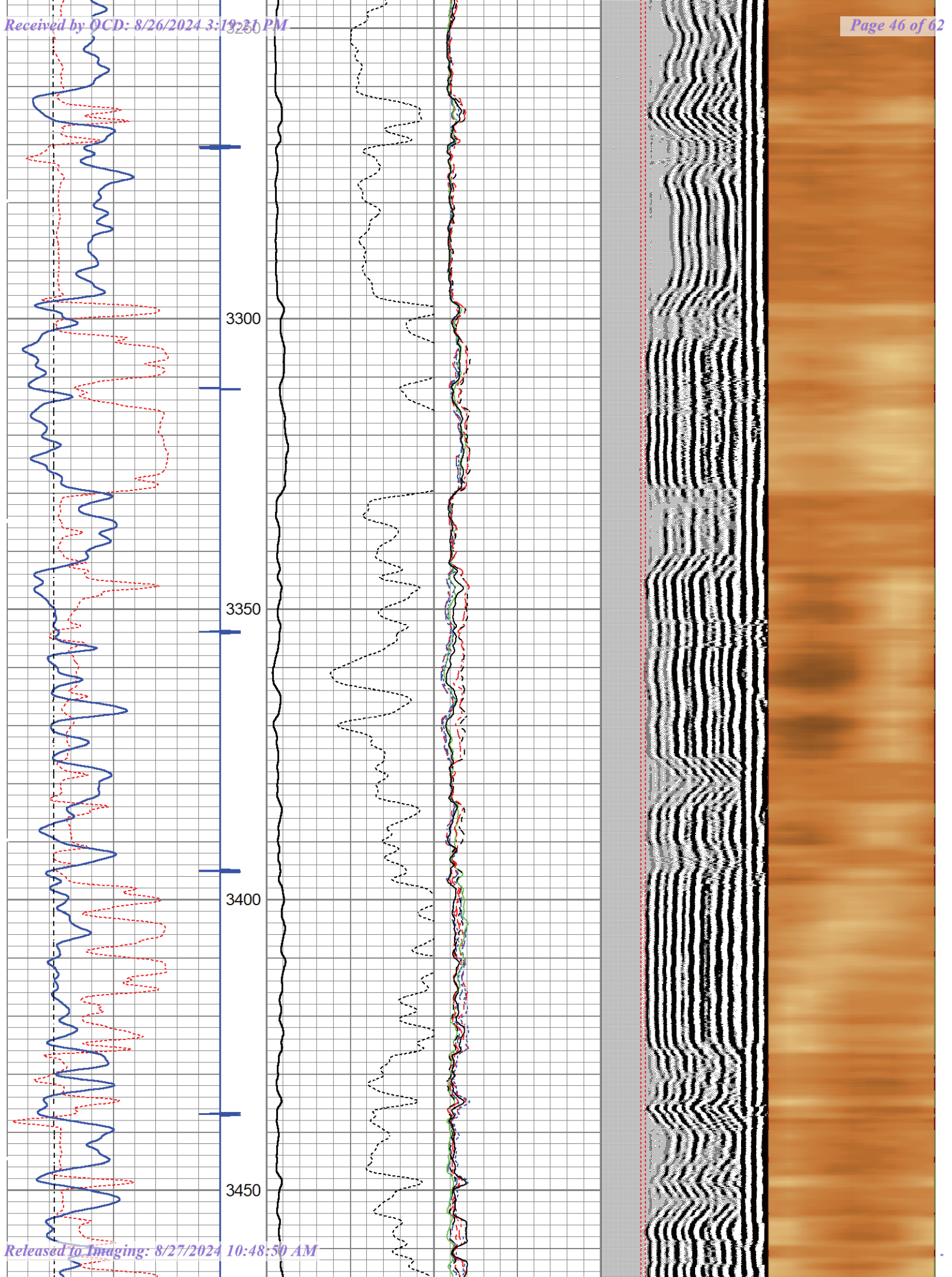


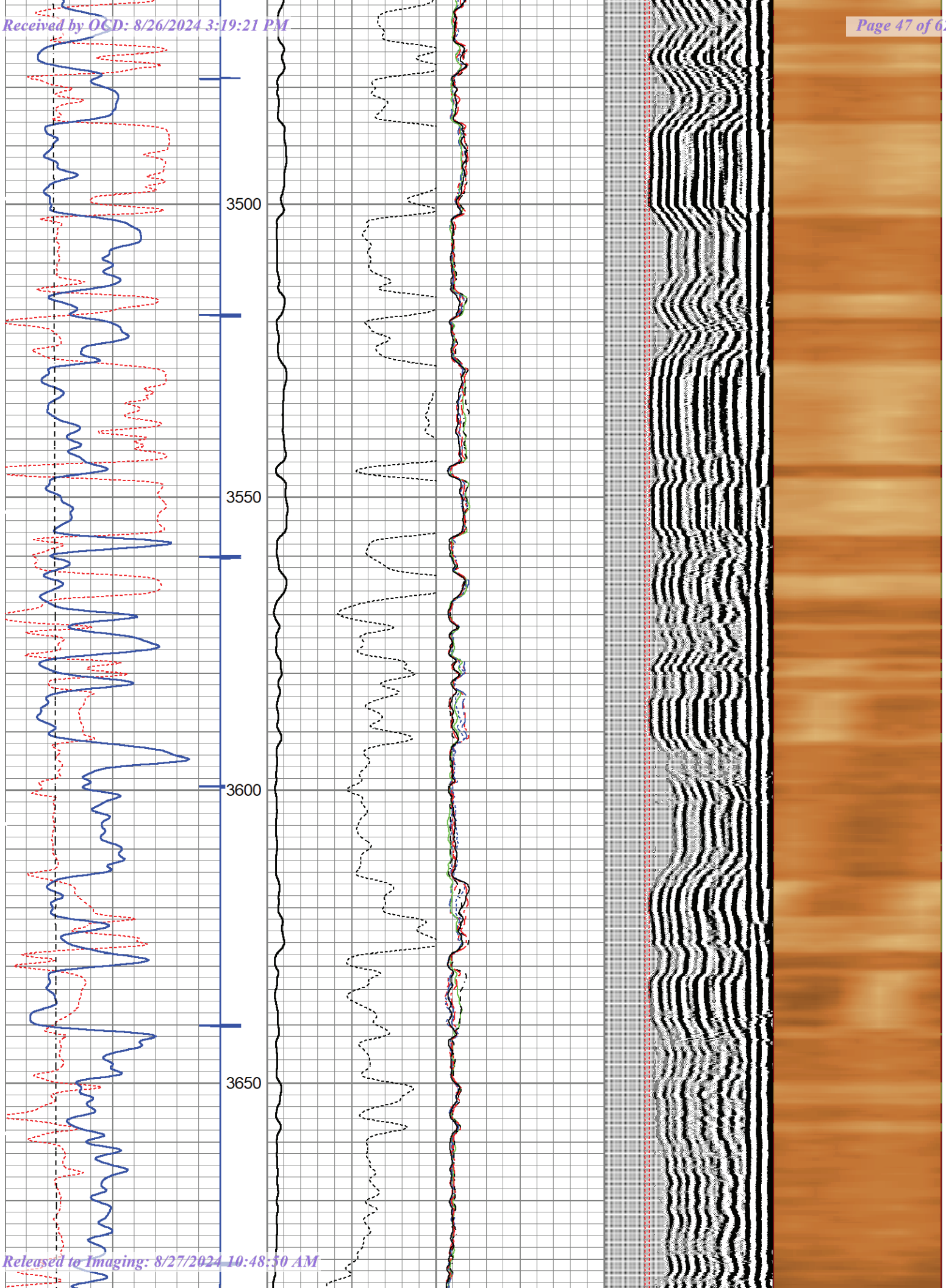




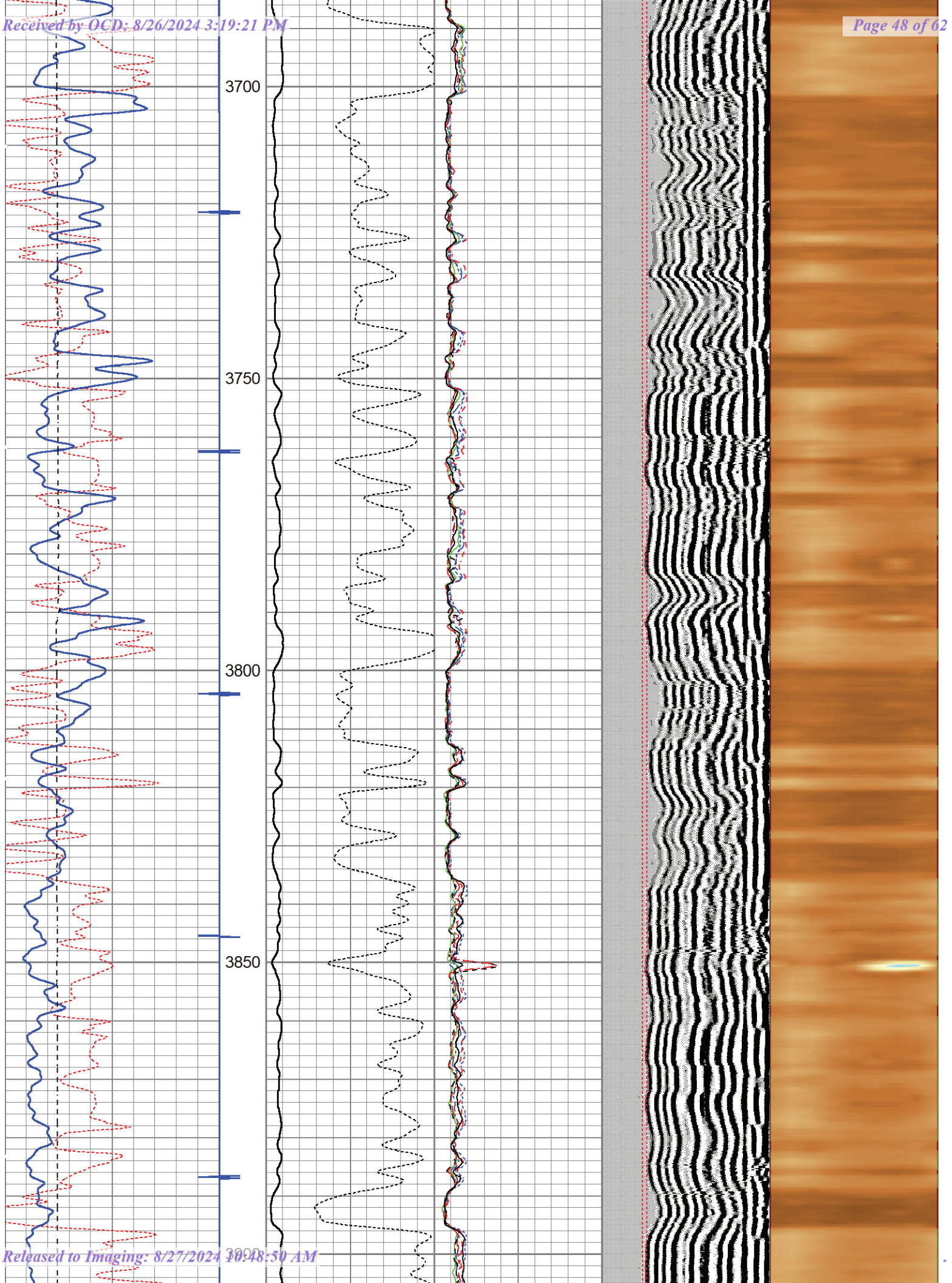




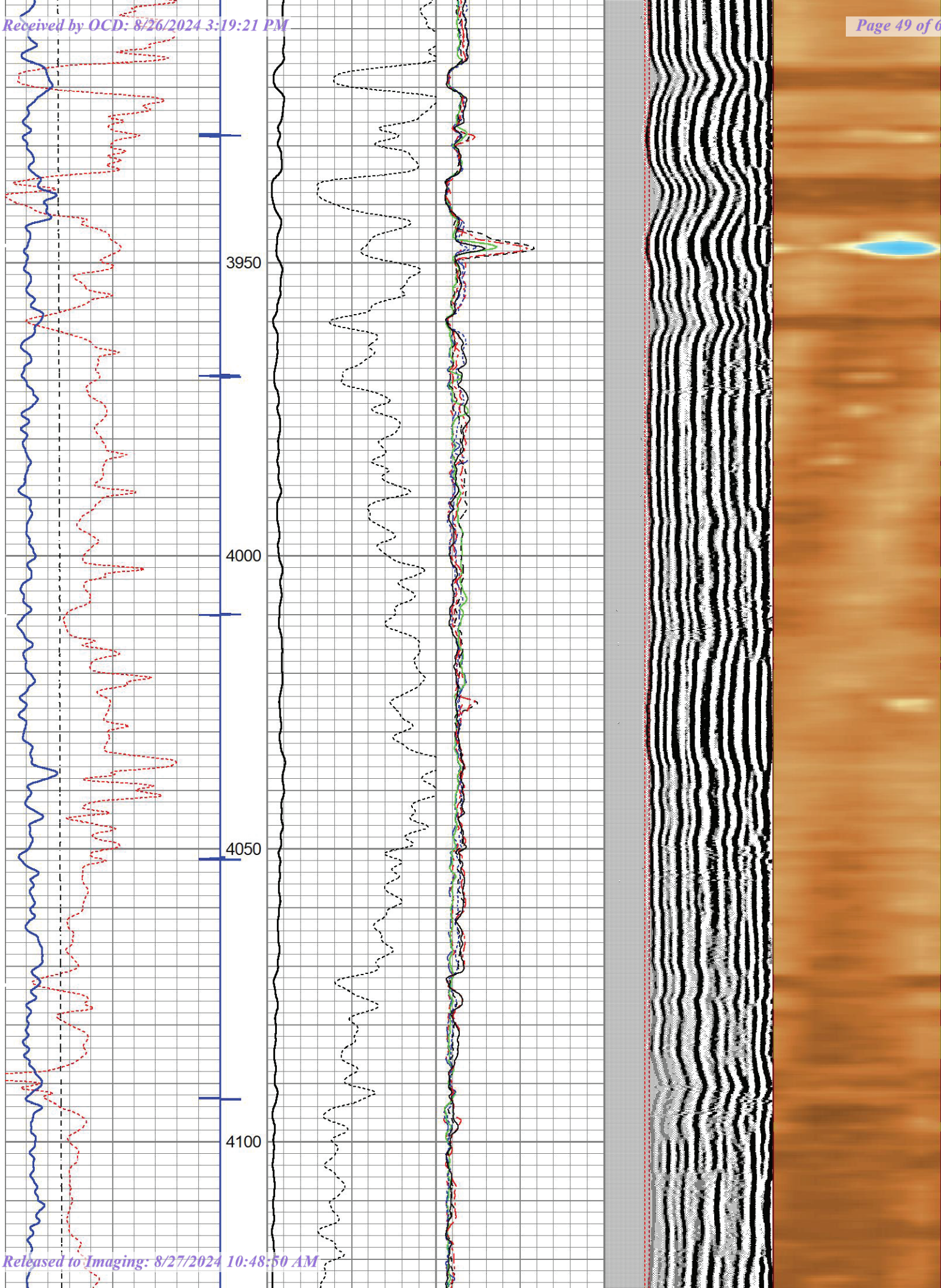




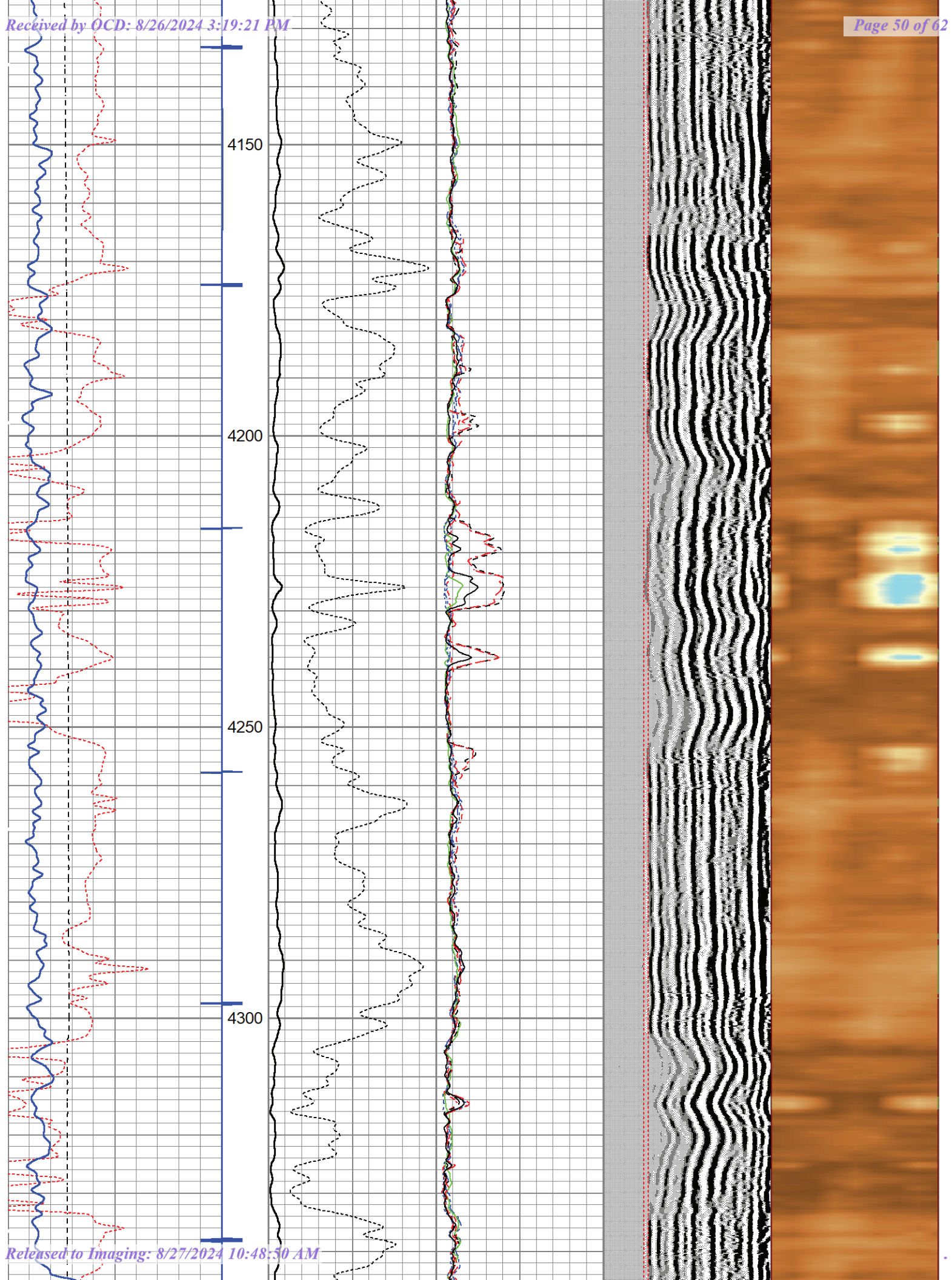






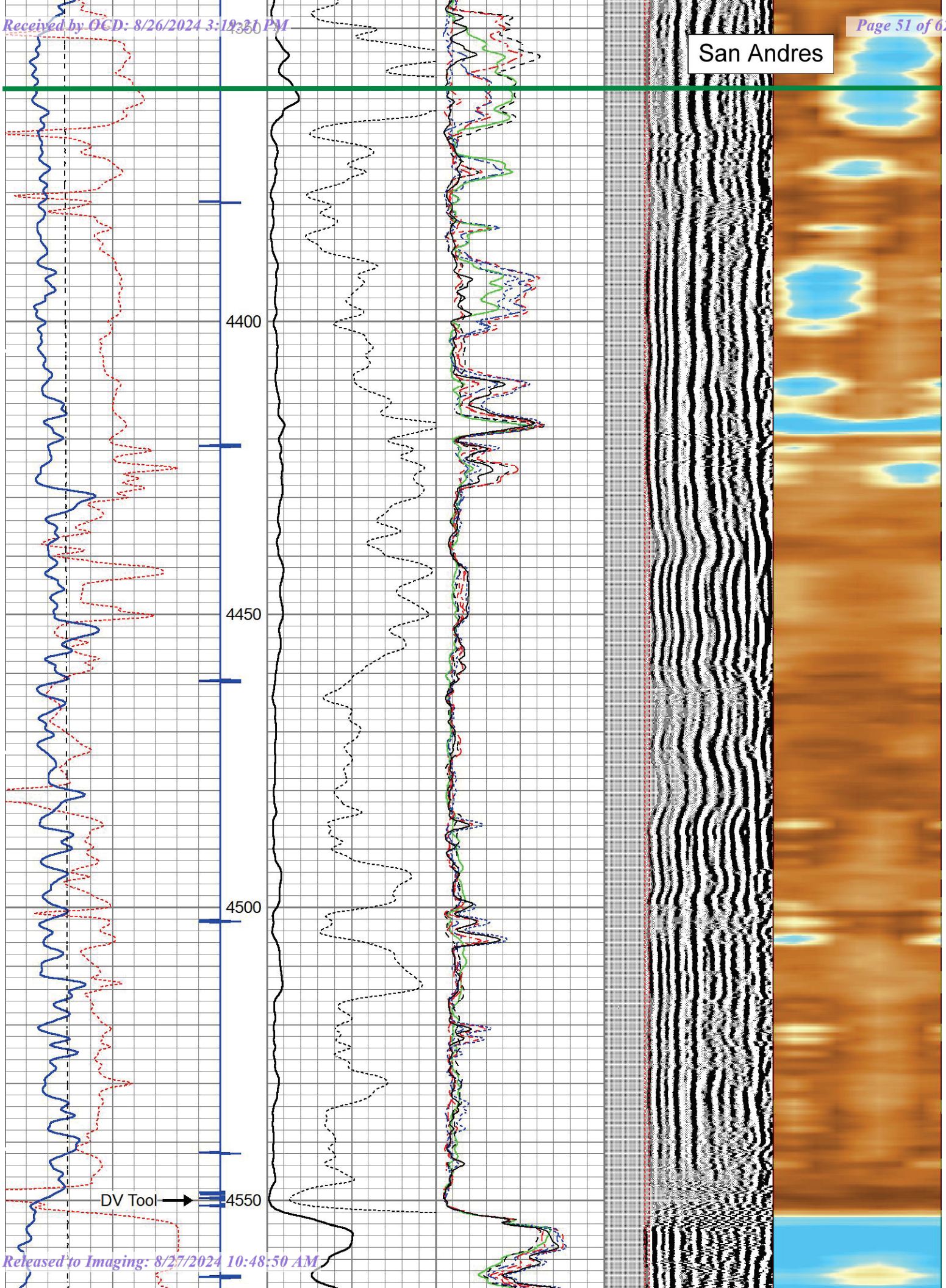




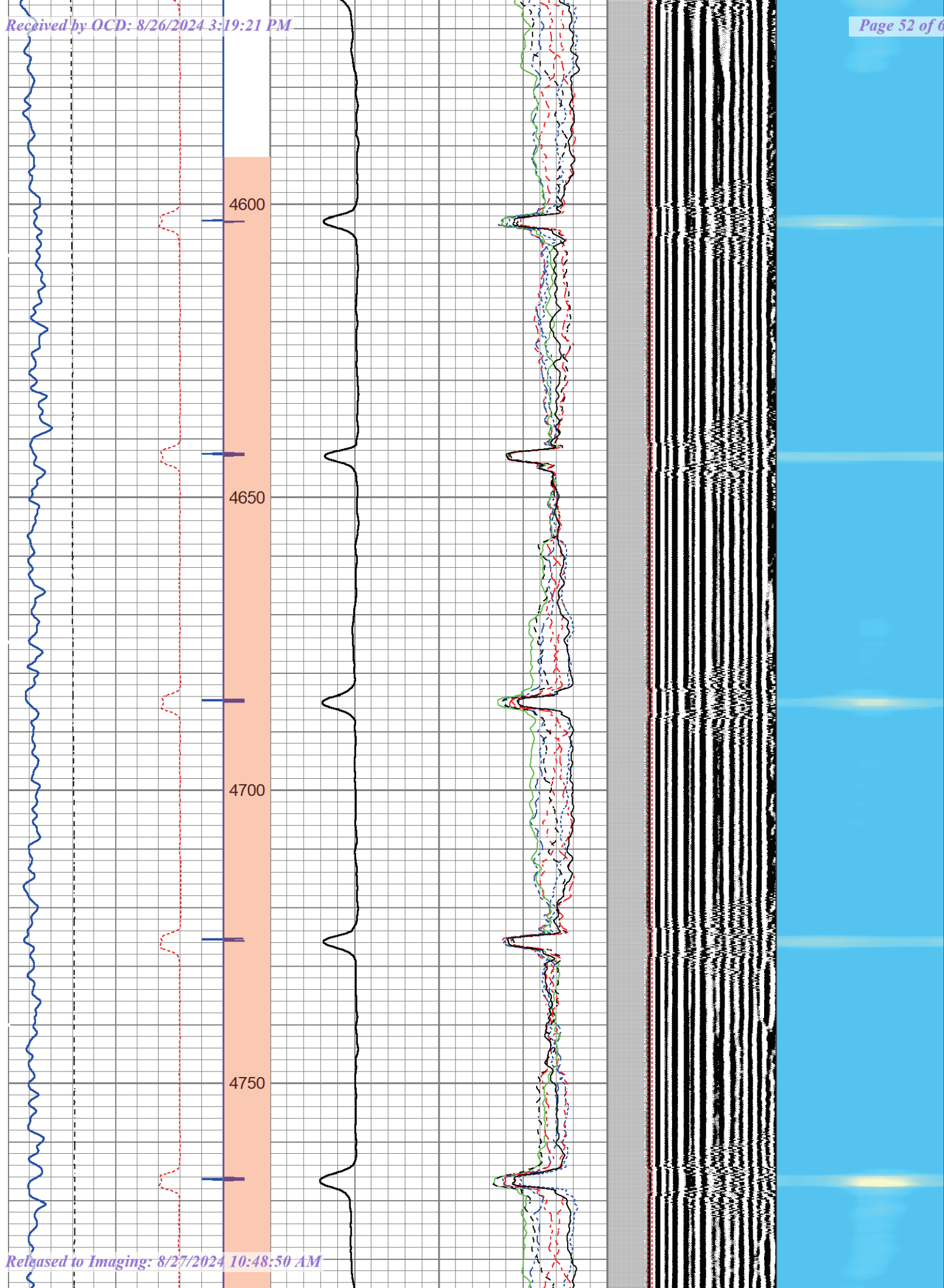




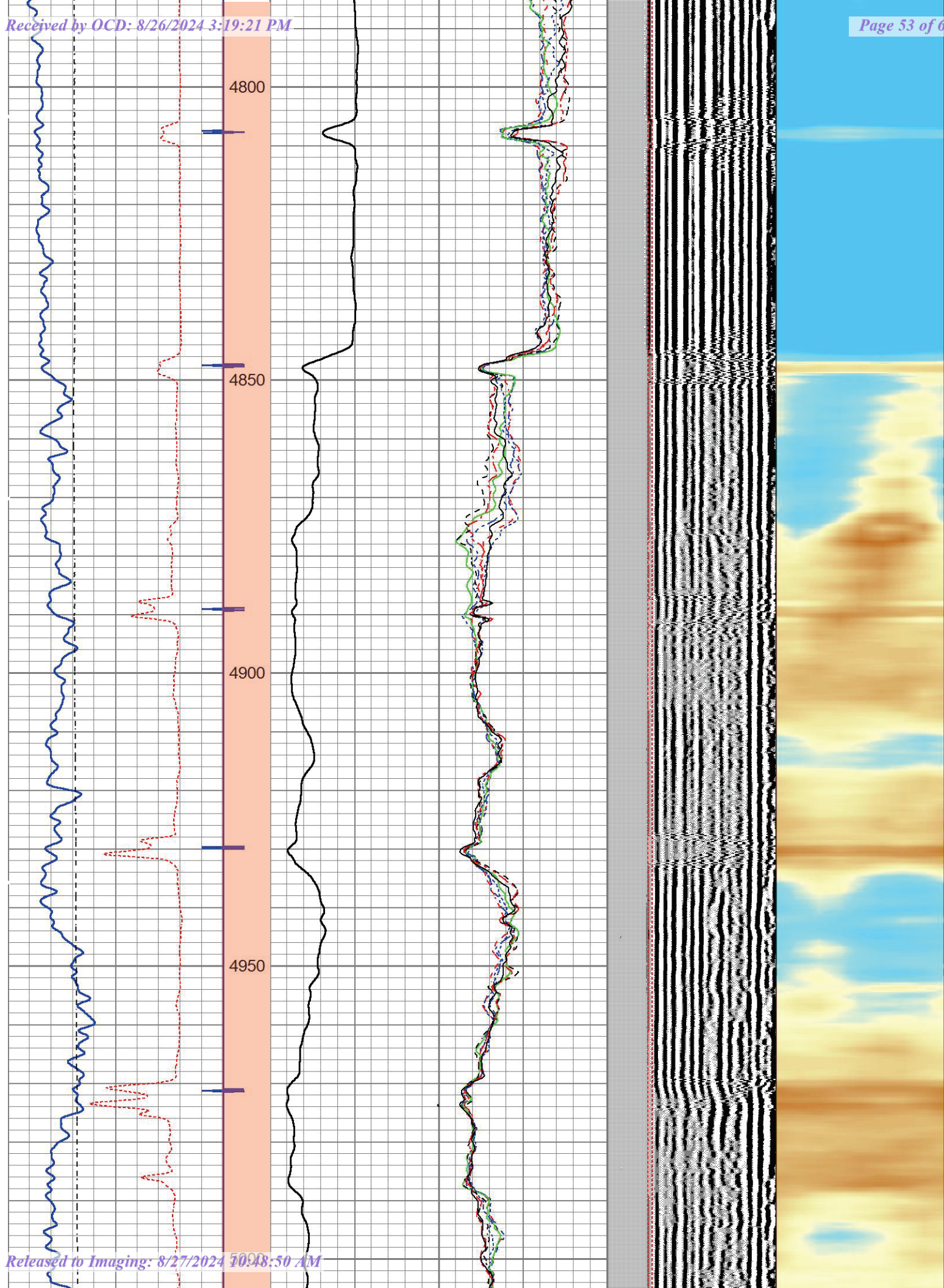
San Andres



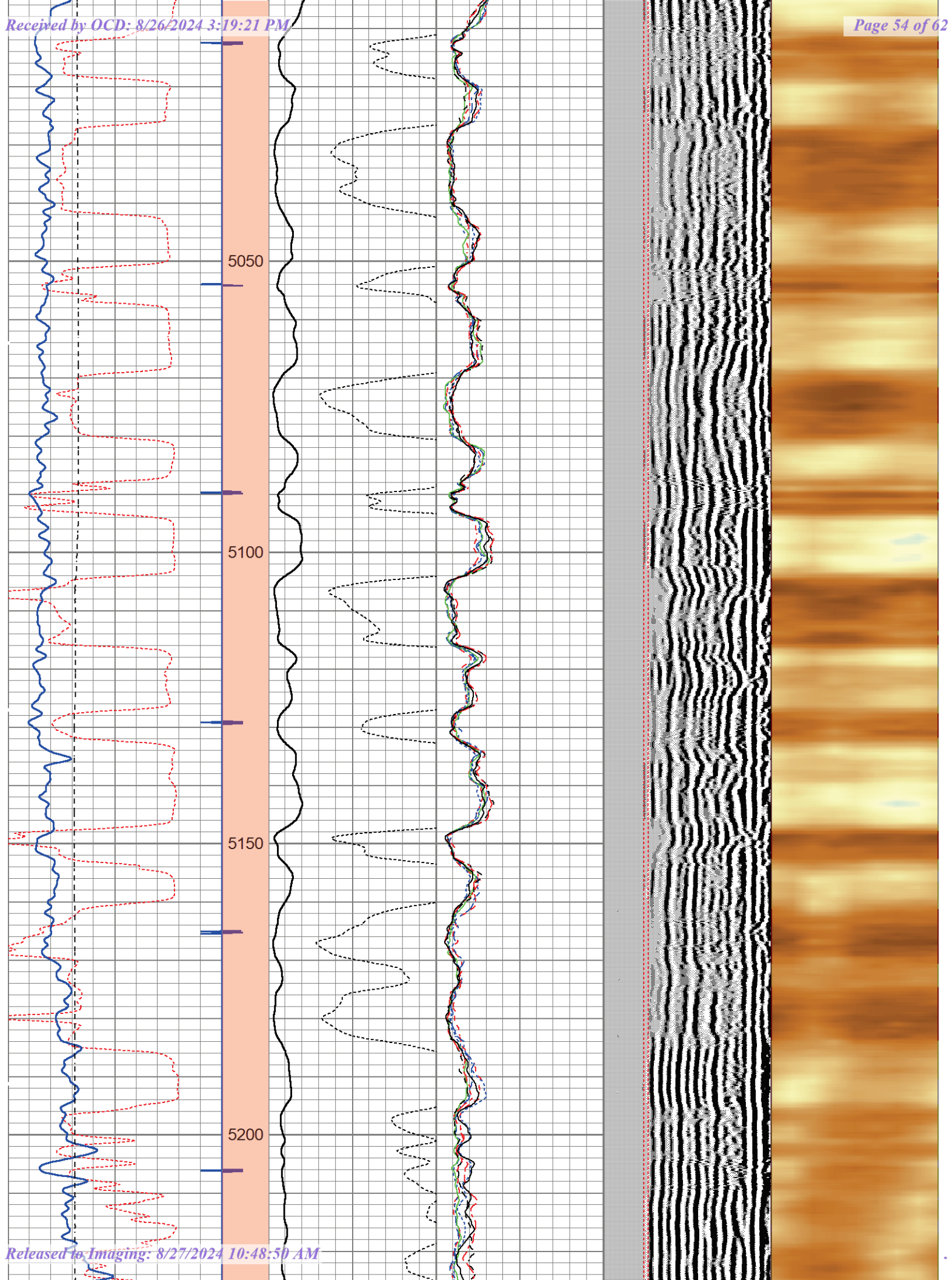




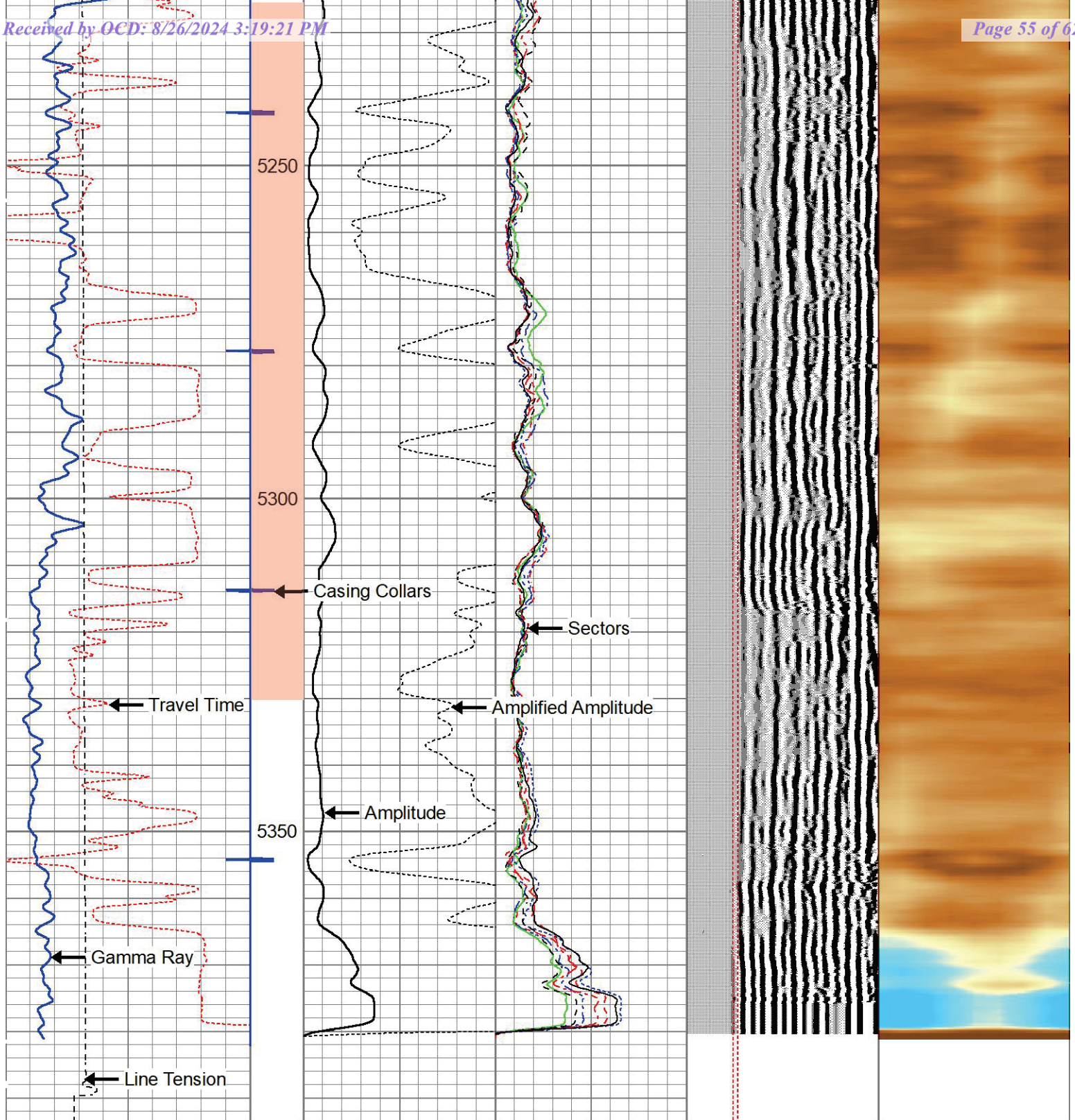










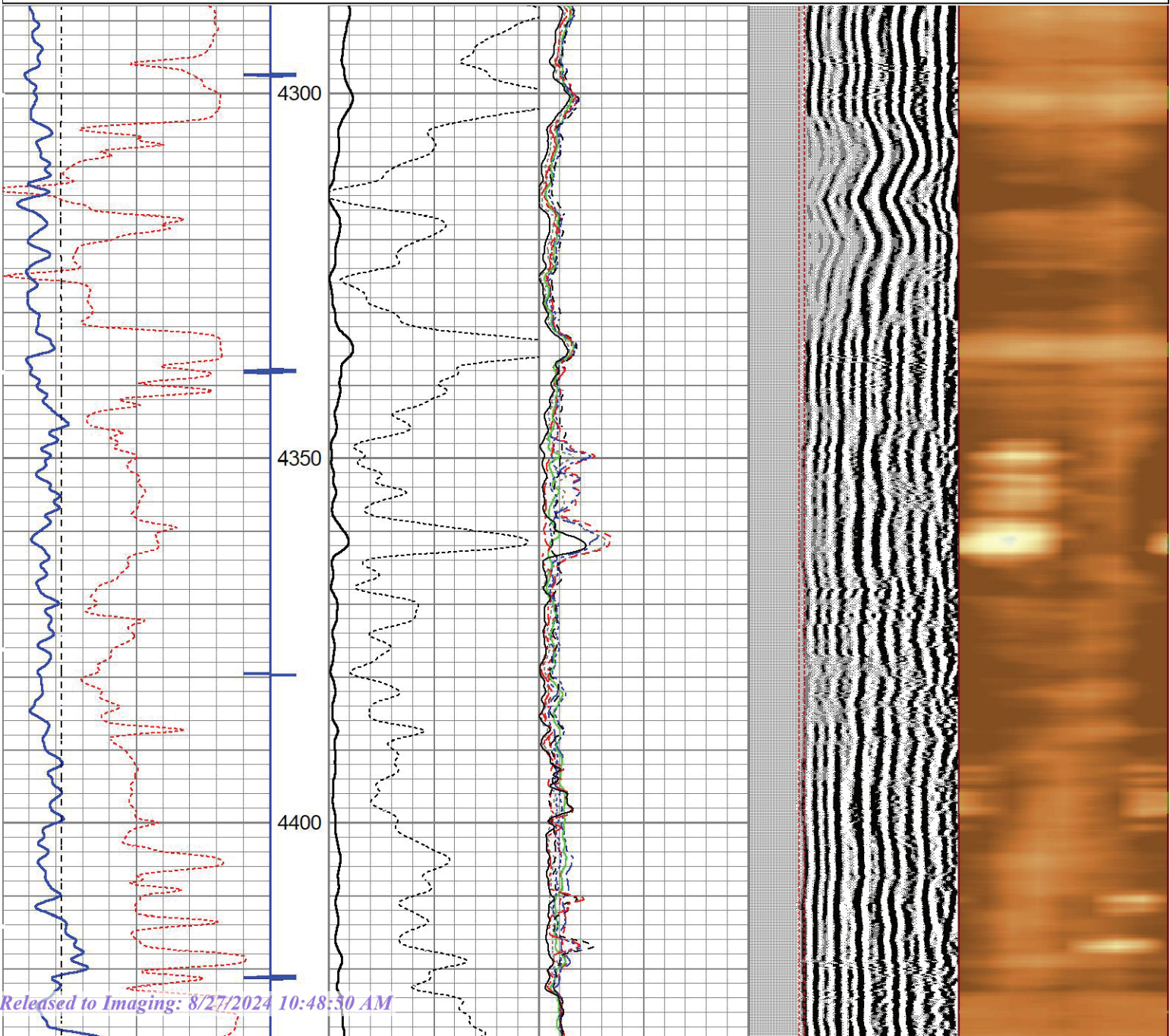


|     |           |      |   |                     |     |    |       |     |     |                |      |            |
|-----|-----------|------|---|---------------------|-----|----|-------|-----|-----|----------------|------|------------|
| 406 | TT (usec) | 306  | 0 | Amplitude (mV)      | 100 | -5 | AMPS2 | 150 | 200 | VDL (usec)     | 1200 | Cement Map |
| 0   | GR (GAPI) | 150  | 0 | Amplified Amplitude |     | -5 | AMPS3 | 150 |     |                |      |            |
| 0   | LTEN (lb) | 3000 | 0 | (mV)                | 10  | -5 | AMPS4 | 150 |     | Free Pipe Gate |      |            |
|     |           |      |   |                     |     | -5 | AMPS5 | 150 |     |                |      |            |
|     |           |      |   |                     |     | -5 | AMPS6 | 150 |     |                |      |            |
|     |           |      |   |                     |     | -5 | AMPS7 | 150 |     |                |      |            |
|     |           |      |   |                     |     | -5 | AMPS8 | 150 |     |                |      |            |
|     |           |      |   |                     |     | -5 | AMPS1 | 150 |     |                |      |            |

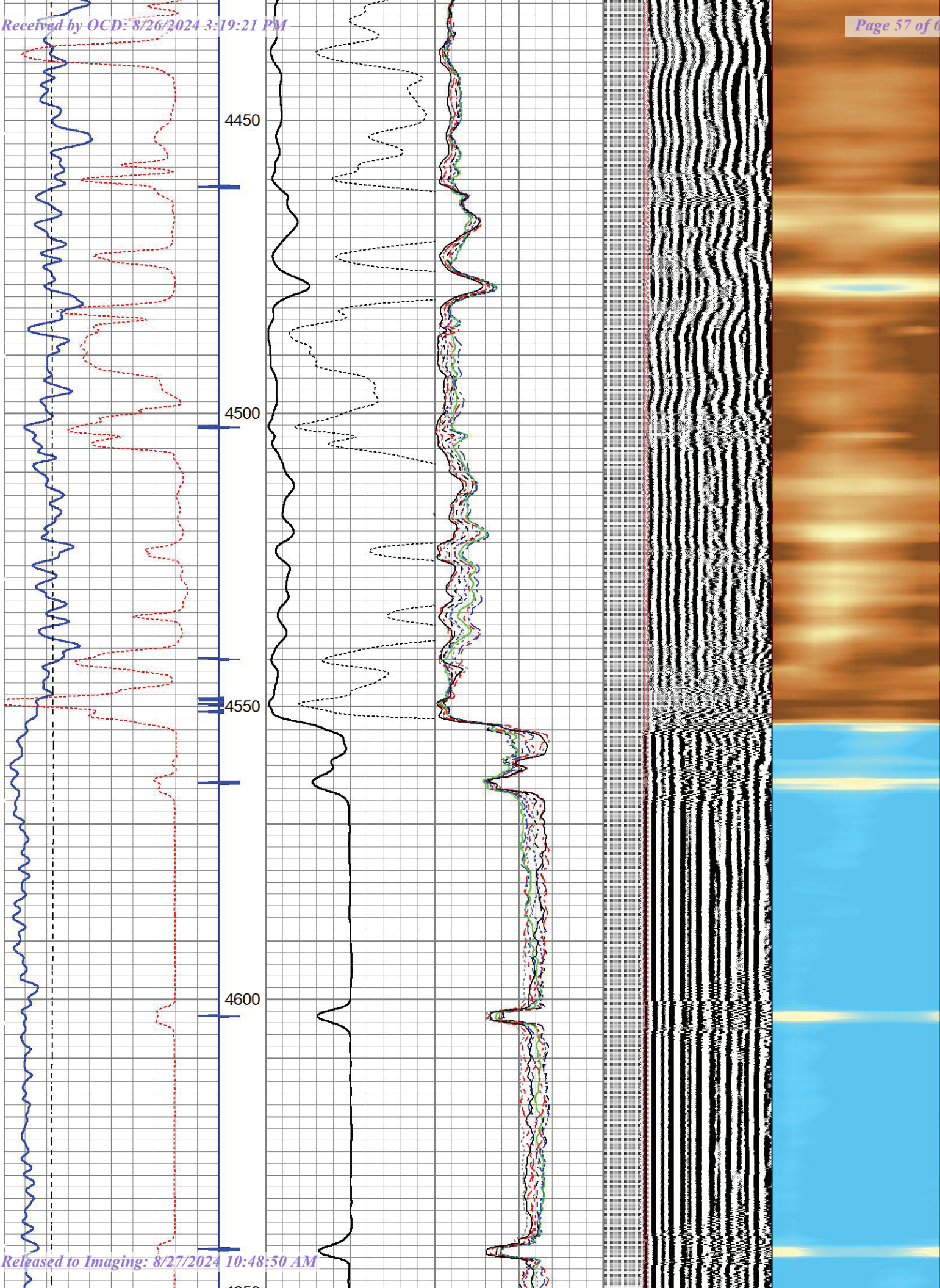


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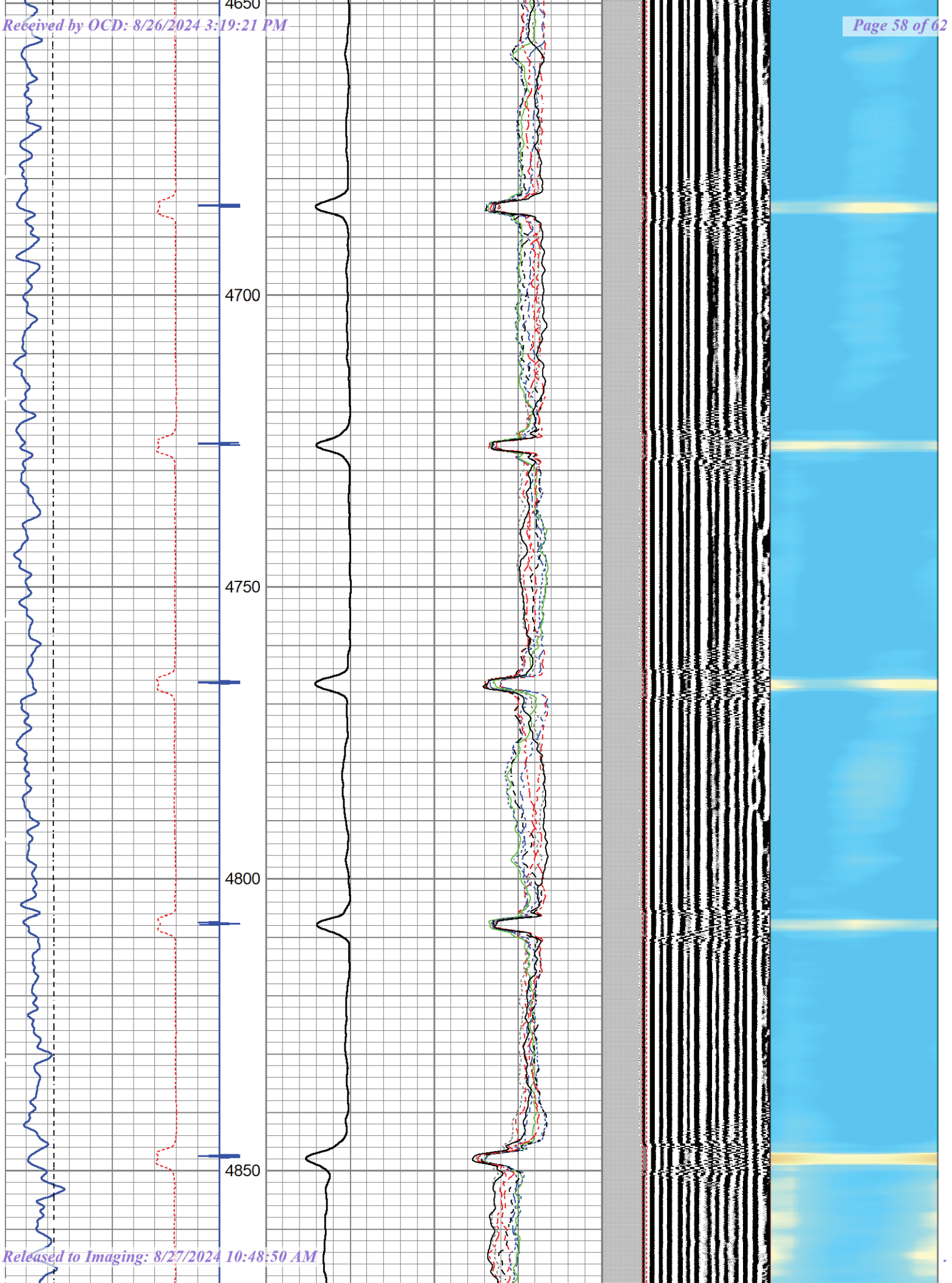
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| 406 | TT (usec) | 306  | 0 | Amplitude (mV)100   | -5 | AMPS2 | 150 | 200 | VDL (usec) 1200 | Cement Map |
| 0   | GR (GAPI) | 150  |   | Amplified Amplitude | -5 | AMPS3 | 150 |     |                 |            |
| 0   | LTEN (lb) | 3000 | 0 | (mV) 10             | -5 | AMPS4 | 150 |     | Free Pipe Gate  |            |
|     |           |      |   |                     | -5 | AMPS5 | 150 |     |                 |            |
|     |           |      |   |                     | -5 | AMPS6 | 150 |     |                 |            |
|     |           |      |   |                     | -5 | AMPS7 | 150 |     |                 |            |
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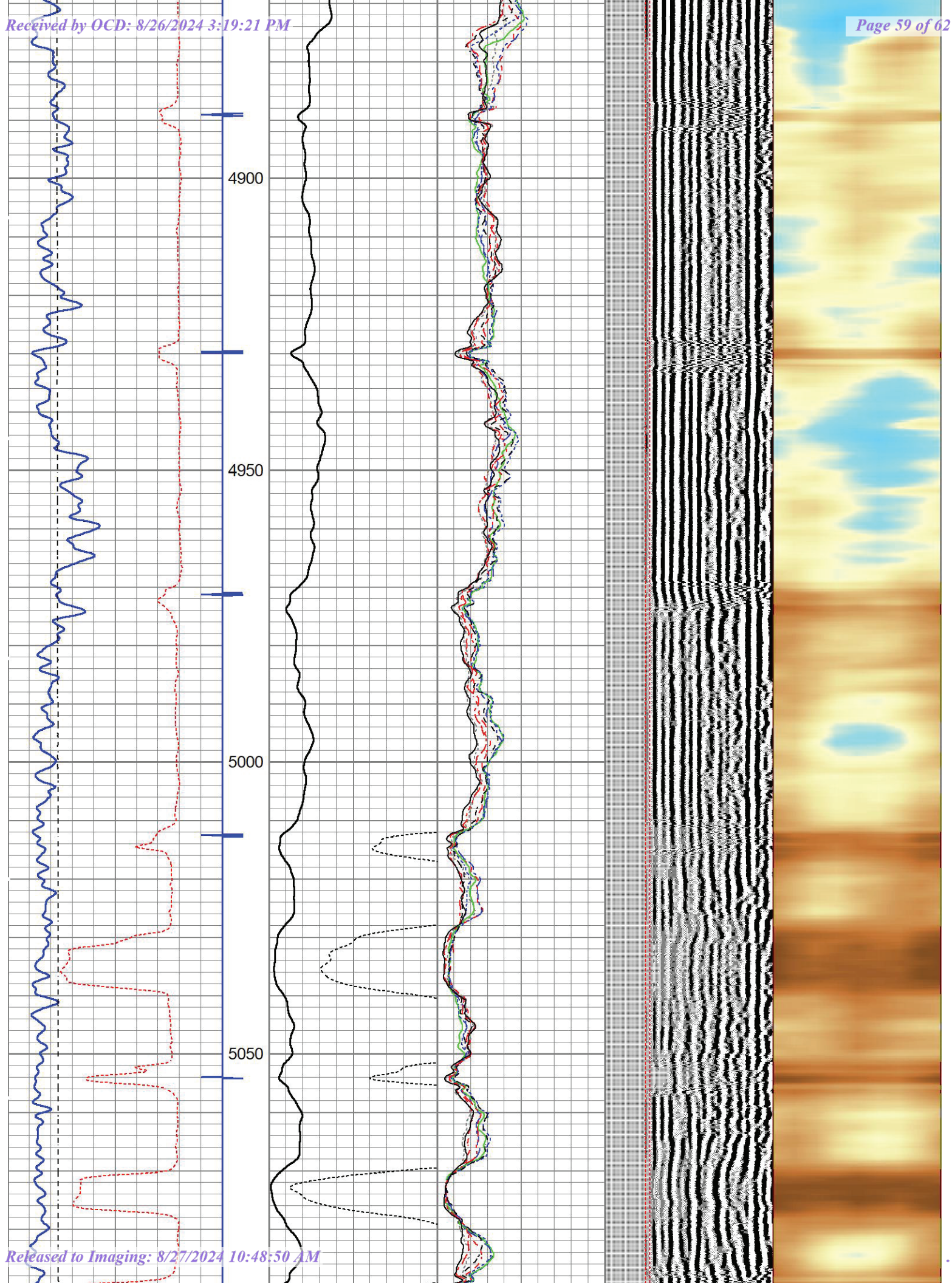




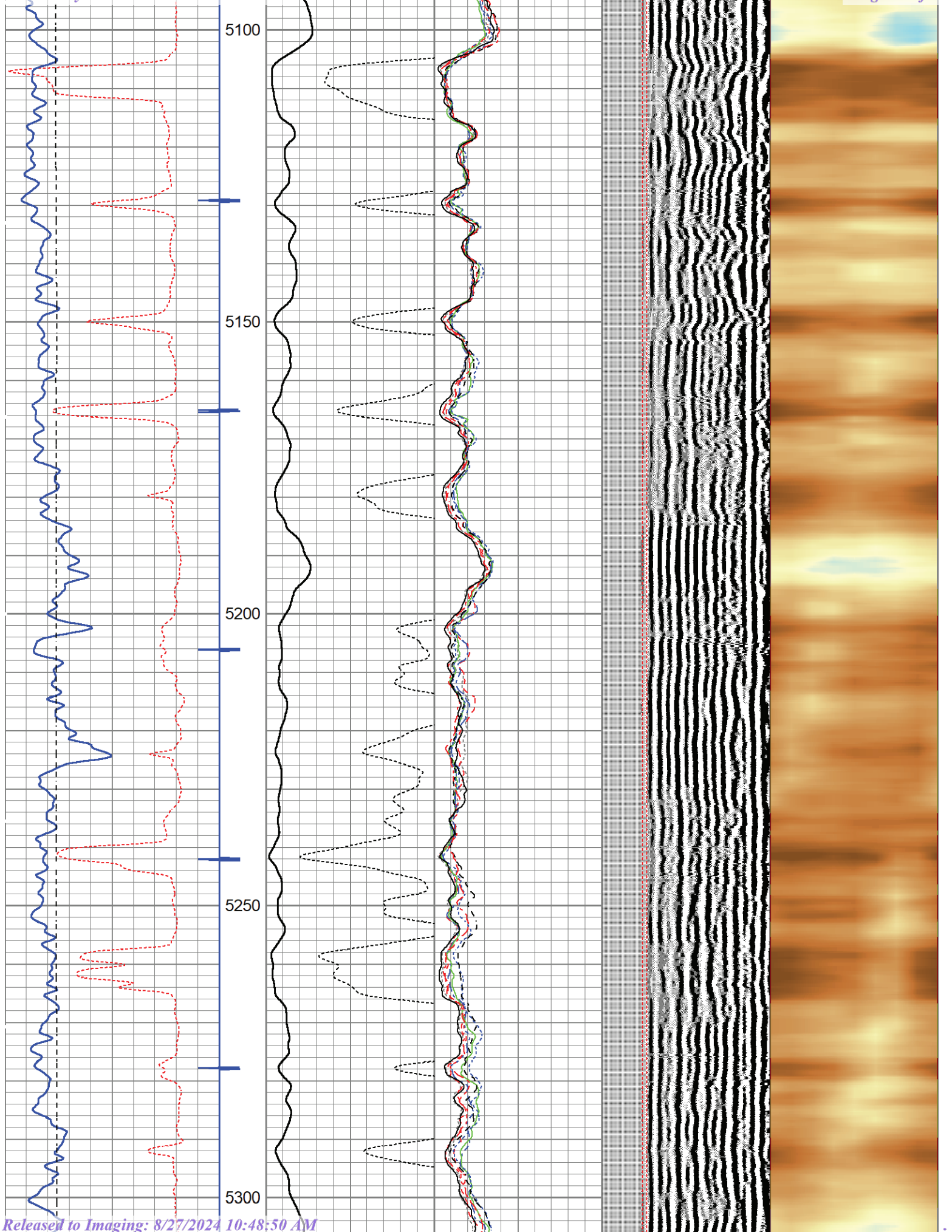




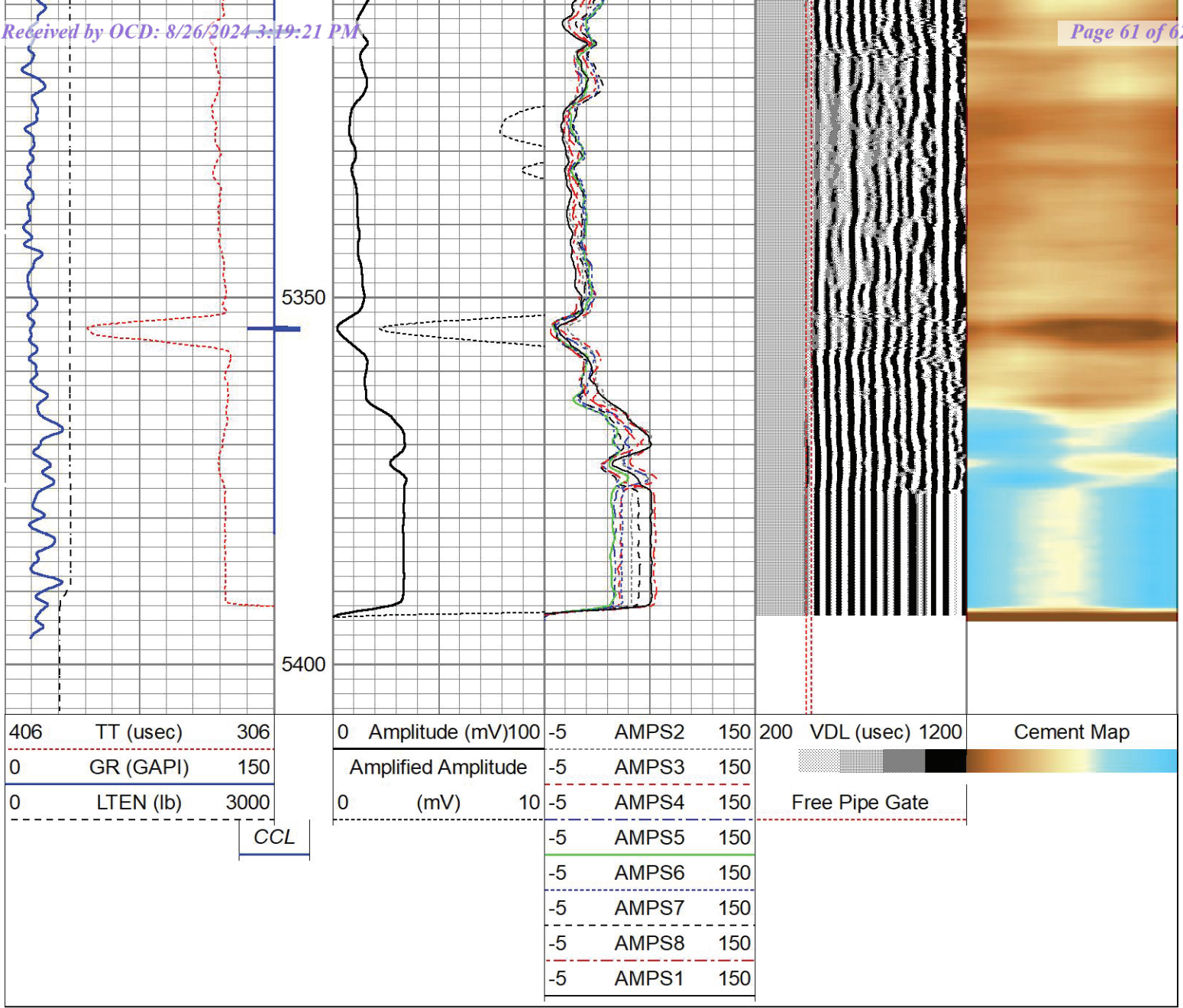












### Log Variables

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 Dataset field/well/run1/pass5/\_vars\_

#### Top - 1349.00 ft

|            |            |               |         |              |             |             |              |  |
|------------|------------|---------------|---------|--------------|-------------|-------------|--------------|--|
| BHTEMP_Src | BOREID     | BOTTEMP       | CASED?  | CASEOD       | CASETHCK    | CASEWGHT    | CMNTTHCK     |  |
| TEMP       | in<br>17.5 | degF<br>100   | Yes     | in<br>9.625  | in<br>0.395 | lb/ft<br>40 | in<br>3.9375 |  |
| CMTTKCOR   | CSTKCOR    | MAXAMPL       | MINAMPL | MINATTN      | NPORSEL     | PERFS       | PPT          |  |
| On         | On         | mV<br>52.2799 | mV<br>1 | db/ft<br>0.8 | Limestone   | No          | usec<br>0    |  |
| SRFTEMP    | SZCOR      | TDEPTH        |         |              |             |             |              |  |
| degF<br>0  | On         | ft<br>0       |         |              |             |             |              |  |

#### 1349.00 ft - Bottom

|             |              |
|-------------|--------------|
| BOREID      | CMNTTHCK     |
| in<br>12.25 | in<br>1.3125 |

Variable Description

|   |   |
|---|---|
| BHTEMP_Src : BHTEMP Input Source Selector | MAXAMPL : Maximum Amplitude             |
| BOREID : Borehole I.D.                    | MINAMPL : Minimum Amplitude             |
| BOTTEMP : Bottom Hole Temperature         | MINATTN : Minimum Attenuation           |
| CASED? : Cased hole ?                     | NPORSEL : Neutron Porosity Curve Select |
| CASEOD : Casing O.D.                      | PERFS : Perforation Flag                |
| CASETHCK : Casing Thickness               | PPT : Predicted Pipe Time               |
| CASEWGHT : Casing Weight                  | SRFTEMP : Surface Temperature           |
| CMNTTHCK : Cement Thickness               | SZCOR : CN Size Cor. ?                  |
| CMTTKCOR : CN CemThk. Cor. ?              | TDEPTH : Total Depth                    |
| CSTKCOR : CN CasThk. Cor. ?               |   |

Calibration Report

Database File c:\programdata\warrior\data\cambrian\_sosa\_17\_swd\_2\_cnl\_rbl\cambrian\_sosa\_17\_swd\_2\_cnl\_rbl.db  
 Dataset Pathname pass2.2  
 Dataset Creation Thu Mar 11 20:21:25 2021

Compensated Neutron Calibration Report

Serial Number: 110503dig  
 Tool Model: 275Dig

TANK CALIBRATION Tue Mar 09 09:44:18 2021

|                  |            |            |          |
|------------------|------------|------------|----------|
|                  | Tool Ratio | Tank Ratio | K-Factor |
| Tank Calibration | 11.0899    | 11.6940    | 1.0545   |

|             |            |
|-------------|------------|
| Detector    | Readings   |
| Short Space | 776.60 cps |
| Long Space  | 70.03 cps  |

Gamma Ray Calibration Report

Serial Number: PROFW140845  
 Tool Model: Probe275dig  
 Performed: (Not Performed)

Calibrator Value: 1.0 GAPI

Background Reading: 0.0 cps  
 Calibrator Reading: 1.0 cps

Sensitivity: 1.0000 GAPI/cps

Segmented Cement Bond Log Calibration Report

Serial Number: FW1901-108  
 Tool Model: RBT-TEMP

Calibration Casing Diameter: 9.625 in  
 Calibration Depth: -2448.279 ft

Master Calibration, performed (Derived):

| Raw (v) |       | Calibrated (mv) |        | Results |        |
|---------|-------|-----------------|--------|---------|--------|
| Zero    | Cal   | Zero            | Cal    | Gain    | Offset |
| 0.000   | 0.394 | 2.000           | 51.280 | 125.000 | 1.998  |